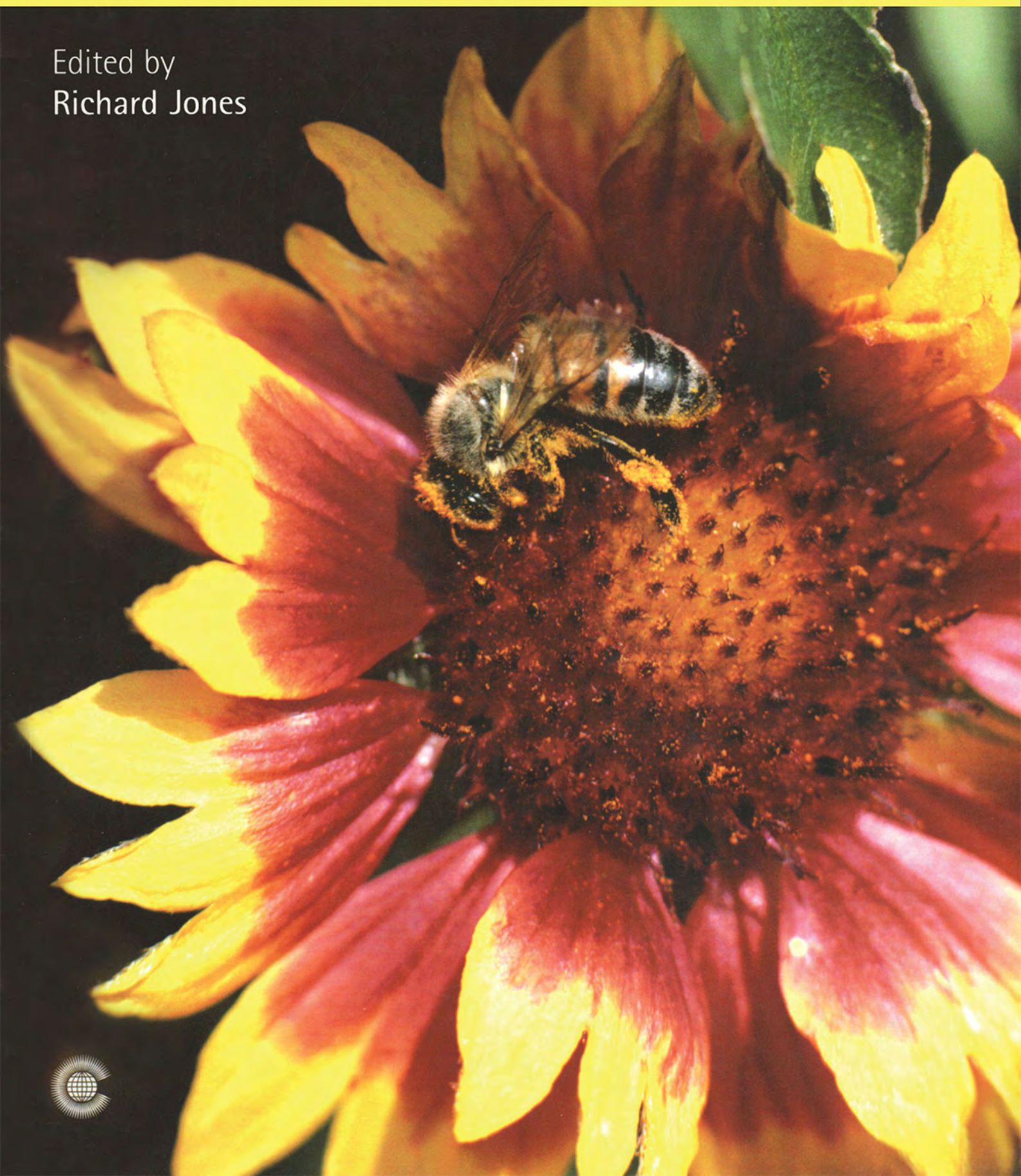


Bibliography of Commonwealth Apiculture

Edited by
Richard Jones



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From the databases of

**The International Bee Research Association
18 North Road, Cardiff CF10 3DT
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Notes

The original *Bibliography of Tropical Apiculture*, edited by Dr Eva Crane, was published in 1978. It consisted of 24 Parts published separately and as a whole, with an index, as a bound volume.

The volume, as is clear from the name, covers the countries of the Commonwealth, including those well outside tropical latitudes. The referencing system has been simplified. Entries within each section are in alphabetical order of first author. Some entries include a note or further useful information to amplify the title.

To avoid excessive cost, each publication is entered primarily where it is most relevant. Users are therefore likely to find much additional useful material in the sections on neighbouring countries or regions where similar geographic conditions prevail.

Symbols and Abbreviations

Apicultural Abstracts, which is one of IBRA's quarterly journals, has produced abstracts on all aspects of apiculture since 1949. The system used is as follows:

B shows that the Eva Crane/IBRA Library in Cardiff, Wales has a copy of the publication.

a, b, c, d, do, j are IBRA shelfmarks.

X shows that IBRA has been unable to obtain a copy of the publication.

wf shows that IBRA is trying to obtain a copy of the publication.

The name of a language with a capital initial (e.g. English) indicates that the original is in that language. The name of a language with a lower case initial (e.g. arabic) indicates that it has a summary in that language. A summary in english, french, german, portuguese or spanish is indicated by en, fr, de, pt, es respectively.

Abstracts are either produced by the author or by a team of highly qualified abstractors. The name of an abstractor is often indicated at the end of the abstract.

Information about Publication of the Bibliography

- (a) Institutions and organisations can purchase the *Bibliography of Commonwealth Apiculture* from the Commonwealth Secretariat or from IBRA.
- (b) IBRA is always interested in receiving information about beekeeping in developing countries.
- (c) All such correspondence should be addressed to International Bee Research Association, 18 North Road, Cardiff, CF10 3DT, Wales, UK or info@ibra.org.uk

The design on the cover of the original volume has been retained. This is an adaptation of the IBRA symbol in which a tetrahedral gnomonic projection of the earth's surface is mapped on three hexagons meeting at the North Pole. The countries covered by the *Bibliography of Commonwealth Apiculture* are indicated.

Foreword

When the *Bibliography of Tropical Apiculture*, or 'Bota', as it is invariably known, was first published, it was a groundbreaking project that was much needed and appreciated not only in the countries covered but worldwide as a work of reference. It proved beneficial to field workers at the grassroots and to those agency or government workers planning projects in sustainable agriculture as part of small aid programmes or more wider national development schemes in what was then referred to as the Third World.

The early work is still of great relevance today and much reinvention of the wheel could be saved by a few hours reference to this literature.

Over a quarter of a century has passed since *Bota* was first published and the progress achieved in information gathering and dissemination in that time has surpassed that made in any other period in history. Apiculture and apicultural research have been very much a part of this progress, and so this new volume of the bibliography, which now covers more specifically the countries of the Commonwealth, is a much fuller tome than its predecessor. It goes beyond the tropics to include such beekeeping giants as Australia, Canada, New Zealand and, of course, the United Kingdom.

It is available in hard copy but, in keeping with the age, it is also available as a CD-ROM. This medium offers compactness, speed and ease of accessibility to the searchable material, making this volume an even more useful and necessary tool in the twenty-first century.

Richard Jones

Editor

Director IBRA

Cardiff, 2004

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Antigua and Barbuda

Antigua, Organization for Agricultural Development. *Beekeeping in Antigua and Barbuda, West Indies.* St. John's, Antigua: Organization for Agricultural Development. (1987?) 10 pp. [En, Ba]

A brief history of beekeeping in Antigua and Barbuda is given and a development project set up in Antigua in 1982 by the Meals for Millions/Freedom from Hunger Foundation is described. This was based at first on the use of Kenya top-bar hives, then Langstroth hives were introduced. Nectar sources are described and listed. The chief pests are wax moths, ants and frogs. The average annual honey yield is 120 lbs/hive [54.5 kg/hive], and there is a high local demand. Future developments, including a project begun in Barbuda in 1987, are discussed and lists of beekeepers on the two islands are given. *D. G. Lowe*

Inter-American Institute for Cooperation on Agriculture. *Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992.* Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]
IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia.

The first section of the *Proceedings* gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados, Dominica, Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey-bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agro-forestry and environmental protection in the Caribbean. *D. G. Lowe*

Jaima, A. S. *Beekeeping and food security in integrated rural development programmes for Antigua and Barbuda.* Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988. London, UK; International Bee Research Association. (1989) 182–184 ISBN 0-86098-196-7. [En, Bdo]

Australia

Australian Bee Congress, 1st, Queensland. *First Australian Bee Congress.* Bucharest, Rumania: Apimondia Publishing House. (1972 publ. 1973) 239 pp. [En, 4 pl., B]

The theme of the congress was 'presenting Australian honey to the world'; 38 papers are published on the following topics: beekeeping and organisations in different countries; characteristics of individual honeybee workers; races of honeybees; bee forage; beekeeping management; hives and hive parts; rearing and breeding; digestive diseases; poisoning of bees; honey composition, properties and processing; pollination by honeybees. *A. S. Attwood*

International Beekeeping Congress, 26th, Adelaide. *The XXVIth International Congress of Apiculture of Apimondia.* Bucharest, Romania; Apimondia Publishing House. (1977) 616 pp. [En, B]

In Part 1 the proceedings of the Congress are reported. In Part 2 the papers delivered at the Congress sessions are published. Many of these papers are separately abstracted or listed in *Apicultural Abstracts*. Part 3 consists of a report on the activities of Apimondia, 1975–1977. Names and addresses of Congress participants are included. The book is also published in the other languages used by Apimondia (French, German, Russian, Spanish). The five versions differ in that Part 2 contains in full only the papers of greatest interest in the countries speaking the language concerned; the other papers are abstracted. Some papers are given in full in all versions, however, and others are always given as abstracts. The original language of each paper is indicated by a letter under the title, so that readers will know which language version to refer to for comparison. *P. Walker*

Australian Honey Board. *Sixteenth annual report 1978–1979.* Sydney, Australia: Australian Honey Board. (1979) 30 pp. [En, B]

On pp. 10 and 11 the research projects grant aided by the Board are listed as continuing: Nutritional management of colonies on the basis of body protein of the bee; The incidence of nosema disease in relation to the overall nutrition of the bee; Pollination of agricultural and horticultural crops; Synthesis and evaluation of repellants to reduce the pesticide hazards to honeybees. New projects are: Evaluation of strains of honeybees; Prevalence of *Streptococcus pluton* in honeybee colonies in South Australia; Epizootiology and management of European foul brood disease of honeybees in Australia. *E. E. Crane*
647 George Street, Sydney, NSW 2000, Australia.

Queensland Department of Primary Industries. *Beekeeping information.* Brisbane, Australia; Queensland Department of Primary Industries. (1980) 12 pp. [En, B]

Queensland. Laws and Statutes. *Apiaries Act 1982.* Queensland, Australia: Government Printer. (1982) 27 pp. [En, B]

New South Wales Department of Agriculture. *Inquiry by the Industries Assistance Commission into the honey industry.* New South Wales, Australia; Department of Agriculture. (1983) ii + 26 pp. + 12 pl. [En, B]

The honey industry of New South Wales, Australia, has three main sectors – honey production, honey packing sector, and honey retailing sector. These are described, and market factors affecting prices are analysed. Proposals for market reform are made, but the implementation of any

formal price equalisation scheme is not recommended. The Appendices give details of honey packer market shares, gross margins for a 500-hive apiary, and honeybee pollination market potential. D.G. Lowe

Australia, Victorian Apiarists' Association. *Beekeeping on public land.* *Australian Bee Journal* (1990) 71 (10) 14–22 [En, Bj]

This is a submission made by the Victorian Apiarists' Association (VAA) in response to an Issues Paper of the Department of Conservation and Environment, Land Use Policy Section. Data in the Issues Paper are considered to be inaccurate and are amended here. The VAA is strongly in favour of the present licensing system, but feels there may be difficulty in agreeing a fair licence fee. P. Walker

Australia, Honey Research Council. *Commercial beekeeping in Tasmania.* Australia: Honey Research Council. (1990) ii + 40 pp. [En, Bdo]

In Tasmania, Australia, 70% of honey is produced from leatherwood (*Eucryphia lucida* and *E. milliganii*), virtually all of which is located on public land. An average of 822 t of honey and 13 t of beeswax are produced annually: currently there are 777 beekeepers owning 15,213 hives. AFB and EFB are widespread: oxytetracycline is fed to prevent AFB (the only Australian state in which this is permitted) and EFB, though there is considerable variation among beekeepers in disease prevention practices. Other diseases and pests include nosema disease, sac brood, wax moth, *Braula coeca* and possibly chronic bee paralysis. The report describes in detail seasonal colony management, hive and apiary equipment, honey processing and marketing and provision of pollination services. There is a useful summary containing recommendations for improvements in beekeeping practices. Appendices include detailed statistics, beekeeping legislation and lists of flora. A.G. Matheson

Australia, Honeybee Research and Development Council. *Commercial beekeeping in Western Australia.* Kingston, Australia: Honeybee Research and Development Council. (1991) ii + 34 pp. [En, Bdo]

This is the second in a series of reports analysing beekeeping practice in Australia. In Western Australia there are 1248 beekeepers and 51–526 hives; 87 beekeepers, with at least 200 hives each, produce 92% of the state's average honey production of 2454 t. The state produces 10% of Australia's honey, and 60% of its production is exported. Most honey comes from native flora on public land, and most beekeeping is migratory: pollen nutrition is normally adequate, and sugar feeding is not practised. No queen bees are imported to the state, and a government bee breeding programme aiming to provide quality bee stock is described in detail [see also Allan and Carrick, *Australasian Beekeeper* (1989) 90 (2) 72, 74, 78]. AFB is the most serious bee disease present, and the report details government disease inspection and compensation programmes, and beekeepers' disease prevention systems. EFB is not present in the state, so importation of bees, bee products and hive equipment is controlled by permit. Sac brood is also present, nosema disease is thought to occur but has not been confirmed, and wax moth infestations are adequately controlled by hydrogen phosphide (Phostoxin) fumigation.

This report describes the hive and apiary equipment used, methods of product processing and marketing, and the provision of pollination services. It is a valuable analysis of the strengths and weaknesses of a beekeeping industry. A.G. Matheson

Australia, Honeybee Research and Development Council. *National workshop on economic viability of the Australian beekeeping industry, 30 April and 1 May 1991, Australian National University, Canberra, ACT.* Kingston, Australia: Honeybee Research and Development Council and Australian Honey Board. (1991) iv + 321 pp. [En, Bdo]

This publication reports on a 2-day workshop held to analyse the economic viability of the Australian beekeeping industry and to propose a strategy for increasing its profitability. Participants included commercial beekeepers from different industry sectors, scientists, beekeeping advisers, government officials and representatives of industry organisations. The 43 papers, which are given in full, cover production (including diversification and increasing efficiency) and marketing (including quality assurance). The 41-page summary documents the workshop's conclusions and details strategic goals and proposed actions. A.G. Matheson

Australasian Beekeeper. *Biosecurity or disease risk mitigation strategy for the Australian honey bee industry.* *Australasian Beekeeper* (2002) 104 (4) 151–158 [En, Bj]

Measures to reduce the risk of introducing pests and diseases to an apiary and preventing the spread of diseases are set out and explained; action to prevent the introduction of exotic bees, pests and diseases is included. The information has been obtained from the AHBIC website.

Australasian Beekeeper. *Natural resources and public land management conference.* *Australasian Beekeeper* (2002) 103 (12) 500–505, 511–514, 516–517, 520, 522–523 [En, Bj]

Australasian Beekeeper. *Importing bees into the Northern Territory.* *Australasian Beekeeper* (1982) 84 (1) 3 [En, B]

Honeybees have been declared to be stock under the Stock Diseases Act, and imports to NT must be accompanied by a health certificate.

Australasian Beekeeper. *Apiculture in New South Wales: situation statement.* *Australasian Beekeeper* (1992) 93 (11) 448, 450, 454, 460, 464 [En, Bj]

Australia. *Laws and Statutes. Revised conditions for the importation of honeybees (Apis mellifera) into Australia.* *Australasian Beekeeper* (1992) 94 (5) 199–202, 204 [En, Bj]

The regulations described came into force on 9 August 1992.

Australian Bee Journal. *Beekeeping in Australia.* *Australasian Beekeeper* (1993) 74 (9) 8–9 [En, Bj]

Figures are given for the numbers of beekeepers and honeybee colonies, the annual production and value of honey and beeswax, in Australia for 1985–86 to 1991–92 seasons inclusive. Data for each category are broken down by state. In 1991–92 production was 18,948 t of honey and 390 t of beeswax, worth \$A25 million and \$A1.5 million respec-

tively, from 366,000 colonies. Honey production figures for that year are further broken down by hive holding category, with 9348t (49%) produced by beekeepers with 800 colonies or more. A. G. Matheson

Honey Packers and Marketers Association of Australia Inc. Phenol residue in honey. *Australasian Beekeeper* (1993) 74 (3) 15 [En, Bj]

The text of an information bulletin (No. 28, 26 February 1993) issued by the Honey Packers and Marketers Association of Australia is reproduced. It comments on the analysis of honey samples from 75 beekeepers who supply honey to the Honey Corporation of Australia. The results indicate that if a beekeeper uses phenol to clear bees from supers before honey removal, there is a high probability (more than 90%) that phenol will be present in the extracted honey. In the samples examined, the phenol concentration ranged from a trace (less than 0.2 mg/kg) to 12 mg/kg; the average in honey supplied by phenol users was 4.3 mg/kg. Also, the larger the scale of the beekeeping operation, the higher the phenol content in the honey. The HCA Board has issued a direction that its suppliers should stop using phenols and other chemicals for clearing bees before honey extraction. P. Walker

Apimondia. Program and proceedings, International Symposium on bee breeding on the islands, April 19–26, 1995, Island of Vis, Croatia. Bucharest, Romania; Apimondia Publishing House. (1995) 92 pp. [En, Bd]

This book contains the texts of 16 papers presented at this symposium and also includes details of six other contributions given as posters. A list of participants is also included. Most of the papers concern honeybee breeding, but only a small proportion are specifically concerned with island mating stations. Contributions from Croatia deal with beekeeping, bee breeding, oilseed rape and honeybees, radioactive isotopes in honey, poisoning of honeybees, and propolis. Other subjects dealt with include breeding projects with *Apis mellifera carnica*, *A. m. ligustica* and *A. m. caucasica*, queen rearing in Slovenia, South Australia and Greece, breeding for resistance to diseases and parasites, technical aspects of bee breeding (4-allele and 6-allele systems, inbreeding coefficients), and beekeeping in Bosnia and Herzegovina. D. G. Lowe

Australia, Australian Centre for International Agricultural Research (ACIAR). Improving honey and tree seed production in Indonesia and Australia. *ACIAR Research Notes* (1996) (No. RN 17) 4 pp. [En, Bc]

This research note summarises results from a project to improve beekeeping management for honey production and pollination in the tropical forests of Indonesia. In trials in Australia and Indonesia, the importance of high quality pollen sources (at least 20% crude protein) or the feeding of pollen supplements based on yeast, soyabean flour and pollen, was established. In Indonesia, in 1994, feeding before the kapok [*Ceiba pentandra*] honey flow increased average colony populations from 8 to 10.5 combs of bees, and increased honey yields (kapok plus rubber [*Hevea brasiliensis*]) from 24.4 kg/hive to 68.7 kg/hive. The introduction of hives to Eucalyptus plantations increased seeds/fruit and mean seed weight in *E.*

alba and *E. camaldulensis* but not in *E. globulus* or *E. nitens*. D. G. Lowe

Australasian Beekeeper. Investing in commercial honey production. The 4th Mansfield Report. *Australasian Beekeeper* (1996) 97 (11) 454, 458–462 [En, Bj]

Individual capital outlay costs, production costs and standing costs are compared for a 600-hive apiary in 1979, 1981 and 1996; present costs for a 1000-hive apiary are also included. The figures are discussed and, using average yield figures for honey and wax, a cost analysis is set out and examined. P. Walker

Australasian Beekeeper. A new organisation to head up the Australian beekeeping industry. *Australasian Beekeeper* (1996) 97 (11) 451–454 [En, Bj]

The proposed body will be provisionally known as the Honey Industry Council of Australia (or possibly the Council of Australian Honeybee Industries). The preferred plan is to form a council consisting of members from all sections of the industry and all states. Its proposed structure and budget are outlined and its responsibilities, which will devolve from the FCAAA, are set out. P. Walker

Australia, Honeybee Research and Development Council. Research Report 1980–1995. Barton, Australia; Honeybee Research and Development Council. (1996) vii + 104 pp. ISBN 0-642-24437-. [En, Bd]

This report contains summaries of research projects funded by the statutory research levy introduced in the Australian Honey Research Act 1980. Since 1980, there have been 13 projects on bee diseases and pests, one on hive husbandry and management, seven on honey-bee nutrition, 10 on pollination, six on the effects of pesticides, seven on the marketing of Australian honey, seven on breeding and genetics, 10 on resources (bee forage), and three on economic aspects. During the period under review, the HRDC held seven workshops and also published five reports on commercial beekeeping (in New South Wales, Tasmania, Western Australia, South Australia and Queensland). A bibliography lists 178 publications, by author, for research relating to the Australian honey industry, including work carried out before 1980. D. G. Lowe

Australasian Beekeeper. Proposals for a new beekeeping industry peak body. *Australasian Beekeeper* (1997) 98 (7) 275–278, 282 [En, Bj]

This article provides information on the proposed replacement of the FCAAA (Federal Council of Australian Apiarists' Associations) by a new national body for the beekeeping industry [see also *Australasian Beekeeper* (1996) 98 (6) 233–234, 238]. D. G. Lowe

Allan, L. F. Preventing the spread of American foul brood disease through barrier management of hives. *Bulletin, Western Australia Department of Agriculture* (1996) (No. 4318) 16 pp. [En, Bc]

This illustrated booklet describes the causes, effects, propagation, control and economic impact of AFB in Western Australia, and sets out in detail the principles of 'barrier management' to control the disease. This system was intro-

duced in the 1980s and is now used by about 80% of Western Australia's commercial beekeepers. Beekeepers may either use queen excluders to confine brood to the lower box, leaving supers free of brood for extracting, or they may manage their hives without excluders and extract honey on-site using a mobile extracting van. The merits and risks of the two methods are discussed. Numbering and colour coding of equipment can be used to ensure that frames can be returned to the same super, and the super to the hive which had it originally. The aspects of management discussed include making nuclei, honey extraction, autumn and winter management, keeping apiary records and hygiene. *D.G. Lowe*
Agriculture Western Australia, Perth, WA, Australia

Allan, L. F. *Beekeeping in Sichuan Province, China*. *Bee Biz* (1997) (No. 6) 30–32 [En, B] Animal Research and Development Services, Agriculture Western Australia, South Perth, WA 6151, Australia

Allan, L. F. and Carrick, M. J. *The Western Australian Bee Breeding Programme. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apirists' Associations. (1988) 51–53 ISBN 0-86774-011-6 [En, Bdo]

Andersen, E. M. *Hive protection and bee disease eradication by heat sterilisation. Proceedings of the XXVIIIth International Congress of Apiculture, Athens, 1979*. Bucharest, Romania; Apimondia Publishing House. (1980) 329–334 [En, B] 53 Randall Road, Wynnum West, Qd. 4370, Australia

A method for treating wooden beekeeping equipment, originally used for prolonging its life in Australian conditions, is claimed to be useful in killing organisms associated with bee diseases and with destruction of timber, although a full study of this claim has not yet been made. A mixture, preferably 70% paraffin wax, 10% micro-crystalline wax, and 10% each of the polyethylene plastics AC 540 and AC 400, is melted in a suitable tank. The temperature is maintained at 135° C, and hive parts are submerged in the mixture for 10 minutes. In a 2-tank process, supers or other parts are submerged for 8 minutes at 135 deg and then for 4 minutes in a second tank kept at 150 deg. (Flash point of the mixture is 200°.) After drying for two minutes, the supers are sprayed with vinyl-acrylic paint. *P. Walker*

Anderson, D. *The disease and pest situation in the Pacific region; the threat of exotic diseases and pests from Papua New Guinea; diseases and disorders of queen bees*. *Australasian Beekeeper* (1990) 92 (6) 227–231 [En, B] The situation in each of the following is summarised briefly: Fiji, Norfolk Island, Western Samoa and New Zealand. In Papua New Guinea (PNG), beekeeping in the Highland region has been developed with aid from New Zealand, and over 200 beekeepers now have 4000 *Apis mellifera* colonies in hives. However, this beekeeping is threatened by the continuing spread of *A. cerana* swarms

(55–100 km/yr) which are infected with AFB and Kashmir bee virus. These pathogens have not previously been reported in PNG. The swarms are also infested with *Varroa jacobsoni* and possibly low numbers of *Tropilaelaps clareae*. The likely future directions of spread of *A. cerana* are suggested; if they reached Australia, the situation would be very serious. The last part of this article discusses research, just started, on diseases and disorders of *Apis mellifera* queens. *P. Walker*
Division of Entomology, CSIRO, ACT 2601, Australia

Ayling, R. I. *Rev. John Ayling Australian pioneer. The life of Rev. John Ayling clergyman, educator, beekeeper 1825–1897*. Florida, USA; R. I. Ayling (99) 256 pp. [En, Bd]

Ayton, H. *Tasmania, Department of Agriculture. Bee keeping in Tasmania*. *Bulletin, Department of Agriculture, Tasmania* (1981) (No. 58) 40 pp. [En, B]

Barrett, P. William Charles Cotton Grand Bee Master of New Zealand 1842 to 1847. Springwood, NSW, Australia; Banjo Bee Books (97) 160 pp. ISBN 0 646 29300 1 [En, Bd] This is a detailed account of the life of W. C. Cotton from the year in which he published *My bee book* until 1847 when he left New Zealand. During his time there he did much to advance beekeeping, and to improve methods used by both European settlers and Maoris. In 1848 he published *A manual for New Zealand beekeepers*, and in 1849 *Ko uga pi*, a treatise on bees in Maori. *P. Walker*

Barrett, P. *The immigrant bees 1788 to 1898: Volume II. An update on the introduction of European honeybees into Australia and New Zealand*. Springwood, NSW, Australia; Peter Barrett (99) 164 pp. ISBN 0 9586146 0 1 [En, Bd]

Barrett, P. *The immigrant bees 1788–1898: a cyclopaedia on the introduction of European honey bees into Australia and New Zealand*. Springwood, Australia; Peter Barrett. (1995) 200 pp. ISBN 0-646-25812-5 [En, Bd] This is a well-documented account of the very earliest beekeeping history of Australia and New Zealand, based on extensive research into the available literature. It describes the earliest introductions of English or German 'black' bees [*Apis mellifera mellifera*] into New South Wales, Tasmania, Western Australia, and the North and South Islands of New Zealand. The period involved was 1788–1842, although the first undisputed successful introduction of honey-bees into Australasia appears to have occurred in 1822, from the ship 'Isabella'. The subsequent introduction of Italian bees [*A. m. ligustica*] into New South Wales, Tasmania, South Australia (Kangaroo Island) and New Zealand in the period 1862–1880 is also described, and methods of transporting bees by sea during the period from the 1820s to the 1890s are discussed. Once established in Australia and New Zealand, bees were transported by land and accounts of such movements in the period 1827–1870 are given. Some figures for 19th century exports of honey, bees and beeswax are included. A selected bibliography of books, journals, newspapers, encyclopedias and unpublished manuscripts is given and there is a detailed combined author and subject index.

This book will be of value to all those with an interest in beekeeping history. *D. G. Lowe*

Braybrook, L. H. *Forest and flora – their economic value for beekeeping*. *Australasian Beekeeper* (1984) 86 (4) 72–78 [En, B]

This is a report to the Workshop on Apiculture (Standing Committee on Agriculture). It is stressed that the beekeeping industry in Australia must work to ensure that apiculture is accepted as an essential part of agriculture. Research is needed to establish, among other things, the benefits of pollination by honeybees. Beekeepers should be more active on committees and management boards concerned with forest areas, and should work with those who are fighting to preserve forests for other reasons. In particular, beekeepers must ensure that their rights of access to forests are preserved. Submissions from the Public Resource Managers of the Australian States are summarised; none quotes figures for honey production per hectare. *P. Walker*

Briggs, L. *National bee breeding and research project at Hawkesbury Agricultural College*. *Australian Bee Journal* (1983) 64 (1) 11–22 [En, B]

This article is an extract from an application to two Australian grant institutions for financial assistance for this project; the aim of the full HAC project is to establish the capability to service the honeybee breeding research needed in Australia, and to provide high quality breeding stock to Australian beekeepers, and potentially to other countries. In the past most breeding queens have been imported, but the risk of importing disease is now recognised and a quarantine facility has been built near HAC. It is proposed that the College should import queens via this facility and make available instrumentally inseminated stock. At present 16 lines of pure races and strains are held at the College and it is important that evaluation of these lines and of new selections should continue. Also of considerable interest for research are the unique pure Ligurian honeybee population of Kangaroo Island, and the population of pure 'black English bees' near Tarraleagh. The historical background of the College and its present funding are summarised. *P. Walker*

Briggs, L. *The next 200 years. The Second Australian and International Bee Congress, 21–26 July 1988. Keynote address – melliferous flora*. *Australasian Beekeeper* (1989) 90 (7) 307, 310–312, 320–321, 323 [En, B]

This keynote address to the second Australian and International Bee Congress surveyed the distribution and importance of the main bee forage plants of Australia. These include both native plants that evolved with native bees (not honeybees) and other insects and animals and birds, and introduced plants. Since European settlement 200 years ago, much forest and woodland, especially in the south, has been taken for farming land, and much remaining eucalypt woodland is threatened, for various reasons. The proposal to exclude beekeeping from conserved public land is being discussed, but there are insufficient data to allow a decision to be made and further research is needed. Looking ahead over the next 200 years, a fairly optimistic view is taken that the native bee plants in the

forests will not be diminished. It is more difficult to make predictions about introduced crops and weeds. *P. Walker*

Burking, R. C. *A suitability survey of nature reserves for beekeeping in Western Australia*. *Australasian Beekeeper* (1984) 86 (6) 106–107 [En, B]

Burking, R. C. *The effects of wildfires on the Western Australian beekeeping industry*. *Australasian Beekeeper* (1986) 87 (12) 255–258 [En, B]

Between January 1984 and January 1986, fires at six locations in Western Australia damaged over 100,000 ha. A total of 189 apiary sites were affected, with 25–100% of bee forage being burnt. Most were in areas of coastal heath where *Hakea trifurcata* and *Dryandra sessilis* (two important nectar plants) grow, or in areas of *Banksia* woodland with associated ground flora useful for wintering colonies. A formula was developed for estimating losses to the beekeeping industry; it is calculated that the overall projected loss for the 5-year period 1985–89 will be \$A130,000. Several proposals are made for assistance to be given to beekeepers, and for fire control management. *P. Walker*
Apiculture Section, Dept. Agric., WA, Australia

Cahill, D. J. *A short history of beekeeping in the Warwick district*. *Australasian Beekeeper* (1983) 84 (11) 231–234 [En, B]

Carter, K. *More effective crop pollination by stingless bees*. *Aussie Bee* (99) (10) 10–11 [En, B]
Includes some results for water melons.

Chapman-Taylor, R. and Davey, I. *Practical beekeeping: handbook for Australia and New Zealand*. Melbourne, Australia; Inkata Press. (1988) (Ed. 2) xii + 168 pp. ISBN 0-909605-00-0 [En, Bd]

The principles of hive management for the amateur beekeeper.

Clemson, A. *New South Wales, Department of Agriculture. Honey and pollen flora*. Melbourne, Australia; Inkata Press. (1985) iv + 263 pp. ISBN 0-909605-33-5 [En, B]

Although primarily written for the NSW beekeeper, this book is an exceptional production covering over 300 species of bee forage plants in the eastern states of Australia. The book is based on a series of articles that were published in *Australasian Beekeeper* over seven years. It is illustrated with over 700 superb colour photographs, almost all taken by the author. The introductory pages are devoted to a map of the geographical districts, sections on nectar and pollen, and on management of bees particularly when experiencing some of the difficulties associated with certain honey flows, e.g. pollen-deficient flows. The largest part of the book is devoted to trees and shrubs, particularly eucalypts (pp. 13–100) and other native species (pp. 101–178). Three further chapters cover crops, weeds, and ornamental trees, shrubs and garden plants. The entry for each species gives details of nomenclature (botanical and common names), morphology, distribution, flowering cycle, apicultural value, and general value. Each entry has one or (usually) more photographs. The final section of the book contains detailed distribution

guides, a flowering calendar and a glossary of technical terms. There is also an index of common and scientific names. The author refers to several publications consulted in the preparation of this volume, but there is no bibliography as such. As well as its value to beekeepers, especially in NSW, this book should be of particular interest to botanists as it represents the latest and most definitive work on *Eucalyptus* spp., as well as many other Australian trees and shrubs. *R. B. Gulliford*
Dept. Agric., New South Wales, Australia.

Cobey, S. and Lawrence, T. *Commercial application and practical use of the Page-Laidlaw closed population breeding programme. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 68–69 ISBN 0-86774-011-6 [En, Bdo]

Coffey, I.A., Rice, N.V., McIlvride, K.H. and White, B.R. *Report on Australian mission to USSR on genetic improvement of honey bees, 26 August to 9 September 1990. Australasian Beekeeper* (1991) 92 (8) 322–323, 329–330 [En, Bj]

Beekeeping statistics for the USSR are given. The mission, which visited Rybnoe Bee Research Institute and also inspected queen breeding programmes in the Caucasian region, obtained 10 Mountain Grey Caucasian queens for evaluation in Australia. Further exchanges of information and material were agreed. *P. Walker*

Cramb, J. *Climatic influences on honey production. Australasian Beekeeper* (1997) 98 (10) 406–412 [En, Bj]

A graph shows average annual honey production per colony in Western Australia for the period from 1950 to 1992; values vary between 30 and 120 kg/colony. The low production in some years can be explained by climatic conditions and/or bush fires. Long-term records (1910–1989) show an overall decrease in rainfall. The effect of this trend and of possible future climatic changes are discussed. *P. Walker*

Crane, E. *The importance of stingless bees to man in the past. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992*. Cardiff, UK; International Bee Research Association. (1994) 259–264 ISBN 0-86098-215-7 [En, Bdo]

Stingless bees were almost the only source of honey and beeswax in regions outside the Old World until European honey-bees were introduced after 1600. The first of these regions reached by early man, at least 40,000 years ago, was northern Australia. Aboriginal rock paintings show techniques used for locating stingless bee nests and harvesting the honey. Hive beekeeping did not develop but there is some evidence of a form of tree beekeeping. In the Americas, some 10,000 to 20,000 years later, the early inhabitants found many species of stingless bees in the tropical regions, but no rock paintings associated with bees are known from the Americas. From the 1500s

onwards there have been several accounts of the use of stingless bees. In Central America, stingless bees have been kept in hives for over 2000 years, particularly by the Maya people, who used horizontal log hives with stone discs as end-closures. These stone discs have been found at numerous archaeological sites. In parts of South America, beeswax was important for the lost-wax method of gold casting, but there is no direct evidence that beekeeping was practised in these areas. *D. G. Lowe*
Woodside House, Woodside Hill, Gerrards Cross, SL9 9TE, UK

Crosland, M. *The present and future impact of European wasps on beekeeping in Australia. Australian Bee Journal* (1990) 71 (1) 18–23 [En, Bj]

Crozier, R.H. and Crozier, Y.C. *Mitochondrial DNA sequence studies on honey bees. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 99–101 ISBN 0-86774-011-6 [En, Bdo]

Davis, A. and McRory, D. *Various mites from Ontario bee hives. Canadian Beekeeping* (1987) 13 (9) 209 [En, Bj]

In 1986, 22 honeybee colonies in six apiaries in Ontario, Canada, were examined for external or free-living mites. Most of the colonies had been established from New Zealand package bees. Of the four mites found, one was an adult female *Melittiphis alvearius*, and the other three were nymphs of *Parasitus* sp., *Bryobia* sp. and *Cheyletus* sp., respectively. *D. G. Lowe*

Dept. Development Biology, Australian Natn. Univ., Canberra, ACT 2601, Australia.

Day, J.H. *The assesement of risk of severe allergic reactions to bee stings. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 241–242 ISBN 0-86774-011-6 [En, Bdo]

Desailly, N. *American brood disease – prevention using management techniques in Australia. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 97–98 ISBN 0-86774-011-6 [En, Bdo]

Dollin, A. *Australia's first survey on stingless beekeeping. The fascinating results ... Aussie Bee* (99) (10) 6–7 [En, Bj]
Reports survey results from 257 stingless bee beekeepers.

Dollin, A. and Heard, T. North Richmond, NSW, Australia; Australian Native Bee Research Centre *Keeping Australian stingless bees in a log or box. Native Bees of Australia Series, Booklet 5* (97) 14 pp. [En, Bc]

Describes methods of keeping *Trigona carbonaria* or *T. hockingsi* in a hollow log or a box. Different box designs and methods of dividing a colony and harvesting honey are described. P. Walker

Dollin, A., Zabel, R. and Zabel, J. *Boxing and splitting hives: a complete do-it-yourself guide for stingless bee keepers*. North Richmond, NSW, Australia; ANBRC (Native Bees of Australia Series, Booklet 9) (2001) 18 pp. [En, Bc]

Doull, K.M. *The harmful effects of pesticides on pollinators*. *Australasian Beekeeper* (1969) 71 (5) 115–122 [En, B]

Doull, K. M. *Biological and technical factors affecting profitability in beekeeping*. *Australasian Beekeeper* (1973/1974) 75 40–42; 71–73; 97–99; 118–120; 146–147; 163–167 [En, B] Waite Agric. Res. Inst, Univ. Adelaide, Adelaide, SA, Australia

The author draws upon his own experience, as well as the standard works listed, in presenting biological factors which affect honey production. He shows ways in which an understanding of honeybee biology is necessary for successful colony management. Topics covered include: population size; length of life of individual bees; oviposition and brood development; effects of nosema disease, temperature and hive size; bee forage and the importance of pollen. D.G. Lowe

Doull, K.M. *Effect of distance on the attraction of pollen to honeybees in the hive*. *Journal of Apicultural Research* (1974) 13 (1) 27–32 [En, B] Waite Agric. Res. Inst., Univ. Adelaide, Adelaide, SA, Australia

Experiments were made to establish the distance over which pollen in the hive could 'attract' bees (elicit oriented movement in them). The bees' response to pollen declined significantly when its distance was increased from 1.0 to 1.5cm, and even more so when it was increased to 1.5 and 2.0cm; no further significant changes occurred until the distance was increased from 3 to 4 cm. These results relate to a 1-minute period; over a 3-minute period there was a significant decline when the distance was increased from 2 to 4 cm. Only a few bees responded at 6 and 7 cm, and none at greater distances. Behavioural aspects of the results and the significance of the findings in relation to the use of pollen in the hive are discussed. The results are related to behavioural responses of insects to chemicals whose molecules are diffused in the air. The main deduction from the findings of significance in beekeeping is that pollen in the hive is unlikely to be located and used by the bees in the brood area unless it is very close to this area. Author

Eastburn, K. *Migratory beekeeping [in Australia]*. *Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council

of Australian Apiarists' Associations. (1988) 194–196 ISBN 0-86774-011-6 [En, Bdo]

Ellis, R.W., Lacey, P.F. and Ottens, F. *Development of balansa clover for bee production. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 172–173 ISBN 0-86774-011-6 [En, Bdo]

Trifolium balansae was released in South Australia in 1985. During October and November, 1986, observations were made on 16 hives situated on 10-ha sites of flowering *T. balansae*, and 16 control hives kept in areas without *T. balansae*. All hives gained weight and there were significant increases in brood area, stored pollen and honey, but hives in areas of *T. balansae* were no more productive than controls. This clover flowers from late September to mid-November in S. Australia, and produces a light-coloured honey of acceptable quality, but its capacity to produce large amounts of nectar is not yet proven. The pollen contains 27–29% protein (dry weight) and an amino acid composition satisfactory for honeybee nutrition. D.G. Lowe

Dept. Agric., Struan, SA, Australia.

Evans, S. Victoria, Department of Agriculture. *An economic survey of the honey industry in Victoria: 1980–81*. Research Project, Department of Agriculture, Victoria (1984) (No. 186) v + 63 pp. [En, B]

The survey was based on the operations of 30 of the 53 commercial beekeepers in Victoria (each managed 400 or more hives and received at least 60% of their income from honey and other products). Most were in central and north-east Victoria; on average they had been involved in beekeeping for 25 years or more. The beekeepers earned over 90% of their gross income from honey production; 95% of honey produced was sold to commercial packers. Direct transport costs and labour costs together accounted for 59% of the total costs; family labour costs (paid or imputed) represented, on average, 22% of total costs. From this small survey, average net operating profits and average investment figures are calculated. Most of the beekeepers would be prepared to borrow for profitable business expansion, but the actual level of borrowing (at 30 June 1981) was low. P. Walker

Economics and Marketing Branch, Dept. Agric., Victoria, Australia

Ferguson, F. *Long term effects of systemic pesticides on honey bees. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 137–141 ISBN 0-86774-011-6 [En, Bdo]

The effects of feeding sub-lethal doses of systemic pesticides in sugar syrup to honeybees in 6-frame nucleus hives were evaluated in Queensland, Australia. Brood mortality

occurred within six days in colonies receiving dimethoate, methamidophos, monocrotophos and omethoate at 2.5 and 5.0 ppm; these colonies died out or were robbed. In colonies treated with the 1.0, 0.5 and 0.1 ppm concentrations of these pesticides larval mortality occurred at between 14 and 40 days of feeding, but the majority of these colonies recovered. Colonies fed methidathion, 2,4-D, demeton-s-methyl, fenthion and fenamiphos at 2.5 and 5.0 ppm were devoid of larvae within 17–25 days of feeding, but the effects of this group of pesticides were not as severe as those of the former group. Glyphosate did not significantly affect adult bees or brood. Pesticide residues in pollen collected by honeybees from sunflower and oil seed rape crops treated with pesticides at recommended field rates were at a level that caused larval mortality. Queens in colonies fed methamidophos ceased laying and did not recommence for up to 52 days. Management of colonies which may be exposed to systemic pesticides is discussed. *D.G. Lowe*
Queensland Agric. Coll., Lawes, Qld., Australia.

Gill, R.A. *The cost of carting bees.* *Australasian Beekeeper* (1988) 90 (3) 129,135 [En, Bj]

As part of an overall analysis of the profitability of Australian beekeeping, transport costs were assessed in relation to several variables for beekeeping enterprises with 100, 400, 700 and 1200 colonies. Costs for moving hives were calculated as a percentage of total variable costs, and the percentage was consistently highest for 400 hives and lowest for 700 hives. Whatever the number of hives the percentage increased directly with increasing distance travelled; for 1200 hives, figures were 5% for 5000 km and 55% for 60,000 km. If honey yield and price were high it was found that, for 1200 colonies, it was profitable to move hives, even 60,000 km annually, but if yield and price were low it was not worth transporting them more than 10,000 km annually. When assessing available honey flows, the cost of transport must always be taken into account. *P. Walker*

Dept. Agric. Economics and Business Management, Univ. New England, Armidale, NSW,

Gill, R.A. *An economic evaluation of alternative management practices and enterprise structures in the Australian beekeeping industry.* Armidale, NSW, Australia; University of New England, Department of Agricultural Economics and Business Management. (1989) viii + 175 pp. ISBN 0-85834-791-1 [En, Bdo]

This study comprises a detailed analysis of a wide array of individual beekeeping enterprise structures. The selected structures range from the smallest enterprises likely to be encountered up to the largest. For each enterprise structure, costs and returns are assessed over a wide range of values for key parameters such as price, yield and annual travel distance. The parameter values considered range from the lowest to the highest values likely to be encountered under Australian conditions. For example, the costs and returns associated with specialised honey production are calculated for honey prices ranging from \$A0.80 to \$A1.20/kg, for annual honey yields ranging from 60 to 120 kg/hive and for travel distances ranging from 5,000 to 60,000 km. A very large array of beekeeping enterprise

structures is conceivable. Only a limited set of such structures have been considered in this paper, but it is hoped that the reader will be able to use the details given for basic enterprise structures to construct a financial appraisal for any diversified structure. Pollination services operations are considered as dual product, diversified structures incorporating various levels of simultaneous involvement in contract pollination and honey production. Queen breeding is similarly considered for various combinations of queen rearing and honey production activity. The main sections of the study are: beekeeping enterprise organisation, beekeeping plant and equipment, enterprise overheads, enterprise variable costs, income, gross margins analysis, enterprise profit and return on capital, discussion. The three appendices give detailed figures for depreciation, gross margins and profits and return on capital. This study is aimed at beekeepers and policy makers and is also intended to serve as a database for subsequent beekeeping industry studies to be conducted by the author and others. *D.G. Lowe*

Gill, R.A. *The value of honeybee pollination to society. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990* [edited by Heemert, C. van and Ruijter, A. de]. Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 62–68 ISBN 90-6605-384-4 [En, Bd]

Previous attempts to evaluate the benefits attributable to the pollinating activities of honeybees are reviewed and criticised, and a value for the relatively undeveloped pollination services market in Australia is derived and discussed. *D.G. Lowe*

Dept. Agric. Economics & Business Management, Univ. New England, Armidale, NSW 2351, Australia.

Gisz, P. *Income taxation for beekeepers.* Goulburn, NSW, Australia; Department of Agriculture. (1979) 12 pp. + 2 pl. [En, B]

Goebel, R. *Beekeeping in tropical Australia. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988* [edited by Rhodes, J.W.]. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 190–193 ISBN 0-86774-011-6 [En, Bdo]

Goebel, R.L. *Beekeeping – some plants of use to beekeeping in central Queensland [Australia].* *Beekeeping Information Sheet, Queensland Department of Primary Industries* (1987) (No. 200) 4 pp. [En, Bc]

Goodman, R. and Oldroyd, B. *Business opportunities in agriculture and horticulture: beekeeping.* Warragul, Australia; Victorian College of Agriculture and Horticulture. (1987) iv + 73 pp. ISBN 0-947185-64-X [En, Bdo]

This booklet is part of the literature provided by the Victorian College of Agriculture and Horticulture for use in a correspondence course on business opportunities. It does not aim to teach beekeeping management techniques but to introduce prospective commercial beekeepers to

the special nature of the beekeeping industry. After an overview of the Victorian beekeeping industry, instructions are given on how to start and on what physical factors (climate, apiary sites, sources of forage, etc.) need to be taken into account. This is followed by chapters on apiary products and economic considerations. A case study is presented to illustrate the problems and lifestyle of a new commercial beekeeper. The final chapters cover marketing and possible future trends in Victorian apiculture. The booklet includes question and answer exercises and a worksheet. *D. G. Lowe*

Victorian Coll. Agric. & Hort., McMillan Campus, PO Box 353, Warragul, Victoria 3820, Australia.

Goodman, R. D. *Cinnamon fungus: with comments on its relation to the beekeeping industry*. *Beekeepers' Bulletin* (1973) 17 (2) 10–14 [En, B] Apicultural Res. Unit, Ferntree Gully, Victoria, Australia

The life history, occurrence, spread and hosts of *Phytophthora cinnamoni* are given. The effect on beekeeping is at present minimal as the trees affected are mostly those of lesser importance for honey production. The main honey-yielding forests, red gum, box and ironbark, appear to be out of the climatic range of the disease. Areas of grass trees, shrubs and other pollen-yielding plants in diseased areas may be badly affected, and thus colony building potential there would be reduced. *A. S. Attwood*

Goodman, R. D. *Information guide for beekeepers*. Ferntree Gully, Victoria, Australia; Apicultural Research Unit, Department of Agriculture. (1976) 17 pp. [En, B] Contains names, addresses and phone numbers of firms and organisations within the state of Victoria; a new edition is usually printed every year.

Goodman, R. (ed.) *Victoria, Australia, Department of Agriculture. Beekeeping*. Melbourne, Australia; Creative Solutions. (1991) (Ed. 7) viii + 177 pp. ISBN 0-7241-9839-3 [En, Bd]

This book was first published as *Beekeeping in Victoria* in 1925. It combines a basic text for the beginner with ideas for the experienced commercial beekeeper. The text has now been thoroughly revised and the book has a more attractive, modern appearance. It should continue to be of use to beekeepers throughout southeastern Australia. *D. G. Lowe*

Institute of Plant Sciences, Department of Agriculture, Burnley Gardens, Burnley, Victoria 3121, Australia.

Guilfoyle, J. L. *New product development in beekeeping equipment. Proceedings of the XXVth International Apicultural Congress, Grenoble*. Bucharest, Romania; Apimondia Publishing House. (1975) 519–526 [En, B] Illustrated account of equipment used in Australia.

Gulliford, R. B. *[The Australasian Beekeeper – centenary issue]*. *Australasian Beekeeper* (99) 100 (12) 488–601 [En, B]

Over 100 pages of this centenary issue of the journal are devoted to an account of Australian beekeeping during the period, as reflected in the journal. A little information for New Zealand is included. Each decade is dealt with in

turn (Chapters 1–10), and each Chapter is subdivided into states and subject topics; the presentation is described as 'notebook style'. As a result, a great deal of information is collected together, and it will be useful to anyone interested in particular periods of beekeeping history in the region; a subject index would enhance its value. *P. Walker*

Gulliford, R. B. *A dictionary of scientific and practical beekeeping*. Tamworth, Australia; Author (2001) 520 pp. [En, Bd] Starting with a core selection of English terms listed in Dictionary of beekeeping terms, Vol. 1 (E. Crane, 1951), the author added new ones from the beekeeping field and also useful terms from other sciences. Each term is defined and explained, and the correct English pronunciation is given if necessary. The dictionary is up to date; it includes, for example, *Varroa destructor* and genetic engineering. There are numerous cross-references leading to preferred terms. *P. Walker*

Gulliford, R. B. *Apiary Extension Officers*. *Bee World* (1974) 55 (4) 145–148 [En, B] Refers especially to Australia.

Gulliford, R. B. *Management of commercial apiaries in Australia*. *Apiacta* (1980) 15 (4) 152–158 [En, B]

Gulliford, R. B. *Bees – abandoned, neglected and a nuisance*. *Bee Management Series*, New South Wales Department of Agriculture (1987) 16 pp. [En, Bc] Outlines the requirements of the New South Wales 1985 Apiaries Act, regarding situations where bees are a nuisance.

Gulliford, R. B. *The layman's guide to the Apiaries Act 1985*. *Bee Management Series*, New South Wales Department of Agriculture (1987) (Ed.2) 24 pp. [En, Bc] Legislation to regulate the keeping of bees in New South Wales, Australia.

Gulliford, R. B. *Computer aided beekeeping management and financial control. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 221–222 ISBN 0-86774-011-6 [En, Bdo]

Gulliford, R. B. *Australia, NSW Agriculture & Fisheries. Beekeeping for business and pleasure*. Tamworth, NSW, Australia; NSW Agriculture & Fisheries. (1989) 512 pp. + 3 audio tapes ISBN 1-86277-344-0 [En, Bdo]

This home study course has been developed by NSW Agriculture & Fisheries to help both new and experienced beekeepers. The student profile is described as 'A beekeeper with a range of 1 to 200 hives who is predominantly interested in honey production. The beekeeper may be a part-time farmer or have no involvement with farming. In either case there is a financial interest in the enterprise.' The course comprises a course pack (268 pp.), which consists of six booklets in a loose-leaf folder, and a resource pack (244 pp.), which consists of a second folder

with eight booklets in the 'Bee Management Series', five 'Agfacts' leaflets and three audio tapes. The basic course consists of 10 chapters: introduction to beekeeping; hives, equipment and maintenance; honey and pollen flora; selecting sites and moving bees; comb manipulation and hive management; the production enterprises [hive products, pollination]; swarming; queen rearing; diseases; financial management and decision making. Each chapter includes objectives, a technical section, a review and a series of practical exercises. The resource pack supplements the course by providing additional information and alternative ideas. The course is designed for Australian (and particularly NSW) beekeepers, but much of the well-presented information and helpful advice it contains could also be useful to beekeepers keeping *Apis mellifera* in movable-comb hives elsewhere in the world. The course is available from Home Studies Courses, C.B. Alexander Agricultural College, Paterson, NSW 2421, Australia. D.G. Lowe
NSW Agriculture & Fisheries, PO Box 547, Tamworth, NSW 2340, Australia.

Gulliford, R.B. and White, B.R. New South Wales Department of Agriculture. *Commercial beekeeping [in New South Wales, Australia]*. New South Wales, Australia; Department of Agriculture. (1975) 6 pp. [En, B]

Gulliford, R.B. (ed.) *Investing in commercial honey production (an outline and commentary on the 3rd Mansfield Report)*. NSW, Australia; Department of Agriculture. (1981) 9 pp. [En, B]

Guy, R.D. *Australian beemen – thank you*. *South African Bee Journal* (1973) 45 (1) 3–14 [En, B] P.O. Box 151, Empangeni, Zululand, South Africa

This illustrated account of a study tour of Australian beekeeping by a group from South Africa gives much information on practices and equipment used in commercial beekeeping. E. E. Crane

Hall, D.W. *Consumer directed [honey] marketing – the industrial manufacturing market segment opportunity*. *Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 260–264 ISBN 0-86774-011-6 [En, Bdo]

Heard, T.A. and Dollin, A.E. *Stingless bee keeping in Australia: snapshot of an infant industry*. *Apiacta* (2000) 35 (2) 57–64 [En, B] CSIRO Entomology, PMB 3, Indooroopilly, Qld 4068, Australia.

Heard, T.A. and Dollin, A.E. *Stingless bee keeping in Australia: snapshot of an infant industry*. *Bee World* (2000) 81 (3) 116–125 [En, B]

In a survey made in 1998/99, replies were received from 257 stingless bee keepers with 1429 colonies; 82% of these colonies were in hives and the rest in logs and other natural cavities. The industry is concentrated in coastal Queensland, and *Trigona carbonaria* is the most common species

kept. The beekeepers expected their rate of future colony increase to be 15–18% per annum. Main reasons for keeping stingless bees were: enjoyment, conservation, crop pollination (especial/stingless bees, beekeepingly macadamia nut), honey production and hive sales. P. Walker
CSIRO Entomology, Long Pocket Laboratories, 120 Meiers Rd, Indooroopilly, Qld 4068, Australia.

Heard, T. *Establishment and propagation of hives of the stingless bee Trigona carbonaria*. *Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 114–116 ISBN 0-86774-011-6 [En, Bdo]

Hornitzky, M., McDonald, R. and Kleinschmidt, G. Australia, *Honeybee Research and Development Committee. Commercial beekeeping in Victoria*. Barton, Australia; Honeybee Research and Development Committee. (1996) 25 pp. [En, Bdo]

This report covers the following aspects: management for honey production and pollination services, nutrition, queens, diseases and pests, equipment, harvesting honey and beeswax, marketing honey and beeswax, pollination, resource base (apiary sites). Appendix 1 lists plant species used as bee forage in Victoria, and instructions for the control of AFB are given in Appendix 2. D.G. Lowe

Hornitzky, M.A.Z. *Commercial use of gamma radiation in the beekeeping industry*. *Bee World* (1994) 75 (3) 135–142 [En, B]

The greatest use of gamma radiation in the beekeeping industry is in the control of AFB by sterilising hive equipment contaminated with *Bacillus* larvae. Doses of 1–10 kGy have been recommended. In Australia, gamma irradiation treatment has been recognised legally as an alternative to burning contaminated hives; the instructions which are given to beekeepers in New South Wales are listed. Combs exposed to up to 8 kGy of gamma radiation still contain viable *Melissococcus pluton*, the causative agent of EFB, and the dose required for decontamination has not yet been determined. It is likely that spores of *Nosema apis* and other protozoa would be killed by comparatively low doses of gamma radiation, but the effects on fungal pathogens (e.g. *Ascosphaera apis*) and bee viruses have not yet been determined. Gamma radiation treatment of honey can cause a foamy scum and cloudiness; no significant deterioration in quality has been found, but further work is necessary. Gamma radiation can also be used for the decontamination of sugar 'candy' and pollen used for feeding bees. A limitation of the use of gamma radiation in beekeeping is the small number of treatment plants that exist worldwide. D.G. Lowe

NSW Agriculture, Elizabeth Macarthur Agric. Inst., Regional Veterinary Laboratory, PMB 8, Camden, NSW 2570, Australia

Jamieson, B.R. *Detections of Apis cerana in the Australian port of Brisbane*. *Canadian Beekeeping* (2000) 21 (6) 130 [En, B]

Two detections are reported.

Jones, W.A. Pesticides affecting beekeeping and crop pollination. Australia; New South Wales Department of Agriculture. (1985) 20 pp. [En, B]

How poisoning of honeybees occurs; symptoms of poisoning; suggestions for reducing bee losses; toxicity ratings of 100+ pesticides.

Jones, W.A. A pollination study into relative self compatibility levels of 25 sunflower oilseed cultivars. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 131–134 ISBN 0-86774-011-6 [En, Bdo]

The seed yields (g/head) of (A) unbagged and (B) bagged heads of 25 sunflower cultivars were determined in trials in NSW, Australia, in 1984–85 and 1986–87. The relative self-compatibility (A divided by B x 100) of cultivars varied from 37.5 to 105.2 g, while the percentage of yield increase produced by honeybee pollination varied from –4.89 to 167%. With the exception of two cultivars that gave decreases of 4.77% and 4.89% in the 1986–87 trial, all cultivars showed a significant increase in yield in the presence of bees. *D.G. Lowe*

Dept. Agric., P.O. Box 865, Dubbo, NSW, Australia.

Jones, W.A. The role of supplementary feeding in managed pollination. *Bee Briefs* (1993) 10 (1) 5–8 [En, Bj] The building-up of colonies for pollination, and especially the presence of workers with 40–60% body protein, may require supplementary feeding. Various ways of feeding carbohydrates and proteins are discussed. For dry feeding of a protein supplement in the open, a drum with the end removed and replaced by wire mesh can be used. A large drum is laid horizontally on the ground; a smaller one can be fixed in a tree. Alternatively, a protein supplement can be made into a flat patty that is put in the hive. The top-hat type feeder is considered to be the most practical for wet or dry feeding. A table gives the amounts of individual amino acids in torula yeast and brewer's yeast, and in expeller flours from canola, soya and sunflower. Some information on their attractiveness to bees is given. *P. Walker*

NSW Agriculture, Dubbo, NSW, Australia.

Jones, W.A. 'To bee or not to bee': honey-bees in the Australian environment. *Australasian Beekeeper* (1996) 98 (1) 29–34 [En, Bj] Pinecrest, Durraveen Lane, MS1, Dubbo 2830, NSW, Australia

The important current and potential benefits of a stable beekeeping industry in New South Wales are set out. However, the increasing restriction of access to forest areas is considered to be a threat to the long-term viability of beekeeping and agriculture. It is hoped that the National Parks and Wildlife Service will reconsider its policy of restricting access by beekeepers to conserved areas. *P. Walker*

Kersell, A.C. and Burking, R.C. Western Australia's beekeepers' reserves. *Journal of Agriculture – Western Australia* (1983) 24 (3) 100–101 [En, B]

An extensive area of land in Western Australia has been allotted to the conservation of flora for beekeeping.

Kessell, A.C. and Burking, R.C. 'Management proposals for beekeepers' reserves'. *Australasian Beekeeper* (1984) 85 (8) 149–156 [En, B]

Areas of land in Western Australia unsuitable for agriculture that have been reserved for exclusive use by beekeepers.

Kim, Jai Gil and Lee, SuHan. Comparative research on the microbiological examination of domestic honey and foreign honey (illegally distributed). *Korean Journal of Apiculture* (1992) 7 (2) 156–161 [Ko, en, Bj] Korea Beekeeping Association, 301 Sambo Bld., Chongro 6-Ga, Seoul 110–126, Korea Republic

Eight samples of one-year-old honey (two each of acacia, chestnut, rape and multifloral honey), four samples of imported honey (three from Australia, one from Canada), and one sample of 'honey' from sugar-fed bees were analysed for microorganisms. The total mesophilic aerobic plate count for Korean honeys ranged from 30 to 90 (average 60), whereas for imported honeys it ranged from 70 to 240 (average 155) and in sugar 'honey' it was 350. The higher microbiological contamination of imported honeys is attributed to long-term distribution, packing etc. None of the samples contained coliform bacteria. *D.G. Lowe*

Kleinschmidt, G. Influence of hive design & hive position on pallet on honey production on the Atherton Tableland. *Australasian Beekeeper* (1993) 95 (3) 111–113, 115 [En, Bj]

In Queensland, Australia, 56 honey-bee (*Apis mellifera*) colonies were housed in hives of eight different designs, varying in colour, ventilation, and type of hive body. Hives were mounted on pallets in groups of four. Monthly checks were made of brood area and bee numbers, and samples of honey taken. The temperature and RH of the hive interior and environment were recorded. Hives were weighed weekly. Hive design had no effect on honey production, honey sugar content, bee numbers or brood area. There were significant differences in honey production, honey sugar content, bee numbers and brood area during different months: it is suggested that the major determinant of colony strength is availability of food resources. Honey sugar content was highest when ambient humidity was lowest. Bee numbers, brood area and hive weight were correlated during the first three months of the trial as colonies expanded. Drifting of bees between adjacent hives on pallets with entrances facing in the same direction was minimised by placing a metal sheet between the hives: honey production was not influenced by position on the pallet. *A.G. Matheson*

Kleinschmidt, G.J. Field evaluation of production from colonies operated in a range of hive bodies. *Australasian Beekeeper* (1976) 77 (12) 266–268 [En, B] Queensland Agric. Coll., Lawes, Gatton, Qd. Australia

The following question was investigated: is honey colour (equated to quality) at each individual 'robbing' (extraction) affected by management, and movement of combs in the hive previously? Hive bodies, full depth and shallow, and with eight and 10 frames, were used; some had fixed frames. The total weight of cappings (wax + honey) per

super at one extraction ranged from 3.66 kg (Manley) to 9.36 kg (fixed-frame); the beeswax yield was 0.38–1.08 kg. The honey yield from cappings varied from 11% (Manley) to 29% (fixed-frame) of total honey yield. The average (17%) is regarded as an estimate of the potential hazard to honey quality by the addition of the (overheated) honey separated from cappings wax. Translocation of old stores in the hive darkened honey obtained at the first extraction; subsequent use of a second brood chamber as a honey super darkened a later honey crop. Honey extraction must be programmed to prevent admixture of darkened honey with light honey. *E. E. Crane*

Kleinschmidt, G.J. *The influence of hive design on honey production and colony management.* Australasian Beekeeper (1978) 80 (2) 35–38 [En, B]

Selection of hive size on an economic basis is dependent on the management system practised. Honey production units manned by semi-skilled or single operators were more economic in two 8-frame full-depth and two 8-frame W.S. Pender hives. An experienced honey production team was equally economic with two 8-frame full-depth, two 8-frame W.S. Pender, and single-chamber full-depth hives. Reduced production and increased labour requirements made six other hive equipment combinations less profitable. *Author*

Queensland Agric. Coll., Lawes, Gatton, Qd, Australia.

Kleinschmidt, G.J. *Influence of management on the effects of nosema disease.* Australasian Beekeeper (1979) 81 (2) 34–35 [En, B] Queensland Agric. Coll., Lawes, Gatton, Qd., Australia

During the winter and spring of 1977 and 1978 in Queensland, Australia, one group of colonies was used from July onwards to work heavy flows with inadequate pollen resources, and a second group remained in an area of light nectar and pollen flows. Bees in both groups were infected with *Nosema* spores by feeding. In the first group nosema disease reached a peak in August (4.5×10^6 spores/bee) and was still high in September. Breed rearing was low because of poor quality pollen, mortality was high, and colonies were reduced to too small a size to take advantage of the major spring flows. The colonies kept at the original site were not used for honey production until late June. By September, the level of nosema disease had increased (up to 1.9×10^6 spores/bee), but the rapid brood rearing in July–September compensated for the increased bee mortality. *J.M. Gedy*

Kleinschmidt, G.J. *Standardization of hive equipment.* Apiacta (1981) 16 (1) 3–11, 14 [En, B] Queensland Agric. Coll., Lawes, Gatton, Qd., Australia

Several combinations of hive equipment were tested in various climatic conditions in Australia, and assessed according to labour requirements and colony productivity. Different combinations are recommended for different conditions of temperature and RH. The results show that it is impractical to standardise hive equipment for all conditions, but if a single standard is to be used, the 10-frame full-depth Langstroth hive body is the most suitable for Australian conditions. When two brood chambers are used, the full depth may be too deep, and a W.S. Pender

hive body (19.4 cm) would be more effective. However, length and width should be Langstroth size so that the same covers, bottom boards etc., can be used on all units. *P. Walker*

Kleinschmidt, G.J. *Graham J. Kleinschmidt research papers.* Lawes, Qld., Australia; Queensland Agricultural College and the Queensland Beekeepers Association. (1986) 265 pp. [En, Bdo]

The research described in these papers was carried out at the Queensland Agricultural College in the period 1967–85. Much of it was financed by the honey and/or oil seed industries, and it was conducted in commercial situations under normal production conditions so that the findings would be directly applicable to industry. The individual papers, which are producer – management oriented, have been presented at conferences and workshops, and a number have appeared in *Australasian Beekeeper*. They are gathered together here in a loose-leaf ring binder, and it is intended that future papers will be issued in the same format. The papers are grouped under nine main headings – population management, nutrition, pollen, queen bees, diseases, hive equipment, honey processing and storage, pollination, and pesticides. Where applicable, a summary combining results from several projects is presented. The individual research topics include aspects such as colony management for maximum populations, advantages and disadvantages of supplementary feeding, pollen sources in agricultural areas, evaluation of honeybee breeding stock, influence of management on the effects of nosema disease, influence of hive design on honey production, temperature darkening of honey, management of honeybees for pollination, and toxicity of insecticides to honeybees in major entomophilous crops in Australia. The management methods described and discussed in the book are especially applicable to Australian conditions, but the research and basic principles they are based on should be of interest to anyone concerned with managing honeybee colonies. *D.G. Lowe*

Plant Protection Dept., Queensland Agric. Coll., Lawes, Qld. 4345, Australia.

Kleinschmidt, G.J. *Feeding and populations.* Australian Bee Journal (1988) 69 (1) 8–12 [En, Bj]

Some research and current projects at the Queensland Agricultural College are reviewed briefly. The subjects covered are: determination of honeybee colony population level that is optimal for honey production; management for optimal population, including feeding with sugar syrup and/or pollen (or pollen supplements) when necessary. Current research includes field trials with various pollen supplements. *P. Walker*

Queensland Agric. Coll., Lawes, Gatton, Qld., Australia.

Kleinschmidt, G.J. and Furguson, F. *Honey bee protein fluctuations in the Channel Country of south-west Queensland.* Australasian Beekeeper (1989) 91 (4) 163–165 [En, Bj]

In 1987 and 1988, the value and quality of available plant pollens varied widely between sites in this area and from month to month. Strong colonies with sufficient brood and protein reserves were able to forage actively for nectar

during pollen dearths, but weaker colonies produced less honey during such periods. Colonies that had been foraging on nectar sources such as *Helianthus annuus* or *Eucalyptus moluccana* had low protein reserves and at some sites were unable to build up satisfactorily before the *E. ochrophloia* flow. Such colonies would benefit from pollen supplements, perhaps given before migration to remote sites. *P. Walker*

Kleinschmidt, G. J. and Kondos, A. C. *The effect of dietary protein on colony performance.* Australasian Beekeeper (1978) 79 (12) 251–257 [En, B] Queensland Agric. Coll., Lawes, Gatton, Qd., Australia

Protein in adult bees examined in Queensland constituted between 21 and 67% of body weight; it was directly related to the quantity and composition of pollen available. During heavy nectar flows, bees in colonies with a rapid decrease in body protein lived for 20–26 days; in colonies in which body protein remained above 40%, workers lived for 46–50 days. In the latter, large populations were maintained during a flow lasting 12 weeks. Thus it is recommended that body protein levels should be kept above 40%, and a suitable management system used in Queensland is described. *P. Walker*

Kleinschmidt, G. J. and Kondos, A. C. *Colony management for low quality pollens.* Australasian Beekeeper (1979) 81 (1) 5–6 [En, B] Queensland Agric. Coll., Lawes, Gatton, Qd., Australia.

Colonies of honeybees which wintered in an area of light nectar and pollen flows in Queensland, Australia, were able to maintain brood rearing and body protein. Colonies which foraged throughout summer on sunflower (which has low quality pollen) maintained their colony strength although body protein decreased. When moved to a winter honey flow with a scarcity of pollen, colony size showed a rapid reduction. If the winter flow was light and intermittent, the colonies were able to build up body protein gradually. *J. M. Gedy*

Kleinschmidt, G. J., Kondos, A. C., Harden, J. and Turner, J. W. *Colony management for maximum populations.* Australian Bee Journal (1987) 68 (11) 17–20 [En, B]

Experimental colonies were overwintered in hives with two full-depth hive-bodies separated by a queen excluder. Ten weeks before the flow, the average population in these colonies was 25,000 bees, and the queen was laying 700 eggs/day. The following comb movement procedure was then applied. (1) Outside brood chamber combs were positioned in the middle of the super, and empty combs were introduced into positions 3 and 7 of the brood chamber (nine combs per hive-body). (2) Two weeks later, a new super of 'sticky' combs was placed on to the brood chamber, and two of the poorest brood combs were moved into the new super. These combs were replaced by two 'sticky' combs in positions 3 and 7 of the brood chamber. (3) Two weeks later, two more combs from the new super were exchanged as in (2). (4) Step (3) was repeated after two weeks. (5) One or two weeks after step (4) the colonies were moved to a honey flow where they were left for at least one week or until honey and pollen became freely available. At this stage, a new super was placed on to the brood chamber and two or three combs of brood exchanged with

empty combs placed in positions 3 and 7 or 2, 5 and 8 of the brood chamber. At this stage, hives were four boxes high and the procedure was completed in approximately 10 weeks. A high rate of egg laying was stimulated, and when the flow started the colony population was about 50,000–62,000 adults, with a further 30,000–35,000 bees developing (provided pollen was available). Where there are two build-up periods in a year, it is advised that colonies must be requeened annually. [Article published originally in *The Gippsland Apiarist*] *P. Walker*
Queensland Agric. Coll., Lawes, Gatton, Qd., Australia.

Knight, R. C. *Results of a survey of beekeepers in New South Wales.* Quarterly Review of Agricultural Economics (1972) 25 (1) 56–65 [En, B]

The survey, which covered the production year 1969–70, showed that seasonal conditions were generally favourable for honey production in New South Wales in that season. Calculations estimated the average net enterprise income to be \$A6,856, and the rate of return to capital and management 23%. This rate is comparable with those from industries which do not have a major land and building component. It was found that beekeepers were inclined to be individualistic and independent. One major effect was that this tended to limit the extent of investment undertaken which had to be financed by external sources. Consequently investment in capital items was restricted, in particular the installation of central extraction plant which allows the beekeeper to spend more time at headquarters and overcomes the problem of attracting suitable labour. It was concluded that management factors, particularly the ability and willingness to undertake new management systems, were the major features that limited the scale of operation of individual beekeepers.

Author

Federal Council of Australian Apiarists' Associations, Sydney, NSW, Australia.

Langridge, D. and Goodman, R. *Bees and the law: the Bees Act and Regulations [Victoria, Australia].* Australasian Beekeeper (1978) 79 (10) 215–216 [En, B]

Langridge, D. F. and Ilton, C. D. *Victoria, Department of Agriculture. Beekeeping in Victoria.* Melbourne, Australia; Victorian Government Printing Office on behalf of the Department of Agriculture. (1981) iii + 139 pp. ISBN 0-7241-7866-X [En, B]

Lee, B. *Mites, bees, and plagues that are and might be.* Partners in Research for Development (1995) (No. 8) 2–9 [En, Bc]

The successful beekeeping industry in the highlands of Papua New Guinea (PNG) based on *Apis mellifera* has been threatened by the introduction of the mite *Varroa jacobsoni* and its natural host *Apis cerana*, and the mite *Tropilaelaps clareae*. This article reviews recent research showing that in PNG *V. jacobsoni* does not reproduce in *A. mellifera* colonies, and *T. clareae* does not infest colonies of *A. cerana*. It details the distribution of mite and honey-bee species in PNG and neighbouring Irian Jaya, and proposes strategies for eradicating *T. clareae* from the island of New Guinea.

A. G. Matheson

ACIAR, GPO 1571, Canberra, ACT 2601, Australia.

Leigh, J.H. *Honey and beeswax production in semi-arid and arid Australia. The use of trees and shrubs in the dry country of Australia*, by N. Hall et al. Canberra, Australia; Australian Government Publishing Service for the Department of National Development. (1972) 264–283 ISBN 0-642-00021-2 [En, 1 pl., B]

A short general introduction on beekeeping is followed by detailed tables of honey and pollen flora of semi-arid and arid regions of each state. These include 98 entries for eucalypts and 22 for other species, and give habitat, distribution, etc., and significance for honey and pollen. E.E. Crane

Div. Plant Industry, CSIRO, Canberra, Australia.

Lew, Young Soo and Kim, Choong Kyum. *Questionnaire survey on imported package bees from Australia*. *Korean Journal of Apiculture* (1991) 6 (2) 95–105 [Ko, en, Bj]

Package honey-bees (*Apis mellifera*) which were imported from Australia to Korea in 1991 were considered satisfactory by beekeepers replying to a questionnaire. Performance after hiving, honey-gathering capacity and temperament (docility) were good, but there were a few problems with resistance against disease and wintering ability. Author

Korea Beekeeping Association, 301 Sambo Bld., 173 Jongro 6-Ga, Seoul 110–126, Korea Republic.

Liu, T.P. *A scanning electron microscope study on the damage caused by *Acarapis woodi* to the tracheal system of the honey bee. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 117–119 ISBN 0-86774-011-6 [En, Bdo]

Liu, T.P. *Australian strains of Kashmir bee virus*. *Canadian Beekeeping* (1991) 16 (4) 82 [En, Bj]

Beekeepers who import honey-bees (*Apis mellifera*) from Australia should be aware that three strains of Kashmir bee virus have been isolated from bees in different parts of Australia. It is known that bees can carry the virus which, however, may not be active. Affected bees show no symptoms, but some sudden deaths of bees may perhaps be due to the virus. If it is present in imported bees, it will not necessarily cause a problem, although the possibility cannot be ruled out. P. Walker

Agriculture Canada Research Station, Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Lorence, C. and Lorence, K. *Beekeeping down under in New Zealand and Australia*. *American Bee Journal* (2003) 143 (7) 545–548 [En, Bj]

Manning, R. *The Beetube – a new honey bee pollination device in Western Australia*. *Australian Journal of Experimental Agriculture* (2002) 42 (5) 643–647 [En, wf]

The development of a simple, durable, lightweight and disposable beehive for high-density (and netted) orchards and crops distant from beekeeping areas provides a useful product and a further diversification for beekeepers

involved in professional pollination services. The total weight of a Beetube ranged from 2.23 to 3.64 kg, contained about 9101 bees, 3038 cm² of comb, and had a morning and afternoon flight activity of 19–43 and 11–34 honey-bees/min, respectively.

Animal Protection Program, Animal Research and Development Services, Dept of Agriculture, Locked Bag No. 4, Bentley Delivery Centre, WA 6983, Australia.

Manning, R. and Harvey, M. *Fatty acids in honeybee-collected pollens from six endemic Western Australian eucalypts and the possible significance to the Western Australian beekeeping industry*. *Australian Journal of Experimental Agriculture* (2002) 42 (2) 217–223 [En, X]

The pollens analysed had low lipid levels (0.59–1.9%) when compared with many other plant species that have evolved with the European honey-bee. Linoleic acid was found to be dominant (35.7–48%) in the eucalypt pollen lipids; concentrations were 2.77–5.81 mg/g pollen. The six other major fatty acids present in the lipid were myristic, palmitic, stearic, oleic, linolenic and arachidic acids. Two fatty acids with known antibacterial properties were dominant in the pollen lipids of *Corymbia calophylla*: myristic acid (0.25 mg/g pollen) and linolenic acid (1.06 mg/g). It has been reported from other studies that these could inhibit EFB and AFB.

Dairy and Apiculture Program, Animal Research and Development Services, Agriculture WA, Locked Bag No. 4, Bentley Delivery Centre, WA 6983, Australia.

Manning, R. *Environmental factors affecting queen bee matings at Rottnest Island*. *Australasian Beekeeper* (1990) 92 (3) 114, 116 [En, Bj]

This island, which is west of Perth, Western Australia, has no feral honey-bees and is used as a controlled mating station. For queens hatching on 11 different dates from September to December, their mating success (MS, i.e. percentage that mated) ranged from 34.2 to 81.7%. For six of the dates, queens at a mainland mating station had from 71.0 to 89.5% MS. Weather conditions were recorded on the island during the study. The only significant correlation was a negative one between MS and rainfall two days after queens hatched. Although other correlations were not significant, the following may have had some effect on MS: wind speed on day 2, cloud cover and rainfall on day 3, rainfall on day 7, and cloud cover on day 8. Temperature apparently had no effect. P. Walker

Western Australian Department of Agriculture, South Perth, WA, Australia.

Manning, R. *Australia, Western Australian Department of Agriculture. Honey production, economic value and geographical significance of apiary sites in Western Australia. Final report (from a natural resource questionnaire for beekeepers)*. Australia; Western Australian Department of Agriculture, Apiculture Section. (1992) 132 pp. [En, Bdo]

A questionnaire on beekeeping practices and resources was returned by 41% of the 374 beekeepers in Western Australia owning 10 hives or more, and a further 28% of beekeepers were interviewed. Commercial beekeepers use each apiary for c. 12 wk/yr, and stock each site with an average of 101 colonies: for non-commercial beekeepers

the figures are 26 weeks and 60 colonies. About 75% of honey production by commercial beekeepers is from public land (25% for non-commercial beekeepers), and details are given of fluctuations in honey production, apiary site usage and colony migration with flowering of nectar sources in 2-, 3-, 4-year and intermittent cycles. Pollen production in the state is estimated at 78 t/yr, and wax production at 198 t/yr. The author suggests that factors restricting honey production include beekeepers' practices of not stocking apiaries frequently enough or for sufficient duration, and the 1.5 km minimum distance between apiaries on public land. Major threats to honey production are fire, extremes of temperature, decreasing rainfall and increasing deforestation. Honey production could be increased by the planting of more nectar sources (especially *Eucalyptus* spp.). This detailed analysis of the beekeeping industry in Western Australia suggests that its economic value is underestimated by routine statistical surveys. *A. G. Matheson*

Manning, R. *The effect of drawing wax foundation on honey production and the cost of production for export.* *Australasian Beekeeper* (1996) 98 (3) 99–102 [En, B]

The economics of using colonies to draw wax foundation were examined for colonies in a *Eucalyptus calophylla* area north of Perth, Western Australia. In the study period (51 days) 12 test colonies produced an average of 37.4 kg honey/colony compared with 62.3 g in 12 controls (given recently extracted combs). In this period 261 frames were drawn, each at a cost of \$A1.38 (1.15 kg honey/frame). Calculations of other costs, e.g. labour, freight, showed that it would be profitable to export drawn frames to beekeepers in countries where honey prices are much higher, such as Saudi Arabia, where the cost of drawing each foundation sheet is calculated to be about \$A146. Australian-produced frames would cost Saudi beekeepers from \$A8.46 to \$A11.00 per frame. *D. G. Lowe*

Manning, R. *Evaluation of an eleven year queen bee breeding program in Western Australia.* *Australasian Beekeeper* (1996) 97 (8) 317 [En, B]

Queens produced by instrumental insemination in the breeding programme described by Kuhnert et al. [*Apidologie* (1989) 20 (5) 371–381] have been evaluated. Honey production was recorded over 218 days (including two nectar flows) in 40 colonies belonging to beekeepers who regularly obtained queens from the programme. The average honey yield was 34% higher than in 40 control colonies (headed by queens from commercial sources). *P. Walker*

Manning, R. *Evaluation of the Western Australian queen bee breeding program.* *Australian Journal of Experimental Agriculture* (1996) 36 (4) 513–518 [En, 9 ref.]

Agriculture Western Australia's former Queen Bee Breeding Program (QBBP) was successful in significantly raising the productivity of honey-bee colonies for those beekeepers who regularly purchased queen bees from the program. The increased productivity was measured through honey production. Over two nectar flows, colonies headed by queens purchased from the breeding program (group 2) showed a 35% increase in honey production over unselected colonies (group 1 – not pur-

chased from the QBBP). Over individual nectar flows, colonies headed by queens purchased from the breeding program showed a 22% increase in honey production from a *Eucalyptus calophylla* nectar flow, and for a second protracted winter nectar flow from coastal heath they also produced 46% more honey than unselected queen bees. Honey production (kg/colony.day) from *Eucalyptus calophylla* was 0.95 and 1.13 kg for groups 1 and 2, respectively. Honey production from the coastal heath was 0.27 and 0.4 kg/colony.day for groups 1 and 2, respectively. Results were projected for 1 year and scaled up to represent a commercial apiary of 400 colonies. According to estimates from the data, group 2 beekeepers should have benefited from the QBBP by being able to produce 24 t of honey from their apiaries, valued in excess of \$A32,000, more than group 1 beekeepers.

Agriculture Western Australia, Baron-Hay Court, South Perth, WA 6151, Australia.

Manning, R. *Packaged honey bees: the export market, package bee research and economics of the enterprise. A reference for Western Australian beekeepers.* South Perth, Australia; Department of Agriculture, Western Australia. Miscellaneous Publication – Western Australian Department of Agriculture (1996) (No. 17/96) 59 pp. [En, Bdo]

The first part of this publication gives a general background to the production of package bees. It covers: structure and size of packages, health certification, export opportunities and costs, timing and supply, production sites, methods of extracting bees from hives, productive capacity of apiaries, supplementary feeding of colonies, supply problems and factors involved in air transport of package bees. Four research studies, carried out by Agriculture Western Australia, on specific aspects of package bee production, are then described in detail. The studies examined economic aspects of package bee production versus honey production, methods for increasing the yield of bees from hives, the effects of hatching virgin queens above the queen excluder after raising three brood frames into the super, and methods of extracting bees from hives. A reference list of 24 publications is given and an article on transport of live bees by air, by D. MacCulloch, previously published in *Australasian Beekeeper* (1993) 95(3) 122, 125–126, forms an appendix; there are 16 colour photographs. This publication is aimed at Western Australian beekeepers but it will be of interest to any beekeeper seeking an in-depth analysis of the commercial aspects of package bee production. *D. G. Lowe*

Manning, R. *The honey bee debate: a critique of scientific studies of honey bees *Apis mellifera* and their alleged impact on Australian wildlife.* *Victorian Naturalist* (1997) 114 (1) 13–22 [En, Ba]

Factors which could affect the interactions between honey-bees and native Australian flora and fauna are discussed. The main factors are: the nectar resource and its use by honey-bees, bee predation by birds, resource utilisation by commercial hives on apiary sites, mutual exclusion of apiary sites where buffer zones exist; environmental factors. It is concluded that there is no conclusive proof that honey-bees have a significant effect on wildlife and that any interaction which can be found could arguably be a

normal reaction in a complex ecosystem that has its primary food source as nectar and pollen. After 170 years some form of equilibrium has probably been reached.

Author

Animal Research and Development Services, Agriculture Western Australia, 3 Baron-Hay Court, South Perth, Western Australia 6151, Australia.

Manning, R. Honey production, economic value and geographical significance of apiary sites in Western Australia. A natural resource questionnaire for Western Australian beekeepers. *Australasian Beekeeper* (1997) 98 (9) 376–380 [En, Bj]

Through a questionnaire, information was obtained from c. 260 beekeepers with 3475 apiary sites, and this has been analysed. The main results include the following (but tables and figures referred to in the paper are not published here). Commercial beekeepers used their sites for about 12 wks/yr with an average density of 101 hives/site; they produced 77% of the total honey value from these apiary sites. For non-commercial beekeepers figures were 26 wks/yr and 60 hives/site. Total annual production of pollen was estimated as 78 t, and of beeswax 198.4 t. In 1990–91, fires in or around apiary sites probably caused the loss of over 1000 t honey. The estimated value of the sites, calculated from average production figures, was 2.3 times greater than the figure used by the Australian Bureau of Statistics. *P. Walker*

Marstella, C. W. and Thompson, J. K. Beekeeping – Queensland Southern Downs – costs and returns. *Australasian Beekeeper* (1983) 84 (8) 147–149 [En, B]

Matheson, A. Hot news from Sydney. *New Zealand Beekeeper* (1987) (No. 194) 25–27 [En, Bj]

Early trials of the use of gamma radiation (at a plant in Victoria, Australia) to kill *Bacillus* larvae spores in hive parts have been reported (e.g. *Apicultural Abstracts* 601, 602/84). A plant has now been constructed in Sydney, mainly for sterilising medical equipment, and beekeeping equipment is also treated. The procedure is described. Hives must be free of bees and honey. Afterwards, sterilised hives can be immediately restocked with bees, which remove the irradiated AFB scales. Provided a beekeeper has paid a registration fee, the cost of irradiation is paid for by the state government bee diseases compensation scheme. *P. Walker*
Min. Agric. and Fisheries, Nelson, New Zealand.

Matheson, A. G. Preparing the most efficient honey bee colonies for kiwifruit pollination. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 124–126 ISBN 0-86774-011-6 [En, Bdo]

The development of a recommended standard for hives of honeybees used to pollinate *Actinidia deliciosa* is outlined. Hives should contain at least 7000 cm of brood (four full-depth frames), at least one quarter of the brood should be unsealed, most of the brood should be in

the lower box, there should be a young prolific queen, 12 full-depth frames of bees, enough drawn combs to allow for colony expansion, and sufficient honey stores (three frames or the equivalent) to prevent the colony from exhausting its reserves during the pollination period. *D. G. Lowe*
Ministry of Agriculture and Fisheries, Tauranga, New Zealand.

Mathieson, S. Floral resources and limiting factors affecting commercial beekeeping in Australia. *Australasian Beekeeper* (1988) 90 (5) 208–209, 214 [En, Bj]

Introduced flora of value to beekeepers include the controversial *Echium plantagineum* (which contributes over 15% of the total honey production), some legume crop plants especially lucerne, sunflower and oilseed rape. It is considered that the value of honeybees as crop pollinators is not sufficiently recognised, and pollination services could be more widely developed. The harm to the beekeeping industry that would result from the exclusion of colonies from national parks is discussed. *P. Walker*

McKee, B. Prevention of residues in honey: a future perspective. *Australasian Beekeeper* (2003) 104 (9) 377–379 [En, Bj]

The Australian National Residue Survey monitors honeys on a stratified randomised basis for the presence of 44 chemical compounds and elements. If a residue is detected, the problem is traced back and dealt with; if misuse is proved, sanctions and/or penalties are imposed. Australia has introduced a temporary max. limit of 0.3 ppm oxytetracycline in honey sold direct by the beekeeper, but there can still be zero tolerance in honey for export. Recently the beekeeping industry established a company (B-Qual) to facilitate the adoption by the industry of quality assurance programmes. It is concluded that worldwide co-operation is required to maintain the quality of honey, with the introduction of max. residue limits where necessary. *P. Walker*

Moncur, M. W., Kleinschmidt, G. and Somerville, D. The role of acacia and eucalypt plantations for honey production. Advances in tropical acacia research. Proceedings of an international workshop held in Bangkok, Thailand, 11–15 February 1991 [edited by Turnbull, J. W.]. Canberra, Australia; Australian Centre for International Agricultural Research (ACIAR). (1991) 123–127 [En, Bb]

Large areas of land in south-east Asia are being planted with *Acacia* and *Eucalyptus* species for timber, paper and pulp production, but their potential for honey production has not yet been evaluated. Where eucalypts are a main nectar source, their flowering time should be established and honey-bee (*Apis mellifera*) colonies built up in advance. The value of *Acacia* species as pollen and nectar sources should also be determined. In one test, when pollen traps were fitted to 12 hives near *A. mearnsii*, up to 35% of their contents came from this source in one year (heavy flowering), but less when flowering was light. A management system for honey production from *acacia* and *eucalypt* plantations is presented. *P. Walker*

Division of Forestry, CSIRO, Canberra, Australia.

Moncur, M.W. and Kleinschmidt, G.J. A role for honey bees (*Apis mellifera*) in eucalypt plantations. *Bee Briefs* (1993) 9 (4) 1–5 [En, Bj]

In this review [which lacks full references], the potential use of honey-bee pollination to improve eucalypt forests in Australia is discussed, and research results are summarised. Honey production from eucalypts is important in some areas; the potential in other areas has yet to be evaluated. *P. Walker*

Moncur, M.W., Mitchell, A., Fripp, Y. and Kleinschmidt, G.J. The role of honey bees (*Apis mellifera*) in eucalypt and acacia seed production areas. *Commonwealth Forestry Review* (1995) 74 (4) 350–354, 386, 388 [En, fr\es, 28 ref.]

In many countries Eucalyptus and Acacia seed orchards are being established to provide a reliable source of genetically improved seed for reforestation. Yield of seed from some orchards has been low and a lack of appropriate pollinators has been suggested as a possible cause. This paper reviews the role of honey-bees in plantation forestry (both as pollen vectors and for products), and reports on recent studies in Australia and Indonesia. The studies, with *Eucalyptus* spp., were carried out to determine the causes of limited seed production, and showed that the number of seeds formed per capsule through natural open pollination was low in relation to the number of ovules in the flower. Controlled pollination generally increased the number of seeds per capsule, indicating that the amount of pollen reaching the stigma under open pollination may be a limiting factor in seed production. Placing hives in seed production areas increased seed quantity and quality (outcrossing rate) at the same time producing useful amounts of honey. Beekeeping products such as honey, honeydew, pollen and propolis, have significant economic value in a number of countries and play an important role in many forestry enterprises.

CSIRO, Division of Forestry, PO Box 4008, Canberra, Australian Capital Territory 2600, Australia.

Monson, T. Income supplemented by pollination. *Australasian Beekeeper* (1991) 92 (12) 511–513 [En, Bj]

An Australian commercial beekeeper describes the practicalities and economics of preparing and hiring out honey-bee colonies for pollination.

Morthorpe, K.J. Pollination services agreements and pricing [Australia]. *Australasian Beekeeper* (1991) 93 (2) 71, 81 [En, Bj]

New, T.R. Significance of honey bees in the Australian environment: setting the scene. *Victorian Naturalist* (1997) 114 (1) 4–7 [En, Ba]

The history of honey-bees (*Apis mellifera*) in Australia is outlined and recent allegations that honey-bees can have adverse effects on native Australian fauna and flora are discussed. Beneficial effects, such as crop pollination, and the value of the beekeeping industry, are also mentioned.

D. G. Lowe

School of Zoology, La Trobe University, Bundoora, Victoria 3083, Australia.

Nicel, D. and Briggs, L. Pollination of lucerne – the beekeeper's view. *Australian Bee Journal* (1979) 60 (11) 13–16 [En, B]

Migratory beekeeping for honey production in Australia, and the economic aspects of hiring out bees for pollination.

O'Brien, L. C. Demaree usage for arid and semi-arid areas of Australia. *Australasian Beekeeper* (1988) 90 (1) 21–23 [En, Bj]

With a programme based on the use of nucleus colonies, honey production can be increased by 50% or more. To achieve the best results, two batches of nuclei are used during a season; in arid or semi-arid areas of NSW the best times have been found to be September/October and February/March. When the programme is started there must be a good nectar flow and a wide variety of pollens available so that colonies can develop rapidly. The queen cells to be used can be reared from a selected queen or obtained commercially. Details of the procedure are described and advantages and disadvantages are mentioned. *P. Walker*

Oldroyd, B. and Moran, C. Hawkesbury Agricultural College Apiary Section. Research progress report.

Australasian Beekeeper (1982) 84 (6) 116–119 [En, B]

Research on bee breeding and genetics.

Oldroyd, B., Silvester, K. and Moran, C. Hawkesbury Agricultural College Apiary Section. Research progress report for the period July 1982–July 1983. *Australasian Beekeeper* (1984) 85 (9) 176–181 [En, B]

Reports seven projects, including *Eucalyptus* honey yields, hoarding tests, and bee breeding and genetics.

Oldroyd, B.P. Biological and practical problems in bee breeding. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 62–64 ISBN 0-86774-011-6 [En, Bdo]

Oldroyd, B.P. Genetic improvement for New Zealand beekeeping. *New Zealand Beekeeper* (1988) (No. 198) 12–15 [En, Bj]

This article, which is based on a short series of lectures, explains first the aims and principles of honeybee breeding. Problems that have to be overcome include inbreeding, and the difficulty of controlling mating. The use of discriminant function analysis to classify races of honeybees is explained, as well as the effect of crossing two races of bees. The advantages and disadvantages of importing new races or lines of honeybees into New Zealand is discussed briefly. *P. Walker*

Plant Res. Inst., Dept. Agric. & Rural Affairs, Burnley Gardens, Richmond 3121, Australia.

Oldroyd, B.P. Evaluation of Australian commercial honey bees for hygienic behaviour, a critical character for tolerance to chalkbrood. *Australian Journal of Experimental Agriculture* (1996) 36 (6) 625–629 [En, Bc]

Chalk brood of honey-bees (*Apis mellifera*) is new to Australia. The best prospects for control are likely to come

from the use of bees with a strong genetic tendency to uncap and remove dead pupae, together with good bee-keeping practice. Ten strains of Australian commercial honey-bees were evaluated for hygienic behaviour. Dead pupae were inserted into the colonies and checked after three, five and seven days for the number of pupae removed. Most colonies (80%) were non-hygienic, but two strains gave a good overall performance in the test and comprised one or two colonies that were highly hygienic. Colonies were evaluated three times, and the good performance of these colonies was repeatable across trials. The results suggest that hygienic behavioural morphs exist in Australia's commercial bee strains, and that selective breeding should be able to produce suitable genotypes.

Author

School of Genetics and Human Variation, La Trobe University, Bundoora, Vic. 3068, Australia.

Page, J.R. and Roff, C. *Beekeepers can improve their honey extraction system.* Australasian Beekeeper (1978) 79 (9) 173–176 [En, B]

The advantages of installing a centrifuge system for capings are discussed, and the economics of operating such a system are compared with those of extracting by straining, which involves some honey wastage. In a 700-hive apiary in Queensland, a centrifuge was found to give a good return on investment. *P. Walker*

Queensland Dept. Primary Indus., Queensland, Australia.

Papworth, E. Victorian Apiarists' Association Inc. VAA Inc. Resources Committee report to the 93rd Annual Conference of the VAA Inc. Australian Bee Journal (1992) 73 (8) 17–23 [En, B]

In Victoria, Australia, forage for honey-bees is being reduced as a result of some areas of 'wilderness estate' being closed and entry to national parks being restricted. Proposed management plans for several areas are summarised and discussed in relation to beekeeping and to overall conservation aims. *P. Walker*

Paton, D.C. Canberra, Australia; Australian Nature Conservation Agency Overview of feral and managed honeybees in Australia: distribution, abundance, extent of interactions with native biota, evidence of impacts and future research (96) 71 pp. ISBN 0-642-21381-X [En, Bdo]

This review of research on the environmental impact of honey-bees (*Apis mellifera*) in Australia, with 176 references, covers the following aspects: distribution, abundance and behaviour of both feral and managed honey-bees in Australia; interactions between honey-bees and Australian flora and fauna; the management of honey-bees in Australia; possibilities for future research. Honey-bees have been present in Australia for about 170 years, but their distribution and abundance has increased dramatically over the last 60 years. There are over 500 000 hives in Australia, and an unknown number of feral colonies. Managed colonies are patchily distributed in time and space, with beekeepers usually moving groups of around 100 hives into and out of areas for 2–4 month periods coinciding with peaks in flowering of key plants (often species of *Eucalyptus*). A concentration of 100 hives at an apiary is equivalent to about 0.1 colonies/ha, because

honey-bees forage to distances of at least 2 km from their hives.

Feral colonies are also patchily distributed being least abundant, if not absent, from alpine areas and inland are as away from water. Limited quantitative data show densities ranging from 0.001 colonies/ha in inland mallee-heaths to locally high densities of 0.77 colonies/ha in riparian woodlands. The cavities used by feral honey-bees broadly overlap with those used by a variety of native birds and mammals, but feral colonies appear to occupy only a small proportion of the available cavities (often < 1%). This suggests that interactions between feral colonies and cavity-nesting Australian fauna may not be substantial. Honey-bees visit the flowers of at least 200 Australian plant genera and interact with a wide diversity of native flower-visiting animals. For many plants, honey-bees are the most frequent floral visitors, and often consume more than half of the floral resources being produced.

Numbers of native bees may decline following influxes of honey-bees into an area but data on this relationship are equivocal. It is concluded that future research should measure the effects of honey-bees on a wide diversity of flora and flower-visiting fauna; both descriptive and experimental studies are needed. Research on the population dynamics of feral honey-bees is also a priority. Management of honey-bees and natural resources will depend on cooperation from the beekeeping industry.

Paust, G. *The Australian and Western Australian honey industries.* Farm Policy (1975) 15 (2) 44–48 [En]

Paust, G. *Income variation in the Western Australian bee-keeping industry.* Paust, G.: *The Australian and Western Australian honey industries.* Farm Policy (1975) 15 (3) 85–89 [En, B] Dept. Agric. Economics, Univ. Western Australia, Nedlands 6009, WA, Australia

The main source of income variation was linked with revenue from honey sales, which in turn depended on the price of honey and the yield per hive. The number of hives owned was a factor in this variation; changes in honey yield and in the number of hives owned tended to be in the same direction, with the result that variations in income fluctuated widely from year to year. *E. E. Crane*

Pinnock, D.E. *Research on bee diseases at the Insect Pathology Laboratory, Department of Entomology, the University of Adelaide, Waite Agricultural Research Institute.* Beekeepers' Bulletin (1980) (No. 10) 2–3 [En, B]

Rayner, C.J. and Langridge, D.F. *Amino acids in bee-collected pollens from Australian indigenous and exotic plants.* Australian Journal of Experimental Agriculture (1985) 25 722–726 [En, B]

Protein and amino acid contents were determined in bee-collected pollens from 10 indigenous species (eight *Eucalyptus* species, *Acacia baileyana* and *Banksia ornata*) and 16 exotic species. Mean dry matter content was 87.5% (range 76.4–94.2%). Crude protein content ranged from 9.5% of dry matter in *Pinus radiata* pollen to 36.9% in *B. ornata* pollen. Results for several pollens compare well with those for the same pollens collected in other parts of

Australia. Pollens favoured by beekeepers were found to have high protein contents (*E. macrorhynca*, *B. ornata*, *Prunus dulcis*, *Lupinus albus*, *Echium plantagineum*); pollens considered by beekeepers to be nutritionally inferior had low protein contents (e.g. *Pinus radiata*, *Helianthus annuus*, *Hypochoeris radicata*). Individual amino acid contents are tabulated. Patterns are similar for pollens from both native and exotic species. Compared with other pollens, that from *P. radiata* had a very low content of amino acids, except for arginine, the content of which was 100% above the mean. For pollens from other species, the contents of essential amino acids are adequate for bee requirements, although all the *Eucalyptus* pollens had limited tryptophan contents. *P. Walker*

Dept. Agric. & Rural Affairs, State Chemistry Lab., 5 Macarthur St., Melbourne, Vic. 3001, Australia.

Redpath, N. *Keeping your own bees*. Melbourne, Australia; Thomas Nelson (Australia). (1978) 128 pp. ISBN 0-17-005307-5 [En, B]

Written by an Australian for Australian conditions.

Rhodes, J. *Bee hives, bees, bee products and apiary equipment introduced into Queensland – legislation requirements*. *Australasian Beekeeper* (1989) 91 (1) 47 [En, Bj]

Rice, N.V. *Queensland*. Hebden Bridge, UK; Northern Bee Books. (1994) 132 pp. ISBN 0-907908-68-3 [En, Bd]

This autobiography of a large-scale commercial beekeeper, who specialised in queen rearing in Queensland, Australia, contains a wealth of useful advice and also provides an insight into how certain methods and equipment, accepted as the norm today, came to be developed over the last 50 years or so. The author writes about 'reading' honey-bee colonies, maintaining records, breeder queen management, queen mailing cages, nucleus colonies, package bees, marketing, instrumental insemination, marking queens, queen introduction, queen cell cup production, feeding colonies, pollen and pollen substitutes, processing honey and beeswax, hot wax treatment of wooden equipment, and many other topics. The book, which should be of interest to all beekeepers, both professional and hobbyist, is illustrated by over 40 photographs. *D. G. Lowe*

Richards, G. *Report on the activities of the National Apicultural Research Centre, and the Australasian Honeybee Stock Centre*. *Australasian Beekeeper* (1981) 82 (10) 238–239 [En, B]

Robinson, P.J. and French, J.R.J. *Beekeeping and wood preservation in Australia*. *Australian Bee Journal* (1986) 67 (1) 11–14 [En, Bj]

The various wood preservation systems are discussed briefly, and methods of application are compared. Preliminary results for dip/soak treatments of *Pinus radiata* blocks are reported. Microcrystalline wax in contact with blocks held for 1 hour in an oven at 135°C penetrated 2 mm on the radial face and 5 mm on the tangential face. When blocks were dipped for 20 minutes in alcoholic solutions of benzalkonium chloride at various concentrations, penetration of the preservative was shallow. Blocks dipped

for 10 minutes in white spirit solutions of copper naphthenate are still being tested for decay. *P. Walker*
Div. Chemical and Wood Technol., CSIRO, Melbourne, Vic., Australia.

Robinson, P.J. and French, J.R.J. *Wood preservation in Victorian commercial apiaries*. *Australian Bee Journal* (1986) 67 (1) 8–10 [En, Bj]

As part of a survey made throughout Australia, questionnaires were sent to commercial beekeepers in Victoria; the 74 replies are summarised here. Many of these beekeepers (45%) treated their hive boxes with paint only (group P); 31% used a wood preservative before painting (group W), and of these, 60% preferred copper naphthenate. In P, 5.7 years (average) elapsed between repaints, and in W 7.9 years. However, in both groups, wood decay – especially in joints – was often noticed before a repaint. Many beekeepers (P 48%, W 45%) reported termite damage, particularly to bottom boards, and in W also in cleats and risers. Most of those in W carried out their own preservative treatment on pre-cut wood; they spent more time than those in P on treatment, but time spent on repairs was similar in each group. For P, the average life of supers was 16.6 years and for W 21.8 years. *P. Walker*

Div. Chemical and Wood Technol., CSIRO, Melbourne, Vic., Australia.

Roff, C. *Queensland Department of Primary Industries. Beekeeping information*. Brisbane

Ronan, G. and Petrenas, E. *Economic analysis of honey bee disease management strategies for the South Australian apiary industry*. *Australasian Beekeeper* (99) 101 (3) 98–99, 101–102, 105–106, 109–110, 112–113, 116 [En, Bj]

Various strategies were assessed by the South Australia Apiary Industry Task Force for their success in reducing the prevalence of American foulbrood in South Australia; economic criteria to determine the government's role in a disease programme were also examined. A 'mandatory disease control program' was recommended. One of the appendices set out the details and results of the different programmes. *P. Walker*

Schwarz, M.P. and Hurst, P.S. *Effects of introduced honey bees on Australia's native bee fauna*. *Victorian Naturalist* (1997) 114 (1) 7–12 [En, Ba]

Apis mellifera has been present in Australia as both a commercially managed and feral species for over 150 years and there is concern that it may have negative impacts on Australian flora and fauna. Several aspects of Australia's native bee fauna are described and the potential for resource competition between honey-bees and native bees is discussed. Factors which augment the competitive ability of honey-bees compared to native bees are the extended foraging periods and seasonal activity of honey-bees, their ability to rapidly recruit foragers in the exploitation of food sources, and their ability to forage over long distances. However, the few Australian investigations into resource competition between honey-bees and native bees have been inconclusive. In some cases experimental designs were inadequate, and in all cases study sites were in areas with relatively rich floral resources. It is pro-

posed that competition for floral resources will be greater in areas of low floristic abundance and that future studies should examine the effects of honey-bees in these areas. In addition, bee species with a restricted range of food resources, such as some short-tongued bees, may be more susceptible to competition and therefore warrant investigation. The problem of controlling feral honey-bee populations is discussed. *Author*

School of Biological Sciences, Flinders University of South Australia, GPO Box 2100, Adelaide, SA 5001, Australia.

Shaw, D.E. and Ching, J.S. *Bee and bee interest postage stamps of the world: supplement 1.* *Bee World* (1994) 75 (4) 181–193 [En, 4 colour plates, Bj]

This is a supplement to a list published by Pruess (1973) [*Bee World* 54 (2) 53–56]. It includes stamps of honey-bees and their castes, skeps and hives, beekeeping and honeycomb, products of the hive and stamps on pollination. Stamps of solitary bees are also included. Stamps which had been issued but were not in Pruess's list are included in this supplement. The stamps are listed under countries in an 8-page table, which gives details of year, denomination and catalogue numbers (Gibbons, Scott, Michel). Four colour plates illustrate 54 of the stamps listed. *D.G. Lowe* Plant Protection Unit, Department of Primary Industries, Meiers Road, Indooroopilly, Queensland 4068, Australia.

Shimizu, K., Igarashi, M., Takano, N., Takatsuka, J. and Takeuchi, S. *Inhibition of platelet aggregation by honey.* *Honeybee Science* (1990) 11 (4) 171–173 [Ja, en, Bj]

Three of the honeys tested in in vitro studies (sunflower honey from USA, clover honey from Australia and Salvation Jane [*Echium vulgare*] honey from Australia) strongly inhibited platelet aggregation caused by ADP [adenosine diphosphate]. It is suggested that such honeys could be used for prophylaxis in patients with cardiac or cerebral infarction. *Robinia pseudoacacia* honeys from Hungary and China did not have this inhibitory effect. *Author* Saitama Beekeeping Co. Ltd., Kitamoto, Saitama, Japan.

Skillman, G.J. *Queen bee imports – a trial run.* *Animal Quarantine* (1979) 6 (2) 12–16 [En, B]

In 1977 57 Austrian and Italian queens were imported with special Ministerial approval, by Sydney and Metropolitan Branch of the Commercial Apiarists Association of New South Wales. Safeguards imposed to prevent import of bee diseases were: health certificates (allowances for *Braula coeca* as widespread in Austrian hives); examination of imported workers, maintenance of imported queens in quarantine cages. Grafting was done in the cages, and only eggs and larvae were taken outside. Problems associated with maintaining bees in the quarantine cages and other confined spaces are discussed, and action taken to overcome them. *M. Nixon* Animal Quarantine, Dept. Agric., Sydney, NSW, Australia.

Sloane, H. *Beehive management in Australia.* Ballarat, Victoria, Australia; published by the author. (1975) 56 pp. [En, 1 pl., B]

The book comprises articles from the *Australasian Beekeeper*, based on the author's beekeeping experience since 1953. *E.E. Crane*

2125 Geelong Rd., Mt. Helen, Ballarat, Victoria 3350, Australia.

Smith, F.G. *Three cells of honeycomb.* Nedlands, Australia; F.G. Smith. (1994) xii + 248 pp. ISBN 0-9587538-5-7 [En, 12 plates, Bd]

In this autobiography by Dr Francis Smith, the three cells in the title represent his three periods of beekeeping work: in Britain, Tanganyika and Australia. He studied forestry and kept bees in Scotland from 1946, and was Beeswax Officer in Tanganyika from 1949 until independence in 1962. Thereafter he worked in Western Australia, as Senior Apiarist until 1975 and then as Director of National Parks. Beeswax and honey were important exports of Tanganyika and Western Australia, respectively, and Francis Smith initiated many improvements in the production and quality of both products. The book also includes details of some of his scientific work on bees and a list of his publications, of which *Beekeeping in the Tropics* (1960) became a standard text book. An appendix sets out the methods of pollen analysis used by Francis Smith in his studies of bee botany in Tanganyika and Australia. There is also a detailed index. *E. Crane*

Somerville, D. *Beekeeping in the state forests: Eden-Bombala forestry district; Wauchope; Tumut-Tumbarumba; Taree; Narrandera; Mildura forestry management area; Kempsey; Inverell and Glen Innes.* NSW Agriculture (97) [En, Bdo]

A series of 10 booklets describing beekeeping in the state forests of New South Wales.

Apiculture, NSW Government Offices, 159 Auburn Street, P.O. Box 389, Goulbourn, NSW 2580, Australia.

Somerville, D. *NSW National Parks and beekeeping.* *Australasian Beekeeper* (99) 100 (10) 404–405, 407 [En, Bj]

Between August 1995 and February 1998, the number of beekeeping sites in the National Parks has decreased by 31%, although the number of beekeepers using sites has probably doubled. A further reduction in permits for beekeeping is forecast unless the management policy for the Parks becomes more favourable to beekeeping. One positive step was a decision by the Minister of the Environment that bee site licences in the Parks will be transferable between family generations. *P. Walker* NSW Agriculture, Goulbourn, NSW, Australia.

Somerville, D. *The Tasmanian beekeeping industry and pollination.* *Australasian Beekeeper* (2002) 103 (10) 422–426 [En, Bj]

In Tasmania, which produces 2–3% of Australia's honey, the main honey source is leatherwood [*Eucryphia*]. There is potential to increase professional pollination services, and the most important crops are discussed. *P. Walker*

Somerville, D.C. *State forests – a valuable beekeeping resource.* *Australasian Beekeeper* (98) 100 (3) 96–101 [En, Bj] NSW Agriculture, PO Box 389, Goulbourn, NSW, Australia 2580

In 1995/96 NSW State Forests issued 3749 occupation permits for bee framing. Results of a survey of beekeepers in 25 districts, carried out in January 1997, are presented;

these include the plants providing the most important nectar and pollen flows in each area, and their flowering periods. Ten of the 14 most useful nectar plants are species of *Eucalyptus*; average honey yields per colony from each species ranges from 20 kg/colony from *Banksia ericifolia* or *E. largiflorens* to 80 kg from *E. paniculata* or *Lophostemon confertus*. P. Walker

Somerville, D. Beekeeping information sources: report of a survey conducted May/July 1993. *Australasian Beekeeper* (1994) 96 (6) 240–243 [En, Bj]

The results of a survey of 444 beekeepers in NSW, Australia, are presented and discussed. Of the 12 information sources assessed, the following were considered to be the three most useful: newsletters, apiary officers and journals. Assessments by a beekeeper depended, to some extent, on his/her years of experience. Strong and weak points of each information source are mentioned. P. Walker

Somerville, D. Central Murray Valley Forestry Area apiary management survey results. *Bee Briefs* (1996) 13 (1) 7–12 [En, Bj]

This area of 98,000 ha in New South Wales contains one of the largest naturally occurring populations of river red gum (*Eucalyptus camaldulensis*) in Australia. *E. camaldulensis* produces heavy yields of nectar, yielding high quality honey, and is a major source of pollen. Apiary permits for the area are held by 39 beekeepers, with over 16,000 hives (100–150/site). Results from a 1995 survey are summarised in this report and other good sources of bee forage are listed. Forestry practices as they affect the beekeeping industry are discussed and responses to survey comments by the State Forests department are included; flooding is a major problem. P. Walker

NSW Agriculture, P. O. Box 389, Goulburn 2580, Australia.

Stace, P. Pollen quality, honey production and strong bees. *Australasian Beekeeper* (1987) 88 (7) 145–148 [En, Bj]

In assessing the value to bees of a pollen from a particular plant species, the crude protein content and the contents of individual amino acids should be considered. Some pollens may have a low content of an amino acid which is essential to bees, e.g. *Eucalyptus albens* (white box) pollen has a low isoleucine level. It is suggested that, if bees are to be moved to *E. albens* for the winter flow, they should be first sited near a good autumn pollen source such as stringybark [*Eucalyptus macrorhyncha*] or *Banksia*. Alternatively, colonies can be fed with pollen (trapped earlier) during the winter. P. Walker

Dept. Agric., Lismore 2480, NSW, Australia.

Stace, P. The apiary industry and the north coast N.S.W. heath areas (inc. national parks). *Australasian Beekeeper* (1988) 89 (10) 196–199 [En, Bj]

In 1986, between 12,000 and 14,000 colonies were overwintered in the heath areas of the Richmond and Clarence rivers, NSW, Australia. Overwintered colonies have good populations by September and give high honey yields or are used for pollination of crops in these areas. Much of the heath is now under the control of the National Parks and Wildlife Service. This paper discusses the likely effects

if beekeeping on the heath is restricted, or phased out. P. Walker

North Coast Agric. Inst., Wollongbar, NSW, Australia.

Stace, P. Beekeeping and National Parks. To bee or not to bee. *Australian Bee Journal* (1988) 69 (12) 14–20 [En, Bj]

The NSW National Parks and Wildlife Service's policy is to remove commercial beekeeping from the conservation areas under its control. The reasons given are that honeybees (1) take floral resources needed by native animals, (2) take nectar from, and damage, bird-pollinated flowers, (3) after swarming, occupy nest sites in hollow logs that are needed by native animals, (4) accelerate hybridisation of native plants. Each of these reasons is discussed in this paper, with evidence from relevant studies reported in the literature. It is concluded that properly managed migratory beekeeping in the National Parks of New South Wales does not conflict with the objectives for these areas. P. Walker

NSW Dept. Agric., North Coast Agric. Inst., Wollongbar, NSW, Australia.

Stace, P. Beekeeping on the north coast of N.S.W. *Australasian Beekeeper* (1989) 90 (10) 456,459 [En, Bj]

Estimates future demand for colonies for fruit pollination, and provides a sample pollination contract.

Stace, P. The submission presented to the Resources Assessment Commission on Australian forests and timber resources, re beekeepers utilization of north east N.S.W. forests. *Australasian Beekeeper* (1990) 92 (4) 157–160 [En, Bj]

NSW Agriculture and Fisheries, Wollongbar, NSW, Australia.

Stace, P. Inverell and district – the home of a large honey producing industry. *Australasian Beekeeper* (1991) 93 (1) 8–9, 14, 20 [En, Bj]

This area of New South Wales, Australia, has 24,000 honey-bee colonies owned by some 120 beekeepers, producing from 1600 to 2400 t of honey per year and 26–35 t of beeswax. The average annual production is 70–100 kg honey/hive. Management methods, marketing, other hive products, bee forage, and tourism, are discussed. D. G. Lowe

Stace, P. Pollen quality – Paterson's curse (*Echium plantagineum*). *Australasian Beekeeper* (1992) 93 (12) 504 [En, Bj]

This plant is a useful source of nectar and pollen in south-east Australia. In analyses of two samples of pollen, crude protein contents were 31% and 33%, which are higher than in most other pollens analysed. Contents of individual amino acids are also reported. The collection of *E. plantagineum* pollen for feeding to bees (0.5 kg/wk) is recommended, especially for colonies on winter honey flows with little or no pollen. P. Walker

Stace, P. The Tenterfield Forestry District environmental impact study. *Bee Briefs* (1993) 9 (4) 12–16 [En, Bj]

A table lists 27 tree species (including 22 eucalypts) that are important for honey production in this forest (NSW, Australia). Flowering period, flowering frequency and

honey characteristics are given. Suggestions are made for changes in forest management that would help beekeepers, including improved access to apiary sites and multi-species planting. *P. Walker*

Sugden, E.A., Thorp, R.W. and Buchmann, S.L. *Honey bee-native bee competition: focal point for environmental change and apicultural response in Australia*. *Bee World* (1996) 77 (1) 26–44 [En, Bj]

Studies on the environmental impact of honey-bees, especially in Australia, are reviewed, with 117 references. Aspects dealt with include: competition for food resources with native wild bees and other flower-feeding species; potential loss of species diversity due to apicultural over-exploitation; competition with other species for nest sites; enhancement of weed reproduction. A table summarises the evidence and conclusions of 23 relevant studies and a critical and conservative interpretation of the results is given, with detailed discussion of some of the studies. Seventeen of these studies are assessed as indicating resource competition, but dependent on certain conditions, and the other six are judged 'unclear'. It is considered unlikely that any single study could provide proof of honey-bee competition with other species. Many issues remain to be resolved but it is suggested that beekeepers, scientists and land managers could work together to address problems, and several co-operative and proactive responses that could be made by each of these groups are suggested. *D.G. Lowe*

Honey Bee Unit, Subtropical Agricultural Research Laboratory, ARS, USDA, 2413 E. Hwy 83, Weslaco, TX, USA.

Taplin, J. and Smallhorn, P. *The supply of honey in Australia*. *Quarterly Review of Agricultural Economics* (1970) 23 (2) 97–109 [En, B]

The industry has expanded consistently since the late 1930s. The honey yield per hive doubled between 1935 and 1968 (the period reviewed), annual results showing various fluctuations, notably two very good years in the late 1940s. Such an increase is possible by moving hives from one eucalyptus flow to another: such migratory beekeeping accounts for half the total production. Internal consumption doubled since 1952; exports reached a peak in 1961–62. In 1967–68 the average yield per hive was 55 kg, the total production 19 thousand tonnes of which 41/2 were exported. In a statistical analysis, honey supply was examined in three stages: number of productive hives, total honey produced, supply from stock. The elasticity of supply from stocks, held mainly by beekeepers, is sufficiently high to effect considerable price stabilisation. *P. Walker*

Tapper, T. *Beekeeping in the north west of Western Australia*. *Beekeepers' Bulletin* (1981) (No. 11) 3–4 [En, B]

Tealdi, C. *The Seychelle islands, a paradise also for bees and beekeeping. [Le isole Seychelles, paradiso anche delle api e degli apicoltori.]*. *Ape Nostra Amica* (1990) 12 (5) 40–42 [It, Bj]

Hybrids have been obtained by crossing *Apis mellifera unicolor* with *A. mellifera* from Australia.

Thorp, R.W. *Australian pollination reviewed*. *Australian Bee Journal* (1983) 64 (4; 5; 7) 16–21; 11–15; 17–18 [En, B]
Recommendations for honeybee pollination services in Australia.

Tobler, P. and Jolly, L. *The outlook for crops [in Australia] suitable for bee pollination. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 253–254 ISBN 0-86774-011-6 [En, Bdo]

Walker, R. *The red imported fire ant. Australasian Beekeeper* (2003) 104 (10) 422 [En, Bj]

Ward, B. *Beginning in bees. Agfact, Department of Agriculture, New South Wales* (1981) (No. A8.9.1) 24 pp. [En, B]

Ward, B.A. *Beekeeping and the law in N.S.W. Bee Briefs, Department of Agriculture, New South Wales* (1979) (No.79/2) 2 pp. [En, B]

Ward, B.A. *Beginning in bees*. Goulburn, NSW, Australia; Department of Agriculture. (1979 ?) 42 pp. [En, B]

Warhurst, P. and Goebel, R. *The bee book: beekeeping in the warmer areas of Australia*. Brisbane, Australia; Queensland Department of Primary Industries. (1995) xii + 244 pp. ISBN 0-7242-5919-8 [En, Bd]

The authors give a strong emphasis to practical beekeeping techniques for commercial producers and hobbyists, with straightforward text including highlighted summaries, good quality photographs (136 black and white, 59 in colour), and 17 tables. Subjects covered include bee biology, beginning with bees, hive equipment, colony management, hive products, pollination, exotic and endemic pests and diseases, and Australian native bees (*Apoidea*). There are lists of Australian industry contacts, a glossary, reading list and index. This book is written from a Queensland perspective, but despite the inclusion of some material with only local interest much of its content will be useful to beekeepers in other tropical, subtropical and warm temperate areas of the world. *A.G. Matheson*

Weatherhead, T. *Boxes to bar hives: beekeeping history of Queensland*. Stanthorpe, Australia; International Colour Productions. (1986) 132 pp. ISBN 0-86774-009-4 [En, Bd]
This illustrated history of Queensland beekeeping begins with an account of the introduction of honeybees to Australia, and the introduction of honeybees of various races (Italian, Caucasian, Carniolan, Punic, Cyprian) to Queensland. Three chapters then describe early beekeeping to 1900, beekeeping from 1900 to 1930, and from 1930 to the present day. Short entries on beekeeping literature published in Queensland, the Royal National Association, and exhibiting bees and bee products are followed by histories of the Queensland Beekeepers Association and its seven branches, 10 amateur groups,

the Queensland Honey Producers Association, the Department of Primary Industries and Queensland Agricultural College. Finally, historical aspects of the following are discussed: honey flora, equipment manufacturers and suppliers, queen breeding, diseases and pests, bees exported from Queensland, marketing, beekeeping personalities. The book ends with a collection of information gleaned from letters received by the author and an 'intermission' (rather than a 'conclusion'). The book was written to coincide with the Centenary of the Queensland Beekeepers Association in 1986. *D. G. Lowe*

Wheen, G. *The use of the Australian quarantine facility for honey bees. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 57–58 ISBN 0-86774-011-6 [En, Bdo]

White, B. *Disease control strategies in New South Wales – now and in the future. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 85–87 ISBN 0-86774-011-6 [En, Bdo]

White, B. *Importation of queen bees – quarantine facility and procedures [in Australia]. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J. W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 65–67 ISBN 0-86774-011-6 [En, Bdo]

White, B. *Exotic honey bee disease found in Queensland. Australasian Beekeeper* (1993) 94 (8) 345–346 [En, Bj]
Chalk brood was identified in February 1993 by the CSIRO in specimens taken from honey-bee colonies [*Apis mellifera*] near Warwick, Queensland, Australia. Shortly afterwards further cases were found near Brisbane, Queensland. These are the first reported findings of chalk brood in Australia. The symptoms of the disease are discussed, and a quarantine order restricting the movement of bees, beekeeping equipment and bee products from Queensland into New South Wales is reprinted. *A. G. Matheson*

White, B. R. *Travel to Korea study the package bee industry and exotic diseases. Australasian Beekeeper* (1995) 96 (11) 478–479 [En, Bj]

This is a summary of a report made in 1993, which includes beekeeping statistics for the country. The aims of the study visit included: an assessment of the demand for package honey-bees and how they are used; to find out how Australian queens perform; to get details of quarantine procedures for imported bees. *P. Walker*

Williams, M. A. J. and Faure, H. *The Sahara and the Nile*. Rotterdam, Netherlands; A. A. Balkema. (1980) xvi + 608 pp. + 17 pl. ISBN 90-6191-012-9 [En\Fr, B]

The historical importance of the Nile Valley in beekeeping, and the possibilities of using arid waste areas round the Sahara for bee pasture, make the prehistoric sequences of climate and land utilisation by man of wide interest. In 22 chapters (four in French) specialists examine the evidence from research in the geology, histology, climatology and archaeology of the area, with detailed information for countries in the northern half of Africa. *E. E. Crane*
Macquarie Univ., Sydney, NSW, Australia.

Wills, R. T. *Management of the flora utilised by the European honey bee in kwongan of the Northern Sandplain of Western Australia*. PhD Thesis, University of Western Australia, Perth, Australia. (1989) xviii + 317 pp. [En, Bdo]

Beekeeping in Western Australia relies on the native sclerophyll shrublands ('kwongan') of the Northern Sandplain as a source of pollen and nectar over winter. Loss of floral resources as a result of fire can have dramatic consequences on the apicultural industry. This study was directed at identifying environmental and biological factors of importance in determining the forage for honey-bees in this region and to use these data to explore eco-logically-based management strategies which would enhance apicultural production without deleteriously affecting the conservation values of the region. A total of 413 vascular plant species from 192 genera in 66 families were identified from the study region, with the *Myrtaceae* and the *Proteaceae* contributing the largest number of species. The range of community types which was found throughout the study area was largely explained by geology, soil types, moisture gradients, distance from other plant communities and the effects of fire. Variations in patterns of plant flowering and plant reproductive strategies in response to environmental factors were quantified over a period of 30 months. The timing of flowering was largely seasonally constrained, resulting in a flowering peak of 241 species in late winter. The duration of flowering appeared to be largely a reflection of phylogeny and growth form. Flowering patterns also varied in relation to pollination biology and post-fire regenerative strategy. The importance of all flowering plant species as a resource for honey-bees (*Apis mellifera*) was evaluated. Honey-bees foraged widely amongst the available species, visiting 30% of all species as a source of pollen and/or nectar, but showed preferences for plant species with particular attributes. Honey-bees tended to use plants which: flowered for longer; were woody perennial dicotyledons of particular taxa; were vertebrate-pollinated species; regenerated from seed after fire; were widespread and/or locally abundant; and occurred in the more diverse plant communities. Honey-bees selected the longer flowering species, and it is suggested that length of flowering period may be indicative of plant reproductive effort so that species with a longer average duration of flowering may also provide the best floral resource. The possible ecological effects of honey-bees are considered and management requirements for areas used for apiculture are explored based on the attributes of bee plant species identified in the study.

The need for an ecological approach to management is discussed. D. G. Lowe

Wilshire, W. Honey marketing 1994 and beyond. *Australian Bee Journal* (1994) 75 (10) 12–25 [En, Bj]

In the absence of official statistics for total honey sales in Australia an attempt is made to develop a profile of the market using available data. In 1992–93 an estimated 29,541 t honey was sold by the beekeeping industry: 20,503 t for the domestic market and 9038 t for export (7020 t in bulk and 2018 t in retail packs). On the domestic market 54% was sold through supermarkets (35% under packers' brands, 19% under generic brands), 24% directly by beekeepers, 10% to industrial customers, 7% through specialty shops and 5% to the catering trade. The honey market in Australia is mature, at least in the grocery and supermarket trade, with limited prospects for increased consumption through generic promotion or product innovation. Opportunities for increasing sales lie in identifying niche markets outside the grocery and supermarket segment and developing products for them. Australia's export market for bulk honey has declined in size and value from 1985 to 1993, but the opposite is true for packed honey. Opportunities for increasing export sales of packed honey are in identifying niche markets overseas and developing new products for them. A commitment to quality assurance will be important in doing this. A. G. Matheson

Wilshire, W.B. Honey markets and marketing – the next decade. *Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 255–257 ISBN 0-86774-011-6 [En, Bdo]

Winn, B. Importation and release of leafcutter bees [*Megachile rotundata*] in South Australia. *Bee keeping in*

the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 209–210 ISBN 0-86774-011-6 [En, Bdo]

Winn, R.A. Management of colonies for maximum honey production in South Australia. *Australasian Beekeeper* (1972) 74 (6) 151–154 [En, B]

Woyke, J. Brood survival in productive bee colonies in Australia as test for breeding honey bees in closed populations. *Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 45–46 ISBN 0-86774-011-6 [En, Bdo]

Brood survival was investigated in (A) 15 colonies in an apiary with natural (uncontrolled) queen mating, (B) 20 colonies with queens supplied by 4 commercial queen breeders, and (C) 16 colonies headed by queens that had been instrumentally inseminated with semen from one drone. Brood survival ranged from 73.2 to 97.1% in A (mean 85.5%), and from 59.2–96.4% (mean 85.8%) to 81.3–99.7% (mean 91.4%) in B. Two of the queens in C produced brood with 50% survival, whilst the other 14 produced brood with survival from 87.8 to 99.2% (mean 93.5%). The results suggest that about 6.5% of brood was lost due to factors other than the sex alleles. The number of sex alleles present in apiary A was calculated to be 12.5, and similar numbers were present in 3 of the B apiaries, but in the fourth (mean survival 91.4%) it was calculated that 47.6 sex alleles were present; this is considered doubtful and it is suggested that the queens were not from a closed system. D. G. Lowe

Bee Div., Agric. Univ., Warsaw, Poland.

The Bahamas

Collins, P. and Solomon, G. (eds). Proceedings of the First Caribbean Beekeeping Congress, Tobago, West Indies, 17–20 November, 1998. Tobago Apicultural Society ([1999]) 230 pp. [En, Bdo]

Papers presented are published in full, and contain much information on various aspects of beekeeping in Caribbean islands (with Bermuda and Guyana). One section covers activities of institutions and non-governmental organisations.

Morton, J.F. Brazilian pepper – its impact on people, animals and the environment. *Economic Botany* (1978) 32 (4) 353–359 [En, B]

Univ. Miami, Coral Gables, FL, USA.

This vigorous tree (*Schinus terebinthifolius*), 12 m high, is indigenous to the coast of tropical Brazil; it was introduced as an ornamental in Florida, and has now spread over considerable areas of this state, Hawaii and the Bahamas, often crowding out the natural vegetation. The tree causes dermatitis in humans and animals, and the flowers cause respiratory difficulties in humans. However, the flowers are rich in nectar which gives a medium-amber, slightly peppery honey in commercial yields, and some beekeepers are opposed to attempts to eradicate this species. P. Walker

Bangladesh

Indian Bee Journal. Special conference number. *Indian Bee Journal* (1979) 41 (3/4) 68pp. [En, B]

This issue was published to coincide with the second International Conference on Apiculture in Tropical Climates held in Delhi, 29 February–4 March, 1980. It includes contributions on various aspects of beekeeping in India, and on honeybees (*Apis cerana* and *A. mellifera*); several of these papers are abstracted separately in *Apicultural Abstracts*. Also of interest are reviews of the work of some Indian institutions concerned with beekeeping, and a note on a pilot project for beekeeping in Bangladesh. P. Walker

Food and Agriculture Organization of the United Nations. Proceedings of the Expert Consultation on Beekeeping with *Apis mellifera* in Tropical and Sub-Tropical Asia, Bangkok/Chiang Mai, Thailand, 9–14 April 1984. Rome, Italy; Food and Agriculture Organization of the United Nations. (1984) v + 250 pp. [En, B]

The proceedings include nine technical papers on various aspects of beekeeping in Asia, including: constraints caused by parasitic mites; bee forage; pollination; honey production; beekeeping in rural economies. Of these papers, four are abstracted or listed individually in *Apicultural Abstracts*. There are also 'status reports' for the following: Afghanistan, Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Western Samoa. The proceedings also contain a list of participants, list of apiaries visited, and the resolutions of the meeting. D.G. Lowe

Food and Agriculture Organization of the United Nations, Agricultural Industries Division. Tropical and sub-tropical apiculture. Rome, Italy; Food and Agriculture Organization of the United Nations. *FAO Agricultural Services Bulletin* (1986) (No. 68) xiii + 283 pp. ISBN 92-5-102444-8 [En, Bdo]

The aim of this book is to provide a general introduction to beekeeping, but confined to those aspects necessary for an understanding of the problems of apiculture which are specific to the developing countries of the tropics and sub-tropics. It will be especially valuable to beekeepers in tropical countries, both those just beginning and those with more experience, and to apicultural and agricultural planners involved in development programmes. The contribution of many world experts to this comprehensive, well-illustrated FAO Bulletin, and the involvement of the International Bee Research Association during its preparation, are acknowledged. The plan of the book, and the subjects it covers, are outlined in the introductory chapter. Chapter 2 describes the species, races and strains of honeybees, their biology in the tropics, and the plants they forage on. The value of bees in pollination is emphasized. Chapter 3 describes the enemies of bees – diseases, parasites, predators, and man himself through his effects on the environment. Chapter 4 deals with honey hunting and traditional methods of beekeeping, including the construction and use of various hives. Transitional hives (the Kenya top-bar hive and the modified African long hive) are

described in this chapter. Chapter 5 gives details of modern techniques for beekeeping with *Apis mellifera* and *A. cerana*; the aspects which are discussed include types of movable-frame hive, comb foundation, disease and pest control, colony management, and protective clothing and equipment. Honey, beeswax, and other hive products are the subject of Chapter 6, whilst Chapter 7 is devoted to a study of beekeeping economics in developing countries. A 'Bangladesh case study' is used to illustrate the principles involved. Chapter 8 considers the case history of a long-term programme for national beekeeping development in Tanzania and discusses education, training, extension work, research, and their organisation. The final chapter describes technical assistance projects with examples of FAO schemes in Burma, El Salvador, and Tunisia. The four appendices give information on world honey plants, European Codex honey standards, beekeeping in the Kalahari (by B. Clauss), and pesticide toxicities. All the chapters include a guide to further reading, and there is a 12-page bibliography. D.G. Lowe

International Bee Research Association. Research to provide guidelines for future development of beekeeping in Bangladesh. Science and technology for development. 1st Programme. Tropical and subtropical agriculture. Research projects 1983–1986. Summaries of the final reports. Brussels, Belgium; Commission of the European Communities. (1989) 470–472 ISBN 92-9081-020-3 [En, Bdo]

An apiary of two *Apis cerana* colonies was established at each of five sites in rice-growing areas of Bangladesh, and records of foraging activity, colony strength and available bee forage were made at intervals of two weeks from 1 July 1985 to 30 June 1987. Samples of pollen loads and honey were collected for later examination. At each site, the amount of foraging for nectar reached its peak in December–January; at three sites a secondary peak occurred in February. Peaks of pollen collection tended to coincide with those of nectar collection. Foraging *A. cerana* were seen to visit 93 plant species, with many more bees seen foraging on *Brassica napus* than on any other species. *Litchi chinensis*, *Cocos nucifera*, *Citrus grandis* and *Bombax ceiba* received many visitors, and *Moringa oleifera*, *Musa* spp., *Mikania scandens*, *Syzygium cumini* and *Ziziphus mauritiana* were also attractive. Species flowering and visited outside the main foraging period, which are valuable for colony maintenance, are listed. A mean of 3.0 kg honey/colony was harvested during the two seasons. Recommendations for planting bee forage are made, and it is envisaged that returns of 5 kg/colony (worth TK500) would be realistic. It is recommended that similar studies should be carried out in other areas of Bangladesh. D.G. Lowe

Alam, M.K. Reproductive biology of *Thyrsostachys regia* (Munro) Bennet (Bambusoideae: Poaceae). *Bangladesh Journal of Forest Science* (97) 26 (1) 25–30 [En, bengali, X] Flowering was studied in two clumps of this species (syn. *Thyrsostachys siamensis*, from Thailand) grown in

Bangladesh; two bee species (*Apis dorsata* and an unidentified sp.) visited the flowers, and plants produced fruits. Bangladesh Forest Research Inst., PO Box 273, Chittagong 4000, Bangladesh.

Alam, M. Z., Alam, M. B. and Quadir, M. A. Comparative evaluation of some pollinating methods on onion seed and subsequent bulb production. *Bangladesh Journal of Botany* (91) 20 (2) 125–130 [En, X]

Caged blowfly (*Calliphora* sp.), caged honey-bee (*Apis cerana*) and open pollination were compared for the pollination of onion. All the seed yield parameters showed that caged blowfly pollination was significantly better in comparison to other treatments and was followed by caged bee pollination, open pollination and the control. Insect pollination improved germination and, to a lesser extent, bulb production.

Inst. Postgraduate Studies Agric., Gazipur, Bangladesh.

Alam, M. Z., Rahman, M. S. and Ali, M. Role of pollinating agents on the mode of pollination in mustard. *Bangladesh Journal of Botany* (95) 24 (1) 13–18 [En, X]

The mustard variety Sonali Sharisha (SS–75) was subjected to eight pollination treatments comprising open pollination and combinations of emasculated/unemasculated flowers under mosquito net/polyethylene caging with or without honey-bees. In the absence of self-pollen, up to 81% cross-fertilisation was achieved with honey-bee pollination under caged conditions. Wind contributed 12% and 20% cross- and self-pollination, respectively.

Dept. Genetics Plant Breeding, IPSA, Salna, Gazipur, Bangladesh.

Alam, M. Z. and Gul-E-Zannat. Apiculture in Bangladesh. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 82–86 [En, B]

Alam, M. Z. and Quadir, M. A. Role of honeybee in fruit and seed setting of bottle-gourd, *Lagenaria siceraria* (Mol.) Standl. *Punjab Vegetable Grower* (1986) 21 32–34 [En, Ba]

The fruit set of *L. siceraria* pollinated by honeybees (*Apis cerana*) was 15.00%, compared with 8.33% for hand-pollinated flowers and 3.33–5.00% for isolated plants. Honeybee-pollinated flowers also produced the greatest percentage of filled seed (60.35%). J. M. Gedy

Inst. Postgraduate Studies in Agric., Salna, Gazipur, Bangladesh.

Alam, M. Z., Quadir, M. A. and Ali, M. Pollinating behaviour of honeybee, *Apis indica* F. and its influence on seed production of cauliflower. *Bangladesh Horticulture* (1987) 15 (1) 25–30 [En, Bb]

Honeybees (*Apis cerana*) visiting open plots of cauliflowers spent 9.03 s on each flower and 149.0 s on each plant. Corresponding values for plants caged with a small colony of honeybees were 6.69 s and 160.8 s. The number of flowers visited per minute was higher in caged plots. Open plots produced more seeds (11.5 per siliqua) compared with caged plots (9 per siliqua) and had a higher percentage of filled seed (69.70% compared with 54.20%). J. M. Gedy

Inst. Postgraduate Studies in Agric., Salna, Gazipur, Bangladesh

Alam, M. Z., Quadir, M. A. and Ali, M. S. Effect of bee pollination on seed production of carrot, *Daucus carota* L. *Bangladesh Journal of Botany* (1987) 16 (2) 199–201 [En, Ba]

Open plots of carrots visited by *Apis cerana* foragers and a negligible number of wild insects produced 2396 seeds/umbel weighing 3.49 g. Plots caged to exclude insects produced only 160 seeds/umbel, weighing 0.34 g. Honeybee activity was highest between 09.00 and 11.00 hours when the temperature averaged from 31.8 to 34.9°C. Foraging activity declined as temperature increased and did not resume again in favourable temperatures in the evening, possibly because of lack of pollen and nectar. J. M. Gedy

Inst. Postgraduate Studies in Agric., Salna, Gazipur, Bangladesh

Ansary, A. B., Hossain, M. and Bari, M. N. Analysis of honey and incidence of diseases, pests and predators in the colony of honeybee, *Apis cerana* (F.). *Bangladesh Journal of Entomology* (2001) 11 (1/2) 21–30 [En, X]

Two *A. cerana* honeys were analysed. Mustard honey contained on average: 67.5% reducing sugars, 4.9% non-reducing sugars, 72.3% total sugars, 25.5% water and 0.2% ber (*Ziziphus mauritiana*) honey contained 65.4%, 4.7%, 70.1%, 27.4% and 0.6%, respectively. Colonies were infected with EFB, especially in January (76%), but were not infected from July to November. *Galleria mellonella* infestation was highest in June (59.3%). *Varroa mites* were found only in May and June. *Vespa orientalis* and the wax beetle, *Platybolium alvearium*, and were also recorded but did little damage.

Proshika (A Centre for Human Development), I/1-Ga, Sec.-2, Mirpur, Dhaka-1216, Bangladesh.

Attfield, H. H. D. A beekeeping guide. Arlington, VA, USA; Volunteers in Technical Assistance. (1981?) ii + 45 pp. ISBN 0-86619-154-2 [En, B]

Written for those beginning beekeeping in Bangladesh.

Bhuiya, B. A. and Miah, I. A preliminary report on the bees (Hymenoptera: Apoidea) of Chittagong, with brief biological notes. Chittagong University Studies, Science (1990) 14 (2) 61–71 [En, hi, Ba]

Eighteen species of Apoidea (four Apidae, seven Xylocopidae, four Megachilidae, two Anthophoridae and one Halictidae), found in this area of Bangladesh, are described.

Department of Zoology, University of Chittagong, Chittagong, Bangladesh.

Burgett, M. Honey hunters of the Sundarbans. *Beekeeping & Development* (2000) (No. 56) 6–7 [En, Bj]

Collection of honey from *Apis dorsata* nests in mangrove forest in Bangladesh and India.

Dept. of Entomology, Oregon State Univ., Corvallis, OR, USA.

Dewan, S. M. A. L. Apiculture in Bangladesh. *Adeb News* (1982) 9 (4) 33–37 [En, B]

Includes a list of 45 bee plants with local, English and botanical names.

Dewan, S. M. A. L. *Apiculture in Bangladesh – management and extension. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980.* (1983) 123–135 [En, B] After briefly describing the geography, honeybees (*Apis dorsata*, *A. cerana*, *A. florea*), and beekeeping history of Bangladesh, the author summarises the objectives and progress of a Canadian University Service Overseas (CUSO) development programme. Data are given for: sizes of hive boxes and equipment used; honey yields from *A. cerana* colonies in nine areas of Bangladesh; 37 plant species identified as bee forage. Training methods are described. *D. G. Lowe*
CUSU-Apiculture Programme, GPO Box No.414, Dacca, Bangladesh.

Dewan, S. M. A. L. *Report on the farmers training on apiculture.* Dhaka, Bangladesh; Bangladesh Institute of Apiculture. (1985) 41 pp. [En, Bd]
This report describes a project initiated by the Agricultural Research Council and Agricultural Research Institute of Bangladesh. Its main objectives were to disseminate information about beekeeping, especially in rural areas, and to increase honeybee populations for pollination purposes. The methods used (by the Bangladesh Institute of Apiculture) are described and illustrated. *D. G. Lowe*
Bangladesh Inst. Apiculture, Shyamoli, Mohammadpur, Dhaka-7, Bangladesh.

Dewan, S. M. A. L. *Beekeeping in Bangladesh and the role of the Bangladesh Institute of Apiculture.* Dhaka, Bangladesh; Bangladesh Institute of Apiculture. (1988) viii + 48 pp. + 12 pl. [En, Bd]
A brief background history of beekeeping in Bangladesh leads to a description of the origins of the Bangladesh Institute of Apiculture (BIA). The rest of the book, which forms the 8th Annual Report (1986–87) of the BIA, describes its achievements, functions, available facilities and future research and training objectives. Constraints and limitations are discussed, and a number of case studies are presented. A 12-page section of photographs illustrates the work of the BIA. *D. G. Lowe*
Bangladesh Inst. Apiculture, 23/12 Khilji Rd., Shyamoli, Dhaka 1207, Bangladesh.

Dewan, S. M. A. L. *Foraging and resource utilization of Apis spp. (Hymenoptera: Apidae) of Bangladesh.* PhD Thesis, University of Wales, Cardiff, UK. (1995) xxviii + 294 pp. [En, Bdo]
To examine the potential for beekeeping in the rice-growing areas of Bangladesh, a 2-year field investigation was undertaken at five sites in the Dhaka region. Observations on *Apis cerana*, *A. dorsata* and *A. florea* revealed that more foragers collected nectar only than pollen only or both nectar and pollen. The peaks of pollen collection were at 10.00 hours for all species of bees whereas the peaks of nectar collection were different. The diurnal patterns of foraging by *A. cerana* and *A. dorsata* were similar. All the species started foraging before 05.00 hours and continued later than 18.00 hours except in winter, when the day-time is shorter. Surplus honeys were extracted in winter (from *Brassica napus*) and in spring (from *Litchi chinensis*). A total of 86 plant species were visited, of which 29 were for-

aged on by all three bee species, and 29 by *A. cerana* and *A. dorsata*. *Cocos nucifera* (pollen) and *Musa paradisiaca* (nectar) were visited by all three species of bees throughout the year. *Amaranthus spinosus*, *Benincasa hispida*, *Moringa oleifera*, *Phoenix sylvestris*, *Tamarindus indica* and *Ziziphus mauritiana* were the other important plants visited by the three *Apis* species. A total of 132 plants were identified from 233 pollen samples collected from *A. cerana* colonies. Species of *Amaranthaceae*, *Averrhoaceae*, *Cruciferae*, *Leguminosae*, *Myrtaceae*, *Palmae*, *Rhamnaceae*, *Rutaceae* and *Sapindaceae* were represented most in the pollen samples. *Cocos nucifera* was the major source of pollen for *A. cerana*; the others were *Brassica napus*, *Phoenix sylvestris*, *Borassus flabellifer* and *Amaranthus spinosus*. Pollen analyses of 39 honey samples showed that *A. cerana* utilised 118 plants for nectar collection. The greatest number of pollen types in the samples was 23 and the lowest was four. Of the total honey samples, four were unifloral and 35 were multifloral. Twenty-five plant species occurred either as dominant (more than 45%) or secondary (16–45%) in the samples. *Brassica napus*, *Litchi chinensis* and *Ziziphus mauritiana* were the predominant species. Bangladesh Author

Gill, L. S. and Chinnappa, C. C. *Pollen morphology of the West Himalayan Asia Labiatae.* *Bangladesh Journal of Botany* (1982) 11 (2) 107–123 [En]

Habibullah, M. S. and Ismail, M. M. *Production frontier and technical efficiency: the case for beekeeping farms in Malaysia.* *Bangladesh Journal of Agricultural Economics* (1994) 17 (1/2) 31–43 [En, 41 ref.]

The paper presents a study examining the level of technical efficiency of a sample of beekeepers in Malaysia. A Cobb-Douglas production frontier equation is used to assess the level of efficiency. Beekeeping is labour intensive, but is usually done on a part-time basis using family labour. Data were collected in 1989 from 116 beekeepers (from which the data of 52 beekeepers were used) in eight areas of four states in Peninsular Malaysia. The technical efficiency index produced from the frontier production function suggests that the sample of Malaysian beekeepers are highly technical inefficient. There is considerable potential to increase output using available inputs and technology. It is also noted that technical inefficiency decreases with increasing farm size.

Faculty of Economics and Management, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Hannan, M. A. *[Beekeeping and apicultural products in Bangladesh].* *Honeybee Science* (2000) 21 (4) 154–158 [Ja, en, Bj]

In this country there has been little effort to produce honey on a commercial scale, and little beeswax is produced, although demand for it is high. Very few crop growers use bees for pollination.

Bangladesh Center for Advanced Studies, House 23, Road 10/A, Dhanmondi, Dhaka-1209, Bangladesh.

Hirashima, Y. *Natural history of wild bees and honey bees.* *Honeybee Science* (1991) 12 (2) 49–54 [Ja, en, Bj]

The morphological and behavioural characteristics of *Apis* species and other Apoidea are discussed briefly. Observations on the nesting behaviour of *Apis dorsata*,

made in Dhaka, Bangladesh, in 1990, are reported. The utilisation of wild bees for crop pollination is mentioned.
Author

2-12-12-105 Kusagae, Chuo-ku, Fukuoka-shi 810, Japan.

Hossain, A. B. M. E. and Sharif, M. *Beekeeping potentials of Bangladesh. I. Studies on the important honey and pollen sources of northern Chittagong region.* Bangladesh Journal of Zoology (1988) 16 (1) 23–30 [En, Bc]

Honeybee forage species were identified in areas surrounding an *Apis cerana* apiary at Mirsarai in 1982–86. Although *A. cerana*, *A. dorsata*, *A. florea* and *A. mellifera* all foraged in the area nearly 80% of plant species were visited by *A. cerana* alone. A table lists the 140 species identified, with details of their scientific and local names, flowering periods and value as a nectar and/or pollen source. D. G. Lowe

Dept. Biology, Mirsarai Coll., Mirsarai, Chittagong, Bangladesh.

Hossain, A. B. M. E. and Sharif, M. *Control of mite infestations of hives of Apis cerana Fabr. (Hymenoptera: Apidae).* Bangladesh Journal of Zoology (1991) 19 (1) 101–106 [En, Bb]

In Chittagong, Bangladesh, it was found that *Varroa jacobsoni* infestations of *Apis cerana* colonies could be controlled by caging the queen for 35–40 days to interrupt breeding, cleaning the hive thoroughly and placing the brood chamber above the super chamber. With the appearance of *Varroa* infestation in an apiary, it is recommended that the brood chamber and super of all uninfested colonies should be reversed and a queen excluder used. J. M. Gedy

Mirsarai College, Mirsarai, Chittagong, Bangladesh.

Hossain, A. B. M. E., Sharif, M. and Baqui, A. H. *Nest site selection of the Asian hive bee, Apis cerana F., in Bangladesh.* Journal of Apicultural Research (1992) 31 (1) 45–46 [En, Bj]

Data on 80 natural nests of *Apis cerana* were collected from the Chittagong region of Bangladesh in the period from November 1981 to March 1991. Most (56.2%) of the nests were situated in human dwellings and other artificial structures, while 41.3% were located in tree cavities and 2.5% were found in underground sites. Nest entrance direction showed a pronounced southerly bias, with 48% of entrances facing S, 25% E, 16% N and 11% W. It is suggested that this preference is due to climatic conditions; the prevailing monsoon winds usually blow from the south and south-west, whereas cold winter winds blow from the north. D. G. Lowe

Mirsarai College, Chittagong, Bangladesh.

Hossain, A. B. M. E., Sharif, M. and Baqui, M. A. *Appropriate time for colony nursing and honey extraction of Apis cerana Fab. during honey flow season.* Bangladesh Journal of Zoology (1993) 21 (1) 35–39 [En, Bb]

Using strong colonies of *Apis cerana*, the numbers of incoming and outgoing bees were counted from 05.00 to 18.00 hours during the honey flow season. There was little foraging activity between 11.00 and 14.00 hours, and it is suggested that hive management should be carried out during this period. J. M. Gedy

Mirsarai College, Mirsarai, Chittagong, Bangladesh.

Hossain, A. B. M. E., Sharif, M. and Laskar, M. R. *Beekeeping potentials of Bangladesh: II. Annual honey production by Apis cerana L. at Mirsarai area of Northern Chittagong region.* Bangladesh Journal of Zoology (1989) 17 (1) 75–82 [En]
Studies with seven *A. cerana* colonies in the Mirsarai area showed that April and May are the peak honey flow months, and that December–February is a dearth period. The peak period yielded 3–5 kg of marketable honey. The best flow in terms of honey production was from *Barringtonia acutangula*, followed by those from *Syzygium fruticosum* + *S. cumini* + *S. jambos*, *Citrus medica*, and *Ziziphus mauritiana*.

Inst. Life Sci., Jahangirnagar Univ., Savar, Dhaka, Bangladesh.

Hye, M. A., Rahman, M. S., Enam-E-Rasul. Chowdhury, Faruq, M. O. Hossain, M. E., Ali, M. A. and Islam, M. S. *Investigations on honey. Part I: Studies on probable mathematical derivations on the types of honey.* Bangladesh Journal of Scientific and Industrial Research (98) 33 (2) 196–199 [En, X]

A mathematical method for estimating the types of honey that can be produced when two factors, bee species and type of flowers, are considered, is described and discussed. BCSIR Laboratories, Rajshahi-6206, Bangladesh.

Karlsson, T. *The natural nest of the Asian hive bee (Apis cerana) in Bangladesh: a minor field study. Working Paper, International Rural Development Centre, Swedish University of Agricultural Sciences* (1990) (No. 134) iii + 32 pp. + xii [En, Bdo]

This study was carried out in Bangladesh in February–March 1989. The aim of the study was to get a biological basis for the development of a suitable hive for *A. cerana*. Several characteristics of feral nests were studied. The most common nesting places were in trees of different species, but some ground nests were also found. The entrances faced south to east in 15 of 29 nests. The entrance was placed 1.5 (+/–0.4) m above ground level. The entrance area was 78.5 (+/–21.4) cm². The nest volume (6.7 +/–1.1 litres) filled only a comparatively small part of the total cavity volume available (20.3 +/–5.6 litres). The average number of combs per colony was 6.4 (+/–0.6) and the mean total comb area per colony was 2239 (+/–4380) cm². The comb distributions of brood, honey and pollen are given. Comb thickness (19.18 +/–0.14 mm), comb midrib distance (26.46 +/–0.49 mm) and cell dimensions are also given. The egg-laying capacity of queens in feral colonies is discussed. The results are compared with findings from other studies on *A. cerana* and *A. mellifera*, of both temperate and tropical races. A movable-comb top-bar hive with a volume of at least 10 litres, preferably 15–20 litres, allowing the honeybees to place their combs 26–27 mm apart, is suggested. It should be possible to construct the hive with locally available materials, such as straw, cane and bamboo, with no or very little expenditure. Author

Khan, M. R. and Razzaque, M. A. *A microbiological approach to the causes of migration of honey bees from their hives.* Bangladesh Journal of Botany (1981) 10 (1) 53–57 [En, B]

It was observed that *Apis cerana* bees were leaving their hives in Dacca, Bangladesh, for no apparent reason. A microbiological study of honey from the hives revealed the presence of *Bacillus alvei* and *B. circulans*, which were able to develop in crude undiluted honey. It is suggested that the spoilage of their honey stores by bacteria caused the bees to migrate. M. R. Khan

Dept. Botany, Univ. Dacca, Bangladesh.

Masilamani, P. and Vadivelu, K. K. Seed development and maturation in honey mesquite (*Prosopis juliflora* Swartz. DC.). *Bangladesh Journal of Forest Science* (97) 26 (1) 68–73 [En, bengali, X]

In a study of seeds on a 10-year-old tree in Tamil Nadu, India, physiological seed maturity was reached about 91 d after anthesis. The seeds extracted at this stage had maximum seed weight, germination and vigour potential.

Dept of Seed Technology, Tamil Nadu Agricultural Univ., Coimbatore-641 003, Tamil Nadu, India.

Mohammad, A. Economic impact of beekeeping: a case study of Bangladesh. Proceedings of the Expert Consultation on Beekeeping with *Apis mellifera* in Tropical and Sub-Tropical Asia, Bangkok/Chiang Mai, Thailand, 9–14 April 1984. Rome, Italy; Food and Agriculture Organization of the United Nations. (1984) 111–122 [En, B]

The potential for the development of beekeeping in Bangladesh is discussed. Costs and profits for honey production are given, based on a limited survey and data provided by the Bangladesh Institute of Apiculture. It is estimated that a net return per colony of Tk 927/yr (1983 prices) is possible once an apiary has been established. This represents 15–20% of the total income of most small farms in Bangladesh. A national development programme for beekeeping could add US\$ 50 million to the economy, with most of the benefits being felt in rural areas. Other possible benefits, such as increased crop production, are discussed. D. G. Lowe

Canadian International Dev. Agency, Agric. Sector Team, Canadian High Commission, Dhaka, Bangladesh.

Murrell, D. C. and Nash, W. T. Nectar secretion by toria (*Brassica campestris* L. v. *toria*) and foraging behaviour of three *Apis* species on toria in Bangladesh. *Journal of Apicultural Research* (1981) 20 (1) 34–38 [En, B]

Nectar secretion by toria florets reached a peak at about 9 hours and decreased thereafter. Anthesis also occurred in the early morning. *Apis florea* appeared on the crop later, and in smaller numbers, than *A. cerana*, and spent more time on one floret. *Apis dorsata* was intermediate in foraging speed. Most bees of all species collected both nectar and pollen, but pollen collection by *A. cerana* was observed only in the morning. The highest proportion of *A. cerana* foragers carrying pollen loads followed shortly after anthesis. Maximum numbers of foragers were observed at 10.30 hours for *A. cerana* and at 12.30 hours for *A. florea*. Author

Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Nash, W. T. and Murrell, D. C. Beekeeping in Bangladesh. *American Bee Journal* (1981) 121 (5) 352–356 [En, B]

With *Apis cerana*; honey is also taken from wild *Apis dorsata* and *Apis florea* colonies.

Nessa, Z., Muttalib, M. A. and Begum, A. Studies on pollen collection pattern of honey bee. *Bangladesh Journal of Agriculture* (1980) 5 (2) 75–82 [En, B]

Some of the pollens were identified in pollen loads from *Apis mellifera* and *A. cerana* in localities in Bangladesh. Although not many plants were in flower during March, the amount of pollen collected was sufficient for brood rearing. Several plant species were visited, especially *Bombax ceiba*, *Cocos nucifera*, *Phoenix* sp., *Cosmos* sp., *Loranthus* sp., and species of *Graminae*. Of 24 loads, 20 were unifloral. P. Walker

BCSIR Lab., Dacca 5, Bangladesh.

Nessa, Z., Muttalib, M. A. and Begum, A. A preliminary study on nosema disease of honeybee and its control. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 19–March 4, 1980. (1983) 457–460 [En, B]

Detected in Bangladesh for the first time in an *Apis cerana* colony in November 1977; in 1978 metronidazole was used to control the disease in *A. mellifera* colonies.

Nessa, Z., Muttalib, M. A. and Begum, A. Wax moth and its control in Bangladesh. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 461–465 [En, B]

Partap, U. Bee flora of the Hindu Kush-Himalayas: inventory and management. Kathmandu, Nepal; International Centre for Integrated Mountain Development (ICIMOD). (1997) xi + 297 pp. ISBN 92-9115-662-0 [En, Bd]

This book is intended to be a practical guide to the main bee forage resources of the Hindu Kush-Himalayan region, for the use of beekeepers, farmers, extension workers and scientists. The book has two sections. The first consists of four chapters, the first of which provides an introduction to the honey-bee species and beekeeping of the region (which includes parts of Afghanistan, Bhutan, India, Nepal, Bangladesh, China, Myanmar and Pakistan). The second chapter gives an overview of Himalayan bee forage and assesses its potential as a beekeeping resource. Chapter 3 gives aids to the identification of bee flora, particularly their pollen grains. Chapter 4 focuses on methods of bee forage management; a flowering calendar for the Kathmandu Valley is provided. The second section of the book (pp. 61–226) describes 237 of the most promising honey plants in the Hindu Kush-Himalayas area, including species which provide surplus honey, those which are useful during colony build-up and those which support colonies during dearth periods. The plants are arranged in five groups: agricultural crops, horticultural crops, forage legumes, ornamental plants, wild plants and forest trees. Plants in each group are arranged according to their importance in honey production, and details are provided on distribution, morphology, flowering period, honey characteristics and pollen grain structure; over 120 colour plates illustrate the form and habit of the plants. Sources of honeydew honey and species which secrete

nectar toxic to bees or man are also listed. The four annexes comprise a general inventory of 366 species of bee flora of the region, a glossary of technical terms, a key for the identification of 279 pollen types and a list of multipurpose plants which could be grown in plantations, on common land and on roadsides. There is also a bibliography of 160 references and a subject index. This will be a valuable reference work for all those interested in beekeeping in the region. *D.G. Lowe*

Pasha, M.K. *Palynological investigations of medicinal plants from Bangladesh.* *Bangladesh Journal of Scientific and Industrial Research* (1979) 14 (1/2) 175–181 [En, B]

Pasha, M.K., Ghosh, D.R. and Roy, S.K. *A melittopalynological study of Sunderban honey.* *Bangladesh Journal of Botany* (1991) 20 (1) 105–107 [En, Ba]

Pollen analysis was carried out on six samples of honey from hives in three different areas around Sunderban, Bangladesh. A further six samples were collected from traders outside Sunderban. Eight samples contained mainly goran (*Cerriopes decandra*) pollen, two samples mainly khalshi (*Aegiceros corniculatum*) pollen and two were multifloral. *Derris sinuata* pollen was found in all samples and smaller amounts of *Hibiscus tiliaceous*, *Nypa fruticans* and *Rhizophora mucronata* were present in most samples. Vegetational zones and ecotypes had no marked effect on the pollen types found. *J.M. Gedye*

Department of Botany, University of Chittagong, Chittagong, Bangladesh.

Pasha, M.K. and Roy, S.K. *Pollen morphology of some species of Rauwolfia.* *Bangladesh Journal of Botany* (1980) 9 (2) 106–110 [En, B]

Peyara, S.A. *Effect of gamma rays on the sperms of honey bees (Apis mellifera carnica Pollm.) in vivo and in vitro.* *Vedecke Prace Vyzkumneho Ustavu Vcelarskeho v Dole u Libcic* (1974) 6 51–66 [En, cs\u00a0ru, B]

Motility of preserved semen (PS) in glass tubes after irradiation decreased with increasing dose, but was not completely destroyed even at 106 rads. Queens were instrumentally inseminated with PS irradiated at different doses. From 3 queens, which received PS exposed to 10,000, 600,000 and 700,000 rads, worker progeny were obtained with body dimensions smaller or larger than those of controls. Eleven queens which received PS exposed to 105–106 rads produced many eggs which did not hatch and brood which died; surviving pupae and adults were mainly drones. When naturally mated queens were exposed to gamma radiation at 5 x 105 rads they died immediately; those exposed to 104 rads died within 30 days, and those exposed to 2000 rads survived. Spermatozoa in the spermatheca of each dead queen showed the same motility as that of PS exposed to a similar radiation dose. *Author*

Dept. Entomology, Bangladesh Agric. Univ., Mymensingh, Bangladesh.

Peyara, S.A. *Rearing of honeybee queens (Apis mellifera carnica) in a Central European apiary.* *Bangladesh Journal of Agricultural Science* (1974) 1 (1) 1–4 [En, X]

Peyara, S.A. and Vesely, V. *Studies on artificially inseminated honeybee queens with irradiated semen under incubator conditions.* *Bangladesh Journal of Zoology* (1974) 2 (2) 125–131 [En, B]

This gives some of the results already reported in a previous publication. Spermatozoa showing the highest motility were in a sample irradiated with 50,000 rads before insemination. *P. Walker*

Dept. Entomology, Bangladesh Agric. Univ., Mymensingh, Bangladesh.

Rathore, M. S. and Verma, L.R. *Economics of beekeeping in Hindu Kush-Himalayan (HK-H) region. Honeybees in mountain agriculture [edited by Verma, L. R.].* New Delhi, India; Oxford & IBH Publishing Co. (1992) 221–233 ISBN 81-204-0650-8 [En, Bdo]

The economics of beekeeping are discussed, using previously published figures for Bangladesh, Pakistan, Himachal Pradesh (India) and Nepal. *D. G. Lowe*

International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Svensson, B. *Frame hive beekeeping in Bangladesh – a suitable income generating activity among the rural poor? Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.* London, UK; International Bee Research Association. (1989) 195–197 ISBN 0-86098-196-7 [En, Bdo]

Verma, L.R. *Beekeeping in integrated mountain development.* Edinburgh, UK; Aspect Publications with support from the International Centre for Integrated Mountain Development. (1991) xvi + 367 pp. ISBN 1-85529-088-X [En, Bd]

This book covers frame-hive beekeeping as a feature of rural development in the Hindu Kush and Himalayan region of Asia; the region includes mountainous parts of Burma, Pakistan, India, Nepal, Bangladesh, Bhutan and China. The first part of the book is intended to make planners and other experts aware of the importance of beekeeping in the region, and the second part provides information on bees and beekeeping for specialists more directly concerned. Its main content is a study of the present situation, but there are also some recommendations for the future. It is science-oriented, with an extensive compilation of data on morphological and other characteristics of *Apis cerana*, many resulting from the author's own work. The book sets out the status and economics of mountain beekeeping with *A. cerana* and/or introduced *A. mellifera* in the countries concerned. It also refers in passing to other Asiatic *Apis* species, to traditional beekeeping and the use of top-bar hives, and to mountain regions in other continents. Species and genera of honey plants are listed under their botanical families, with information on flowering period, distribution, and value as a nectar/pollen source. The use of *A. cerana* and other insects in crop pollination is covered, with special attention to apple and some reference to the effects of altitude. The book contains a reference section of about 650 publications and general and scientific name indexes. It should be a useful source of information for those concerned with assessing and developing beekeeping in the Hindu Kush and Himalayan region. *E. Crane*

Barbados

Barbados National Standards Institution. *Specification for honey.* Barbados National Standard (1978) (No. BNS 35) 28 pp. [En]

Inter-American Institute for Cooperation on Agriculture. *Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992.* Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]

The first section of the Proceedings gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados, Dominica, Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey-bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agro-forestry and environmental protection in the Caribbean. D.G. Lowe
IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia.

Edgar, W.M. and Jenkins, G.N. *Solubility-reducing agents in honey and partly-refined crystalline sugar.* *British Dental Journal* (1974) 136 (7) 7–14 [En, B]

Raw (Barbados) sugar contains cations (probably Ca⁺⁺, Fe⁺⁺⁺ and Cu⁺⁺) which reduce the solubility of tricalcium phosphate or enamel in acetate buffer, pH 5.0, and in saliva incubated for 4 hours, compared with that in pure sucrose controls. The effect is much reduced or reversed after 24-hour incubations; this reduction is attributed to (a) greater buffer strength in saliva or raw sugar mixtures than in controls which is observed after 24 hours but not after 4-hour incubations, (b) diminished effectiveness of the cations at the pH attained after 24-hour incubations, and in buffers other than acetate. The solubility-reducing agent of honey is tentatively identified as an organic phos-

phate ester, and degradation by salivary enzymes may explain the absence of a solubility effect in incubations with saliva and enamel. Although the results suggest that partly refined sugars, but not honey, may be less cariogenic than refined sugar, the evidence is as yet inadequate to support their use as an anti-caries measure. *Author*
Dept. Oral Physiology, Univ. Newcastle-upon-Tyne, Markham Laboratories, Upper Claremont Street, Newcastle-upon-Tyne, UK.

Persano Oddo, L., Krell, R. and Festuccia, N. *Quality of selected honeys from the southeastern Caribbean.* *Apicoltura* (1989) (No. 5) 137–145 [En, it, B]

After analysing 47 honeys from Guyana, seven from Barbados and three from Trinidad, results were compared with the standard recommended by the Codex Alimentarius Commission. Minimum permitted levels were exceeded for water content in eight honeys, for mineral content in four and for HMF in 10. Amylase level was too low in 13 honeys. In addition, organoleptic examination showed that 12 honeys did not conform to standards of cleanliness, 10 honeys were fermented and 10 had 'off-odours'. Altogether, 33 of the honeys did not fulfil the requirements of the standard, but only five were of really poor quality. *P. Walker*

Sezione di Apicoltura, Istituto Sperimentale per la Zoologia Agraria, Via Leonida Rech 36, 00156 Rome, Italy.

Pollard, G. *Update on new pest introductions in the Caribbean.* *CARAPHIN News* (1997) (No. 15) 11 [En]

Among the pest introductions noted is the finding of *Varroa jacobsoni* in Curacao.

Food and Agriculture Organization of the United Nations, Sub-Regional Office for the Caribbean (SLAC), P.O. Box 631-C, Bridgetown, Barbados, West Indies.

Rindfleisch, J.K. *Beekeeping in Barbados, West Indies.* *American Bee Journal* (1979) 119 (2) 131, 135 [En, B]

Belize

Commonwealth Secretariat and International Bee Research Association (eds). *Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth.* London, UK; Commonwealth Secretariat. (1979) viii + 196pp. ISBN 0-85092-160-0 [En, B]

The papers selected for this book present widely differing examples of achievements and difficulties in various parts of the developing world. There are 11 original contributions, and these are abstracted or listed separately. *P. Walker*

Marlborough House, London SW1Y 5HX, UK.

Belize, Ministry of Agriculture. *A guide to beekeeping.* Belmopan, Belize; Beekeeping Section, Ministry of Agriculture. (1987) 82 pp. [En, Bd]

Bennett, F.D. *Baited McPhail fruitfly traps to collect euglossine bees.* *Journal of the New York Entomological Society* (1972) 80 (3) 137–145 [En, B] Commonwealth Inst. Biological Control, Gordon St., Curepe, Trinidad

McPhail traps, modified to include wicks soaked with an attractant, were used to capture male euglossine bees in British Honduras. Of the attractants tested, beta-ionone and skatole were the most successful. The species most frequently trapped were *Eulaema cingulata*, *Eulaema poly-*

chroma, *Euglossa purpurea*, *Euglossa tridentata* and *Euglossa heterosticta*. Female euglossines were caught in McPhail traps that were baited with a partially hydrolysed protein to trap Mexican fruitflies. J. M. Gedye

Burgett, M. and Fisher, G. A review of the Belizean honey bee industry. Corvallis, USA; Oregon State University. (1990) 30 pp. [En, Bc]

This report describes a 6-week investigation of the bee-keeping industry in Belize, carried out in January–February 1990. The recent history of beekeeping in Belize is reviewed and the current situation is described, with statistics for the number of beekeepers, number of hives, and honey production. In 1983, there were 550 beekeepers with about 11,000 hives producing 499,000 lbs [226,500 kg] of honey. In 1987, the number of beekeepers had fallen to 503, but 678,000 lbs [308,000 kg] of honey were produced. The number of beekeepers has continued to fall, to 361 in 1989, with 4399 hives and an annual honey production of 484,000 lbs [220,000 kg]. Many apiaries that were examined were in a state of decline or had been abandoned. A condition described as 'beekeeper discouragement' was identified. The primary cause for the decline is the presence and continued spread of the Africanised honeybee, first identified in Belize in 1987. During the survey 39% of samples examined were classed as Africanised. The results of field trials and feeding experiments indicated that the aerial spraying of glyphosate during the marijuana eradication programme has not been a factor in the deterioration of the beekeeping industry. It is recommended that the following be carried out: (1) development of European queen honeybee sources; (2) establishment of a queen rearing programme; (3) development of Africanised honeybee management programmes and training; (4) an increase in government support. D. G. Lowe

Dept. Entomology, Oregon State Univ., Corvallis, OR 97331, USA.

Burgett, M., Fisher, G. and O'Doherty, R. The Africanization of a nation: Belize, Central America. *Gleanings in Bee Culture* (1990) 118 (9) 534–537 [En, Bj]

Most of the c 10,000 colonies in Belize are kept by small-holders with 15–25 colonies each. Average annual honey production (1984–88) was over 273 t, most of which was exported: average colony yield (1980–89) was 35 kg. Africanised honeybees reached the country early in 1987, or before. In January–February 1990, when 58 apiaries with 620 colonies were examined throughout Belize, many hives were found empty and only a few colonies had a honey surplus. Some apiaries had been abandoned and others were deteriorating. On testing samples of bees from the apiaries, all were found to be highly or partly Africanised. *Acarapis woodi* was identified at one apiary. Although many beekeepers are discouraged, and some have stopped beekeeping, a few are changing their management methods to make the best use of the new situation. Recommendations for action are given. P. Walker

Dept. Entomology, Oregon State Univ., Corvallis, OR 97331, USA.

Cal, M. and Mayer, D.F. Tracheal mites and Africanized honey bees in Belize. [Abstract]. *American Bee Journal* (1987) 127 (12) 841–842 [En, Bj]

In 1987 worker honeybees were collected from 234 colonies in 66 apiaries throughout Belize. No *Acarapis woodi* were found in any of the 4301 bees dissected. A programme for the control of Africanised bees was introduced in Belize in March 1987 and these bees were first detected there in May 1987. By August, 343 swarms of Africanised bees had been caught in baited traps. P. Walker

Natn. Beekeeping Center, Belmopan, Belize.

Choate, L.D. Belize – the quiet before the storm. *American Bee Journal* (1985) 125 (10) 697–699 [En, B]

Beekeeping in Belize is threatened by the spread of Africanised bees from the south and acarine disease from the north.

Heath, L. A. F. Occurrence and distribution of chalk brood disease of honeybees. *Bee World* (1985) 66 (1) 9–15 [En, B]

This review, with 74 references, describes the distribution of *Ascosphaera apis*, particularly in temperate regions. Until recently chalk brood disease had been reported only from the North, but since 1980 it has also been reported from New Zealand and Argentina. Its occurrence in tropical regions seems to be limited, though it has been reported from southern Mexico, Belize, Honduras and the Philippines. It is suggested that more accurate measures of chalk brood disease frequency and importance in various parts of the world are needed, as many reports fail to indicate whether a single colony is involved or whether the infection is widespread. Recent experiences in New Zealand, Australia and North America suggest that strains of honeybee resistant to the disease exist and could be used in selective breeding programmes. D. G. Lowe

Dept. Biological Sci., Plymouth Polytechnic, Plymouth, Devon, UK.

Jackson, J.F. Mimicry of *Trigona* bees by a *reduviid* (Hemiptera, Heteroptera) from British Honduras. *Florida Entomologist* (1973) 56 (3) 200–202 [En]

Kennedy, K. Beekeeping in Belize, C.A. *Gleanings in Bee Culture* (1974) 102 (9) 273, 291 [En, B]

Krell, R. The results of diminishing forest resources on management and productivity of honey bees, based on examples of three tropical countries. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 35–37 ISBN 0-86098-215-7 [En, Bdo]

Nectar sources provided by the forests of Guyana, Belize and Sri Lanka are discussed.

ICON Development, Viale Regina Margherita 239, 00198 Rome, Italy.

Linhardt, Y.B. and Mendenhall, J.A. Pollen dispersal by hawkmoths [Sphingidae] in a *Lindenia rivalis* Benth. [Rubiaceae] population in Belize. *Biotropica* (1977) 9 (2) 143 [En]

Mayer, D. F. and Cal, M. **New beekeeping industry in Belize faces many of the same problems we have.** *American Bee Journal* (1988) 128 (3) 197–198 [En, Bj]

McElroy, C. S. **Stingless bees of Belize.** *American Bee Journal* (1982) 122 (12) 824–826 [En, B]

Miranda, U. Y. and Duran, M. **Beekeeping in Belize. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.** London, UK; International Bee Research Association. (1989) 519 ISBN 0-86098-196-7 [En, Bdo]

Mulzac, H. C. **Beekeeping in Belize. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth.** London, UK; Commonwealth Secretariat. (1979) 155–163 [En, B]
In some areas stingless bees are kept as they have been since antiquity, but generally meliponiculture has declined. *Apis mellifera* was introduced 20 years ago, and many colonies are now kept in the dry tropical region of the north of Belize, where about 95% of the country's honey is produced. In the wet subtropical region in the south, some upland areas with tropical hardwood forests are also quite productive. Important bee forage plants are listed in Appendix Ib (p. 194); pollen is available throughout the year, and there is a wide variety of nectar-yielding trees. Annual honey production has increased steadily (280 t in 1976); average overall yield is 44.5 kg/colony, and 51 kg/colony in the tropical region. Honey is exported to the UK, and also some to the USA. Most beekeepers use movable-frame hives which are made in Belize or imported from Mexico. Some farmers are starting to use fixed-comb hives into which they introduce feral swarms. Enemies include birds, toads and ants; chalk brood and nosema disease are present and, less commonly, American foul brood. In a few areas pesticide spraying is a problem, but some agreements between beekeepers and growers have reduced bee losses in other places. There are two government demonstration apiaries which run beekeeping courses, and the Ministry of Social Services sponsors that training of young beekeepers in Belmopan. P. Walker
624 McDonough Street, Brooklyn, NY 11233, USA.

Nunamaker, R. A., Wilson, W. T., Cal, M., Choate, L. and Tween, G. **Beekeeping in Belize, Central America, with notes on diseases and parasites.** *Bee World* (1986) 67 (4) 151–156 [En, Bj]

There are approximately 600 beekeepers in Belize owning about 7500 colonies. Annual honey production in commercial apiaries ranges from 45 to 90 kg/hive. All the hives that were seen in a 1984 survey were Langstroths, made of mahogany. Primitive hives were either scarce or non-existent. Most queens are imported from California. Honeybee forage is abundant and migratory beekeeping is rare. Diseases and pests include foul brood, chalk brood, wax moth and bee paralysis, but none of the 46 colonies examined during the survey were affected by AFB, EFB, chalk brood, *Acarapis woodi* or *Varroa jacobsoni*. Nosema disease was within acceptable limits. Toads, ant-eaters and several

species of birds can cause problems, but the most serious pests are termites and ants. Enzyme analyses indicated that the honeybees of Belize are not Africanised. Beekeeping extension work and other government activities in apiculture are described. D. G. Lowe
Arthropod-borne Animal Disease Res., ARS, USDA, Laramie, WY 82071, USA.

Phipps, J. (ed.) **The beekeeper's annual 1987.** Hebden Bridge, UK; Northern Bee Books. (1986) 192 pp. ISBN 0-907908-36-5 [En, Bd]

This edition of the Annual contains an illustrated calendar and diary, a directory of UK beekeeping associations and statistics, and eight articles on a wide variety of topics, including swarming, beekeeping in Belize, plastic hives, toxicity of insecticides to bees, the bee and the hive in art, and willows for bees. D. G. Lowe

Sherriff, B. **A beekeeping trip to Belize.** *Beekeepers' Quarterly* (1997) (No. 51) 20–23 [En, Bj]

Villanueva G. R., Cesar-Dachary, A. and Sanchez-Vazquez, A. **The impact of the Africanized honey bee in north Belize.** *American Bee Journal* (1991) 131 (3) 183–185 [En, Bj]
A survey of beekeeping was carried out in 1990, four years after Africanised bees arrived in Belize. Total annual honey production has decreased from over 200 t to 50 t. Most of the honey is produced in the Orange Walk and Corozal districts in the north. Half the beekeepers there have given up, and there are now 116 beekeepers with 2541 hives; about 80% of the colonies are Africanised. Little protective clothing is available, and training in the management of Africanised bees started only recently. In 1990, 800 European queens were imported from Hawaii. In 1986 and 1987, paraquat spraying of marijuana killed many bees, but different chemicals are now used under stricter controls. The area under intensive cultivation of sugar cane and other crops has increased, with a resulting increase in pesticide usage and a decrease in bee forage. P. Walker
Centro de Investigaciones, Apdo. Postal 424, Chetumal, Quintana Roo 77000, Mexico.

Young, A. M. **Studies of cecidomyiid midges (Diptera: Cecidomyiidae) as cocoa pollinators (Theobroma cacao L.) in Central America.** Proceedings of the Entomological Society of Washington (1985) 87 (1) 49–79 [En, Bb]
At two localities in Costa Rica, the most abundant insects on cacao flowers were two midge species, *Clinodiplosis* sp. and *Mycodiplosis* sp. *Cecidomyiid* midges were also found in a less detailed study in Belize. Females were more common than males. The adults have certain characteristics and activity patterns that make them good pollinators. The pollination mechanism is similar to that of ceratopogonids, except that cecidomyiids also forage on the stomate-type nectaries lining petal ligules and the inner surfaces of petal hoods. Relevant information on the biology of these midges is discussed. P. Walker
Invertebrate Zoology Section, Milwaukee Public Museum, Milwaukee, WI 53233, USA.

Botswana

Beeline. *The stingless honey-bees [Meliponinae] of Botswana.* Beeline, Zimbabwe (1989) 26 (1) 10–14 [En, Bj]

Beekeeping & Development. *Zooming in on [beekeeping in] Botswana.* Beekeeping & Development (1992) (No. 25) 15 [En, Bj]

Clauss, B. *Bee keeping handbook.* Gaborone, Botswana; Ministry of Agriculture. (1982) (Ed. 2) iv + 76 pp. [En, B] Revised edition of AA

Clauss, B. *Bees and beekeeping in Botswana.* Botswana; Ministry of Agriculture. (1983) v + 122 pp. [En, B]

For several years the author worked on beekeeping development projects in Botswana. He describes the small-scale introduction of beekeeping in western central Kalahari and its subsequent extension to other areas. There is much information on the bee forage of several parts of Botswana, and other chapters deal with: colony development, and the behaviour of *Apis mellifera adansonii* bees; local wild bees; enemies and diseases of honeybees (with an Appendix on Palarus, bee pirates). Appendix II describes the procedure for opening a top-bar hive. P. Walker
Schlebuschweg 20, 2050 Hamburg 80, Germany.

Clauss, B. *Ex Africa: Botswana. Some observations on biology and behaviour.* South African Bee Journal (1984) 56 (5) 113–116 [En, B]

Bee colonies are common in the central Kalahari desert although there is little water. Bees have been observed collecting dew from leaves just after sunrise, and also blood and other liquids from dead animals. Nests are often situated in a hollow tree, and the inside of the hollow is usually coated with propolis; this helps conserve water. However, propolis sources are quite scarce; bees collect resin drops from Acacia and also from the surface of edible figs. Further brief notes describe drone control by the colony, an observation of queen aggression, piping outside queen cells, supersedure, emergency queen rearing, and absconding. P. Walker
Schlebuschweg 20, 2050 Hamburg 80, Germany.

Clauss, B. *Ex-Africa: Botswana. The colony in the course of the year.* South African Bee Journal (1984) 56 (4) 89–93 [En, B]
Foraging, forage plants, colony development and swarming of *Apis mellifera adansonii* in Botswana.

Clauss, B. *Bee forage in Botswana. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 217–221 [En, B]

Information is given on plants valuable to bees in two parts of Botswana; some of the species are rather little known elsewhere. In the Kalahari climatic conditions are extreme, but many plants have long flowering periods provided there is sufficient rain. Several of the most useful Kalahari species are described. A preliminary list is given of bee plants in east and south-east Botswana, with the plants

grouped according to flowering period. The value of each species as a nectar and/or pollen source is indicated, and also the colour of the fresh pollen load, and other characteristics. The most important forage plants in this area are *Aloe marlothii*, *A. cryptopoda* and herbaceous plants. There are only small Eucalyptus plantations here, but several of the species are valuable to bees. P. Walker
Schlebuschweg 20, 2050 Hamburg 80, Germany.

Clauss, B. *Beekeeping handbook. [Kiongozi cha ufugaji wa nyuki.]* Gaborone, Botswana; Ministry of Agriculture. (1985) 72 pp. [Swahili, Bdo]

Clauss, B. *The status of the banded bee pirate, Palarus latifrons, as a honeybee predator in Southern Africa. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 157–159 [En, B]

The activity of this wasp, which was observed in different parts of Botswana, is described. During the rainy season the wasp attacks guard bees or foragers returning to the hive. Some beekeepers in southern Africa have suggested that bees communicate to each other the presence of a wasp near the hive and that foraging therefore ceases. However, the evidence presented does not support this view. Natural enemies of Palarus include a small wasp (probably *Oxybelus* sp.) and a fly (possibly belonging to the *Sarcophagidae* or *Multigramidae*). Although Palarus causes numerous honeybee losses, strong colonies can compensate for these. Beekeepers are therefore recommended to manage their colonies well, and to provide shade, insulation and ventilation for hives. P. Walker
Schlebuschweg 20, 2050 Hamburg 80, Germany.

Clauss, B. and Phokedi, K. *A beekeeping handbook. [Menate ya dinotshe.]* Gaborone, Botswana; Ministry of Agriculture. (1983) 73 pp. [Setswanese, B]

Clauss, B. and Tiernan, L. *A beekeeping handbook.* Gaborone, Botswana; Ministry of Agriculture. (1980) 65 pp. [En, B]

This simple teaching book is based on experience with *A. m. adansonii* in Southern Africa. It uses photographs, diagrams and easily understood captions to explain: reasons for keeping bees; equipment (top-bar hives, cardboard/cow-dung hives, and equipment improvised from local inexpensive materials); basic biology; management (how to start, handle, maintain and harvest honey from colonies); problems, pest and beneficial animals; beekeeping terms; costs; useful addresses. M. Nixon
Ghanzi District Council, PO Box 4, Ghanzi, Botswana.

Crane, E. *Honey sources of some tropical and subtropical countries.* Bee World (1973) 54 (4) 177–186 [En, Reprinted as B.R.A. Reprint M73, price £0.25 or \$0.80, B]

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented: Africa – Botswana, Cameroon, Ethiopia, Mauritius,

Morocco, Mozambique, Nigeria, Somalia, Zanzibar; America (South) – Ecuador, Guyana, Venezuela; Asia – Afghanistan, India, Iran Pakistan. D.G. Lowe
Bee Research Association, Chalfont St. Peter, Gerrards Cross, Bucks, UK.

Gnagi, A. *Beekeeping developments in Africa.* [Entwicklungsprojekte mit Bienenhaltung in Afrika.]. Bern, Switzerland; Universitat Bern. (1988) vi + 90 pp. [De, Bdo]

The present state of beekeeping in Africa is summarised. Reasons for encouraging beekeeping in developing countries are discussed, and examples are given of successful projects in Kenya, Botswana, Upper Volta and Tanzania, and of some that failed. Views differ on the type of hive suitable for such projects; experiences with modern hives are discussed and a case is presented for the use of traditional hives. Recommendations are made for future projects. P. Walker
Inst. Ethnologie, Univ. Bern, Schwanengasse 7, CH-3011 Bern, Switzerland.

Kepaletswe, K. M. *Beekeeping in Botswana. Bees and beekeeping in Southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B.].* Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 152–154 ISBN 0-620-15132-3 [En, Bd]

Beekeeping Unit, Department Field Services, Ministry of Agriculture, Private Bag 003, Gaborone, Botswana.

McNally, L. C. and Schneider, S. S. *Seasonal cycles of growth, development and movement of the African honey bee, *Apis mellifera scutellata*, in Africa.* *Insectes Sociaux* (1992) 39 (1) 167–179 [En, Ba]

The relationship between the annual colony cycle and seasonal patterns of forage availability was investigated for *A. m. scutellata* in the Okavango River Delta, Botswana. The annual cycle occurred in three distinct periods. The swarming season occurred from October to November, following 2–3 months of intense brood production, and coincided with the end of peak forage abundance. The migration season occurred from November to May and coincided with reduced and variable floral resources. During the migration season, brood production and food storage were generally low but quite variable from month to month, and swarms passing over the study area at this time travelled in an easterly direction. The migration season was followed by the establishment period (June–September), in which large numbers of new colonies travelling from the west moved into the study area. The establishment period coincided with, and slightly preceded, the period of peak forage abundance, and colonies devoted resources collected at this time almost entirely to brood rearing, which culminated in swarm production. The data suggest that honey-bee colonies in the Okavango are mobile and gear their reproduction and movement to seasonally shifting resource patterns. Author
Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

McNally, L. C. and Schneider, S. S. *Drone production and drone comb utilization in colonies of the African honey bee, *Apis mellifera scutellata* Lepeletier, in Africa.* *Apidologie* (1994) 25 (6) 547–556 [En, fr\de, Bj]

Drone production and drone comb utilisation were investigated in naturally occurring colonies of *A. m. scutellata* in the Okavango River Delta, Botswana. Drone production occurred primarily in larger, thriving and swarming colonies that contained large proportions of worker brood, and by inference were experiencing a period of growth. Drone production was rarely observed in smaller, newly established colonies, or in larger colonies with reduced worker brood rearing. Maximum drone production occurred in September–October, and coincided with the swarming season and the period of peak resource abundance. Drone production occurred sporadically throughout the remainder of the year. Food storage in drone comb was lowest in July–October (when colonies concentrated on brood production), and low and variable throughout the remainder of the year. Author
Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

McNally, L. C. and Schneider, S. S. *Spatial distribution and nesting biology of colonies of the African honey bee *Apis mellifera scutellata* (Hymenoptera: Apidae) in Botswana, Africa.* *Environmental Entomology* (1996) 25 (3) 643–652 [En, Bb]

The biology of naturally occurring *A. m. scutellata* colonies was studied in the Okavango River Delta, Botswana. Colonies had a density of 4.2/km² but exhibited considerable spatial clumping. Nest aggregations did not appear to result from short swarm dispersal distances, clumped resources or benefits derived from increased nest defence. Nests occurred predominantly in wooden cavities, particularly in abandoned woodpecker nests in dead palm trees. Nest cavities had a volume of 33 l and south-facing, top-located entrances. Colonies constructed approximately 6000 cm² of comb, devoted the majority of comb area to worker brood production, stored relatively little food, and allocated approx 8% of comb area to drone rearing. A comparison of the *A. m. scutellata* colonies in the Okavango with neotropical African colonies throughout Central and South America revealed that the neotropical colonies were more likely to construct exposed comb nests and less likely to occupy wooden cavities. However, no differences were found between the Okavango and neotropical colonies in nest density, cavity volume, total comb area, or the proportions of comb devoted to worker brood production, food storage or drone rearing. Thus, the aspects of nesting biology examined appear to have remained largely unchanged from the ancestral African condition during the colonisation of Central and South America. Author
Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

Moody, T. (ed.) *Botswana – notes on the first stage of a project. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth.* London, UK; Commonwealth Secretariat. (1979) 85–89 [En, B]

Mulder, V. *Beekeeping training in developing countries.* Wageningen, Netherlands; Agricultural University, Department of Education and Teacher Training. (1986) iv + 78 pp. [En, Bdo] This volume is subtitled 'A theoretical paper illustrated by four field cases'. The main theoretical aspects are introduced in the first three chapters, the first of which deals mainly with historical aspects. In the second chapter, the author recognises four steps in the process of becoming a beekeeper: information: motivation, motion, manipulation, continuation. He also lists the needs and personal qualities required of the aspirant beekeeper. This chapter gives a theoretical guide to when and where a beekeeping training course can enter the learning process. 'The structure of non-formal beekeeping training' is described in Chapter 3, with four main elements: starting points, objectives, methodology, evaluation. Chapter 4 describes beekeeping training in projects carried out in Nepal, Botswana, Rwanda and Surinam. The objectives of each project, and the training that was given, are described, and in chapter five particular elements of the training which were of major importance to the success or failure of the course are discussed further. Use is made of evaluation reports or personal comments of the persons in charge of the training. A list of recommended literature is given, and the four annexes comprise a farmer's beekeeping checklist (from the Nepal project), examples of instructional leaflets used in Botswana, IBRA List 3 (audio-visual material), and two illustrative pages from a 1976 UNICEF report on communicating with pictures in Nepal. D.G. Lowe

Phokedi, K.M. *Apiculture and its problems in Botswana. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5-9 November 1984.* (1985) 64-65 [En, B]

Schneider, S.S. and Blyther, R. *The habitat and nesting biology of the African honey bee *Apis mellifera scutellata* in the Okavango River Delta, Botswana, Africa.* *Insectes Sociaux* (1988) 35 (2) 167-181 [En, de, B]

The habitat and nesting biology of naturally occurring colonies of *Apis mellifera scutellata* were studied in the Okavango River Delta, Botswana. Vegetational surveys revealed that the forage available was abundant and potentially available year round. Colonies had a population density of 7.8 nests/km². Nest cavities occurred with equal frequency in trees and termite mounds, had a volume of approximately 17 litres, were unpropolised, and had south-facing, top-located entrances. Delta colonies were small (c. 6500 workers), constructed small amounts of comb (c. 3000 cm²), stored little food, devoted 78% of comb space to brood production, exhibited little nest defence, and experienced a 48% predation rate during the 5-month study period. The characteristics observed for *scutellata* in this study are discussed as adaptations to the hot climate, long foraging season, and high predation rate experienced in the Delta. Data for the Delta colonies are compared to those for *scutellata* in other tropical areas, and to honeybees in temperate climate regions. Author

Dept. Biology, Univ. North Carolina, Charlotte, NC 28223, USA.

Schneider, S.S. *Dance behaviour of successful foragers of the African honeybee, *Apis mellifera scutellata* (Hymenoptera: Apidae).* *Journal of Apicultural Research* (1989) 28 (3) 150-154 [En, Bb]

Vibration dance behaviour was monitored for foragers of *A. m. scutellata* in the Okavango River Delta, Botswana. Approximately 50% of successful foragers performed vibration dances within 5 minutes of entering the hive. Also, 30-40% of the foragers observed within a colony at any given time were vibrators. Since the vibration dance may enhance recruitment, vibrating foragers may play an important role in the regulation of foraging activity in African honeybee colonies. A new dance behaviour, the 'buzz dance', is described for African honeybees. While the function of the buzz dance was not determined, it was performed by successful foragers, frequently in conjunction with vibration and waggle dances. The buzz dance may therefore be associated with recruitment. Author

Dept. Biology, Univ. North Carolina, Charlotte, NC 28223, USA

Schneider, S.S. *Spatial foraging patterns of the African honey bee, *Apis mellifera scutellata*.* *Journal of Insect Behavior* (1989) 2 (4) 505-521 [En, Ba]

Waggle dances by foragers were monitored in two field observation colonies in the Okavango delta, Botswana. From the dances, maps could be constructed of daily recruitment patterns. These showed that the colonies frequently adjusted the allocation of recruits among food patches, recruited for 16-17 different food sites/day over areas of 55-80 km (2), and concentrated the majority of recruitment within 1 km of the hives (median foraging distances for the two colonies were 295 and 563 m). In both colonies pollen foragers were more abundant than nectar foragers, and pollen sources indicated by waggle dances were significantly closer to the hives than the nectar sources. Compared with colonies in temperate climates, the *A. m. scutellata* colonies had smaller recruitment areas, smaller mean recruitment distances and a greater emphasis on pollen foraging. These differences may be related to the contrasting survival strategies used by tropical and temperate climate honey-bees. Author

Dept. Biology, Univ. North Carolina, Charlotte, NC 28223, USA.

Schneider, S.S. *Nest characteristics and recruitment behavior of absconding colonies of the African honey bee, *Apis mellifera scutellata*, in Africa.* *Journal of Insect Behavior* (1990) 3 (2) 225-240 [En, Ba]

Absconding behaviour was investigated in a naturally occurring population of honey-bees in the Okavango delta, Botswana. Half of all colonies examined in the field between October and December had abandoned the nest or were preparing for absconding, suggesting that an 'absconding season' began in the delta in October or November. However, the factors influencing absconding were unclear, and there were no distinct differences in nest characteristics of the absconding and non-absconding colonies. Waggle dance activity in observation colonies preparing for absconding was not used to preselect a specific nest site prior to departure. However, in two of the three colonies examined, recruitment activity indi-

cated the general direction of colony travel. The distances indicated by these dancers was 6–16 km. Since these distances were 3–4 times greater than those communicated by dancers in non-absconding colonies, workers from absconding colonies may sample potential forage or nest sites well outside their regular foraging range. *Author*
Dept. Biology, Univ. North Carolina, Charlotte, NC 28223, USA

Schneider, S. S. Queen behavior and worker – queen interactions in absconding and swarming colonies of the African honey bee, *Apis mellifera scutellata* (Hymenoptera: Apidae). *Journal of the Kansas Entomological Society* (1990) 63 (1) 179–186 [En, Bj]

The behaviour of two swarming and three absconding *A. m. scutellata* queens was examined in the Okavango River Delta, Botswana. Compared to the swarming queens, the absconding queens: (1) spent significantly less time active per observation interval; (2) were less mobile; and (3) exhibited greatly reduced egg laying activity. Worker treatment of the two queen types also differed. The absconding queens were fed and harassed by attendant workers significantly less than were the swarming queens. Likewise, while workers frequently performed vibration dances on the swarming queens, absconding queens were not observed to be vibrated. The differences in queen activity and worker-queen interactions are discussed with respect to the contrasting functions of swarming versus absconding. *Author*

Dept. Biology, Univ. North Carolina, Charlotte, NC 28223, USA

Schneider, S. S. Modulation of queen activity by the vibration dance in swarming colonies of the African honey bee, *Apis mellifera scutellata* (Hymenoptera: Apidae). *Journal of the Kansas Entomological Society* (1991) 64 (3) 269–278 [En, Bj]

The relationship between the vibration dance of workers and queen activity was examined for two laying queens (LQs) and five virgin queens (VQs) in swarming colonies of *A. m. scutellata* in Botswana. Queens were vibrated approximately twice as often when inactive than when active, and responded to the dance with heightened activity, expressed primarily as increased locomotion. However, other behaviours (inspecting and egg laying by LQs; piping by VQs) were also enhanced, although for the LQs the degree to which these behaviours were affected depended upon whether the dance was received while inactive or active. The vibration dance therefore appeared to exert a non-specific, activating influence on queen activity, which elicited a variety of responses depending in part upon contextual cues. Thus, the dance may help regulate queen activity during swarming preparations. *Author*

Department of Biology, University of North Carolina, Charlotte, NC 28223, USA

Schneider, S. S. and McNally, L. C. Colony defense in the African honey bee in Africa (Hymenoptera: Apidae). *Environmental Entomology* (1992) 21 (6) 1362–1370 [En, Bb]
Defensive behaviour was investigated in a naturally occurring population of *Apis mellifera scutellata* colonies in the Okavango River Delta, Botswana. In general, colonies exhibited low levels of stinging activity during nest dissec-

tion. However, positive associations were observed between defensiveness and increasing colony size (inferred from total comb area) and swarming activity. The lower stinging activity of the smaller colonies and the increased defensiveness of the larger and swarming colonies may have reflected relative levels of investment in colony growth and reproductive potential. Seasonal patterns of colony defensiveness were not associated with fluctuations in resource abundance, although some changes in forage availability may have influenced aggressive behaviour. Colony defensiveness was not associated with nest entrance location and orientation, the proportions of comb area devoted to brood rearing, food storage, or the area that was empty, or any of three weather parameters measured. *Author*

Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

Schneider, S. S. and McNally, L. C. Factors influencing seasonal absconding in colonies of the African honey bee, *Apis mellifera scutellata*. *Insectes Sociaux* (1992) 39 (4) 403–423 [En, Ba]

Four colonies of *A. m. scutellata* in the Okavango River Delta, Botswana, were studied during the honey-bee migration season (November–May), when the availability of flowering species was reduced. Two of the colonies (colonies 1 and 2) migrated during the study period, while the remaining two (colonies 3 and 4) did not. During the 4–6 weeks preceding the onset of migration preparations, colonies 1 and 2 exhibited increasing population sizes, high levels of brood production with low brood mortality, relatively large stores of food, and increasing mass. The populations of colonies 3 and 4 did not increase, brood rearing activity was erratic and lower, brood mortality was higher, food stores became depleted and colony mass declined. Both colonies 3 and 4 ceased rearing brood, and colony 3 died of starvation. For 4–6 weeks before the onset of migration in colonies 1 and 2, daily foraging areas and mean daily foraging distances became increasingly large and variable. Colonies 3 and 4 exhibited foraging patterns similar to those observed for colonies 1 and 2 preceding migration. There was no clear association between seven weather parameters examined and migration behaviour. These data suggest that migration is influenced by an interaction of intra-colony demographics, food reserves and foraging patterns. *Author*

Department of Biology, University of North Carolina, NC 28223, USA.

Schneider, S. S. and McNally, L. C. Seasonal patterns of foraging activity in colonies of the African honey bee, *Apis mellifera scutellata*, in Africa. *Insectes Sociaux* (1992) 39 (2) 181–193 [En, Ba]

Seasonal foraging patterns were investigated using six observation colonies maintained in the Okavango Delta, Botswana. Pollen collection, flight from the hive, and recruitment for pollen and nectar sources occurred throughout the 11 months of the study. However, the distribution of foraging activity throughout the day changed seasonally. There was an emphasis on pollen collection throughout most of the year. Brood production occurred in all months except May, and there was a significant, posi-

tive correlation between the proportion of recruitment activity devoted to pollen sources and the amount of brood comb in colonies. The seasonal foraging patterns of *A. m. scutellata* in the Okavango were similar to those of Africanised honey-bees in the neotropics. The extended foraging season and emphasis on pollen collection may be associated with the high swarming rates and migrational movements of tropical honey-bees. *Author*

Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

Schneider, S.S. and McNally, L.C. *Spatial foraging patterns and colony energy status in the African honey bee, *Apis mellifera scutellata. *Journal of Insect Behavior* (1993) 6 (2) 195–210 [En, Ba]**

The relationship between changes in foraging patterns (inferred from waggle dance activity) and colony energy status (inferred from brood rearing activity, food storage, and colony weight) was examined for *A. m. scutellata* in Botswana during a period of relative resource abundance and resource dearth. When resources were more abundant mean foraging distances (about 400 m) and foraging areas (4–5 km²) were small, and colonies recruited to 12–19 different sites per day. Colony foraging ranges and sites visited increased slightly during the dearth period, yet foraging continued to be concentrated within less than 10 km². The degree to which fluctuations in foraging patterns were correlated with colony energy status varied with the availability of floral resources. During periods of relative forage abundance, increases in foraging range and number of sites visited were significantly correlated with increases in brood rearing and colony weight. In contrast, colonies examined during periods of resource dearth exhibited no correlations between foraging areas, foraging distances, and fluctuations in brood rearing, food storage, or colony weight. Thus, during dearth periods colonies may not be able to coordinate foraging patterns with changes in colony energy status. *Author*

Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

Schneider, S.S. and McNally, L.C. *Developmental patterns associated with founding and swarming in colonies of the African honey bee race, *Apis mellifera scutellata* Lepeletier*. *Apidologie* (1994) 25 (6) 530–539 [En, fr\de, Bj]
The developmental patterns of naturally occurring, recently founded colonies of *A. m. scutellata*, were examined in the Okavango River Delta, Botswana. Colonies started moving into the study area in mid-June. During the first 3–4 months after founding, colonies devoted most comb area to worker brood production, reared few or no drones, emphasised pollen collection, yet stored little food. Reproductive swarming occurred in October–November, at which time brood production declined, and food storage and drone production increased. Thus, the developmental strategy of newly founded colonies is

geared towards rapid growth and the immediate channeling of harvested resources into worker brood, which culminates in a relatively brief period of reproductive swarming. The developmental patterns for the Okavango colonies are similar to those reported for the Africanised honey-bee in South America, although the Okavango colonies studied may have a shorter swarming season. *Author*

Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

Schneider, S.S. and McNally, L.C. *Waggle dance behavior associated with seasonal absconding in colonies of the African honey bee, *Apis mellifera scutellata. *Insectes Sociaux* (1994) 41 (2) 115–127 [En, Ba]**
Department of Biology, University of North Carolina, Charlotte, NC 28223, USA.

Dance behaviour was monitored for 36 days in two colonies in observation hives in Botswana. For the first 27 days the bees appeared to be foraging normally, and waggle dances communicated average distances of 400 m and 473 m. In the final nine days, during which the colonies were preparing for seasonal absconding (migration), distances communicated averaged over 6 km and over 7 km (the maximum was over 23 km). In this period, flight activity was significantly less than before, which suggests that there was little immediate recruitment associated with pre-migration dances. Most dances were orientated in easterly or south-easterly directions, and when the colonies migrated they generally flew E-SE; the prevailing wind was also easterly, but this was probably only one of the factors involved. *P. Walker*

Werger, M.J.A. (ed.). *Biogeography and ecology of Southern Africa*. Hague, Netherlands: Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first six chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation e.g. the afro-montane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16–31 each cover a major taxonomic group of animals. Chapter 27, by A.J. Prins, covers the *Hymenoptera*. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853–857 briefly describe the *Apoidea* known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man–land relationships are described, including conservation. This two-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. *D.G. Lowe*

Brunei Darussalam

Becker, P., Moure, J.S. and Peralta, F.J.A. More about euglossine bees in Amazonian forest fragments. *Biotropica* (1991) 23 (4b) 586–591 [En, Bb]

Male euglossine bees were captured monthly for one year in modified McPhail traps baited with cineole, methyl salicylate and skatole. The traps were operated 90 km of Manaus, Brazil, in continuous forest and forest fragments of 1, 10 and 100 ha. Of the 16 species of euglossine bees captured, *Euglossa chalybeata* and *E. stilbonota* accounted for 85% of bees caught. The traps had the advantage of operating unattended, but their capture efficiency was low. Bee abundance and species richness were significantly correlated and peaked in the wet season when flowering also peaked. Contrary to a previous study in the same area, bee abundance was greater in 10- and 100-ha fragments than in continuous forest. Fragments of 1 ha had the smallest number of individuals and species. It appears that male euglossine abundance may vary considerably over short distances, making it difficult to characterise a forest by sampling a single site. *Author*

Biology Department, Universiti Brunei Darussalam, Gadong 3186, Brunei.

Roubik, D.W. Wild bees of Brunei Darussalam. Tropical rainforest research – current issues [edited by Edwards, D.S. et al.]. Dordrecht, Netherlands; Kluwer Academic Publishers Group. (1996) 59–66 [En, Ba]

The wild bee fauna of Borneo and Brunei is singularly depauperate compared with other tropical areas, but very rich in highly social species. Monitoring in the forests of Belalong revealed the presence of four *Apis* and 22 stingless bee species; the latter, mostly *Trigona*, included 76% of all stingless bee species known from Borneo, and all three endemics. Other bee species probably number about 80 if the proportions of the highly social bees found in Indonesia apply to Belalong. A 'rapid assessment' of the highly social bee fauna was possible in Brunei, even during rainy weather in November, by spraying sugar and salt baits on vegetation. Virtually every species of *Trigona*, *Apis* and *Pariotrigona* came to these baits during a few days. Assays of various salt solutions revealed the following preferences by the stingless bees (predominantly *Trigona*

melina) and honey-bees (predominantly *Apis koschevnikovi* and *A. dorsata*): Na more than Mg more than K more than NH₄ more than PO₄. Preference for sodium, magnesium, and potassium is possibly linked to neural transmission requirements, osmotic water balance and low levels of these elements in soil, expressed directly in the nectar and pollen that bees consume. *Apis koschevnikovi* was found to be similar to African and other tropical cavity-nesting *Apis* in showing the highest profitability (measured as energy harvest rate of sucrose solutions) at 45% sugar solutions, compared with solutions as low as 15% and as high as 65% sugar. Ground-level surveys of bee nests located 33 colonies of stingless bees along 12 km of trails. The density of stingless bee colonies was calculated to be approximately 3/ha – lower than the 4–6 colonies/ha found in some Neotropical forests. The sugar-salt baiting technique also revealed the first known association between an orchid and the genus *Apis*. *Apis koschevnikovi* was found with a small orchid pollinarium attached to its scutellum, thus it may have a pollinator role often played by *Trigona* in the neotropics for a few orchid genera. Other noteworthy bees were the large, nocturnal *Xylocopa myops*, *megachilids* and long-tongued *Amegilla*, all likely principal pollinators of obligately outcrossing tree species. *Author*

Smithsonian Tropical Research Institute, Unit 0948, APO AA 34002-0948, USA.

Vries, R. de. Bees and beekeeping in the former Dutch East Indies with some references to Brunei, Serawak and Peninsular Malaysia. Kathmandu, Nepal; R. de Vries. (1994) 49 pp. [En, Bd]

A number of studies have been published in Dutch on honey hunting and beekeeping with various species of honey bees and stingless bees in islands (now in Indonesia) which were part of the Dutch East Indies. The author, who worked on a beekeeping project in Java has now made this material available in English, together with studies in parts of Borneo and peninsular Malaysia. The bees are *Apis cerana*, *A. dorsata*, *A. florea* and introduced *A. mellifera*, and also *Trigona* spp. Appendices list races of bees, bee trees, forage plants and harvesting tools, with names in local languages. There is an 8-page bibliography.

Cameroon

Association Francaise des Volontaires du Progres. Beekeeping. [Apiculture.]. *Revue de l'Association Francaise des Volontaires du Progres* (1983) (No. 36) 48 pp. [Fr, B]

This special number is devoted to the apicultural work of members of the French voluntary service in developing countries. Apiculture projects are or have been in operation in Central African Republic, Gabon, Cameroon, Togo, Niger, Senegal, Rwanda, Haiti, Seychelles, and are planned also for Benin, Burundi, Guinea Bissau, Mali and Mauritius. Traditional methods of honey hunting and beekeeping in various countries are described and illustrated,

together with various top-bar hives and other applications of appropriate technology. Production and use of honey, beeswax and pollen are dealt with on a similar level. *E. Crane*

Beccari, M., Castiglione, A., Cavaliere, G., D'Aloia, G., Fabbri, C., Losi, B.; Ranzini, C., Romagnoni, G. and Sorgato, G. Unusual case of anuria due to African bee stings. *International Journal of Artificial Organs* (1992) 15 (5) 281–283 [En, Bc]

A man in Cameroon who received more than 1200 stings

from honey bees (about 25,000 micro g of venom) did not exhibit hypovolemic or anaphylactic shock, or haemolysis and/or rhabdomyolysis. After 11 days, he was suffering from oligoanuric acute renal failure, and renal biopsy 18 days after the attack showed acute tubular necrosis. This is the first report of such reactions to multiple bee stings.

P. Walker

Department of Nephrology and Dialysis, Ospedale Fatebenefratelli e Oftalmico, Milan, Italy.

Bradbeer, N. (ed.). *Proceedings of a scientific workshop for West African bee researchers: the First West African Bee Research Seminar, Bakau, Gambia, 25–28 November 1991*. Monmouth, UK; Bees for Development. (1993) 86 pp. ISBN 1-898807-00-0 [En, Bdo]

The texts are given for the 22 papers presented at the seminar, together with the addresses given at the opening and closing ceremonies. The subjects covered include beekeeping in Gambia, Nigeria, Cameroon, Mali and Ghana, descriptions of beekeeping development projects in western Africa, and the biology and management of the indigenous honey bee, *Apis mellifera adansonii*. The conclusions and recommendations of the seminar are presented in 'The Banjul Bee Declaration of 1991'. *D.G. Lowe*

Crane, E. *Honey sources of some tropical and subtropical countries*. *Bee World* (1973) 54 (4) 177–186 [En, Reprinted as B.R.A. Reprint M73, price pounds-sterling 0.25 or \$0.80, B]

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented: Africa – Botswana, Cameroon, Ethiopia, Mauritius, Morocco, Mozambique, Nigeria, Somalia, Zanzibar; America (South) – Ecuador, Guyana, Venezuela; Asia – Afghanistan, India, Iran Pakistan. *D.G. Lowe*

Bee Research Association, Chalfont St. Peter, Bucks, UK.

Douet, J. *Beekeeping in tropical Africa [Cameroon]. [Apiculture en Afrique tropicale.]*. *Ouest Apiculture* (1982) (No. 30) 6–7 [Fr, B]

Etoa, F.-X. and Adegoke, G.O. *Evolution of thermal resistance of spores of two Bacillus species in pepper and honey*. *Sciences des Aliments* (1996) 16 (1) 49–59 [En, fr, Ba]

A solution was made from ground and homogenised peppers (*Capsicum frutescens*) and then sterilised. A sterile honey-water mixture was also prepared. Solutions were inoculated with spores of *B. stearothermophilus* (two strains) or *B. cereus* (two strains); after slow or rapid preheating from 25 to 100°C, the spores showed increased or unaltered thermoresistance to higher challenge temperatures. One of the *B. stearothermophilus* strains displayed higher thermoresistance than the other in honey, but in pepper solution the difference was not significant. Patterns of thermoresistance of the two *B. cereus* strains also varied. Heat-induced thermoresistance was shown to be transient in nature. The results are discussed in relation to heat sterilisation of foods. *P. Walker*

Department of Food Science and Nutrition, University of Ngaoundere, BP 455, Cameroon.

Field, O. *Notes on Cameroon bee farming*. Teddington, UK; Central Association of Bee-Keepers (2000) 8 pp. Ba]

Forboseh, P.F. *Estimating benefits from beekeeping in the montane forests of north-western Cameroon*. *Bee World* (2002) 83 (4) 171–178 [En, B] Centre for Environmental Monitoring, c/o Kilum-Ijim Forest Project, PO Box 275, Barmenda, Cameroon.

Yields of honey, beeswax and propolis from Kenya top-bar and traditional hives kept within and outside the forests are reported. Most of the beekeepers participate in forest conservation.

Gadbin, C. *Bee plants of southern Chad. [Les plantes utilisees par les abeilles au Tchad meridional.]*. *Apidologie* (1980) 11 (3) 217–254 [Fr, en\de, B]

In a study made in an area round N'Djamena, next to the Cameroon Republic, pollen analyses of 17 honeys and of pollen stored in hives were supplemented by observations on the plants visited by *Apis mellifera adansonii*. Over 30 species and a further 12 genera (28 families altogether) were identified as nectar sources, including *Graminaceae*, *Nymphaeaceae* and *Psidium gayava* (*Myrtaceae*); 22 Pollen sources are also listed. *P. Walker*

Lab. Botanique Historique et Palynologie, Fac. Sci. et Techniques Saint-Jerome, rue Henri-Poincare, 13397 Marseille Cedex 4, France.

Godlove, S.N. *Beekeeping and honey production in the North West Province [of Cameroon]*. Cameroon; Provincial Delegation of Agriculture. (1989) (Ed.2) 25 pp. [En, Bdo]

Hepburn, H.R., Radloff, S.E. and Oghiakhe, S. *Mountain honeybees of Africa*. *Apidologie* (2000) 31 (2) 205–221 [En, de, fr, B]

Honey bee samples from seven transects through different mountain regions of Africa (five in the east, from South Africa to Ethiopia, and one each in Namibia and Cameroon) were studied by analyses of morphometric characters, flight dimensional measurements and mitochondrial DNA restriction length fragments derived from the non-coding region of COI-COII by *DraI* restriction. Morphocluster definition was consistent with mtDNA cluster membership but not with flight dimensional data. When all three character suites are combined, six different kinds of unrelated mountain bees are obtained, the only common factor among the mountain bees is that they are larger than bees at lower altitudes. Because of fundamental differences in the restriction length fragments and other clusters obtained, it is concluded that mountain bees should probably be regarded as ecotypically differentiated populations of the subspecies surrounding each particular mountain. *Author* Dept of Zoology and Entomology Rhodes Univ., Grahamstown, South Africa.

Kanmegne, J. and Degrande, A. *From alley cropping to rotational fallow: farmers' involvement in the development of fallow management techniques in the humid forest zone of Cameroon*. *Agroforestry Systems* (2002) 54 (2) 115–120 [En, X]

Alley cropping was introduced to increase soil fertility, and one suitable species was found to be *Calliandra calothyrsus* which provides good bee forage.

IRAD/ICRAF Research Programme, PO Box 2067 Yaoundé, Cameroon.

Kengue, J., Fohouo, F.N. T. and Adewusi, H. G. **Towards the improvement of safou (*Dacryodes edulis*): population variation and reproductive biology.** *Forests, Trees and Livelihoods* (2002) 12 (1/2) 73–84 [En, X]

In the humid forest zone, the main insect pollinator of this fruit tree species indigenous to West and Central Africa is *Meliponula erythra*.

Inst. of Agricultural Research for Development (IRAD), PO Box 2067, Yaoundé, Cameroon.

Massaux, F., Tchiendji, C., Misse, C. and Decazy, B. **Study of cocoa pollen dispersal by 32P labelling. [Etude du transport du pollen de cacaoyer par marquage au 32P].** *Café-Cacao-Thé* (1976) 20 (3) 163–172 [Fr, en\de\es, B]

Two labelling techniques are described. Pollen dispersal was greatest around 08.00 and 17.00 hours. Wind played a negligible part in transporting pollen, but 25 insect species were observed carrying pollen. These included *Trigona* sp. and several *Diptera* other than *Forcipomyia*. D. G. Lowe

Ecole nationale supérieure agronomique, Univ. Yaounde, Cameroon.

Mire, B. de and Mbondji Mbondji, P. **Insect pollinators in cross-fertilization of cocoa in Cameroon. [Insectes pollinisateurs du cacaoyer en fécondation croisée au Cameroun].** *IVth International Cocoa Research Conference, St. Augustine, Trinidad, 8–18 January, 1972.* West Indies, Government of Trinidad and Tobago. (1972) 566–569 [Fr, En]

Drosophila triangulifer (Diptera) was responsible for 43% of fertilisation; ceratopogonids for 23%.

Radloff, S.E. and Hepburn, H.R. **Multivariate analysis of honeybee populations, *Apis mellifera* Linnaeus (Hymenoptera: Apidae), from western central Africa: morphometrics and pheromones.** *African Entomology* (1997) 5 (2) 195–204 [En, Ba]

Morphometric characters and sting pheromones of worker honey bees (*Apis mellifera*) were analysed by multivariate methods to characterise their populations along a transect through three ecological-climatological zones in Cameroon. The results showed three distinct homogeneous populations and two zones of hybridisation. The bees are designated as *A. m. adansonii* whose area of distribution is intruded by an *A. m. monticola*-like montane group of bees and a third group, *A. m. yemenitica*. The delineation of the hybrid zones is supported by intercolonial variance spectra and these significant asymmetries are coincident with transitions between the ecological-climatological zones. Author Department of Statistics, Rhodes University, Grahamstown 6140, South Africa.

Segnou, Fatokun, C.A., Akoroda, M.O. and Hahn, S.K. **Studies on the reproductive biology of white yam (*Dioscorea rotundata* Poir.).** *Euphytica* (1992) 64 (3) 197–203 [En, Bb]

At Ibadan, Nigeria, insects belonging to the *Coleoptera* (48.0%), *Diptera* (20.4%), *Hymenoptera* (20%), *Hemiptera* (5.8%) and *Thysanoptera* (5.8%) were caught around yam plants and presumed to be pollinators: they entered open-receptive flowers and their presence coincided with the duration of the flowering period. Hand pollination gave a

greater fruit set (31.8% maximum) than natural pollination (19.2% maximum). D. G. Lowe

Institute of Agronomic Research (IRA), B. P. 13 Nyombe, Cameroon.

Syed, R.A. **Studies on oil palm pollination by insects.** *Bulletin of Entomological Research* (1979) 69 (2) 213–224 [En]

In Cameroon, about 12 insect species were associated with oil palm (*Elaeis guineensis*) inflorescences. All except one visited female inflorescences after male ones during anthesis, thus transporting pollen to receptive female flowers. About 20,000 individuals visited each female inflorescence during the period of receptivity, and about 70% of the pollen transported was viable. In western Malaysia, *Thrips hawaiiensis* is the main pollinating agent; some 200,000 individuals were estimated to visit a single male inflorescence. They also visited female inflorescences, where up to seven thrips/flower were present at any one time, each carrying 4–5 pollen grains. In western Malaysia and Sabah, a moth, *Pyroderces* sp., may contribute to oil palm pollination. Natural pollination of all oil palms in Cameroon and taller palms in western Malaysia is considered adequate; in most areas of Sabah, where few insects visit the flowers, it is inadequate. The oil palm should be considered as an entomophilous rather than an anemophilous plant. Author

Commonwealth Inst. Biological Control, Pakistan Stn., Rawalpindi, Pakistan.

Syed, R.A. **Insect pollination of oil palm: feasibility of introducing *Elaeidobius* spp. into Malaysia. The oil palm in the eighties. A report of the Proceedings of the International Conference on Oil Palm in Agriculture in the Eighties, Kuala Lumpur, 17–20 June 1981. Volume I [edited by Pushparajah, E.; Chew Poh Soon].** Kuala Lumpur, West Malaysia; Incorporated Society of Planters. (1982) 263–289 [En, B]

Poor pollination of *Elaeis guineensis* in Malaysia has already been reported (*Apicultural Abstracts* 742/81). Three species of weevils of the genus *Elaeidobius*, which are important pollinators of oil palm in Cameroon, have been studied. They are highly specialised and are host-specific; they breed on male inflorescences and visit female inflorescences only during anthesis. The most numerous species in dry and wet seasons on the coast of Cameroon is *E. kamerunicus*; this weevil also carries more pollen grains than the other two species. Thus it seems to be a suitable species for introduction to Malaysia to improve pollination. P. Walker

Tchoumboue, J., Tchouamo, I.R., Pinta, J.Y. and Njia, M.N. **[Socio-economic and technical characteristics of beekeeping in the Western Highlands of Cameroon.]** *Caractéristiques socio-économiques et techniques de l'apiculture dans les hautes terres de l'ouest du Cameroun.* *Tropicicultura* (2001) 19 (3) 141–146 [Fr, en, X]

A survey of 39 beekeepers found the following: most (97%) are male, aged 18–58, and all are educated. Many (52%) have received training. No. hives kept is 2–300 (av. 42); improved hives are used by 43.3% of the beekeepers, but traditional types of hive are still common. Colonies are obtained by capturing natural swarms using different types of bait, wax being the most frequently used. Hive

occupation is relatively low (64.4%), being higher for traditional hives than for improved hives (78.5% and 43.3%, respectively). Honey is harvested once a year (from March to July); average yield is 6–10 l/colony. The major constraints to beekeeping in the area are: lack of training; and honey bee pests and diseases.

Département des Productions Animales, FASA, Université de Dschang, Cameroon.

Tchuenguem Fohouo, F.N., Messi, J. and Pauly, A. [The activity of *Meliponula erythra* on the flowers of *Dacryodes edulis* and its effect on fructification.] *Activité de *Meliponula erythra* sur les fleurs de *Dacryodes edulis* et son impact sur la fructification*. Fruits (Paris) (2001) 56 (3) 179–188 [Fr, en, es, X]

The bees foraged on the flowers all day and throughout the flowering period; they collected much nectar and some pollen. Pollination was significantly higher on open-pollinated flowers than on bagged flowers.

Laboratoire de Zoologie, Université de Ngaoundéré, BP 454, Ngaoundéré, Cameroon.

Tchuenguem Fohouo, F.N., Messi, J. and Pauly, A. [The gathering activity of wild bees on flowers of maize at Yaoundé (Cameroon) and further considerations on pollination of the tropical Gramineae.] *L'activité de butinage des Apoïdes sauvages (Hymenoptera Apoïdea) sur les fleurs de maïs à Yaoundé (Cameroun) et réflexions sur la pollinisation des graminées tropicales*. Biotechnologie, Agronomie, Société et Environnement (2002) 6 (2) 87–97 [Fr, en, X]

Five bee species were observed collecting pollen from *Zea mays*: *Dactylurina staudingeri*, *Lipotriches andrei*, *L. langi*, *L. notabilis* and *Leuconomia granulata*. Generally, bees forage on the flowers all day and the flowering period, but visits are more numerous in the morning. Although bees seldom touch the stigmas, their activity shakes the anthers, so pollen grains are released into the air, even on windless days, and thus the flowers are pollinated. It is estimated that wild bees increase yields by up to 3%, and if *Apis mellifera* is present, its contribution is 21%. Literature on bee pollination of grasses and *Poaceae* in general is reviewed. Laboratoire de Zoologie, Université de Ngaoundéré, BP 454, Ngaoundéré, Cameroon.

Tsacas, L. and Desmier de Chenon, R. *Taxonomy and distribution of the genera *Cacoxenus*, *Paracacoxenus*, *Gitonides*, *Gitona* and biology of a new African species, a commensal of *Apoidea. [Taxinomie et biogéographie des 'genres' *Cacoxenus* – *Paracacoxenus* – *Gitonides* – *Gitona* [Dipt., *Drosophilidae*] et biologie d'une nouvelle espèce africaine commensale d'*Apoidea* [Hymenoptera].]. Annales de la Société Entomologique de France (1976) 12 (3) 491–507 [Fr, en, B]**

The taxonomy of these *Diptera* is discussed, and *Cacoxenus* (*Gitonides*) *apidoxenus* n. sp. is described. This has been found as a commensal of *Chalicodoma* species in many parts of Africa including Senegal, the Ivory Coast and Cameroon. P. Walker

Lab. d'Entomologie, Muséum Natn. d'Histoire Naturelle, 45, rue Buffon, F 75005 Paris, France.

Yamagiwa, J., Yumoto, T., Ndunda, M. and Maruhashi, T. *Evidence of tool-use by chimpanzees (*Pan troglodytes schweinfurthii*) for digging out a bee-nest in the Kahuzi-Biega National Park, Zaire*. Primates (1988) 29 (3) 405–411 [En, Bb]

Two sticks were found near a broken nest of *Trigona* (*Meliplebeia*) *tanganyikae* aff. *nigrita* in the Mt. Kahuzi region of Zaire, and were thought to have been used by a chimpanzee or perhaps several chimpanzees to dig out the subterranean nest. Honey, larvae, and most of the nest had been eaten by them. No evidence was observed to indicate tool-use by chimpanzees in the Masisi or Itebero-Utu regions, although stingless bees were observed and honey was eaten by chimpanzees in both regions. The sticks resembled in length and diameter those known to be employed for digging termite mounds in south-west Cameroon and Equatorial Guinea. The tool behaviour of the chimpanzees observed at Mt. Kahuzi may be similar to that of those in central Africa, rather than of those in east Africa where digging tools have yet to be found. Another possibility is that the chimpanzees have developed the digging tools independently, based on the need to take animal protein in the Mt. Kahuzi region, where termite mounds are rarely observed. Instead of seeking termites, they may have a stronger motivation to seek bee larvae, especially the larvae of stingless bees beneath the ground. Author
Primate Res. Inst., Kyoto Univ., Aichi 484, Japan.

Canada

Canadian Beekeepers' Council. E. T. [Excise Tax] values and classification. Circular, Canadian Beekeepers' Council (1972) (14/72) 2 pp. [En, B]

Canada, Canadian Honey Council. Canadian Honey Council Research Symposium Proceedings 1995. Nipawin, Canada; Canadian Honey Council. (1995) 148 pp. [En, Bdo]
The proceedings of this symposium, which was held on 15 January 1995 in Edmonton, Alberta, represent the product of a 3-year research programme on a diversity of topics. The research described in the 17 papers which were presented covered most management areas of current concern to Canadian beekeepers, including control of mite

pests (*Varroa jacobsoni*, *Acarapis woodi*), Africanised honey bees, border closure issues, queen breeding, viruses, overwintering management, and pollination.

Individual papers are reported separately. G. Lowe

Saskatchewan, Canada. Laws, Statutes, etc. An act for the prevention and suppression of disease among bees. Regina, Canada, Legislative Assembly of Saskatchewan. (1973) 5 pp. [En, B]

Canada. Laws and Statutes. Bees Act, 1987. Statutes of Ontario, 1987, Chapter 31 and Regulation 81, Revised Regulations of Ontario, 1980 as amended to O. Reg.

721/88. March 1989. Ontario, Canada; Ministry of the Attorney General. (1989) 21 pp. [En\ Fr, Bc]

Canada. Laws and Statutes. Proposed regulations: Honey Fees Order. *Canadian Beekeeping* (1997) 19 (8) 184–185 [En, Bj]
The proposed regulations, which are still under discussion, are reprinted here from *Canada Gazette* (Part 1) 8 February 1997. Their purpose is to introduce fees for the inspection and certification of exported and imported honey, and for the registration of establishments that process and pack honey. P. Walker

USA. Laws and Statutes. Importation of African/Brazilian honeybees: Hearing before the Subcommittee on Agricultural Research and General Legislation of the Committee on Agriculture and Forestry, United States Senate, Ninety-fourth Congress, First Session on S.18 ... June 3, 1975. Washington, DC, USA; US Government Printing Office. (1975) 36 pp. [En, B]

An Act of 31 August 1922 was passed to prevent the introduction and spread of diseases and parasites harmful to honeybees. The proposed amendment, S.18, would enable the USA to prohibit the importation of African honeybees in all stages of development and to authorise a programme of eradication and control in cooperation with the Governments of Canada, Mexico and Central American countries. The sections are set out, and the statements and documents submitted to the hearing are included. P. Walker

Agriculture Canada. Research Branch report 1982. Ottawa, Canada; Agriculture Canada. (1983) xiv + 400 pp. [En\ Fr, B]

Progress in research on the following aspects of honeybee biology is briefly reported: queen pheromones (p. 234); diseases (pp. 234 and 323) breeding for honey production (p. 323); herring meal as a pollen substitute (p. 323); nectar production by *Brassica napus* and *B. campestris* (p. 324). Parasitism of *Megachile rotundata* nests by driedfruit moth larvae (p. 344) is also mentioned. D.G. Lowe
Res. Branch, Agriculture Canada, Ottawa, Ont. K1A 0C6, Canada.

Agriculture Canada. Research Branch report 1981. Ottawa, Canada; Agriculture Canada. (1982) xii + 404 pp. [En\ Fr, B]

Progress in research on the following aspects of honeybee biology is briefly reported: relationships between queen and workers (p. 232); pollen and pollen traps (p. 232); AFB and chalk brood (p. 232); pollen foraging (p. 329); dead bees as dried turkey meal (p. 329). Work on pollinators of forage crops is also mentioned (p. 351). D.G. Lowe
Res. Branch, Agric. Canada, Ottawa, Ont. K1A 0C6, Canada.

Agriculture Canada. Research Branch report 1985. Ottawa, Canada; Agriculture Canada. (1986) vi + 398 pp. [En\ Fr, Bj]
Progress in research on the following aspects of apiculture is briefly reported: nectar secretion and pollen production of legumes (p. 327); nectar secretion and pollen production in canola (p. 327); nectar secretion in dandelion (pp. 327–328); temperatures in wintering honeybee colonies (p. 328); parasitism by *Malpighamoeba mellificae* (p. 328). Research on parasites of *Megachile rotundata* is also reported (p. 347). D.G. Lowe

Res. Branch, Agriculture Canada, Ottawa, Ont. K1A 0C6, Canada.

Agriculture Canada. Research Branch report 1984. Ottawa, Canada; Agriculture Canada. (1985) xvi + 369 pp. [En\ Fr, B]

Progress in research on the following aspects of honeybee biology is briefly reported; diseases and parasites (p. 217); instrumental insemination of queens (p. 300); effects of queens on honey production (p. 300). The incidence of chalk brood disease of *Megachile rotundata* in Canada is also described (p. 319). D.G. Lowe

Res. Branch, Agriculture Canada, Ottawa, Ont. K1A 0C6, Canada.

American Bee Journal. Proceedings of the North American Apicultural Research Symposium. *American Bee Journal* (2003) 143 (4) 317–324 [En, Bj]

This meeting was held in Niagara Falls, Ontario, on 5–6 December 2002. Abstracts of 24 papers presented at the conference are given, and those of particular interest are reported individually in *Apicultural Abstracts*. P. Walker

Beelines. Cost of production 2000. *Beelines* (2002) (Winter) 4–9 [En, Bj]

The results of a survey of 18 commercial beekeepers (350–2240 colonies) in Saskatchewan, Canada, are tabulated and discussed. Comparisons are made with the results of the previous survey in 1992.

Beelines. Cost of honey production in Saskatchewan, 1991. *Beelines* (1992) (No. 93) 8–14 [En, Bj]

A table gives a breakdown of the various costs of 20 beekeepers (with 200–1800 colonies). Average honey production was 215 lb [98 kg] per colony. The overall costs, and the costs of some items in particular, have increased compared with those found in a similar study in 1987. P. Walker

Beelines. Estimates of the number of beekeepers and colonies of bees, production and value of honey and wax in Canada, 1992 and 1993. *Beelines* (1993) (No. 95) 7–8 [En, Bj]

Estimates of the numbers of beekeepers and honey bee [*Apis mellifera*] colonies, honey production and the value of honey and beeswax produced, are given for each Canadian province. Figures are given for 1992 and 1993 (provisional), and an average for 1987–1991. In Canada in 1992, 13,100 beekeepers kept 501,420 colonies and produced 30,339 t of honey worth \$C48,328,000 and beeswax worth \$C 1,170,000. For 1987–1991 the average figures were 15,753, 576,445, 33,566 t, \$C46,229,000 and \$C1,078,000 respectively. A.G. Matheson

Beelines. Cost of production study, 1992. *Beelines* (1994) (No. 97) 8–14 [En, Bj]

The cost of honey production in Saskatchewan, Canada, was studied in 1987, 1991 and 1992, using incomes and costs of 13 beekeepers (average holding 966 colonies). The 1992 figures are presented and compared with those for the earlier years. Average gross income in 1992 was almost double that of 1987 due to higher production and much higher honey prices. In 1992, cash costs were slightly lower than in 1991; it is calculated that the first 110 lb [50

kg] of honey production would cover the cash costs of production. P. Walker

Bee World. Correspondence and home study courses in beekeeping. *Bee World* (1981) 62 (1) 31–33 [En, B]
From USA, UK, Canada, Sweden, South Africa, USSR.

British Columbia, Ministry of Agriculture and Food. Pollination and honey production, southern interior – estimated costs and returns. Publication, Economics Branch, Ministry of Agriculture and Food, British Columbia (1984) (No. 267) ii + 15 pp. ISBN 0-7719-9380-3 [En, B]

Canadian Beekeeping. Honey bee importation prohibition regulations, 1999. *Canadian Beekeeping* (2000) 21 (6) 133–134 [En, B]

Canadian Beekeeping. Risk assessment for opening the border to US honey bee queens and packages. *Canadian Beekeeping* (2003) 23 (2) 7–9 [En, B]

The risk assessment, which is summarised here, was prepared at the request of the Canadian Import/Export Section of the Animal Health and Production Division. The assessment gives the following overall risk estimates: resistant *Varroa* mite, high; oxytetracycline-resistant AFB, moderate; Africanised honey bees, low; small hive beetle, low. P. Walker

Canadian Beekeeping. About wax – a visit to Dilmont Inc. *Canadian Beekeeping* (1978) 7 (7) 97, 100–101 [En, B]
Describes a Canadian beeswax processing plant.

Canadian Beekeeping. A new mite. *Canadian Beekeeping* (1985) 12 (4) 78 [En, B]

Mellitiphis alvearius was found on attendant workers accompanying a queen, and in 14 of 16 package colonies, all imported from New Zealand.

Canadian Beekeeping. Beekeepers protest regulatory action. *Canadian Beekeeping* (1987) 13 (9) 207 [En, B]

Regulations introduced in 1987 in Quebec set the tolerance level for sulphathiazole [used against AFB] in honey at 0.2 ppm, whereas Canadian federal legislation set it at 1.0 ppm. The USA government then restricted imports to sulphate-free honey (in line with the German Federal Republic and Japan) and some honey imported from Saskatchewan was seized. Tests of Canadian honeys for sulphathiazole are now being standardised. D. G. Lowe

Canadian Beekeeping. First Varroa find in Ontario [Canada] as volunteers take on the job. *Canadian Beekeeping* (1991) 16 (7) 149 [En, B]

Canadian Beekeeping. Statistics show a further decrease in the number of beekeepers and colonies. *Canadian Beekeeping* (1995) 18 (5) 105 [En, B]

Statistics are given, by province, for the number of beekeepers and honey bee colonies in Canada, with the volume and value of honey production: averages for 1988–1992, actual figures for 1993 and estimates for 1994. In 1994, 12,339 beekeepers with a total of 503,986 colonies produced an estimated 32,920 t honey. A. G. Matheson

Gleanings in Bee Culture. Who's who in apiculture [USA and Canada]. *Gleanings in Bee Culture* (1983) 111 (4) 198–200 [En, B]

Names and addresses of apiary inspectors, extension workers, secretaries of beekeepers' associations, and others.

Gleanings in Bee Culture. 1988 – Who's who in apiculture [USA and Canada]. *Gleanings in Bee Culture* (1988) 116 (4) 210–216 [En, B]

Manitoba Beekeeper. Using hydrogen cyanide to kill bees. *Manitoba Beekeeper* (1986) (Summer) 11–14 [En, B]

Methods are given for using hydrogen cyanide, liberated from calcium cyanide on exposure to moist air, to destroy honeybees. In Canada it is registered for destroying colonies after the honey crop has been removed. Because of its highly poisonous nature, first aid treatment and safety procedures are detailed. J. M. Gedy

Manitoba Beekeeper. Wintering honeybee colonies. *Manitoba Beekeeper* (1987) (Summer) 9–17 [En, B]

Overwintering colonies in parts of Canada is becoming increasingly common, and has certain advantages. For successful wintering, the beekeeper must plan ahead and must carry out the necessary operations at the correct times. Practical advice is given on: feeding colonies for winter (which should start in early September), preparations for outdoor wintering, and the requirements of an indoor wintering facility. Plans and tables show examples of suitable arrangements for facilities for 100, 300, 500 and 1000 hives. [Reprinted from *Prairie Beekeeping Manual*.] P. Walker

Quebec, Canada, Ministère de l'Agriculture, des Pêcheries, et de l'Alimentation. Beekeeping. Wintering honey bee colonies. [Apiculture. Hivernage des colonies d'abeilles]. Quebec, Canada; Ministère de l'Agriculture, des Pêcheries et de l'Alimentation. (1990) (No. Agdex 616) 38 pp. ISBN 2-551-12467-0 [Fr, Bdo]

This is the second edition of a booklet first published in 1981. It contains advice for beekeepers in Quebec who wish to overwinter their colonies. There are chapters on colony preparation, indoor wintering and outside wintering, and also five annexes giving specifications and details for constructing a room for wintering up to 20 honey bee colonies. D. G. Lowe

Akre, R. D. and Mayer, D. F. Bees and vespine wasps. *Bee World* (1994) 75 (1) 29–37 [En, Ba]

This review, with 32 references, describes predation on honey bee colonies by members of the subfamily Vespinae. It includes a summary of the results of a survey on the impact of wasps on beekeeping in USA and Canada. The defensive techniques used by honey bee colonies against attacks by wasps are described briefly. Control methods, including baiting, trapping, destruction of overwintering queens and biological control, are discussed and it is suggested that efforts to find and propagate wasp pathogens would be of practical use to beekeepers. D. G. Lowe
Department of Entomology, Washington State University, Pullman, WA 99164, USA.

Alcock, A. and Alcock, L. *Beekeeping in the Yukon.* Canadian Beekeeping (1989) 15 (3) 53 [En, Bj]

Andruchow, L. *The economics of beekeeping in Alberta 1981.* Edmonton, Canada; Alberta Agriculture. (1983) v + 58 pp. [En, B]

This is the third and final report in a 3-year study. Detailed information provided by 58 beekeepers selected by stratified random sampling is presented and discussed. After an analysis for the whole study sample, the effect of the number of colonies in an apiary on costs and returns is considered. Costs and profits for honey production in various regions are compared, and the economics of wintering bees are assessed. Results are compared with those for the previous study years 1979 and 1980. *P. Walker*

Economic Serv. Div., Production Economics Branch, Alberta Agriculture, 7000-113 St., Edmonton, Alta. T6H 5T6, Canada.

Befus-Nogel, J., Nelson, D.L. and Lefkovitch, L.P. *Observations on the effect of management procedures on chalkbrood levels in honey bees (Apis mellifera L.; Hymenoptera: Apidae) colonies.* Bee Science (1992) 2 (1) 20-24 [En, Bj]

In this study, in the Peace River region of northern Alberta, Canada, 16 similar overwintered colonies were divided into four groups in June; except for the control group, colonies were given chalk brood mummies and subjected to varying degrees of disturbance (reversing brood chamber and manipulating frames). The highest mean number of mummies per week consistently occurred in the colonies receiving more severe management (brood nest re-arrangement). However, the large variation between colonies in all treatment groups resulted in no statistically significant differences between management procedures. Disturbances of the colony such as placing honey in the middle of the brood nest may disrupt communication and reduce larval feeding, thus causing stress to a colony and increased chalk brood levels. *P. Walker*

Agriculture Canada Research Station, Box 29, Beaverlodge, Alta, T0H 0C0, Canada.

Blawat, P and Fingler, B. *Indoor wintering costs for a 500 colony operation.* Manitoba Agriculture Farm Management Bulletin (1984) (No. 9) 8 pp. [En, B]

Blawat, P. and Finglar, B. *Indoor wintering costs for a 500-colony operation.* Canadian Beekeeping (1984) 11 (9) 202-203 [En, B]

Based on a consensus of a group of beekeepers in Manitoba, Canada.

Blum, H. *Ontario Ministry of Agriculture and Food. The beekeeping industry of Ontario: A marketing study.* Toronto, Canada, Ontario Ministry of Agriculture and Food. (1972) 51 pp [En, B]

The number of honeybee colonies has declined in recent years, mainly because of reduction in nectar sources. In 1970 there were 125 000 colonies in the province, yielding 49-77 lb honey/hive [22-35kg], which is more than 30% below the Canadian average. The market is dominated by a few large packers, and the price is affected by the large quantities of honey produced by the Prairie provinces. A

study of distribution and marketing of all Canadian honey is recommended. Further reduction in the number of colonies in Ontario will seriously affect pollination of crops, and thus production of fruit, vegetables and seeds. Already some beekeepers are paid for pollination services, but more co-operation between seed producers and beekeepers is essential. The other main recommendation of this report is that nectar sources must be increased; governmental action may be necessary to rejuvenate the beekeeping industry in the province. *P. Walker*
Economics Branch, Min. Agric. and Food, Parliament Buildings, Toronto 5, Canada.

Boch, R. and Neilson, S. *Some recent tests of pollen traps.* Canadian Beekeeping (1981) 9 (3) 45-46 [En, B]

Three types of pollen trap were tested in spring 1980: (A) modified OAC-type; (B) Central Experimental Farm design (this trap is fitted in the same way as A but instead of horizontal screens has a pair of vertical screens of 5 x 5 mesh, 1/4 in [0.6 mm] apart, and it has no refuse tray); (C) Teasdale trap, which fits in front of the entrance of a standard hive and has separate trays for pollen and debris collection. The most pollen was collected in trap C which has a double screen of 5 x 5 mesh hardware cloth which can be easily removed or refitted. A disadvantage of this screen is its small surface area, which causes congestion of bees and reduces ventilation when used with a strong colony in warm weather. However, it is recommended for use with smaller colonies, in cooler periods. *P. Walker*

Ottawa Res. Stn., Agriculture Canada, Ottawa, Ont. K1A 0C6, Canada.

Bradbear, N. and Mackay, K. *Developing agencies funding and interinstitutional cooperation. The Asiatic hive bee: apiculture, biology, and role in sustainable development in tropical and subtropical Asia [edited by Kevan, P. G.].* Cambridge, Canada; Enviroquest Ltd. (1995) 271-291 ISBN 0-9680123-0-2 [En, Bdo]

Lists are provided for: (1) beekeeping development projects under way and feasibility studies completed during the period 1981-1988 in countries where *Apis cerana* is present; (2) institutes reporting *Apis cerana* research; (3) sources of information on *Apis cerana*. *D. G. Lowe*
International Bee Research Association, 18 North Road, Cardiff CF10 3DT, UK.

Bryant, T.G. *Why we should not use drugs to control Bacillus larvae.* Apiarist (1980) (No. 14) 3 [En, B]

Comparison of situation in New Zealand (drugs prohibited) and Alberta, Canada (drugs used).

Cantwell, G.E. *The use of ethylene oxide to fumigate honey bee equipment in the United States and Canada during the 1970s.* American Bee Journal (1980) 120 (12) 840-843 [En, B]

In the early 1970s a co-operative programme for fumigation of hive equipment with ethylene oxide was instituted between the USDA and the states of Virginia, New Jersey and Connecticut. The results demonstrated the cost-effectiveness of such a programme on a state-wide basis. By the end of the 1970s, 13 states and four Canadian provinces had ethylene oxide fumigation programmes underway. A survey revealed that nearly 500,000 separate

pieces of bee equipment valued at nearly \$800 000 have been fumigated in the US since 1971. The Canadians have treated over 650,000 pieces of equipment since 1976, valued at over \$1,000,000. *Author*
Bioenvironmental Bee Lab., USDA-SEA, Beltsville, MD 20705, USA.

Chapleau, J.-P. [*The treatment of wooden beekeeping equipment with hot paraffin.*] *Le traitement du matériel apicole de bois à la paraffine chaude.* *L'Abeille* (Quebec) (98-99) 19 (3) 14-17 [Fr, Bj]

In New Zealand, beekeepers regularly treat hive parts by immersing them in paraffin at 160°, in order to kill micro-organisms and to preserve the wood. Submersion for 10-15 minutes kills AFB spores. The equipment required and the method are described, and costs are analysed. The method is recommended for beekeepers in Quebec.

P. Walker

Saint-Adrien, Quebec, Canada.

Chapleau, J.-P. [*Apicultural research in Quebec is in danger.*] *La recherche apicole québécoise est en danger.* *L'Abeille* (2001) 22 (1) 10-12 [Fr, Bj]

Coffin, R., Coffin, J. and Lowenberger, C. *Alfalfa seed production.* *Canadian Beekeeping* (1983) 10 (7) 156-157 [En, B]

This preliminary study showed that *Megachile rotundata* can be successfully introduced to lucerne fields in Ontario, Canada. On small plots within the bees' flight range, seed yield was 121 kg/ha compared with 20 kg/ha on plots beyond their flight range. On the second growth of the crop, the yields were 74 and 20 kg/ha respectively, and on plots caged to exclude insects, no seed was set. It is concluded that with improved management of these bees and suitable agricultural practices, lucerne seed production may become profitable in this area once again.

P. Walker

Serendipity Apiary, Arthur, Ont., Canada.

Cosgrave, L. *Overwintering of honeybees on P.E.I. [Prince Edward Island].* Prince Edward Island, Canada; Agriculture Canada. (1985) i + 19 pp. [En, B]

Crane, E. and Townsend, G.F. *Index to Apicultural Abstracts 1950-1972.* Folkestone, UK; Dawson for Bee Research Association. (1976) xxii + 1824 pp. ISBN 0-7129-0684-3 [En, in 2 volumes, B]

This index provides a comprehensive cross-reference to the literature on bees and apiculture during 23 years of important worldwide development. It was closed at 1972, because since 1973 *Apicultural Abstracts* has been published in the CAB system. A revised computer programme, which continues the *Index* from CAB tapes, is now operated at the University of Guelph, Canada. The first volume of the *Index* includes instructions for use and other material (in French, German and Spanish as well as English), and a single alphabetical index of all authors and co-authors. The second volume is the subject index, arranged in numerical order according to Universal Decimal Classification numbers. The full key leading to these numbers from the alphabetical subject index (descriptors, search terms, key words) is in Volume I, so that the alphabetical

list and the subject index can conveniently be used together. The two volumes comprise some 43,000 subject entries and 20,000 author entries, to a total of 14,424 publications (9,986 abstracted and 4,438 listed) which, with few exceptions, appeared between 1949 and 1972. There are about 5,600 main subject divisions, and the works of 7,000 authors are represented. In both author and subject index the title of each publication is given in English, in descending date order, the most recent publications coming first. The original language is stated; any English summary is noted, and also the availability of the original publication (and any translation of it) from the International Bee Research Association Library. A unique code number gives the location in the journal *Apicultural Abstracts*, which contains the full reference to the original publication. Subjects covered include beekeeping, especially technical developments in bee management and new equipment; honeybees and other *Apoidea*; hive products; and nectar, honeydew and pollen and their plant sources. The material scanned covers a wide range of sources including patents, theses and annual reports as well as books and periodicals, in over 50 languages. The book is possibly the first computer-generated index to abstracts covering such an extensive period. The University of Guelph carried out the computer operation. *D.G. Lowe*
International Bee Research Association, Hill House, Gerrards Cross, Bucks. SL9 0NR, UK.

Currie, R. W. and Jay, S. C. *Factors affecting the acceptance of foreign drones into honey bee (*Apis mellifera* L.) colonies.* *Apidologie* (1988) 19 (3) 231-240 [En, fr, de, Bj]

Studies on drone management could aid in breeding honeybees by improving the efficiency and quality of mating. In this study the effects of introducing foreign drones into honeybee colonies were examined. Marked drones were introduced into single-storey colonies in the afternoon, evening and on the following morning. The number of drones accepted was counted for five consecutive days after drones were introduced. The number of drones that was accepted was significantly higher when the marked drones were confined in the colony overnight using queen excluders and acceptance was higher when the drones were introduced in the afternoon than when they were introduced in the evening or on the following morning. If drones were not confined within the colony (i.e. no excluders were used) acceptance was highest in the evenings. When 50 or 95 drones were introduced the mean number of drones accepted after five days was not significantly different. However, when 50 or more drones were introduced, acceptance after five days was significantly higher than when only 25 drones were introduced. Therefore, the number of drones accepted by a colony can be increased by confining the drones in the colony for about 18 hours after introduction and by introducing drones in the afternoon or evening rather than in the morning. *Author*
Dept. Entomology, Univ. Manitoba, Winnipeg, Man. R3T 2N2, Canada.

Dae, T. *A simple and practical explanation of an insurance policy and the explanation of SGI's bee floater policy.* *Proceedings of the First International Symposium on Alfalfa Leafcutting Bee Management, August 16-18,*

1982, University of Saskatchewan, Canada [edited by Rank, G. H.]. Saskatoon, Canada; University of Saskatchewan. (1982) 175–179 [En, B]

Davis, A. and McRory, D. Various mites from Ontario bee hives. *Canadian Beekeeping* (1987) 13 (9) 209 [En, B]

In 1986, 22 honeybee colonies in 6 apiaries in Ontario, Canada, were examined for external or free-living mites. Most of the colonies had been established from New Zealand package bees. Of the four mites found, one was an adult female *Melittiphis alvearius*, and the other three were nymphs of *Parasitus* sp., *Bryobia* sp. and *Cheyletus* sp., respectively. *D. G. Lowe*

Dept. Development Biology, Australian Natn. Univ., Canberra, ACT 2601, Australia.

Davis, A.R., Boyes, D.F., Otis, G.W. and Grant, G.M. A portable incubator for transporting mature queen cells. *Canadian Beekeeping* (1985) 12 (5) 105–107 [En, B]

The incubator was made by adapting a lightweight portable unit which is sold to carry picnic food. It can be heated by plugging it into a vehicle's cigar lighter, or (with an adaptor) to a wall socket. The temperature, which should be about 34°C, must be checked with a thermometer. The incubator has been used several times to transport queen cells about two days before the queens were due to emerge. The cells were held in holes made in foam rubber, which was fixed to a more rigid layer of styrofoam. (Alternatively, they can be held in folded towelling.) Queens were left to emerge in the portable incubator. Perfect queens emerged from 88.8% of the 258 queen cells that were transported distances up to 500 km; for comparable queen cells not transported the figure was 90.4%. *P. Walker*

Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Davis, A.R. and Shuel, R.W. Invisible damage to honeybee colonies from pesticides. *Canadian Beekeeping* (1985) 12 (3) 60–61 [En, B]

Acetylcholinesterase activity did not appear to be reduced in larvae fed with royal jelly containing carbofuran or dimethoate, but activity varied widely in untreated controls, and it is concluded that cholinesterase activity is probably not suitable as an indicator of insecticide poisoning. The weight gain of larvae fed on a diet containing carbofuran or dimethoate was smaller than that of untreated larvae. This was not observed in older larvae (72–96 hours) fed for 48 hours with doses that were not immediately lethal to adults, but long-term insecticide feeding (started when larvae were young) had an adverse effect on larval mortality, growth rate, mature weight and success at pupation. It is concluded that if low levels of insecticides are brought into the hive the immediate effects may not be apparent to the beekeeper, but the colony population may eventually be reduced. *P. Walker*

Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Delfinado-Baker, M. A harmless mite found on honey bees – *Melittiphis alvearius*: from Italy to New Zealand. *American Bee Journal* (1994) 134 (3) 199 [En, B]

The mite *Melittiphis alvearius* causes some concern to bee-

keepers, and is still hindering international trade in bees because it lives in beehives and attaches to adult bees for dispersal. However, it is not a nuisance in hives and there is positive evidence that it is not parasitic on honey bees (*Apis mellifera*). This article briefly reviews current knowledge on *M. alvearius* and its distribution. It has so far been reported from much of Europe, as well as Canada, Korea, New Zealand and the USA. It is suggested that the mite is present in many countries where beekeeping with *A. mellifera* is practised, but that it remains undetected because of its small size. *A. G. Matheson*

Systematic Entomology Laboratory, USDA, ARS, Beltsville, MD 20705, USA.

Dixon, D. Small hive beetle in Manitoba. *Canadian Beekeeping* (2002) 23 (1) 13–14 [En, B]

The mite was apparently introduced in late July 2002 in a load of beeswax cappings from Texas, USA; this is the first report of its presence in Canada.

Duffy, D.N. and Vickery, V.R. Outdoor wintering of honeybees. *MacDonald Journal* (1981) (June) 3–8 [En, B]

In Quebec, Canada.

Dziadyk, A. How we produce great honey crops. Part 1. Part 2. Part 3. Part 4. *American Bee Journal* (2002) 142 (8; 9; 10; 11) 574–575; 637–638; 731–732; 809–811 [En, B] 1333 Arlington Ave, Saskatoon, SK, S7H 2Y1, Canada.

Dziadyk, A. How we produce great honey crops. Part 6. Part 7. *American Bee Journal* (2003) 143 (1; 3) 34–36; 205–206 [En, B]

1333 Arlington Ave, Saskatoon, SK, S7H 2Y1, Canada.

Dziadyk, A. How we produce great honey crops. Part 8. Part 9. *American Bee Journal* (2003) 143 (4; 5) 305–306; 380–381 [En, B]

1333 Arlington Ave, Saskatoon, SK, S7H 2Y1, Canada.

Dziadyk, A. Multi-functional 'hot' room. *American Bee Journal* (2003) 143 (10) 769–770 [En, B]

Used for honey drying, honey extraction and overwintering of colonies.

1333 Arlington Ave, Saskatoon, SK, Canada S7H 2Y1.

Eaton, L.J. Effect of pollinator number on fruit set and yield of lowbush blueberry. *Canadian Beekeeping* (1992) 17 (2) 32–34 [En, B]

Pollinators were counted on plots of *Vaccinium angustifolium* in fields at seven locations in Nova Scotia, Canada. Numbers of honey bees and of wild bees and other insects differed greatly between the fields. Numbers of pollinators did not differ significantly between the centre and edge of a plot, nor between large and small fields at the same location. Fruit set and berries per stem (expressed as percentage of original flowers/stem) were both significantly correlated with the number of honey bees and the total number of pollinators, but not with the numbers of wild bees and other insects. *P. Walker*

Department of Biology, Nova Scotia Agricultural College, Truro, NS B2N 5E3, Canada.

Engelsdorp, D. van and Otis, G. W. **Application of a modified selection index for honey bees (Hymenoptera: Apidae).** *Journal of Economic Entomology* (2000) 93 (6) 1606–1612 [En, 55 wf.]

Nine different genetic families of *Apis mellifera* were compared using summed z-scores (phenotypic values) and a modified selection index (I_{mod}). I_{mod} values incorporated both the phenotypic scores of the different traits and the economic weightings of these traits, as determined by a survey of commercial Ontario beekeepers (Canada). Largely because of the high weight all beekeepers place on honey production, a distinct difference between line rankings based on phenotypic scores and I_{mod} scores was apparent, thereby emphasising the need to take care in weighing the traits being evaluated to select bee stocks most valuable for beekeepers. Furthermore, when beekeepers who made >10% of their income from queen and nucleus colony sales assigned relative values to the traits used in the I_{mod} calculations, the results differed from those based on weightings assigned by honey producers. The results underscore the difficulties the North American beekeeping industry must overcome to devise effective methods of evaluating colonies for breeding purposes.

Dept of Entomology, Comstock Hall, Cornell Univ., Ithaca, NY 14850, USA.

Engelsdorp, D. van and Otis, G. **Ontario field evaluation of tracheal mite resistant honey bee stocks.** *Canadian Honey Council Research Symposium Proceedings 1995*. Nipawin, Canada; Canadian Honey Council. (1995) 41–44 [En, Bdo]

This paper briefly highlights some of the results from a study of three honey bee lines (BCSS) which had been selected for resistance to tracheal mites [*Acarapis woodi*]. These three lines gave relatively poor honey production under Ontario conditions, whereas three Buckfast lines did well. The wide variations in performance in different traits, and the relative importance of various traits for commercial beekeeping are discussed. D. G. Lowe

Erridge, C. P. **Honey house standards: possible effect of free trade on grades and container sizes.** *Canadian Beekeeping* (1989) 15 (3) 56–59 [En, Bj]

Eyre, D. **Morphometry.** *Canadian Beekeeping* (2002) 22 (5) 6–8 [En, Bj]

An example illustrates how morphometrics can be used to determine the degree of hybridisation between subspecies of *Apis mellifera*. Brief details of a suitable computer method are given.

Bee Works, Orilla, Ontario, Canada.

Fairey, D. T. and Lefkovitch, L. P. **Reproduction of *Megachile rotundata* Fab. foraging on *Trifolium* spp. and *Brassica campestris*.** *The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990* [edited by Heemert, C. van and Ruijter, A. de]. Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 185–189 ISBN 90-6605-384-4 [En, Bd]

When shelters, each containing 20,000 *M. rotundata* cells, were introduced into fields of lucerne (*Medicago sativa*), alsike clover (*Trifolium hybridum*), red clover (*T. pratense*) and canola (*Brassica campestris*), bee populations increased

on all crops and there was no significant difference between crops in the ratio of cell increase. This ratio averaged 2.6, 2.5, 2.3 and 2.2 for populations on lucerne, alsike clover, red clover and canola, respectively; it varied from 1.5 to 3.2 and was affected by year and location. On all crops, over 90% of cells produced were viable and about 30% of these were female. D. G. Lowe

Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Feller-Demalsy, M.-J. and Lamontagne, Y. **Pollen analysis of honeys from Quebec.** [*Analyse pollinique des miels du Quebec.*] *Apidologie* (1979) 10 (4) 313–339 [Fr, en\de, B]

Results of pollen analyses are tabulated for 206 honey samples collected from all beekeeping areas of Quebec in 1974 and 1975. The most important sources were *Trifolium hybridum*, *Solidago* spp., fruit trees and *Salix* spp. Several geographical indicators were found. Quebec can be divided into six large zones according to their characteristic honeys. Author

Univ. Quebec a Rimouski, 300 Ave. des Ursulines, Rimouski, Que. G5L 3A1, Canada.

Foote, L. **California nosema survey 1969–70.** *American Bee Journal* (1971) 111 (1) 17 only [En, B]

Nosema disease was found in 79 of 860 apiaries producing package bees (73,000 colonies). The average infection was light in 46 apiaries, moderate in 28 apiaries, and severe in five apiaries. Examination of samples from 10,296 nuclei in 67 apiaries showed nosema infection in 18 (queen-mating) apiaries. Spore counts in large nuclei were all light, but severe infections were sometimes found in small nuclei. Of 115 dead queens in queen banks 14% contained nosema spores. Bees from 40 packages, in a shipment of 1000 packages from California to Canada, were sampled on three dates. Only five of the 40 had (light) infections at the time of shipment. Three weeks after installation 18 were infected, including 10 with moderate and one with a severe infection (8 million spores per bee). J. D. Hitchcock California Dept. Agric., Sacramento, CA, USA.

Forget, A. and Turcotte, L.-M. **Oka, [History of beekeeping in Quebec 1608–1966.] Canada; Abbaye cistercienne d'Oka. Histoire de l'apiculture québécoise 1608–1966** (97) xi + 250 pp. ISBN 2-921592-08-8 [Fr, Bd]

Gauvreau, H. **Airborne molds a hazard for beekeepers.** *Canadian Beekeeping* (1995) 18 (8) 176 [En, Bj]

In assessing airborne moulds as a health hazard the commonly accepted standard for indoor air quality is 500 colony-forming units, c.f.u., per m³. Air samples from buildings for overwintering honey bee colonies in Alberta were analysed, and most had high spore counts. The relatively high RH and the presence of many dead bees favour mould growth. Sweeping caused levels of 6334–8167 c.f.u./m³ in spring, and scraping boxes resulted in over 6000 c.f.u./m³ (max. 54,700 c.f.u./m³). Approximately 150 moulds were identified, the most common spores being from *Penicillium* species, many of which produce toxins. The spores can cause adverse reactions, including allergies, in operatives; precautions for avoiding inhalation of spores are recommended. P. Walker

Gauvreau, H. and McKenna, D. Occupational exposure of beekeepers to mold spores. Canadian Honey Council Research Symposium Proceedings 1995. Nipawin, Canada; Canadian Honey Council. (1995) 46–49 [En, Bdo]

The data collected in this study [also reported in *Canadian Beekeeping* (1995) 18 (8) 176] indicate that cleaning activities in buildings used for overwintering honey bee colonies release large numbers of airborne fungal spores, some of which are toxigenic. Beekeepers are at risk during the activities studied and should take precautions to prevent inhalation of spores. *D. G. Lowe*
Fairview College, Fairview, Alberta, Canada.

Gauvreau, H., Sigler, L. and Abbott, S. Assessment of airborne molds as a biological hazard for Alberta commercial beekeepers. Fairview, Canada; Alberta Occupational Health and Safety. (1995) 72 pp. [En, Bdo]

This is the full report of an investigation summarised in *Canadian Beekeeping* (1995) 18 (8) 176.
Fairview College, Box 3000, Fairview, Alberta, Canada.

Giovenazzo, P. Rearing [queens]: storing and wintering queen honey bees [technical leaflet 2 1 14]. [Elevage: stockage et hivernage des reines (*Apis mellifera* L.) [fiche technique 2 1 14].]. *Bulletin Technique Apicole* (1992) 19 (3/4) 139–144 [Fr, Bj]

Departement de Biologie, Universite Laval Quebec, Quebec G1K 7P4, Canada.

Gochnauer, T.A., Hughes, S.J. and Corner, J. Chalkbrood disease of honeybee larvae ... a threat to Canadian beekeeping? *Canada Agriculture* (1972) 17 (2) 36–37 [En, fr, B]

The fungus, *Ascosphaera apis*, which causes chalkbrood disease of honeybees, was found for the first time in Canada in 1971. Photographs of infected larvae and of spore cysts are presented. *M. D. Seager*

Entomology Section, Ottawa Res. Stn., Dept. Agric., Ottawa, Ontario, Canada.

Goettel, M.S. and Richards, K.W. Biology and control of chalkbrood, a fungal disease of the alfalfa leafcutter bee, *Megachile rotundata*. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de].

Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 386–390 ISBN 90-6605-384-4 [En, Bd]

The biology of *Ascosphaera aggregata* is reviewed, with 17 references. Aspects dealt with are life cycle, distribution and incidence, and methods of controlling the fungus in populations of *M. rotundata* managed for lucerne pollination. *D. G. Lowe*

Agriculture Canada Res. Stn., Lethbridge, Alta. T1J 4B1, Canada.

Gruszka, J. (ed.). Beekeeping in Western Canada. Edmonton, Canada; Alberta Agriculture, Food and Rural Development (98) 172 pp. ISBN 0-7732-6139-7 [En, Bdo]

This illustrated book is intended to help beekeepers who are managing honey bees under prairie conditions. Among the topics of the chapters are: supplementary feeding, spring management, harvesting and extracting honey,

marketing honey and other hive products, requeening, diseases and pests. Five appendices provide other useful information, such as further reading and addresses. There is no index, but the contents list is detailed. *P. Walker*

Gruszka, J. Outdoor wintering of honey bee colonies [in Saskatchewan, Canada]. *Beelines* (1980) (No. 61) 17–26 [En, B]

Gruszka, J. Outdoor wintering in Saskatchewan [Canada]. *Beelines* (1991) (No. 91) 6–9 [En, Bj]

Guzman-Novoa, E. and Page, R.E. Jr. The impact of Africanized bees on Mexican beekeeping. Canadian Honey Council Research Symposium Proceedings 1995. Nipawin, Canada; Canadian Honey Council. (1995) 138–141 [En, Bdo]

IA fuller version of this paper was published in *American Bee Journal* (1994) 134 (2) 101–106.
NIFAP-SARH, Santa Cruz 29-B, Las Haciendas, 52140, Metepec, E. de Mex., Mexico.

Hergert, G. Status of the Canadian beekeeping industry. *Canadian Beekeeping* (1993) 17 (7) 150–152 [En, Bj]

Official figures show that the reduction in size of the Canadian beekeeping industry appears to have ceased. From 1986 to 1991 the numbers of beekeepers and colonies in Canada dropped by 32% and 29% respectively, to 13,096 beekeepers and 498,780 colonies. Estimated figures for 1992 are 13,080 and 499,520 respectively. Canadian honey production for 1992 was estimated at 29,624 tonnes (59 kg/hive), down nearly 3000 tonnes from the average for the previous five years (56 kg/hive). Approximately one-third of the crop is exported. Figures are detailed by province for honey production and value, and numbers of beekeepers and colonies (hives). *A.G. Matheson*

Hergert, G. Shortage of honey bees for wild blueberry pollination. *Canadian Beekeeping* (1994) 18 (3) 58–59 [En, Bj]

The shortage of honey bees for pollination is shown in a table giving figures for five Canadian east coast provinces: area of wild (low-bush) blueberry, numbers of colonies needed for pollination and actual numbers available. Reasons for the shortage include legislation controlling movements of bees and equipment into and within Canada and low honey production and prices. Suggestions for improving the situation include: introducing contracts, preferably long-term, that are satisfactory for both grower and beekeeper; encouraging beekeepers to move bees for pollination; establishing a honey cooperative to extract and sell bulk honey. Blueberry growers should perhaps consider whether to become beekeepers themselves. *P. Walker*

Horticulture Section, Market and Industry Services Branch, Agriculture and Agr-Food Canada, Ottawa K1A 0C5, Canada.

Hergert, G. and Magnusson, G. Exports down, imports up and production steady. The 1994 honey situation. *Canadian Beekeeping* (1995) 18 (6) 128–130 [En, Bj]

Honey production in Canada was 33,000 t in 1994 (30,700 t in 1993), and the number of honey bee colonies was static at 505,000. Trade was characterised by decreasing exports and rapidly increasing imports, so the stable

production and price indicate increased domestic consumption. A.G. Matheson
Market and Industry Services Branch, Agriculture and Agri-Food, Canada.

Hiemstra, H. Experiments in land honey production. *Canadian Beekeeping* (98) 20 (9) 205–206 [En, Bj]
Some trials in planting and growing bee forage for honey bees are described. In 1998 a mixture of six plants, including anise hyssop (*Agastache foeniculum*), was successfully grown on 0.5 acre [0.2 ha] of land and was actively foraged by bees from late June until October. The costs and returns are set out. P. Walker
Clovermead Apiaries, RR 5, Alymer, Ontario, Canada N5H 2R3.

Hobbs, G.A. Beekeeping with alfalfa leafcutter bees in Canada. *Bee World* (1972) 53 (4) 167–173 [En, B]
Available as an IBRA Reprint.

International Beekeeping Congress, 36th Vancouver. The XXXVIth International Apicultural Congress of Apimondia, Vancouver, Canada, 12–17 Sept. 1999. *Apimondia* ([1999]) 309 pp. [En, Bd]
Papers presented by speakers at plenary sessions and symposia are published, some in full and with references; summaries are given of other papers. Authors of all papers, and also authors of posters submitted, are indexed.

Jay, S.C. Apiculture at the University of Manitoba (1907–1990). Part I. *Canadian Beekeeping* (1990) 15 (8) 180–182 [En, Bj]
Summarises research in 1907–54.

Jay, S.C. Apiculture at the University of Manitoba (1907–1990). Part II. *Canadian Beekeeping* (1990) 15 (9) 200–201 [En, Bj]
Covers the period 1961–1990 (S.C. Jay and students).

Jay, S.C. Apiculture at the University of Manitoba (1907–1990). Part III. *Canadian Beekeeping* (1990) 15 (10) 224–226 [En, Bj]
Continues the summary of research 1961–90, begun in Part II.

Jay, S.C. Apiculture at the University of Manitoba (1907–1990). Part IV. *Canadian Beekeeping* (1990) 15 (10) 227–230 [En, Bj]
Concludes the summary of research 1961–90, begun in Parts II and III.

Jay, S.C. Pollination of crops in Manitoba by bees (1990). *Canadian Beekeeping* (1990) 16 (1) 16–17 [En, Bj]
The most important insect-pollinated crops in Manitoba, Canada, are canola, sunflower, buckwheat, mustard and faba beans. They are grown in areas with large numbers of honeybee colonies, and estimates are made of the value of honeybee pollination in 1987 and 1988. Total value, after subtracting an estimated contribution by wild bees, may be between 20 and 50 million dollars annually. P. Walker
Dept. Entomology, Univ. Manitoba, Winnipeg, Man. R3T 2N2, Canada.

Jay, S.C. and Dixon, D. Infertile and Nosema-infected honeybees shipped to western Canada. *Journal of Apicultural Research* (1984) 23 (1) 40–44 [En, B]

Counts of spermatozoa and tests for nosema disease were carried out on queen honeybees (*Apis mellifera*) over a 6-year period on their arrival in western Canada from the USA. During that period, *Nosema apis* spores were found in 0.5–18% of the queens (mean 7.5%); 11% of the queens had fewer than 3 million spermatozoa. In each year a high percentage (i.e. 45–64%) of the queens had over 5 million spermatozoa. Sperm counts and nosema disease in queens were also examined in relation to the State of origin in USA and their date of arrival in Canada. The results are discussed in relation to package beekeeping. Author
Dept. Entomology, Univ. Manitoba, Winnipeg, Man. R3T 2N2, Canada.

Jay, S.C. (ed.). Manitoba Beekeepers' Association, Pollination Committee. Honey bee pollination in Manitoba. Publication, Manitoba Department of Agriculture (1971) (No. 525) 16 pp. [En, B]

Guidelines are given for beekeepers, who provide colonies for pollination, and for seed growers who use this service. A beekeeper's costs in Manitoba in 1971 are outlined, and recommendations are made as to the charges for pollination services and the number of hives per acre, according to the crop. The arrangement of hives in the field is also discussed. P. Walker
Manitoba Dept. Agric., Winnipeg, Canada.

Johansson, T.S.K. and Johansson, M.P. Apicultural literature published in Canada and the United States. New York, USA, Johansson. (1972) 103 pp. [En, B]

This bibliography lists 613 known books and pamphlets and 689 Federal, Provincial and State publications; it does not deal with articles in journals. In addition to the bibliographical details, libraries which contain each of the books published up to 1940 are designated: nine in North America and the BRA Library in England. This compilation has an author index, and also includes guides to source material on beekeeping associations, beekeeping journals, trade catalogues of beekeeping equipment, library collections, films and film strips. E.E. Crane
Dept. Biology, Queens College, Flushing, N.Y. 11367, USA.

Kevan, P. Pollination and pollinator requirements for Canadian crops (current status of understanding). *Canadian Beekeeping* (1989) 15 (1) 12–16 [En, Bj]

The general pollination requirements of the main types of crop are discussed, and a table shows the value of honeybees as pollinators of 40 specific crops. However, for many crops information is lacking, and trials are also needed on newly-developed cultivars of certain crops. P. Walker
Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Kevan, P.G. Pesticides and bees. A legal case from England with relevance to Canada. *Canadian Beekeeping* (1987) 13 (9) 208 [En, Bj]

A brief report is given of a case in which growers of oilseed rape were found to be negligent because they did not give beekeepers sufficient warning of their intention to spray flowering crops with insecticides.

Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Kevan, P.G. Keeping up with pollination concerns and options for the future [Canada]. *Canadian Beekeeping* (1988) 14 (4) 79–80 [En, Bj]
Particularly with honeybees and other bees.

Kevan, P.G. Beekeeping and pollination at the crossroads: III Alternative [bee] pollinators [to honeybees, in Canada]. *Canadian Beekeeping* (1990) 16 (1) 8–11 [En, Bj]

Kevan, P.G. Pollination: keystone process in sustainable global productivity. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de]. Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 103–110 ISBN 90-6605-384-4 [En, Bd]
The importance of pollination in agricultural and natural systems is discussed and threats to pollination processes are identified. The importance of conservation and environmentally sensitive management practices in agriculture and forestry is emphasised. *D.G. Lowe*
Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Kevan, P.G. Skunk cabbage: an early source of pollen. *Canadian Beekeeping* (1992) 16 (10) 221–222 [En, Bj]
Skunk cabbage (*Symplocarpus foetidus*) is one of the first plants to flower in eastern Canada, and honey bees actively gather its pollen.
Department of Environmental Biology, University of Guelph, Guelph, Ont. N1G 2W1, Canada.

Kevan, P.G. Introductory apiculture at Guelph [University, Canada]: 102 years young and more apiculture students than anywhere. *American Bee Journal* (1995) 135 (3) 185–187 [En, Bj]
Development of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1.

Kevan, P.G. and Laverty, T.M. A brief survey and caution about importing alternative pollinators into Canada. *Canadian Beekeeping* (1990) 15 (8) 176–177 [En, Bj]
This literature survey, with 19 references, collects together evidence that *Varroa jacobsoni* can survive temporarily outside the honeybee hive, on flowers or on other insects. It is concluded that it is unwise to import more non-honeybee pollinators into Canada until a quarantine procedure has been set up to ensure that these insects are free from *Varroa* mites. Meanwhile, solutions to pollination problems should be sought that do not rely on imports of other insects. *P. Walker*
Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. Canada.

Kim, JaiGi and Lee, SuHan. Comparative research on the microbiological examination of domestic honey and foreign honey (illegally distributed). *Korean Journal of Apiculture* (1992) 7 (2) 156–161 [Ko, en, Bj]
Eight samples of one-year-old honey (two each of acacia, chestnut, rape and multifloral honey), four samples of

imported honey (three from Australia, one from Canada), and one sample of 'honey' from sugar-fed bees were analysed for microorganisms. The total mesophilic aerobic plate count for Korean honeys ranged from 30 to 90 (average 60), whereas for imported honeys it ranged from 70 to 240 (average 155) and in sugar 'honey' it was 350. The higher microbiological contamination of imported honeys is attributed to long-term distribution, packing etc. None of the samples contained coliform bacteria. *G. Lowe*
Korea Beekeeping Association, 301 Sambo Bld., Chongro 6-Ga, Seoul 110–126, Korea Republic.

L'Arrivee, J.C.M. Canada, Department of Agriculture. Beekeeping in Eastern Canada. Publication, Canada Department of Agriculture (1977) (No.1600) 30 pp. [En, B]

L'Arrivee, J.C.M. Bee research by Agriculture Canada: early years (1891–1914). *Canadian Beekeeping* (1984) 11 (3) 63–65 [En, B]

Leclerc, M. Beekeeping as practised by fourteen commercial beekeepers in Quebec. [L'apiculture telle que pratiquée par quatorze apiculteurs commerciaux du Québec.] *Abeille* (1992) 13 (1) 18–19 [Fr, Bj]
This is a short account of the methods used by the Federation des Apiculteurs du Québec, who own a total of 7000 hives.

Lew, Y.-S. A study on trends in, and settlement of, emigrant beekeepers from Korea. *Korean Journal of Apiculture* (1990) 5 (1) 76–102 [Ko, en, Bj]
The experiences of Korean beekeepers who emigrated to Canada and Argentina, and the difficulties that have occurred, are outlined and discussed. *D.G. Lowe*
Korea Beekeeping Association, Seoul, Korea Republic.

Lidstone, R. and Rubenstein, R. A research study on beekeeping and disease management in Canada. *Canadian Beekeeping* (1982) 10 (3) 52–53 [En, B]

Liu, T.P. A possible control of chalkbrood and nosema diseases of the honey bee with neem. *Canadian Beekeeping* (1995) 18 (5) 107–109 [En, Bj]
Northern Agricultural Research Centre, Agriculture and Food Canada, Beaverlodge, Alberta, Canada.
Azadirachtin, an extract of the neem tree, *Azadirachta indica* (= *Lelia azadirachta*), was fed to honey bee (*Apis mellifera*) colonies as 1 ml or 2 ml Margosan-O (3000 ppm a.i.)/litre of sugar syrup. These colonies produced fewer chalk brood (*Ascosphaera apis*) mummies, had lower levels of Nosema *apis* spores, produced more honey and collected more pollen than controls. Azadirachtin added to a growth medium inhibited the growth and development of *A. apis*. *A.G. Matheson*

Liu, T.P. A rapid differential staining technique for live and dead tracheal mites. *Canadian Beekeeping* (1995) 18 (7) 155 [En, Bj]
The standard technique for determining the infestation level of *Acarapis woodi* in honey bees is time-consuming; live mites are distinguished by watching for movements in their extremities. A more rapid technique, which is also simple and reliable, is now described. On staining with

tetrazolium dye, live mites show up bright purple, due to the presence of dehydrogenases [oxidoreductases] in the cells. Dead mites do not contain active enzymes, so they merely absorb the stain and turn greenish yellow. The procedure is described. *P. Walker*

Northern Agriculture Research Center, Agriculture Canada, Box 29, Beaverlodge, Alberta T0H 0C0, Canada.

Liu, T.P., McKenna, D., Farrish, S., McRory, D. and Scott-Dupree, C. *The sterilization of American foulbrood by gamma irradiation. [Summary]. Canadian Beekeeping* (1991) 16 (6) 141 [En, Bj]

Twenty hives heavily contaminated with *Bacillus* larvae were sterilised at a commercial gamma-irradiation plant (final dose 1.2 Mrad), and then used for colonies in an apiary. After five weeks no brood was suffering from AFB, although some symptoms of sac brood and possibly of Kashmir bee virus were seen. In another apiary containing 20 contaminated but unsterilised hives, 50% of brood had developed AFB after five weeks and subsequently all brood was diseased. *P. Walker*

Research Station, Agriculture Canada, Beaverlodge, Alta. T0H 0C0, Canada.

MacDonald, D. and Monner, G. *An economic comparison of wintering and package bees in the Peace River region. Publication, Alberta Agriculture* (1984) (No. 821-14) iii + 19 pp. [En, B]

This report presents typical figures for a 2000-hive operation, based on a survey of beekeepers in the Peace River region, Alberta, Canada. Tables give itemised figures for investment and for costs and returns for: (a) an apiary using package bees; and (b) an apiary in which the colonies are overwintered. In both, the use of pallets is necessary in the honey house, but the use of forklifts and pallets in the field is optional. It is calculated that in (b), the return over cash costs is Can\$29.62 per hive compared with \$16.48 per hive in (a); taking into account depreciation costs the figures are \$15.52 and \$5.71, respectively. The difference between the two methods of operation decreases as the price of sugar increases. Other variables are discussed. The advantages of overwintering are summarised; beekeepers who normally use package bees are encouraged to overwinter some of their colonies for a year or two so that they can gain experience in the necessary management techniques. *P. Walker*

Alberta Agriculture, Falher, Alta., Canada.

MacDonald, D. N. *Diseases of the honeybee, Apis mellifera (Hymenoptera: Apidae) in British Columbia with special emphasis on nosema disease, Nosema apis (Sporozoa: Nosematidae), in the Lower Fraser Valley. Pest Management Papers; Simon Fraser University* (1978) (No.13) xii + 125 pp. [En, B]

This paper is adapted from the author's Master of Pest Management thesis. After a general review of honeybee diseases, statistics are presented for incidence in this area from 1914 to 1976; they have been obtained from the Annual Reports of the B.C. Department of Agriculture which, up to 1958, dealt mainly with AFB and EFB. After 1958 other diseases were included; since 1971 a dramatic increase in chalkbrood has been evident. Nosema disease

is discussed in detail, including its effect on beekeeping economics. The Department of Agriculture's figures for nosema incidence were low, so the disease was surveyed in about 130 colonies in the coastal Fraser Valley, in spring, summer and autumn 1976. A characteristic spring epidemic was recorded with 92% of colonies infected, and the mean spore count was 10.6×10^6 spores/bee. Later in the year, spore counts declined significantly, although in the summer, counts were still significantly higher than those at two inland locations. No significant differences were found: between colonies in the east and west of the valley; between colonies moved short distances and those not moved; between colonies treated by beekeepers with Fumidil-B and those not treated. It is concluded that beekeepers are underdosing, and it is recommended that correct dosage levels should be used, in conjunction with comb sterilisation (which is not at present practised). A diagnostic service should be set up. *P. Walker*
Pestology Centre, Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC, Canada.

Macey, A. (ed.). *Organic livestock handbook: a project of Canadian Organic Growers Inc.* Ottawa, Ontario; Canadian Organic Growers Inc. (2000) 179 pp. ISBN 0-9695851-2-8 [En, X]

Maeceau, J. and Houle, E. *Effect of the arrangement of hives in the winter bee house on [food] consumption. [Effet de la disposition des ruches dans la chambre d'hivernage sur la consommation]. Abeille* (1991) 11 (3) 12-13 [Fr, Bj]

A total of 125 hives were kept in a bee house at Deschambault, Canada, from 23 November-18 April at a temperature of $3^\circ \pm 1^\circ\text{C}$. Air was blown from a conduit along one wall, at a speed corresponding to 0.04 m/s across the floor. The hives were arranged in rows (A) parallel to the direction of air flow, or (B) perpendicular to it, or (C) against the wall (under the air conduit). B colonies consumed on average 2.2 kg (15%) more food than A and 3.4 kg (26%) more than C colonies. It is concluded that arrangement A is preferable. If the air conduit runs across the middle of the winter bee house, hives can be arranged in rows parallel to the conduit, and on each side of it, with a gap of a metre around the conduit to allow air circulation. *P. Walker*

Manitoba Agriculture Manitoba, Canada; Manitoba Agriculture. *Guidelines for estimating honey production costs* (97) 15 pp. [En, Bc]

Martineau, M.-C. and Gauthier, D. *Women's work in bee-keeping. [Le travail des femmes en apiculture.]. Abeille* (1982) 3 (2) 11-13 [Fr, B]

Matheson, A., Buchmann, S.L., O'Toole, C., Westrich, P. and Williams, I.H. (eds). *The conservation of bees.* London, UK; Academic Press for the Linnean Society of London and the International Bee Research Association. (1996) viii + 254 pp. ISBN 0-12-479740-7 [En, Bd]

This book is based on the proceedings of a symposium with the theme 'Conserving Europe's bees', organised by the International Bee Research Association and the

Linnean Society and held in London, UK, on 6–7 April 1995. It has 18 chapters covering topics in bee biology and conservation that are important, not only in Europe but worldwide, contributed by researchers from nine European countries, USA, Canada and Israel. The first five chapters consider the environmental requirements of bees (*Apoidea*) and how these can be provided by conservation efforts. The point is made that a bee's requirements – a nest site, nest building materials and food plants – may each be provided by 'partial habitats' within the habitat complex as a whole. Man-made habitats may provide substitutes for threatened or destroyed natural habitats; for example, sand and gravel pits may provide habitats originally found within the floodplains of wild river systems. The urban environment may provide numerous habitats for bees, and examples in the city of Berlin are described. General ecological principles for bee conservation are discussed and management plans for specific sites in the UK are presented. Chapters 6–9 are concerned with plant-bee relationships, particularly the importance of bees as managed or incidental pollinators of crops and native plant species. The question is posed 'Which bees do plants need?' Plant communities may depend on a local guild of pollinating bee species and to try to supplement or replace this guild with a managed honey bee (*Apis mellifera*) population may be counter-productive. This aspect of bee-bee relationships is discussed further in Chapters 10–16, which include examples of competition between introduced honey bees and native bees. Environmental pressures mean that honey bees and beekeeping will have to be regarded increasingly from an overall ecological perspective, particularly where habitats managed primarily for other purposes are concerned. The study of wild bee populations is handicapped by the poor state of bee systematics in Europe and suggestions are made for improving this situation. As an example of how systematics can contribute to studies of biological communities, the final chapter describes the work of the Programa Cooperativo sobre la Apifauna Mexicana (PCAM) in Mexico. This book succeeds in portraying the vital role of bees in both natural and farmed environments and in indicating areas where further research is urgently needed. It will be of interest to anyone who is concerned about bees, or insect and plant communities in general, and it should be required reading for those involved with habitat management and conservation. Chapters are abstracted individually in *Apicultural Abstracts*. G. Lowe

McCutcheon, D.M. *Developing a queen and package bee production industry in B.C. [British Columbia, Canada].* *Canadian Beekeeping* (1984) 11 (4) 81 [En, B]

McCutcheon, D.M. *Wintering honeybees in a controlled atmosphere chamber.* *Canadian Beekeeping* (1977) 6 (8) 98–102 [En, B]

Results are reported for the first half of trials being made during three winters in a part of British Columbia, Canada, where winters are mild and very humid. In the first year, preparation of 200 nuclei took longer than expected, autumn feeding was curtailed and winter stores were inadequate. From early November to March the hives were kept in a dark building at 4° F (10° C), RH 50%. When the hives

were brought out in spring the colonies were fed with syrup; there was little pollen available, and brood rearing was slow. By mid-May, 27% of hives had failed to survive; colonies with Caucasian queens suffered fewer losses. In the second season, nucleus preparation was done more quickly, and each nucleus was provided with four combs of honey and one comb of pollen. P. Walker
British Columbia Min. Agric., Surrey, BC, Canada.

McCutcheon, D.M. *Indoor wintering of hives.* *Bee World* (1984) 65 (1) 19–37 [En, B]

Methods for overwintering bees indoors in temperate climates are reviewed and discussed. Cellars were used for wintering hives in the early 1900s, but interest in this method diminished because of various disadvantages. From the mid-1920s to the mid-1960s the technique of cellar wintering was improved, but overwintering of bees both outside and in cellars fell into disfavour as package beekeeping became an economic alternative. Technological improvements from 1960 to the present have made wintering indoors once again a viable alternative. Special buildings with ventilation, temperature and humidity controls are used, and these are described. Recommended management procedures for colonies that are to be overwintered are given. Hives are prepared as single or double brood chamber units in late August or early September. Sucrose syrup is the preferred food for winter stores, and feeding should be finished by early October. Hives are placed in the building in early November. Losses of overwintering colonies vary from 5% to 10%, but it is estimated that colonies wintered inside produce 40% more honey than package colonies, at a cost which is almost equal to that of a 0.90-kg package. The method is now widely used in the Canadian Prairie provinces and Quebec. [Available as IBRA Reprint No. M113, price #1.65 or US\$3.20. D.G. Lowe

Min. Agric. and Food, 17720 57th Ave., Surrey, BC, Canada V3S 4P9.

McElheran, W.J. *Importation of honey bees from the United States – risk assessment summary. Package bees and queen bees from the USA.* *Canadian Beekeeping* (1995) 18 (6) 125–126 [En, B] Animal Health Division, Food Production and Inspection Branch, Agriculture and Agri-Food, Canada.

Possible strategies evaluated are: allowing the importation of queen honey bees after acaricidal treatment, renewing the import ban for two years, or renewing the ban indefinitely. Recommendations are made for certification and treatment procedures to reduce the risk of importing *Varroa jacobsoni*, *Acarapis woodi* and the Africanised honey bee, should bee imports from the USA be permitted. A.G. Matheson

Mitchell, S.R., Bates, D., Winston, M.L. and McCutcheon, D.M. *Comparison of honey bee queens overwintered individually and in groups.* *Journal of the Entomological Society of British Columbia* (1985) 82 35–39 [En, Ba]

Queen honeybees were overwintered in British Columbia, Canada, in 1982–83 and 1983–84, either in a 2-frame nucleus or in a mass holding facility as described by Harp [American Bee Journal (1969) 109 (9) 340–341]. Subse-

quent productivity of the queens, measured by area of sealed worker brood and net weight of colonies, was generally higher with queens overwintered in nuclei than with queens overwintered in a group. Poor acceptance and supersedure of group-overwintered queens suggests that this method of storage is not yet acceptable for commercial use. Survival of the nucleus queens was low in outdoor 2-frame units during the winter, but was higher with an indoor system. Overwintering queens indoors in 2-frame nuclei and outdoors in 3–5 frame nuclei with supplemental feeding in late winter should provide a source of queens which could partially fulfill market demands in spring. *Author* Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada.

Moeller, F.E. *United States Department of Agriculture. Development of hybrid honey bees. Production Research Report, United States Department of Agriculture* (1976) (No. 168) v + 11 pp. [En, B]

The history and development of the technique of instrumental insemination into a usable and essential tool for breeding honeybees are discussed, followed by a description of the hybrid honeybee breeding programme developed by the USA (Department of Agriculture) and Canada over 20 years. The breeding methods used are described with selected examples of observed stock variability, problems in holding or maintaining inbreds, and how the industry has used and benefited from the work. The need for methods using less intensive inbreeding, and for the development of queen and sperm banks, is emphasised. *Author* Bee Management and Entomology Res., ARS, USDA, Madison, WI 53706, USA.

Murrell, D. C. and MacDonald, D. N. *The Alberta beekeeping manual*. Edmonton, Canada; Alberta Agriculture. (1982) vi + 98 pp. [En, B]

Clearly set out contents and drawings; glossary of terms and Alberta regulations on beekeeping and honey.

Murrell, D. C. and MacDonald, D. N. *The prairie beekeeping manual*. Edmonton, Canada; Alberta Agriculture. (1986) v + 97 pp. [En, Bd]

Revised edition of *The Alberta Beekeeping Manual*.

Nasr, M.E. Tech-Transfer program 1994–1998 progress report. *The Sting* (99) 17 (3) 23–26 [En, Bj] 861/99

The beekeeping situation in Ontario is described and compared with that in the USA. A Tech-Transfer programme, launched in 1994, has achieved the following: (a) the production of selected mite-resistant queens (14,000 annually in 1997 and 1998); (b) the establishment of a breeding programme for Buckfast bees in Ontario; (c) the development of safe methods for treating varroa-infested honey bee colonies with formic acid; and (d) the development of an IPM strategy for mite control which has been tested in Ontario. *P. Walker*

Ontario Beekeepers' Association, Bayfield, Ontario, Canada NOM 1G0.

Nasr, M.E. *Tracheal mite resistant and hygienic honey bee stocks in Ontario*. *Canadian Beekeeping* (1997) 20 (3) 63–64 [En, Bj]

The number of bee breeders taking part in the programme described here has increased from 10 in 1993 to 28 in 1997. Colonies are selected for good performance and resistance to the tracheal mite (*Acarapis woodi*). Since the start of the programme, mite infestation levels in tested bees have decreased significantly; in 1997 they averaged 1.5 mites/bee. In that year, an estimated 12,000 queens were produced from mite-resistant lines of Buckfast, Carniolan and Ontario bees and distributed throughout Ontario. Field tests of colonies with resistant queens showed that 45% of the colonies had no tracheal mites and 50% had less than a 10% infestation after 17 months. A method was developed for the evaluation of hygienic behaviour (eviction of killed pupae) in honey bees. This trait could also be used in the selection programme.

P. Walker

Ontario Beekeepers' Association, Bayfield, Ontario NOM 1G0, Canada.

Nelson, D. and McKenna, D. *Relative cost of wintering six-frame nuclei indoors*. *Canadian Beekeeping* (1989) 15 (2) 27–28 [En, Bj]

The costs of overwintering honeybees in (a) 6-frame nuclei and (b) single brood boxes are compared. Mean weight loss for (a) was 6 kg (initial wt 23 kg), and for (b) 12 kg; for colonies in two boxes mean loss was 24 kg. Of 595 nuclei overwintered, 4.2% died, 2.5% were weak or queenless at the first brood check after transfer to brood boxes, and 1.5% were requeened before late June (total loss 8.2%). It is concluded that wintering of nuclei is a viable option in Canada for beekeepers making nuclei in late summer or autumn, or purchasing or rearing queen cells or queens in summer. Some modifications in management are necessary, and a few are mentioned briefly. *P. Walker*

Fairview Coll., Fairview, Alta., Canada.

Nelson, D. L. *Bear damage and control*. *Canadian Beekeeping* (1974) 4 (9) 67–69 [En, B]

Beekeepers in most Canadian provinces suffer losses through bear damage; an estimate for Alberta in 1973 is \$200,000. It is estimated that the figure would have been \$500,000 if the Peace River bear control programme had not been undertaken. It was concluded from this operation that electric fences are probably the most effective in preventing hive damage by bears. Five suitable types of fence are described; hives should be situated at least 3 ft [1 m] inside the fence, and the battery must be well maintained. *P. Walker*

Agriculture Canada, Beaverlodge, Alta., Canada.

Nelson, D. L. *An evaluation: a cross between New Zealand and California honey bee stocks*. *American Bee Journal* (1975) 115 (6) 228–229, 234 [En, B]

During three summers, comparisons were made between the areas of sealed brood measured at intervals after introducing queens to package bee colonies, and the annual surplus honey production of specific California and New Zealand stocks, and their hybrid stock. Differences were not statistically significant, but the hybrids had fewer queen losses, and fewer cases of chalk brood disease. The hybrid stock and the California stock were compared during outdoor and indoor wintering in one winter, and only

slight differences were found. *J.D. Hitchcock*
Res. Stn., Beaverlodge, Alta., Canada.

Nelson, D.L. *Western Canada's beekeeping industry.*
Canada Agriculture (1976) 21 (3) 23–24 [En, fr, B]

Over the period 1972–1975 the cost of package bees tripled, and poor weather delayed and/or limited packages and/or queens from the main source, the USA. Thus, the practice common in this area of killing stock and replacing each spring, became too costly to be offset by increased honey prices. One solution was to use another source: in this period 15,000 queens and about 2,000 packages were obtained from Mexico. A more important alternative, overwintering, is gaining favour: in 1969 only about 6,000 colonies were overwintered, but this increased to an estimated 25,000–30,000 in 1975, excluding southern British Columbia, and the trend is expected to continue. Wintering studies indicate that timing, colony preparation, and queen type are important to success, and selections are in progress to obtain a bee better suited to Canadian conditions, and to long winter confinement. Heavy investment has been made in controlled-environment overwintering, a system for which evaluation of economics and success has not been completed. *F.B. Wells*
Apiculture Unit, Agriculture Canada Res. Stn., Beaverlodge, Alta, Canada.

Nelson, D. L. *Assessment of queen quality in honey bees. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.].* Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 47–48 ISBN 0-86774-011-6 [En, Bdo]

An experiment using 47 colonies was carried out to determine the effects of queen attractiveness (to workers), queen weight (QW) on removal from the mating nucleus, and queen storage method, on colony honey production. Queen attractiveness was not correlated with sealed brood area or honey production, but QW was correlated with both. Honey production was also correlated with sealed brood area. QW varied markedly with the method of storage used; storage in a 4-frame nucleus hive gave the best results. It is suggested that poor queens could be eliminated by discarding the lightest 15–20% of queens upon their removal from mating nuclei. *D.G. Lowe*
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta., Canada.

Nelson, D.L. *Assessment of queen quality in honey bees.*
Canadian Beekeeping (1989) 14 (9) 207–208 [En, Bj]

During a season, between 15% and 40% of a beekeeper's colonies may suffer queen-related problems (swarming, queen loss or failure) and the honey production of each such colony will be only about 40% of that of a colony without the problems. It is therefore desirable to assess a queen's 'quality' before introducing her to a colony. This paper, presented to the Ontario Beekeepers' Association, summarises some previously published work on queen attractiveness to workers, queen weight, and methods of storing queens. A practical approach to eliminating poor

queens is to discard the lightest 10–15% of queens taken from the mating nuclei. *Author*
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Nelson, D.L. *Control of the honey bee tracheal mite with menthol and formic acid.*
Canadian Beekeeping (1995) 18 (6) 136–137 [En, Bj]

Different formulations of menthol and formic acid were evaluated for the control of honey bee tracheal mites (*Acarapis woodi*) in Alberta, Canada. All menthol treatments reduced mite prevalence (% of bees infested with mites) to less than 1% by late summer, compared with control colonies (26%, from an initial 12%). Some treatments showed decreased brood rearing (though the difference was not significant) and significantly lower honey production. Brood mortality was seen in most treatments for a few days after application. All formic acid treatments reduced mite prevalence to less than 1% by late summer; though dead bee counts increased with one treatment there was no significant difference in honey production. *A.G. Matheson*

Agriculture and Agri-Food Canada, Northern Agriculture Research Centre, Box 29, Beaverlodge, Alberta T0H 0C0, Canada.

Nelson, D.L. *Population and brood dynamics of indoor wintered colonies. [Abstract].*
American Bee Journal (1995) 135 (12) 828–829 [En, Bj]

Colonies were overwintered in a building in Alberta, Canada, at a temperature of 4–6°C except for three days in early November when it rose to 14°. In November the number of bees in single-box hives averaged 14,200 and in two-box hives 31,700; these levels remained fairly constant. Colonies were moved outside in late March, and in April the numbers of bees were 7,800 and 25,000, respectively. In November the number of eggs was low (c. 200), then it increased each month; in April the numbers of eggs were 1,150 and 1,760, respectively. Numbers of larvae remained fairly constant at 200 and 630, respectively, until April when numbers increased to 1157 and 3,440. In November the number of pupae was 0, in December–March 105 and 717, and in April 607 and 3,454, respectively. *P. Walker*
Northern Agriculture Research Centre, Box 29, Beaverlodge, Alberta T0H 0C0, Canada.

Nelson, D.L., Barker, R., Bland, E., Corner, J., Soehngen, U. and Villeneuve, J.L. *Chalk brood disease survey of honey bees in Canada, 1975.*
Canadian Beekeeping (1976) 5 (10) 76 [En, B]

In two surveys made during late May and from 1 June–4 July, it was found that 32% of the 5374 colonies inspected had 'mummies' in the frames. However, 75% of the infected colonies had less than 10 cells with the disease. The level of infection was generally higher during the second period than in the first. *P. Walker*
Agriculture Canada Res. Stn., Beaverlodge, Alta., Canada.

Nelson, D.L. and Grant, G.A. *Cooperative tracheal mite analysis and technology transfer initiative.*
Canadian Honey Council Research Symposium Proceedings 1995. Nipawin, Canada; Canadian Honey Council. (1995) 45 [En, Bdo]

An enzyme-linked immunosorbent assay (ELISA) for tracheal mites [*Acarapis woodi*] can practically measure mite levels of 6% or greater from small liquid samples of homogenised honey bees (six bees infested per 100 bees analysed at a 95% confidence level). This technology is capable of more efficiently processing large numbers of samples than the traditional dissection method. This test has been validated by extensive trials where bees were collected in salt solution from various locations across the continent. The kit is not intended for use by beekeepers directly, but will give researchers, governments and private businesses a chance to evaluate and promote the application of ELISA in the beekeeping industry. *Author*
Agri-Food Canada, Box 29, Beaverlodge, Alberta T0H 0C0, Canada.

Nelson, D.L. and Jay, S.C. Producing honey in the Canadian prairies using package bees. *Bee World* (1982) 63 (3) 110–117 [En, B]

Nelson, D.L. and Sheehan, L.R. A simple method of weighing honey-bee queens. *American Bee Journal* (1988) 128 (7) 492–493 [En, B]

An inexpensive reloading scale was compared to a precision balance for ranking mated queens by weight. There was a significant correlation between the two methods. The weighing of queens using a reloading scale should provide beekeepers with a method for culling poor quality queens reared under similar conditions. The main advantages of a reloading scale are low cost and mobility; also, it does not require electricity and is easy to operate. *Author*

Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Oliveira, D. de, Gingras, J. and Chagnon, M. Honey bee visits and pollination of red raspberries. *The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de]*. Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 415–419 [En, Bd]

A study on raspberry (*Rubus idaeus*) pollination was undertaken in southern Quebec. Raspberry flowers were bagged before flowering began. Once the flowers bloomed, the bags were removed while data were collected. The number and length of honeybee visits to these flowers were recorded and their effect on pollination was quantified using the weight and number of drupelets on the resulting berries. The weight of berries and number of drupelets increased with the number and length of visits. The product harvested by honeybees, either nectar or both pollen and nectar, was determined by observing foraging behaviour. The cumulated visiting time to a given flower was most effective when foraging involved the collection of pollen and nectar rather than nectar only. Once this cumulated time added up to about 150 seconds pollination reached a maximum. Five or six honeybee visits per flower are sufficient to attain adequate pollination and raspberry development. *Author*

Dept. des Sci. Biologiques, Univ. du Quebec a Montreal, C.P. 888, Succursale 'A', Montreal, Que. H3C 3P8, Canada.

Oliveira, D. de, Savoie, L. and Vincent, C. Pollinators of cultivated strawberry in Quebec. *The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de]*. Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 420–424 ISBN 90-6605-384-4 [En, Bd]

This study of pollinators was conducted in 1987 at Frelighsburg, Quebec, in a 'Redcoat' plantation. Thirty-two insect species were collected, compared to 19 species collected at the same site in 1978 and 1979 by Pion (1980) [MSc thesis, University of Quebec, Montreal, Canada]. The taxa visiting the flowers were, in decreasing order of importance, honeybees, syrphids and halictid bees. Their relative abundance on strawberry flowers is presented. Species richness (45 species) at Frelighsburg was low compared to the 108 species observed in Logan (Utah) by Nye and Anderson (1974) [*Journal of the American Society for Horticultural Science* 99, 40–44]. There were two hives near the plots and honeybees accounted for 56% of all insect visits to the crop. Better knowledge of pollinator ecology and behaviour is required for the design of sound integrated pest management programmes that would take into account the contribution of pollinators to yield. *Author*
Dept. des Sci. Biologiques, Univ. du Quebec a Montreal, C.P. 8888, Succursale 'A', Montreal, Que. H3C 3P8, Canada.

Otis, G.W. Tracheal mite project in New York. *Canadian Beekeeping* (1986) 12 (10) 231–232 [En, B]

Preliminary results are reported from a study of *Acarapis woodi* populations in 39 colonies at one location in NY State, USA, during the winter of 1985–86. Over 40% of colonies had more than a fifth of bees infested; in a larger study of 1006 colonies in England in 1955–60 by L. Bailey only 11% of the colonies were infested at this level. In the present study, colony mortality was higher at most levels of infestation than that recorded in England. *P. Walker*
Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Otis, G.W. Results of a survey on the economic impact of tracheal mites. *American Bee Journal* (1990) 130 (1) 28–31, 41 [En, B]

The effects of *Acarapis woodi* on beekeeping in different continents is summarised; the survey is based on answers to a questionnaire [numbers of replies not stated] and on published reports. There is rather little information for Africa and Asia. Diagnostic examinations of honeybees for the mite are estimated to cost over \$10 million per annum, worldwide; costs in Europe are especially high. Mite populations seem to be higher in North America (where present) than in Europe or India, and seem to cause considerable damage. *P. Walker*
Dept. Environmental Biology, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Otis, G.W. Survey of overwintering success and practices in Ontario, 1996–97. *Sting (Ontario)* (1997) 15 (3) 10–16 [En, B]

A survey in 1997 produced a 32% response (75 replies) from beekeepers in Ontario who owned more than 50

hives. Average winter losses were 10%, with another 2.3% considered to be too weak to be viable. A high proportion of beekeepers treated for *Varroa jacobsoni* and *Acarapis woodi* infestations, and almost all used terramycin to control bacterial infections. Requeening had no effect on wintering success. The majority of beekeepers fed colonies with sugar, usually in the form of syrup (2:1 or 1:1). Most colonies were wintered as doubles (two deep hive bodies), but other sizes of wintering unit were reported; there was only 6.8% mortality in colonies wintered as singles. Most beekeepers wrapped or insulated hives for winter and provided top entrances. *D. G. Lowe*

Department of Environmental Biology, University of Guelph, Guelph, Ont. N1G 2W1, Canada.

Pankiw, P. and Nelson, D.L. Agriculture Canada. Beekeeping in western Canada. Publication, Agriculture Canada (1975) (No. 1542) 15 pp. [En, B]

Pawlowski, S. Choosing suitable sites for outdoor wintering of honey bees. *Skeptic* (1984) 4 (1) 18–19 [En, B]

Pawlowski, S. Multiple queening. *Skeptic* (1984/1985) 4 (2; 3/4) 10–11; 5–6 [En, B]

Pedersen, J. Use of pheromones in beekeeping. *American Bee Journal* (2000) 140 (5) 381–383 [En, B]
Pedersen Apiaries, Cut Knife, Saskatchewan, Canada.

Pedersen, J., Pedersen, G. and Pedersen, E. Outside wintering of single brood-chamber hives 'revisited'. *Canadian Beekeeping* (1996) 19 (3) 61–65 [En, B]

Various colony wintering procedures used in a commercial operation in Saskatchewan, Canada, were described in *Canadian Beekeeping* (1995) 18 (7) 152–153. This present article supplies additional information and deals particularly with hive entrances, sugar feeding, use of drugs (oxytetracycline, fumagillin), packing and use of pallets, insulation and ventilation, swarm control during subsequent spring build-up, queen breeding and replacement and making increases using 5-frame nuclei. The authors stress that their methods have been successful in western Canada, but beekeepers in different winter climates should be cautious in using the methods described. *D. G. Lowe*

Pedersen Bros. Apiaries, Cut Knife, SK, Canada.

Pederson, J., Pederson, G. and Pederson, E. Outside wintering of single brood chamber hives. *Canadian Beekeeping* (1995) 18 (7) 152–153 [En, B]

Various colony wintering procedures were used in a commercial operation (c. 500 colonies) in Saskatchewan, Canada, and results for 1988–1994 are summarised. Colony losses were slightly lower in hives wintered outdoors, under insulation, than in those wintered inside. In 1990–1991, when all colonies were wintered outside, about 11% of colonies in single brood boxes were lost, and the figure was similar for those in double brood boxes. In 1992–1993, overall losses were 8%, but the level was much lower in single boxes than in doubles. In 1993–1994, when all colonies were kept in single boxes, nearly 20% were lost. It was found that colonies in boxes covered in snow sur-

vived better, probably because temperature fluctuations inside the hive were smaller. *P. Walker*

Pederson Bros. Apiaries, Cut Knife, Saskatchewan, Canada.

Peer, D. F. A warm method of wintering honeybee colonies outdoors in cold regions. *Canadian Beekeeping* (1978) 7 (3) 33, 36 [En, B]

The usual methods of overwintering were not successful in Saskatchewan, Canada, where minimum temperatures are very low, but a simple, economic method has been developed and tested at temperatures down to –40°F [–40°C]. In September the colony is fed, a bottom entrance reducer is put on, and a thick plywood inner cover is put in position; with a hole over the top entrance of the hive. In October, pre-cut fibreglass insulation is packed round a group of four hives, and the whole is covered with black building paper. There is a gap in the insulation over each top entrance hole, and this is finally covered with a piece of plywood in which there is a slot 4 x 0.75 in [10 x 1.9 cm], allowing moisture to escape from the hive. Another piece of plywood tied on top of the wrapped hives serves as a roof. Of colonies overwintered in this way, about 90% have survived, and the following year their honey production has been 50–125% higher than that of control package colonies. *P. Walker*

Pernal, S. F. Tylosin and management of rAFB. *Canadian Beekeeping* (2003) 23 (2) 13–14 [En, B]

At present, in Canada, tylosin is only available for use on honey bees resistant to oxytetracycline. One disadvantage of its use is that residues in honey are persistent, and at present the max. residue limit is zero. It is therefore recommended that colonies are treated in the autumn. Other methods for treatment of resistant colonies are discussed. *P. Walker*

775/03 Agriculture and Agri-Food Canada, Beaverlodge, Canada.

Pirker, H. J. Impact of ground level ozone and climate-change on forage legumes, ranching and honey production in western Canada. *Canadian Beekeeping* (2003) 23 (3) 6–10 [En, B] 776/04

In the late 1990s, honey yields in Alberta decreased, and this (and other results) were partly attributed to increasing levels of ground level ozone; this had adverse effects on legume plants, including reduction of nectar. In some areas, it has been shown that reduction of industrial emissions has resulted in decreased ozone levels, with consequent increases in honey yields. *P. Walker*

Peace County Agricultural Protection Assn, Box 363, Debolt, AB, T0H 1B0, Canada.

Pirker, H. J. Package bee production in northern Canada. *Canadian Beekeeping* (1978) 7 (2) 17, 20–21 [En, B]

Colonies are wintered in a bee house with controlled heating and ventilation.

Pirker, H. J. Brood rearing in the winter: factors and methods. *Canadian Beekeeping* (1980) 8 (5) 69–71 [En, B]

The dwindling of colonies in winter (*Apicultural Abstracts* 949/79) can be counteracted, and the population can be increased before the first spring flow. In Alberta, Canada, a

total of 84 colonies in 14 groups were kept in similar conditions in a wintering building until early January; groups were then kept under different conditions with different food supplies, and the resulting brood development was compared. The presence of solid drone brood was taken as a good indicator of colony build-up. Build-up was best in colonies kept at 4.4° C, 63% RH, and with sufficient pollen stores, preferably in partly filled combs throughout the cluster. Feeding with honey or syrup was necessary; the presence of stored honey in combs had no significant effect. Over four years, honey production from colonies built up early increased, and there were no serious health problems. *P. Walker*

Pirker Apiaries, Box 63, Debolt, Alta. T0H 1B0, Canada.

Punnett, E.N. and Winston, M.L. *A comparison of honey bee (*Apis mellifera* L.) colonies established from packages or nuclei in two areas of British Columbia, Canada.* *Journal of the Entomological Society of British Columbia* (1989) 86 1–6 [En, Bb]

A comparison of the biological performance and economic returns from honey bee colonies established in April from either 0.9-kg packages or 4-frame nuclei was made in both the Lower Fraser Valley and Peace River areas of British Columbia, Canada. In the Lower Fraser Valley, nuclei were superior to packages both biologically and economically, while in the Peace River area, no biological differences were found between the two, and packages provided higher economic returns. Either packages or nuclei would be viable in commercial beekeeping operations, depending on individual circumstances. *Author*
Department of Biological Sciences, Simon Fraser University, Burnaby, BC V5A 1S6, Canada.

Punnett, E.N. and Winston, M.L. *A comparison of package and nucleus production from honey bee (*Apis mellifera* L.) colonies.* *Apidologie* (1989) 20 (6) 465–472 [En, fr\ de, Bj]

In April, in the Lower Fraser Valley, BC, Canada, various combinations of packages and/or nuclei were removed from colonies to determine the biological and economic impact of package and/or nucleus production on these colonies. All colonies used for bee production yielded greater economic returns than the control colonies from which no packages or nuclei were removed. In addition, the colonies used for package and/or nucleus production did not differ significantly from the control colonies by the end of the season in nearly all of the biological characteristics monitored. The results indicate that both package and nucleus production is feasible in this area of BC, and would provide local beekeepers with additional income. *Author*

Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada.

Ramsay, J. *Plants for beekeeping in Canada and the northern USA.* (Reissue) (2001) 198 pp. [En, X]

This book, originally published by IBRA in 1987 (*Apicultural Abstracts* 559/88), has been reissued in Canada.

Ramsay, J. *Plants for beekeeping in Canada and the northern USA: a directory of nectar and pollen sources found in Canada and the northern USA.* London, UK; International

Bee Research Association. (1987) xii + 198 pp. ISBN 0-86098-191-6 [En, Bd]

This book has been written for beekeepers, agriculturalists, botanists and gardeners who wish to know about plants which are attractive to honeybees, where they will grow in Canada, when they bloom, and the characteristics of their honeys. The main part of the book (pp. 16–114) consists of descriptions of over 450 plants arranged into three sections: annuals and biennials; perennials; and trees and shrubs. The entries contain, wherever possible, the following information: scientific name; common name(s); horticultural designation; hardiness rating; blooming period; height range; whether nectar, pollen or honeydew collected; value for honey (yield, nectar sugar concentration, flow characteristics); value for pollen (quality, quantity, attractiveness); honey characteristics; notes, including range in Canada and the northern USA. Other chapters provide information on ways to improve attractiveness of plantings to bees, planning for continuous bloom, unpalatable honey sources, honeydew, poisonous plants, pesticides and honeybees, Canadian beekeeping, and useful lists (e.g. early pollen sources, flowering calendar, plants for roadsides). There is a list of 120 references, and there are indexes to common and scientific names. Five maps show plant hardiness zones in Canada. The book contains a wealth of useful information that can be found easily and quickly. It is published as a paperback, at an economical price, and is available only by mail order from the author. *D.G. Lowe*

99 Hurst Park Avenue, Cambridge, CB4 2AB, UK.

Rank, G.H. and Rank, F.P. *Chalkbrood resistance in a univoltine strain of the alfalfa leafcutting bee. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de].* Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 164–168 [En, Bd]

In southerly latitudes of North America the main limiting factors in the field management of this bee (*Megachile rotundata*) are the occurrence of a second generation and chalk brood (*Ascosphaera aggregata*) sensitivity. Undesirable features of the field-emergent second generation include a reduction of the female to male sex ratio, reduced population increase, and mechanical spread of *A. aggregata* spores. Over an 8-year period, in Saskatoon, Canada, the authors have bred a univoltine chalk brood resistant strain of the bee. Field tests at Ontario, Oregon (44°N) showed the percentage of univoltine prepupae infected with sporulating *A. aggregata* to be 1% compared to 12% for a commercial bivoltine strain. The univoltine bee's increased resistance was due to a hereditary tolerance to the pathogen and a reduction in spore dispersion by summer-emergent progeny. The magnitude of the resistance is sufficiently high to be useful in the commercial management of populations of *M. rotundata*. *Author*
Dept. Biology, Univ. Saskatchewan, Saskatoon, Sak. S7N 0W0, Canada.

Richards, K.W. *Effectiveness of the alfalfa leafcutter bee as a pollinator of legume forage crops. The Sixth International Symposium on Pollination, Tilburg,*

Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de]. Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 180–184 ISBN 90-6605-384-4 [En, Bd]

The potential use of managed *Megachile rotundata* populations to pollinate legume forage crops, other than lucerne, was investigated. Thirty plant species were evaluated using three treatments (caged with leafcutter bees, open-pollinated, and pollinators excluded). The perennial and biennial species had favourable seed sets and yields when exposed to bee pollination, but annual legumes did not benefit from bee pollination. The results indicate that when insufficient numbers of wild bees or honeybees are present, supplemental populations of *M. rotundata* could improve seed yields of certain crops. More information on bee population requirements and *M. rotundata* productivity is needed and methods for obtaining such data are discussed. *D.G. Lowe*

Agriculture Canada Res. Stn., Lethbridge, Alta. T1J 4B1, Canada.

Robertson, J.N. No fireweed honey. *Canadian Beekeeping* (1987) 13 (7) 161 [En, Bj]

Yields of fireweed (*Epilobium angustifolium*) honey have been decreasing in parts of Vancouver Island, British Columbia, Canada, and the growth of many plants appears to be stunted. This is probably caused by the larvae of two chrysomelid beetle species, *Bromius obscurus* and *Altica tombacina*, which eat the leaves. *P. Walker*

Ruijter, A. de. Commercial bumblebee rearing and its implications. Proceedings of the 7th International Symposium on Pollination, Lethbridge, Alberta, Canada, 23–28 June 1996 [edited by Richards, K. W.]. Leiden, Netherlands; International Society for Horticultural Science. (1997) 261–269 ISBN 90-6605-978-8 [En, Bd]

Various aspects of the use of bumble bees (*Bombus* spp.) for pollination of greenhouse crops are reviewed, with 71 references. Commercial rearing of bumble bees started less than 10 years ago in the Netherlands and in Belgium when it became apparent that bumble bee pollination could replace hand pollination of greenhouse tomatoes. Bumble bee pollination of greenhouse tomatoes now occurs throughout the world. It appears that catching queens in spring and the release of many colonies in greenhouses have not had a significant effect on the abundance of bumble bees in nature. In Europe, *Bombus terrestris* is the main species used for commercial pollination. Local species are used both in the USA and Canada. Importing animal species or subspecies that are new to an area is very risky if little is known about their taxonomy, diseases and parasites, as was the case with bumble bees. The year-round availability of bumble bee colonies has given an impetus to further research, and progress has been made on bumble bee parasites and diseases. Bumble bees have been added to the list of beneficial insects which should be tested for undesirable effects of pesticides and toxicity tests have been developed. *D.G. Lowe*

Research Centre for Insect Pollination and Beekeeping 'Ambrosiushoeve', Ambrosiusweg 1, 5081 NV Hilvarenbeek, Netherlands.

Ruzicka, B. MiteGone™: formic acid evaporator treatment for varroa and tracheal mites. *Canadian Beekeeping* (2001) 22 (4) 6–7 [En, Bj]

2910 Glenmore Rd N, Kelowna, BC, Canada, V1V 2B6.

Sarling, A.J. Northern exposure – 90 days or die. *Gleanings in Bee Culture* (1992) 120 (4) 208–211 [En, Bj]

At Fairview, Alberta, Canada, the major honey flow may last for less than six weeks. It starts about eight weeks after overwintered hives are unwrapped, so it is essential to build up colony populations rapidly. When 2-box hives were unwrapped in late April, a good colony had 6–8 frames of brood spread over both boxes, with adult bees occupying 1–1.5 boxes. Reversing the boxes stimulated the colony to join the two separated brood areas, and two or three weeks later the population expanded rapidly (10–14 frames of brood in the two boxes). At this stage, some colonies benefited from requeening, and suitable colonies were divided. Maximum colony populations could be obtained for the honey flow, and afterwards the colonies were prepared for overwintering. *P. Walker*

Sauriol, C.A. Beeman's journey. Toronto, Canada; Natural Heritage/Natural History Inc. (1984) vi + 96 pp. ISBN 0-920474-32-2 [En, B]

Anecdotal, biographical account of beekeeping in southern Ontario, with an appendix of bee forage plants.

Scott, C.D. and Winston, M.L. Honeybee colony characteristics and profitability of pollination management systems. *Journal of Apicultural Research* (1985) 24 (1) 43–48 [En, B]

Colony characteristics and profitability were examined for three systems of honeybee management in the North Okanagan Valley, British Columbia, Canada: (1) moving bees for pollination (current system); (2) honey production without pollination; and (3) package and nucleus production with and without pollination. A total of 60 colonies were used, divided equally into six management systems. Gross profit/colony was highest (\$109 or \$104) for colonies used for pollination and from which a nucleus or package was removed. The lowest profit (\$14.36) was for colonies managed solely for honey production [figures are in Canadian dollars]. Measurements of colony weight, area of sealed worker brood, and surplus honey production indicated that management systems which involve the most intensive colony management for pollination, honey production and bee production do not detract from overall colony vigour and yield the best income; they also can provide a new source of income through the sale of packages and/or nuclei. *Author*

Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC, Canada, V5A 1S6.

Scott-Dupree, C., Mohr, N. and Bath, J. Ontario beekeeping manual. Bayfield, Ontario, Canada; Ontario Beekeepers' Association in collaboration with Agriculture Canada, Ontario Ministry of Agriculture and Food and University of Guelph. (1991) x + 174 pp. [En, Bdo]

This manual contains much information on topics such as honey bee biology, getting started in beekeeping, management techniques, the honey house, harvesting and marketing honey, other hive products, pollination and bee forage,

pesticide poisoning, and pests and diseases. There is a chapter on the history of beekeeping in Ontario, and other information of special relevance to Ontario is given wherever possible. The manual has a useful glossary, but no index. D. G. Lowe

Shaparew, V. Report on clustering bees on front wall of the hive in summer. *Canadian Beekeeping* (1979) 8 (3) 42–46 [En, B]

Clustering is often observed in strong colonies during a nectar flow, if the air temperature is above 70°F [21°C] and RH above 80%. The bees cluster on the front wall and at the entrance, and those bees facing the hive are fanning, thus sucking air out of the hive. Tests showed that the bees cluster not because of high temperature in the hive but in order to improve the air supply to dry the honey in the cells. This they do by creating an air flow out through the bottom entrance (air inflow is through the top ventilator). Some beekeepers try to improve hive conditions by staggering the brood chambers, but this method has several disadvantages. The author has devised a honey drying ventilator. 3371 Trafalgar Rd., Oakville, Ont., Canada.

Shuel, R.W. Apicultural research at the University of Guelph. *Canadian Beekeeping* (1976) 6 (2) 12, 14–15 [En, B]

Shuel, R.W. New nectar sources and the improvement of nectar plants. *Canadian Beekeeping* (1983) 10 (7) 161–162 [En, B]
In Ontario, Canada.

Sigler, L., Abbott, S.P. and Gauvreau, H. Assessment of worker exposure to airborne molds in honeybee overwintering facilities. *American Industrial Hygiene Association Journal* (1996) 57 (5) 484–490 [En, 39 ref.]

Airborne fungi in honeybee overwintering and equipment cleaning facilities in Alberta, Canada, were enumerated and identified to determine worker exposure during cleaning and routine beekeeping operations. Testing was prompted by observations of extensive mould growth on dead bees and associated material and by results of a preliminary study at one beekeeping facility that showed very high numbers of mould colonies on air samples taken during worker activity. To evaluate whether high mould counts were indicative of a problem at a single site or were industry wide, approx. 120 air samples were collected with a Reuter centrifugal sampler inside 10 overwintering facilities before and during routine beekeeping activity during autumn, winter and spring periods. A set of 30 samples was collected from 15 sites used for annual equipment cleaning. This study showed that mean spore counts per overwintering site ranged from 238 to 1,442 colony forming units (CFU)/m³ prior to disturbance by workers and from 2,200 to 13,931 CFU/m³ while workers swept up dead bees. Levels of airborne moulds recovered during annual cleaning of beekeeping equipment ranged from 300 to 54,700 CFU/m³. Potentially toxigenic, pathogenic or allergenic moulds were recovered at all sites. Since the data indicated that exposure to high levels of airborne moulds is widespread throughout the industry, actions that might help minimise worker exposure are discussed.

University of Alberta, Microfungus Collection and

Herbarium, Devonian Botanic Garden, Edmonton, Alberta T6G 2E1, Canada.

Smith, I.B. (ed.). Proceedings of the 2000 Annual Conference of Apiary Inspectors of America, Gainesville, Florida, January 16–21, 2000. Annapolis, MD, USA; Apiary Inspectors of America ([2000]) 109 pp. [En, Bdo]

This publication includes 1999 apiary inspection statistics (pp. 94–97) and a paper on 'Pest risk assessment: importation of adult queens, package bees and germplasm of honey bees, *Apis mellifera* L., from New Zealand' by R.V. Flanders.

Smith, I.B. (ed.). Proceedings of the 1999 Annual Conference of Apiary Inspectors of America, Lawrence, Kansas, January 20–24, 1998. Annapolis, MD, USA; Apiary Inspectors of America (98) 85 pp. [En, Bdo]

This publication contains useful information, including the constitution of the AIA, 1997 apiary inspection statistics (pp. 66–60), maps showing the movement of Africanised honey bees in South California and Texas (pp. 70–71), directories of state and provincial apiarists (pp. 74–81) and USDA-ARS research directory (pp. 84–85). P. Walker

Smith, M. The history of beekeeping and bee research in Ontario. *Canadian Beekeeping* (1992) 17 (2) 30–31 [En, Bj]
An outline of the history of the apicultural department at Guelph University is included.

Smith, M.V. Ontario Agricultural College. Caring for bees in schools. Publication, Ontario Department of Agriculture and Food (1969) (No. 169) 8pp. [En, B]

Smith, M.V. Northern (*Diabrotica longicornis*) and western (*Diabrotica vergifera*) corn rootworm beetles as competitors of foraging honey bees, *Apis mellifera*. *Canadian Beekeeping* (1983) 10 (8) 173–174 [En, B]

In southern Ontario, Canada, the larvae of these beetles feed on sweet corn roots, and the adults forage on the pollen and flower parts of many wild plants, crops, and garden plants; their preferred host is golden rod (*Solidago*). When the population numbers 50–100 beetles per head, foraging honeybees may be obstructed. The beetles also mutilate the flowers, which may result in reduced nectar secretion. At nine localities in South Ontario, the relative abundance of the two beetle species was studied in 1982. Populations were lower than in previous years, probably due to a reduction in the area of corn grown, and late emergence of adult beetles after a cool summer. No interference with foraging honeybees was observed, and reasonable autumn honey crops were collected from golden rod. P. Walker

Dept. Environmental Biology, Univ. Guelph, Guelph, Ont., Canada.

Spitznagel, H., Gajuska, H., Hmara, P. et al. Overwintering of honeybee colonies in comb-free bee hives. *Newsletter, Canadian Honeybee Research Association of British Columbia* (1988) (August) 2–3 [En, Bj]

Further details of the combless hive [see previous abstract] are given. The wall material used was waxed hardboard, the lid was plywood and the bottom was of wire mesh. The lid

held four 'baskets' for pollen stores. In a small trial in British Columbia, Canada, five of these hives were built and all the colonies that wintered in them survived, whereas two of five control colonies (wintered outside in hives at high altitude) died. *D.G. Low*
Canadian Honeybee Res. Assoc., 22930 - 48th Ave., Langley, BC V3A 4R1, Canada.

Switzer, C.M. Conclusions and recommendations from a proposed amendment to the health of animals regulations to allow the importation of honey bees from the continental United States. *Canadian Beekeeping* (1993) 17 (9) 200–201 [En, Bj]

Imports of honey bees from USA to Canada have been prohibited since November 1987, to reduce the risk of introducing *Varroa jacobsoni*. The Canadian government has now accepted a report by Dr C.M. Switzer who recommends that the prohibition should be extended until the end of 1995, but the importation of queen honey bees from USA in 1995, under strictly controlled conditions, should be considered. He also recommends that the beekeeping industry, under the leadership of the Canadian Honey Council, should develop a strategy to ensure its viability and competitiveness in the future. Eight immediate actions are suggested. The report's conclusions and recommendations are published here. *P. Walker*

Szabo, T.I. and Szabo, D.C. The principles of successfully overwintering honey bees: an examination of colony weight losses during ten winters in southern Ontario. *American Bee Journal* (2003) 143 (11) 876–880 [En, Bj]

Hive weights were monitored for 26 weeks (early November to end April) every winter from 1992 to 2002. Mean weight loss was 16.65 kg, range 10.2–23.5 kg. Overall, 97.5% of colonies were successfully overwintered. *Author*

RR1, Puslinch, Ontario, Canada N0B 2J0.

Szabo, T.I. Outdoor wintering of honey bee colonies in the Nipawin area of Saskatchewan. *Canadian Beekeeping* (1974) 4 (12) 89–91 [En, B]

In autumn 1973, 4600 colonies, divided into four groups according to strain of bees and type of wintering pack, were prepared for wintering in the Nipawin area, and results were evaluated in the following April. Losses were highest (42% of colonies dead or queenless) in individually insulated hives; best results were obtained by packing two hives together on one platform, and covering both with a wintering case (5.5% of colonies lost). Other recommendations for successful wintering are: a good queen in two brood chambers with an autumn population of about 4.5 kg bees; provision of about 50 kg honey in dark combs in three hive bodies, or about 30 kg in two hive bodies, plus spring feeding; five combs of pollen reserve or equivalent pollen supplement in March and April; provision of top and reduced bottom entrances. *P. Walker*
Agriculture Canada Res. Stn., Beaverlodge, Alta., Canada.

Szabo, T.I. Comb building after the honeyflow. *American Bee Journal* (1975) 115 (8) 306–307, 322 [En, B]

In an area in western Canada, where bees are usually killed instead of overwintered, colonies were transferred at the

end of the honey-producing season to hives containing frames of wax foundation, and were fed 60% sugar syrup. Between 12 August–18 September, 15 colonies were fed for periods of 12–20 days. After five days, combs built near the centre of the hive were moved toward the side walls, and foundation was moved to the centre; syrup stored in the new combs was extracted. Fifteen colonies built 313 combs, in spite of cool autumn weather with rain and frost in September. It is calculated that the colonies used about 320 g sugar per comb built. *J.D. Hitchcock*
Agriculture Canada Res. Stn., Beaverlodge, Alta, TOH 0C0, Canada.

Szabo, T.I. Apicultural research at Beaverlodge [Alberta, Canada]. *American Bee Journal* (1980) 120 (3) 186–191, 200–201 [En, B]

Szabo, T.I. Effects of various entrances and hive direction on outdoor wintering of honey bee colonies. *American Bee Journal* (1983) 123 (1) 47–49 [En, B]

During the winters of 1979–80 and 1980–81, 128 honeybee colonies were kept in Langstroth hives in one of four ways: (1) with bottom and top entrances; (2) with a fully open bottom entrance; (3) with bottom and upper-side entrances; (4) with a bottom entrance and a 2.5-cm auger hole in the middle of the second chamber. Except in (2), all entrances were 1 x 5 cm. Hives were packed in groups of four in fibreglass and building paper. Colonies in treatments (1) and (4) consumed less food than colonies in (3). Although the spring counts of *Nosema* spores were similar in all treatments there was an interaction of years and treatments. Mean spring adult populations for (1) and (4) were identical (8.5 combs covered) and significantly greater than those of colonies in treatments (2) and (3) (7.0 and 5.0 combs, respectively). The capped worker brood area was also larger in (1) and (4) than in (3). The mean populations in SE- and SW-facing colonies covered 8.1 and 8.3 combs, significantly more than those in NW- and NE-facing colonies which covered 6.0 and 6.5 combs respectively. The colonies had less honey stores for the first winter than for the second. Although the second winter was shorter and milder, the adult populations, and areas of capped worker and drone brood, were larger during the 1980 spring than during the 1981 spring. *Author*
Agriculture Canada Res. Stn., Beaverlodge, Alta. TOH 0C0, Canada.

Szabo, T.I. The thermology of wintering honeybee colonies in 4-colony packs as affected by various hive entrances. *Journal of Apicultural Research* (1985) 24 (1) 27–37 [En, B]

Daily winter hive temperatures were recorded in multiple-packs of hives equipped with different types of entrance. Sixteen hives, each of two Langstroth boxes, were divided into four groups; these were then packed with insulation and tar-paper for wintering. In each group, two hives faced north and two south and the same treatment was used within each group. Treatments were: (1) bottom and top entrances (1 x 5 cm each); (2) fully open bottom entrance; (3) bottom and upper-side entrances (1 x 5 cm each); (4) bottom entrance (1 x 5 cm) and a 2.5-cm diameter auger-hole in the middle of the second chamber. During the

1979–80 and 1980–81 winters the temperature was recorded daily at 08.00 hours using thermistors at 54 points in the SW hive in each of the groups. The ambient temperature fell as low as -38.8°C but the lowest hive temperature did not go below a range from -1° to -14° . All colonies in treatments (1) and (4) maintained a temperature of 30° or higher in the winter cluster throughout both winters. All colonies occupied the upper hive body; colonies in treatment (1) occupied the area close to the top entrance and in treatment (4) the area close to the auger-hole. The temperature of the cluster in colonies in treatments (2) and (3) fell to 28° or 29° on two days in December 1980. Colonies with the side top entrance – treatment (3) – appeared to be unable to move consistently to that entrance. Colonies in treatment (2) appeared to move slowly to the upper hive body; whilst ambient temperatures remained relatively high they developed rapidly, but with a consequent drop in temperature they lost more cluster size than other colonies. The large quantity of stored food and absence or scarcity of empty cells appeared not to hinder cluster movement.

Author
Agriculture Canada Res. Stn., Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Outdoor wintering of honeybees in multiple-nucleus and four-colony packs of honeybees. *Journal of Apicultural Research* (1987) 26 (4) 238–239 [En, Bb]

Two methods of outdoor wintering of honeybee colonies were compared at Beaverlodge, Canada. In the 'multiple-nucleus' method, single brood chambers were stacked three or four high on a base of four bottom boards, thus providing packs of 12–16 nuclei. Inner covers separated the chambers and provided a 1 x 5-cm bottom entrance for each nucleus. Fibreglass insulation and waterproof material were wrapped around and placed over the entire pack. In the 4-colony packs, double brood chambers were used. For the winters of 1981 and 1982 combined, 78 colonies survived in the multiple-nucleus packs and nine died, whereas 64 survived and none died in the 4-colony packs. With the multiple-nucleus packs, the spring Nosema spore count was 2–10 times as high and the population decline greater. It is concluded that overwintering colonies in multiple-nucleus packs is inferior to the 4-colony method commonly used in northwestern Alberta.

Author
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Queen rearing in Chile. *American Bee Journal* (1987) 127 (8) 568–571 [En, Bj]

The author describes his visit to two parts of Chile – around Santiago and some areas in the north of the country – which are becoming increasingly important for queen rearing. Climatic conditions are good and colonies are generally healthy. The author also visited Easter Island which he reports is apparently ideal for queen rearing.

P. Walker
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Queen rearing in northern California. *American Bee Journal* (1987) 127 (6) 444–448 [En, Bj]

The methods used by 19 queen rearers (estimated production 510,000 queens/yr) were studied, and the most commonly used methods are described here. The nucleus hives used by the majority of the beekeepers are described, with dimensioned drawings.

P. Walker
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Thermology of wintering honey-bee colonies in 4-colony packs. 1. The direct effects of hive insulation on colony temperatures. *American Bee Journal* (1989) 129 (5) 338–339 [En, Bj]

The effect of insulation on hive and cluster temperatures in a group of four honeybee colonies was recorded daily. Before the hives were packed together and covered with fibreglass insulation (in early October), three of the colonies had areas where the temperature was 30°C or higher, but in the other colony no area reached 30° . Following insulation large clusters with temperatures above 30° developed in all four colonies. Temperatures in these hives remained high during the next 24-hour observation period.

Author
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Thermology of wintering honey-bee colonies in 4-colony packs. 2. Effects of the removal of insulation on colony temperatures. *American Bee Journal* (1989) 129 (6) 405–406 [En, Bj]

Temperatures within the SW hive of each of four 4-colony wintering packs were recorded before and after removal of the fibreglass insulation at 6-hour intervals from 17 to 19 May, 1983. Before removal of the insulation (18 May), the temperatures throughout the honeybee clusters were almost constant. Within 3–24 hours after removal of the insulation temperatures decreased on the outer sides of all colony clusters.

Author
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Thermology of wintering honey-bee colonies in 4-colony packs. 3. Cluster positions. *American Bee Journal* (1989) 129 (7) 472–473 [En, Bj]

During the 1983–1984 winter, each pack had two hives (each with two boxes) facing north and two facing south. In each pair facing the same direction, both clusters moved nearer to each other, and at the adjacent hive wall a temperature of -10°C was recorded when the ambient temperature was -30.3° . The bottom entrance was the coldest part of the hive (-17°); temperatures at the centre of the inner cover ranged from 9° – 36° . The hive temperatures showed that the air flow is from the bottom entrance to the top entrance. Usually all hive temperatures were above the ambient. Highest cluster temperatures did not necessarily occur at the centre of the cluster. In spring 1987, the cluster positions of 166 colonies wintered in 4-colony packs were investigated. In April and May all clusters were located in the upper brood chamber and the cluster positions were: 102 at the inner walls of adjacent colonies facing to the same direction; 43 at the hive centres; 21 at the outer walls.

P. Walker
Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. Thermology of wintering honey-bee colonies in 4-colony packs. 4. Colony population and honey production. *American Bee Journal* (1989) 129 (8) 554–555 [En, B]

Temperatures within each SW hive of four 4-colony wintering packs were recorded daily at 08.00 hours from 22 November 1982 to 22 April 1983. The size of three honeybee clusters, as indicated by their temperatures, varied greatly during the winter, while the fourth cluster remained nearly unchanged. The temperature in the three colonies was usually 30°C or higher throughout the winter, but in the fourth colony it was less than 30° until 22 March. During the winter all clusters moved into the second brood box. By the end of April all colonies were developing very rapidly. Colony cluster size appeared not to influence honey production. *Author*

Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. and Davis, D.T. Number of spermatozoa in the spermathecae of queens from 0–3 years old reared in Beaverlodge, Alberta, Canada. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.J.] Australia: International Colour Productions Pty. Ltd. for the Federal Council of Australian Apirists' Associations. (1988) 110–111 ISBN 0-86774-011-6 [En, Bdo]

Queen honeybees aged 0 (1–2 weeks old), one, two or three years were dissected and the numbers of spermatozoa in the spermatheca were determined. The weight of the queens at emergence ranged from 171 to 272 mg (mean 213 $\pm$ 2.02 mg). The mean numbers of spermatozoa in the spermatheca were 9.77 $\pm$ 0.79, 7.63 $\pm$ 0.85, 5.57 $\pm$ 0.64 and 2.08 $\pm$ 0.62 million for queens aged 0, 1, 2 and 3 years, respectively. The results are discussed in relation to requeening and the frequency with which this is carried out. *D. G. Lowe*

Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta., Canada.

Szabo, T.I. and Heikel, D. T. Effect of dry fumagillin feeding on spring Nosema spore counts in overwintered colonies. *American Bee Journal* (1987) 127 (3) 210–211 [En, B]

Overwintering colonies in Alberta, Canada, were fed 200 mg fumagillin in sugar syrup in the autumn of 1985. In the following spring, the average *Nosema apis* spore count was 15.53 $\times$ 10⁶/bee. Sixty colonies were fed 42 mg of dry fumagillin in a 1:5 mixture of Fumidil B:icing sugar in two treatments over a 10-day period, while 68 colonies received no medication. Mean *Nosema* counts of the medicated colonies one week and three weeks after treatment were 4.05 $\pm$ 0.51 and 4.82 $\pm$ 0.59 $\times$ 10⁶ spores/bee, respectively, while colonies that were not treated had 18.47 $\pm$ 0.82 and 18.09 $\pm$ 1.00 $\times$ 10⁶ spores/bee. This method of medication is a simple and effective means of reducing *Nosema* levels in spring. *Author*

Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. and Heikel, D. T. Effect of fumagillin treatment on Nosema infection, survival and populations of over-

wintering honeybee colonies. *Journal of Apicultural Research* (1987) 26 (3) 186–190 [En, Bb]

Winter survival of 194 honeybee colonies was not affected adversely by nosema disease. Numbers of *Nosema* spores per bee after medication in the autumn and in the spring decreased logarithmically with an increase in the amount of fumagillin fed in the range 200–800 mg per colony. Average numbers of spores in millions per bee for surviving colonies in the spring were 10.15, 4.93, 2.76 and 3.20; and for the dead colonies 16.02, 6.48, 7.32 and 0, with autumn feedings of 200, 400, 600 and 800 mg fumagillin per colony, respectively. It is recommended that overwintering colonies in northern areas of Canada where the levels of *Nosema* infection may be high be medicated in autumn to minimise adverse effects. *Author*

Agriculture Canada Res. Stn., Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. and Lefkovitch, L.P. Effects of honey removal and supering on honey bee colony gain. [Abstract]. *American Bee Journal* (1990) 130 (12) 815–816 [En, B]

Daily weight changes were recorded in two groups of four honeybee (*Apis mellifera*) colonies; honey combs were removed alternately from each group (and replaced by empty combs). During the four days after honey comb removal, mean weight gain was 2.41 kg/colony, compared with 3.37 kg/colony in the 'un-harvested' group. The difference was statistically significant. It is calculated that in an apiary of 1000 colonies, the total loss in weight gain after each harvesting operation could be over 3800 kg. It is suggested that the number of harvesting operations could be reduced from four or six to two or three. Sufficient empty combs would have to be added each time. It is concluded that removal of honey combs causes stress to the colony, and the empty combs that are put in require extra work by the bees in cleaning and repairing the cells. *P. Walker*

Agriculture Canada, Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Szabo, T.I. and Nelson, D.L. Beekeeping in Western Canada. Publication, Agriculture Canada (1981) (No. 1542) 28 pp. ISBN 0-662-11501-5 [En, B]

Szabo, T.I. and Sporns, P. A comparison of top and bottom supering on honey quantity and quality. *American Bee Journal* (1994) 134 (10) 695–696 [En, B]

During a major honey flow in Alberta, Canada, 36 honey bee (*Apis mellifera*) colonies each had nine honey supers added in different ways: top-supering (supers added above any previously on the hive) with honey removed, one, two or three times; and bottom-supering (empty honey supers added below those previously on the hive, nearest the brood nest) with honey removed twice. There was no significant difference in any of the parameters measured: honey production (76.8–102.4 kg), honey water content (16.1–17.4%) or diastase level (24.1–27.2). This experiment suggests that the less labour-intensive method of top-supering can be used without affecting beekeepers' incomes. *A. G. Matheson*

Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G,2W1, Canada.

Szabo, T.I., Sporns, P. and Lefkovitch, L.P. Effects of frequency of honey removal and empty comb space on honey quantity and quality. [Abstract]. *American Bee Journal* (1992) 132 (12) 815–816 [En, B]

Honey was removed from honey bee (*Apis mellifera*) colonies one, two or four times during a 44-day test period. Colonies from which honey was removed twice produced more (mean total weight 142.1 kg) than colonies with one (106 kg) or 4 (116.2 kg) removals. Colonies with 1-year-old queens produced 140.8 kg, which was significantly more than the production of colonies with 2-year-old queens (102.1 kg). The weight of honey produced was not significantly affected by the amount of empty comb space or the number of supers with empty combs (5, 10, 11–15). The water content of honey was highest (19.0%) in colonies with five supers and four honey removals, and lowest (16.7%) in those with 12 supers and two removals. Amylase (diastase) numbers were all high, with slight but significant differences between treatments. It is concluded that in areas similar to the Peace River region of Canada, colonies should be given 6–7 supers with empty combs at the start of the main nectar flow. Honey should be removed at mid-flow and six empty supers provided until the end of the flow. *P. Walker*

Department of Environ. Biology, University of Guelph, Guelph, Ont. N1G 2W1, Canada.

Szabo, T.I., Sporns, P. and Lefkovitch, L.P. Effects of frequency of honey removal and empty comb space on honey quantity and quality. *Bee Science* (1992) 2 (4) 187–192 [En, B]

A study of the effects of the frequency of honey removal (four, two and one times), the application of various numbers of empty supers (5, 10 and 11–15) and queen age (1- and 2-year-old) on the quantity and quality of honey was conducted on 36 honey bee (*Apis mellifera*) colonies. Colonies with two honey removals, one at mid-flow and the second at the end of nectar flow, produced significantly more honey (142.1 kg) than colonies with one (106.0 kg) and 4 (116.2 kg) removals. Colonies with 1-year-old queens produced more (140.8 kg) honey than those with 2-year-old queens (102.1 kg). The amount of comb space or number of empty supers did not influence the quantity of honey produced. The water content of honey was highest in colonies with applications of five supers and four honey removals (19.0%) and the lowest with two honey removals and 12 supers (16.7%). The diastase [amylase] numbers were consistently high; the highest value was for honey removed once (28.6), at the end of the nectar flow only; significantly less with honey removed twice (26.5) at mid-flow and end of flow; and again significantly less with honey removed 4 times (23.2). *Author*

Agriculture Canada Research Station, Beaverlodge, Alberta T0H 0C0, Canada.

Tegart, D. Two-queen hive management using package bees in the Peace River area, Alberta, Canada. *Bee World* (1984) 65 (2) 80–84 [En, B]

Termeer, B. and Liu, T.P.S. Using a solar menthol applicator. *Minnesota Beekeeper* (1991) 45 (2) 9, 12–13, 18 [En, B]

A variety of designs of solar applicators were tested on

empty hives. The simplest and most efficient design was a box applicator with a clear reinforced plastic top that fits on a feeder board on top of the hive. This solar applicator was tested during the beekeeping season in 1990 in the Peace region of Alberta, Canada. The rate of menthol vaporisation from an impregnated sponge, measured by weight loss, was 56% higher in the solar applicator than in the standard in-hive treatment. The level of tracheal mite (*Acarapis woodi*) infestation was reduced slightly. Honey production was 42% higher in the solar treatment groups than in the in-hive treatment group; and 82% higher than in the control group. The significance of the use of a solar menthol applicator for tracheal mite control is discussed. *Author* Honeybear Apiaries Ltd., Rollyview, Alta. T0C 2K0, Canada.

Townsend, G.F. Introductory apiculture. Guelph, Canada; University of Guelph in co-operation with the Ontario Ministry of Agriculture and Food. (1981) iii + 105 pp. + 23 filmstrips + 2 cassettes [En, B]

This home study course covers the following topics: the honeybee colony, species and races of honey-producing bees, beekeeping equipment, management of colonies, removing honey and extracting it, honeybee diseases, predators and poisoning. It refers particularly to Canadian conditions, but is sufficiently detailed to be of value to students in other countries. The text is illustrated with black-and-white photographs and with 23 13-frame colour filmstrips (supplied with a hand viewer). There are also two tape cassettes with a commentary on, and giving additional information to, the filmstrips. The whole course may be purchased for reference, or, in Canada, the course can be studied as part of the Ontario Diploma in Horticulture and the Ontario Diploma in Agriculture. In this case, the course includes a separate workbook containing self-marking question assignments and instructions for three papers and a final examination to be submitted to the Independent Study Division of the University of Guelph for marking. *P. Walker*

Dept. Environmental Biol., Univ. Guelph, Guelph, Ont., Canada.

Townsend, G.F. Tropical apiculture. Guelph, Canada; University of Guelph. (1984) iii + 34 pp. + 2 fiches + 1 cassette [En, B]

This audiovisual study course is based on the author's experiences in directing beekeeping development programmes in Kenya and Sri Lanka and on his consulting experiences in the Americas and elsewhere. It covers the following topics: African bee behaviour, management and pests; Africanised bees in South and Central America; behaviour, management and pests of *Apis cerana*; processing and marketing hive products; beekeeping equipment for the tropics; protective equipment; tropical honey-producing trees and plants. The text is accompanied by two microfiches containing 120 colour photographs, which can be examined using the hand viewer supplied or a reader with a 24 times magnification. The cassette gives a commentary to, and additional information on, the photographs (sets of individual slides are also available). *D.G. Lowe* Dept. Environmental Biol., Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Townsend, G.F. *Advanced apiculture*. Guelph, Canada; University of Guelph. (1985) vii + 92 pp. + 3 fiches + 2 cassettes [En, Bdo]

This audiovisual home study course covers the following topics: the history of beekeeping development; honeybee anatomy; honeybee physiology and behaviour; queen rearing and breeding; pollination, both in temperate and tropical climates; physical and chemical properties of honey and beeswax; hive products other than honey; packing and processing of honey and beeswax; preparing honey and beeswax for competition. The text is illustrated with black-and-white figures and photographs, and is accompanied by three fiches containing 170 colour photographs (supplied with a hand viewer). The two tape cassettes give a commentary to, and additional information on, the photographs. The subjects covered are dealt with only on a superficial basis, or not at all, in the Introductory apiculture course. The course on Tropical apiculture, comprising text, two fiches and one cassette, is included in the advanced course as an appendix. In Canada the course may be studied as part of the Ontario Diploma in Horticulture and the Ontario Diploma in Agriculture. A workbook containing review questions and mail-in assignments is supplied; the assignments have to be submitted to the Independent Study Division of the University of Guelph for marking. *D.G. Lowe*

Dept. Environmental Biol., Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Townsend, G.F. and Burke, P.W. *Beekeeping in Ontario*. Publication, Ministry of Agriculture and Food, Ontario, Canada (1976) (No. 490) 38 pp. [En, B]

Turcotte, L.-M. *In searching ... [En furetant ...]*. Abeille (1982) 3 (1) 22–23 [Fr, B]
History of beekeeping in Quebec.

Vandenberg, F. and Miller, A. *Recommendation for regulatory measures to protect honeybees in Ontario*. Canadian Beekeeping (1983) 10 (9) 201–202 [En, B]

Vickery, V.R. *The honey bee: a guide for beekeepers*. Quebec, Canada; Particle Press. (1991) xx + 249 pp. ISBN 0-9694759-0-X [En, Bdo]

The author's many years' experience of practical beekeeping, research and teaching is reflected in the content of this book. It is written in an easy, conversational style and illustrated with many photographs from the author's collection. There is comprehensive coverage of all the 'usual' aspects of beekeeping e.g. anatomy and physiology of the honeybee, the colony, starting beekeeping, apiary sites, management, swarm prevention, honey production, enemies and diseases, hive products and pollination. In addition, more specialised topics such as the 'African bee problem' and economics of beekeeping in Canada are also covered. There is a short glossary and a subject index. The book provides a practical guide for beekeepers in Canada and the northern USA, and would be of interest to beekeepers in other temperate, northern hemisphere countries. It could also form a suitable text for an introductory apiculture course. *D.G. Lowe*

102 Souvenir Drive, Pincourt, Quebec, Canada

Villeneuve, J.-L. *Recent observations on overwintering hives in cellars. [Observations recentes sur l'hivernage des ruches en caveau.]*. Abeille (1982) 3 (2) 9–10 [Fr, B]

Groups of test colonies were overwintered from 15 September to 30 April in cellars in which air was recirculated at a steady rate. RH was maintained at 55% and the temperature was kept at 1, 3, 5 or 7° C. Food consumption and bee mortality were lowest in colonies kept at 3°; at 1° food consumption was similar but more bees died. Average food consumption was highest at 5°, and mortality was highest at 7°. In an experiment to find the best date to put colonies in cellars, winter food consumption was lowest and the April bee population was highest in the group put in on 20 November. Other groups (put in on 19 October and 4 October) did not do as well. *P. Walker*

Div. Apiculture, Min. Agric., Fisheries and Food, Que., Canada.

Villeneuve, J.-L. *Recent observations on wintering hives in cellars [in Quebec]. [Observations recentes sur l'hivernage des ruches en caveau.]*. Abeille (1983) 4 (2) 9 [Fr, B].

Winston, M.L. *Trends in Canadian beekeeping. American Bee Journal* (1983) 123 (12) 837–840 [En, B]

Overwintering of bees in Canada is now commercially viable; environmental control in indoor wintering facilities has been greatly improved, and methods for outdoor wintering have also been introduced. These developments result partly from concern that imports of package bees from the USA may decrease if Africanised bees and/or Acarapis or Varroa mites spread to States producing package bees. In 1982 almost half the colonies in Canada were overwintered compared with 31% in 1973; imports of package bees have increased only slightly in that period. Other developments are based on research on the selection of queens suitable for Canadian conditions, and on queen rearing for either spring package production or summer requeening. *P. Walker*

Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada.

Winston, M.L. *The impact of a tropical-evolved honey bee in temperate climates of North America. Africanized honey bees and bee mites [edited by Needham, G.R.; Page, R.E., Jr.; Delfinado-Baker, M.; Bowman, C.E.]*. Chichester, UK; Ellis Horwood. (1988) 135–140 ISBN 0-7458-0319-9 [En, Bd]

The implications for North American beekeeping of the arrival of Africanised honeybees are examined, and management techniques for dealing with these bees are suggested. *D.G. Lowe*

Dept. Biological Science, Simon Fraser Univ., Burnaby, BC, Canada V5A 1S6.

Winston, M.L. *The biology and management of Africanized honey bees*. Annual Review of Entomology (1992) 37 173–193 [En, Ba]

This review, with 94 references, describes the differences between temperate and tropical honey bees, including their nest architecture, worker characteristics, colony reproduction and population growth rates, absconding behaviour, defensive behaviour and foraging. The process

of Africanisation of a honey bee population and the impact that this has had in the tropical Americas is described. The possible effects of the spread of Africanised bees in North America is also discussed and actions that could be taken to minimise these effects are outlined. *D. G. Lowe*

Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada.

Winston, M. L. *Killer bees: the Africanized honey bee in the Americas*. Cambridge, USA; Harvard University Press. (1992) xiii + 162 pp. ISBN 0-674-50352-X [En, Bd]

This is a highly readable introduction to the subject of Africanised honey bees which will be particularly useful to non-specialist readers who perhaps have previously read only popularised articles using the more emotive term 'killer bees'. The author attempts to put the facts about Africanised bees into perspective by explaining their biology, their impact in the Americas, and their likely effects on beekeeping in the USA as they spread northwards. *D. G. Lowe*

Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada.

Winston, M. L. *The Africanized 'killer' bee: biology and public health*. *Quarterly Journal of Medicine* (1994) 87 (5) 263–267 [En, Bc]

This brief review, with 33 references, summarises the history of Africanised bees, their main characteristics, and their impact on beekeeping and the general public. Suitable management procedures are described. *P. Walker*
Department of Biological Sciences, Simon Fraser University, Burnaby, BC, Canada.

Winston, M. L. and Mitchell, S. R. *Timing of package honey bee (Hymenoptera: Apidae) production and use of two-queen management in southwestern British Columbia, Canada*. *Journal of Economic Entomology* (1986) 79 (4) 952–956 [En, Bc]

Three 0.9-kg packages were shaken from colonies during April; only one of the colonies from which all three packages were shaken on one day (7 April) survived. For all other timings (two packages shaken on one date and one package a week earlier or later), subsequent colony performance was unaffected. Profit per package-producing colony was more than double that of controls from which no packages were shaken. In a second study, colonies managed with two queens following package-shaking were superior to single-queen colonies in brood area (measured during the summer) and adult populations at the end of the season. However, extra costs and labour, and the decreased profit, did not justify the use of the 2-queen method. *P. Walker*

Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada.

Winston, M. L. and Slessor, K. N. *Applications of queen honey bee mandibular pheromone for beekeeping and crop pollination*. *Bee World* (1993) 74 (3) 111–128 [En, Bj]
Recent discoveries concerning the mandibular gland pheromone (QMP) of queen honey bees (*Apis mellifera*) are reviewed, with 74 references. QMP has been identified as a

blend of five components: (E)-9-keto-2-decenoic acid (9-ODA), (R,E)-(-)-9-hydroxy-2-decenoic acid (-9-HDA), (S,E)-(+)-9-hydroxy-2-decenoic acid (+9-HDA), methyl p-hydroxybenzoate (HOB) and 4-hydroxy-3-methoxyphenyl-ethanol (HVA). Other substances may also be present in QMP. Artificial QMP can be synthesised and used for a number of applications in beekeeping and crop pollination. It can be used as a queen substitute during transportation of queenless packages of bees, it can be used as a 'pseudoqueen' to maintain colony populations in mating nuclei, and it can be used in a limited way in swarm traps (although Nasonov pheromone is used as the main long-distance attractant). Small queenless colonies with QMP can also be set up as disposable pollination units in remote areas. Other possible applications being investigated include the use of QMP to delay swarming, and in sprays to attract honey bees to flowering crops; investigations on pear, apple, cherry, cranberry and blueberry are described. *D. G. Lowe*

Department of Biological Sciences, Simon Fraser University, Burnaby, BC V5A 1S6, Canada.

Wrubleski, E. M. and Bland, S. E. *Honey bee overwintering – management and facilities*. Saskatchewan, Canada; Department of Agriculture. (1976) 17 pp. [En, B]

Maintaining colonies through the winter is a fairly new technique in northern Saskatchewan. Controlled environment buildings are used, and those seen during a tour of the area are discussed here, and a cost analysis is presented. The bulk of the report, Appendix A, gives the bees' requirements with regard to temperature, fresh air, light, relative humidity and noise levels. Recommended building construction and controls are described, with plans. *P. Walker*

Plant Indus. Div., Alberta Dept. Agric., Edmonton, Alta. T6H 4P2, Canada.

Wyborn, M. H. *Guidelines for package bee production in B.C. [British Columbia]*. *Bee Notes*, Ministry of Agriculture and Food, British Columbia (1983) (No. 1302) 10 pp. + 3 pp. [En, B]

With a 3-page supplement giving addresses of suppliers for queen and package bee production materials (1985).

Wyborn, M. H. *Mass storage and overwintering of honey bee queens*. *Canadian Beekeeping* (1990) 15 (9) 206–207 [En, Bj]

Two short handouts, distributed at an Ontario Beekeepers' Association meeting, are reproduced. The first summarises trial results of two mass storage systems. The Harp system, even with modifications, was unsatisfactory. In the standard system, workers have contact with the individually caged queens only through the mesh of the cage. Queen survival was about 60%, and queen performance in the following season was normal. These and other results showed that mass storage of queens in winter is commercially feasible. The second handout describes the preparation of colonies as overwintering queen banks in British Columbia. The procedures for queen introduction and subsequent colony maintenance are listed. *P. Walker*
Dept. Biological Sci., Simon Fraser Univ., Burnaby, BC V5A 1S6, Canada.

Wyborn, M.H. *Mass storage of honey bee queens during the winter*. MSc Thesis, Simon Fraser University, Burnaby, Canada. (1991) xii + 121 pp. [En, Bdo]

Approximately 500 *Apis mellifera* queens were introduced into various storage systems for three years of winter tests in British Columbia, Canada. Individually wintered queens in nucleus colonies were the control and these were compared to colony 'banks' with queens held in: (1) screened wooden cages; (2) excluder cages; (3) screened cages and transferred to mini-nuclei until late March; (4) excluder cages constructed in the form of a cube and held in colony banks; and (5) excluder cages held over indoor colonies. Queens held in excluder cages (2) and stored in queen-right or queenless colony banks showed poor survival in all three years of testing, and this method is not viable for commercial use; survival for any one year, or any treatment, was never greater than 25%. There was extremely high initial mortality of greater than 80% in the indoor (5) and redesigned systems (4). In contrast, an average of 60% of queens that were stored in screened wooden cages (1) and held inside queenless colony banks survived. There were no differences in survival of queens that were moved between colonies and those that remained in the same colony for six months. The success of these systems was due to the preparation of colony banks that contained large numbers of adult workers produced from 2-queen colonies that were well-fed, and insulated in groups of four to preserve heat and reduce worker clustering in the winter. Queens from different winter storage systems were introduced to colonies, and those that survived the winter were virtually identical in quality and performance. Mass queen storage is considered to be economically viable for Canadian beekeepers. It is calculated that the annual profit for a commercial beekeeper who uses his own labour

for storage and hires workers for queen production is \$16,625 when 4800 queens are successfully stored over the winter, and sold for \$10 each in the spring. *Author*
Department of Biological Sciences, Simon Fraser University, Burnaby, BC V5A 1S6, Canada.

Wyborn, M.H., Winston, M.L. and Laflamme, P.H. *Mass storage of honey bee (Hymenoptera: Apidae) queens during the winter*. *Canadian Entomologist* (1993) 125 (1) 113–128 [En, fr, Ba]

The methods and results of this study were described by M.H. Wyborn (1991) [MSc Thesis, Simon Fraser University, Burnaby, Canada].

Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia V5A 1S6, Canada.

Wyborn, M.H., Winston, M.L., Laflamme, P.H. *Storing mated queens during the winter in managed honey bee s*

Four systems of overwintering queens were compared in trials in western Canada. Queens held in excluder cages in a colony queen bank had a low survival rate. Queens held in a mini-nucleus system survived as well as those in a 5-frame nucleus hive (controls), but specialised equipment was needed, so it was not economically viable. Queens in wooden cages with wire screen, held in a queenless colony bank, survived best; on average, 60% of these queens survived (range 30–83%). At this rate, the method was economically viable. Queens that had been stored in a queen bank were as productive as those overwintered singly in a colony. Details of the method are given. It has also been used in Ontario, where queen survival was 50%. *P. Walker*
Westgro Sales, Inc., 7333 Progress Way, Delta, BC V4G 1E7, Canada.

Cyprus

Melissokomiki Epitheorisi. *Beekeeping in Cyprus. [E melissokomia ste Kupro]*. *Melissokomiki Epitheorisi* (1992) 6 (9) 287–289 [Gr, Bj]

Adam, Brother. *Breeding honeybees. [Zuchtung der Honigbiene]*. St. Augustin, Germany; Delta-Verlag. (1982) 144 pp. ISBN 3-922898-02-5 [De, B]

The author's long experience in bee breeding is recorded in the last two parts of this book; Part I deals with theoretical aspects. Part II covers practical possibilities for breeding honeybees. Aims of breeding are discussed one by one – the behavioural and morphological desiderata, including resistance against various diseases. Different systems of breeding (line, combination, etc.) are also dealt with. Part III deals with the evaluation of the breeding potential of different races of *Apis mellifera*, and enumerates their characteristics. In addition to European races, those in the following areas are covered, under the names quoted: Syria, Cyprus and Crete (*syriaca*, *cypria*, *adami*), Egypt (*fasciata*), and eastern parts of Africa north of the Sahara (*intermissa*, *sahariensis*, *major nova*). A table compares char-

acteristics of these bees with Brother Adam's own Buckfast bees. The book has an index of technical terms, but no subject index and no bibliography. *E. E. Crane*
St. Mary's Abbey, Buckfast, Devon, UK.

Çakmak, I. and Wells, H. *Foraging ecology of the Cyprus honey bee (Apis mellifera cypria) and its implications for agriculture*. *Journal of Faculty of Agriculture, Uludag University* (98) 14 (2) 115–124 [En, tr, Bb]

The responses of foragers were tested on artificial flower patches containing blue, white, and yellow flowers in which rewards could be varied. Bees visiting blue flowers and white flowers preferred the colour offering the higher molar reward or the larger quantity. When a smaller volume of reward was provided in yellow flowers, the bees responded by visiting more blue and white flowers. The behaviour of this subspecies is compared with that of *A. m. ligustica* and *A. m. caucasica*; differences are attributed to wasp predation on Cyprian bees. *Author*
Animal Science Dept, Faculty of Agriculture, Uludag Univ., Bursa, Turkey.

Chevet, R. *Beekeeping with [traditional, fixed-comb] horizontal hives in the Mediterranean region. [Apiculture horizontale en Mediterranee].* *Revue Francaise d'Apiculture* (1990/1991) (No. 493; 494; 496; 497; 499; 502; 506; 507; 510; 511) 86–87; 143–144; 243–246; 296–298; 397–400; 575–578; 187–198; 243–246; 398–401; 443–445 [Fr, Bj]

This series of articles describes historical aspects of beekeeping with horizontal hives made from various materials. Hives of this type, and in some cases also the structures built to accommodate them, are described from Egypt, Israel, Jordan, Syria, Lebanon, Turkey, Cyprus, Greece, Spain and France. The writings of early Greek and Roman authors, and others, are considered, and various ideas on the origins of beekeeping and explanations for the use of horizontal and upright hives are put forward. A hypothesis that Phoenician sailors brought the horizontal hive to Europe is proposed. *D. G. Lowe*

Church, L. J. *Minimising the possibility of disease transfer-ence [to honeybees] in honey packing and processing plants using imported honey. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980.* (1983) 669–671 [En, B]

Gives details of precautions taken at a packing and processing plant recently constructed in Cyprus for the repacking of imported honey for export.

Church, L. J. and White, R. *Beekeeping and honey production in Cyprus. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980.* (1983) 110–118 [En, B]

Includes statistics on types of hive used, bee forage, honey yields.

Ifantidis, M. D. *The movable-nest hive: a possible forerunner to the movable-comb hive.* *Bee World* (1983) 64 (2) 79–87 [En, B]

An hypothesis is presented that the Greek movable-comb clay hive with top-bars developed by stages from a horizontal cylindrical fixed-comb hive (1) built into a wall, and that it was only in the Aegean Islands, not mainland Greece, that all the elements necessary for this transition existed. It is proposed that the key steps from (1) were: (2) hives stacked but not fixed together; (3) hives, more conical in shape, placed in simple rows on a platform; (4) conical hives used upright, with a wooden cover on which the combs were built i.e. a movable-nest hive; (5) hives with a cover divided into two or three, and ultimately into separate top-bars. Descriptions of different types of hive found in present-day Crete, the Cyclades, mainland Greece, Cyprus and Egypt, are used to support this hypothesis. The possible transition from clay to woven wicker skeps is also described. *D. G. Lowe*

Lab. Beeculture, Fac. Agric., Univ. Thessaloniki, Thessaloniki, Greece.

Kandemur, I. *Beekeeping experience and developments in Turkey and in northern Cyprus.* *American Bee Journal* (2003) 143 (6) 464–467 [En, Bj]

This article includes beekeeping statistics for Turkey and comparisons with other countries. In 1997, 94.9% of the

four million colonies were kept in modern hives; average honey production was 15.8 kg/colony. By 2,000, total honey production was 71,000 Mt (ranked fourth in the world).

Dept of Biology, Zonguldak Univ., Zonguldak, Turkey 67100.

Konstantinidis, K. *The development of the Cypriot hive.* *Melissokomiki Epitheorisi* (1997) 11 (2) 55–58 [Gr, Bj]

Wall hives harvested from inside the house were used first, then horizontal cylindrical hives of mud, clay, straw, or other materials (gyvertia). These were stacked in piles, and spaces between them filled with clay. In 1960 Cyprus had 2,780 frame hives and 28,000 gyvertia; in 1969 40,000 and 12,000 respectively. *F. Hatjina*

Nachtigall, W. *Flight and foraging behaviour of Eucera and Anthophora species on Cyprus (Hymenoptera: Apidae).* *Entomologia Generalis* (1994) 19 (1/2) 29–37 [En, de, Bc]

Observations were made in March 1992 on the flight and foraging behaviour of *Eucera dimidiata*, *E. graeca*, *Anthophora rutilans* and *Apis mellifera* in arid coastal areas of Cyprus with only a few sources of bee forage. Characteristic differences between the four species were observed in flight style, harvesting style, flight time, time spent per flower, and in the intermittent phases of zig-zagging flights, and these are discussed. The three plant species visited were *Erucaria myagroides*, *Echium angustifolium* and *Hyoscyamus albus* (*A. mellifera* was rare on *H. albus*). *D. G. Lowe*

Zoologisches Institut der Universitat des Saarlandes, D-66041 Saarbrücken; Germany.

Oustuani, A. M. *Microscopic analysis of the honeys of the Eastern Mediterranean region. [Das mikroskopische Bild der Honige des ostlichen Mittelmeergebietes]. Dissertation zur Erlangung des Grades eines Doktors der Naturwissenschaften, Universität Hohenheim (LH), Germany.* (1976) 64 pp. [De, 5 pl., 12 tab., Bt]

The 294 honeys studied came from Turkey, Cyprus, Lebanon, Syria and Jordan. Detailed results of orientation analyses of individual honeys are presented in 13 tables. Characteristics were sought that would differentiate honeys of the individual countries, and honeys of the Eastern Mediterranean from those of the Central and Western Mediterranean and Europe. Honeys from certain regions, e.g. the Pontic coastal mountains in Turkey, and the Bekaa plateau in Lebanon, showed highly specific pollen combinations. Citrus honeys from all coastal regions were very similar. On average 22 pollens could be distinguished by an orientation analysis, and 32 by a more complete analysis. The absolute pollen content per unit weight of honey was low compared with what other authors have found. Certain pollens found in the honeys were not adequately reported in melissopalynological literature, and these are described in detail and shown in photographs. From the microscopical data it is possible to establish which plants and plant groups in a given area are important for bees. When the results are compared with field observations, it is possible in very many cases to improve and correct the latter. *E. E. Crane*

Univ. Hohenheim (LH), Hohenheim, Germany.

Papaioannou, N. *Beekeeping in Cyprus*. Nicosia, Cyprus. (1973) 44pp. [Gr, B]

Politistiko Teknologiko Idryma Etba and others. [*Honey and its products. Three-day workshop, Nikiti, 12–15 September 1996*]. Athens, Greece; Politistiko Teknologiko Idryma Etba (2000) 486 pp. ISBN 960-244-054-6 [Gr, de, en, fr, X]

The papers presented at the workshop are published in Greek, together with illustrations; summaries in Greek and English – or German (3) or French (4) – are given at the end of the book under the titles: Antiquity (pp. 449–460), Middle Ages (pp. 461–465), Traditional techniques (pp. 466–477). One paper is in English: E. Crane, 'The development of hive beekeeping in the Mediterranean region during Antiquity' (pp. 441–443).

Ruttner, F., Pourasghar, D. and Kauhausen, D. *Honeybees of Iran. 2. Apis mellifera meda Skorikow, the Persian bee. [Die Honigbienen des Iran. 2. Apis mellifera meda Skorikow, die persische Biene]*. *Apidologie* (1985) 16 (3) 241–264 [De, en, fr, B]

Samples of 20 honeybees were collected from 63 locations in Iran, and from 149 locations in countries nearby (Turkey, Iraq, Lebanon, Israel, Jordan, Cyprus and also Italy). Measurements of nine characteristics were subjected to multivariate analyses which showed a cluster containing all samples from Iran and also those from the mountain region of Iraq and part of South East Anatolia. The name used for these bees is *A. m. meda*, first used by A.S. Skorikow in 1929. Distinctly separate clusters were obtained for *A. m. cypria*, *A. m. syriaca* and the honeybees of Central and West Anatolia. Six subgroups were found within *A. m. meda*, which is similar to, but can be distinguished from, *A. m. ligustica*; drones of the former are

darker and slightly smaller. The swarming tendency and defensive behaviour of *A. m. meda* are described as 'medium to high'; at swarming no more than 10–20 queen cells are built. A colony uses much propolis. The desert in the east of Iran defines the eastern limit of *A. mellifera*; the distance from this limit to the western limit of *A. cerana* distribution in Pakistan and Afghanistan is over 500 km. P. Walker
Inst. Bienenkunde, Univ. Frankfurt, Karl-von-Frisch Weg 2, 6370 Oberursel, Germany

Zohary, M. *Geobotanical foundations of the Middle East*. Stuttgart, Germany, Gustav Fischer. (1973) 739 pp. ISBN 3-347-30145-4 [En, Bdo, in two volumes, 8 pl]

The 'Middle East', as defined here, covers Turkey, Iran, Iraq, Syria, Lebanon, Cyprus, Crete, Israel, Jordan, Arabia and Egypt. Information on the vegetation, including many types of bee forage is, very sketchy from all these countries, and these two excellently produced volumes form a valuable reference work based, as they are, on the author's records made during 40 years of study of the plant communities of this area. In the first volume the general characteristics of landforms, climate, soils and flora are described. The plant-geographical regions are defined and the plants found in these regions are discussed. The second volume considers the distribution of specific genera and species, and describes the characteristic vegetation of the following climatic zones: deserts; semi-deserts and steppes; Mediterranean maquis; Euxino-Hyrcanian forest; temperate steppe forest, sudanian; hydrophytic. The influence of man on vegetation throughout the ages is also considered. There are 23 pages of references, an excellent index, and many useful diagrams, drawings, photographs and maps. D.G. Lowe

Dept. Botany, Hebrew Univ., Jerusalem, Israel.

Dominica

Bennett, F.D. *Baited McPhail fruitfly traps to collect euglossine bees*. *Journal of the New York Entomological Society* (1972) 80 (3) 137–145 [En, B]

McPhail traps, modified to include wicks soaked with an attractant, were used to capture male euglossine bees in British Honduras. Of the attractants tested, beta-ionone and skatole were the most successful. The species most frequently trapped were *Eulaema cingulata*, *Eulaema polychroma*, *Euglossa purpurea*, *Euglossa tridentata* and *Euglossa heterosticta*. Female euglossines were caught in McPhail traps that were baited with a partially hydrolysed protein to trap Mexican fruitflies. J.M. Gedyé

Commonwealth Inst. Biological Control, Gordon St., Curepe, Trinidad.

Brown, B.V. *Preliminary analysis of a host shift: revision of the neotropical species of Apocephalus, subgenus Mesophora (Diptera: Phoridae)*. *Natural History Museum of Los Angeles County Contributions in Science* (96) (No. 462) 36 pp. [En, Bb]

Twelve new species of *Apocephalus*, subgenus *Mesophora*, are described and named: an additional six unassociated males and females are described but not named. The 12 new species are *A. apivorus*, *atavus*, *emphysemus*, *laminiscus*, *lizanoi*, *megalops* and *niveus* from Costa Rica and *A. crassus*, *echinatus*, *pilatus*, *prolixus* and *secundus* from the Dominican Republic. *A. leptotarsus* Brown is synonymised with *A. antennatus* Malloch new synonymy. The previously unknown male of *A. absentis* Brown is described, as are the previously unrecognised females of *A. adustus* and *A. curtus*. A new key to species of the neotropical region is given. The relatively most primitive species, *A. apivorus* and *adustus*, are parasitoids of stingless bees, whereas *A. tritarsus* is a parasitoid of lampyrid beetles, like most other *Mesophora*. The host shift within the subgenus *Mesophora* from ants to lampyrid beetles appears to have been the parasitism of stingless bees. Author

Entomology Section, Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles, California 90007, USA.

Cano, R.J., Poinar, H. and Poinar, G.O. Jr. *Isolation and partial characterisation of DNA from the bee Proplebeia dominicana (Apidae: Hymenoptera) in 25–40 million year old amber*. *Medical Science Research* (1992) 20 (7) 249–251 [En, Bc]

DNA hybridisation studies with *P. dominica* DNA, isolated from amber in the Dominican Republic, indicated that it was well preserved. Attempts to identify the sequences of segments of the DNA in order to establish evolutionary relationships with modern species of stingless bees (*Meliponinae*) are continuing. D.G. Lowe

Biological Sciences Department, California Polytechnic State University, San Luis Obispo, CA 93407, USA.

Genaro, J.A. [*The genus Ceratina in Spain and Hispaniola (Hymenoptera: Apidae)*]. *El género Ceratina en Cuba y La Española (Hymenoptera: Apidae)*. *Caribbean Journal of Science* (98) 34 (1–2) 95–98 [Es, en, Bc]

A key for *Ceratina* species from the two islands is given. *Ceratina guarnacciana* n. sp. is described, from Hispaniola, and *C. cockoerelli* is recorded for the first time in Cuba and the Bahamas. Author

Museo Nacional de Historia Natural, Obispo 61, esquina Oficos, Plaza de Armas, Habana Vieja 10100, Cuba.

Genaro, J.A. [*New species of bees from Cuba and Hispaniola (Hymenoptera: Colletidae, Megachilidae, Apidae)*]. *Especies nuevas de abejas de Cuba y La Española (Hymenoptera: Colletidae, Megachilidae, Apidae)*. *Revista de Biología Tropical* (2001) 49 (3/4) 1027–1035 [Es, en, X]

Five new species are described and illustrated: *Colletes granpiedrensis* (Cuba); *Osmia (Diceratosmia) stangei* (Dominican Republic); *Coelioxys (Cyrtocoelioxys) alayoi* (Cuba); *Coelioxys (Boreocoelioxys) sannicolarensis* (Cuba); *Tripeolus nisibonensis* (Dominican Republic).

Museo Nacional de Historia Natural, Obispo #61, esquina

Oficios, Plaza de Armas, Habana Vieja 10100, Cuba.

Hertz, O. *Beekeeping in the tropics. [Biavl i troperne]*. *Tidsskrift for Biavl* (1996) 130 (11, supplement) 1–32 [Da, Bj]

The different species of bees in the various tropical regions are discussed. Short articles are devoted to traditional beekeeping in West Africa, and in East Africa, and with stingless bees. Denmark's beekeeping development projects in the following countries are described: Gambia, Guinea Bissau, Tanzania, and Dominica. P. Walker

Inter-American Institute for Cooperation on Agriculture. *Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992*.

Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]

The first section of the *Proceedings* gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados, Dominica, Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agro-forestry and environmental protection in the Caribbean. D.G. Lowe

IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia.

Jackson, J.F. *Mimicry of Trigona bees by a reduviid (Hemiptera, Heteroptera) from British Honduras*. *Florida Entomologist* (1973) 56 (3) 200–202 [En]

Fiji Islands

Anderson, D. *The disease and pest situation in the Pacific region; the threat of exotic diseases and pests from Papua New Guinea; diseases and disorders of queen bees*. *Australasian Beekeeper* (1990) 92 (6) 227–231 [En, Bj]

The situation in each of the following is summarised briefly: Fiji, Norfolk Island, Western Samoa and New Zealand. In Papua New Guinea, beekeeping in the Highland region has been developed with aid from New Zealand, and over 200 beekeepers now have 4,000 *Apis mellifera* colonies in hives. However, this beekeeping is threatened by the spread of *A. cerana* swarms (55–100 km/yr) which are infected with AFB and Kashmir bee virus. These pathogens have not previously been reported in PNG. The swarms are also infested with *Varroa jacobsoni* and possibly low numbers of *Tropilaelaps clareae*. The likely future directions of spread of *A. cerana* are suggested; if they reached Australia, the situation would be very serious. The last part of this article discusses research on diseases and disorders of *Apis mellifera* queens. P. Walker

Division of Entomology, CSIRO, Canberra, ACT 2601, Australia.

Anderson, D.L. *Pests and pathogens of the honeybee (Apis mellifera L.)*. *Fiji Journal of Apicultural Research* (1990) 29 (1) 53–59 [En, Bb]

The occurrence and distribution of pests and pathogens of *Apis mellifera* in Fiji, surveyed during October–November 1986, are reported. AFB was detected in 33 (47%) hived colonies at one locality but only one (0.8%) of all other colonies examined in other localities. Infestations of wax moth (*Galleria mellonella* or *Achroia grisella*) were observed in 139 (70%) hived colonies. The cane toad, *Bufo marinus*, was also observed as a pest of bee colonies. Chronic bee paralysis virus (CBPV) and sacbrood virus (SBV) were present in 30 (31%) and 76 (79%) hived colonies, respectively. Bee virus X, bee virus Y, black queen cell virus (BQCV), Kashmir bee virus (KBV), and slow bee paralysis virus were also detected in these colonies but they were less common than CBPV and SBV. Unapparent infections of SBV, BQCV and KBV were detected in seemingly healthy bees from hived colonies. SBV and CBPV were also detected in feral colonies. The Fijian KBV isolates were serologically distinguishable from New Zealand and

Australian KBV isolates. *Nosema apis* was found in 45 (47%) hived colonies. It was also detected in feral colonies. *Malpighamoeba mellificae* was detected in workers from one hived colony. EFB and chalk brood disease, the tracheal mite, *Acarapis woodi*, and other mites such as *Varroa jacobsoni* and *Tropilaelaps clareae*, were not detected in any colonies. *Author*

Dept. Sci. & Industrial Res., Entomology Div., Mt. Albert Res. Centre, Private Bag, Auckland, New Zealand.

Chandra, S. A review of recent research on the yellow passionfruit. *Fiji Agricultural Journal* (1976) 38 (2) 41–48 [En, B] Includes a section on pollination by honeybees and other bees.

Farber, I. Finding the beekeeper in paradise. *Bee Culture* (1997) 125 (10) 47–49 [En, Bj] Beekeeping on Rarotonga, Cook Islands, situated between Tahiti and Fiji, is described.

Matheson, A. G. Apiculture in Fiji – report of an investigation carried out in October and November 1986. Nelson, New Zealand; Ministry of Agriculture and Fisheries. (1987) 82 pp. [En]

Fiji includes over 300 islands in the South Pacific, of which about 100 are inhabited. Honeybees have been introduced to five of the larger islands, beginning with shipments of black European bees in the late nineteenth century. In the past 3–4 years most of the very aggressive mixed-race bees have been replaced with Italian stock from New Zealand. There are currently about 1000 hives in Fiji, and 71 beekeepers. Five commercial beekeepers own a total of 500 hives, and most of the remaining hives are kept by domestic beekeepers. Langstroth hives are used almost universally. Annual honey production is around 30 kg per hive, though well managed businesses can average 50 kg per hive. Serious pests and diseases present are AFB, the cane toad (*Bufo marinus*) and greater wax moth (*Galleria mellonella*). Rotting of hive parts is also a significant problem. *A. Matheson*

Min. Agric. & Fisheries, Private Bag, Nelson, New Zealand.

Michener, C.D. The genus *Homalictus* in Fiji (Hymenoptera: Halictidae). *Pacific Insects* (1979) 21 (2/3) 227–234 [En, B]

Poncini, L. Recommendations for the prevention of fermentation in Fiji honeys. *Fiji Agricultural Journal* (1986) 48 1–3 [En, Bb]

A study of seven Fijian honeys (unpublished data) showed that four contained *Saccharomyces* and five contained *Zygosaccharomyces*. These yeasts are capable of producing undesirable fermentations in honey. The problems associated with honey fermentation – yeast populations, water content, acidity – are discussed, and methods for reducing fermentations are suggested. Collecting apparatus should be sterilised and the processed honey should be quickly sealed in sterile containers to protect it from atmospheric moisture. *D.G. Lowe*

61 Robert St., Wickham, NSW 2293, Australia.

Poncini, L. A method for evaluating the effects of holocoenosis on the geographical distribution of beeswax formed by the hive bee, *Apis mellifera* L. *Apiacta* (1992) 27 (3) 72–85 [En, Bj]

A study was made on 50 beeswax samples collected at each of four isolated locations in Fiji; three locations were at different distances from the fourth location (base) and they had different climates. In trials comparing different methods of saponification, the procedure of Turner (1927) gave the most accurate and reproducible results. Values obtained for the ester: acid ratio ranged from 5.37:1 to 6.49:1 (average 5.90:1); these values are towards the top of the range of results reported in the literature (average 5.40:1). Values for content of the abundant monoester myricine were used as an indicator of the effect of environmental influences on beeswax composition. Statistical analysis revealed a linear relationship between the environmental variational factors for the three sites and their distances from the base location. *P. Walker*
P.O. Box 251, Mt. Druitt, NSW 2770, Australia.

Poncini, L., Poncini, A. and Prakash, D. The effects of washing on the fluorescent impurities and chemical properties of Fijian beeswax from *Apis mellifera* L. *Apiacta* (1993) 28 (2) 42–51 [En, Bj]

Physical and chemical properties of seven crude beeswax samples were compared with those of the samples after washing with water to remove impurities. When examined in UV light (200–400 nm), all samples except one fluoresced. Two crude samples which showed intense blue fluorescence contained many pollen grains (and possibly conidia) and some propolis. The fluorescence is probably attributable to amino acids that are present in pollen grains (but not in beeswax) and to flavonoids in propolis. The importance of washing beeswax before analysis is stressed. *P. Walker*

Department of Chemistry, University of South Pacific, Suva, Fiji.

Poncini, L., Poncini, A. and Prasad, B. Endemism of island colonies of *Apis mellifera* L. giving chemical evidence for race differentiation. *Apiacta* (1994) 29 (2) 51–64 [En, Bj]

Proline content was determined in Fijian honey samples collected from seven mainland sites and one island site. Each site was geographically isolated, and honey bee colonies were not migrated, so bees from different sites had not intermixed. Proline contents were high (maximum site average 142 mg/100 g honey) in honeys from sites in high rainfall areas in the north and low (min. 52 mg/100 g) in the drier south, with intermediate values at intermediate sites. Proline value was not correlated with forage sources. The importance of proline in the stability of honey and as an energy source for bees is discussed. It is concluded that in these honey bee colonies, which constitute isolated static gene pools, the first stage of endemism is apparent, i.e. chemical differentiation of colonies due to environmental factors. Thus Fijian *Apis mellifera* populations show chemical variation not only from world populations but also between each other. *P. Walker*
P.O. Box 251, Mt. Druitt, NSW 2770, Australia.

Poncini, L., Prasad, B., Singh, S.K. and Wimmer, F.L. A survey of some Fijian honeys. *New Zealand Journal of Science* (1984) 27 141–144 [En, B]

Twelve honeys produced in different parts of Fiji were examined; colour, degree of granulation and main chemical components are tabulated. Results are compared with those for honeys of other countries, and with the Codex Alimentarius Commission 1969 Recommended European Standard for honey. Water content of all samples (14.9–18.4%) conformed with the Standard; values for total reducing sugars ranged from 61.6 to 73.8%, four samples having values below the Standard's limit of 65%. Contents of glucose, fructose, and values of fructose/glucose ratio and of pH are also reported. The nectar sources of the honeys were not identified, but one sample came from bees near a sugar-cane mill. *P. Walker*

School of Natural Resources, Univ. S. Pacific, PO Box 1168, Suva, Fiji.

Poncini, L. and Wimmer, F.L. The composition of some Fiji honeys. *Fiji Agricultural Journal* (1983) 45 (1) 25–30 [En, Bb]

Six samples of honey collected from different locations in Fiji were analysed. Water content ranged from 16.3% to 18.5% (mean 17.5%), total reducing sugars 61.6–71.3%, glucose 29.0–32.3%, fructose 30.3–43.0%, sucrose 0.6–6.4%, dextrin 1.4–2.8%, ash 0.17% and 0.35% (two samples), pH 3.8–4.0. Munsell classification, colour and polarisation are also reported. All except one of the samples were completely granulated after 12 months storage at 4°C. *P. Walker*

School of Natural Resources, Univ. South Pacific, PO Box 1168, Suva, Fiji.

Poncini, L. and Wimmer, F.L. Characterization of the yeasts (Blastomycetes) in some Fijian honeys. *Apiacta* (1985) 20 (4) 118–126 [En, B]

Media and conditions suitable for the growth of the yeasts and bacteria were studied, and the best substrate was found to be 50% honey diluted with sterile water and containing 2% agar. Seven honey samples from four locations were examined; water content (determined in six samples) was between 16.3% and 18.5%. Eleven species of osmophilic yeasts were found, as well as two bacterial genera, *Gluconobacter* (in four honeys from the same place) and *Brevibacterium* (in all samples). Four honeys contained *Saccharomyces* species and *Zygosaccharomyces* species, and one contained only the latter. Recommendations are made for preventing fermentation in Fijian honey. *P. Walker*

School of Natural Resources, Univ. S. Pacific, PO Box 1168, Suva, Fiji.

Poncini, L., Wimmer, F.L. and Sheridan Poncini, G.F. An unusual honey colour resulting from bees feeding on factory wastes. *Journal of Apicultural Research* (1987) 26 (4) 255–260 [En, Bb]

One comb of a hive located near Nasinu, Fiji, in 1981, was found to contain an olive-green honey, while the surrounding frames contained ordinary (brownish-orange) honey. The constituents of the green and ordinary honeys respectively were: moisture 17.4, 18.4%; glucose 32.9, 32.3%; fructose 38.9, 40.6%; sucrose 0.2, 0.64%; dextrin 2.9, 1.6%; ash 0.32, 0.17%; nitrogen 0.092, 0.80%. The amino acid content of both honeys is described. The green colour was due to the common food colourant, 44090 green S. A possible source of the colourant was factory effluent, foraged by honeybees, during the preparation of lime-flavoured milk. *Author*

School of Natural Resources, Univ. South Pacific, Suva, Fiji.

Poncini, L., Wimmer, F.L. and Vakamoce, V. The amino acid composition of some Fiji honeys. *Fiji Agricultural Journal* (1983) 45 (2) 65–70 [En]

The free amino acids in seven honeys from Fiji were examined by qualitative paper chromatography. The amino acids, their R_f values and their ninhydrin-induced colours are tabulated. Sixteen amino acids were present in varying amounts; of these, only 10 were essential amino acids (arginine, histidine, lysine, phenylalanine in abundance, plus cystine, cysteine, leucine, threonine, tyrosine and valine in trace amounts) and not all were present in all samples. Non-essential amino acids found in abundance were alanine, glycine and serine. Aspartic acid and glutamic acid were found only in minute quantities. Cysteine, not previously reported from honey, was found in trace amounts in four of the honeys and in a larger quantity in one. Total nitrogen content was from 0.074% to 0.100%, similar to that reported for other honeys. *Author*

School of Natural Resources, Univ. South Pacific, Suva, Fiji.

Walton, G.M. Beekeeping development programmes in the tropical and subtropical Pacific. *Apiculture in tropical climates*, editor E. Crane. London, UK; International Bee Research Association. (1976) 159–164 [En, B]

The area dealt with is perhaps the least well known of all from the point of view of beekeeping development. The report covers New Zealand aid programmes in Papua New Guinea, Niue, Tonga, Gilbert Islands, Western Samoa; other aid projects in Rarotonga and Fiji; beekeeping activities in the Hawaiian Islands, American Samoa, French Polynesia, Micronesia, New Caledonia, Wake Island. *E. E. Crane*

Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

The Gambia

Angeby, O. *Beekeeping in Gambia. [Biodling i Gambia].* *Bitidningen* (1981) 80 (6) 191–195 [Sv, B]
With *Apis mellifera adansonii*.

Angeby, O. *Development of beekeeping in Gambia. [Utveckling av biodling i Gambia].* *Bitidningen* (1983) 82 (3) 85–88 [Sv, B]

Bradbeer, N. (ed.). *Proceedings of a scientific workshop for West African bee researchers: the First West African Bee Research Seminar, Bakau, Gambia, 25–28 November 1991.* Monmouth, UK; Bees for Development. (1993) 86 pp. ISBN 1-898807-00-0 [En, Bdo]

The texts are given for the 22 papers presented at the seminar, together with the addresses given at the opening and closing ceremonies. The subjects covered include beekeeping in Gambia, Nigeria, Cameroon, Mali and Ghana, descriptions of beekeeping development projects in western Africa, and the biology and management of the indigenous honey bee, *Apis mellifera adansonii*. The conclusions and recommendations of the seminar are presented in 'The Banjul Bee Declaration of 1991'. *D. G. Lowe*

Enger, E. *Beekeepers in Gambia. [Biodlarresa till Gambia].* *Bitidningen* (1986) 85 (11) 390–393 [Sv, B]

Hansen, H., Brødsgard, C.J., Kryger P. and Nicolaisen, M.A. *A scientific note on the presence of Paenibacillus larvae larvae spores in sub-Saharan African honey.* *Apidologie* (2003) 34 (5) 471–472 [En, Bj]

Spores were found in two of 10 South African and in a sample from Guinea Bissau, but not in any of the three Gambian honeys examined. The three positive samples had only light contamination. All honey imported to South Africa is irradiated before marketing, so viable spores should not be present. *P. Walker*

Danish Inst. of Agricultural Sciences, Dept of Crop Protection, Research Centre Flakkeberg, DK-4200 Slagelse, Denmark.

Hertz, O. *The top-bar basket hive.* *Beekeeping & Development* (1994) (No. 33) 8–9 [En, Bj]

In the Gambia, a joint project with the Danish Beekeepers' Organisation is helping villagers to make and use cheap top-bar hives and basic equipment. The hive is not wooden but is a basket woven from rhun-palm leaves; it is made c. 70 cm in diameter and 50 cm deep and then attached to four straight sticks so that it can be suspended from a wooden frame. An entrance hole and cover are provided. The top-bars, which must be exactly 33 mm wide, are made from sticks such as bamboo or from palm-leaf ribs.

Preparation and operation of the hives are described. *P. Walker*

Hertz, O. *Traditional beekeeping and beekeeping projects in the Gambia. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.* Cardiff, UK; International Bee Research Association. (1994) 139–141 ISBN 0-86098-215-7 [En, Bdo]
Gudhjemvej 50, 3760 Gudhjem, Denmark.

Hertz, O. *Beekeeping in the tropics. [Biavl i troperne].* *Tidsskrift for Biavl* (1996) 130 (11, supplement) 1–32 [Da, Bj]
The different species of bees in the various tropical regions are discussed. Short articles are devoted to traditional beekeeping in West Africa, and in East Africa, and with stingless bees. Denmark's beekeeping development projects in the following countries are described: Gambia, Guinea Bissau, Tanzania, and Dominica. *P. Walker*

Jones, H. R. *Beekeeping in the Gambia.* *Bee World* (2000) 81 (1) 38–42 [En, Bj]

Jones, H. R. *Beekeeping in The Gambia. A technical report.* London, UK; Commonwealth Secretariat (2000) 33 pp + 48 photographs. [En, Bdo]

This report of a 2-week visit to the country gives information on the present status of beekeeping and recommendations for future action.

Maane, J. *BSc report, Reading, UK; University of Reading. An economic evaluation of DANIDA funded beekeeping project in the Gambia* (99) 54 pp. [En, Bt]

In this extended essay, the history of beekeeping in the Gambia is outlined briefly, and recent beekeeping development projects are summarised. The main objective of the DANIDA project, started in 1991, was to train men and women to make and use Kenya top-bar hives. For this study in 1998, 20 of the 408 trainees were interviewed using a standard questionnaire. Some of the beekeepers who own their own hives get reasonable honey yields, but hive occupancy and yields are low in hives that are co-operatively owned and managed. Constraints to beekeeping include vandalism, pests (especially lizards), and insufficient training in some areas. *P. Walker*

Mohammed, O. *Beekeeping in a Gambian village.* *Community Development Journal* (1989) 24 (4) 240–246 [En, Bb]

An account is given of a beekeeping development project in Jali, Gambia.

Ghana

Beekeeping & Development. Zooming in on [beekeeping in] Ghana. *Beekeeping & Development* (1993) (No. 28) 13 [En, Bj]

Adjare, S. *The golden insect: a handbook on beekeeping for beginners*. London, UK; *Intermediate Technology Publications*. (1984) (Ed. 2) xii + 104 pp. + 1 pl. ISBN 0-946688-60-5 [En, B]

Adjare, S.O. *The golden insect: a handbook on beekeeping for beginners*. Kumasi, Ghana; University of Science and Technology. (1981) 59 pp. [En, B]
Largely based on frameless top-bar hives.

Adjare, S.O. *Hive predators in Ghana*. *Ghana Bee News* (1982) (No. 6) 4–5 [En, B]
Describes six types of ant (*Formicidae*).

Adjare, S.O. *A decade of Ghana's apiculture development Technology Consultancy Centre's experience. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 496–497 ISBN 0-86098-196-7 [En, Bdo]

Adjare, S.O. *Beekeeping in Africa*. Rome, Italy; *FAO. Agricultural Services Bulletin, Food and Agriculture Organization of the United Nations* (1990) (No. 68/6) xii + 130 pp. ISBN 92-5-102794-3 [En, Bd]

This is a clearly written, practical guide for the use of persons wishing to begin beekeeping in Africa. The introduction discusses such questions as 'Is the African bee worth keeping?'

'Where to keep bees?' and 'Who should keep bees?'. This is followed by a chapter describing the honey bee colony and its annual cycle, and honey bee castes. Chapter 3 is a short chapter on anatomy. It is unfortunate that there is no mention of taxonomy, as the impression is given that there is just one type of African honey bee. The author has a long experience of beekeeping in Ghana and this is apparent in the remaining seven chapters of the book, which deal with traditional, top-bar and frame hives, equipment, management, harvesting honey and beeswax, adverse factors (e.g. rain, bush burning, honey hunting) and enemies, diseases, pollination and queen rearing. The descriptions of colony manipulations should be particularly helpful to beginners. The book has a short appendix listing sources of bee forage, but there is no index.

Apiculture Promotion Unit, Technology Consultancy Centre, University of Science and Technology, Kumasi, Ghana.

Aidoo, K.S. *Honey quality and marketing in Ghana. Perspectives for honey production in the tropics: proceedings of the NECTAR symposium held in Utrecht, 18 December 1995* [edited by Sommeijer, M. J., Beetsma, J., Boot, W.-J., Robberts, E.-J. and Vries, R. de]. Bennekom, Netherlands; Netherlands Expertise Centre for Tropical

Apicultural Resources. (1997) 53–66 ISBN 90-801204-3-X [En, Bd]

In Ghana, honey hunters exploit the honey bee (*Apis mellifera adansonii*) as well as various species of stingless bees for honey. Methods of harvesting and processing always have a direct relationship to the quality of the honey. Traditional beekeepers still rely much on harvesting and processing methods like those used by honey hunters. These include total/partial colony destruction prior to comb removal from the nest, separation of honey combs from brood, and straining/squeezing/burning or heating honey combs to extract the honey. Beekeepers using top-bar hives have adopted straining of the honey. Honey quality is also related to the time of the year in which the honey is harvested, and to its botanical sources. Peak production of honey occurs between February and April, and a minor peak occurs in November and December. The honey is mainly produced for the local market. The various strategies that exist for marketing honey in Ghana are discussed and strategies for improvement are outlined. *Author*

Akukumah, N.R. *GRATIS: an approach to training and small-scale entrepreneurship. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 299–301 ISBN 0-86098-196-7 [En, Bdo]

Training beekeepers, especially women, in Ghana.

Amoako, J. and Pickard, R.S. *Beekeeping in Ghana*. *Bee World* (99) 80 (2) 100–105 [En, Bj]
Bee Research Unit, School of Pure and Applied Biology, Univ. of Wales, Cardiff, UK.

Amoako, J. *Apiculture in Ghana and the use of palynology to determine the renewable resources exploited by the honeybee *Apis mellifera adansonii.** PhD Thesis, University of Wales, Cardiff, UK. (1997) xxi + 408 pp. + 146 pl. [En, Bdo]
Questionnaires were sent to 50 beekeepers in Ghana. The 37 who replied were generally over 30, predominantly male, highly educated, and they regarded beekeeping as an important source of income. They had acquired training, used mainly the Kenyan top bar hive, involved labour and harvested honey between December and March, and September and December, using straining and pressing extraction techniques. They had six or more hives and each colony produced 5–50 kg of honey, priced between 500 and 4000 Ghanaian cedis. Honey was predominantly used for food and medicine. The beekeepers were enthusiastic and satisfied with their beekeeping. They required assistance with container provision, marketing of beeswax, financial and technical help, and the provision of beekeeping equipment. A total of 399 pollen types belonging to 59 families, collected from the herbarium and the field, were described, measured, photographed and documented. Nectar sources for honey bees (*Apis mellifera adansonii*) were investigated by pollen analysis of 47 honey samples

collected after the major and minor flows in seven regions within four vegetational zones in Ghana, in 1994. Pollen sources were investigated by pollen analysis of bee bread. A total of 255 plant species belonging to 56 families were identified from plants acting as nectar and/or pollen sources. The most common nectar sources in order of decreasing rate of occurrence were: *Elaeis guineense*, *Tridax procumbens*, *Panicum maximum*, *Ceiba pentandra*, *Mimosa pudica*, *Zea mays*, *Leucena glauca*, *Securinega virosa*, *Morus mesozygia* and *Cocos nucifera*. A total of 143 plants were identified as pollen sources. The most common in order of decreasing rate of occurrence were *Zea mays*, *Manihot esculenta*, *Elaeis guineense*, *Euphorbia heterophylla*, *Leucena glauca*, *Panicum maximum*, *Tridax procumbens*, *Croton* sp., *Sida acuta*, *Ceiba pentandra* and *Cocos nucifera*. *Author*
School of Pure and Applied Biology, University of Wales, College of Cardiff, Cardiff, UK.

Amoako, J. and Yeboah-Gyan, K. *Insect pollination of three solanaceous vegetable crops in Ghana with special reference to the role of African honey bee (Apis mellifera adansonii) for fruit set. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de].* Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 255–259 ISBN 90-6605-384-4 [En, Bd]
Preliminary investigations were conducted in Kumasi, a humid forest area in Ghana, on the floral morphology, relative abundance of insect visitors, mode of reproduction and the efficiency of African honeybees (*Apis mellifera adansonii*) in increasing the yields of *Lycopersicon esculentum*, *Capsicum frutescens* and *Solanum melongena*, commonly grown in Ghana. Results indicated that these three species are partly self-incompatible and need cross-fertilisation for greater fruit set. They share a common spectrum of insect species as visitors, the most abundant being the bees *A. mellifera* and *Xylocopa* spp. The foraging patterns and abundance of the insects were affected by temperature and RH. Plants visited by insects generally produced more fruits of better quality. Flowers of the crops pollinated by honeybees produced significantly greater fruit yields than those excluded from insects. Flowers also showed earlier petal fall which resulted in more uniform fruit ripening. The results indicate the effectiveness of using honeybees to increase fruit set of these crops. *Author*
Dept. Biological Sci., Univ. Sci. & Technol., Kumasi, Ghana.

Bérubé, C. *Beekeeping in Ghana. Part 1. Part 2.* *American Bee Journal* (2003) 143 (5; 6) 384–389; 474–479 [En, Bj]
Part 1 describes the current state of beekeeping and the hives used. Part 2 deals with improvements made by using the Kenya top-bar hive.
Elberts St, Nanaimo, Bc, V9S 1P6, Canada.

Bradbeer, N. (ed.). *Proceedings of a scientific workshop for West African bee researchers: the First West African Bee Research Seminar, Bakau, Gambia, 25–28 November 1991.* Monmouth, UK; Bees for Development. (1993) 86 pp. ISBN 1-898807-00-0 [En, Bdo]
The texts are given for the 22 papers presented at the

seminar, together with the addresses given at the opening and closing ceremonies. The subjects covered include beekeeping in Gambia, Nigeria, Cameroon, Mali and Ghana, descriptions of beekeeping development projects in western Africa, and the biology and management of the indigenous honey bee, *Apis mellifera adansonii*. The conclusions and recommendations of the seminar are presented in 'The Banjul Bee Declaration of 1991'. *D. G. Lowe*

Brew, A.H. *The effect of colours and specific features of floral parts on the pollination of cocoa by ceratopogonid midges in Ghana. Proceedings of the Tenth International Cocoa Research Conference, Santo Domingo, Dominican Republic, 17–23 May 1987.* London, UK; Cocoa Producers' Alliance, Lagos, Nigeria. (1987) 307–310 [En, fr\es\pt]
Cocoa (*Theobroma cacao*) flowers were grease-banded at the bases and flower visitors were trapped by applying adhesive compounds lightly to the stamens, petals or sepals. In a second experiment, batches of flowers were tagged with various coloured papers. Pollinator midges were always captured on the stamens and never on the sepals or petals. The amount of pollination for flowers tagged with different colours was not significantly different, indicating that colours failed to enhance flower attractiveness to midges. It is suggested that the midges' preference for the vertically oriented stamen may be attributed to its use as a landing site en route to the nectaries. *D. G. Lowe*
Cocoa Res. Inst., PO Box 8, New Tafo, Ghana.

Brew, A.H. *Natural pollination of kola. Annual report, Cocoa Research Institute, Ghana, 1985/86.* Tafo, Ghana; Cocoa Research Institute. (1987) 40–42 [En]
Of 3249 insects collected from kola nut [*Cola acuminata*] flowers in Ghana, 972 were *Thysanoptera*, 891 *Collembola*, 648 *Diptera*, 747 *Coleoptera*, 94 *Homoptera* and 58 *Hymenoptera*. Hand-pollination of self-pollinated flowers gave 2.5% fruit set, hand-pollination of cross-pollinated flowers 30% and natural pollination 12.7%. There was no fruit set on flowers enclosed to exclude insects.
PO Box 8, Tafo, Ghana.

Brew, A.H. *Cocoa pod husk as a breeding substrate for Forcipomyia midges and related species which pollinate cocoa in Ghana. Cocoa Growers' Bulletin* (1988) (No. 40) 40–42 [En]
The occurrence of cocoa pollinators in cocoa pod husks was assessed in a husk dumping ground in Ghana in January–December, 1981. A wide range of species of the ceratopogonid genus *Forcipomyia* was collected, including *F. ashantii*. The ceratopogonids were most abundant during April–December. It is suggested that cocoa pod husks could be dumped near farms or plantations to minimise mortality of pollinators due to insecticides.
Cocoa Res. Inst. Ghana, P.O. Box 8, New Tafo, Ghana.

Doku, E.V. *Flowering, pollination and pod formation in bambara groundnut (Voandzeia subterranea) in Ghana. Doku, E. V. and Karikari, S. K.: The role of ants in pollination and pod production of bambara groundnut. Experimental Agriculture* (1968) 4 (1) 41–48 [En, 3 pl., B]

Edwards, D.F. *Pollination studies on cultivar Upper Amazon cocoa clones in Ghana in relation to the production of hybrid seed*. *Journal of Horticultural Science* (1973) 48 (3) 247–259 [En]

Insect pollinator populations and flowering patterns.

Glendinning, D.R. *Natural pollination of cocoa*. *New Phytologist* (1972) 71 (4) 719–729 [En, B]

Supposed agents are discussed; the midge *Forcipomyia* (*Ceratopogonidae*) is thought to be the main agent.

Holt-Wilson, N. *The potential of beekeeping as a means for facilitating rural development in Wenchi District, Ghana*. Msc Thesis, University of Edinburgh, UK. (1996) 57 pp. [En, Bdo] Wenchi District in Ghana has a largely rural population, agriculture employing more than 80% of the people. The majority are small-scale farmers whose financial security depends upon diversification of income-generating activities. This thesis assesses the potential of beekeeping to facilitate rural development through income generation. At present, most honey is obtained by honey hunting and the extent of indigenous knowledge of the habits and management of bees is great amongst those that practice honey hunting. A sophistication of the methods of honey collection by building on this knowledge would improve the quality of honey and wax. In addition it would ensure a more regular supply and reduce the environmental damage and threat of bush fires that honey hunting causes. The natural environment of the district is able to provide raw materials for hives suitable for this development. A major limitation to beekeeping development is the lack of communication amongst honey hunters and between villagers, and poor communication with organisations outside the villages. There are national organisations which promote beekeeping, but they are disunited and do not recognise the extent and value of indigenous knowledge. It is concluded that there is great potential for beekeeping as a means for facilitating rural development in the Wenchi District, but it requires encouragement, education, communication and co-operation at all scales of implementation. *Author*

Kaufmann, T. *Biology and ecology of Tyora tessmanni (Homoptera, Psyllidae) with special reference to its role as cocoa pollinator in Ghana*. *West Africa. Journal of the Kansas Entomological Society* (1973) 46 (3) 285–293 [En]

Kaufmann, T. *Preliminary observations on cecidomyiid midge and its role as a cocoa pollinator in Ghana*. *Ghana Journal of Agricultural Science* (1973) 6 193–198 [En, fr, B]

Kaufmann, T. *Behavioral biology of a cocoa pollinator Forcipomyia inornatipennis (Diptera; Ceratopogonidae) in Ghana*. *Journal of the Kansas Entomological Society* (1974) 47 (4) 541–548 [En]

Kaufmann, T. *Cocoa pollination by males of Forcipomyia squamipennis (Diptera: Ceratopogonidae) in Ghana*. *Tropical Agriculture* (1975) 52 (1) 71–74 [En]

Males of this species pollinated cocoa in field cage experiments, although it was previously thought that the species was a non-pollinator. *D.G. Lowe*
Cocoa Res. Inst., P.O. Box 8, Tafo, Ghana.

Kaufmann, T. *Ecology and behavior of cocoa pollinating Ceratopogonidae in Ghana, West Africa*. *Environmental Entomology* (1975) 4 (2) 347–351 [En]

Kaufmann T. *An efficient, new cocoa pollinator, Lasio-glossum sp. (Hymenoptera: Halictidae) in Ghana, West Africa*. *Turrialba* (1975) 25 (1) 90–91 [En, es, B]

A species of *Lasioglossum* was seen gathering pollen from cocoa flowers at canopy level (3–4 m). The bee's zigzag movement in and out of the petal hoods caused it to brush against the pistil five times in each flower, resulting in a characteristic distribution of pollen grains around the style. The pollinating efficiency of *Lasioglossum* was more than twice that of some of the commonest ceratopogonids in Ghana. This advantage is further enhanced by the bee's longer active hours and much greater flying distances. *Author*

Cocoa Res. Inst., Tafo, Ghana.

Kaufmann T. *Pollinators of Theobroma cacao in Ghana. Proceedings, 4th Conference of West African Cocoa Entomologists, Legon, Ghana, 9–13 December 1974*. Legon, Ghana; University of Ghana. (1975) 77–80 [En]
Review of work on *Halictidae*, *Ceratopogonidae*, *Cecidomyiidae* and *Psyllidae*.

Kaufmann T. *Studies on the ecology and biology of a cocoa pollinator, Forcipomyia squamipennis I. and M. (Diptera, Ceratopogonidae), in Ghana*. *Bulletin of Entomological Research* (1975) 65 (2) 263–268 [En, B]

The life cycle is reported from field and laboratory observations. At least 12 generations are produced each year and both sexes are efficient pollinators of cocoa. It was found that four times more males than females visited the flowers. *P. Walker*

Cocoa Res. Inst., P.O. Box 8, Tafo, Ghana.

Lack, A. *Genets feeding on nectar from Maranthos polyantha in northern Ghana*. *East African Wildlife Journal* (1977) 15 (3) 233–234 [En]

Lock, J.M. and Profita, J.C. *Pollination of Eulophia cristata (S.W.) Steud. (Orchidaceae) in southern Ghana*. *Acta Botanica Neerlandica* (1975) 24 (2) 135–138 [En]
Pollinated by *Xylocopa olivacea*.

Moody, T. *Ghana and Nepal: beeswax used in lost-wax brass-casting. A photographic review. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) 185–189 [En, B]

Newton, L.E. and Lomo, A. *Relationship between pollen load and flight in agaonid wasps*. *Entomologische Berichten, Netherlands* (1977) 37 (5) 72–73 [En, B]

Observations of *Allotriozone heterandromorphum*, which pollinates *Ficus vogelii*, indicate that wasps newly emerged from intact syconia can fly away only if they are carrying pollen in their mesothoracic pockets. When syconia were split open, the wasps crawled away without gathering pollen. *J.M. Gedy*

Dept. Biological Sci., Univ. Sci. & Technol., Kumasi, Ghana.

Newton, L. E. and Lomo, A. *The pollination of Ficus vogelii in Ghana*. Botanical Journal of the Linnean Society (1979) 78 (1) 21–30 [En]

F. vogelii is a primitive monoecious species, in which staminate and pistillate flowers are distributed throughout the syconium without localisation. The chief pollen vector is the agaontid wasp *Allotriozoom heterandromorphum*, which is an obligate symbiont. Adult females of this species have mesothoracic pockets in which pollen is carried. Adult males do not display the anther-cutting activity reported in other species. The life cycle of the pollinator is described in relation to the development cycle of the syconium.

Dept. Biological Sci., Univ. Sci. & Technol., Kumasi, Ghana.

Peterson, M. *African honeybees in East and West Africa, and Africanized honeybees in Venezuela: some observations on behaviour*. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 109–111 [En, B]

The author worked with honeybees in Mali, Sierra Leone, Ghana, Uganda and Venezuela, and noted wide variations in absconding and swarming behaviour, stability on combs and 'aggressiveness'.

Ricciardelli d'Albore, G. and Owusu, M. *Beekeeping and pollen spectra of some honeys from Ghana*. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 106–109 ISBN 0-86098-215-7 [En, Bdo]

Istituto di Entomologia Agraria, Università di Perugia, Perugia, Italy.

Schoenmakers, J. *The Ghana National Service Beekeeping Training Programme*. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 161–163 ISBN 0-86098-215-7 [En, Bdo]

Ghana National Service Secretariat, PO Box 46, State House, Accra, Ghana.

Woyke, J. *Diurnal and seasonal variation in defensive behavior of African bees *Apis mellifera adansonii* in Ghana*. Apidologie (1992) 23 (4) 311–322 [En, fr\ de, Bj]

Defensive behaviour was measured by the number of stings in a leather ball suspended near the hive entrance for one minute; the numbers of workers returning to the hive during periods of five minutes were also counted. A typical pattern of diurnal behaviour was observed; in the rainy summer season (dearth), a single peak in defensive behaviour occurred, at 09.00 hours, but in the dry winter season (honey flow) three peaks were recorded on one day, and three weeks later there were two peaks, at 06.00 hours (30 minutes before sunrise) and at 18.00 hours (just before sunset). Defensive behaviour was highly correlated with flight activity, and so it is recommended that any necessary handling of colonies should be done during periods of low flight activity. As an indicator of potential defensive behaviour of a colony, the ratio of number of stinging bees

to number of flying bees is better than defensive behaviour (number of stings in ball) alone. *P. Walker*
FAO Representation, Accra and Technology Consultancy Centre, Kumasi University, Kumasi, Ghana.

Woyke, J. *Diurnal flight activity of African bees *Apis mellifera adansonii* in different seasons and zones of Ghana*. Apidologie (1992) 23 (2) 107–117 [En, fr\ de, Bj]

The number of worker honey bees returning to the hive during a 5-minute period was counted every 0.5–1.0 hours throughout the day during the dry and rainy seasons in three zones of Ghana. The pattern of flight activity in different zones did not differ much within each season, but it differed greatly between seasons. In the rainy season, a single peak of foraging activity occurred during the morning. During the honey flow (winter dry season) there were two peaks of foraging activity: the one shortly after sunrise and the other shortly before sunset. The presence of the second (evening) peak is explained by nectar availability. *Author*

Technology Consultancy Center of the University, Kumasi, Ghana.

Yeboah-Gyan, K. and Marfo, E. K. *The colour and mineral composition of honeys produced in major vegetation areas of Ghana*. Journal of Apicultural Research (98) 37 (2) 79–84 [En, Bj]

Mineral constituents of light and dark honey samples collected from three major vegetation areas in Ghana were analysed by atomic absorption spectrophotometry (AAS). A questionnaire survey, supported by field observations, was carried out in beekeeping areas of each of the vegetation areas to identify the bee-plant species. Calcium, phosphorus, magnesium, potassium, iron, manganese and copper were detected in all the samples. Sodium was detected only in the dark honey samples. The concentration of all the elements was generally much higher in the dark samples than in the light ones, and this was attributed to differences in nectar-plant species.

Dept. Biological Sci., Univ. Sci. & Technol., Kumasi, Ghana.

Yeboah, G. K. and Woodell, S. R. J. *Analysis of insect pollen loads and pollination efficiency of some common insect visitors of four species of woody Rosaceae*. Functional Ecology (1987) 1 (3) 269–274 [En]

Pollen loads of honey bees (*Apis mellifera*), bumble bees (*Bombus* spp.) and hover flies (*Syrphidae*) were analysed and pollination efficiency estimated for visits to *Prunus spinosa*, *Crataegus monogyna*, *Rosa canina* and *Rubus fruticosus*. The relative efficiency of the different insect groups varied, depending on the plant species visited, but in every instance the high flower constancy of the visitors, their rapid foraging rates and the amounts of pollen they carried, ensured that they were adequate pollinators.
Department of Biological Science, University of Science and Technology, Kumasi, Ghana.

Yeboah-Gyan, K. and Agyemang, O. *Extracts of *ahomafuo* (a species of *Adenia*, Passifloraceae) as anaesthetic for tropical African honeybees (*Apis mellifera*)*. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.

London, UK; International Bee Research Association. (1989) 37–39 ISBN 0-86098-196-7 [En, Bdo]

Sun-dried bark of *A. cissampeloides* (used locally for subduing honeybees) was extracted with water, ethanol or hexane, and the extracts evaporated to dryness. The extracts were then dissolved in acetone and various concentrations of the solutions were sprayed on worker honeybees confined in a petri dish (20 µl/bee). The hexane or

ethanol extracts were significantly more effective than the aqueous extract or acetone (control) in immobilising or subduing bees. Mortality was low in all treatments. Plant volatiles emitted by pieces of crushed vine were similar to alcohol extracts in effect, but were effective only within 15 cm of a bee. *D.G. Lowe*

Dept. Biological Sci., Univ. Sci. & Technol., Kumasi, Ghana.

Grenada

Inter-American Institute for Cooperation on Agriculture. *Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992.* Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]
IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia. *D.G. Lowe*

The first section of the Proceedings gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados,

Dominica, Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agro-forestry and environmental protection in the Caribbean.

Guyana

Beekeeping & Development. *Zooming in on [beekeeping in] Guyana.* *Beekeeping & Development* (1992) (No. 24) 15 [En, Bj]

Beetsma, J. *Improving honey production and disposal in Guyana and Surinam. Apiculture in tropical climates, editor E. Crane.* London, UK; International Bee Research Association. (1976) 81–83 [En, B]
Includes information on beekeeping.

Bittrich, V. and Amaral, M.C.E. *Flower morphology and pollination biology of some Clusia species from the Gran Sabana (Venezuela).* *Kew Bulletin* (1996) 51 (4) 681–694 [En, 20 ref.]

The flower morphology and its relation to the pollination biology of four species of *Clusia* (*Guttiferae*) from the Gran Sabana (Guyana highland) belonging to three sections of the genus is described. The flowers of both genders of *C. schomburgkiana* (sect. *Polythecandra*) and of *C. columnaris* (sect. *Omphalanthera*) offer resin as a reward for small bees acting as pollinators. In both species the androecial morphology is highly derived. Functionally, this can be interpreted in terms of minimisation of contact of the sticky resin and the pollen. Male flowers of *C. pusilla* and *Clusia* sp. of sect. *Clusiastrium* offer pollen as a reward for large, middle-sized and small bees, who vibrate the anthers to collect pollen. Female flowers are rewardless and unusual in the genus by the presence of long styles. The pollinating bees are probably deceived by the combination of papillose stigmas and the yellowish staminodes directly below these. The bees pollinate the stigmas when trying to vibrate them. The evolution of the flower biology in the genus *Clusia* is briefly discussed.

Dept. de Botanica, IB - Universidade Estadual de

Campinas, C.P. 6109, 13081–970 Campinas, SP, Brazil.

Crane, E. *Honey sources of some tropical and subtropical countries.* *Bee World* (1973) 54 (4) 177–186 [En, B]

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented: Africa – Botswana, Cameroon, Ethiopia, Mauritius, Morocco, Mozambique, Nigeria, Somalia, Zanzibar; America (South) – Ecuador, Guyana, Venezuela. Asia – Afghanistan, India, Iran Pakistan. *G. Lowe*

International Bee Research Association

Collins, P and Solomon, G (eds). *Proceedings of the First Caribbean Beekeeping Congress, Tobago, West Indies, 17–20 November, 1998.* Tobago Apicultural Society ([1999]) 230 pp. [En, Bdo]

Papers presented are published in full, and contain much information on various aspects of beekeeping in Caribbean islands (with Bermuda and Guyana). One section covers activities of institutions and non-governmental organisations

Gulmahamad, H. *The arrival of the Brazilian honeybee in Guyana – implications for apiculture, animal husbandry and public health and safety.* Occasional Paper of the Department of Biology, University of Guyana (1976) (No.1) 9 pp. [En, B]

Dept. Biology, Univ. Guyana, Georgetown, Guyana.

Krell, R. *The results of diminishing forest resources on management and productivity of honey bees, based on examples of three tropical countries. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.*

Cardiff, UK; International Bee Research Association. (1994) 35–37 ISBN 0-86098-215-7 [En, Bdo]

Nectar sources provided by the forests of Guyana, Belize and Sri Lanka are discussed.

ICON Development, Viale Regina Margherita 239, 00198 Rome, Italy.

Otis, G. W. and Taylor, O. R. Jr. *Beekeeping in the Guianas. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth.* London, UK; Commonwealth Secretariat. (1979) 145-154 [En, B]

This is an attempt to record the situation in Surinam, Guyana and French Guiana before the expected arrival of large numbers of Africanised bees; it should then be possible to assess the effect of these bees. In these countries most beekeeping is along a narrow coastal strip with a typically equatorial climate; the main nectar source is *Avicennia nitida* (black mangrove) from which it is estimated 90% of Guyana honey is produced. Other forage plants include coconut, *Pterocarpus officinalis* and *Triplaris surinamensis*. The main honey crop is harvested in October or November, and sometimes a small crop in April. Colonies often need feeding in June and July; swarming is rather uncommon, and when it does occur it is usually at the beginning of a dry season. Beekeeping is not a well developed industry; there are less than 1000 managed colonies in Surinam, about 2000 in Guyana and in French Guiana only 15 in 1975. Stingless bees are seldom used for honey production. In Surinam a beekeepers' association is doing much to help beekeepers, who receive no government support. In Guyana there are government bee officers and the government has funded the building of a honey processing centre and the establishment of 325 hives, but unfortunately these apiaries declined to about 25 colonies, largely as a result of pesticide poisoning. Other problems discussed include the high cost of imported equipment, and the lack of queen-rearing facilities; there are many predators and pests, but no diseases. Typical honey yields are from 5 to 20 litres, but can be as high as 30 litres/colony. Quality is also very variable; most honeys are amber coloured, with a strong taste, but that from black mangrove is very light in colour with a mild flavour. Honey prices are generally high. *P. Walker*

Dept. Entomology, Systematics & Ecology, Univ. Kansas, Lawrence, KS 66045, USA.

Persano Oddo, L. *Guyana: stingless bees for the Indians. [Guyana: api senza pungiglione per gli indios].* *Apitalia* (1989) 16 (15/16) 18–19 [It, Bj]

Persano Oddo, L., Krell, R. and Festuccia, N. *Quality of selected honeys from the southeastern Caribbean.* *Apicoltura* (1989) (No. 5) 137–145 [En, it, Bj]

After analysing 47 honeys from Guyana, seven from Barbados and three from Trinidad, results were compared with the standard recommended by the Codex Alimentarius Commission. Minimum permitted levels were exceeded for water content in eight honeys, for mineral content in four and for HMF in 10. Amylase level was too low in 13 honeys. In addition, organoleptic examination showed that 12 honeys did not conform to standards of cleanliness, 10 honeys were fermented and 10 had 'off-

odours'. Altogether, 33 of the honeys did not fulfil the requirements of the standard, but only five were of really poor quality. *P. Walker*

Sezione di Apicoltura, Istituto Sperimentale per la Zoologia Agraria, Via Leonida Rech 36, 00156 Rome, Italy.

Rai, B. K., Allicock, P. and Delph, G. *Honeybee and injection of monocrotophos into coconut palm.* *Indian Bee Journal* (1977) 39 (1–4) 13–14 [En, B]

Within 5–8 hours of injection of the systemic insecticide monocrotophos at a dose of 4.8 g a.i./palm (to kill defoliating insects), honeybees (*Apis mellifera*) at nearby hives were seen to be poisoned. After two days, populations in two hives had been reduced by 50%, and after eight days by 75%. The colonies recovered when fed with sugar. New colonies brought into the area seven days after the injections were not affected by monocrotophos, although residual toxicity to the defoliating caterpillar *Brassolis sophorae* lasted 72 days. *P. Walker*

Central Agric. Stn., Mon Repos, Guyana.

Taylor, O. R. and Levin, M. D. *Observations on Africanised honey bees reported to South and Central American government agencies.* *Bulletin of the Entomological Society of America* (1978) 24 (4) 412–414 [En, B]

The findings of a visit to French Guiana, Trinidad, Venezuela, Colombia, Panama, Costa Rica and Mexico are discussed. From 1974, Africanised bees have spread north-west from French Guiana through Surinam and Guyana, and they reached Venezuela during 1977. The rate of spread through the rain forests of the Guianas was 320 km per year. A second, faster, spread into eastern Venezuela from Brazil was at 480 km per year. Africanised bees do not appear to have spread across the Andes and may have reached their climatic limits in northern Argentina. The management of Africanised bee colonies and ways of protecting the public are discussed. *J. M. Gedy*
Dept. Systematics and Entomology, Kansas Univ., Lawrence, KS 66045, USA.

Taylor, O. R. and Williamson, C. B. *Current status of the Africanized honey bee in northern South America.* *American Bee Journal* (1975) 115 (3) 92–93, 98–99 [En, B]

During an extensive tour through Venezuela, Guyana, Surinam, French Guiana, and northern Brazil, in July and August 1974, the authors collected honeybees from hives, flowers and sugar refineries, and interviewed local beekeepers, officials, and others. A map based on the results shows the present northern limit of the spread of Africanised honeybees. They have crossed the Amazon river in a number of places, but have entered only French Guiana of the northern countries of South America, their spread being primarily through the drier coastal savannas, and not through the rain forests. It is suggested that Africanised bees are not likely to hybridise much further with gentle 'domestic' bees, either naturally (because the latter are scarce), or through amateur beekeeping (because queens are expensive and management of the stinging colonies is difficult). It is planned to place baited swarm boxes along the advancing front, to obtain quantitative data on the northward spread of these bees. *J. D. Hitchcock*

Dept. Entomology, Univ. Kansas, Lawrence, KS 66045, USA.

Taylor, O.R. Jr. *The past and possible future spread of Africanized honeybees in the Americas.* Bee World (1977) 58 (1) 19–30 [En, Reprinted as IBRA Reprint No. M89, price pounds-sterling 0.35 or \$0.65, B]

Observations on the spread of Africanised bees from Rio Claro, Brazil, in 1957, to as far as Guyana in April 1976, are summarised. The average rate of spread in 1957–1963 was about 80 km/yr, but in 1974–1976, in French Guiana and Surinam, it was 250–400 km/yr. Possible mechanisms for this speed of spread are discussed. In assessing the prospects for future spread the climatic tolerances and directional preferences of *adansonii* bees, and their possible interactions with European subspecies, are consid-

ered. It is suggested that where Africanised bees reach the limits of their climatic tolerance, interface zones will be formed in which they will form hybrids with European bees. This may have already happened in the south and west of Argentina and the higher altitudes of Bolivia. At their fastest rate of spread Africanised bees could reach USA in 13–20 years, and perhaps survive south of a line marking 240 frost-free days per year, but there are so many factors involved that precise predictions on spread and initial impact in USA are not possible. *D.G. Lowe*
Dept. Entomology, Univ. Kansas, Lawrence, KS 66045, USA.

India

India. Indian Standards Institution. India. Indian Standards Institution. *Specification for hive stands.* Indian Standard (1961) (No. IS:1735-1960) 4 pp. [En, B]

India. Indian Standards Institution. India. Indian Standards Institution. *Specification for honey extractor, tangential type.* Indian Standard (1961) (No. IS:1736-1960) 5 pp. [En, B]

India. Indian Standards Institution. India. Indian Standards Institution. *Specification for comb foundation sheets.* Indian Standard (1962) (No. IS:2072-1962) 4 pp. [En, B]

India. Indian Standards Institution. *Specification for commercial beeswax.* Indian Standard (1969) (No. IS:1504-1968) 20 pp. [En, B]

India. Indian Standards Institution. *Specification for honey.* Indian Standard (1969) (No. IS:4941-1968) 18 pp. [En, B]

India. Indian Standards Institution. *Specification for bee-hives.* Indian Standard (1970) (No. IS:1515-1969) 20 pp. [En, B]

India. Indian Standards Institution. *Specification for honey extractor, radial type.* Indian Standard (1970) (No. IS:5427-1969) 10 pp. [En, B]

India. Indian Standards Institution. *Specification for travelling bees-box.* Indian Standard (1970) (No. IS:5426-1969) 8 pp. [En, B]

India. Indian Standards Institution. *Code for conservation and maintenance of honey bees.* Indian Standard (1973) (No. IS:6695-1972) 28 pp. [En, B]

Subjects covered by this wide-ranging standard include registration of beekeepers, procurement of colonies, apiary management, migratory practices, extraction of honey and beeswax, crop pollination, conservation of bee flora, and of various species of honeybee, notifiable bee diseases, pooling, processing, testing and packing of honey, use of pesticides. Appendix E is a 9-page list of plants 'suitable for apiculture'.

India. Indian Standards Institution. *Layout for a honey*

***house. Part 1. Large scale honey handling units.* Indian Standard (1975) (No. 7849 (Part 1) 1975) 8 pp. [En, B]**

India. Indian Standards Institution. *Layout for honey processing plant.* Indian Standard (1975) (No. IS : 3891-1974) 8 pp. [En, B]

India. Indian Standards Institution. *Specification for extracted honey.* Indian Standard (1975) (No. IS: 4941-1974) 16 pp. [En, B]

India. Indian Standards Institution. *Specification for wasp trap.* Indian Standard (1975) (No. 7459-1974) 8 pp. [En, B]

Indian Bee Journal. *Honey bees in Kashmir.* Indian Bee Journal (1976) 38 (1–4) 39–41 [En, B]

India. Indian Standards Institution. *Specification for Carvia callosa honey.* Indian Standard (1977) (No. 8512-1977) 6 pp. [En, B]

India. Indian Standards Institution. *Specification for [chlorobenzilate] fumigant strips for treatment of honey-bees.* Indian Standard (1977) (No. 8444-1977) 6 pp. [En, B]
For treatment of acarine disease in *Apis cerana indica*.

India. Indian Standards Institution. *Specification for solar wax extractor.* Indian Standard (1977) (No. 8524-1977) 6 pp. [En, B]

India. Indian Standards Institution. *Specification for squeezed honey.* Indian Standard (1977) (No. IS: 8464-1977) 8 pp. [En, B]

The requirements and methods for sampling and testing of squeezed (pressed) honey are described; it is mainly honey collected from wild *Apis dorsata* nests. Chemical and physical characteristics are tabulated, and requirements for packing and marking are given. *P. Walker*
9 Bahadur Shah Zafar Marg, New Delhi 110002, India.

India, National Symposium on Pollination Ecology and Applied Palynology. *National Symposium on Pollination Ecology and Applied Palynology, March 29–31, 1979. Abstracts.* Hissar, India; Haryana Agricultural University. (1979) 50 pp. [En, B]

Section 1, on pollinators' reactions to flowers, includes abstracts of 21 papers mostly dealing with pollination by the four *Apis* spp. and other bees. Crops mentioned include cauliflower, litchi, cucurbits, sunflower, Momordia, safflower and lucerne. Various botanical aspects of pollination are described in the 26 abstracts in Section 2, and the final section of 8 abstracts covers aeropalynology and pollen allergens. *D. G. Lowe*

Indian Bee Journal. Special conference number. *Indian Bee Journal* (1979) 41 (3/4) 68pp. [En, B]

This issue was published to coincide with the 2nd International Conference on Apiculture in Tropical Climates held in Delhi, 29 February–4 March, 1980. It includes contributions on various aspects of beekeeping in India, and on honeybees (*Apis cerana* and *A. mellifera*); several of these papers are abstracted separately in *Apicultural Abstracts*. Also of interest are reviews of the work of some Indian institutions concerned with beekeeping, and a note on a pilot project for beekeeping in Bangladesh. *P. Walker*

India. Indian Standards Institution. Specification for comb foundation mill (first revision). *Indian Standard* (1979) (No. 3894-1978) 8 pp. [En, B]

Indian Standard 2072, Specification for comb foundation sheets (*Apicultural Abstracts* 229L/77), is now revised as IS 2072-1976.

University of Agricultural Sciences, Bangalore. Bee-keeping development in Karnataka. Hebbal, Bangalore, India; Department of Entomology, University of Agricultural Sciences. (1980) 10 pp. [En, B]

Indian Bee Journal. Patterns of assistance under beekeeping programme of the Khadi and Village Industries Commission. *Indian Bee Journal* (1980) 42 (3) 79–83 [En, B]

Indian Bee Journal. Work on bee pollination in India. *Indian Bee Journal* (1981) 43 (4) 140–144 [En, B]

Results of honeybee pollination demonstrations on farmers' fields are summarised. Yields on the following crops were shown to be increased by the introduction of *Apis cerana* colonies: sunflower (*Helianthus annuus*), sesame (*Sesamum indicum*), mustard (*Brassica* spp.), safflower (*Carthamus tinctorius*), horsegram (*Dolichus biflorus*), lemon (*Citrus aurantifolia*), grape (*Vitis vinifera*), lychee (*Litchi chinensis*) and cucumber (*Cucumis sativa*). *P. Walker*

Indian Bee Journal. All India Coordinated Project on Bee Research and Training. *Indian Bee Journal* (1982) 44 (1) 17–19 [En, B]

Brief outline of research and training programmes; a map gives the location of the central and regional units involved.

Indian Bee Journal. Honey production. *Indian Bee Journal* (1982) 44 (1) 26 [En, B]

Apiary honey production in India was 5037 t in 1980–1981.

Indian Bee Journal. List of bee plants suggested for propagation in the hills of Uttar Pradesh. *Indian Bee Journal* (1983) 45 (2/3) 74 [En, B]

List of 31 species with local/common names, botanical names, economic uses.

Indian Bee Journal. Dr. G. B. Deodikar commemoration volume. *Indian Bee Journal* (1986) 48 (1/4) 90 pp. [En, B]

This issue of *Indian Bee Journal* is dedicated to the memory of the late Professor G. B. Deodikar.

Indian Bee Journal. Beekeeping industry in India: progress during 198–86 under KVIC. *Indian Bee Journal* (1987) 49 (1–4) 58–60 [En, B]

Includes figures for honey and beeswax production, and discusses financial aspects.

Indian Bee Journal. Bibliography on Asiatic honey bees and Indian apiculture (publications up to 1989). *Indian Bee Journal* (1989) 51 (4) 150–153 [En, B]

This bibliography contains 113 references for items published in 1980–89.

Khadi and Village Industries Commission. Introducing: Central Bee Research and Training Institute (India). *Asian Apicultural Association Newsletter* (1993) (No. 4) 6 [En, B]

Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Veer Chaphekar Chowk, Pune 411016.

Beekeeping & Development. Zooming in on [beekeeping in] India. *Beekeeping & Development* (1994) (No. 30) 13 [En, B]

Abed, L., Abed, M. and Louveaux, J. Some honeys from Kashmir used in traditional medicine in India. [A propos de quelques miels du Cachemire utilises en medecine traditionnelle aux Indes]. *Annales Pharmaceutiques Francaises* (1983) 41 (3) 287–291 [Fr, en, B]

In India, certain honeys from Kashmir, particularly lotus and saffron honeys, are valued for their medicinal properties. Five retail samples labelled as lotus and/or saffron honey from Kashmir were examined. No samples contained pollen grains from lotus, *Nelumbium speciosum*, or saffron, *Crocus sativus*; the main pollens in four samples were from *Artemisia*, *Salvia* and *Rumex* species and the honeys were thus incorrectly labelled. The fifth honey was apparently not even from Kashmir. *P. Walker*

Lab. Matière Médicale et Pharmacologie, Inst. Pharmacie, Univ. d'Alger-Centre, Alger, Algeria.

Abrol, D. P. Bee pollinators and their host-plant relationship. *Science and Culture* (91) 57 (12) 288–290 [En, B]

Flower visitors foraging on horticultural and agricultural crop plants in Srinagar, Kashmir, India, were collected during March–December 1987. A table summarising the results shows that these crops are visited by several non-*Apis* species. *P. Munn*

Abrol, D. P. Diel pattern of *Apis cerana indica* in *Asparagus officinalis* Lin. *Science and Culture* (92) 58 (1/2) 25 [En, B]

Abrol, D. P. Foraging ecology of *Xylocopa valga* Gerst. (Hymeno: Anthophoridae) visiting almond flowers. *Science and Culture* (92) 58 (3/4) 71–72 [En, B]

Abrol, D.P. Seasonal activity, population dynamics and behaviour of bee eater birds (Coraciiformes: Meropidae) attacking honeybees. Pavo (94) 32 (1/2) 153–159 [En, Bb]
Honey bees *Apis mellifera* and *A. cerana* are preyed upon by the European bee-eater, *Merops apiaster*, and the blue-tailed bee-eater, *M. superciliosus*. Both these bird species are active from late March to early November. Their peak predatory activity occurs during April–May and September–October. Predation on honey bees was more pronounced during the earlier part of the day. *M. apiaster* was a more serious predator than *M. superciliosus*. Author 525/99 Section of Entomology Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agricultural Research Station, R. S. Pura-181-102, Jammu Tawi, Jammu and Kashmir, India.

Abrol, D.P. Occurrence of *Varroa jacobsoni* (Acari: Mesostigmata) Oudemans associated with honey bees in Jammu, India. Science and Culture (95) 61 (10–12) 205 [En, Bb]

Section of Entomology, Sher-e-Kashmir University of Agriculture, Science and Technology, Regional Agricultural Research Station, R. S. Pura, Jammu -181-102, Kashmir, India.

Abrol, D.P. Seasonal activity, flower relationships and biology of *Xylocopa valga* Gerstaecker (Hymenoptera: Anthophoridae). Korean Journal of Apiculture (96) 11 (1) 13–20 [En, Bj]

The biology of *X. valga* was studied in 1988–89 at Shalimar, Srinagar, India. The bees were active from mid-February to mid-November, foraging on 45 plant species for nectar and pollen. Nest provisioning started by mid-March and immature stages were found up to early May. Of 32 nests examined, 27 were in wooden poles used to carry electricity cables and five were in stems of *Robinia pseudoacacia*. The number of cells ranged from 13 to 15 per nest (average 13.75). Development (egg to adult) took 929–940 hours for females, 899 hours for males

Div. Entomology, Sher-e-Kashmir Univ. Sci. & Technol., Shalimar Campus, Srinagar 191121, Jammu and Kashmir, India.

Abrol, D.P. Environmental factors influencing flight activity in honey bees, *Apis cerana* Fab. and *Apis mellifera* L. (Hymenoptera: Apidae). Indian Bee Journal (98) 60 (2) 71–75 [En, Bj]

Flight activity was studied in one colony of each species during a period when bee forage in the area was abundant. In both species, flight activity was negatively correlated with relative humidity and positively correlated with ambient temperature (T), light intensity (L), solar radiation (S), and nectar sugar concentration. *A. cerana* started flying earlier in the morning than *A. mellifera* did, and also at a lower (T), (L) and (S). *A. cerana* also worked for longer periods. S directly affected the activity of *A. cerana*, and S and L directly affected that of *A. mellifera*. Author

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences & Technology, Regional Agricultural Research Station, R S Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. Foraging ecology and behaviour of the alfalfa pollinating bee species *Megachile nana* (Hymenoptera: Megachilidae). Entomologia Generalis (98) 22 (3/4) 233–237 [En, X]

The flight activity of *M. nana* foraging on *Medicago sativa* in India in April 1986 was related to some weather factors. Bees were generally most active between 12.00 and 14.00 hours. Of the five factors studied, only relative humidity and solar radiation were found to influence flight activity directly.

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, Regional Agricultural Research Station, RS Pura, Jammu-181012, Jammu & Kashmir, India.

Abrol, D.P. Mite pests of *Apis mellifera* L. in Jammu region, India. Indian Bee Journal (98) 60 (2) 99–100 [En, Bj]

202/01 Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences & Technology, Regional Agricultural Research Station, R S Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. Cultivation of *Plectranthus rugosus* Wall. in lowland areas. Insect Environment (99) 5 (1) 34 [En, X]

Cultivation of this species as a nectar source for honey bees (*Apis cerana indica* and *A. mellifera*) in lowland areas of Jammu is discussed.

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, Regional Agriculture Research Station, RS Pura, Jammu-181 102, India.

Abrol, D.P. Bear attack on beehives. Insect Environment (2000) 6 (1) 33 [En, X]

Division of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences & Technology, Shalimar, Srinagar-191 121, Jammu and Kashmir, India.

Abrol, D.P. Beekeeping with *Apis cerana* in Jammu and Kashmir: present status and future prospects. Bee World (2000) 81 (3) 149–152 [En, Bj]

86/01 Div. of Entomology, Sher-e-Kashmir, Univ. of Agricultural Sciences and Technology, Regional Agricultural Research Station, R S Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. Floral biology and foraging behaviour of honeybees visiting guava (*Psidium guajava* L.) flowers. Insect Environment (2000) 6 (1) 23 [En, X]

Division of Entomology, Shere-Kashmir Univ. of Agricultural Sciences and Technology, Shalimar Campus, Srinagar-191 121, Jammu & Kashmir, India.

Abrol, D.P. Insect pollinators of kiwifruit (*Actinidia deliciosa*). Indian Bee Journal (2000) 62 (3–4) 55–57 [En, Bj]

Div. of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, Faculty of Agriculture, R S Pusa Jammu 181102, Jammu & Kashmir, India.

Abrol, D.P. *Acacia modesta*. Bee World (2001) 82 (2) 90–91 [En, Bj]

Div. of Entomology, Sher-e-Kashmir Univ. of Agricultural

Sciences and Technology, Shalimar Campus, Srinagar 191 121, Jammu & Kashmir, India.

Abrol, D.P. Antigonon leptopus. *Bee World* (2003) 84 (3) 130–131 [En, B]

A source of pollen and nectar.

Div. of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, Shalimar Campus, Srinagar 191 121, Jammu & Kashmir, India.

Abrol, D.P. and Abrol, B.L. Important plant species for apiculture in Jammu region and their impact on beekeeping. *Journal of Animal Morphology and Physiology* (95) 42 (1/2) 57–64 [En, B]

Four honey bee species, *Apis cerana indica*, *A. dorsata*, *A. florea* and *A. mellifera*, were found to collect nectar and pollen from 162 plant species belonging to 54 families throughout the year. Bees depend on cruciferous crops (April), berseem (May), sunflower, cucurbits, bhindi and cotton (June–August), cotton, arhar and toria (September), eucalyptus, sarson, toria, bottlebrush and marigold (November–December). The major honey flow occurs during February to May. Diversity of bee flora available gives a strong indication for success in establishing.

Author

Section of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agricultural Research Station, Jammu-180 011, Kashmir, India.

Abrol, D.P. and Andotra, R.S. Contact toxicity of some pesticides to honey bee *Apis mellifera* L. *Pest Management and Economic Zoology* (97) 5 (1) 47–51 [En, X]

In contact tests, honey bee mortality increased with increases in concentration and in exposure time. Neem oil was safe for *A. mellifera*.

Regional Agricultural Research Station, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, R S Pura, Jammu, Jammu & Kashmir 168 102, India.

Abrol, D.P. and Kakroo, S.K. Observations on concurrent parasitism by mites on four honeybee species in India. *Tropical Agriculture* (97) 74 (2) 150–156 [En, 26 wf]

Apis cerana indica, *A. mellifera*, *A. dorsata* and *A. florea* in the Jammu Region were examined for the presence of mites in 1991–92. *Varroa jacobsoni* was present in *A. cerana* colonies. *Tropilaelaps clareae* was found associated with *A. mellifera*, *A. cerana* and *A. dorsata* colonies, whereas *Euvarroa sinhai* occurred with *A. florea* only. In all the honey bee species, maximum infestation of mites was observed in March–May and August–September. Phoretic mites *Neocyphophthalmus indica* and stored product mites *Tyrophagus longior*, *Caloglyphus indica* and hypoi (immature stages in the life of astigmatid mites) were also found in hives. Population dynamics of mites varied during different seasons as well as from one bee species to another.

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, Regional Agricultural Research Station, R S Pura Jammu-181 102, Jammu & Kashmir, India.

Abrol, D.P. and Kakroo, S.K. Pests, predators and pathogens of honey bee, *Apis cerana* in Jammu, India. *Indian Bee Journal* (98) 60 (3) 147–150 [En, B]

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences & Technology, Regional Agricultural Research Station, R S Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. and Kakroo, S.K. Studies on seasonal activity and control of predatory wasps attacking honey bee colonies. *Indian Bee Journal* (98) 60 (1) 15–19 [En, B]

In Jammu region, India, six *Vespa* species were observed preying on *Apis mellifera* and *A. cerana* in apiaries and in the field (*V. velutina*, *V. cincta*, *V. magnifica*, *V. orientalis*, *V. mandarina* and an unidentified sp.). *V. orientalis* was the most abundant. Peak predatory activity was recorded in July–September which was often also the period of floral dearth. Wasps could be effectively controlled by killing them by ‘flapping’ them, and by using poisoned baits. Of eight baits tested, chicken meat was the most attractive to the wasps. Baits containing 0.02% carbaryl significantly reduced the number of wasps. Author

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences & Technology, Regional Agricultural Research Station, R S Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. and Kapil, R.P. On homing ability and pollination effectiveness of bees. *Mysore Journal of Agricultural Science* (94) 28 249–252 [En, B]

Foraging range of *Pithitis smaragdula*, *Megachile cephalotes*, *M. lanata* and *Xylocopa fenestata* was studied in two seasons, October–November 1983, and April–May 1984. The results indicate that *P. smaragdula*, *Megachile* spp. and *X. fenestata* forage efficiently up to 100 m, 400 m and 2500 m, respectively. Weight and size decreased in the order: *X. fenestata*, *M. lanata*, *M. cephalotes*, *P. smaragdula*. Foraging was related to body size and energy demands of the bees. Author

Section of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agricultural Research Station, Jammu-181 102, India.

Abrol, D.P. and Kumar, R. Impact of pesticides on the brood rearing activity and foragers of honeybee, *Apis mellifera* L. visiting *Brassica campestris* L. var. *toria*. *Indian Bee Journal* (2000) 62 (1–2) 19–27 [En, B]

Colonies were monitored after nearby flowering plots were sprayed with the recommended dose of pesticide. All the pesticides caused a significant increase in no. dead bees inside and near the hive, and a decrease in the number of frames covered with bees and in brood area.

Div. of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences and Technology, Faculty of Agriculture, R S Pusa Jammu 181102, Jammu & Kashmir, India.

Abrol, D.P. and Parmar, S. Ant pests of honey bees and their management. *Indian Bee Journal* (98) 60 (1) 22–26 [En, B]

Section of Entomology, Sher-e-Kashmir Univ. of Agricultural Sciences & Technology, Regional Agricultural

Research Station, R S Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. and Putatunda, B.N. *Discovery of the ectoparasitic mite Tropilaelaps koenigerum Delfinado-Baker and Baker (Acari: Laelapidae) on Apis dorsata F., A. mellifera L. and A. cerana F. in Jammu and Kashmir, India.* *Current Science* (95) 68 (1) 90 [En, X]

Abrol, B.L. and Abrol, D.P. *Significance of environmental cues in pollination activity of bees Andrena ilderda.* *Environment and Ecology* (1986) 4 (1) 169–171 [En, Bb]

Andrena ilderda bees were observed to hover for a few seconds above the nest entrance when first leaving it in order to orientate themselves before flying away to forage. When returning they hovered in a circle about 90 cm from the ground over the nest entrance, alighted away from the entrance and walked to it. Slight disturbance to the nest entrance did not affect this behaviour but removal of pebbles, sticks or leaves resulted in the bees being unable to locate the nest. If the nest was disturbed while the bee was inside, it made a fresh orientation flight to acquaint itself with the changed surroundings. *J.M. Gedye*
Dept. Zoology, Intermediate Coll., Nowshera, India.

Abrol, D.P. *Eco-physiological adaptations between pollinating bees and their flowers.* *Environment and Ecology* (1986) 4 (1) 161–162 [En, Bb]

At Hissar, India, the minimum threshold temperature for initiation of foraging activity by *Apis* spp. was 15°C. Nectar secretion in *Brassica juncea*, a plant pollinated by *Apis* spp., began at 12° and nectar was observed in most nectaries as the temperature reached 15°. Nectar secretion reached a first peak at 10.00–11.00 hours, declined at mid-day, probably because of evaporation, and reached a second peak at 15.00 hours. *J.M. Gedye*
Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. *Analysis of environmental factors affecting foraging behaviour of Megachile bicolor F on Crotalaria juncea L.* *Proceedings, Indian National Science Academy, B* (1987) 53 (1) 21–26 [En, Bb]

Studies were made in September–October, 1984, in Hissar, India, to examine the foraging activity of *M. bicolor* on *C. juncea* in relation to seven environmental variables. Commencement of flight activity occurred only when a minimum threshold of environmental factors was passed, while the cessation of foraging activities was governed mainly by the fast decline in light intensity and solar radiation. Between the initiation and cessation, the foraging population exhibited a highly significant positive correlation with air temperature, light intensity, solar radiation, soil temperature and nectar sugar concentration, but it was negatively correlated with relative humidity. There was no significant association with wind velocity. Path coefficient analysis revealed that the direct effects of solar radiation and soil temperature were pronounced, followed by light intensity, but the direct effects of the other variables were low, although their relationship with bee activity was strengthened through their favourable or unfavourable interactions with other factors. *Author*

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. *Influence of thermal and energetic constraints on the pollination activity of carpenter bee Xylocopa pubescens.* *Environment and Ecology* (1987) 5 (1) 90–93 [En, Bb]
Studies were made in May–October, 1984, in Hissar, India, to examine the foraging activity of the bee *X. pubescens* on *Helianthus annuus*, *Cajanus cajan* and *Crotalaria juncea* in relation to temperature, solar radiation and available nectar. The bees exhibited a bimodal pattern of activity which was negatively correlated with temperature and solar radiation and positively with nectar volume (micro l/flower). Foraging activity was low when the temperature exceeded 35°C and solar radiation 38 mW/cm², thus maximum pollination occurred early in the morning and late in the afternoon, on all three crops. *Author*
Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. *Interrelationship and path coefficient analysis of environmental factors influencing pollination activity of Apis dorsata F. on Prunus persica L.* *Tropical Ecology* (1987) 28 147–154 [En, fr\ it\ es, Bb]

Pollination activity of *Apis dorsata* on *Prunus persica* flowers commenced only when a minimum threshold of environmental factors was attained, while the cessation of pollination was governed mainly by a decline in light intensity and solar radiation.

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. *Ecology and behaviour of three bee species pollinating loquat (Eriobotrya japonica Lindley).* *Proceedings of the Indian National Science Academy, B* (1988) 54 (2/3) 161–163 [En, Bb]

The foraging behaviour of *Apis cerana*, *Bombus asiaticus* and *B. albopileus* on flowers of loquat (*Eriobotrya japonica*) was studied at four sites in India.

Div. Entomology, Univ. Agric. Sci. & Technol., Shalimar Campus, Srinagar 191121, India.

Abrol, D.P. *Effect of climatic factors on pollination activity of alfalfa-pollinating subtropical bees Megachile nana Bingham and Megachile flavipes Spinola (Hymenoptera: Megachilidae).* *Acta Oecologica* (1988) 9 (4) 371–377 [En, Ba]

The flight activity of *Megachile nana* and *M. flavipes* on *Medicago sativa* began when a minimum threshold of environmental factors was achieved. *M. flavipes* had a lower threshold than *M. nana* and began foraging earlier in the day. Cessation of foraging was initiated by a rapid decline in light intensity and solar radiation. Bee abundance was positively correlated with air temperature, light intensity, solar radiation and nectar sugar concentration, and negatively correlated with relative humidity.

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. *Foraging range of alfalfa pollinating Megachile flavipes Spinola and Megachile nana Bingham (Megachilidae: Hymenoptera).* *Journal of Animal Morphology and Physiology* (1988) 35 (1) 11–16 [En, Bb]

Marked individuals of *Megachile flavipes* and *M. nana* were released at distances of up to 800 m from their nest sites. *M. flavipes* individuals were able to orient efficiently at up to 250 m whereas the orienting range of *M. nana* was 150 m. *M. flavipes* had a body weight of 43.72 mg, compared with 27.17 mg in *M. nana*, and 13.70 wing hooks compared with 8.50. J. M. Gedye
Dept. Zoology, Haryana Agric. Univ., Hisar 125004, India.

Abrol, D.P. Pollination studies in almond (*Prunus amygdalus* L). *Current Science* (1988) 57 (7) 397–398 [En, Bc]
Flowers of almond (*Prunus amygdalus*) [*Prunus dulcis*] grown in India were self-incompatible and set no fruit when covered with muslin. Uncovered flowers set 30 fruits per 100 flowers. The main insect visitors were *Apis cerana*, *Xylocopa fenestrata* and *Lasioglossum* sp. All species were active on sunny days, but on cloudy days no individuals of *Lasioglossum* were observed and numbers of the other species were reduced. *A. cerana* and *X. fenestrata* began foraging at 8°C whereas *Lasioglossum* did not become active before the temperature reached 13.5°C. J. M. Gedye
Div. Entomology, Univ. Agric. Sci. & Technol., Shalimar Campus, Srinagar 191121, India.

Abrol, D.P. Studies on abundance, diversity, behaviour and importance of native pollinators for crop production. *Korean Journal of Apiculture* (1989) 4 (2) 25–40 [En, ko, Bj]
Observations on insect pollinators were carried out in Srinagar, Kashmir, India, during the blooming period of several fruit and field crops in 1987–1988. The 20 species caught were from 12 families of *Hymenoptera* and *Diptera*. Honeybees (*Apis cerana* and *A. mellifera*) were the most numerous visitors and the most important pollinators. *Xylocopa valga*, *Bombus asiaticus*, *B. albopileus* and *B. similis* were important pollinators of solanaceous and leguminous crops. Halictine bees, *Halictus* sp. and *Lasioglossum* sp., were important pollinators of fruit and Brassica crops, whereas hoverflies (*Syrphidae*), houseflies (*Muscidae*) and black ants (*Formica* sp.) seemed to be efficient pollinators of umbelliferous crops. Author
Div. Entomology, Sher-e-Kashmir Univ. Agric. Sci. & Technol., Shalimar Campus, Srinagar 191 121, Jammu & Kashmir, India.

Abrol, D.P. Studies on ecology and behaviour of insect pollinators frequenting strawberry blossoms and their impact on yield and fruit quality. *Tropical Ecology* (1989) 30 (1) 96–100 [En, fr, es, pt, Bb]
The main insect visitors to flowering strawberry plants on an observation plot in Srinagar, Kashmir, were honey bees (*Apis cerana*) and *Lasioglossum* sp. The honey bees, although less numerous, visited an average of 6.2 flowers/minutes compared with 3.0/minutes for *Lasioglossum*.
Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences & Technology, Srinagar 191121, Jammu and Kashmir, India.

Abrol, D.P. Bee pollinators and their host-plant relationship. *Science and Culture* (1991) 57 (12) 288–290 [En, Bb]
A survey was conducted of all bee species visiting horticultural and agricultural crops during March–December

1987 in Kashmir, India. Non-*Apis* pollinators included *Andrena flavipes*, *Xylocopa valga*, *Amegilla* spp., *Colletes eous*, *Lasioglossum* sp., *Halictus* sp., *Bombus* spp. and *Megachile* sp., which were all considered to be important potential pollinators if conserved and managed. J. M. Gedye
Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, R. S. Pura (Jammu)-181/102, Jammu & Kashmir, India.

Abrol, D.P. Conservation of pollinators for promotion of agricultural production in India. *Journal of Animal Morphology and Physiology* (1991) 38 (1/2) 123–139 [En, Bb]
In this review, with 55 references, the non-*Apis* bee pollinators of a range of crops in India are listed and their importance as pollinators is indicated. Progress made in management of wild bee species for pollination of crops is outlined and the importance of further research in this area is emphasised. J. M. Gedye
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Srinagar-191 121, Jammu & Kashmir, India.

Abrol, D.P. Foraging strategies of honeybees in pollinating apple flowers. *Journal of Animal Morphology and Physiology* (1991) 38 (1/2) 109–113 [En, Bb]
Apis cerana workers were observed foraging on Golden Delicious apple flowers near Srinagar, India. Nectar collectors were predominant in the morning. P. Walker
Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar Campus, Srinagar 191/121, Jammu & Kashmir, India.

Abrol, D.P. Diel pattern of *Apis cerana indica* in *Asparagus officinalis* Lin. Calcutta, India; Indian Science News Association. *Science and Culture* (1992) 58 (1/2) 25 [En, Ba]
The numbers of honey bees (*A. c. indica*) foraging on plots of *Asparagus officinalis* were recorded from 10.00 to 16.00 hours. Bee numbers increased from 9/m² at 10.00 hours to a maximum of 53/m² at 13.00 hours. There were still 21/m² at 16.00 hours. The importance of *A. officinalis* as a source of nectar and pollen in Kashmir during the lean period of May–June is emphasised. J. M. Gedye
Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, R.S. Pura (Jammu)-181 102, Jammu & Kashmir, India.

Abrol, D.P. Possible immune mechanism in indigenous honeybee *Apis cerana indica* F. against 'Thai sac brood virus'. *Journal of Animal Morphology and Physiology* (1992) 39 (1/2) 165–166 [En, Bb]
A report is given of an outbreak of Thai sac brood virus which destroyed 50 colonies of *Apis cerana indica* in an apiary in Kashmir. Of the five remaining colonies, one had a severe infection, another showed a small amount of infection and the other three were free from symptoms. Reports from other apiaries indicated that 5.6% of colonies had resisted the disease. *A. mellifera* colonies were unaffected. J. M. Gedye
Division of Entomology, Sher-e-Kashmir University of Agricultural Science & Technology, Shalimar Campus, Srinagar-191/121, Jammu & Kashmir, India.

Abrol, D.P. Ecology and utilisation of insect pollinators frequenting pear flowers and their impact on fruit production. *Korean Journal of Apiculture* (1993) 8 (1) 18–21 [En, Bj]

Fruit set on pear trees (*Pyrus communis*) in Shalimar, India, was much higher on open-pollinated flowers compared to those where pollinating insects were not allowed access. The flower visitors were bees (*Lasioglossum* sp., *Colletes*), flies (*Musca* sp., *Syrphus* sp.), mosquitoes, black ants, thrips and butterflies. Of the various flower visitors, *Lasioglossum* sp. was the most abundant (80%).

Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar Campus, Srinagar-191/121, Jammu & Kashmir, India.

Abrol, D.P. Honeybee-virus infection and immunity. *Korean Journal of Apiculture* (1993) 8 (2) 116–118 [En, ko, Bj]

The possibility of immunity in honey bees against Thai sac brood virus (TSBV) infections was studied. A survey of bee-keeping areas in Kashmir revealed that 5.7% of colonies of *Apis cerana* were free from viral infections and did not show any apparent symptoms of the disease. The results also indicated that percentage mortality in hived colonies was much higher (96.3%) than in feral colonies (79.2%). The results suggest that hive bees are more susceptible to viral infections compared to feral colonies, which seem to have more immunity than hive bees. *Author*

Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agri. Res. Station, R. S. Pura-181/102, Jammu & Kashmir, India.

Abrol, D.P. New pollinator bee. *Current Research – University of Agricultural Sciences (Bangalore)* (1993) 22 (9/10) 130 [En, Bc]

Andrena flavipes was collected from the flowers of almond, apple, cherry, peach, pear, plum, strawberry and Brassica. This is the first record of *A. flavipes* in India. *A. flavipes* emerged in March and April and foraged at 13–14°C on clear sunny days.

Section of Entomology, RARS, SKUAST, R.S. Pura, Jammu (J&K), India.

Abrol, D.P. Comparative ecology of European and Asian honeybee species in subtropical and temperate climates.

1. Beekeeping and honey resources in subtropical-temperate transition climate of Jammu. *Korean Journal of Apiculture* (1994) 9 (1) 11–20 [En, ko, Bj]

Plant species in this area in the foothills of the north-west Himalayas which provide honey bee forage are listed, with details of scientific and common names, flowering period, nectar/pollen source and abundance. In all, 162 plant species belonging to 54 families were foraged on by the four honey bee species (*Apis cerana*, *A. mellifera*, *A. dorsata*, *A. florea*) during the study period, March 1990 to March 1991. The major flow occurred in February–May. *D.G. Lowe*

Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agric. Res. Station, R. S. Pura Jammu 181/102, Jammu & Kashmir, India.

Abrol, D.P. Studies on abundance, diversity and behaviour of insect visitors of okra (*Hibiscus esculentus* L. (Moench))

blossoms and their importance as pollinators. *Korean Journal of Apiculture* (1995) 10 (1) 1–4 [En, Bj]

Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agri. Research Station, R. S. Pura Jammu Tawi 181 102 (J & K), India.

Abrol, D.P. A contribution to the floral biology of *Acacia modesta* Wall. and its importance as a source of forage to honey bees. *Indian Bee Journal* (1996) 58 (3) 134–136 [En, Bj]

Section of Entomology, Sher-e-Kashmir University of Agricultural Sciences & Technology, Regional Agricultural Research Station, R. S. Pura 181 102, Jammu & Kashmir, India.

Abrol, D.P. Incidence of *Varroa jacobsoni* Oudemans in *Apis cerana* F. colonies in Jammu, India. *Indian Bee Journal* (1996) 58 (1) 15–17 [En, Bj]

Section of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, R. S. Pura, Jammu 181 102, India.

Abrol, D.P. Sunflower pollination: abundance and diversity of pollinating insects and their effect on seed yield. *Indian Bee Journal* (1996) 58 (2) 60–63 [En, Bj]

Insect visitors were recorded on fields of *Helianthus annuus* in Jammu, India. *Bombus haemorrhoidalis* constituted 34% of the total, *Apis cerana* 26%, *Xylocopa aestuans* 8% and *Halictus* sp. 6%; *Syrphus* sp. (Diptera) was also quite common (16%). *A. cerana* was the first to start foraging, at about 06.00 hours, and continued until 17.45 hours. This species and bumble bees had two peaks of foraging activity. Bumble bees visited 1.90 capitula/min, *Xylocopa* 1.74 and *A. cerana* 1.28. Seed set and yield parameters were higher on plots caged with bees than on open-pollinated plants; results were much lower on plants caged to exclude insects. *P. Walker*

Section of Entomology, Sher-e-Kashmir University of Agricultural Sciences & Technology, Regional Agricultural Research Station, R. S. Pura, Jammu 181 102, Jammu & Kashmir, India.

Abrol, D.P. Bees and beekeeping in India. Ludhiana, India; Kalyani Publishers. (1997) 450 pp. [En, Bd]

This is a basic beekeeping textbook covering: history of beekeeping; beekeeping for beginners; honey bee biology and social behaviour; hives and equipment; bee forage; aspects of management, including migratory beekeeping; pests and diseases; breeding and queen rearing; hive products, including marketing; pollination, including non-*Apis* bees; honey bees as environmental indicator organisms. The five appendices give information on publications and visual aids, beekeeping suppliers in India, training courses, honey analysis, and economic considerations. There is also a 14-page reference section, and author and subject indexes. *D.G. Lowe*

Abrol, D.P. Honey bee diseases and their management. Ludhiana, India; Kalyani Publishers. (1997) viii + 194 pp. [En, Bd]

This is a compilation of material from a number of sources covering bacterial, viral and fungal diseases of adult honey

bees and honey bee brood, parasitic infestations, and non-infectious disorders. The appendices include a list of books, visual aids, and journals on beekeeping. There are subject and author indexes. D. G. Lowe

Abrol, D.P. and Bhat, A.A. Influence of behaviour of *Apis cerana indica* Fabr. on cross pollination in apple. *Indian Bee Journal* (1989) 51 (3) 103–104 [En, B]

The foraging behaviour of *A. cerana* on five branches of different trees of Golden Delicious was observed from 09.00 to 17.00 hours.

Abrol, D.P. and Bhat, A.A. New record of *Xylocopa valga Gerstaecker* (Hymenoptera: Anthophoridae) from India. *Current Science* (1989) 58 (1) 41 [En, B]

This species was found foraging on almond flowers, and the possibility of its management for pollination is discussed.

Abrol, D.P. and Bhat, A.A. Studies on 'Thai sac brood virus' affecting indigenous honeybee *Apis cerana indica* Fab. colonies – prospects and future strategies – I. *Journal of Animal Morphology and Physiology* (1990) 37 (1/2) 101–108 [En, B]

Symptoms of Thai sac brood virus (TSBV) are described. No method has been found for treating affected colonies, and in Kashmir over 94% of *A. cerana* colonies in movable-frame and wall hives have been killed. A survey showed that a few colonies survive in some areas. These may well possess some resistance or immunity to TSBV, and a selective breeding programme has been started. Problems that are likely to be caused by recent introductions of *A. mellifera* are outlined, and it is suggested that efforts should be made to rebuild the *A. cerana* population. P. Walker
Division of Entomology, Shere-e-Kashmir University of Agricultural Sciences & Technology, Shalimar Campus, Srinagar 191 121, Jammu & Kashmir, India.

Abrol, D.P., Bhat, A.A. and Khan, A.R. On pollinating bees of Kashmir. *Indian Bee Journal* (1989) 51 (3) 107–108 [En, B]

The following information is given for 25 crop plants: common and botanical names, family, flowering period, non-*Apis* bees that visit the flowers. P. Walker
Division of Entomology, S. K. University of Agricultural Sciences and Technology, Shalimar Campus, Srinagar 191/121, Jammu & Kashmir, India.

Abrol, D.P. and Kakroo, S.K. Studies on seasonal activity and control of wax moths (*Galleria mellonella* L. and *Achroia grisella* F.) attacking combs of four honeybee species. *Mysore Journal of Agricultural Sciences* (1996) 30 (4) 365–373 [En, 21 ref.]

In field studies conducted in India, larvae of *Galleria mellonella* and *Achroia grisella* were recorded infesting colonies of *Apis mellifera*, *A. dorsata*, *A. cerana indica* and *A. florea*. Peak infestations occurred from May onwards, up to September.

Sher-e-Kashmir University of Agricultural Sciences & Technology, R.S. Pura, Jammu-181102, India.

Abrol, D.P., Kakroo, S.K. and Putatunda, B.N. Stored product mite *Tyrophagus longior* (Gervais) (Astigmata: Acaridae) with bee hives in India. *Current Science* (1994) 66 (2) 105 [En, 8 ref.]

The stored products mite *Tyrophagus longior* is reported associated with hives (specifically in honeycombs and hive debris) of *Apis mellifera* in India for the first time.

Section of Entomology, Shere-Kashmir University of Agricultural Sciences and Technology, Regional Agricultural Research Station, R. S. Pura, Jammu 181 102, India.

Abrol, D.P. and Kapil, R.P. Factors affecting pollination activity of *Megachile lanata* Lepel. *Proceedings of the Indian Academy of Sciences, Animal Sciences* (1986) 95 (6) 757–769 [En, B]

The daily start of foraging by *M. lanata* on *Crotalaria juncea* was usually between 08.00 and 09.00 hours, but it varied from day to day and was probably most affected by various ambient conditions.

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. and Kapil, R.P. Foraging range of *Andrena ilerda* and *Andrena leaena* (Hymenoptera: Andrenidae). *Research and Development Reporter* (1988) 5 (1/2) 65–67 [En, B]

Marked individuals of *Andrena ilerda* and *A. leaena* were released at different distances from their nest sites. All *A. ilerda* individuals returned from 400 m. After this distance the number declined and only a few bees returned from 1100 m. In *A. leaena*, the distance from which all individuals returned was 300 m, although a few returned from 1000 m.

Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. and Kapil, R.P. Pollination studies in *Crotalaria juncea* L. *Science and Culture* (1988) 54 (7) 243–244 [En, B]

Observations of a crop of *Crotalaria juncea* at Hissar, India, showed that *Megachile lanata* was the main pollinator (47.38% of bees observed), followed by *Apis dorsata* (16.72%). *M. flavipes* (7.36%) and *Xylocopa fenestrata* (7.30%). The emergence of *M. lanata* was synchronised with the flowering period of *C. juncea*. J. M. Gedye

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Abrol, D.P. and Katwal, D.R. Occurrence of *Varroa jacobsoni* Oudemans in Jammu, India on honeybee. *Insect Environment* (1996) 2 (2) 48 [En]

Varroa jacobsoni was recorded for the first time as an ectoparasite of *Apis cerana indica* in Jammu & Kashmir, India, in 1993.

Sher-e-Kashmir University of Agricultural Sciences and Technology, RRS, Pura, Jammu 181 102, J&K, India.

Adlakha, R.L. Egg laying capacity of *Apis mellifera* queens. *Indian Bee Journal* (1972) 34 (1/2) 20–23 [En, B]

A study of the egg-laying capacity of *A. mellifera* queens was conducted at Nagrota in the Kangra Valley. The brood area in five colonies headed by newly mated queens was measured on every twenty-first day during one year. The average

daily rate of laying varied from 287 to 462 (mean 374) over the year, and from 871 to 1368 (mean 1180) during maximum brood rearing activity (March to April).
Dept. Zoology-Entomology, Himachal Pradesh Univ., Palampur (Kangra), India.

Adlakha, R. L. Acarine disease of adult honey bees in India. *American Bee Journal* (1976) 116 (7) 324, 344 [En, B]

Acarine disease was first reported in India in 1956. In a survey of the whole of India during 1962–1967 it was found to be present only in the northern states, and this is still true. It is found only in *Apis cerana*, and in some *A. mellifera* which were infected from native bees (they were disease-free when imported). It has not been found in *A. dorsata* or *A. florea*. The following were tested as fumigants against the mite: (a) Folbex; (b) methyl salicylate (ineffective); (c) menthol (ineffective); (d) a mixture of nitrobenzene, methyl salicylate and petrol, which was effective, but induced severe and uncontrollable robbing, and damaged brood. The usual treatment with Folbex during the active period is thus recommended. If treatment is necessary during a dearth period, a push-in cage should be used to isolate the queen, which should be released 1–7 days after treatment. In the conditions of the low hills of India, April is the best time for prophylactic fumigation. *P. Walker*
Dept. Entomology, Himachal Pradesh Univ., Himachal Pradesh, India.

Adlakha, R. L. and Dhaliwal, H. S. Insect pollination of seed cauliflower (*Brassica oleracea* var. *botrytis*) with particular reference to the role of honey bees. *Indian Bee Journal* (1979) 41 (1/2) 13–16 [En, B]

This review discusses the importance of *Apis cerana* and refers to work on competition between this species and *A. mellifera* on cauliflower, and problems of insecticide poisoning of bees. *P. Walker*

Dept. Entomology, Himachal Pradesh Krishi Vishva Vidyalaya, Solan 173 213, India.

Adlakha, R. L. and Sharma, O. P. Intraspecific robbing. *American Bee Journal* (1974) 114 (7) 248–249 [En, B]

Goyal thought that *Apis mellifera* (A.m.) would eventually dominate *A. cerana indica* (A.c.) in certain areas when both species were kept there. Robbing by A.m. of A.c. colonies in the Kangra Valley, Himachal Pradesh, has been observed during poor nectar flow, but only when the day temperature was 13–32°C. When the maximum temperature dropped below 18°C, A. m. colonies became less active, whereas A. c. continued to work, and also attempted (unsuccessfully) to rob A.m. colonies. A mixed apiary of six A. m. colonies and 16 A. c. colonies is being kept in this valley. *P. Walker*
Coll. Agric., Himachal Pradesh Univ., Palampur, India.

Adlakha, R. L. and Sharma, O. P. *Apis mellifera* vs. *Apis indica*. *Gleanings in Bee Culture* (1975) 103 (5) 160 [En, B]

Adlakha, R. L. and Sharma, O. P. *Stylops* (Strepsiptera) parasites of honey bees [*Apis cerana*] in India. *American Bee Journal* (1976) 116 (2) 66 [En, B]

Aggarwal, K. Incidence of *Tropilaelaps clareae* on three *Apis* species in Hisar (India). Africanized honey bees and

bee mites [edited by Needham, G. R., Page, R. E., Jr., Delfinado-Baker, M. and Bowman, C. E.]. Chichester, UK; Ellis Horwood. (1988) 396–403 ISBN 0-7458-0319-9 [En, Bd]

The geographical distribution of *T. clareae* on its known hosts (*A. dorsata*, *A. mellifera*, *A. cerana*, *A. laboriosa* and *A. florea*) is summarised. In Hisar, India, *T. clareae* reproduces on *A. mellifera* in January–March, and on *A. dorsata* in March–May. On *A. florea*, adult female mites have been found only on adult bees; no mites have been found inside sealed worker or drone cells. Infestations on *A. florea* are always very low. *D. G. Lowe*

Acarology Lab., Dept. Zoology, Haryana Agric. Univ., Hisar 125004, India.

Aggarwal, K. and Kapil, R. P. Seasonal population dynamics of *Tropilaelaps clareae* (Acari: Laelapidae) in *Apis dorsata* colonies. Progress in acarology. Volume 2 [edited by Channabasavanna, G. P. and Viraktamath, C. A.]. New Delhi, India; Oxford & IBH Publishing Co. (1988) 283–286 [En, Ba]

Apis dorsata colonies located on the plains of the Hisar district, Haryana, India, were inspected for the presence of *T. clareae* during the period March 1982 to April 1985. The highest infestation levels occurred in March and April. The mite appeared to reproduce between March and May when eggs, larvae and nymphs were seen inside sealed brood cells. *T. clareae* showed no significant affinity for drone brood and was found infesting both drone and worker brood. *D. G. Lowe*

Acarology Lab., Dept. Zoology, Haryana Agric. Univ., Hisar, Haryana 125 004, India.

Ahmad, R. Beekeeping with Indian hive bee *Apis cerana indica* F. in the Andaman and Nicobar Islands. *Indian Bee Journal* (1993) 55 (1/2) 1–8 [En, Bj]

Apis cerana colonies have been successfully kept (in hives) on the islands since 1980. Flowering plants provide a good nectar flow from January to May, but careful colony management is needed during the prolonged rainy season (June–October). Feeding with sugar has been found impractical because of the unpredictable weather and the high humidity, so it is essential to leave enough honey in a hive for the dearth period. Average honey yield per colony is about 3.5 kg, but in coconut groves, where the dense canopy protects foraging bees, colonies continue to make honey in the rainy season. In the post-rainy season (October–December) colonies build up again rapidly in some areas, and swarming coincides with the start of flowering in January. *Galleria mellonella* and *Vespa orientalis* are major pests of *A. cerana* on the islands, and termites can be a problem, but no diseases have been found. It is concluded that the potential for the development of beekeeping is considerable. *P. Walker*

Central Agricultural Research Institute, Port Blair 744 101, India.

Ajay Kumar, Rana, B. S. and Gupta, J. K. Incidence and extent of damage by predatory wasps to honey bees at Solan, Himachal Pradesh. *Pest Management and Economic Zoology* (98) 6 (1) 37–42 [En, X]

Four species of wasp were observed visiting an *Apis mellifera* apiary in Himachal Pradesh. *Vespa auraria* queens were present from March to mid-June 1996; the average number

of workers of this species increased from 64.4/day in mid-June to a max of 282.4/day in early September and then decreased again by the third week of December 1996. *V. basalis* was present from late August until December with a maximum of 29.5/day in November. *V. cincta* [*V. tropica*] was seen in the apiary from September, with a max of 7/d in October. Only a few *V. magnifica* workers were observed there throughout the year. Only *V. auraria* is considered to be a serious threat to *A. mellifera* due to its continuous presence in the apiary and capacity to kill up to 96.3 bees in 30 minutes and as many as 718 bees in a period of 4 hours during Sept.

Dept of Entomology & Apiculture, Dr Y.S. Parmar Univ. of Horticulture & Forestry, Solan, Himachal Pradesh 173 230, India.

Aluri, R. J. S., Subba Reddi, C. and Rama Das, K. Temporal dioecism and pollination by wasps and bees in *Allophylus serratus* (Roxb.) Radlk. (Sapindaceae). *Plant Species Biology* (98) 13 1–5 [En, Bj]

The phenology and pollination mechanism of the flower are described. The most frequent visitors were two species of nectar-foraging wasps, followed by *Apis cerana*, *A. dorsata*, *Trigona* sp. and *A. florea*; the bees collected nectar and/or pollen. P. Walker

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Aluri, R. J. S. Ecology of pollination in *Pedicularis racemosa* var. *alba* (Pennell) Cronq. (Scrophulariaceae) on Olympic Mountains in North America. *Proceedings of the Indian National Science Academy. Part B, Biological Sciences* (1992) 58 (4) 209–216 [En]

P. racemosa is obligately dependent upon *Bombus* workers that remove pollen by vibration from its short-tubed, nectarless, rostrate, white flowers which reflect visible light attractive to bumble bees. All four *Bombus* species in the study areas pollinated the plant; *B. mixtus* was most abundant. Analysis of corbicular pollen loads of *Bombus* pollinators in one area showed that pollens of other species were also present (*Pedicularis bracteosa*, *Polygonum*, *Valeriana*, *Lupinus*, *Erigeron* and *Bidens*), while pollen loads in corbicular collections in another area indicated homogeneous pollen, suggesting *Bombus* fidelity to *Pedicularis racemosa alba*. Phenological considerations are discussed. Dept. Environ. Sciences, Andhra Univ., Waltair 530 003, India.

Ananthakrishnan, T.N. The role of thrips in pollination. *Current Science* (1993) 65 (3) 262–264 [En, Bj]

This article reviews, with 18 references, the role of thrips in the pollination of some members of the *Asteraceae* [*Compositae*], *Solanaceae* and *Fabaceae* [*Leguminosae*]. Entomology Research Institute, Loyola College, Madras 600/034, India.

Anderson, P.N. Community-based conservation and social change amongst south Indian honey-hunters: an anthropological perspective. *Oryx* (2001) 35 (1) 81–83 [En, 14 wf.]

The involvement of a South Indian honey-hunting 'tribe' with an ecodevelopment programme and the market econ-

omy is discussed, and it is noted that the commercialisation of traditional livelihoods may increase the general standard of living but may also undermine the social fabric of the community. It is suggested that social development should precede economic development for communities in transition between subsistence and commodity-orientated economic practices.

Inst. of Ecology and Resource Management, Univ. of Edinburgh, Kings' Buildings, Edinburgh EH9 3JU, UK.

Anita, M., Sivaram, V. and Reddy, C. C. The bee flora, pesticidal application and honeybee poisoning in south Karnataka. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G. K., Shaanker, R. U. and Ganeshiah, K. N.]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 238–240 [En, Bd]

In the area studied, the bee flora comprised 321 plant species from 67 families. Plants yielding both nectar and pollen represented 59.81% of the total. Laboratory tests of 17 insecticides used in the area showed that all except BHC and malathion were highly toxic to honey bees. The percentage of species of bee flora normally sprayed with insecticide was comparatively low (24%), consisting mainly of cultivated crops. J.M. Gedye

Department of Zoology, Bangalore University, Bangalore 560 056, India.

Aparna, A. R. and Rajalakshmi, D. Honey – its characteristics, sensory aspects, and applications. *Food Reviews International* (99) 15 (4) 455–471 [En, Ba]

A review of the properties, processing and uses of honey. The ISI/Agmark specifications for honey and the detection of adulteration are discussed.

Dept of Sensory Science, Central Food Technological Research Inst., Mysore 570 013, Karnataka, India.

Arif, M. and Kumar, N. Occurrence of pollinator bees in Leh: Ladakh (Jammu & Kashmir) at 3430 metres (11,200 feet) altitude in India. *Entomologist's Record* (97) 109 205–206 [En, Bc]

In a survey of insects on crop plants (*Brassica campestris*, *B. juncea*, *B. rapa*, *B. oleracea* var. *gonglyodes*, *Raphanus sativus*, *Daucus carota* and *Allium cepa*), two bee species were recorded. *Andrena peregrina* was found at low densities on all crops (3–10 bees/plant) and seemed to be actively pollinating the flowers. The bees carried pollen in their pollen baskets. An unidentified *Colletes* species was also present (1–4 bees/plant). P. Walker

Defence Agricultural Research Laboratory, Pithoragarh 262502, India.

Arun, Kumar and Chandel, Y.S. Pattern of nuptial flight of *Apis mellifera* L. during different seasons in the hills of northern India. *Pest Management and Economic Zoology* (2000) 8 (1) 29–34 [En, X]

In the Kangra valley of Himachal Pradesh, well-synchronised nuptial flights of drones and queens occurred on calm sunny days during the spring, summer and monsoon seasons. Drones started flying around midday, with a peak between 14.00 and 16.00 hours. Virgin queens generally

made two orientation flights before mating. Spring was found to be the best season for mating.

CSK Himachal Pradesh Krishi Vishvavidyalaya, Bee Research Station, Nagrota Bagwan, Himachal Pradesh 176 047, India.

Arun, Kumar, Srivastava, S. and Chandel, Y.S. Symptomatology and behaviour of Thai sac brood virus (TSBV) infected honey bee colonies. *Insect Environment* (99) 5 (3) 103–104 [En, wf]

Following reports of problems with *Apis cerana* colonies in parts of Himachal Pradesh, India, during 1993, the colonies were examined. Bees were seen to leave their hives and to enter other colonies which then deserted 7–8 days later. The pattern was repeated, and 50–92% of colonies in different apiaries were found to have died or absconded. Various peculiarities were observed within the hive, and examination of samples of scales and different stages of brood confirmed that the losses were caused by Thai sac brood virus. Pupae were free of the disease, and *A. mellifera* in the same area were not susceptible to this strain of the virus.

HPKV Bee Research Station, Nagrota Bagawan, 176 047, India.

Arun, Kumar, Srivastava, S. and Kashyap, N.P. Susceptible age of *Apis mellifera* L. workers to acarine. *Insect Environment* (99) 5 (3) 141–142 [En, wf]

Three groups of marked *A. mellifera* workers (5, 7 or 14 hours old) from an uninfected colony were released into a colony heavily infested by *Acarapis woodi*. Generally the marked bees became infested from 32 hours old (mites observed in the tracheae), but an adult mite was found on the thorax of a bee released at 5 hours and in contact with the colony for 16 hours, so a worker may become infested only 24 hours after emergence.

Bee Research Station, Himachal Pradesh, Krishi Vishvavidyalaya, Nagrota Bagwan-176 047, India.

Arun, Kumar, Srivastava, S. and Kashyap, N.P. Infestation phenology of *Tropilaelaps clareae* Delfinado and Baker and *Acarapis woodi* (Rennie) in *Apis mellifera* L. and *Apis cerana* Fab. *Journal of Entomological Research* (2001) 25 (1) 41–46 [En, 15 wf.]

In *A. mellifera*, infestation of brood by *T. clareae*, as well as mite mortality, showed two peaks (June–July and October–November). In both honey bee species, *A. woodi* infestation remained quite low during March–May and was high in October–November. The proportion of acarine-infested bees was strongly correlated with the highest number of mites per trachea. Confinement of bees in the colony either due to rain or cold, or conditions unfavourable to colony development, may enhance mite infestation.

Himachal Pradesh Krishi Vishvavidyalaya, Bee Research Station, Nagrota Bagwan – 176047, HP, India.

Arya, D.R., Sihag, R.C. and Yadav, P.R. Role of insect pollination in seed yield of sunflower (*Helianthus annuus* L). *Indian Bee Journal* (1994) 56 (3/4) 179–182 [En, Bj]

Seed yield and oil contents of seed from two cultivars, EC-68415 and MSFH-8, were significantly higher on insect-

pollinated flowers than on those bagged to exclude insects. The main pollinators at the experimental site at Hisar, India, were honey bees (*Apis mellifera*). The effects of insect pollination were greater on EC-68415 than on MSFH-8. P. Walker

Department of Entomology, CCS Haryana Agricultural University, Hisar 125 004, India.

Arya, P.S. Effect of mode of pollination on seed setting in chicory (*Cichorium intybus* L). *Udyanika* (1982/1983) 5 (1/2) 33–36 [En, Bb]

The absence of pollen grains on glass slides smeared with glycerine and placed at three heights in a field of flowering chicory at Kalpa, India, indicated that wind pollination is not important in this species. Hourly observations of insects visiting the crop, between 6.00 and 19.00 hours, showed that honeybees (*Apis cerana*) were the commonest species, followed by *Bombus* spp., *Andrena* spp., other solitary bees, flies (*Eristalis tenax*) and sphingid moths. Peak bee activity was between 06.00 and 10.00 hours, and the maximum seed set was in July (73%) and June (70%), the months of greatest bee activity. D.G. Lowe

Regional Res. Stn., Dhaultkuan, Himachal Pradesh, India.

Ashok, Thakur. Foraging of honey bees on Khair. *Insect Environment* (2000) 5 (4) 187–188 [En, X]

Observations in Hamirpur district, Himachal Pradesh, India, showed that two *Apis mellifera* colonies were able to maintain honey stores in 3–4 frames/colony during the monsoon period due to flowering of khair (*Acacia catechu*). Krishi Vigyan Kendra (HPKV), Bara Dist., Hamirpur – 177 044, H.P., India.

Attar, Singh, Sandeep Singh and Gagandeep, Kaur. Important bee flora of the Punjab. *Insect Environment* (2002) 8 (1) 12–13 [En, X]

Dept of Entomology, Punjab Agricultural Univ., Ludhiana-141 001, India.

Attri, B.S. and Sharma, P.L. Toxicity of some new insecticides to the Indian honey bee *Apis indica*. *Pesticides*, India (1969) 3 (6) 27–29 [En]

Atwal, A.S. Essentials of beekeeping and pollination. Ludhiana, India; Kalyani Publishers (2000) 394 pp. ISBN 81-7663-589-8 [En, Bd]

In the first part of this book, Chapters 2–7 describe honey bees, and their biology and behaviour; Chapters 8–11 cover beekeeping methods for *Apis mellifera*, and Chapters 12 and 13 bee forage in India and bee diseases. There is also information on the beekeeping industry, and trade in honey and beeswax. Part 2 (pp. 261–329) discusses pollination by bees in hives and wild bees, and then gives details of the pollination requirements of 38 crops grown in India. The book contains a few line drawings and colour photographs, a 50-page bibliography and detailed index. P. Walker

Atwal, A.S. Performance and prospects of *Apis mellifera* L. (Apidae: Hymenoptera) in the Indo-Gangetic plains [India]. *Indian Journal of Ecology* (1987) 14 (1) 92–101 [En]

The introduction of *A. mellifera* into Punjab and Himachal

Pradesh during the 1960s, and its successful establishment in the following decade, are described. Since 1985, *A. mellifera* has replaced *A. cerana* in many areas where the latter has been wiped out by Thai sac brood disease. The experiences of two successful beekeepers in the Punjab plains are described in some detail, and the prospects for *A. mellifera* beekeeping in the Himalayan region and the Indo-Gangetic plains are assessed.

Punjab State Planning Board, Chandigarh, India.

Atwal, A. S., Bains, S. S. and Singh, B. Bee flora for four species of *Apis* at Ludhiana. *Indian Journal of Entomology* (1970) 32 (4) 330–334 [En, B]

The foraging activities of *Apis mellifera*, *A. cerana indica*, *A. dorsata* and *A. florea* at Ludhiana are reported. Tables give results for different plants, and daily flight times. *A. indica* and *A. mellifera* were both able to exploit the available bee flora throughout the year, even in the very high summer temperatures, and collected surplus honey from berseem (*Trifolium alexandrinum*). *A. dorsata* and *A. florea* worked it, but stopped earlier in the afternoon. A. S. Attwood
Coll. Agric., Punjab Agric. Univ., Ludhiana, India.

Atwal, A. S. and Goyal, N. P. Introduction of *Apis mellifera* in Punjab plains. *Indian Bee Journal* (1973) 35 (1–4) 1–9 [En, B]

Observations were made on colonies of Italian honeybees reared during 1966–73. Bee forage was available throughout the year, with *Trifolium*, Brassica and Eucalyptus forming the main sources of honey. It was estimated that the region could support at least 100,000 colonies (one per 3–4 ha). Colonies produced up to 51 kg of honey annually, mostly in May. Brood rearing was greatest during the last week in April, with a second peak during the first half of November. During the summer months the hives were cooled by covering with wet sacks. The mite, *Tropilaelaps clareae*, was controlled by a light dusting with sulphur every month. Drone rearing was encouraged in an attempt to overcome the failure of queens to mate. J. M. Gedy
Coll. Agric., Punjab Agric. Univ., Ludhiana, India.

Atwal, A. S. and Goyal, N. P. *Apis mellifera* turns indifferent to shain (*Plectranthus rugosus*). *Everyday Science* (1974) 19 (2) 25–26 [En, B]

In the Kulu Valley where shain is the main source of nectar and pollen in the autumn, *Apis mellifera* colonies did not do well, although *A. cerana indica* thrived (see Atwal and Sharma, *Apicultural Abstracts* 585/71). From June to August, bees were counted on plants within 2.5 km of an apiary containing 73 *A. mellifera* colonies and 87 *A. c. indica* colonies; there were 1.25–3.1 *A. c. indica* per plant, but only three *A. mellifera* were recorded in the whole count. P. Walker
Coll. Agric., Punjab Agric. Univ., Ludhiana, India.

Atwal, A. S. and Sharma, O. P. Brood rearing activity of the Italian honey bee *Apis mellifera* L., in the Punjab plains at Ludhiana. *Indian Bee Journal* (1970) 32 62–67 [En, B]

The possibility was investigated of keeping *A. mellifera* colonies on the Punjab plain, to utilise major nectar-flow there (from *Trifolium alexandrinum*). Floral and climatic conditions in Ludhiana were quite favourable; problems of severe heat, attacks by ectoparasites, sterility of drones and

failures in mating of queens, are discussed. Data for brood-rearing activity are tabulated monthly for 1966–1969. Migration between mountainous areas and plains could be profitable if the above problems can be solved. E. E. Crane

Coll. Agriculture, Punjab Agricultural Univ., Ludhiana, India.

Atwal, A. S. and Sharma, O. P. The dominance of *Apis mellifera* over *Apis indica*. *American Bee Journal* (1971) 111 (9) 343 [En, B]

From 1966 to 1969 the number of colonies of *A. cerana indica* kept within a 2-mile [3-km] radius of the Bee Research Station at Nagrota showed little increase, varying from 68 to 86 (average 76). Although new colonies were raised, acarine disease caused the loss of 11–30 in each of these four years. *A. mellifera*, which was introduced in 1962 at the Research Station, increased rapidly in numbers during the same four years. It often robbed the colonies of the smaller *A. c. indica*, and even caused excessive absconding of the latter (about 30% of the colonies). J. D. Hitchcock
Coll. Agric., Punjab Agric. Univ., Ludhiana, India.

Avdresh, Kumar and Alexander Lall. Bumble bee species and flowering plant relationships at high altitude in north west India. *Indian Journal of Ecology* (98) 25 (1) 1–7 [En, X]

The relationships between bumble bee species (*Bombus tunicatus*, *B. funerarius* var. *lateritius*, *B. haemorrhoidalis*, *B. manaliensis* sp. nov., *B. atrocinctus*, *B. flevescens*, *B. rufofasciatus* var. *ladakhensis*, *B. trifasciatus*, *B. simillimus* and *B. melanurus*) and flowering plants are described, and the distribution of the bees at high altitude during premonsoon, monsoon and postmonsoon periods is presented. The most important plants visited by the bees are listed, including *Trifolia repens* [*Trifolium repens*].

School of Entomology, St. John's College, Agra-282 006, India.

Ayyanna, C., Subrahmaniam, S. S. and Chiranjivi, C. Spot test for detecting honey adulterated with jaggery. *Chemical Era* (1978) 14 (11) 476 [En]

Sulphate, formed from sodium bisulphite during heating of honey adulterated with jaggery (a dark crude sugar from the juice of palm trees), is detected by the addition of barium ions. If no white precipitate of barium sulphate forms, no jaggery is present. F. B. Wells

Dept. Chem. Eng., Andhra Univ., Waltair, Andhra Prad, India.

Azmi, H. K. and Ali, S. Z. Use of invertebrates as traditional drugs among the tribals of Chhatisgarh (M P). *Journal of Living World* (98) 5 (2) 22–29 [En, 14 wf]

Apis cerana is among many different invertebrates used in traditional medicine in this area of Madhya Pradesh.

Dept of Zoology, Shibli National P. G. College, Azamgarh-276 001, India.

Badiyala, S. D. and Garg, R. Studies on the pollination and fruit production by *Apis mellifera* L. in seven cultivars of litchi (*Litchi chinensis* Sonn). *Indian Bee Journal* (1990) 52 (1–4) 28–30 [En, B]

Four *A. mellifera* colonies were introduced to a litchi orchard in Himachal Pradesh, India, at the start of flowering. Honey bees visited the flowers, especially in the morning (9.30–11.30), and less actively from 15.00–17.00. A few *Vespa basalis* and hoverflies were also observed. Fruit set in inflorescences accessible to insects was two to three times greater than in bagged inflorescences; fruits/inflorescence and fruit weight were also greater. Results varied between the different cultivars. The introduction of *A. mellifera* colonies to litchi orchards is strongly recommended. *P. Walker*

Litchi and Mango Research Station, Niagoto Bagwan, Distt. Kangra (H.P.) 176 047, India.

Bai, A. R. K. and Reddy, C. C. Laboratory toxicity of some insecticides to *Apis cerana indica*. *Journal of Apicultural Research* (1977) 16 (3) 161–162, 142 [En, B]

The comparative topical toxicity of 16 insecticides to *Apis cerana indica* was determined under laboratory conditions. All insecticides were tested at the dosage recommended in India for agricultural purposes, and all were lethal to *A. c. indica*. Organophosphates (op) and carbamates (c) showed a similar toxicity, which was greater than that of chlorinated hydrocarbons (ch). Toxicity, assessed by the speed with which all bees were killed, was found to be in the following order, starting with the most toxic: dichlorvos, methyl parathion, phosphamidon, quinalphos (all op); carbaryl (c); fenitrothion, monocrotophos, oxydemeton-methyl, dimethoate (all op); carbofuran (c), carbophenothion (op), malathion (op); heptachlor, DDT, endrin, BHC (all ch). *Author*

Dept. Zoology, Bangalore Univ., Bangalore-1, India.

Baker, D. B. *Eupetersia*, a genus of parasitic halictine bees (Hymenoptera, Apoidea) new to the oriental region. *Entomologists' Monthly Magazine* (1974) 110 (1316–1318) 59–63 [En]

One female *Eupetersia* (*Nesoeupetersia*) *nathani* sp. nov. was found in the Nilgiri Hills, India.

Baker, D. B. Two genera of nomadine bees new to India. *Entomologist's Monthly Magazine* (1974) 110 (1325–1327) 237–240 [En]

Ammobates chionospilus n.sp. and *Morgania castanomelaena* n.sp.

Baker, E. W. and Delfinado, M. D. A new genus of *Scutacaridae* (Acarina) on a bumble bee from India. *Cooperative Economic Insect Report* (1975) 25 (19) 379–382 [En, B]

Parascutacarus indicus is described.

Basavanna, G. P. C. Role of insect pollinators in sunflower production. *Current Research* (1979) 8 (1) 1–3 [En]

The introduction of honeybee (presumably *Apis cerana*) colonies into a sunflower crop in India increased seed setting by c. 27%.

Basavanna, G. P. C. Thai sacbrood disease of the Indian honey bee, *Apis cerana indica*. Thai sacbrood disease of the Indian honey bee and problems and prospects of establishing the European bee (*Apis mellifera*) in Karnataka. Proceedings of a workshop, 15th June, 1994,

Bangalore, India [edited by Veeresh, G. K.]. Bangalore, India; Institution of Agricultural Technologists. (1994) 3–7 [En, Bd]

This review, with 16 references, summarises information on the symptoms, severity and spread of Thai sac brood disease and on the virus itself, and on preventive measures. Suggestions for future research are made. *P. Walker*

Department of Entomology, University of Agricultural Sciences, Bangalore 560/065, India.

Basavarajappa, S. Status of natural colonies of *Apis dorsata* in maidan region of Karnataka, India. *Indian Bee Journal* (98) 60 (3) 143–146 [En, B]

Bee flora and *A. dorsata* nests were surveyed in a plains area (nearly 1000 ha) containing four different habitats; 39 plant species were identified. The number of nests/ha in each habitat type was: (A) coconut plantations, 6.3; (B) areca nut and banana plantations, 4.1; (C) natural vegetation on canal bank, 3.1; (D) uncultivated land with trees, 2.7. Honey production was highest in A (27.1 kg/ha, 33.1% of total), followed by B, 3.8 kg, 29.2%, C 3.5 kg, 26.2% and D 1.3 kg, 11.5%. Constraints to the survival of *A. dorsata* are discussed. *Author*

Dept of Post-Graduate Studies and Research in Applied Zoology, Kuvempu Univ., B R Project 577 115, Karnataka, India.

Baskaran, S., Vigneswari, A. and Kasthuribai, M. Composition and relative abundance of the flower visitors of *bhendi*, *Abelmoschus esculentus* Linn. *Insect Environment* (2001) 7 (1) 17 [En, X]

The flowers were visited by *Apis florea*, *A. cerana*, *A. dorsata* and *Anthophora occidentalis* with relative abundances of 39.84%, 33.93%, 12.74% and 13.49%, respectively.

Dept of Zoology, Ayya Nadar Janaki Ammal College (Autonomous), Sivakasi (West)-626 124, Tamil Nadu, India.

Baswana, K. S. Role of insect pollinators on seed production in coriander and fennel. *South Indian Horticulture* (1984) 32 (2) 117–118 [En, Ba]

Seed yields on open plots of *Coriandrum sativum* and *Foeniculum vulgare* were compared with those on plots that were caged and sprayed with insecticide. On open plots the most common visitors were honeybees (*Apis florea* and *A. dorsata*), which were most active from about 11.00 to 14.00 hours; the peak of anthesis also occurred during this period. Other insect visitors were solitary bees, wasps, flies, chrysomelid beetles and various Hemiptera. Seed yield per plant, by weight, on open plots was about twice as great as that on caged plots, and the same was true for seed yield per plot. *P. Walker*

Dept. Vegetable Crops, Haryana Agric. Univ., Hissar, India.

Bath, P. K. and Narpinder, Singh. A comparison between *Helianthus annuus* and *Eucalyptus lanceolatus* honey. *Food Chemistry* (99) 67 (4) 389–397 [En, 39 ref.]

Dept of Food Science and Technology, Guru Nanak Dev Univ., Amritsar-143 005, India.

Batra, S. W. T. Bees of India (Apoidea), their behaviour, management and a key to the genera. *Oriental Insects* (1977) 11 (3) 289–324 [En, B]

This review lists 47 genera (belonging to 16 families) reported in India, and provides a key to their identification. The value of wild bees as crop pollinators, and methods for managing and increasing their numbers, are discussed. Beneficial Insect Introduction Lab., ARS, USDA, Beltsville, MD 20705, USA.

Batra, S.W.T. Nests of the solitary bee, *Anthophora antiope*, in Punjab, India. *Journal of the Kansas Entomological Society* (1980) 53 (1) 112–114 [En, B]

In January and February some nests of *A. antiope* were examined in loess cliffs near the Beas River, Punjab. The shallow nest had 1–4 cells lined with a lipid material smelling of butyric acid. Females were observed collecting nectar and pollen from cultivated *Brassica* spp., and also from *Eruca* sp. and *Ipomoea crassicaulis* within 1000 m of the nests. Males pursued foraging females, but mating was not observed. *P. Walker*
Beneficial Insect Introduction Lab., USDA-SEA, Beltsville, MD 20705, USA.

Batra, S.W.T. India's buzzy biodiversity of bees. *Current Science* (1993) 65 (3) 277–280 [En, B]

The historical background of research on the bees (*Apoidea*) of India is reviewed, with 16 references. Current knowledge is compared with that in other parts of the world. Recommendations for further research in India are made, with suggestions regarding the conservation of bee species and the management of their populations to benefit both agriculture and wildlife in India. *Author*
Bee Research Laboratory, Bldg. 476, USDA, Beltsville, MD 20705, USA.

Batra, S.W.T. Biology of *Apis laboriosa* Smith, a pollinator of apples at high altitude in the Great Himalaya range of Garhwal, India (Hymenoptera: Apidae). *Journal of the Kansas Entomological Society* (1996) 69 (2) 177–181 [En, Bb]

A. laboriosa was found near Uttarkashi (1300 m) and Harsil (2660 m), along the gorge of the Bhagirathi Ganga, about 600 km west of its known range in Nepal. This rare, seasonally migrating bee is a good pollinator of apple trees in early May at Harsil, and populations should be conserved. They may be viewed by eco-tourists, bringing some income to this region.

Bee Research Laboratory, Bldg. 476, ARS, USDA, Beltsville, MD 20705, USA.

Batra, S.W.T. Fruit-pollinating bees of the Garhwal Himalaya, U. P., India. Proceedings of the 7th International Symposium on Pollination, Lethbridge, Alberta, Canada, 23–28 June 1996 [edited by Richards, K.W.]. Leiden, Netherlands; International Society for Horticultural Science. (1997) 325–328 ISBN 90-6605-978-8 [En, Bd]

Fruit trees in the Lesser Himalaya of Uttar Pradesh and adjacent northern Haryana are pollinated primarily by the honey bees *Apis cerana*, *A. florea*, *A. dorsata* and *A. mellifera*. Bee Res. Lab., USDA, Bldg. 476, Beltsville, MD 20705, USA.

Belavadi, V.V. and Parvathi, C. Landing and departure rules used by honeybees on cardamom (*Elettaria cardamomum* Maton). Pollination in tropics: Proceedings of the

International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G. K.; Shaanker, R. U.; Ganeshiah, K. N. (eds)]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 73–76 [En, Bd]
University of Agricultural Sciences, Regional Research Station, Mudigere 577 132, India.

Bhalla, O.P. and Dhaliwal, H.S. Potentialities and progress of beekeeping in India. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 100–109 [En, B]

The present state of beekeeping in India is assessed, and it is concluded that there is potential for greatly increasing annual honey production from the present average of 250 t of apiary honey from *Apis cerana*, and 7500 t from wild *A. dorsata* colonies. The main constraints preventing progress are identified as: (1) lack of high-yielding strains of *A. cerana*; (2) lack of standardised equipment, especially hives; (3) diseases and enemies, especially parasitic mites and predatory wasps; (4) destruction and lack of knowledge of floral resources; (5) poor management; (6) inadequate training facilities; (7) scarcity of trained research and extension workers. *D.G. Lowe*
Dept. Entomology & Apiculture, Himachal Pradesh Krishi Vishva Vidyalaya, Solan-173213, India.

Bhalla, O.P., Verma, A.K. and Dhaliwal, H.S. Insect visitors of mustard bloom (*Brassica campestris* var. *sarson*), their number and foraging behaviour under mid-hill conditions. *Journal of Entomological Research* (1983) 7 (1) 15–17 [En, B]
Dept. Entomology and Apiculture, Himachal Pradesh Agric. Univ., Solan-173230, Himachal Pradesh, India.

Bhaskara Rao, C., Subba Reddi, C., Aluri, R.J.S. and Atluri, J.B. Pollination ecology of *Cassia alata* L. (Caesalpinaceae). *Journal, Bombay Natural History Society* (98) 95 (3) 454–459 [En, B]

The flowers are described. In the study area, the only visitors were *Xylocopa latipes* and *X. pubescens* which collected pollen by buzzing, thus pollinating the flowers. *P. Walker*
Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Bhaskar, V. Pollination biology and fertilization in *Santalum album* L. (Santalaceae). *Flora (Jena)* (1992) 187 (1/2) 73–78 [En, Ba]

Department of Farm Forestry, University of Agricultural Sciences, Bangalore 560 065, India.

Bhat, A.A. Relative toxicity of some insecticides to adults of the beetle, *Adoretus* spp. and to the honeybee, *Apis cerana indica* Fabr. *Indian Journal of Plant Protection* (1987) 15 (1) 97–99 [En, Bb]

The toxicity of endosulfan, phosalone, dichlorvos and toxaphene to *Adoretus* spp., pests of cherry trees, and to *A. cerana* workers, was determined in laboratory tests in India. The beetles were exposed to sprayed leaves, and the bees to sprayed flowers. Phosalone and toxaphene were the most toxic of the four insecticides to *Adoretus* both immediately and 12 hours after application. Phosalone and dichlorvos

12 hours after application were the least toxic of the treatments to *A. cerana*, followed by phosalone immediately after application. It is concluded that applications of phosalone to cherry trees in the evening when there is no bee activity will effectively control *Adoretus* without harming foraging honeybees. D. G. Lowe

Div. Entomology, S. K. Univ. Agric. Sciences & Technol., Shalimar, Srinagar 191 121, Jammu & Kashmir, India.

Bhat, A.A. Efficiency of crossing Kashmir and Himachal strains of Indian honey bee, *Apis cerana indica* Fab. *Journal of Insect Science* (1994) 7 (1) 106–107 [En, 10 ref.]

Crosses made between Kashmir (female parent) and Himachal (male parent) strains of *Apis cerana indica* showed that F₁ hybrid workers had intermediate characters with respect to body weight and length, length and width of fore and hind wings, thorax width, number of wing hooks, proboscis length and honey yield. Assessment of hoarding ability showed that F₁ hybrids consumed 1 ml of sugar solution more rapidly than either of the parental strains.

Department of Entomology, Dr Y.S. Parmar University of Horticulture and Forestry, Solan, Nauni 173 230, India.

Bhat, K. G. Effect of honey on bacteria isolated from burn wound infection: an in vitro study. *Biomedicine* (98) 18 (2) 68–72 [En, 14 wf]

The in vitro effect of honey on bacteria isolated from burn wound infections was evaluated.

Dept of Microbiology, Kasturba Medical College Mangalore-575 001, India.

Bhat, N.S., Kandoria, J.L. and Goyal, N.P. Quantity and quality of nectar in some South Indian bee plants. *Indian Bee Journal* (1987) 49 (1-4) 28–29 [En, Bj]

A table gives the following information for 11 plant species visited by honeybees: volume of nectar/flower, sugar concentration of nectar, total sugar/flower, flowering period, *Apis* species visiting (*cerana*, *dorsata*, *floreana*).

Bhat, N. S., Manjunath, M. and Lingappa, S. Studies on bee flora of transitional zone of Karnataka. *Mysore Journal of Agricultural Sciences* (1990) 24 (4) 463–470 [En, Bb]

About 140 plant species were recorded as bee forage sources in Dharwad, Karnataka, India, and a table gives details of these, including frequency of occurrence, whether nectar and/or pollen source and main flowering period. The importance of the various species is discussed, and 14 are identified as major food sources. There is a nectar dearth period in February–May and a pollen dearth period in February–July. Recommendations for planting species to improve nectar sources are made. D. G. Lowe
University of Agricultural Sciences, Dharwad 580/005, Karnataka, India.

Bhat, S. S. and Sudharshan, M. R. Studies on the efficacy of 'Bee-Q' in augmenting pollination, fruit and seed set in cardamom (*Elettaria cardamomum* Maton) – a preliminary report. *Indian Bee Journal* (99) 61 (1–4) 49–54 [En, Bj]

When flowering plants were sprayed with Bee-Q, the number of bee visits doubled (104.8% increase), fruit set increased by 13% compared with unsprayed control

plants, and recovery of seed also increased slightly. Author
Indian Cardamom Research Inst., Spices Board, Donigal Post, Sakleshpur 573134, Karnataka, India.

Bhattacharyya, P., Samui, R. C., Ghosh, M. R., Dasgupta, S. K. and Roy, A. Sunflower seed yield as influenced by pollination and insect pests. *Proceedings. 10th International Sunflower Conference, Surfers Paradise, Australia, March 14–18 1982*. Toowoomba, Australia; Australian Sunflower Association (1982) 132–134 [En, B]

Three insecticides (monocrotophos, endosulfan and quinalphos) were sprayed on sunflowers at the initiation of flower opening and at 10 and 20 days afterwards. Monocrotophos and quinalphos were effective against the pests *Amrasca berri*, *Bemisia tabaci* and *Plusia orichalcea* but they also reduced the number of foraging honeybees (mean of 10.5 and 8.25 bees per 30 sweeps, respectively). Honeybees were the chief pollinators. J. M. Gedye

Dept. Agronomy, Bidhan Chandra Krishi Viswa Vidyalaya, Kalyani 741 235, West Bengal, India.

Bhuyan, M. and Bhattacharyya, P. R. Honey bee foraging upon sunflower (*Helianthus annuus*) under the agro-climatic conditions of Jorhat, Assam, India. *Indian Bee Journal* (98) 60 (2) 87–90 [En, Bj]

The foraging behaviour of *Apis cerana* on sunflowers was studied.

Div. of Plant Sciences and Ecology, Regional Research Lab., Jorhat, Assam, India.

Biradar, A. P., Shaila, H. M. and Patil, D. R. Honey bees menace on grape. *Insect Environment* (2001) 7 (3) 121–122 [En, wf.]

Honey bees as pests in vineyards used to be quite rare, but in recent years they have caused considerable damage.

Regional Research Station, PB No18, Bijapur-586 101, India.

Bisht, D. S. Pollen gathering activity of honey bees and *Halictus* sp. in roses. *Indian Bee Journal* (1975) 37 (1–4) 1–3 [En, B]

Low seed set in the Delhi area in rose varieties with a double flower was previously thought to be due to pollen robbing by *Apis cerana*, but it was observed that *A. cerana* from 10 hives foraged little on such varieties in a nearby 3-acre [1.2 ha] rose garden, probably because the pollen in such flowers is concealed by the large corolla. *Apis florea* was the main pollen gatherer throughout the year, and *Halictus* sp. was active in March–May. The times of day when the three species foraged varied according to season. P. Walker

Div. Entomology, Indian Agric. Res. Inst., New Delhi-12, India.

Bisht, D. S., Naim, M. and Mehrotra, K. N. Comparative efficiency of Jeolikote villager and Newton beehives for maintaining *Apis cerana indica*. *Indian Journal of Entomology* (1982) 44 (4) 368–372 [En, B]

During a 5-year study in Delhi, India, the areas of brood, and of pollen and honey stores, were recorded regularly for five colonies in Jeolikote hives (J) and five colonies in Newton hives (N). These hives, which are the subject of an

Indian Standard (IS: 1515-1969, published 1970), have brood frame dimensions of 30 x 18 cm and 20 x 15 cm respectively. The average monthly brood area in J was 1.6 times as great as in N, and the number of cells with stored pollen was 1.4 times as high as in N. Honey storage (disregarding that in supers) was also higher in J than in N, therefore the Jeolikote hive is preferred. In both types of hive brood rearing was highest in February-May, with a minimum in December. Pollen storage was highest in April-July. *P. Walker*

Div. Entomology, Indian Agric. Res. Inst., New Delhi 110012, India.

Bisht, D.S., Naim, M. and Mehrotra, K.N. Studies on the role of honeybees in rapeseed production. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29-March 4, 1980. (1983) 491-496 [En, B]

The rape variety Pusa Kalyani, grown on 16 plots at New Delhi, India, in 1977, was visited mainly by *Apis cerana* and *A. florea* (62% and 36% respectively of the insect population); 14 *A. cerana* colonies were located nearby. *A. cerana* started foraging when the temperature reached 15°C; the highest number recorded on the experimental field was 225 when the temperature was 20°. In 1977-78, plants visited by pollinators yielded 472 pods/plant and 14 seeds/pod, whereas plants caged to exclude insects yielded 37 pods/plant and three seeds/pod. Results in 1978-79 were similar, although yields were generally lower. *D. G. Lowe*

Div. Entomology, Indian Agric. Res. Inst., New Delhi-110012, India.

Brahmachary, R.L., Saha, L., Mondal, A.K., Dasgupta, P. and Paul, P. Apis florea and dammar bees (Trigonidae): as the pollinating agents of certain fruit trees in Bengal. Proceedings, state-level seminar on beekeeping, 13-14 July, 1980, West Bengal [ed. Dan, D.K.]. (1980) 63-66 [En, bengalee, B]

Indian Statistical Inst., Calcutta, India.

Brar, H.S., Gatoria, G.S. and Jhaji, H.S. Field toxicity of insecticides recommended on American cotton, Gossypium hirsutum L. to honeybee, Apis mellifera L. *Indian Journal of Ecology* (1992) 19 (2) 183-186 [En, 6 ref.]

In field trials in the Indian Punjab in 1991, carbaryl, endosulfan, fluvalinate and monocrotophos were all toxic to *Apis mellifera* on cotton when sprayed. Fluvalinate was least toxic and had the shortest residual activity.

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Brar, H.S., Gatoria, G.S. and Jhaji, H.S. Seasonal brood rearing of Apis mellifera Linn. under different agroclimatic regions of the Punjab. *Journal of Insect Science* (1992) 5 (1) 27-29 [En, Bc]

Brood area was recorded fortnightly from 1982 to 1988 in 10 colonies in each of four different areas. Brood rearing continued throughout the year, with a major peak in March-May in all areas. A second smaller peak occurred in November, especially in colonies in the toria-growing area. Management methods should be adapted to suit this pattern of brood rearing behaviour. *P. Walker*

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Brar, H.S., Gatoria, G.S. and Jhaji, H.S. Seasonal variations in honey stored by Apis mellifera Linn. colonies in different agroclimatic regions of the Punjab. *Journal of Insect Science* (1992) 5 (2) 141-143 [En, Bc]

Honey stores were recorded fortnightly from 1984 to 1988 in 10 colonies in each of four different areas. A major peak was found in March-May in all areas; a second short peak in November occurred in only two areas. A long dearth period (June-February) was apparent in two areas, but only a short one in the others. These results emphasise that management methods must be adapted to the conditions of the area. *P. Walker*

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Brar, H.S., Gatoria, G.S. and Jhaji, H.S. Quantitative and qualitative evaluation of Eucalyptus as a nectar source to honeybees. *Indian Bee Journal* (1994) 56 (1/2) 76-79 [En, B]

In Ludhiana, India, in 1989-90, the flowering period of *Eucalyptus* [species not given] was from mid-October until the following April. On average each flower was open for two days and produced 38 mg nectar, with a sugar content of 54.7%. Total nectar production of a single tree was estimated to be 15.5 kg, with a potential honey yield of 11 kg. *P. Walker*

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Brar, H.S., Gatoria, G.S., Jhaji, H.S. and Brar, B.S. Seasonal activity, infestation and damage of greater wax moth in Italian honeybee colonies. *Indian Journal of Ecology* (1993) 20 (2) 136-140 [En, 3 ref.]

Department of Entomology, Punjab Agricultural University, Ludhiana-141 004, India.

Brar, H.S., Jhaji, H.S. and Gatoria, G.S. Abundance and activity of the bee visitors to pigeon pea (Cajanus cajan (L.) Millsp.) and role of Apis mellifera L. in its pollination. *Indian Bee Journal* (1992) 54 (1-4) 76-80 [En, B]

Five species of bees were recorded on plots of flowering *C. cajan* in Punjab, India.

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Brar, H.S., Jhaji, H.S., Gatoria, G.S. and Chahal, B.S. Effect of different winter packing materials on brood rearing and honey storage in Apis mellifera Linn. colonies in Punjab. *Journal of Research, Punjab Agricultural University* (1987) 24 (4) 623-627 [En, B]

Apis mellifera has acclimatised to the Punjab plains and lower hill regions of Himachal Pradesh, India, but winter conditions from the second half of December to the middle of February can weaken colonies, and some may even die. Studies on hive insulation were carried out in 1981-83, using wheat bhusa, sawdust, rice straw and 'thermocole sheets' as inner packings (in polythene bags), alone or in combination with outer polythene wrappings. Colonies insulated with thermocole sheets (with and without outer wrappings) showed, on average, an increase in

brood area from 15 December to 15 February of 1060cm², compared with 347cm² for control colonies (no insulation). Results for colonies in hives insulated with rice straw, sawdust and wheat bhusa were 873, 765 and 760cm² respectively. None of the treatments had any significant effect on the amount of honey stored. Rice straw was the cheapest and most easily available material, thus its use is recommended. *D.G. Lowe*

Dept. Entomology, Punjab Agric. Univ., Ludhiana, Punjab, India.

Brar, J.S. and Nandpuri, K.S. Study on floral biology of *Curcubita pepo* Linn. *Journal of Research, Ludhiana (Supplement)* (1969) 6 (3) 786–792 [En, B]

It was noted that honeybees and bumble bees were the chief pollinators. *A.S. Attwood*

Dep. Horticulture, Punjab Agricultural University, Ludhiana, India.

Burgett, M. Honey hunters of the Sundarbans. *Beekeeping & Development* (2000) (No. 56) 6–7 [En, Bj]

Collection of honey from *Apis dorsata* nests in mangrove forest in Bangladesh and India.

Dept. of Entomology, Oregon State Univ., Corvallis, OR, USA.

Chahal, B.S., Brar, H.S., Gatoria, G.S. and Jhaggi, H.S. Aggressive behaviour of *Apis florea* towards *Apis mellifera* in hive robbing and in foraging. *Journal of Apicultural Research* (1986) 25 (3) 134–138 [En, Bb]

Robbing of *Apis mellifera* colonies by *Apis florea* bees was observed in seven of 109 apiaries examined in the Punjab, India, in 1984 and 1985. Eleven of 54 colonies in the seven affected apiaries, most of them relatively weak, were robbed and disorganised. Observations of individual bees under simulated conditions for robbing and at a feeding dish indicated that *A. florea* bees behaved aggressively towards *A. mellifera*. Although casualties occurred in both species during robbing, *A. florea* bees stung *A. mellifera* bees but escaped being stung themselves by the latter. *Author*

Dept. Entomology, Punjab Agric. Univ., Ludhiana-141004, India.

Chahal, B.S. and Gatoria, G.S. Import of exotic bees (*Apis mellifera* Linn.) and spread of bee diseases? *Indian Bee Journal* (1983) 45 (1) 11–13 [En, B]

Chahal, B.S., Goyal, N.P. and Harcharan Singh. Establishment of exotic honey bee (*Apis mellifera*) in Punjab. *Indian Bee Journal* (1981) 43 (2) 40–43 [En, B]

After the successful introduction of Italian *Apis mellifera*, local beekeepers were trained to manage them, and by 1980 there were 1087 colonies kept by 103 beekeepers producing 7280 kg honey. The average yield per colony in 1980 was 6.7 kg, and the maximum was 11.8 kg/colony in the Kapurthala district. No bee diseases have been reported on *A. mellifera* in Punjab state; no serious competition with *A. florea* and *A. dorsata* has been observed, and *A. cerana* is not found on the Punjab plain, as reported earlier. *P. Walker*

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Chakrabarti, K. Sundarbans honey and the mangrove swamps. *Journal of the Bombay Natural History Society* (1987) 84 (1) 133–137 [En, Bb]

Studies were made of various aspects of honey harvesting from *Apis dorsata* combs and of honeybee behaviour. The plants giving the main nectar flows were also investigated. Most of the results were reported previously in *Science and Culture* (1972) 38 (6) 269–276.

Wild Life Preservation, Eastern Region, Min. Environment & Forests, Nizam Palace, Calcutta 700020, India.

Chand, H., Singh, R. and Hameed, S.F. Studies on the flowering period, density of Indian mustard and competing flora for honeybees in and around Pusa, Bihar, India. *Journal of Entomological Research* (94) 18 (4) 361–367 [En, X] Dept. Entomol. Agric. Zool., Rajendra Agric. Univ. Bihar, Pusa, Samastipur 848125, India.

Chand, H. and Singh, R. Effect of pollination by *Apis cerana* Fabr. on yield of mustard, *Brassica juncea* Linn. *Indian Bee Journal* (1995) 57 (4) 173–174 [En, Bj]

Department of Entomology and Agricultural Zoology, Rajendra Agricultural University, Pusa (Samastipur) 848125, Bihar, India.

Chand, H. and Singh, R. Evaluation of sugar concentration in the nectar of four flowering plants for honeybees. *Journal of Entomological Research* (1995) 19 (2) 123–126 [En, Ba]

Department of Entomology & Agricultural Zoology, Rajendra Agricultural University, Bihar, Pusa, Samastipur 848124, India.

Chand, H., Singh, R. and Hameed, S.F. Population dynamics of honeybees and insect pollinators on Indian mustard, *Brassica juncea* L. *Journal of Entomological Research* (1994) 18 (3) 233–239 [En, 9 ref.]

Foraging activity of the insect pollinators *Apis cerana indica*, *A. mellifera*, *A. dorsata*, *A. florea* and other hymenopterous, lepidopterous and dipterous insects was studied on Indian mustard from December 2, 1990 to January 14, 1991 at weekly intervals, from 9.00 to 16.00 hours at Pusa, Bihar, India. *A. c. indica* was the dominant pollinator of Indian mustard, followed by *A. dorsata*, *A. mellifera* and *A. florea*. The maximum number of visits was recorded with *A. c. indica* (34–43%), followed by *A. dorsata* (20–26%). The average activities of *A. mellifera*, *A. florea* and insects of the t3 orders were below 13% throughout. Activity of *A. c. indica* was positively correlated with temperature, while humidity had no significant effect. *A. florea* had a significant negative correlation with minimum temperature.

Department of Entomology & Agricultural Zoology, Rajendra Agricultural University, Bihar, Pusa, Samastipur-848125, India.

Chandel, Y.S. Placement of bee hives for the control of predatory wasps (*Vespa* spp.). *Insect Environment* (99) 5 (1) 31 [En, X]

Bee Research Station, Himachal Pradesh Krishi Vishwavidyalaya, Nagrota Bagwan 176 047, India.

Chandel, Y.S. and Arun, Kumar. Effect of sugar feeding to *Apis mellifera* L. colonies on their performance during

maize bloom period. *Pest Management and Economic Zoology* (2000) 8 (1) 53–56 [En, X]

Twelve colonies with 5–6 frames of bees were fed on 500, 1000, 1500, 2000 g sugar/colony during maize flowering in Himachal Pradesh, India. It was found that a minimum of 1500 g sugar was required to achieve a significant increase in brood area.

CSK Himachal Pradesh Krishi Vishvavidyalaya, Bee Research Station, Nagrota Bagwan, Kangra, Himachal Pradesh 176 047, India.

Chandel, Y.S. and Arun, Kumar. A note on requeening of *Apis mellifera* L. colonies. *Pest Management and Economic Zoology* (2000) 8 (1) 97–98 [En, X]

Bee Research Station, CSK Himachal Pradesh Krishi Vishvavidyalaya, Nagrota Bagwan, District Kangra, Himachal Pradesh 176 047, India.

Chandel, Y.S., Arun, Kumar and Ball, B.V. Sacbrood disease in Italian honey bee, *Apis mellifera* L., in Himachal Pradesh, India. *Pest Management and Economic Zoology* (99) 7 (2) 181–182 [En, X]

This is the first report of sacbrood disease in India. It caused considerable losses of *A. mellifera* colonies in Himachal Pradesh in 1998 and 1999.

Bee Research Station, Himachal Pradesh Krishi Vishvavidyalaya, Nagrota Bagwan, Kangra, HP 176 047, India.

Chandel, Y.S., Arun, Kumar and Srivastva, S. Comparative performance of *Apis mellifera* L. vis à vis *Apis cerana* Fab. on toria (*Brassica campestris* var *Toria*) in mid-hill zone of Himachal Pradesh, India. *Indian Journal of Agricultural Research* (2000) 34 (4) 264–267 [En, 7 wf.]

Observations were made on five colonies of *A. mellifera* (M) and three colonies of *A. cerana* (C). C started foraging earlier than M, and at high temperatures the maximum number of foragers leaving was 122.2 and 68.7 bees/min, respectively. Size of C's nectar load brought into the hive was 10.2–18.3 mg, and for M it was 6.9–18.9 mg. C worked faster than M did. When toria was at its blooming stage, C stored more nectar than M did. Lastly, it was observed that M was attacked more often by predators (wasps) than C was. It is concluded that C performs better in the mid-hill conditions of Himachal Pradesh, India.

Bee Research Station, Himachal Pradesh Krishi Vishvavidyalaya, Nagrota Bagwan-176 047, India.

Chandran, K., Rajan, P., Joseph, D. and Suryanarayana, M.C. Studies on the role of honeybees in the pollination of cardamom. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–4 March 1980. (1983) 497–504 [En, B]

Cardamom (*Elettaria cardamomum*) is an important spice crop which is grown on 90,000 ha in the Western Ghats region of S.India. Central Bee Res. Inst., Khadi & Village Industries Commission, Pune-411004, India.

Chandran, K., Rao, G.M., Rao, K.S., Singh, T.S.M.S. Prospects for *Apis mellifera* beekeeping in Cumbum Valley, Tamilnadu, India. *Indian Bee Journal* (1995) 57 (4) 165–170 [En, B]

After the death of *A. cerana* colonies from Thai sacbrood

disease, 50 *A. mellifera* colonies were introduced in 1993, and they developed well during the next two years. Brood rearing was maximal in May–June (which was the best time for dividing colonies) and in September. Colonies drew comb from foundation throughout the year. Feeding with sugar syrup was necessary from July to December. In February colonies were taken to rubber estates in Kerala for honey production. Honey was also obtained during the flowering of tamarind (April–June), sesame (June–July) and sunflower (July and December–January). A table lists other pollen and nectar sources in the area. P. Walker
Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Chandran, K. and Shah, F.A. Beekeeping in Kodai hills (Tamilnadu, India). *Indian Bee Journal* (1974) 36 (1–4) 1–8 [En, B]

A flowering calendar lists, in order of flowering, 56 species foraged by bees, with botanical and local names, distribution, and type of plant (nectar and/or pollen source). The most important are *Gmelina arborea*, *Syzygium cumini* and *Ligustrum walkeri*. Evaluation of the Newton hive by the Regional Bee Research Centre at Kodaikanal showed several disadvantages, and the 8-frame Indian Standards Institute 'A' hive is proving to be more suitable. Seasonal management for the area is summarised. The main flow is during April–June; long-distance migration to agricultural areas on the plains is advised during the monsoon season. Honey and beeswax production, once high in this area, are decreasing, probably as a result of deforestation. It is recommended that efforts should be made to improve bee forage, e.g. by planting *Syzygium*, *Mallolotus* and *Erythrina*. P. Walker

Regional bee Res. Centre, Kodaikanal, Tamilnadu State, India.

Chaturvedi, M. An analysis of honey bee pollen loads from Banthra, Lucknow, India. *Grana* (1973) 13 (3) 139–144 [En, B]

Pollen analysis was carried out on 192 pollen loads collected between January and April, 1970. During January all loads were unifloral, with *Cruciferae* pollen the commonest. All but three loads were unifloral during February, *Cruciferae* and *Asphodelus* being the most common types. *Compositae* and *Cucurbitaceae* pollens were dominant during March. *Cucurbitaceae* pollen was also collected during April, together with *Citrus*, *Cichoreae* and *Gramineae*. J.M. Gedye

Nat. Botanic Gardens, Lucknow, India.

Chaturvedi, M. Pollen analysis of autumn honeys of Kumaon region. *Proceedings, Indian National Science Academy, B* (1983) 49 (2) 125–133 [En, Bb]

Results are reported for 13 honeys collected from six localities at altitudes up to 1890 m in the Kumaon region, Uttar Pradesh, India. Six honeys are described as unifloral, the dominant pollens being *Brassica* (three samples), *Eucalyptus*, *Myrica*, and *Asteraceae* – *Anaphalis*. These and 14 other taxa (families or genera) contributed over 5% of pollen in the multifloral honeys. The results show that in some areas crop plants are important sources of forage. P. Walker

Palynology Lab., Natn. Botanical Res. Inst., Lucknow 226001, India.

Chaturvedi, M. Pollen analysis of some spring honeys from the western Himalayan region of Uttar Pradesh, India. *Proceedings of the Indian Academy of Sciences, Plant Sciences* (1989) 99 (3) 241–246 [En, Bb]

Samples of honey were obtained from the Garhwal and Kumaon regions. Of the 12 samples, 10 were unifloral and two multifloral. A total of 62 pollen types was found, with the number of pollens in a sample varying from one to 31. One sample contained only *Rosaceae-Prunus* pollen, and another only *Brassica* pollen. In other honeys considered as unifloral, the dominant pollen types (more than 45%) were *Rosaceae-Prunus*, *Eucalyptus*, *Brassica*, *Alnus* and *Rumex*. It is suggested that the anemophilous pollens of *Alnus* and *Rumex* may be used as indicators for honeys from the Himalayan region. D.G. Lowe

Palynology Lab., Natn. Botanical Res. Inst., Lucknow 226 001, India.

Chaubal, P.D. Melittopalynological studies of Shivaji University Campus. Part I: Floral calendar. *Journal of Shivaji University* (1980/1981) 20 89–94 [En, Bb]

Pollen loads of honeybees and samples of honey from colonies at Shivaji, Maharashtra, India, were collected at 2-week intervals in 1977–78 and subjected to pollen analysis. The occurrence in the samples of pollen grains of 45 species or genera is shown in a table, and a flowering calendar for 59 species is also presented. D.G. Lowe
Dept. Botany, Shivaji Univ., Kolhapur 416 004, India.

Chaubal, P.D. Palynological studies of some bee-forage plants from Sagarmal, Maharashtra, India. *Geophytology* (1982) 12 (2) 307–312 [En, B]

Pollen morphological studies of 57 common species of flowering plants constituting bee forage on the plains of Sagarmal are presented, along with a note, in each case, as to their food value to bees by way of nectar or pollen, or both. Author

Botany Dept., Shivaji Univ., Kolhapur 416 004, India.

Chaubal, P.D. and Kotmire, S.Y. Floral calendar of bee forage plants at Sagarmal (India). *Indian Bee Journal* (1980) 42 (3) 65–68 [En, B]

Chaubal, P.D. and Kotmire, S.Y. Contributions to melittopalynology from Sagarmal. *Journal of the Indian Botanical Society* (1983) 62 312–315 [En, B]

Pollen analysis of honeys from this area indicated that bee forage is present throughout the year, and a table gives 39 species with the months in which they were represented in samples. A slight dearth period exists during May–June, and another during December. No single nectar source is dominant, and the honeys are multifloral in character. D.G. Lowe

Botany Dept., Shivaji Univ., Kolhapur 416 004, India.

Chaubal, P.D. and Kotmire, S.Y. Melissopalynological aspects of mangroves. I,II,III: Honey analysis. The Mangroves: Proc. Nat. Symp. Biol. Util. Cons. Mangroves. (1985) 398–400 [En, Ba]

Pollen analyses of honey samples collected in 1982, from sites around Deogad on the western coast of India, were used to construct a flowering calendar of mangrove species. This shows, for 16 taxa, months in which their pollen grains were found in honey and their annual average percentage in honey. D.G. Lowe

Dept. Botany, Shivaji Univ., Kolhapur 416 004, India.

Chaubal, P.D. and Kotmire, S.Y. Pollen morphology of some mangroves and their associates. Marine plants, their biology, chemistry and utilisation. Proc. All India Symp. mar. Plants, Dona Paula, Goa, India, 1985 [edited by Krishnamurthy, V.J.] (1985) 311–314 [En, Bb]

Chaudhari, R.K. Bee forage in Punjab plains (India). 1. Pathankot and adjacent villages. *Indian Bee Journal* (1977) 39 (1–4) 15–20 [En, B]

Chaudhari, R.K. Peculiar foraging behaviour of honeybees in Kangra (India). *Indian Bee Journal* (1977) 39 (1–4) 24–26 [En, B]

Apis mellifera and *A. cerana* were observed to collect corbicular loads of wheat flour.

Chaudhari, R.K. Floral fidelity in the Indian honey bee (*Apis cerana indica* F.). *Indian Bee Journal* (1978) 40 (2) 33–35 [En, B]

About 5200 pollen loads, taken from *A. cerana* in Himachal Pradesh and the Indian Punjab, were analysed; only 56 of the pollen loads contained pollens from more than one plant species. This shows a high floral fidelity for *A. cerana*, comparable to that of *A. mellifera*. Mixed loads were slightly more common during December to March, but not during pollen dearth (June to early July) P. Walker
Regional Bee Res. Centre, KVIC, Pathankot, Punjab, India.

Chaudhari, R.K., Singh, B. and Singh, P.P. Foraging pattern of insect pollinators on litchi (*Litchi chinensis*). *Rau J. Res.* (2002) 12 (1 & 2) 60–62 [En, Bc]

In a litchi orchard in Bihar, India, *Apis dorsata*, *A. mellifera*, *A. florea* and *A. cerana indica* started foraging on the flowers in small numbers by 06.00 hours; activity increased until 09.00 hours and then decreased, although most species had a smaller peak of activity around 11.00 hours. Foraging continued until dusk. P. Walker

Dept of Entomology and Agricultural Zoology, Rajendra Agricultural Univ., Bihar, Pusa (Samastipur)-848 125, India.

Chaudhari, R.K., Singh, B. and Singh, P.P. Population dynamics of honeybees foraging on litchi flowers. *Journal of Entomological Research* (2002) 26 (1) 71–75 [En, Bc]

Apis dorsata was most the dominant *Apis* species (44.5% of total), followed by *A. cerana indica* (41.9%) and *A. florea* (4.6%) amongst honey bee species.

Dept of Entomology and Agricultural Zoology, Rajendra Agricultural Univ., Pusa (Samastipur)-848 125, Bihar, India.

Chaudhary, D.K. and Mattu, V.K. Incidence of *Varroa jacobsoni* Oud. on *Apis mellifera* and *Apis cerana* in Himachal Pradesh, India. *American Bee Journal* (1997) 137 (8) 597–598 [En, Bj]

Samples of bees were collected from wild and managed colonies of both species in two different areas. *Varroa jacobsoni* was found in only one of the 11 *A. cerana* samples and in two of the 33 *A. mellifera* samples. P. Walker Sociobiology & Behavioral Ecology Res. Lab., Department of Biosciences, Himachal Pradesh University, Shimla-171005, India.

Chaudhary, J.L. and Singh, B.P. Bee pasturage and a pattern for seasonal management for Amethi, Uttar Pradesh. *Indian Bee Journal* (1989) 51 (3) 109–111 [En, Bj]

In this district of Uttar Pradesh, India, many plant species are in flower between February and mid-May (when neem, *Azadirachta indica*, flowers). From June until October there are less species in flower. The important species are listed for each month, with some notes on the honeys produced. Instructions are given for seasonal beekeeping management in this area. During gaps in the flowering of crops, colonies [*Apis cerana*] are migrated 40–80 km. P. Walker

Beekeeping Department, Agro-based and Food Industries, Khadi and Village Industries Commission, Irla Road, Vile Parle (West), Bombay 400 056, India.

Chaudhary, J.P. and Jain, K.L. Nesting and foraging behaviour of a mason bee, *Megachile lanata* Lepel (Megachilidae: Hymenoptera). *Indian Journal of Entomology* (1978) 40 (4) 405–411 [En, B]

Megachile lanata was studied in India to evaluate its usefulness as a pollinator of commercial crops.

Dept. Entomology, Haryana Agric. Univ., Hissar 125004, India.

Chaudhary, O.P. Successful introduction of Italian honey bee, *Apis mellifera* L. in South India. *Journal of Insect Science* (97) 10 (1) 23–29 [En, Bc]

The bees were established in one area in Tamil Nadu and two in Maharashtra. A list of bee plants for the first area is published, and analyses of pollen loads from bees showed that they visited 33 species.

Central Bee Research and Training Inst., Pune 411016, India.

Chaudhary, O.P. Performance and prospects of *Apis mellifera* L. in South Western Haryana. *Haryana Agricultural University Journal of Research* (2000) 30 (3/4) 89–97 [En, 7 wf.]

Analysis of the pollen loads collected by *A. mellifera* showed that 48 flower species were visited, especially rapeseed which provided abundant nectar and pollen from December to February. Brood area/colony was good (max. 10 frames); it decreased from June to September. In these two months, there was a partial nectar dearth, so colonies had to be fed with sugar syrup. An average of 18.5 kg honey/colony from rapeseed was extracted during February–March. Minor honey flows occurred in April–May from sunflower and in July. No natural honey bee enemies were recorded in the area. It is concluded that south-west Haryana has good potential for *A. mellifera* beekeeping, but the large-scale cultivation of at least one more bee crop, such as sunflower, is strongly recommended before beekeeping is developed commercially.

Meanwhile, the area can be used for winter migration of colonies and for colony multiplication.

CCSHAU Regional Research Station, Karnal-132 001, India.

Chaudhary, O.P. and Rakesh, Kumar. Studies on honeybee foraging and pollination in cardamom (*Elettaria cardamomum* Maton). *Journal of Spices and Aromatic Crops* (2000) 9 (1) 37–42 [En, wf]

In a study in Kerala, India, bees were the predominant flower visitors (more than 99% of the total). *Apis cerana indica* was the most frequent (95.8%) followed by *Trigona iridipennis* (2.2%).

Regional Research Station, CCS Haryana Agricultural Univ., Karnal-132 001, Haryana, India.

Chaudhary, O.P. and Wakhle, D.M. Honey processing plant with moisture reduction unit. *Journal of Insect Science* (99) 12 (1) 46–50 [En, X]

Honeys from different sources were subjected to the following: liquefaction, preheating and straining, micro-filtration, inactivation of yeast cells, vacuum evaporation, cooling and storage and temperature control treatments. The processing led to an increase in total reducing sugars and a decrease in sucrose content. Microfiltration caused a marginal decrease in total ash content. There were 3–5%, 2–3% and 5–8% processing and handling losses in honeys from *Apis cerana*, *A. mellifera* and *A. dorsata*, respectively, due to water content reduction and microfiltration. There was about 5% reduction of water content, 100% destruction of yeast cells, 60% reduction of foreign materials, a slight increase in HMF and a decrease in amylase activity. Processing also increased the honey's shelf life. The plant can process 100 metric tonnes of raw honey/annum at a rate of 300 kg/8 hours.

Haryana Agricultural Univ., Regional Research Station, Karnal-132 001, India.

Chauhan, P.S. Studies on pollination ecology of apple orchards by hymenopterous insects in Narkanda and Matiana areas of Himachal Pradesh. MPhil Dissertation, Himachal Pradesh University, Shimla, India. (1985) 101 pp. [En]

Of 44 insect species collected on apple flowers, *Apis cerana* was the most abundant (14–43% of insect visitors).

Dept. Bio-Sci., Himachal Pradesh Univ., Shimla-171005, India.

Chauhan, S.K. and Sharma, L. Role and performance of beekeepers' cooperative society. *Indian Cooperative Review* (98) 35 (3) 245–254 [En, Ba]

The membership (80 beekeepers), working capital and profitability of the Kangra Valley Beekeepers' Cooperative Society in Himachal Pradesh, India, are reported for the period 1991–96. The main objectives of the society and the costs and returns for beekeeping are also set out. Author Dept of Agricultural Economics, HPKV Palampur, Himachal Pradesh, India.

Chauhan, S.K. and Sharma, S.K. A study on employment and income generation potential of agricultural products in Himachal Pradesh. Palampur; Himachal Pradesh Krishi

Vishvavidyalaya (HPKV), *Research Report, Department of Agricultural Economics* (2000) (No.17) 135 pp. [En, X]

The study examines the trends in production, the economics of production and marketing of honey, and the constraints in the development of beekeeping in five districts in Himachal Pradesh, India, based on data collected from 200 beekeepers (69 stationary and 131 migratory).

Chaunan, S.K. and Sharma, S.K. *Apis mellifera* bee rearing – a profitable venture. *Indian Farmer's Digest* ([1998?]) 27 (8) 24–25 [En, Bb]

The comparative economics of stationary and migratory beekeeping are compared, using a basic unit of 50 hives. Both types are found to be highly profitable, but maximum returns are given by migratory beekeeping. *E. Claridge*
Dept of Agricultural Economics, HPKV Palampur, Himachal Pradesh, India.

Chaunan, S.K. *Production, marketing and export potential of honey.* *Bihar Journal of Agricultural Marketing* (1995) 3 (1) 65–70 [En, ref.]

Department of Agricultural Economics, Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, India.

Chawla, B.P. and Goyal, N.P. *Occurrence of DDT and BHC residues in honey collected from apiaries and market of Punjab (India).* *Indian Bee Journal* (1988) 50 (4) 96–97 [En]

All the 24 honeys from apiaries (A) and the 10 honeys bought in a market (B) contained residues of DDT and of BHC [HCH]. Levels of DDT in A ranged from a trace to 175 ppb (mean 56 ppb), and in B from a trace to 215 ppb (mean 82 ppb). Levels of BHC in A ranged from a trace to 85 ppb (mean 17 ppb), and in B from a trace to 101 ppb (mean 34 ppb). *P. Walker*

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Chhuneja, P.K., Brar, H.S. and Goyal, N.P. *Studies on some pollen substitutes fed as moist-patty to *Apis mellifera* L. colonies. 1. Preparation and consumption.* *Indian Bee Journal* (1992) 54 (1–4) 48–57 [En, Bj]

The six pollen substitutes tested all had the same protein content as pollen (14.72%) but the fibre content was lower. During the feeding period, colonies must have access to a reliable nectar flow, otherwise they should be given sugar syrup. *P. Walker*

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Chhuneja, P.K., Brar, H.S. and Goyal, N.P. *Studies on some pollen substitutes fed as moist-patty to *Apis mellifera* L. colonies. 2. Effect on colony development.* *Indian Bee Journal* (1993) 55 (3/4) 17–25 [En, Bj]

Compared with seven other diets, two types of patty containing soyabean resulted in significantly higher mortality of unsealed and sealed brood. Brood mortality was lowest in colonies fed with pollen or with a diet of brewer's yeast + guar meal; mean populations in these colonies were 11,650 and 9,700 bees, respectively (compared with less than 7,670 bees in colonies on other diets), and mean weights of individual nurse bees and foragers were significantly higher. *P. Walker*

Department of Processing and Agricultural Structures,

College of Agricultural Engineering, Punjab Agricultural University, Ludhiana 141 004, India.

Chhuneja, P.K., Brar, H.S. and Goyal, N.P. *Studies on some pollen substitutes fed as moist-patty to *Apis mellifera* L. colonies. 3. Effect on honey storage, pollen load and wax production.* *Indian Bee Journal* (1993) 55 (3/4) 26–30 [En, Bj]

Average wax production from colonies fed on a diet of brewer's yeast + guar meal (B) for 6.5 months was 1.325 kg/colony and from pollen-fed (P) colonies 2.455 kg/colony. Colonies fed on other diets yielded significantly less wax. Honey yields were also higher in colonies fed with B or P. Feeding pollen substitutes resulted in a significant decrease in the average weight of pollen loads, indicating a fall in pollen foraging. *P. Walker*

Department of Processing & Agricultural Structures, College of Agricultural Engineering, Punjab Agricultural University, Ludhiana 141 004, India.

Chhuneja, P.K. and Goyal, N.P. *Longevity of *Apis mellifera* L. worker bees during summer and autumn periods in Punjab plains.* *Indian Bee Journal* (1992) 54 (1–4) 45–47 [En, Bj]

Worker honey bees which emerged on 5 April lived for an average of 28.8 days, and those emerging on 3 October lived for 30.1 days. The difference was not significant, probably because ambient temperatures and RH were similar at these times of year. *P. Walker*

Department of Processing & Agril. Structures, Punjab Agricultural University, Ludhiana 141 004, India.

Choudhury, B., Choomsai, M.L.A. and Menon, M.G.R. *Insect pollination in some vegetable crops.* *Haryana Journal of Horticultural Sciences* (1973) 2 (1/2) 56–62 [En]

The main pollinators were: *Apis florea* and *Halictus* sp. for tomato; *A. dorsata* and *A. florea* for eggplant; *Halictus* sp. and *A. cerana indica* for okra; *A. florea* and *Anthophora* sp. for radish. *D.G. Lowe*

Indian Agric. Res. Inst., New Delhi, India.

Crane, E. *The rock art of honey hunters.* Cardiff, UK; International Bee Research Association (2001) 106 pp. ISBN 0 86098 237 8 [En, Bd]

This book provides the first survey of rock paintings and engravings showing bees' nests and/or honey hunters collecting honey combs from them. The rock art dates from prehistoric times onwards. Of the 380 sites included (all of which are listed in an Appendix), most are in Africa, and some – also of *Apis mellifera* – in Europe (Spain). A number showing *A. dorsata* nests have been found in central India. Methods of reaching and harvesting nests shown in the rock art of an area were similar to those of more recent honey hunters. The book is well illustrated with 70 line drawings and photographs, and includes a list of references and an index. *Author*

Crane, E. *Honey sources of some tropical and subtropical countries.* *Bee World* (1973) 54 (4) 177–186 [En, B]

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented: Africa – Botswana, Cameroon, Ethiopia, Mauritius, Morocco, Mozambique, Nigeria, Somalia, Zanzibar.

America (South) – Ecuador, Guyana, Venezuela. Asia – Afghanistan, India, Iran Pakistan *D.G. Lowe*
Bee Research Association, Chalfont St. Peter, Gerrards Cross, Bucks, UK.

Crane, E. *Bibliography of tropical apiculture. Part 3. Beekeeping in the Indian sub-continent (with Afghanistan and Iran)*. London, UK; International Bee Research Association. (1978) 14 pp. ISBN 0-86098-033-2 [En, B]
Annotated list of 171 publications, grouped under country, with an introduction.

Crane, E. *Bibliography of tropical apiculture. Part 4. Beekeeping in Asia east of India*. London, UK; International Bee Research Association. (1978) 12 pp. ISBN 0-86098-034-0 [En, B]
Annotated list of 127 publications, grouped under country, with an introduction.

Crane, E. *The archaeology of beekeeping*. London, UK; Duckworth. (1983) 360 pp. ISBN 0-7156-1681-1 [En, B]
This is the first book to examine the history of man's association with bees as evidenced by material objects that have been discovered and identified. The interpretation of the rich heritage of archaeological finds is enhanced by studies of their equivalents still used by beekeepers and honey hunters in more remote parts of the world. The possible early existence of hives with replaceable combs, like those used in modern beekeeping, is discussed. A final chapter explores representations of bees in sculpture, glass, coins, jewellery, etc., and also objects that were made in the ancient world with honey and beeswax. Over 250 photographs and drawings are cleverly integrated with the text. There is a bibliography of 324 items, and a subject index. Apart from archaeologists, and beekeepers and others working with bees, the book will interest readers concerned with anthropology, the history of apiculture and the biological basis of the relationship between man and bees in past ages. *D.G. Lowe*
International Bee Research Association, Cardiff, CF10 3DT, UK.

Crane, E. *The origination of *Apis cerana* beekeeping and its determining factors. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 425–437 ISBN 0-86098-196-7 [En, Bdo]
The following six possible stages in beekeeping in Asia are discussed: (1) opportunistic collection of honey from wild bees' (*Apis* spp.) nests; (2) ownership of wild *A. cerana* nests; (3) keeping *A. cerana* in fixed-comb hives; (4) keeping *A. cerana* in movable-comb top-bar hives; (5) keeping *A. cerana* in modern movable-frame hives; (6) keeping introduced *A. mellifera* in modern hives. Stages 3, 5 and 6 are described in greater detail, and a table is presented showing the probable dates when these first occurred in various parts of Asia. Regions where beekeeping with *A. cerana* is likely to have started early are thought to include Kashmir, northern India, Pakistan, Afghanistan, Japan, Korea, Russian Far East and China, whereas it probably started late in the rest of India, Sri Lanka, Nepal, Tibet and

Bhutan, and the countries of south-east Asia. It is suggested that knowledge of the history of *A. cerana* beekeeping should be applied to answering questions concerning the promotion of present-day beekeeping and to the choice of hive type in a particular area. *D.G. Lowe*

Das, P.K., Sharma, J.K. and Rahman, S. *A test to measure the knowledge of beekeepers on scientific beekeeping*. *Journal of the Agricultural Science Society of North East India* (97) 10 (2) 222–226 [En, 7 wf]
An attempt was made to construct and standardise a test to measure the knowledge of beekeepers about scientific beekeeping.
Dept of Extension Education, Assam Agricultural Univ., Jorhat 785 013, Assam, India.

Dan, D.K.(ed.). *Proceedings, state-level seminar on beekeeping, 13–14 July, 1980, West Bengal*. Khantura, West Bengal, India; Gobardanga Renaissance Institute. (1980) 88 pp. [Bengalee\En, B]
Most of the proceedings are in Bengalee, but there are brief articles in English on: *Apis florea* and *Trigona* as pollinators (abstracted elsewhere in *Apicultural Abstracts*); beekeeping in Karnataka; a beekeeper's observations on the effect of a solar eclipse on his bees; the need for a census of *Apis cerana* colonies; early beekeeping in India *D.G. Lowe*
Gobardanga Renaissance Inst., P.O. Khantura 742 273, Dist. 24 Parganas, West Bengal, India.

Darade, M.N., Singh, B.P. and Chakrawarty, P. *Flight range of *Apis cerana.** *India. Bee Journal* (1989) 51 (2) 59–61 [En, Bj]
Numbers of foragers were counted at a feeder that was gradually moved further from the hive (up to 950 m away). Between 50 m and 400 m the numbers gradually decreased, then they decreased more sharply, although a few bees visited the feeder when it was 950 m from the hive. It is concluded that *A. cerana* prefers to forage at up to 400 m from the hive, but will fly further if food sources are scarce. *P. Walker*
Central Bee Res. & Training Inst., Khadi & Village Industries Commission, Pune 411 016, India.

Das, K.K. et al. *Measurement of potentiality of communication media for popularising beekeeping in India*. *Indian Bee Journal* (1980) 42 (1) 1–8 [En, B]

Dashad, S.S., Sharma, J.K. and Yadav, P.R. *Foraging speed of insect visitors to the blooms of various cultivars of apple (*Malus domestica* Borkh)*. *Indian Bee Journal* (1992) 54 (1–4) 92–98 [En, Bj]
Results are presented for nectar and/or pollen collection by the honey bees *Apis cerana*, *A. mellifera* and *A. dorsata*, and by the flies *Episyrphus balteatus*, *Eristalis tenax* and *Orthellia* spp. on seven apple cultivars. *A. dorsata* pollen collectors worked significantly faster than *A. dorsata* nectar collectors, *A. mellifera* and *A. cerana* collectors of nectar and pollen, and the flies. Among nectar collectors, *A. dorsata* worked fastest and *A. mellifera* the slowest. *P. Walker*.
Krishi Gyan Kendra, CCS, HAU, Mahendergarh (Haryana), India.

Deodasan, A. Rubber plantation and bee-keeping. *Indian Bee Journal* (1972) 34 (1/2) 38–39 [En, B]

Details are given of the extent of rubber growing (*Hevea brasiliensis*). The plant has both floral and extrafloral nectaries. About 22,000 colonies [of *Apis cerana indica*] are migrated to rubber in Kerala State, and ten times as many could be taken. Well managed apiaries yield 20–25 kg per colony during two months' migration. The honey is white to golden yellow. Aerial insecticide applications have killed most of the pollinating insects and the effectiveness of introduced honeybees needs further study. *E. E. Crane* Directorate of Beekeeping, Khadi and Village Industries Commission, Bombay, India.

Deodikar, G.B. A preliminary survey of beekeeping in Kashmir. *Indian Bee Journal* (1970) 32 (1/2) 12–22 [En, B]

The survey covers the state of Jammu and Kashmir and includes broad physical features, aspects of vegetation, bee plants, local bees and beekeeping. Suggestions for improving the present state of beekeeping include improvement in bee forage, bee management practices and selective breeding. Specific locations are indicated for trying out these suggestions. A suitable size for frames and hives is needed for this area. *Author*

Central Bee Research Inst., Khadi and Village Industries Commission, Poona 4, India.

Deodikar, G.B. Code of conduct for conservation of bees and beekeeping. *Indian Bee Journal* (1971) 33 (1/2) 14–22 [En, B]

India's indigenous species of *Apis* (*A. cerana indica*, *A. dorsata*, *A. florea*) and some species of *Trigona* are economically important for their wax production and pollinating activities. A code of conduct for conservation of these bees is suggested, covering procurement of colonies, registration of hives, keepers and apiaries, and also management practices. *A. S. Attwood*

Central Bee Res. Inst., Poona 4, India.

Deodikar, G.B. Dangers from introduction of exotic pathogenic diseases through import of useful insects like bees, silkworms or lac-insects. *Indian Bee Journal* (1971) 33 (1/2) 1–2 [En, B]

Acarine disease was first reported in India in the 1950s, and is now spreading. Evidence suggests that it may have been imported with infected *Apis mellifera*. It is proposed that import and quarantine laws should apply to bees, silkworms and other insects, to prevent new diseases entering the country. An offshore island should be selected for stricter quarantine measures. *A. S. Attwood*

Central Bee Res. inst., Poona 4, India.

Deodikar, G.B. Apiculture in India – present and future. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980. (1983) 49–59 [En, B]

Deodikar, G.B. Seethalakshmi, V.S. and Suryanarayana, M.C. Floral biology of sunflower with special reference to honeybees. *Journal of Palynology* (1976) 12 (1/2) 115–125 [En, B]

The foraging behaviour of *Apis cerana* was studied in 1972–1974 on a 1-ha plot with about 30 colonies. Pollen

foragers restricted their visits to florets in the male phase; most visits occurred from six to 11 hours, and from 16 to 18 hours. Bees gathered nectar from about nine hours until evening; they were as efficient as pollen foragers in effecting pollination. Seed yields and weights from the plot with *A. cerana* colonies were much higher than from plots without bees; yields were lowest on plots caged to exclude all pollinators. Sunflower is grown in several states in India, but seed yields have been low compared to those in other countries. *D. G. Lowe*

Central Bee Res. Inst., Khadi & Village Indus. Commission, 839/1 Deccan Gymkhana, Poona 411 004, India.

Deodikar, G.B. and Suryanarayana, M.C. Pollination in the service of increasing farm production in India. Advances in pollen-spore research. Vol. II [edited by Nair, P.K.K.]. New Delhi, India; Today & Tomorrow's Printers. (1977) 60–82 [En, B]

The importance in the pollination of crops of the four *Apis* species and of *Trigona* is described, and a summary is made of previously published results for the increase in yields in various crops as a result of pollination by *A. mellifera*. Available data for Indian crops are presented in tables, and discussed. It is estimated that the 40 million ha of bee-pollinated crops require 120 million honeybee colonies for optimum yields, but only 0.5 million colonies of *A. cerana* are at present kept in modern movable-frame hives in India. Although 60 million ha of forests are available for seasonal migration, many of the forests are too far from farmland for migratory beekeeping and improvements in density and floristic composition are required in others. *P. Walker*

Maharashtra Assoc. for the Cultivation of Sci., Pune, India.

Deodikar, G.B. et al. Nesting behaviour of Indian honeybees. III. Nesting behaviour of *Apis dorsata* Fab. *Indian Bee Journal* (1977) 39 (1–4) 1–12 [En, B]

Of 1861 colonies observed in central and western India, 843 (45%) built nests on man-made structures and 1018 used trees of various species. Over half the nests were between 6 and 13 m above the ground. More of the nests were constructed in an approximately north–south direction than east–west, and 19% of them were actually along the north–south axis. Nests were usually in aggregations of up to 50, and were usually constructed over the remains of combs from the previous season. A table gives the dimensions of nests from Indore. Queen cells protruded at the lower edge of the comb. *P. Walker*

Central Bee Res. Inst., Khadi and Village Indus. Commission, Pune 411 004, India.

Desh, Raj, Sharma, S.D. and Sharma, O.P. Effect of varied infestation levels of tracheal mite, *Acarapis woodi* Rennie on *Apis mellifera* Linnaeus. *Journal of Insect Science* (1994) 7 (1) 97–98 [En, 4 ref.]

Studies showed that when populations of *Acarapis woodi* in tracheae of *Apis mellifera* increased to beyond 35, the bees turned into crawlers. At this stage, more than 75% of bees of a colony were found to be infested. Forager bees could sustain a population of about 10 mites per unit trachea. Department of Entomology, Himachal Pradesh Krishi Vishwavidyalaya, Palampur 176 062, India.

Deshmukh, A.K., Rao, G.M. and Karve, A.D. Studies on the effect of honey bee pollination on the yield of safflower. *Indian Bee Journal* (1985) 47 (1-4) 1-2 [En, B]

In pollination trials on irrigated *Carthamus tinctorius* fields at two sites in Maharashtra, India, *Apis cerana* colonies (10/ha) were introduced to two plots growing two different cultivars; two control plots had no hives. Overall, honeybees (*A. cerana*, *A. dorsata* and *A. florea*) represented 81% of total insect pollinators; they collected nectar and pollen from the flowers. All three species started foraging at about 10.00-10.30 hours, but they differed in when they ceased foraging. *A. dorsata* visited more florets and more heads per unit time than the other species did. Seed yield was higher in both cultivars on plots with *A. cerana* colonies. *P. Walker*

Nimbkar Agric. Res. Inst., Phaltan 415 523, India.

Deshmukh, L.S. and Borse, B.T. Acute renal failure following multiple stings by honeybees. *Indian Pediatrics* (1996) 33 (9) 781-783 [En, 5 ref.]

Two case reports are described for (5-month-old and 8-year-old) male children that were admitted to the Government Hospital, Aurangabad, Bihar, India, with multiple honeybee [*Apis mellifera*] stings, and managed on the lines of acute renal failure. Renal failure was ascribed in one case to haemolysis and in the other to a serum sickness-like reaction.

Department of Pediatrics, Government Medical College, Aurangabad 431 001 (MS), India.

Deshmukh, S.D. Effects of bee visits and climate on sunflower pollination. *Science and Culture* (1977) 43 (12) 543-545 [En, B]

During the flowering period of sunflower, which lasted from eight to ten days, visits by pollinators (all species) were observed from 6 to 18 hours. A colony of *Apis cerana* was set up in the field; other pollinators included bumble bees, *A. dorsata*, *A. florea* and *Melipona* sp. No significant correlation was found between the number of bee visits (all species) and seed set. The number of visits increased with temperature from 37-44°C, and was highest from 8 to 11 hours. The number of bee visits was negatively correlated with RH. *J.M. Gedye*

Sunflower Res. Scheme, PKV, Akola, Maharashtra, India.

Devadason, A. Migratory beekeeping in Kerala. *Indian Bee Journal* (1971) 33 (3/4) 35-38 [En, B]

Devadason, S. Sac brood bee-disease in Kumaon region, Uttar Pradesh. *Indian Honey* (1983) 6 (19) 2-5 [En, B]

Devanesan, S. and Jacob, A. Rubber plant (*Hevea brasiliensis* [brasiliensis] Muell. ARQ) as a source of nectar for *Apis mellifera* in South India. *Insect Environment* (2000) 6 (1) 25 [En, X]

AICRP on Honeybee Research & Training Centre, Dept of Agricultural Entomology, Kerala Agricultural Univ., College of Agriculture, Vellayani 695 522, Trivandrum, Kerala, India.

Devaraja, T.S. An evaluation of Bee-Keepers Co-operative Society Limited, Sakleshpur [Hassan District, Karnataka].

Indian Cooperative Review (2000) 37 (4) 242-247 [En, X]

Dept of Commerce, Post-Graduate Centre, Hemangan-gothi, Univ. of Mysore, Hassan-573 201, India.

Dhaliwal, G.S. Impact of chemical control on honeybees. *Pesticides* (1970) 4 (11) 17-19 [En, B]

Toxicity of agricultural pesticides to honeybees is reviewed, and effects of different formulations of the same compound are discussed. Pesticides are listed in three groups according to their toxicity, as found by other workers. Such results as are available for *Aphis cerana indica* are included. *M.D. Seager*

Div. Entomology, IARI, New Delhi, India.

Dhaliwal, H.S. and Bhalla, O.P. On the foraging ecology of *Apis cerana indica*. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February-4 March 1980. (1983) 513-527 [En, B]

Dept. Entomology & Apiculture, Himachal Pradesh Krishi Vishva Vidyalaya, Solan-173213, India.

Dhaliwal, H.S. and Sharma, P.L. Mass marking honeybees for behaviour studies. *Indian Journal of Entomology* (1972, publ. 1973) 34 85-86 [En]

The marking device is a modified hive entrance bar with a built-in colour chamber.

Dept. Entomology, Himachal Pradesh Univ., Agric. Complex, Chambaghat-Solan, Himachal Pradesh, India.

Dhaliwal, H.S. and Sharma, P.L. The foraging range of the Indian honeybee on two crops. *Journal of Apicultural Research* (1973) 12 (2) 131-134 [En]

Counts were made of *Apis cerana indica* foraging on cauliflower and barberry flowers at different distances from the hive, during April 1970 and 1971. The maximum foraging distance on cauliflower was 900 m and on barberry 1100 m; 75% of the foragers were counted within 400 m of the hive on cauliflower and within 600-700 m on barberry. The pattern of forager distribution on the large continuous area of cauliflower was more regular than on the scattered areas of wild barberry. *Author*

Dept. Entomology H.P. Univ., Agric. Complex, Chambaghat-Solan, Himachal Pradesh, India.

Dhaliwal, H.S. and Sharma, P.L. Foraging range of the Indian honeybee. *Journal of Apicultural Research* (1974) 13 (2) 137-141 [En, B]

Dhaliwal, H.S., Srivastava, S. and Adlakha, R.L. Insect pollination of lychee, *Litchi chinensis* Sonn., in the valley areas of the Indian Himalayas. Proceedings of the XXVth International Apicultural Congress, Adelaide. Bucharest, Romania; Apimondia Publishing House. (1977) 396 [En, B]

Apis florea (50%) and *A. cerana* (26%) were the most abundant of the Hymenoptera visiting *L. chinensis*.

Dept. Entomology, H.P. Univ., Agric. Complex, Chambaghat-Solan, HP, India.

Dhaliwal, H.S., Srivastava, S. and Sharma, P.L. Some biological observations on the mite, *Acarapis woodi* Rennie,

infesting honeybees, *Apis cerana indica* F. *Current Science* (1974) 43 (23) 750–752 [En, B]

Infested bees from a hill area of Solan, India, were examined. Bees 2–7 days old were most susceptible to attack by the parasite, and incidence was highest in bees 3–4 days old.

Dept. Entomology, Coll. Agric., Himachal Pradesh Univ., Chambaghat-Solan, 173213 Himachal Pradesh, India.

Dhaliwal, J. S. and Atwal, A. S. Foraging range of *Apis mellifera* L. on berseem (*Trifolium alexandrinum* L.) at Ludhiana. *Indian Bee Journal* (1974) 36 (1–4) 17–18 [En, B]

Insects were collected from berseem at distances between 100 and 3000 m from *A. mellifera* hives. *A. mellifera* bees were not found farther than 2000 m from the apiary, and most were less than 1000 m away. P. Walker

Coll. Agric., Punjab Agric. Univ., Ludhiana, Punjab, India.

Dhuley, J. N., Mujumdar, S. M., Mujumdar, A. M. and Naik, S. R. Laboratory studies on contact toxicity of aureofungin in *Apis cerana indica* Fabr. *Indian Bee Journal* (96) 58 (4) 207–208 [En, B]

In these tests, the fungicide aureofungin was used at concentrations much higher than the recommended dose. From the results it is concluded that, in field use, aureofungin would not be toxic to honey bees.

227/99 Dept. Pharmacology & Toxicology, Res. Div., Hindustan Antibiotics Ltd., Pimpri, Pune 411 018, India.

Dinabandhoo, C. L. and Dogra, G. S. Incidence and control of ectoparasitic mite, *Pyemotes herfsi* Ondenmans of the Indian honey bee, *Apis cerana* Fab. *American Bee Journal* (1980) 120 (1) 44, 46–47 [En, B]

In Himachal Pradesh, N. India.

Dinabandhoo, C. L. and Dogra, G. S. The pyemotids (*Acarina* : *Pyemotidae*) and their significance in apiculture. *Indian Bee Journal* (1982) 44 (2) 29–32 [En, B]

In India, *Pyemotes ventricosus* is often found in the floor debris of stored products. *P. herfsi* has recently been reported as an ectoparasite of adult *Apis cerana* in Himachal Pradesh. The life cycle and behaviour of these species is described. The development from egg to adult occurs in the abdomen of the female, and adults are born viviparously. The presence of *P. herfsi* in a honeybee colony may cause dysentery and absconding, or even death, but the mites do not appear to spread rapidly and may not attack other colonies in an apiary. Infestations can be controlled with dichlorvos. P. Walker

Apicultural Res. Stn., Himachal Pradesh Krishi Vishva Vidyalaya, Katrain 175 129, India.

Divan, V. V. Honey bee behaviour during total solar eclipse. *Indian Bee Journal* (1980) 42 (4) 97–99 [En, B]

On the day of an eclipse (total at 15.38 hours) in Karnataka, India, the behaviour of a colony of *Trigona (Tetragonula) iridipennis* in an observation hive was observed. Foragers were normally active from 8.30 hours. Three hours before the start of the eclipse, the bees removed the top of the tubular tunnel which they had built outside the entrance hole to their hive; during the eclipse, returning foragers seemed to have difficulty in locating the

hive, and formed groups of 20–30 bees. Some bees acted as escorts to these groups, guiding them back to the hive. The effects on *A. cerana* colonies were not clear because, the eclipse coincided with the normal break in their foraging activity. Particularly in strong colonies, pollen collection increased on that day, and the next day. P. Walker
Central Bee Res. Inst., Khadi and Village Indus. Commission, Poona 411 004, India.

Divan, V. V. and Vartak, V. D. Studies on the bee forage of Castle Rock area in Karnataka State. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980. (1983) 528–536 [En, B]

This area of the Western Ghats in India is estimated to contain 4,000 species of flowering plants, but probably only 450 are useful as bee forage. Of these, 340 are very minor sources, 20 are important sources of pollen, and only 10 are major nectar plants.

Central Bee Res. Inst., Khadi & Village Industries Commission, Pune-411004, India.

Diwan, V. V. and Rao, G. V. Altitudinal variation in bee forage of West Coorg. *Indian Bee Journal* (1971) 33 (3/4) 39–50 [En, B]

In the valleys of West Coorg the average honey yield was 5.5 kg per colony in the experimental apiary. Locating apiaries at the transition of hill top plateaux and adjacent valleys significantly increased the honey yield (11.0 kg honey per colony). Two tables give the flowering period, occurrence and forage potential of the bee plants in the valleys and the hill tops. A. S. Attwood

Beekeeping Observation Stn., Central Bee Res. Inst., K & VI Commission, Castle Rock, India.

Dixit, O. P., Singh, U. P. and Gupta, J. N. Significance of [bee] pollination in seed setting efficiency of berseem (*Trifolium alexandrinum* L.). *Journal of Agronomy and Crop Science* (1989) 162 (2) 93–96 [En, de]

Indian Grassland Fodder Research Institute, Jhansi 284003, India.

Dreller, C. and Kirchner, W. H. The sense of hearing in honey bees. *Bee World* (1995) 76 (1) 6–17 [En, B]

Present knowledge about hearing in honey bees is reviewed, with 30 references. Recent research involving sound signals composed of high air particle oscillations (rather than sound pressure changes), and aversive conditioning and learning experiments, are described.

Theodor-Boveri-Institut für Biowissenschaften der Universität, Lehrstuhl für Verhaltensphysiologie und Soziobiologie, Am Hubland, 97074 Würzburg, Germany.

Dulta, P. C., Rana, B. S., Verma, L. R. and Mattu, V. K. Absconding behaviour of the Indian honey bee. *Indian Bee Journal* (1988) 50 (3) 67 [En, B]

Twenty *Apis cerana* colonies (10 strong and 10 weak) were studied from June to October in temperate conditions in India. In colonies that absconded [number not stated] there were marked decreases in areas of honey and pollen stores and of sealed and total brood; the number of larvae dropped to zero. In colonies that did not abscond, honey

stores increased, and decreases in pollen stores and in brood rearing were much less than in absconding colonies. It is concluded that, in this study, colonies absconded when the areas of honey and pollen stores were less than 710 and 20 cm² respectively, and the areas of eggs, larvae, sealed and total brood were less than 50, 1, 10 and 60 cm², respectively. *P. Walker*

Dept. Bio-Sci., Himachal Pradesh Univ., Shimla 171 005, India.

Dutta, T.R., Ahmed, R., Abbas, S.R. and Vasudeva Rao, M.K. Plants used by Andaman aborigines in gathering rock-bee honey. *Economic Botany* (1985) 39 (2) 130–138 [En, Bc]

In the Andaman Islands much honey and beeswax is collected from *Apis dorsata* nests. It has been reported that, before collecting honey, the Onge tribesmen of Little Andaman protect themselves by chewing the leaves of *Orophea katschallica* (Annonaceae) and smearing their bodies with the juice and saliva. They then climb up to the nest and spit more of the mixture on to it, which causes the bees to fly off. The use of stem sap of *Amomum aculeatum* (Zingiberaceae) to tranquilise *A. dorsata* has already been reported from South Andaman. Another plant in this family, *Zingiber squarrosus*, which also grows on S. Andaman, has now been found to have a similar effect on *A. dorsata*. The two Zingiberaceae species were tested on *Apis cerana*, but had no pacifying effect. *P. Walker*

Central Agric. Res. Inst., Port Blair 744101, India.

Dyer, F.C. Nocturnal orientation by the Asian honey bee, *Apis dorsata*. *Animal Behaviour* (1985) 33 (3) 769–774 [En, Bb]

Apis mellifera adansonii and *A. dorsata* have been reported to forage at night. To establish whether the moon is used for orientation, a colony of *A. dorsata* (in South India) was observed. The bees foraged at night only if the moon was half-full or larger and only after moonrise; they must therefore need moonlight for flight. When the moon was full, about 20 bees/minute left the nest throughout the night. The dances of foragers were observed, and the forage sources were checked by identifying the pollen carried. (Usually a colony used only two sources at any one time.) Comparison of shifts in dances with movements of the moon and sun showed that the moon is not used for orientation. It is suggested that bees probably continue to use the sun, even though it is below the horizon, perhaps using the same mechanism as that used on overcast days. Attempts in the USA to encourage European *A. mellifera* to fly on moonlit nights were unsuccessful. *P. Walker*

Dept. Biology, Princeton Univ., Princeton, NJ 08544, USA.

Dyer, F.C. Memory and sun compensation by honey bees. *Journal of Comparative Physiology, A* (1987) 160 621–633 [En, Bc]

Experiments with colonies of *Apis mellifera* in USA, and with *A. cerana* in India, showed that honeybees can remember, in some detail, the spatial and temporal pattern of the sun's azimuthal movement; they use local landmarks as a reference for learning. The mechanism of learning is probably that proposed by New and New: a honeybee stores in its memory several time-linked azimuthal positions rela-

tive to features of the landscape and then refers to this stored array when it needs to determine an unknown azimuth between two known positions. *P. Walker*

Dept. Zoology, Michigan State Univ., East Lansing, MI 48824, USA.

Faccioli, P. Revealing Indian beekeeping. [Alla scoperta dell'apicoltura indiana]. *Ape Nostra Amica* (1989) 11 (4) 35–41 [It, Bj]

Fatima, K. and Ramanujam, C.G.K. Pollen analysis of two multifloral honeys from Hyderabad, A. P. [India]. *J. Phytol. Res.* (1989) 2 (2) 167–172 [En, Ba]

Qualitative and quantitative analysis of two samples of *Apis cerana* honey showed no predominant pollen type. *Helianthus annuus* was the commonest pollen (23.33%) in one sample and *Eugenia jambolana* (23.33%) in the other. The important minor types of pollen were *Cocos nucifera*, *Abutilon* sp., *Amaranthus* sp., *Citrus limonum* and *Jatropha* sp. *J.M. Gedye*

Palaeobotany-Palynology Laboratory, Department of Botany, Post Graduate College of Science, Saifabad, Hyderabad 500/004, India.

Flügel, H.-J. and Geiseler, E. Prehistoric rock art with bee motifs in India. [Prahistorische Felsenmalereien mit Bienenmotiven in Indien]. *Allgemeine Deutsche Imkerzeitung* (1991) 25 (3) 6–8 [De, Bj]

About 20 rock art scenes are known depicting bees, especially *Apis dorsata*, and/or their nests; some show honey collecting. The first site was reported in 1938, and several were found around Bhopal in the 1970s; more were discovered north of Bhimbetka in the late 1970s; more were discovered north of Bhimbetka in the late 1970s. Four photographs taken by Professor S. Tiwari in 1977 are reproduced here (only one has been previously published), all showing trees with *A. dorsata* nests. In two of the scenes, men are shown in the tree. *P. Walker*

Zur Windmühle 367, 1000 Berlin 47, Germany.

Gadagkar, R. Introduction is forever. *Environmental Sciences* (98) 18 28 [En, Bc]

Apis mellifera is currently being introduced to many parts of India, before any rigorous studies have been undertaken to assess the impact this may have on native honey bee species. In Australia, where *A. mellifera* was introduced in 1882 by European settlers, escaped bees have formed a self-sustaining wild population. If this were to occur in India it might have irreversible and detrimental effects on the native honey bee fauna. *Author*

Ganguly, P. and Chanda, S. A calendar of bee plants of India with reference to melissopalynological study. Fifth International Palynological Conference, Cambridge, 1980. Abstracts. (1980) 146 [En, Bc]

Garg, A. Palynocontents of bee-collected pollen loads of autumn season in Bhimal, India. *Taiwania* (1996) 41 (3) 197–207 [En, ch, Bc]

Pollen loads collected by honey bees (*Apis cerana*) in this part of Uttar Pradesh in autumn (September–October) were analysed. All loads were unifloral and represented 18

taxa in 15 families of entomophilous and anemophilous angiosperms. Taxa of the *Compositae* [Asteraceae] were dominant (34.7% of loads) followed by *Gramineae* [Poaceae], *Labiatae* [Lamiaceae] and *Leguminosae* [Fabaceae] (each 10%). Eleven minor sources of bee forage were also used by the bees. The pollen grains are described and illustrated. P. Walker

Taxonomy and Herbarium Division, National Botanical Research Institute, Rana Pratap Marg, Lucknow 226001, U.P., India.

Garg, A. Apiculture, and its role in economy – a case study from Bhimtal. *Journal of Economic and Taxonomic Botany* (1997) 21 (1) 53–65 [En, Bb]

In analyses of pollen loads from *Apis cerana*, 78 genera/species belonging to 33 plant families were identified in a one-year study. The two most important families were *Compositae* [Asteraceae] and *Fabaceae*, and (in spring) *Gramineae* [Poaceae]. Seasonal variations are discussed. The two main nectar flow periods occur in mid-June to mid-August and in November–December. It is recommended that, during dearth periods, honey bee colonies should be taken to areas with suitable plants in flower. A table lists plant species identified and their flowering periods. P. Walker

National Botanical Research Institute, Lucknow-226 001, India.

Garg, A. and Nair, P.K.K. Honey bee pollen load as a bio-indicator of bee pasturage in Bhimtal area of Western Himalayas, India. *Journal of Palynology* (1993) 29 89–107 [En, Bb]

Pollen loads from honey bees [*Apis cerana* ?] foraging in this area during the period April 1985–March 1986 were analysed. Of the 477 pollen loads, all except 20 were found to be unifloral. Pollens from 45 plant families were identified, and a table shows the months in which each was identified. The most important families were *Compositae* [Asteraceae], *Fabaceae*, *Gramineae* [Poaceae] and *Cruciferae* [Brassicaceae]. Some of the pollen grains are illustrated. P. Walker

National Botanical Research Institute, Lucknow, India.

Garg, A. and Nair, P.K.K. Seasonal analysis of honey bee pollen loads from a temperate zone in Kumaon Himalaya in Uttar Pradesh, India. *Journal of Palynology* (1994) 30 (1) 1–34 [En, Bb]

Pollen loads carried by *Apis cerana* in the Bhimtal area during the spring months of 1984 and 1985 were analysed. Of the 188 pollen loads, all except two were unifloral; the pollens belonged to 40 genera in 24 plant families. The dominant family was *Rosaceae*, followed by *Poaceae* and *Fabaceae*. Some families were present in one but not both years; a table shows the dates when each family was present. The shapes of the pollen grains are described and illustrated. P. Walker

National Botanical Research Institute, Lucknow 226 001, India.

Garg, R. Bee flora of Paonta Valley. *Indian Bee Journal* (1989) 51 (3) 113–114 [En, Bj]

The major and minor nectar and pollen sources in this

area of Himachal Pradesh are listed, with an indication of their distribution and value to bees. P. Walker
Regional Research Station, Dhaulakuan 173 001, India.

Garg, R., Sharma, O.P. and Dogra, G.S. Formic acid: an effective acaricide against *Tropilaelaps clareae* Delfinado and Baker (Laelaptidae: Acarina) and its effect on the brood and longevity of honey bees. *American Bee Journal* (1984) 124 (10) 736–738 [En, B]

Each of three infested *Apis mellifera* colonies was fumigated with a daily dose of 5 ml of 85% formic acid; mite populations were effectively reduced in comparison with three untreated colonies. Treatment was continued for 6–13 days, the longer treatment period being necessary in the most heavily infested colony. In a separate trial using healthy colonies, brood exposed to the same dose of formic acid continuously for 21 days appeared to be unaffected by the chemical; the mean lifespan of workers was similar to that of workers in untreated control colonies. P. Walker

Bee Res. Stn., Himachal Pradesh Krishi Vishva Vidyalaya, Nagreta Bagwan 176047, India.

Gatoria, G.S., Singh, Baldev and Singh, Gurmit. Studies on physical characteristics of honey collected by *Apis mellifera* colonies from important floral sources in Punjab. *Journal of Research, Punjab Agricultural University* (97) 34 (4) 393–397 [En, 12 wf]

Physicochemical properties of unifloral honeys from five different floral sources (*Brassica campestris* var. toria, *B. juncea*, *Helianthus annuus*, *Litchi chinensis* and *Trifolium alexandrinum*) are reported.

Dept of Entomology, Punjab Agricultural Univ., Ludhiana, India.

Gatoria, G.S., Chhuneja, P.K. and Singh, D. Import of pollinators, package bees, queen bees and associated problems. *Indian Bee Journal* (2000) 62 (1–2) 1–9 [En, Bj]

Some examples of imports are reviewed, and resulting problems and related legislation are discussed. Recommendations are given for a national bee import policy for India. Dept of Entomology, Punjab Agricultural Univ., Ludhiana 141004, India.

Gatoria, G.S., Singh, B. and Singh, L. Effect of diameter of queen cell cups on mass rearing of *Apis mellifera* L. queen bees. *Indian Bee Journal* (2000) 62 (1–2) 59–61 [En, Bj]

Mean acceptance of grafted larvae in all cell cups was significantly higher in spring (48.6%) than in autumn (39.9%). In both seasons queen cell cups of 9.0 mm diameter showed the highest acceptance (mean 79.2%), followed by 8.0 mm cups (54.3%) and then 10.0 mm cups (34.3%). Acceptance was poor for cups of 11 mm diameter. Queen emergence averaged 73.0%, 49.3%, 31.8% and 8%, respectively, and queen weight was also maximal (mean 200.2 mg) from 9 mm cups. P. Walker

Dept of Entomology, Punjab Agricultural Univ., Ludhiana 141004, India.

Gatoria, G.S., Rataul, H.S., Brar, H.S. and Jhaji, H.S. History of introduction of *Apis mellifera* L. and develop-

ment of beekeeping in the Punjab (India). *Indian Bee Journal* (1994) 56 (1/2) 8–15 [En, Bj]

This review, with 23 references, covers the difficulties in establishing *A. mellifera*. Beekeepers in the Punjab had 100,000 colonies in 1992 with an expected honey production of 1,500 t, and possibilities for further expansion are discussed. Numbers of colonies in 12 other states are also given (total almost 4000). *P. Walker*

Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Gaur, R. D. Resource development through bee farming in the Garhwal Himalaya. *Johsard* (1983/1984) 7/8 51–59 [En, Bb]

In this region of India beekeepers use most of their honey and sell very little. Many colonies are kept, usually in small recesses (30 cm x 20 cm) in the house wall; the inside opening is closed by a flat stone and the outer one by a wooden cover with a hole for the bees. When harvesting honey the beekeeper clears the bees from the combs by using smoke or 'insect-repellent' plants, or by making whistling or other noises. The honey comb is squeezed on a fine bamboo sieve and the honey which drips through is then filtered through a fine cloth. Wax may be obtained by heating the comb, but this is often discarded. Honey is also collected from wild colonies. The appearance and taste of honeys from various plants, common in the region, are described. A table lists 132 plants that are visited by bees, in alphabetical order of botanical name. For each, the highest altitude at which it grows is given, and also its flowering period, and an indication of whether bee visits are 'abundant', 'common' or 'rare'. *P. Walker*

Systematic Lab., Dept. Botany, Garhwal Univ., Srinagar, India.

Gautier, A. A bee hunting scene on a rockpainting from the Mahadeo Hills, India. *Gautier, A.: An unknown rock drawing with bee hunters from India.: Een onbekende rotstekening met bijenjagers uit Indie.* *American Bee Journal* (1974) 114 (7) 258–259 [En, B]

Published English translation of previous item.

Gautier, A. An unknown rock drawing with bee hunters from India. [Een onbekende rotstekening met bijenjagers uit Indie]. *Maandblad van de Vlaamse Imkersbond* (1974) 60 (6) 219–221 [Nl, EB]

The author discusses a rock painting in the Mahadeo Hills in Central India, which he has visited; it was described by D. H. Gordon (1936, 1960). Gordon's drawing, which is reproduced, shows two men on ladders getting honey from an *Apis dorsata* comb; one man is operating a long forked stick (to dislodge the bees?) and the other holds a collecting bag. *E. E. Crane*

Lab. voor Paleontologie, Rijksuniversiteit, 9000 Gent, Belgium.

Ghosh, G. K. and Ghosh, S. Honey as food, medicine, cosmetics and honey recipes. Calcutta, India; Firma KLM Private Ltd (99) 148 pp. [En, Bd]

Goyal, N. P., Rana, V. K. and Gupta, J. K. Royal jelly production as influenced by period of extraction and age of larva

in *Apis mellifera* L. colonies in India. *Indian Bee Journal* (96) 58 (4) 196–198 [En, Bj]

The amount of royal jelly extracted from a queen cell was determined 24–72 hours after grafting larvae 12–24 hours old. Amounts were higher in 10-frame than in 5-frame colonies. In 10-frame colonies, the maximum amount was obtained 72 hours after grafting 12-hour-old larvae (388 mg/cell). When 48-hour-old larvae were grafted, they yielded 296 mg after 48 hours but only 266 mg after 72 hours.

Dept. Entomology & Apiculture, Dr. Y.S. Parmar Univ. Horticulture & Forestry, Nauni-Solan 173 230, Himachal Pradesh, India.

Goyal, N. P. *Apis cerana indica* and *Apis mellifera* as complementary to each other for the development of apiculture. *Bee World* (1974) 55 (3) 98–101 [En, B]

The species were compared under different climatic conditions in areas of Himachal Pradesh, India. The local species, *A. cerana indica* was more suitable for productive beekeeping in the Kulu valley (altitude 1500 m) than *A. mellifera*, which did not work the local flora. The main flow in that area is from the autumn-flowering *Plectranthus rugosus* (shain). At Nagrota (altitude 900 m), both species were successful honey producers, foraging in the spring on *Sapindus detergens* (soapnut) and *Cedela toona* (toon). It appeared that *A. mellifera* would gradually become dominant. The experiment was extended to the Ludhiana Plain, Punjab (altitude 247 m) where no beekeeping was practised, although *Trifolium alexandrinum* (barseem), Brassica and Eucalyptus are plentiful. *A. cerana indica* colonies did not thrive in this area, but commercial honey production was achieved with *A. mellifera*. *P. Walker*

Coll. Agric., Punjab Agric. Univ., Ludhiana, India.

Goyal, N. P. Introduction of *Apis mellifera* in India: background and present status. *Indian Bee Journal* (1990) 52 (1–4) 57–59 [En, Bj]

Dept. of Entomology and Apiculture, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan 173 230, India.

Goyal, N. P. and Atwal, A. S. Introduction of exotic honeybees (*Apis mellifera*) in India. *Indian Bee Journal* (1979) 41 (3/4) 39–46 [En, B]

Goyal, N. P. and Chhuneja, P. K. Development of a pollen trap for *Apis mellifera* L. for the Punjab (India) conditions. *Indian Bee Journal* (1991) 53 (1–4) 103–106 [En, Bj]

The trap is shown fitted to a Langstroth hive; constructional details are given.

Department of Entomology, Punjab Agricultural University, Ludhiana 141004, India.

Goyal, N. P. and Gupta, J. K. Development of beekeeping with *Apis mellifera* L. in India: present status and future scope. *Indian Bee Journal* (1994) 56 (3/4) 127–131 [En, Bj]

In the early 1990s in India there were over 956,700 *Apis cerana* colonies (in hives) and 100,000 *A. mellifera* colonies. The distribution of each species is given, and overall honey yields are compared (6.67 vs. 13.7 kg/colony). A honey production target, set in 1976, for the

year 2000, was based only on *A. cerana*, but the target can be increased if *A. mellifera* beekeeping is developed further in areas where *A. cerana* is not presently used for honey production. The possibility of extending beekeeping with *A. mellifera* in *A. cerana* areas is also considered, and difficulties and opportunities are discussed briefly. Honey processing plants are urgently needed in some states. *P. Walker*

Department of Entomology, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni-Solan 173 230, H. P., India.

Goyal, N. P. Kumar, P. and Atwal, A. S. Transfer of beekeeping technology to the field in Punjab. *Indian Bee Journal* (1989) 51 (3) 115–118 [En, Bj]

This article gives statistics for beekeeping with *Apis mellifera* in Punjab, India, for the period 1976–84 (number of beekeepers, number of colonies, honey production, average yield/colony). Beekeepers have been trained by courses and personal visits, and technical material and advice has been provided. Economic factors, and the role of beekeeping in the state economy, are discussed. *D. G. Lowe*
Department of Entomology, Punjab Agricultural University, Ludhiana, India.

Goyal, N. P. and Rana, B. S. Economics of migratory beekeeping [*Apis mellifera* colonies] between hills and plains of North-West India. *Indian Bee Journal* (1992) 54 (1–4) 19–25 [En, Bj]

Department of Entomology and Apiculture, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan (H.P.) 173 230, India.

Goyal, N. P. and Sharma, R. K. (eds). First National Conference on Beekeeping, 29 June 1993, Chandigarh. Gurgaon, India; National Horticulture Board. (1993) 133 pp. [En, Bd]

The 13 conference papers in these proceedings give a good overall picture of beekeeping in India. There are detailed accounts of the organisational structure of the industry, with descriptions of bodies responsible for extension, training, research, marketing and representing beekeepers. National and state-level statistics for beekeeping, honey and wax production are given, along with an economic assessment of beekeeping, an analysis of research achievements, and the results of a honey quality survey. There are descriptions of beekeeping in three states (Kerala, Punjab and Himachal Pradesh), and appendices listing bee forage plants and statutory honey standards. *A. G. Matheson*

Goyal, N. P., Singh, M. and Kandoria, J. L. Role of insect pollination in seed production of carrot, *Daucus carota* Linn. *Indian Bee Journal* (1989) 51 (3) 89–93 [En, Bj]

Flowering carrot plots at Ludhiana, Punjab, were visited by 71 insect species from 31 families. *Syrphidae* constituted 63% of visitors, *Apis florea* 10%, *A. mellifera* 0.5%, *A. cerana* 0.3% and *A. dorsata* 0.2%. Foraging started at about 07.00 or 08.00 hours, reached a peak at about 10.00 or 11.00 hours and ceased at about 19.00 hours. The foraging behaviour of *A. mellifera* and *A. cerana* in collecting pollen (mainly in the morning) and nectar is described. In trials of two varieties, the greatest seed yield was obtained from

open-pollinated plants; yields from plants caged with *A. mellifera* or *A. cerana* were slightly less, and yields from plants caged to exclude insects were more than one-third less. *P. Walker*

Department of Entomology, Punjab Agricultural University, Ludhiana, Punjab, India.

Grewal, G. S. Influence of irrigation on the nesting activity of *Andrena ilaria* Cam. (Andrenidae: Hymenoptera) in wheat fields near *Brassica campestris* var. *toria*. *Entomon* (1977) 2 (2) 149–151 [En, B]

The activity of this soil-nesting bee was greatly affected by irrigation of its nesting areas. Irrigation during the day was followed by a revival of bee activity in 12 out of 154 nests within 16 days. The reduction in the number of females foraging on *Brassica campestris* was not significant. Irrigation at night trapped bees in their nests and resulted in a steep decline in the number of females foraging. Only four of 139 nests became active again. *J. M. Gedy*
Dept. Entomology, Punjab Agric. Univ., Ludhiana 141 004, India.

Grewal, G. S. and Sidhu, A. S. Insect-pollinators of some cucurbits in Punjab. *Indian Journal of Agricultural Science* (1978) 48 (2) 79–83 [En, B]

Apis species (mainly *A. florea*, with a few *A. mellifera* from one apiary, and *A. dorsata*) collected from (a) *Cucurbita pepo* and from (b) *Cucumis melo*; the most abundant solitary bees on a were *Pithitis smaragdula* or *Xylocopa fenestrata*, and on b, two *Nomioides* species. *Momordica charantia* attracted fewer bees than did a or b; over 60% of bees on this species were halictids, and 27–29% were *A. florea*. *P. Walker*

Dept. Entomology, Punjab Agric. Univ., Ludhiana 141 004, India.

Grewal, G. S. and Sidhu, A. S. Note on the role of bees in the pollination of *Cucurbita pepo*. *Indian Journal of Agricultural Science* (1979) 49 (5) 386–388 [En, B]

Punjab Agric. Univ., Ludhiana, Punjab 141 004, India.

Grewal, G. S. and Sidhu, A. S. Studies on insect pollination in *Cucumis melo* Linn. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 537–544 [En, B]

Punjab Agric. Univ., Ludhiana-141004, India.

Grewal, G. S. and Singh, G. Note on insect pollinators of sunn hemp in Punjab. *Indian Journal of Agricultural Sciences* (1979) 49 (10) 822–824 [En]

Data on bee species visiting *Crotalaria juncea* in 10–12 localities during 1976–1977 indicated that *Megachile lanata*, *M. fasciculata* and *Xylocopa fenestrata* were the most important pollinators. Of the *Apis* species, *A. dorsata* was more efficient at exposing the stigma than *A. florea*.
Punjab Agric. Univ., Ludhiana, India.

Gulati, R., Gulati, B. R. and Sihag, R. C. Antibacterial activity of propolis and honey against *Staphylococcus aureus* and *Escherichia coli*. *Indian Bee Journal* (1996) 58 (3) 128–130 [En, Bj]

Ethanol extract of propolis completely inactivated *S. aureus* and *E. coli*, at 0.1% and 1.0% concentrations, respectively. With pure propolis extract (20 micro l), the zone of inhibition on agar plates was 8.1 $\pm$ 1.32 and 7.12 $\pm$ 1.33 mm diameter against *S. aureus* and *E. coli*, respectively. Honey diluted with distilled water was not effective against these bacteria. However, pure honey showed antibacterial activity against *S. aureus*, forming an inhibitory zone of 6.0 $\pm$ 0.79 mm diameter (with 20 micro l). No antibacterial effect of honey was observed on *E. coli*. Author Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, India.

Gunbir Singh. Clustering behaviour of *Apis cerana indica* in Kashmir valley during dearth and colony depletion. *Indian Bee Journal* (1974) 36 (1-4) 22 [En, B]

Abnormally, in 1972 bees clustered on the alighting board, on the ground and in the hive, and many colonies died.

Gupta, J.K., Goyal, N.P., Sharma, J.P. and Gautam, D.R. The effect of placement of varying numbers of *Apis mellifera* colonies on the fruit set in apple orchards having different proportions of pollinisers. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8-13, 1993, Bangalore, India [edited by Veeresh, G.K., Shaanker, R. U. and Ganeshiah, K.N.]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 197-201 [En, Bd]
Department of Entomology, University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India.

Gupta, J.K., Kaushik, R. and Joshi, V.K. Influence of different treatments, storage temperature and period on some physico-chemical characteristics and sensory qualities of Indian honey. *Journal of Food Science and Technology* (Mysore) (1992) 29 (2) 84-87 [En, Bc]

Darkening of honey (from *Apis mellifera*) was significantly affected by the storage temperature and period.

Department of Entomology and Apiculture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan-173/230, Himachal Pradesh, India.

Gupta, J.K., Kumar, J. and Kumar, R. Observation on the foraging activity of honey bees and nectar production in 'toon', *Toona ciliata* Roem. *Indian Bee Journal* (1990) 52 (1-4) 34-35 [En, Bj]

Department of Entomology & Apiculture, University of Horticulture and Forestry, Nauni, Solan 173 230, India.

Gupta, J.K., Mishra, R.C. and Kumar, J. Evaluation of false acacia, *Robinia pseudoacacia* L., as honey source in Himachal Pradesh. *Apiacta* (1992) 27 (1) 8-12 [En, Bj]

Department of Entomology and Apiculture, University of Horticulture and Forestry, Nauni, Solan, H.P. 173 230, India.

Gupta, J.K. and Reddy, M.C.M. Foraging intensity of insects and nectar of wild cherry, *Prunus pudum* Roxb. *Entomon* (1992) 17 (1/2) 91-94 [En, Bc]

Department of Entomology and Apiculture, University of Horticulture & Forestry, College of Horticulture, Nauni, Solan 173 230, India.

Gupta, J.K. and Sharma, P.L. Cauliflower seed yield as influenced by the date of transplantation, application of insecticides and mode of pollination under mid hill conditions of Himachal Pradesh. *Indian Bee Journal* (1996) 58 (2) 57-60 [En, Bj]

Plants of *Brassica oleracea* var. *botrytis* were sprayed at late bud or at flowering stage with endosulfan or oxydemeton-methyl; this did not significantly affect siliqua set. The number of seeds/siliqua and seed weight were significantly higher in the earliest transplanted plants and sprayed plants than in controls. Seed yields were significantly higher on plants visited by insects than on those caged to exclude insects. P. Walker

Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India.

Gupta, J.K. and Thakur, R.K. Nectar sugar production and flower visitors of the bramble, *Rubus ellipticus* Smith (Rosaceae), at Solan, India. *Apidologie* (1987) 18 (3) 223-229 [En, fr\ de, Bj]

Dept. Entomology & Apiculture, Univ. Horticulture & Forestry, Nauni, Solan 173230, India.

Gupta, J.K., Thakur, R.K. and Kumar, J. Nectar of wild olive, *Elaeagnus umbellata* Thunb. and foraging intensity of different insect visitors. *Indian Bee Journal* (1986) 48 (1-4) 40-42 [En, Bj]

Dept. Entomology-Apiculture, Y.S. Parmar Univ. Horticulture & Forestry, Nauni, Solan 173 230, India.

Gupta, M. Essential oils: a new source of bee repellents. *Chemistry and Industry* (1987) (March) 162-163 [En, Bc]

Essential oils from 24 plant species at concentrations ranging from 0.00625 to 0.5% were tested as repellents in an olfactometer against worker honeybees (*Apis florea*). Oil from *Carum capticum*, containing p-cymene, was the most effective repellent.

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Gupta, M. Honey bee mites: an overview. *Indian Bee Journal* (1993) 55 (3/4) 1-10 [En, Bj]

This review, with 65 references, includes a table listing 44 mite species associated with the four main species of *Apis*. Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125004, Haryana, India.

Gupta, M. and Sihag, R.C. Bee repellents - ecology and mode of action. *Indian Bee Journal* (1991) 53 (1-4) 1-8 [En, Bj]

This review, with 53 references, discusses the mode of action of repellents, with examples of compounds found to repel bees in laboratory tests. Only a few of these have been effective in the field. P. Walker

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, Haryana Agricultural University, Hisar 125 004, Haryana, India.

Gupta, P. and Gupta, M. Influence of queen on the hoarding behaviour of honey bee (*Apis mellifera* L.). *Indian Bee Journal* (1993) 55 (1/2) 21-24 [En, Bj]

Pollen (P) and honey (H) stores were monitored in three queenright and three queenless colonies in Hisar, Haryana, India. In queenright colonies P and H increased as the colony population grew, with maxima in April. In the queenless colonies, populations decreased, and so did P and H, and the colonies died after three months. *P. Walker* Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, Haryana, India.

Gupta, R.K. *Taxonomic studies on the Megachilidae of north-western India*. Jodhpur, India; Scientific Publishers (India) (93) 294 pp. ISBN 81-7233-204-2 [En, Bd]

A key to the genera is followed by a description of 26 genera, 34 subgenera and 166 species, with notes on distribution and flower records. Much of the information was obtained from field studies (1990–93). There is a 12-page bibliography, indexes and a check list. The 1999 reprint contains a few minor changes in taxonomy. *P. Walker*

Gupta, R.K. *Bee species of the Indian region*. www.geocities.com/beesind2 (2003) [En, X]

This e-book is a catalogue that includes taxonomical profiles of 1284 species in 92 genera.

Gupta, R.K. *A key for the identification of Indian genera of family Megachilidae (Hymenoptera: Apoidea)*. *Journal of the Bombay Natural History Society* (1992) 89 (3) 296–301 [En, Ba]

A key for the identification of 34 genera of *Megachilidae* is presented. About 150 species of megachilid bees, in 23 genera, have so far been reported from India. The genera which have not yet been reported from India occur in neighbouring countries and are therefore included in this key. *D.G. Lowe*

Dept. of Zoology, Raj-Rishi College, Alwar, Rajasthan 301 001, India.

Hameed, S.F. and Adlakha, R.L. *Preliminary comparative studies on the brood rearing activities of Apis mellifera L. and Apis cerana indica F. in Kulu Valley*. *Indian Bee Journal* (1973) 35 (1–4) 27–35 [En, B]

Colonies of *Apis mellifera* reared at Kulu were compared with colonies of *A. cerana indica* reared at a similar but cooler location.

Entomological Res. Stn., Himachal Pradesh Univ., Kulu 175 101, India.

Hameed, S.F., Adlakha, R.L. and Giamzo, S.P. *Relative toxicity of some insecticides to the workers of Apis mellifera*. *Madras Agricultural Journal* (1973) 60 (7) 552–556 [En]

Worker honeybees were allowed to forage on cut flowers of mustard, on which systemic and contact insecticides had been sprayed. The relative toxicities of these insecticides in descending order were: fenitrothion, methyl-demeton, phosphamidon, phosalone, dimethoate, vamidothion, carbaryl, formothion, endosulfan, menazon. On the basis of the safety index, formothion, vamidothion, dimethoate and phosalone are thought to be relatively safe to bees. *F.B. Wells*

Entomology Res. Stn., Kulu, India.

Hameed, S.F. and Singh, B. *Effect of Varroa jacobsoni Oud. infestation on foraging and brood rearing in Apis cerana indica Fabr.* *Indian Bee Journal* (1989) 51 (4) 135–136 [En, Bj]

In a study carried out at Pusa, Bihar, India, five healthy colonies (V) were artificially infested with *V. jacobsoni*. For a year, pollen stores, honey stores and brood area were measured each month in V and in five uninfested control colonies (C). Although patterns of activity were similar in the two groups, V were less productive. Compared with C, they stored 57% less pollen, 67% less honey, and reared 46% less brood. *P. Walker*

Department of Entomology, Rajendra Agricultural University, Pusa 848 125, Bihar, India.

Hameed, S.F. and Singh, B. *Effectiveness of various fumigants against Varroa jacobsoni mites in Apis cerana indica F. colonies*. *Journal of Entomological Research* (1990) 14 (1) 75–77 [En, Bc]

Seven fumigants were tested on *A. cerana* colonies infested with *Varroa jacobsoni*. Paradichlorobenzene, naphthalene and methyl salicylate did not increase mite mortality significantly and the first two caused bees to abscond. Tobacco smoke increased mite mortality by 24% but had some adverse effects on bees, while sulphur caused a 46% mortality increase and did not affect bees. Dichlorvos caused a 90% increase in mite mortality and did not affect bees; bromopropylate (Folbex VA strips) caused a 250% mortality increase but seven out of 10 colonies ceased normal activities and some absconded. *P. Walker*

Department of Entomology, Rajendra Agricultural University, Pusa (Samastipur)-848125, India.

Hameed, S. F., Singh, B. and Yazdani, S. S. *Management of Apis mellifera L. in Bihar*. *Indian Bee Journal* (1989) 51 (4) 141–142 [En, Bj]

Since the introduction of *A. mellifera* to Bihar, India, in 1988, suitable management methods, including migration, feeding and honey harvesting, have been developed. Diseases and enemies, and the effects of weather, are discussed. *P. Walker*

Department of Entomology, Rajendra Agricultural University, Pusa 848 125, Bihar, India.

Hari Chand, Yaquin, E. and Singh, R. *Biological development of Apis mellifera L. and Apis cerana indica Fab. during different seasons under north Bihar conditions*. *Shashpa* (2002) 9 (2) 133–137 [En, X]

In both species, total development periods of workers and drones differed significantly between breeding (Nov.–Jan.) and dearth (July–Sept.) seasons.

Dept of Entomology and Agricultural Zoology, Univ. Apiary, Rajendra Agricultural Univ., Pusa-848 125, Samastipur, India.

Hasan, S.B., Deo, P.G. and Majumder, S.K. *Relative toxicity of insecticides to household and beneficial insects*. *Indian Bee Journal* (1986) 48 (1–4) 42–44 [En, Bj]

The topical toxicities of 11 insecticides (aldrin, lindane, DDVP, bromophos, malathion, pirimiphos methyl, monocrotophos, permethrin, cypermethrin, indothrin, decamethrin) to house flies, honeybees (*Apis cerana*) and

silkworm larvae were determined; the LD50 values are tabulated. Monocrotophos was much more toxic, and pyrethroids less toxic, to honeybees than to flies. P. Walker Discipline Infestation Control & Protectants, Central Food Techn. Res. Inst., Mysore 570 013, India.

Jadhav, L.D. Role of insects in the pollination of onion (*Allium cepa* L.) in the Maharashtra State, India. *Indian Bee Journal* (1981) 43 (3) 61–63 [En, B]

Apis cerana was not observed on onion umbels, but 80% of umbel visits were by *A. florea* (average 59 visits/umbel/hour), and 15% by *A. dorsata*. Fruit set was 74%, and the average weight of seed was 3.83 g/umbel. On bagged umbels, results were 8% and 0.18 g/umbel, respectively. P. Walker Dept. Entomology, Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722, India.

Jadhav, L.D. Effect of solar eclipse on the foraging activity of honey bees. *Biovigyanam* (1982) 8 (2) 157–161 [En, B]

The numbers of visits by *Apis florea* and *A. dorsata* to onion umbels at the Central Campus, Mahatma Phule Agricultural University, Rahuri, Maharashtra, India, were recorded on normal days and on the day of a solar eclipse, 16 February 1980. On normal days, *A. florea* and *A. dorsata* foraged up to 17.00 and 16.30 hours respectively. However, on the day of the solar eclipse both species stopped at 15.40 hours when the eclipse was at its peak and did not resume even when the eclipse was over at 16.50 hours. Linear regression equations were obtained expressing relationships between number of visits and light intensity, temperature and humidity. On normal days, the light intensity significantly influenced the number of visits of both species. On the day of the eclipse, the activity of *A. dorsata* was slightly influenced by light intensity, whilst that of *A. florea* was significantly affected by temperature. Author

Dept. Entomology, Mahatma Phule Agric. Univ., Rahuri 413 722, India.

Jadhav, L.D. and Ajri, D.S. Insect pollinators of onion (*Allium cepa*) in Ahmednagar district of Maharashtra, India. *Indian Bee Journal* (1981) 43 (4) 109 [En, B]

Dept. Entomology, Mahatma Phule Agric. Univ., Rahuri 413 722, India.

A total of 19 insect species, belonging to 11 families, was identified in collections made on *Allium cepa* crops. *Apis florea* and *A. dorsata* were the commonest; no *A. cerana* were found.

Jain, K.L. Pollen collection activity of honey bees in alfalfa and sunflower seed crops in semi-tropical regions. *Forage Research* (1992) 18 (2) 140–144 [En, Ba]

Apis florea and *A. dorsata* visited alfalfa (*Medicago sativa*) mainly for nectar. A few individuals collected pollen from flowers tripped by other species. *A. mellifera* colonies placed in alfalfa crops showed a decline in honey and pollen reserves and in brood area. On sunflower crops *A. mellifera* was much more active than *A. florea* and *A. dorsata*, foraging for nectar, but no foragers were seen collecting pollen. J.M. Gedye

Department of Zoology, CCS Haryana Agricultural University, Hisar-125/004, India.

Jain, K.L. and Dhingra, H.R. *Millettia atropurpurea* Benth – a new bee host plant. *Indian Bee Journal* (1994) 56 (3/4) 211 [En, Bj]

The tree *M. atropurpurea* (Fabaceae) has recently been introduced to the northern plains of India. Its flowers are visited by large numbers of bees (*Apis* and non-*Apis* species) collecting nectar and/or pollen. The most numerous visitors observed were *Apis florea* and *A. dorsata*, *Megachile bicolor* and *Chalicodoma cephalotes*. Foraging was observed from 08.00 to 18.00 hours; at noon, 80–85% of bees had pollen in their corbiculae or scopae. P. Walker Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, India.

Jain, K.L. and Guman, S. Sublethal effects of some insecticides on the feeding responses of *Apis* species. *Haryana Agricultural University Journal of Research* (1992) 22 (2) 68–70 [En, Bc]

The toxicities of monocrotophos, phosphamidon, dimethoate, oxydemeton-methyl and endosulfan were determined in feeding tests, using various concentrations of insecticide in 50% glucose syrup. In general, *Apis florea* was less affected than *A. dorsata*. However, phosphamidon and dimethoate were both toxic to *A. florea*; monocrotophos was not. Dimethoate was the most toxic of the insecticides to *A. dorsata*, followed by monocrotophos and phosphamidon. Endosulfan was not toxic to either species at the concentrations used. For both honey bee species, there was an inverse correlation between insecticide concentration and total body carbohydrates after 24 hours of feeding. P. Walker

Department of Zoology, CCS Haryana Agricultural University, Hisar, India.

Jain, K.L. and Puri, G. Effect of soil moisture on foraging activity of bees and seed yield of alfalfa. *Forage Research* (1991) 17 (2) 132–137 [En, Ba]

Interspecific differences in the distribution of three bee species foraging on *Medicago sativa* crops were found to be associated with differences in nectar quality caused by variable soil moisture conditions. *Megachile flavipes* foraged more in areas of low soil moisture whereas numbers of *Apis dorsata* were higher where soil moisture was high. *A. florea* foraged in both areas in the morning but moved to high moisture areas at midday. Nectar volume of flowers increased and sugar concentration decreased with increasing soil moisture content. Seed yield was greater in areas with low moisture. J.M. Gedye

Department of Zoology, Haryana Agricultural University, Hisar-125 004, India.

Jhaji, H.S., Chabal, B.S. and Brar, H.S. Studies on the mating behaviour of *Apis mellifera* L. queens raised in different months. *Indian Bee Journal* (1994) 56 (3/4) 163–167 [En, Bj]

Studies were made on the mating flights of queens reared in each month from February to May, and from September to November, in Ludhiana, India. Mating flights in December took place at about 13.00 hours and lasted 17 minutes, but as the temperature increased, flights started later; flights in May were latest in the day, starting at about 16.50 hours. Flight duration was longest in October (average 18.6 minutes) and shortest in April (15.8 min-

utes). On average a queen made between 1.2 and 1.6 mating flights; there was no significant difference between the months. Mating success was highest in March (96.6%), and in the second period of rearing it was in November (86.6%). Mating success was very low in September (3.3%), but above 60% in other months. *P. Walker*
Department of Entomology, Punjab Agricultural University, Ludhiana 141 004, India.

Jhaji, H.S. and Goyal, N.P. Comparative behaviour of pollen foragers of *Apis cerana indica* and *Apis mellifera*. *Journal of Apicultural Research* (1979) 18 (4) 279–284 [En, B]
No bee of either species collected mixed pollen on all foraging trips on the same day, or on each of the five days observed. Pollen availability decreased from morning to afternoon, and some pollen foragers of both species then changed to nectar collection, but they resumed collection of the original pollen next morning. The two species showed similar behaviour in pollen foraging, with minor differences. *Author*
Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Jhansi, P., Kalpana, T.P. and Ramanujam, C.G.K. Pollen analysis of rock bee summer honeys from the Prakasam district of the Andhra Pradesh, India. *Journal of Apicultural Research* (1991) 30 (1) 33–40 [En, Bb]
Pollen analysis was carried out on six squeezed honey samples collected from rock bee (*Apis dorsata*) combs during the period 1982–1984. All the samples represented summer honeys from tropical dry deciduous forest tracts of the Prakasam district of Andhra Pradesh, India.
Palaeobotany-Palynology Laboratory, Department of Botany, Post Graduate College of Science, Saifabad, Hyderabad, India.

Jhansi, P., Kalpana, T.P. and Ramanujam, C.G.K. Pollen analysis of some *Apis cerana* Fabr. honeys from Andhra Pradesh, India. *Apidologie* (1994) 25 (3) 289–296 [En, fr\de, Bj]
Results of pollen analyses of six honey samples from three districts are reported. In two districts, where the honey sources were in deciduous forest, the main pollen types identified were from *Lagerstroemia parvifolia*, *Crotalaria juncea* and *Schleichera oleosa*. One of the honeys was unifloral (main pollen from *Anogeissus latifolia*). In honeys from the other district, where agricultural crops are important, the main pollens were from *Borassus flabellifer*, *Hygrophila* sp., *Crotalaria juncea*, *Cucumis* sp., *Phylla nodiflora* and *Momordica charantia*. *P. Walker*
Palaeobotany-Palynology Laboratory, Post Graduate College of Science, Osmania University, Saifabad, Hyderabad, India.

Jitendra Mohan, K.V. Some observations on the bee pollination in sunnhemp (*Crotalaria juncea*) and their importance in breeding work. *Jute Bulletin* (1973) 35 (11/12) 214–216 [En, B]
Sunn hemp seed with a recessive yellow marker gene was sown inside and outside a bee-proof cage. Workers from an *Apis cerana indica* colony, which was placed in the cage during flowering, did not pollinate the flowers but collected pollen by boring through the lateral portion of the keel

without touching the stigma. The colony was removed, and a single *Xylocopa fenistroides* bee was put into the cage. This bee was active from 10.00 hours until 14.00 hours and caused a higher percentage of seed set (65.3%) than was achieved in the field (25.8%). The progeny from the caged plants were all pure unpigmented seedlings, whereas the progeny from the plants in the open contained 18% pigmented seedlings. This indicated contamination, although the nearest sunn hemp crop was 120 m away. *J.M. Gedye*
Jute Agric. Res. Inst., Barrackpore, West Bengal, India.

Jodha, N.S. Mountain perspective and beekeeping. Honeybees in mountain agriculture [edited by Verma, L.R.J.] New Delhi, India; Oxford & IBH Publishing Co. (1992) 29–35 ISBN 81-204-0650-8 [En, Bdo]
Mountain 'specificities' are defined as inaccessibility, fragility, marginality, diversity or heterogeneity, 'niche' or comparative advantage and human adaptation mechanisms. The effects of these characteristics of mountain areas on beekeeping are discussed. *D.G. Lowe*
International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Jose, V.T., Thankamony, S., Toms J. and Kothandaraman, R. Economics of beekeeping with *Apis cerana indica* and *A. mellifera* in rubber smallholdings of Kerala. *Indian Journal of Natural Rubber Research* (99) 12 (1/2) 49–54 [En, wf.]
Results from a survey of 24 beekeepers in six locations in Kerala, India, are presented. Annual honey yield for *A. cerana* was 2–17 kg/colony (over 11 years), and for *A. mellifera* 5–60 kg/colony (six years). A comparative economic analysis showed that the cost of maintaining M was 3.4–4.0-fold that for C, but the income from M was 4–8 times more than for C. Results varied from year to year due to weather, disease, etc. In general, M is more profitable and is suitable for larger-scale operations; since C requires lower initial investment, it is more suitable for small-scale beekeepers.
Rubber Research Inst. of India, Kottayam-686 009, India.

Joseph, D. and Mohandas, N. Role of honey bees in the pollination of cardamom. *Indian Bee Journal* (1985) 47 (1–4) 12–13 [En, Bj]
Apis cerana colonies were placed on cardamom (*Elettaria cardamomum*) crops at a density of 0, 2, 4 or six hives/ha. The mean numbers of bee visits per flower per hour were 3.51, 3.67, 3.62 and 4.91, respectively. Ranges of mean fruit set over 3 seasons were 32–42%, 33–52%, 34–57% and 34–57%, respectively. It is concluded that the optimum hive stocking density is four hives/ha. *P. Walker*
Regional Agric. Res. Stn., Kerala Agric. Univ., Kumarakom, India.

Joshi, M.A., Dange, S.G. and Rao, G.M. Bibliography on Asian bees and apiculture. *Indian Bee Journal* (97) 59 (4) 264–268 [En, Bj]
Approx. 120 references (1994–97).
Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Joshi, M.A., Dange, S.G. and Wakhle, D.M. Bibliography on Asian bees and apiculture (publications up to 1996).

Indian Bee Journal (96) 58 (4) 235–240 [En, Bj]

This bibliography lists 150 references to research published in 1990–1996.

Central Bee Res. & Training Inst., KVIC, 1153 Ganeshkhind Rd., Pune 411 016, India.

Joshi, M.A., Lakshmi, K. and Suryanarayana, M.C. Melittopalynological investigations on Apis and Trigona honeys collected in and around Pune, Maharashtra. Indian Bee Journal (98) 60 (2) 90–98 [En, Bj]

Results are presented and discussed for 28 monofloral and 10 multifloral honeys from *Apis cerana* (11) *A. dorsata* (24) *A. florea* (2) and *Trigona iridipennis* (1). A total of 52 pollen types were identified, of which 13 were common to honeys of all three *Apis* species. P. Walker

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkind Rd, Pune 411 016, India.

Joshi, M.A., Rao, G.M. and Suryanarayana, M.C. Nyctanthes arbor-tristis – a bee forage source for Apis dorsata. Indian Bee Journal (98) 60 (1) 20–21 [En, Bj]

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkind Rd, Pune 411 016, India.

Joshi, M.A., Singh, T.S.M.S., Rao, G.M. and Suryanarayana, M.C. Common arboreal bee forage plants of India – Samanea saman (Jacq.) Merr. Indian Bee Journal (98) 60 (1) 26–27 [En, Bj]

Pollen and nectar source (family Oleaceae).

Joshi, M.A. Honey and beeswax trade in India. Indian Bee Journal (1982) 44 (1) 1–6 [En, B]

During the 1980–1981 season in India 5,048 t of honey were produced in apiaries; the same amount or more was also collected from nests of wild bees. Beeswax production was 11.7 t, and much was taken from *Apis dorsata* nests. In an examination of the present position in India and the future potential for these products, figures have been extracted from the Government publication Monthly statistics of foreign trade of India. Tables give total annual exports of honey and beeswax from 1957 to 1979–1980, when the figures were 3.3 t honey and 19 t beeswax. Imports are also given, and for 1979–1980 these totalled 3.4 t and 0.1 t respectively (all from Nepal). The overall figures show the individual countries with which India has traded since 1957; the trends are discussed. It is recommended that honey quality standards be strictly maintained, and that Indian honeys be promoted by advertisements in order to increase exports. It is difficult to export 'Ghedda' beeswax (from bees other than *Apis mellifera*) as no standard exists for this type of wax; such a standard should be developed. Wax from *A. cerana* is suitable for use in the cosmetic and other industries. Villagers could be trained to collect much *A. dorsata* wax, which could be processed centrally using modern methods. P. Walker

Central Bee Res. Inst., Khadi and Village Indus. Commission, Poone 411 004, India.

Joshi, M.A. Honey and beeswax – foreign trade of India. Indian Bee Journal (1995) 57 (4) 177–181 [En, Bj]

The country's annual honey imports and exports are tabulated for the period 1980–1993; The most recent figures were 2.5 t and 1.4 t, respectively. Beeswax has also been exported in most years, although the amount has decreased from 40 t to less than 2 t. India's trade figures with individual countries are also given and discussed.

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Joshi, M.A., Dange, S.G. and Wakode, M.T. Bibliography on Asian bees and apiculture (publications up to 1995).

Indian Bee Journal (1996) 58 (2) 92–94 [En, Bj]

This bibliography lists 80 references to research published in 1990–1995.

Central Bee Research and Training Institute, KVIC, 1153 Ganeshkhind Road, Pune 411 016, India.

Joshi, M.A., Divan, V.V. and Suryanarayana, M.C. Bees and honey in ancient India. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 143–149 [En, B]

Joshi, M.A. and Verma, S.K. Studies on sacbrood disease in Apis cerana indica Fab. in Kumaon hills of U.P., India.

Indian Bee Journal (1985) 47 (1–4) 39–41 [En, Bj]

The incidence of sac brood was recorded in three government apiaries in Uttar Pradesh from January 1983 to March 1984. In the first month of the study sac brood caused 12.5% of colonies (35 of 224) to abscond, and by January 1984 two-thirds of colonies (24 of 36) were being lost. In colonies in other apiaries, and in traditional wall hives in the area, the incidence of sac brood ranged from 50 to 100%. Observations on the behaviour of absconding colonies are presented. P. Walker

Government Beekeeping Stn., Jeolikote, Nainital, India.

Joshi, R.M. Honey flows in desert-like Kutch, Gujarat. Indian Bee Journal (1996) 58 (2) 88–89 [En, Bj]

B/17 'Abhilasha', Sri Ram Nagar, Borivli (W), Mumbai 400 092, India.

Justus, E.R. Beekeeping industry in Tamil Nadu (India): present status, problems and prospects. Indian Bee Journal (1991) 53 (1–4) 96–102 [En, Bj]

The details given include a list of some bee plants, numbers of beekeepers and colonies, and honey and beeswax production (1989–90). Problems and constraints to development are discussed.

Scott Christian College Nagercoil 629001, Tamil Nadu, India.

Justus, E.R. An economic study of the beekeeping industry in Tamil Nadu. [Abstract]. Journal of Rural Development (1991) 10 (1) 119–121 [En]

This abstract summarises a doctoral dissertation describing a survey of beekeeping in Tamil Nadu, India. The study showed that as well as a large number of people employed as beekeepers there were also a sizeable number employed

in assisting in honey collection, in making hives and working in beekeeping agencies. An analysis of environmental factors affecting the growth of the beekeeping industry indicated that the level of organic matter in the soil was the most important. A cost analysis showed that maximum profit per honey bee colony (303 rupees) was achieved by beekeepers with 230 colonies. Insurance, marketing, honey standards, and the support structure of the beekeeping industry were also studied. *J.M. Gedye*
50A West Yesudian Street, Nagercoil 629.001, India.

Jyothi, J.V.A. Incidence of *Varroa jacobsoni* infestation in *Apis mellifera* colonies. *Indian Bee Journal* (97) 59 (2) 81–82 [En, Bj]

Five colonies in Bangalore, Karnataka, were examined monthly during 1993. Infestation was maximal in January–February (2000–5000 mites/colony) and August–September (2000–4000), and lowest in June (200–300). Mean no. mites in a worker brood cell was 9.0–10.3 and in a drone brood cell 3.8–4.7. In highly infested colonies, adult workers carried 4.7 mites, on average. *P. Walker*
1103/00 Dept of Zoology, Bangalore Univ., Bangalore 560 056, India.

Jyothi, J.V.A. Ecological and physiological studies on greater wax moth *Galleria mellonella* L. PhD Thesis, Bangalore University, India. (1989) xi + 180 pp. + 17 pl. [En, Bdo]
Dept. Zoology, Bangalore Univ., Bangalore, India.

Jyothi, J.V.A. Visitation frequency and abundance of *Apis cerana indica* F. on mango (*Mangifera indica* L.) at Bangalore, India. *Indian Bee Journal* (1994) 56 (1/2) 35–36 [En, Bj]

During observations on mango flowers in late February, the number of *A. cerana* visits gave rise to the conclusion that insecticides should not be applied to mango during peak flowering from late February to early March. Department of Zoology, Bangalore University, Bangalore 560 072, India.

Jyothi, J.V.A. *Tropilaelaps clareae* in *Apis mellifera* in Bangalore and its control. *Geobios* (Jodhpur) (1996) 23 (1) 65–66 [En, Bb]

Five colonies of *A. mellifera* in Bangalore, India, were examined during 1992. *T. clareae* infestations varied from an average of 56.4 mites/comb to 90.3 mites/comb. All hives were dusted daily with sulfur (15 g/colony) for 15 days and mite mortality was assessed. Daily mite-fall before dusting was 4.0–5.0, whereas after treatment the average number of dead mites per hive was 90.1–121.2. However, all colonies remained infested after sulfur dusting. *D.G. Lowe*
Department of Zoology, Bangalore University, Bangalore-560 056, India.

Jyothi, P.V., Atluri, J.B. and Reddi, C.S. Pollination ecology of *Moringa oleifera* (Moringaceae). *Proceedings of the Indian Academy of Sciences, Plant Sciences* (1990) 100 (1) 32–42 [En, Bb]

Moringa oleifera, a tree indigenous to north-western India, flowers during February–May and again during

September–November. In observation studies at our sites, carried out over two years, 17 insect species (nine *Hymenoptera*, one *Diptera* and seven *Lepidoptera*) visited the flowers. Department of Botany, Andhra University, Waltair 530 003, India.

Kakar, K.L. Repellent effect of synthetic pyrethroids on Indian honey bee, *Apis cerana indica* Fab. *Journal of Insect Science* (1994) 7 (2) 191–193 [En, 6 ref.]

Contact toxicity of synthetic pyrethroids in the laboratory and their repellency to *Apis cerana indica* foragers on some entomophilous crops were recorded. Department of Entomology, Dr Y.S. Parmar University of Horticulture & Forestry, Solan 173 230, India.

Kallesha, G.R. and Viraktamath, S. Foraging cycle and pollen sources of *Apis mellifera* L. in Dharwad, Karnataka, India. *Indian Bee Journal* (2000) 62 (3–4) 19–27 [En, Bj]
Dept. of Agricultural Entomology, Univ. of Agricultural Sciences, Dharwad 580005, Karnataka, India.

Kalpana, T.P. and Ramanujam, C.G.K. Melittopalynology, bee plants and beekeeping potential in some coastal districts of Andhra Pradesh, India. *Indian Bee Journal* (97) 59 (1) 1–8 [En, Bj]

The most important bee forage plants are given for three districts, based on analyses of 204 *Apis cerana* honey samples. Dept of Botany, Post Graduate College of Science, Saifabad, Hyderabad 500 004, India.

Kalpana, T.P. and Ramanujam, C.G.K. *Carum copticum* – a major source of winter honeys in Ranga Reddy district, Andhra Pradesh. *Proceedings of the Indian National Science Academy. Part B, Biological Sciences* (1994) 60 (6) 583–593 [En, Bb]

Palaebotany-Palynology Laboratory, Dept. of Botany, Post Graduate College of Science, Saifabad, Hyderabad 500 004, India.

Kalpana, T.P. and Ramanujam, C.G.K. Sugarcane honey – its significance. *Current Science* (1996) 70 (4) 261–262 [En, Bc]

Two honey samples from an *Apis cerana* apiary near some sugar cane fields in Andhra Pradesh, India, contained much *Saccharum officinarum* pollen (65% and 68% of total pollen). The honeys contained just over 70% total reducing sugars, over 2.5% sucrose and 21.0–21.5% water. Honey bees were observed foraging avidly on the sugar-rich liquid oozing from stumps left when the sugar cane was cut. *P. Walker*

Palaebotany-Palynology Laboratory, Department of Botany, Post-graduate College of Science, Saifabad, Hyderabad 500 004, India.

Kapil, R.P., Chaudhry, J.P. and Jain, K.L. Biology and utilization of insect pollinators for crop production (A7-ENT-118); third annual report (1975–1976). Hissar, India; Haryana Agricultural University. (1976) 47 pp. [En, B]

This is a continuation of earlier studies, with further information on the life cycle of *Megachile nana* in relation to season, and on the nesting and foraging behaviour of *M.*

nana, *M. flavipes* and *M. femorata*. Parasites of these species are described briefly. The provision of better nesting sites has resulted in a slow increase in populations; *M. flavipes* was always the most numerous species on lucerne. Pod set was much higher than in 1975. *P. Walker*
Dept. Zoology, Haryana Agric. Univ., Hissar-125004, India.

Kapil, R. P., Grewal, G. S., Kumar, S. and Atwal, A. S. Insect pollinators of rapeseed and mustard. *Indian Journal of Entomology* (1971) 33 (1) 61–66 [En, B]

This survey in 1965–1968 covered the main regions of Punjab, Haryana and Himachal Pradesh where *Brassica campestris*, *B. juncea*, and *Eruca sativa* are grown. Insects visiting each site were captured by 30 sweeps with a muslin net over 0.4 ha of crop between 11.00 and 15.00 hours. *Apis florea*, *A. dorsata* and *Andrena ilaria* were the most important pollinators in the plains and sub-mountainous areas of Punjab and Haryana, whereas *A. cerana* was dominant in the lower regions. *A. florea* was abundant in the dry southern plains; *A. dorsata* was abundant in the sub-mountainous area; various halictine bees were the most important pollinators in the extreme south. Other species caught on the 274 sites sampled included various *Megachile*, *Nomia*, *Nomioides*, *Colletes*, *Ceratina*, *Anthophora* and *Xylocopa*. *D. G. Lowe*
Dept. Zoology-Entomology, Punjab Agric. Univ., Ludhiana, India.

Kapil, R. P., Grewal, G. S., Kumar, S. and Atwal, A. S. Insect pollinators of alfalfa, *Medicago sativa* L. *Indian Journal of Entomology* (1974) 36 (3) 214–220 [En, B]

In 1966–1969 insect visitors were surveyed on lucerne fields in six climatic zones in Punjab and Haryana, India. In the drier areas, *Apis florea* was the most common, followed by *Nomioides* spp., and either *Pithitis smaragdula* or *Megachile flavipes*. In 1969 *M. flavipes* outnumbered others in one intermediate zone. Daily activities of the major pollinators were recorded; *M. flavipes* was active by 08.00 hours (earlier than other species) and continued to forage until late in the evening (nearly 18.30 hours). *P. Walker*
Dept. Zoology-Entomology, Punjab Agric. Univ., Ludhiana, India.

Kapil, R. P., Jain, K. L. and Chaudhary, J. P. Adaptive behaviour of megachilid bees to alfalfa. *Proceedings of the XXVth International Apicultural Congress*, Adelaide. Bucharest, Romania; Apimondia Publishing House. (1977) 403–413 [En, B]
Hibernation, emergence and population build-up of a leafcutting bee, *Megachile nana*, and two species of mason bees, *M. flavipes* and *M. femorata*, were studied in a semi-tropical region of India; similarities and differences are discussed. Results are also presented of observations on tripping of lucerne and pollen collection; *M. nana* was the most efficient pollen collector. Population build-up on lucerne took 3–4 weeks to reach a maximum; the maximum period of activity of these species on lucerne was 35–42 days. *P. Walker*
Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Kapil, R. P. and Lamba, D. P. S. Toxicity of some important insecticides to *Apis cerana* Fab. *Indian Journal of Entomology* (1974) 36 (1) 6–10 [En, B]

The contact toxicity to *A. cerana* of insecticides applied as sprays was compared with that of menazon.
Dept. Zoology, Haryana Agric. Univ., Hissar, India.

Kapil, R. P. and Lamba, D. P. S. and Brar, H. S. Integration of bee behaviour with aphid control for seed production of *Brassica campestris* var. *toria*. *Indian Journal of Entomology* (1971) 33 (2) 221–223 [En, B]

Dept. Zoology, Haryana Agric. Univ., Hissar (Haryana), India.

Kapil, R. P. and Sihag, R. C. Wax moth [*Galleria mellonella*] and its control. *Indian Bee Journal* (1983) 45 (2/3) 47–49 [En, B]

Kapila, R. K., Singh, H. B., Sharma, J. K., Lata, S. and Thakur, S. P. Effect of insect pollinators on seed yield and its quality in radish (*Raphanus sativus* L.). *Seed Research* (2002) 30 (1) 142–145 [En, X]

In a study in Himachal Pradesh, India, drone flies and *Apis mellifera* and *A. cerana* constituted 69.3% of insect pollinators. Open-pollinated plants had more grains/silique, higher seed yield/plant and 100-seed weight, than plants caged to exclude insects.
Seed Production Unit, Himachal Pradesh Krishi Vishwavidyalaya, Palampur-176 062, India.

Karayil, S., Deshpande, S. D., and Koppikar, G. V. Effect of honey on multidrug resistant organisms and its synergistic action with three common antibiotics. *Journal of Postgraduate Medicine* (98) 44 (4) 93–? [En, Bc]

Fifteen resistant micro-organisms (seven *Pseudomonas* spp. and eight *Klebsiella* spp.) isolated from infected human samples were tested with honey in vitro. Minimum inhibitory concentration of honey with saline for both genera was 1:2. Honey showed synergistic action with three common antibiotics against *Pseudomonas* but not against *Klebsiella*. *P. Walker*
Dept of Microbiology, T N M C & B Y L Nair Charitable Hospital, Mumbai Central, Mumbai 400008, India.

Kastberger, G. and Sharma, D. K. The predator-prey interaction between blue-bearded bee eaters (*Nyctornis aetherton* Jardine and Selby 1830) and the giant honeybees (*Apis dorsata* Fabricius 1798). *Apidologie* (2000) 31 (6) 727–736 [En, de, fr, Bj]

Interactions between the bird predators and the bees were filmed in a tree in Assam, India, containing 50 *A. dorsata* nests: (A) when the bird passed parallel to a nest, on its sunny side, and (B) when it passed under and perpendicular to a nest. In situation A, more than 700 bees flew off the nest to defend the colony (2–3% of the total population), and in B similar numbers flew off, but from both sides of the nest. Evidence is reported – for the first time – for intercolonial group defence, i.e. non-threatened colonies participate in the defence of a threatened colony. *Author*
Dept of Zoology, Univ. of Graz, 8010 Graz, Universitätsplatz 2, Austria.

Kaur, G. and Sihag, R. C. Bee flora of India: a review. *Indian Bee Journal* (1994) 56 (3/4) 105–126 [En, Bj]

From the literature (32 references) a list of 217 plant

species or genera useful for honey bees has been compiled. For each plant, flowering period, importance as a nectar and/or pollen source, distribution and economic uses are given. *P. Walker*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, Haryana, India.

Kaur, G. and Sihag, R. C. Effect of weather factors on the colony foraging of honeybee (*Apis mellifera* L.). *Indian Bee Journal* (1994) 56 (3/4) 158–162 [En, Bj]

Foraging activity in nine *A. mellifera* colonies, and also ambient temperature and RH, were determined every two hours for one day each week. Total number of foragers (F) and number of pollen foragers (P) were each positively and highly significantly correlated with temperature, and negatively and highly significantly with RH; the number of nectar foragers (N) showed a similar correlation with RH. P was negatively correlated with N and also with F; the correlation between N and F was positive and highly significant. The principles underlying these results are discussed. *P. Walker*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125004, Haryana, India.

Khan, B.M. Honeybee resources in North West Frontier Province of Pakistan. Honeybees in mountain agriculture [edited by Verma, L. R.]. New Delhi, India; Oxford & IBH Publishing Co. (1992) 59–65 ISBN 81-204-0650-8 [En, Bdo] Beekeeping with *Apis cerana* and *A. mellifera*, and honey collecting from wild *A. dorsata* and *A. florea* nests, are described briefly. A honey extraction calendar gives details of nectar flows and average honey yields. *D. G. Lowe* Entomology Department, NWFP Agricultural University, Peshawar, Pakistan.

Khan, M. S., Sharma, S. K. and Kumar, Y. Summer management of the European hive bees, *Apis mellifera* L., under agroclimatic conditions of Haryana, India. *Indian Bee Journal* (1995) 57 (3) 123–126 [En, Bj]

Temperature and RH were measured inside empty hives: (A) in the sun (in the open); (B) under a hut in the open; (C) in the shade of a tree; (D) under a hut in tree shade. Covering hives with wet gunny sacks reduced temperatures in all hives especially in group A; the sacks were more effective in the afternoon than in the morning. RH increased in hives covered with wet sacks. Colony populations and brood areas were monitored in *A. mellifera* colonies kept in conditions A–D, with or without wet sacks on the hives. In uncovered A hives, colony strength decreased by 6–7 frames of bees, and in B hives by 4–6 frames. A and B hives with sacks lost three frames, on average, in 1989, but more in 1990 when it was hotter. Losses were lowest in sack-covered hives in C and D (1–3 frames). *P. Walker*

Department of Entomology, Haryana Agricultural University, Hisar 125 004, India.

Khare, V. S. and Singh, V. P. Some observations on the pollination of certain Asteraceae [Compositae]. *Geobios* (1975) 2 (4) 115–117 [En, India]

Of the 36 species described, 16 have yellow flowers. Most species have abundant flowers with radiating petals, which suggests an adaptation to entomophily. *Author*

Kirchner, W. H. and Dreller, C. Acoustical signals in the dance language of the giant honeybee *Apis dorsata*. *Behavioral Ecology and Sociobiology* (1993) 33 (2) 67–72 [En, Bc]

It has been reported that *A. dorsata* foragers do not produce sound signals during dances. However, in a study of 12 colonies nesting on buildings in India, some (but not all) dancing foragers produced airborne sound signals during the straight run of wagtail dances.

Theodor-Boveri-Institut für Biowissenschaften der Universität, Lehrstuhl für Verhaltensphysiologie und Soziobiologie, Am Hubland, D-97074 Würzburg, Germany.

Kitroo, A. and Abrol, D. P. Studies on pollen carrying capacity and pollination efficiency of honey bees visiting litchi flowers. *Indian Bee Journal* (1996) 58 (2) 55–57 [En, Bj]

Section of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agriculture Research Station, R. S. Pura, Jammu, India.

Bees collecting pollen on *Litchi chinensis* were caught, and they and their pollen loads were weighed. The weight of pollen carried by bees of four *Apis* species correlated significantly and positively with body weight. The weight of the average pollen load was 14.2 mg for *A. dorsata*, 10.7 mg for *A. mellifera*, 8.3 mg for *A. cerana* and 4.2 mg for *A. florea*. 'Pollination importance value' was defined as pollinator abundance $\times$ pollen load, divided by 100; values were 4.02, 2.77, 1.39 and 0.27, respectively, for the four species. *P. Walker*

Koul, A. K., Hamal, I. A. and Gupta, S. K. Pollination mechanism in *Coriandrum sativum* Linn. (Apiaceae). *Proceedings of the Indian Academy of Sciences (Plant Sciences)* (1989) 99 (5) 509–515 [En]

The zygomorphic flowers of *C. sativum*, which have exposed nectar and abundant pollen, attract large numbers of insect species (*Isoptera*, *Hymenoptera*, *Orthoptera*, *Diptera*, *Hemiptera*, *Lepidoptera*, *Coleoptera*). Some species transfer pollen from one flower/umbel to another, but others are only casual visitors.

Dept. Bio-Sciences, Univ. Jammu, Jammu 180,001, India.

Kreuzer, G. Honey hunting in Indian rock art. [Honigsammler in der indischen Felsbildkunst]. *Anzeiger für Schadlingskunde, Pflanzenschutz, Umweltschutz* (1982) 55 (8) 118–119 [De, en, B]

The Mahadeo Hills, in Madhya Pradesh, India, contain numerous sites of rock paintings. Among the paintings of Yambu-Dwip and Imlikho there are scenes showing honey collectors, dating back to between AD500 and 800. It remains unclear why honey collectors were painted on rocks only in this part of India. *Author*

Rikelstr. 11, 8480 Weiden, Germany.

Krishnaswamy, S. V. Introduction and propagation of bee plants in Chikmagalur District (Karnataka). *Indian Bee Journal* (1980) 42 (3) 72–73 [En, B]

- Krishnaswamy, S.V. **A preliminary study of bee flora and its calendar around Beekeeping Observation Centre, Jakkana Halli (Chikmagalur Taluk), Guthi (Mudigere Taluk) and at the migration site at Banur, Chikmagalur district, Karnataka.** *Indian Honey* (1981) 4 (13) 12–13 [En, B]
- Kshirsagar, K.K. **Boosting beekeeping in India.** *Indian Farming* (1980) 30 (6) 30–32 [En, B]
Describes beekeeping training courses offered by the Central Bee Research Institute, Pune, India.
- Kshirsagar, K.K. **Introduction of exotic bees into India.** *Indian Bee Journal* (1980) 42 (4) 108–109 [En, B]
Conclusions of a workshop on 'Animal Genetic Resources' are considered in relation to breeding honeybees, and the introduction of *Apis mellifera* into India.
- Kshirsagar, K.K. **Disorders of bees in India.** *Indian Bee Journal* (1983) 45 (2/3) 39, 42–43 [En, B]
- Kshirsagar, K.K. **Spread of sacbrood disease in Uttar Pradesh.** *Indian Bee Journal* (1983) 45 (2/3) 41–42 [En, B]
- Kshirsagar, K.K., Diwan, V.V. and Chauhan, R.M. **Occurrence of 'sac brood' disease in *Apis cerana indica* Fab.** *Indian Bee Journal* (1981) 43 (2) 44 [En, B]
This viral disease was confirmed in *Apis cerana* in Assam, India.
- Kshirsagar, K.K., Mahindre, D.B., Salvi, S.R. and Mittal, M.C. **Occurrence of a viral disease in Indian hive bee *Apis cerana indica* F.: a preliminary report.** *Indian Bee Journal* (1975) 37 (1–4) 19–20 [En, B]
A disease of adult bees, not previously found in India, is reported from experimental apiaries at the Central Bee Research Institute, and in some colonies in northern Himalayan states. The symptoms are described. Bees become sluggish and leave the combs, and an infected colony does not survive more than six weeks. A virological investigation showed the presence of isometric particles, about 160 nm across, with the characteristics of iridescent viruses (previously found only in *Diptera*, *Coleoptera* and *Lepidoptera*). The virus has been named *Apis Iridescent Virus* (AIV). P. Walker
Central Bee Res. Inst., Poona 411 004, India.
- Kshirsagar, K.K., Saxena, U.C. and Chauhan, R.M. **Occurrence of sac brood disease in *Apis cerana indica* F. in Bihar, India.** *Indian Bee Journal* (1982) 44 (1) 8–9 [En, B]
- Kshirsagar, K.K., Singh, B.P. and Chauhan, R.M. **Queen cells and queen bees in *Apis dorsata* F.** *Indian Bee Journal* (1981) 43 (4) 129 [En, B]
A populous colony which nested on a building in Pune, India, at the end of the monsoon period, was collected with its comb and examined. There were six sealed queen cells, from which five queens emerged in three days; the weight and size of each queen and the dimensions of her cell are tabulated. There are considerable variations in the values. P. Walker
Central Bee Res. Inst., Khadi and Village Indus. Commission, Pune 411 004, India.
- Kshirsagar, K.K., Suryanarayana, M.C. and Thakar, C.V. **Import of exotic bees and quarantine facilities.** *Indian Bee Journal* (1981) 43 (2) 31–36 [En, B]
A 1955 Government Order restricts the import of bees into India, but enforcement of the regulations is difficult. To avoid the risk of bringing new diseases and pests into any country, a strict quarantine procedure is necessary. This involves the setting up of quarantine stations, which for India might be based on offshore islands. In many developing countries, stricter legislation covering bee imports, quarantine and disease prevention is needed. It is concluded that, in order to avoid the problems associated with importing exotic bees, the indigenous bees of south-east Asia should be studied more fully so that their potential can be used more productively. P. Walker
Central Bee Res. Inst., Khadi and Village Indus. Commission, Pune 411 004, India.
- Kumar, A. and Lal, J. **Bee forage plants from the Kanha Tiger Reserve, Madhya Pradesh, India.** *Journal of Economic and Taxonomic Botany* (1991) 15 (2) 495–497 [En]
Bot. Survey India, Howrah-711,103, India.
- Kumar, J., Gupta, J.K. and Dogra, G.S. **Discovery of the ectoparasitic mite, *Varroa jacobsoni* on *Apis mellifera* L. in Himachal Pradesh, India.** *American Bee Journal* (1988) 128 (2) 124 [En]
- Kumar, J., Gupta, J.K., Mishra, R.C. and Dogra, G.S. **Pollination studies in some cultivars of cauliflower (*Brassica oleracea* var. *botrytis* L.).** *Indian Bee Journal* (1988) 50 (4) 93–95 [En, B]
In five cauliflower cultivars, seed set and seed weight were significantly higher in open-pollinated than in bagged flowers. *Apis cerana* constituted 39% of total visitors, and *Diptera* 30%.
Dept. Entomology & Apiculture, Univ. Horticulture & Forestry, Nauni, Solan 173 230, H.P., India.
- Kumar, J. and Kashyap, N.P. **Diversity of bee flora in lower Kullu Valley, Himachal Pradesh and its impact on honey production.** *Indian Bee Journal* (1996) 58 (3) 131–134 [En, B]
A total of 38 plant species were recorded as nectar and/or pollen sources for *Apis mellifera*. Main nectar sources in the summer were *Callistemon citrinus*, *Trifolium repens*, *Eucalyptus* spp., *Sapindus mukorossi* and *Olea ferruginea* [*O. cuspidata*]; the main nectar source in the autumn was *Plectranthus rugosus*. The average annual honey yield is 4–10 kg/colony. Sugar feeding is necessary at certain seasons, and 3–4 kg/colony is required in a year. The bee-keeping potential of three areas is discussed. P. Walker
H.P. Krishi Vishwavidyalaya, Regional Research Station, Bajaura, Kullu 175 125, Himachal Pradesh, India.
- Kumar, J., Mishra, R.C. and Gupta, J.K. **The effect of mode of pollination on *Allium* species with observation on insects as pollinators.** *Journal of Apicultural Research* (1985) 24 (1) 62–66 [En, B]
At two sites in Himachal Pradesh, India, seed set, seed weight and seed germination were compared for three *Allium* species which were open-pollinated, enclosed in nylon cages or covered with cloth bags. Seed set and ger-

mination were significantly higher in open-pollinated umbels than in caged umbels, but there was no significant difference between treatments for mean weight of 100 seeds. *Apis cerana* was the most frequent insect visitor. Of the three onion species, *Allium cepa* was preferred by insect visitors over *Allium fistulosum* and *Allium cepa fistulosum*. *Apis dorsata* foraged exclusively for nectar, but although most *Apis cerana* collected nectar, a small percentage collected both nectar and pollen. The amounts of pollen adhering to the bodies of foraging insects varied greatly, honeybees carrying significantly larger amounts than all other insect species except *Eristalis tenax*. *Author*
Dept. Entomology, Himachal Pradesh Univ., Solan 173 230, Himachal Pradesh, India.

Kumar, J., Mishra, R. C. and Gupta, J. K. Effect of honey bee pollination on onion (*Allium cepa* L.) seed production. *Indian Bee Journal* (1989) 51 (1) 3–5 [En, Bj]

On a plot caged with a 4-frame nucleus of *Apis cerana*, onion umbels received an average of 1.0 bee visits/minute, but on open plots the visiting rate was only 0.6/minute. The times spent by a bee on a flower were similar: 3.5 and 3.3 seconds, respectively. Seed set and seed weight were higher on the plot caged with bees, and estimated seed yield was 275 kg/ha compared with 98 kg/ha on the open plot. On a plot caged to exclude insects seed yield was 73 kg/ha, and for bagged umbels 3 kg/ha. The introduction of honeybee colonies to onion fields at the start of flowering is recommended. *P. Walker*

Dept. Entomology & Apiculture, Dr. Y.S. Parmar Univ. Horticulture & Forestry, Nauni-Solan 173 230, Himachal Pradesh, India.

Kumar, J., Mishra, R. C. and Gupta, J. K. Foraging activity and abundance of insect visitors to chicory (*Cichorium intybus* L.) in mid-hills of Himachal Pradesh, India. *Indian Bee Journal* (1993) 55 (3/4) 31–36 [En, Bj]

On two fields of chicory, 17 insect species from 13 genera and nine families were recorded visiting the flowers. *Bombus* spp. were the most abundant (49.6% of the total), followed by *Ceratina* spp. (27.8%), flies (11.0%), *Megachile* sp. (9.1%) and other *Hymenoptera* (2.5%, mainly solitary Apoidea); no honey bees were seen, although an apiary of *Apis cerana* and *A. mellifera* colonies was only 500 m away. Insect foraging activity was greatest at 09.30 hours, but had almost ceased by 11.30 hours. *P. Walker*

Department of Entomology and Apiculture, University of Horticulture and Forestry, Nauni, Solan (HP) 173 230, India.

Kumar, J., Mishra, R. C., Gupta, J. K. and Dogra, G. S. Pollination requirements of some peach cultivars. *Indian Bee Journal* (1985) 47 (1–4) 3–6 [En, Bj]

In pollination trials on 15 peach cultivars, *Apis cerana* and various *Diptera* were the most frequent visitors to the flowers; honeybees were more numerous than flies in the afternoon. The numbers of visiting honeybees differed significantly between some of the cultivars. For each cultivar percentage fruit set did not differ significantly between twigs bagged with muslin (self-pollinated), twigs in nylon net cages (wind-pollinated), and twigs open to insect pollination. However, average fruit set (all types of pollination)

differed significantly between some cultivars. *P. Walker*
Dept. Entomology & Apiculture, Himachal Pradesh Krishi Vishva Vidyalaya, Nauni-Solan 173 230, Himachal Pradesh, India.

Kumar, J. and Rao, K. V. K. Pollinating efficiency of some bee visitors to the carrot (*Daucus carota* L.) crop in mid hills of Himachal Pradesh (India). *Indian Bee Journal* (1991) 53 (1–4) 34–38 [En, Bj]

Halictus splendidulus, *H. vachalii*, *Allodape* sp. and *Nomioides* sp. were recorded as the most common visitors to carrot flowers in this area. Based on abundance, foraging activity, number of pollen grains carried all over the body, body length and width, number of wing hooks, and proboscis length, *H. splendidulus* was found to be the most efficient pollinator. *Author*

Department of Entomology and Apiculture, University of Horticulture and Forestry, Nauni, Solan 173 230 (H.P.), India.

Kumar, J., Rao, K. V. K. and Gupta, J. K. Pollination efficiency of bees visiting blossoms of *Brassica campestris* L. var. *toria* in mid-hills of Himachal Pradesh, India. *Indian Bee Journal* (1994) 56 (3/4) 202–206 [En, Bj]

In counts of bee visits on plots of flowering toria, *Apis mellifera* made 59% of all visits, *Andrena ilerda* 20.5%, *Halictus catullus* 12%, *H. splendidulus* 4% and an unidentified solitary bee 5%. Pollinating efficiency was calculated for each species, based on abundance, foraging speed, number of loose pollen grains carried on the bee's body and morphometric characteristics. *Apis mellifera* was the most efficient pollinator, followed by *Andrena ilerda*. *P. Walker*

Regional Research Station, HPKV, Bajaura (Kullu) 175 115, H.P., India.

Kumar, J., Rao, K. V. K., Gupta, P. R. and Dogra, G. S. Temporal distribution of bees (*Hymenoptera: Apoidea*) on spring flowering crops in midhills of Himachal Pradesh, India. *Indian Bee Journal* (1989) 51 (2) 55–58 [En, Bj]

Bees visiting the following flowering orchard trees and field crops were collected and identified: peach, plum, apricot, apple, cauliflower, carrot, toria. In addition to *Apis cerana*, *A. dorsata* and *A. mellifera*, a total of 34 bee species/genera were found. A table shows which were present on each crop and indicates the most frequent visitors. *P. Walker*

Dept. Entomology & Apiculture, Dr. Y.S. Parmar Univ. Horticulture & Forestry, Nauni 173 230, Solan, Himachal Pradesh, India.

Kumar, J., Srivastava, S. and Kashyap, N. P. Performance of Italian honeybee (*Apis mellifera* L.) in lower Kullu valley, Himachal Pradesh, India. *Indian Bee Journal* (1994) 56 (1/2) 80–86 [En, Bj]

Colony populations, brood rearing, honey yield and feeding requirements were compared in a group of five colonies at each of two locations which have a similar climate but different bee forage density. One group reared more brood and bees and produced more honey; these colonies needed sugar feeding for 4–5 months in winter (consumption 4.6 kg/colony) but the other group had to be fed for 6–7 months (6.9 kg). *P. Walker*

Regional Research Station, H.P. Krishi Vishavavidyalaya, Bajaura, Kullu 175 125, HP, India.

Kumar, J., Srivastava, S. and Kashyap, N. P. Effect of strength of worker bees on honey production in *Apis mellifera* colonies. *Indian Bee Journal* (1995) 57 (4) 174–176 [En, Bj]

The performance of *A. mellifera* colonies with 10, 8, 6 or 4 frames of bees in Kullu valley, HP, India, were compared. In autumn when the main flow from *Plectranthus rugosus* occurred, the 10-frame colonies produced an average of 18 kg honey/colony, which was significantly more than in the other colonies (9–12 kg). In summer, when there were several short nectar flows, the two groups of stronger colonies produced c. 10 and 9 kg honey, respectively (no significant difference), compared with 5 and 4 kg in the smaller colonies. It is concluded that colonies should be built up to strengths of 8 and 10 frames before the summer and autumn flows. *P. Walker*

Himachal Pradesh Krishi Vishvavidyalaya, Regional Research Station, Bajaura (Kullu) 175 125, Himachal Pradesh, India.

Kumar, M., Singh, R. and Chand, H. Foraging activity of honeybees on different varieties of sunflower. *Indian Bee Journal* (2000) 62 (3–4) 63–64 [En, Bj]

On flowers of five varieties of sunflower, the mean number of honey bees/min/5 capitula was 7.2, with a max. on one variety (Modern) of 7.9. Bee visits peaked around midday. The two most attractive varieties are dark yellow and have a convex-shaped capitulum; the least attractive ones are light yellow or cream with a dilated capitulum. *P. Walker*
University Apiary, Rajendra Agricultural Univ., Pusa 848125, Samastipur, Bihar, India.

Kumar, N.R. and Kumar, R. Insect pollination of apple in mid-hills of Himachal Pradesh. *Indian Bee Journal* (97) 59 (3) 179–180 [En, Bj]

Apis cerana was the most common flower visitor (47% of total); other visitors included *A. mellifera* (15%) and *A. dorsata* (6%).

Dept of Entomology and Apiculture, Dr Y.S. Parmar Univ. of Horticulture and Forestry, Nauni, Solan 173 230, Himachal Pradesh, India.

Kumar, N.R. The special role of women in beekeeping in developing countries. *Bee World* (1993) 74 (3) 153–155 [En, Bj]

Department of Entomology, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni-Solan 173,230 (HP), India. Women as beekeepers in India, Kenya and Malaysia.

Kumar, N.R., Kumar, R. and Bhalla, O.P. Pine marten attacks the colonies of *Apis cerana indica* F. at Nauni (India). *Indian Bee Journal* (1994) 56 (1/2) 64–67 [En, Bj]

In an apiary in Himachal Pradesh at an altitude of 1256 m, hives containing *A. cerana* colonies were toppled or disturbed on five occasions in October and November and combs were taken out and bitten. Hives of *A. mellifera* in the same apiary were not attacked. The damage was caused by a pine marten (*Martes flavigula*) which was persistent even when heavy weights were put on the hives. Wrapping the hives for winter and fastening them with chains prevented further damage. *P. Walker*

Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni 173 230, Solan, HP, India.

Kumar, R. Bee pasturage of Khetri [Assam, India]. *Indian Bee Journal* (1993) 55 (1/2) 40–42 [En, Bj]

Central Bee Research & Trg. Institute, Khadi & V.I. Commission, 1153 Ganeshkind Road, Pune 411016, India.

Kumar, R. and Chaudhary, O.P. Bee flora of Muzaffarpur, Bihar (India). *Indian Bee Journal* (1994) 56 (1/2) 53–63 [En, Bj]

A survey of plants visited by honey bees (mainly *Apis cerana*) and analyses of bees' pollen loads showed which crops and wild plants are important as bee forage. A table lists 93 plant species, with flowering time for each and value as a source of nectar and/or pollen. A floral calendar for the most important sources shows that the main nectar flow is during March–May, after colony build-up (September–February). Management for the short dearth period (July–August) is discussed. *P. Walker*

Central Bee Research and Training Institute, KVIC, 1153 Ganeshkhind Road, Pune 411 016, India.

Kumar, R., Chaudhary, O.P. and Lenin, J.K. Studies on pollination of litchi (*Nephelium litchi* Camb.) in Dehradun, India. *Indian Bee Journal* (1996) 58 (1) 9–12 [En, Bj]

Flowering biology and pollination by *Apis mellifera* were studied in an orchard of *N. litchi* [*Litchi chinensis*] cultivar 'Calcuttia'. All three types of flowers (male, female, imperfect hermaphrodite) produced nectar; sugar concentration ranged from 60% to 75%. Apoidea constituted 89.3% of insect visitors to flowers; *A. mellifera* was the most abundant (44.8% of total), followed by *A. dorsata* (20.7%) and *Trigona iridipennis* (18.9%). There were few *A. cerana* and *A. florea*. The average number of fruits/inflorescence was 1.4 on inflorescences caged to exclude insects, 8.9 on a tree caged with *A. mellifera* and 14.9 on open-pollinated trees; average fruit weight/inflorescence was 15.9, 128.7 and 237.5 g, and average fruit weight was 11.5, 14.5 and 16.0 g, respectively, for these treatments. *P. Walker*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Kumar, R. A check-list of sources of bee forage of Pailitown, South 24-Paraganas district, West Bengal, India. *Indian Bee Journal* (97) 59 (3) 241–242 [En, Bj]

A list of 54 species visited by *Apis mellifera*, *A. cerana* and *Trigona* sp., with flowering period and value to bees of each plant.

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Kumar, R. and Kumar, N.R. Observations on *Varroa jacobsonii* Oudemans (Varroidae: Mesostigmata) parasitizing *Apis cerana* Fabr. and *Apis mellifera* Linn. *Indian Bee Journal* (97) 59 (4) 224–225 [En]

In an apiary of 48 *A. mellifera* and 21 *A. cerana* colonies, five colonies of each species were examined at 21-day intervals. Infestation was unexpectedly low in *A. mellifera* colonies: mites were found in only 2.4% of worker brood and on

2.9% adults, and none were present in drone brood or on adult drones; 7% of debris samples contained mites. In *A. cerana* colonies, 13% drone brood and 28% adult drones were infested, but worker brood and adult workers had no mites. The relatively high proportion of debris samples containing mites (22%) indicates that the bees were removing the mites from their nest. *P. Walker*

Dept of Entomology and Apiculture, Dr Y.S. Parmar Univ. of Horticulture and Forestry, Nauni, Solan 173 230, Himachal Pradesh, India.

Kumar, R. and Lenin, J.K. Studies on foraging behaviour of honey bees and pollination in orange, *Citrus reticulata* Blanco. *Indian Bee Journal* (98) 60 (2) 106–107 [En, Bj]

Five *Apis cerana* and 5 *A. mellifera* colonies were placed in a 2.5-ha orchard of orange trees. Flowers in an area of 5 m² received an average of 653.6 insect visits. *Trigona iridipennis* constituted 41.3% of insect visitors, *A. florea* 30.3%, *A. mellifera* 3.2% and *A. cerana* 3.1%. The last two species were attracted by several other species that were flowering in the area. Bees visiting the orange flowers foraged for nectar from 07.00 to 17.00 hours with a peak at 08.00–10.00 hours; peak of pollen-collection was at 07.30–09.00 hours. Average fruit set was 3.8%, but on flowers bagged to exclude insects it was only 1.3%. *P. Walker*

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkind Rd, Pune 411 016, India.

Kumar, R. and Lenin, J.K. Insect pollinators and effects of cross pollination on yield attributes of sesame (*Sesamum indicum* L.). *Indian Bee Journal* (2000) 62 (1–2) 67–69 [En, Bj]

Apoidea constituted 96% of flower visitors, including *Apis mellifera* (44.9% of total), *A. dorsata* (31.4%) and *A. florea* (19.7%). All three species foraged for nectar, and on average a bee spent 8.9, 8.6 and 11.2 seconds on each flower, respectively, and visited 8, 5 and 4 flowers per minute. The number of pods set/plant, number of seeds/plant, percentage of filled seeds and seed weight were higher on open plots than on plots caged to exclude insects. *P. Walker*

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganesh kind Rd, University Apiary, Pune 411016, India.

Kumar, R., Lenin, J.K. and Chandran, K. Honey bee pollination of *Psidium guajava* L. *Indian Bee Journal* (96) 58 (4) 206–207 [En, Bj]

In trials at Gudalur, India, honey bees (*Apis mellifera*, *A. dorsata*, *A. cerana*) constituted 90.3% of total insect visitors to guava (*Psidium guajava*) flowers. Fruit set was 80% on open-pollinated trees, and 24.4% on trees enclosed to prevent insect pollination.

Central Bee Res. & Training Inst., KVIC, 1153 Ganeshkhind Rd., Pune 411 016, India.

Kumar, R., Lenin, J.K. and Chandran, K. Studies on floral biology and foraging behaviour of honey bees on coconut palm, *Cocos nucifera* L. *Indian Bee Journal* (97) 59 (4) 238–239 [En, Bj]

In a plantation at Gudular, Tamil Nadu, the most common flower visitors were *Trigona iridipennis* (32.0% of total) and *Apis mellifera* (31.2%), followed by *A. cerana* (14.8%) and *A. florea* (8.0%). The *Apis* species visited on average 12.7, 8.6 and 3.7 flowers per minute, respectively. Fruit set on open-pollinated trees was more than double that on bagged spathes (wind- + self-pollinated), and fruit weight and kernel thickness were lower on the latter. *P. Walker*

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Kumar, S., Singh, B., and Chaudhary, D.K. Comparative population build-up and yield of migratory and stationary Italian colonies in Bihar. [Abstract] In 6th Asian Apicultural Association International Conference, Bangalore, India, 24 February–1 March 2002. (2002) 34 [En, Bc]

(Abstract) Dept of Entomology & Agricultural Zoology, Rajendra Agricultural Univ., Pusa (Samastipur)-848 125, India.

Lakshmi, K. and Rao, G.M. Common arboreal bee forage plants of India – *Moringa oleifera* Lamk. *Indian Bee Journal* (98) 60 (3) 151–152 [En, Bj]

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkind Rd, Pune 411 016, India.

Lakshmi, K., Rao, G.M. and Suryanarayana, M.C. Cashew. *Bee World* (2000) 81 (1) 30–33 [En, Bj]

Anacardium occidentale is naturalised on the west coast of India and is cultivated in coastal regions and on hill slopes up to 600 m. When trees are grown on suitable soil, the flowers produce good quantities of nectar which is collected by *Apis dorsata*, *A. cerana* and *A. florea*; the last two species also collect pollen. Honey from honey bee colonies in cashew orchards in Andhra Pradesh and Orissa has a low pollen count (22 400 pollen grains/10 g). *P. Walker*

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkind Rd, Pune 411 016, India.

Lakshmi, K., Soman, A.G. and Suryanarayana, M.C. Dillenia. *Bee World* (2001) 82 (2) 88–89 [En, Bj]

The tree *D. pentagyna* is described; honey bees (*Apis cerana*, *A. florea* and *A. dorsata*) forage on the flowers for pollen and nectar.

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Lakshmi, K. and Suryanarayana, M.C. Common arboreal sources of bee forage in India — *Pterospermum xylocarpum*. *Indian Bee Journal* (96) 58 (4) 209–210 [En, Bj]

This tree is common in semi-evergreen and deciduous forests. In a survey in part of Andhra Pradesh, many *Apis dorsata* nests were found near populations of the tree, which was a major source of nectar and also a minor pollen source for the bees. The tree usually flowers after a rainy period. In the area surveyed it flowered during September–December when there is a dearth. It has other

uses and is recommended for planting in roadside avenues and in forestation programmes.

Central Bee Res. & Training Inst., 1153 Ganeshkhind Rd., Pune 411 016, India.

Lakshmi, K. and Suryanarayana, M.C. Sources of bee forage of *Apis dorsata* Fabr. in forest areas of Andhra Pradesh, India. *Indian Bee Journal* (97) 59 (1) 11–23 [En, Bj]

Plant surveys and observations on foraging bees were made in different seasons (1990–94), and pollen analyses were carried out on samples of 53 honeys and some pollen stores from nests. The resulting table lists 324 species by family, with information on flowering period, value to the bees and other uses.

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Lakshmi, K., Suryanarayana, M. C. and Phadke, R. E. *Peltophorum pterocarpum* (DC) Backer ex Heyne — an important source of bee forage in India. *Indian Bee Journal* (96) 58 (4) 199–202 [En, Bj]

In Pune this tree flowers in March–July and September–October and is visited by many insects including the honey bees *Apis cerana*, *A. mellifera*, *A. dorsata* and *A. florea* and the stingless bee *Trigona iridipennis*, all of which collect nectar and pollen. The sugar concentration of the nectar averaged 51.5%. In honey samples collected from nests of the first three *Apis* species, *P. pterocarpum* pollen was predominant. The full pollen spectra and honey characteristics are described. The tree has several economic uses and is recommended for planting schemes.

155/99 Central Bee Res. & Training Inst., 1153 Ganeshkhind Rd., Pune 411 016, India.

Lakshmi, K. and Singh, T. S. M. S. *Tapioca* – a bee forage source. *Indian Bee Journal* (1996) 58 (2) 71–72 [En, Bj]

Manihot esculenta, a native of South America, is cultivated in humid tropical regions of India. *Apis mellifera* and *A. cerana* collect pollen actively from the staminate flowers; the plant is also a minor source of nectar, which is produced mainly in female flowers. The pollen grains are described. P. Walker

Central Bee Research and Training Institute, KVIC, 1153 Ganeshkhind Road, Pune 411 016, India.

Lakshmi, K. and Suryanarayana, M.C. *Jhingam tree*. *Bee World* (1997) 78 (3) 131–132 [En, Bj]

Lannea coromandelica is a much-visited source of pollen and nectar for *Apis cerana*, *A. florea* and *A. dorsata* in India. Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind, Pune 411 016, India.

Leucht, T. *Beekeeping in the southern Himalayas. [Imkerei im Sud-Himalaya]*. *Imkerfreund* (1985) 40 (10) 364–365 [De, B]

Madhusoodanan, K.J. and Dandin, S.B. *Flower biology of cardamom (Elektaria cardamomun (L.) Maton) in relation to the foraging behaviour of honey bees (Apis sp.)*. *Indian Bee Journal* (1981) 43 (4) 104–108 [En, B]

Floral biology is described. On plots in Kerala, India, anthesis occurred from 05.00 to 08.00 hours and the stigma was receptive until about 10.00 hours. Honeybees started foraging for nectar early and continued until about 11.00 hours; they were active again from 14.00 to 16.30 hours. On two plots with 480 and 200 cardamom plants, and eight and three *Apis cerana* colonies respectively, yields (green weight) were 35–45% higher than on control plots not supplied with hives. The percentage capsule set was directly proportional to the number of bee visits (up to six) to a flower. On panicles caged to exclude bees, fruit set was very low. P. Walker

Indian Cardamom Res. Inst., Kailasanadu 685 553, India.

Mahajan, U. *Physicochemical analysis of honeys of Shimla Hills (Himachal Pradesh)*. MPhil Dissertation, Himachal Pradesh University, India. (1984) 99 pp. [En]

Results are reported for multifloral honeys and for *Plectranthus* honeys and *Eucalyptus* honeys collected in summer and in autumn from (hived) *Apis cerana* colonies. Average water content of samples was 18.5%; no sample contained more than 22% water. Mean ash content was 0.27–0.36%. Values are also reported for specific gravity, viscosity and electrical conductivity. No significant differences were found between samples collected in summer and autumn, although the former were darker in colour. P. Walker

Dept. Bio-Sci., Himachal Pradesh Univ., Simla 171005, India.

Mahindre, D.B. *Apis dorsata* – are they migratory? *Indian Bee Journal* (97) 59 (3) 184–188 [En, Bj]

In an area where *A. dorsata* nests were harvested in May–June, honey hunters destroyed the nests, colonies flew off to find new nest sites, and most of the remaining combs were attacked by wax moths. Nests that had not been harvested were also found to have heavy wax moth infestation in June–July; at seven locations, 57–90% of active nests were infested. Wax moth spreads easily among a group of nests that are close together (25–30 cm apart). Probable means of entry by wax moths into nests and simple deterrent procedures are described. A group of honey hunters is being taught how to harvest honey without destroying the nest, and how to get marketable beeswax from combs. It is concluded that *A. dorsata* leaves its nest if disturbed by honey hunters, if heavily infested by wax moths or if forage is insufficient. P. Walker

Centre of Science for Villages, Magan Sangrahalaya, Wardha 442 001, India.

Mahindre, D.B. *Feeding pollen stores of Apis dorsata to other honey bees*. *Indian Bee Journal* (97) 59 (4) 243–245 [En, Bj]

A. dorsata combs containing pollen stores that had been left on the ground by honey hunters were collected and cleaned. Ten *A. cerana* colonies in hives were fed at intervals with 50 g of this pollen. They consumed all the pollen, and their populations increased rapidly; the beekeepers were able to divide their colonies and obtain surplus honey. It is hoped that honey hunters can be encouraged to harvest *A. dorsata* pollen stores for this purpose. P. Walker

H9/104, HIG, Sant Tukaram Nagar, Pimpri, Pune 411 018, India.

Mahindre, D.B. Improved methods of honey harvest from rockbee colonies. *Indian Bee Journal* (97) 59 (2) 95–98 [En, B]

Centre of Science for Villages, Magan Sangrahalaya, Wardha 442 001, India.

Mahindre, D.B. Income generated from another form of beekeeping – *Apis dorsata* honey harvesting. *Indian Bee Journal* (98) 60 (2) 109–110 [En, B]

A honey hunter in Maharashtra normally harvests from 150–200 colonies each year. Honey hunters are now being taught how to harvest honey without destroying the colony, using attraction planks and bamboo clips. For example, at one village 8 kg honey was harvested from a colony after three months; a further 4 kg was taken five weeks later and also 2 kg stores pollen. After the colony migrated, 3.2 kg beeswax was recovered from the comb. Total income from this colony was Rs. 330. *P. Walker*
Centre of Science for Villages, Dattapur, Wardha 442 001, Maharashtra, India.

Mahindre, D.B. Developments in the management of *Apis dorsata* colonies. *Bee World* (2000) 81 (4) 155–163 [En, B]

The management of colonies on 'attraction planks', and honey and wax harvesting, are described and illustrated. The methods are being taught to village beekeepers in Madhya Pradesh, India.

H 9/104, HIG: Sant Tukaram Nagar, Pimpri, Pune 411 0118, India.

Mahindre, D.B. Handling rockbee [*Apis dorsata*] colonies. *Indian Bee Journal* (1983) 45 (2/3) 72–73 [En, B]

Without destroying combs or brood.

Mahindre, D.B. A suitable hive for *Apis cerana*. *Indian Bee Journal* (1983) 45 (2/3) 80–81 [En, B]

Discusses the use of ISI A/B, Langstroth and British Standard hives for Kashmiri *A. cerana*.

Makhmoor, H.D., Kotwal, D.R., Singh, R. and Rahman, S.J. Problem of robbing and its management in *Apis mellifera* F. (*Apidae: Hymenoptera*). *Research and Development Reporter* (1994) 11 (1/2) 48–51 [En, Bc]

Robbing in colonies of *A. mellifera* is a problem in Jammu, India, especially during the dearth period in August. When triangular tunnels, 2.5 cm wide (glass and plywood), were fixed to hive entrances they reduced the amount of robbing significantly. For hives with tunnels 7.5, 10.0 and 22.5 cm long, or with no tunnel ($n = 3$ for each treatment), the amount of robbing was 44.6%, 33.3%, 0 and 100%, respectively. During the study, robbing of *A. mellifera* colonies by *A. dorsata* in June and in October–November was observed; in some cases the *A. mellifera* colonies were destroyed completely. *D.G. Lowe*

Sher-e-Kashmir University of Agricultural Sciences and Technology, Regional Agricultural Research Station, R. S. Pura-181 102, Jammu & Kashmir, India.

Malaviya, D.R., Pandey, K.C., Roy, A.K. and Kaushal, P. Role of honey bees in seed setting of Egyptian clover. *Crop Improvement* (99) 26 (2) 204–207 [En, X]

Efficacy of different *Apis* spp. on seed set was studied in five genotypes (two diploid and three tetraploid) of *Trifolium alexandrinum*. *A. mellifera* was found to be better pollinator than *A. florea*. Different results for diploid and tetraploid cultivars may be due to differences in flower size.

Indian Grassland and Fodder Research Inst., Jhansi – 284003, India.

Mall, P. and Rathore, R.R.S. Investigations on the foraging pattern of Indian honey bee, *Apis cerana* F. *Pest Management and Economic Zoology* (98) 6 (2) 151–154 [En, wf]

The foraging patterns of marked foragers trained to feed at feeding stations were recorded, and the effects of moving the feeder and of seasonal conditions were studied. The number of trained foragers as well as recruits decreased with increasing distance from the hive; this effect was more pronounced in spring than in winter. Maximum foraging range was 800 m in winter and 700 m during spring, and optimal foraging ranges were 500 m and 300 m, respectively.

Dept of Entomology, G B Pant Univ. of Agriculture and Technology, Pantnagar, UP 263 145, India.

Mann, G.S. and Dhaliwal, G.S. Safety of azadirachtin to honeybee, *Apis mellifera* Linnaeus, foragers. *Pesticide Research Journal* (2001) 13 (1) 118–121 [En, X]

The safety of NeemAzal (azadirachtin) to foraging honey bees was evaluated at different doses (1% at 200, 400 and 800 ppm). At the highest dose it caused 7.6% mortality in direct toxicity tests, which indicates that it is safe for honey bees. Mortality was only 0.74% when bees were caged in a cotton field after spraying. However, in a foliage bioassay, mortality was 17.2%. Triazophos at the recommended dose (2000 ppm) was highly toxic, with mortality varying from 71.4 to 100% in different tests.

Dept of Entomology, Punjab Agricultural Univ., Ludhiana-141 004, India.

Mann, G.S., Gurdip Singh. Activity and abundance of pollinators of plum at Ludhiana (Punjab). *American Bee Journal* (1983) 123 (8) 595 [En, B]

Insect visitors to flowering plum trees were observed at Ludhiana, Punjab, India; honeybees were the main pollinators. *Apis dorsata* constituted 44.9% of all honeybee visitors, *A. mellifera* 40.7%, and *A. florea* 14.4%. *A. dorsata* started visiting the flowers at about 09.00 hours, and *A. mellifera* from about 10.00 hours; activity was greatest from 11.00 to 13.00 hours. Only half of the 26 cultivars studied set fruit, and only four of these set fruit on flowers which were bagged to exclude insects. *P. Walker*

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Mann, G.S. and Sagar, P. Activity and abundance of flower visiting insects of loquat, *Eriobotrya japonica* (Thunb.). *Indian Journal of Horticulture* (1987) 44 (1–2) 123–125 [En]

Studies on the activity and abundance of flower visiting insects of loquat at Samrala in the Punjab, India, showed

that *Apis dorsata* was the main flower visitor. Other insects found occasionally included syrphids, houseflies, *Myrmelontidae*, *Bombinae* and *Pieris rapae*. Fruit set on unbagged flowers was 15% greater than on bagged ones. D.G. Lowe

Dept. Entomology, Punjab Agric. Univ., Ludhiana, Punjab, India.

Mann, G. S. and Singh, G. *Period of activity and comparative abundance of flower visiting insects on pear at Ludhiana (Punjab)*. Entomon (1980) 5 (1) 65–66 [En, B]

On sunny or cloudy days *Apis mellifera* was the most frequent visitor to the pear flowers, followed by *A. dorsata* and *A. florea*; the numbers of all three species were much lower on cloudy days. Most foragers flew between 09.00 and 13.00 hours, and only a few up to 17.00 hours. For *A. mellifera* and *A. dorsata*, peak activity was at about 11.00 hours. Fruit set on bee-pollinated flowers was 2.67 times as high as on flowers bagged to exclude insects. P. Walker

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Mann, G.S. and Singh, G. *A note on activity and abundance of flower visiting insects of peach (Prunus persica L.) at Ludhiana (Punjab)*. Progressive Horticulture (1981) 13 (3/4) 25–27 [En, B]

P. persica flowers were visited by *Apis mellifera*, *A. dorsata* and *A. florea*, and by a few flies and bumble bees. Peak honeybee activity was at 12.00 hours. Fruit set varied considerably among the 11 cultivars studied; in six the fruit set of unbagged flowers was higher than that of bagged flowers. The biggest difference was recorded on Bonita, which had a fruit set of 39% when unbagged, but only 11% when bagged. P. Walker

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Mann, G. S. and Tanda, A.S. *Activity and abundance of insects visiting grape flowers in Punjab, India. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 139 [En, B]

Apis dorsata was the most numerous visitor, and two species of syrphids were also common, but insect visits did not appear to increase the number of fruits obtained.

Manoj Kumar, Hari Chand, Ramashrit Singh, and Ali, M. S. *Effect of different modes of honeybee pollination on oil content in seeds of sunflower (Helianthus annuus L.)*. Journal of Entomological Research (2002) 26 (3) 219–221 [En, X]

In studies on plants receiving different pollination treatments, oil content of seeds was highest for plants receiving hand+insect pollination (36.3%), followed by open-pollination (32.4%), *Apis mellifera* pollination (31.0%), *A. cerana* pollination (28.1%), hand-pollination (26.9%), self-pollination (22.2%).

Rajendra Agricultural Univ., Pusa (Samastipur)-848 125, Bihar, India.

Manoj Kumar, Singh, R. and Hari Chand. *Foraging activity of Apis cerana indica and Apis mellifera visiting sunflower (Helianthus annuus [sic] L.)*. Shashpa (2002) 9 (1) 31–34 [En, wf]

In a study in Pusa (Bihar, India), numbers of bees on flowers every two hours between 10.00 and 16.00 hours. Numbers were highest at 12.00 hours (overall mean for both species, 10.85 bees/min/5 capitula), then at 14.00 hours, while the lowest (6.19) was at 10.00 hours, followed by 16.00 hours. Honey bee numbers were affected by temperature and relative humidity, with maxima recorded at the highest mean temperature (18.30°) and at low humidity (60%). Generally, *A. mellifera* was more abundant than *A. cerana* throughout the flowering period.

Univ. Apiary, Rajendra Agricultural Univ., Bihar, Pusa-848 125, Samastipur, India.

Mathew, T.J. *The introduction of Apis mellifera into India*. American Bee Journal (1973) 113 (10) 372 [En, B]

Mathew, T.J. *The rubber tree as a source of honey [in Kerala, India]*. Gleanings in Bee Culture (1975) 103 (6) 190 [En, B]

Mathpal, Y. *Newly discovered rock paintings in central India showing honey collection*. Bee World (1984) 65 (3) 121–126 [En, B]

Descriptions and illustrations are given of four rock paintings discovered in the Bhimbetka region in 1983; all depict scenes of honey collection from *Apis dorsata* nests in the branches of trees. Two other paintings in the Panchmarhi area depict honey being collected from nests under a rock, or hanging from rocks. Illustrations are given also of honey collection scenes in paintings previously discovered at Ganeshghati near Bhopal. D.G. Lowe

Folk Culture Museum, Geetadham PO Maharagaon, Nainital, Uttar Pradesh, India.

Mattu, V.K. *Scope and strategies for apicultural development in Himachal Pradesh [India]*. Honeybees in mountain agriculture [edited by Verma, L. R.]. New Delhi, India; Oxford & IBH Publishing Co. (1992) 181–192 ISBN 81-204-0650-8 [En, Bdo]

Department of Bio-Sciences, Himachal Pradesh University, Shimla-171005, Himachal Pradesh, India.

Mattu, V.K. and Chaudhary, D.K. *Relative abundance and foraging activity of insect pollinators on almond flowers. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G. K., Shaanker, R. U. and Ganeshaiah, K. N.]*. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 218–221 [En, Bd]

Observations in an almond (*Prunus dulcis*) orchard in Himachal Pradesh, India.

Department of Bio-Sciences, H.P. University, Shimla 171.005, India.

Mattu, V.K., Devi, M. and Mattu, N. *Pollen spectrum of some honeys of Kashmir (India) as determinant of honey bee forage*. Indian Bee Journal (1994) 56 (3/4) 132–141 [En, Bj]

Pollen analyses were carried out on honey samples collected from 10 areas of Kashmir at different altitudes and with different climates; five of the honeys were shown to be unifloral and five multifloral. Of the 37 pollen types

identified, the following were dominant in the honeys of one or more areas: *Plectranthus*, *Salix*, *Rumex*, *Brassica*, *Salvia* and *Artemisia*. From the results, and also a survey of nectar sources, a list of 68 major bee forage species or genera is given, with flowering period, importance as a source of nectar and/or pollen, and economic uses. *P. Walker*
Department of Bio-Sciences, Himachal Pradesh University, Shimla 171 005, India.

Mattu, V.K. and Verma, L.R. *Studies on the annual foraging cycle of *Apis cerana indica* F. in Simla Hills of northwest Himalayas.* *Apidologie* (1985) 16 (1) 1–18 [En, de\ fr, B]

Pollen and nectar were collected throughout the year, regardless of floral and climatic conditions. Foraging activity was greater in summer and autumn than in winter and monsoon periods. Flight activity was greatest at the following times of day: summer, 06.00, 08.00, 10.00 and 16.00 hours; rainy periods, 09.00 and 10.00 hours; autumn, 09.00, 10.00 and 12.00 hours; early winter, 09.00 and 14.00 hours; late winter, 11.00 hours; spring, 08.00 and 11.00 hours. Daily foraging rhythms were observed; the peak of nectar collecting activity was generally observed after the peak of pollen collection. Over the whole year there were more nectar collectors than pollen collectors, pollen + nectar collectors, or water collectors, but there were considerable variations in the percentage of nectar collectors as compared to the pollen, pollen + nectar and water collectors during different seasons.

Author

Dept. Biosci., Himachal Pradesh Univ., Simla 171005, India.

Meeuse, A.D.J. *Palm and pandan pollination: primary anemophily or primary entomophily.* *Botanique India* (1972) 3 (1) 1–6 [Fr]

Mehrotra, K.N. and Bisht, D.S. *Twenty five years of apicultural research at IARI. I. Apiculture in relation to agriculture.* *Indian Bee Journal* (1981) 43 (4) 118–123 [En, B]
Includes a table of crops pollinated by *Apis* spp., with details of flowering and nectar/pollen source.

Mel'nichenko, A.N. *On the origin of species of honeybees.* *Pchelovodstvo* (1984) (No. 12) 12–14 [Ru, B]

The author discusses the origins of honeybees and suggests that they originated in India and spread into subtropical parts of the USSR (Georgia, Armenia, Azerbaijan), and from there through Europe and to Egypt. The mountain varieties of bees from these subtropical areas are thus considered to be the ancestors of all European honeybee races. *D. Galton*

Mel'nichenko, A.N. (ed.). *Pollination of agricultural crops by bees. Volume III.* New Delhi, India; Amerind. (1977) viii + 406 pp. [En, B]
Translated from original Russian.

Melkania, N.P., Pandey, U. and Sharma, T. *Apiculture in rural Himalayas: existing status, problems and strategies for development.* *Indian Bee Journal* (1983) 45 (2/3) 67–68 [En, B]

Mishra, R.C. *Honey marketing in India – an overview.* *Indian Bee Journal* (2000) 62 (3–4) 1–12 [En, B]

The following are examined: cost of honey production in India and honey prices; structure of the Indian honey industry; export possibilities; quality of Indian honey; packaging; need to increase domestic consumption. *P. Walker*

All India Coordinated Project on Honeybee Research & Training, CCS HAU, Hisar 125004, India.

Mishra, R.C. *Technology for honey production and crop pollination in India.* New Delhi, India; Indian Council of Agricultural Research. (1990) 34 pp. [En, Bd]

This extension bulletin provides basic information on honey bee biology, beginning beekeeping, hives and equipment, apiary management, pests and diseases, poisoning by pesticides, hive products, and bee pollination of crops. *D.G. Lowe*

Mishra, R.C. *Bee hive designs for Indian beekeeping.* *Indian Bee Journal* (1995) 57 (1) 15–18 [En, B]

The prototype hive bodies (for *Apis mellifera* beekeeping) described are: wooden multipurpose hives with movable wooden cleats over screen windows (for regulating ventilation); bush material (tree prunings and bush stems) hives; steel frame hives; mud hives. The designs are still being evaluated. *D.G. Lowe*

All India Co-ordinated Project on Honey Bee Research and Training, ICAR, Haryana Agricultural University, Hisar 125 004, India.

Mishra, R.C. *Honeybees and their management in India.* New Delhi, India; Indian Council of Agricultural Research. (1995) viii + 168 pp. [En, Bd]

This book aims to give an overall description of honey bee biology and beekeeping practices worldwide but with the emphasis on information particularly relevant to Indian conditions. It covers honey bee morphology, anatomy, life cycle, colony organisation and social behaviour, and describes how beekeeping management is related to the biology of honey bees (*Apis* spp.). Individual chapters deal with management in relation to swarm control and making colony increases, queen rearing, control of pests and diseases, and seasonal management. There are also chapters on honey bee forage, hive products, pesticide poisoning and pollination. Each of the 13 chapters concludes with a list of references, chosen wherever possible from Indian literature, and there is a subject index. The book will be a useful source of information for anyone interested in beekeeping in India. *D.G. Lowe*

Mishra, R.C., Dogra, G.S. and Gupta, P.R. *Some observations on insect pollinators of apple.* *Indian Bee Journal* (1976) 38 (1–4) 20–22 [En, B]

Three varieties of apple trees grown at Simla (Himachal Pradesh, India) were visited most frequently by honeybees, particularly during the period 12–15 hours, when they constituted 70% of pollinators. Other pollinators included *Eristalis* and *Syrphus* flies and a few bumble bees. In Red Delicious, percentage fruit set was measured on trees at different distances from a hive; values were 33, 17.9, 13.4, 15.5 and 9% at 10, 50, 100, 200 and 300 m. *P. Walker*

Dept. Entomology, Himachal Pradesh Univ., Simla 171005, India.

Mishra, R.C., Dogra, G.S. and Gupta, P.R. Apicultural activities in Himachal Pradesh. *Indian Bee Journal* (1979) 41 (3/4) 29–31 [En, B]

Mishra, R.C., Dogra, G.S. and Gupta, P.R. Some observations on iridovirus of bees. *Indian Bee Journal* (1980) 42 (1) 9–10 [En, B]

In *Apis cerana* in Himachal Pradesh, India.

Mishra, R.C. and Kaushik, H.D. Green bee eater, *Merops orientalis* and evaluation of possible methods to reduce honeybee predation. *Pavo* (1993) 31 (1/2) 113–116 [En, Bb]
M. orientalis is a common predator of honey bees in Punjab, Haryana, Jammu and other areas of India. In attempts to prevent serious damage to honey bee colonies, different methods of scaring the birds were used, including various sound-producing devices and recorded, amplified distress calls made by an injured bee-eater; none of these methods were very effective. Arrays of reflective tapes were also ineffective. Placing hives under a thick canopy of trees (e.g. between rows in eucalypt or poplar plantations) reduced the incidence of predation by the birds, which found it difficult to fly in between the trees. Restricting bee flight activity by closing hive entrances at times when a 'watchman' was not present to scare the birds was also effective.

All India Co-ordinated Project on Honeybee Research & Training, Haryana Agricultural University, Hisar 125 004, India.

Mishra, R.C. and Sihag, R.C. Apicultural research in India. Hisar, India; All-India Co-ordinated Project on Honeybee Research & Training at Haryana Agricultural University. (1987) vi + 120 pp. [En, Bd]

The aim of this book is to review the contributions of Indian scientists in the field of apicultural research. All original research papers published up to 1986 (and abstracted in *Apicultural Abstracts*) are considered, but articles of a general nature are omitted unless of special importance. Research on the following topics is covered: beekeeping in India; honeybee colony development; biometry, morphology and anatomy; physiology and biochemistry; honeybee behaviour; genetics, breeding and introduction of exotic honeybees (*Apis mellifera*); bee botany; pollination; diseases and enemies; pesticide poisoning; honeybee products and technology; non-*Apis* bees. Throughout the book, gaps in existing knowledge are identified and future lines of research suggested. The list of references covers 49 pages, and there is also an author index. The book forms a valuable bibliography of work on the indigenous honeybees of India – *A. cerana*, *A. dorsata* and *A. florea* – and it will be especially useful to those planning future research and development. D.G. Lowe
Haryana Agric. Univ., Hisar, India.

Mishra, R.C. and Verma, A.K. Relative toxicity of some insecticides to *Apis cerana indica* F. workers. *Indian Bee Journal* (1982) 44 (3) 69–71 [En, B]

The contact and oral toxicities of 10 insecticides were

assessed in the laboratory. The 'safety index' of each was calculated by Hameed's method. The results are tabulated for chlorpyrifos, endosulfan, fenvalerate, isofenphos, methamidaphos, fenitrothion, methyldemeton, permethrin, phenthoate and phosalone. P. Walker
Dept. Entomology, Himachal Pradesh Univ., Solan 173 230, Himachal Pradesh, India.

Mohan, R. and Devanesan, S. Studies on the behaviour of the stingless bee, *Trigona iridipennis* Smith. (Apidae: Meliponinae). *Indian Bee Journal* (2000) 62 (3–4) 59–62 [En, B]

A colony was kept in an observation hive; cell construction is described. After the queen had inspected the cells and chosen one, 3–5 workers put in liquid food before the queen laid an egg; usually one worker sealed the cell. Away from the brood cells, waste dumps were observed; some bees took small cakes of this material out of the nest. Pollen and honey storage pots are also described. P. Walker
Dept of Entomology, College of Agriculture, Vellayani, Thiruvananthapuram 695522, India.

Mohana Rao, G. and Singh, T.S.M.S. Current trends in beekeeping in South India. *Indian Bee Journal* (97) 59 (1) 33–36 [En, B]

After the collapse of *Apis cerana* beekeeping due to Thai sacbrood virus, feral colonies were found increasingly from 1994, and many have been collected and hived.

Mondal, M. and Mitra, K. Pollen analysis of honey from Sunderbans (W. Bengal). *Geophytology* (1980) 10 (2) 137–139 [En, B]

Results of photomicrographic analyses are presented for six honey samples [presumed to be from *Apis dorsata*]; all contained pollens of the genera *Bruguiera* and *Phoenix*, but in honeys with a high percentage of the former the percentage of the latter was low, and vice versa. One honey was virtually unifloral (92.4% *Phoenix* pollen). *Aegicera* and *Sonneratia* pollens were also present in all samples. P. Walker

Central Natn. Herbarium, Howrah, 711103, West Bengal, India.

Mossadegh, M.S. Nesting behaviour of *Apis florea* F. (Hymenoptera: Apidae) in Khuzestan, Iran. Proceedings of the 11th International Congress, International Union for the Study of Social Insects, India, 1990. New Delhi, India; Oxford & IBH Publishing Co. Pvt. (1990) 669–670 [En, Bb]

A study of 3,720 *A. florea* colonies over 11 years showed that nest height varied from 0.3 m to 14 m above ground level. Nests were built on trees, bushes, walls, under eaves, and elsewhere, with combs usually constructed in an east–west direction. Brood rearing began in February, peaked in June and, after an interval, began again at the end of August and continued until the end of November. Colonies were able to construct combs 16–25 cm wide and 17–40 cm high in 30 days. Swarming showed two peaks in May and July. Average annual yields of honey varied from 0.1 to 8 kg/colony (average 1.33 kg/colony). J.M. Gedye
Department of Entomology, College of Agriculture, Shahid Chamran University, Ahwaz, Iran.

Mullik, S. R. **Beekeeping industry in Maharashtra.** *Indian Bee Journal* (1977) 39 (1-4) 30-35 [En, B]

Muniswamy, B., Krishna, G., Naveen, K. S. and Sreenath, H. L. **Role of honey bees for pollination in coffee.** *Indian Coffee* (2000) 64 (3) 6-7, 27 [En, X]

Murthy, V. A. and Venkataramanan, R. ***Ellingsenius indicus* (Arachnida; Chelonethi) as a tool to the assessment of the settling nature of honey bee (*Apis cerana indica*) colony in a new habitat.** *Indian Bee Journal* (1986) 48 (1-4) 54-55 [En, B]

This pseudoscorpion reaches a new area by clinging to the leg of a honeybee in a swarm, and a swarm may include from 30 to 250 bees with pseudoscorpions. In two observation hives where *A. cerana* swarms were provided with healthy brood, the bees settled quickly and the pseudoscorpions left the bees' legs within 48 hours. They moved to crevices or the spaces between the frames and hive box walls, and in 72-96 hours they started to make nests. In two damp hives, without brood, the honeybee swarms did not settle and the pseudoscorpions remained on the bees' legs. One colony tried to leave the hive three times in one day, but a queen excluder kept the queen inside. When the excluder was removed the colony left the hive, still carrying the pseudoscorpions. P. Walker
Loyola Coll., Madras 600 034, India.

Muthappa, B. M. **Rock bee culture in forests.** *Myforest* (1979) 15 (3) 189-199 + 1 pl. [En, B]

Apis dorsata colonies which migrate to the Bangalore area of India in October, when forage is plentiful, are attracted to, and build their nests on, wooden planks (150 x 15 x 2.5 cm) smeared with the juice of *Cinnamomum incus* and molten wax; the planks are fixed on tall trees and high rocks where the bees normally nest. Using a pulley and rope system, the plank can be lowered for harvesting the honey, after smoking the bees away temporarily. Quickly, the top part of the nest, containing honey, is cut out with a sharp knife, the pollen and brood cells refixed to the plank, and hoisted up again. Rope ladders are used to reach very high nests. Honey was harvested in this way from eight of 84 colonies in a large banyan tree. Eventually the *A. dorsata* honey will be extracted in specially constructed centrifugal extractors. It is recommended that honey-yielding eucalypts should be planted to provide bee forage over a long period. Tables list some of the possible species, with information (from Australian sources) on their value as honey sources, other uses, and flowering period (in Australia). P. Walker
UAS, Bangalore 24, India.

Muthuraman, M., Desai, S. D., Thangavelu, G. K. and Srinivasan, G. **Coconut inflorescences sap: a food source for honey bees.** *Insect Environment* (2002) 7 (4) 163 [En, X]
Dept of Agricultural Entomology, Tamil Nadu Agricultural Univ., Combatore-641 003, India.

Muzaffar, N. **Seasonal management of honeybee colonies [in India].** *Progressive Farming* (1984) 4 (5) 27-30 [En, Bc]

Nadanasabapathy, S., Srivatsa, A. N. and Arya, S. S. **Development of coconut products of commercial value.** *Indian Coconut Journal* (Cochin) (99) 30 (5) 32-33 [En, X]
Products discussed include coconut honey.
Defence Food Research Lab., Mysore 570 011, India.

Nagaraja, N. **Invasion and infestation of brood parasitic mites, *Varroa jacobsoni* and *Tropilaelaps clareae* in hive honeybee species.** *Indian Bee Journal* (99) 61 (1-4) 37-41 [En, B]

Five colonies of *Apis mellifera* (M) and five of *A. cerana* (C) in an apiary in Bangalore were healthy at the start of the study. Fortnightly examinations of the colonies (August to November) showed that both M and C became infested with varroa mites, but only M with *T. clareae*. The infestation level increased with increasing brood area. The rate of invasion and level of infestation were similar in M drone and worker brood, but in C they were higher in drone brood. Author
Dept of Zoology, Bangalore Univ., Bangalore 560056, India.

Nagaraja, N. **Impact of ectoparasitic brood mites, *Tropilaelaps clareae* and *Varroa jacobsoni* on *Apis mellifera* beekeeping in Karnataka.** *Journal of Ecotoxicology and Environmental Monitoring* (2000) 10 (3/4) 205-210 [En, X]

The mites were present throughout the year, and was highest in March-April and September-October and lowest in May-August. The mites were present in both worker and drone brood. Infestation levels were higher during 1995-96 than 1996-98.
Bee Div., Dept of Zoology, Bangalore Univ., Bangalore 560 056, India.

Nagaraja, N. **Studies on annual foraging cycle of *Apis mellifera* L.** *Indian Bee Journal* (2000) 62 (1-2) 11-17 [En, B]

In a 3-year study, activities of nectar foragers and pollen foragers were monitored in 12 colonies in a Bangalore apiary. Activity varied between seasons; more pollen foragers were observed during the periods February-April and September-October, and the dearth season was June-July. Nectar foragers were most active from October to January. Maximum pollen and nectar loads were 23.0 mg (Oct.) and 28.5 µl (Apr.), respectively. The results show that the performance of *A. mellifera* in this area is satisfactory. Author
Dept of Zoology, Bangalore Univ., Bangalore 560056, India.

Nagaraja, N. and Rajagopal, D. **Colony establishment, nesting and foraging activity of little honey bee, *Apis florea* F. (Hymenoptera: Apidae).** *Journal of Entomological Research* (99) 23 (4) 331-338 [En, wf]

Colonies were monitored in Bangalore district, Karnataka, India. They were well established (based on brood area, pollen stores, honey stores and bee population) during September to December. Preferred nest sites were branches of shrubs and small trees at 3-6 m above ground level. Comb-building activity was continuous and reached a peak 60-120 days after settling at the nest site. Maximum comb size was 26.5 x 23.5 cm. Foraging activity was continuous,

with peaks of pollen foraging around midday and during evening hours. The greatest numbers of pollen foragers (and largest pollen loads) were recorded during October, and of nectar foragers (and largest nectar loads) during December.

Dept of Apiculture, Univ. of Agricultural Sciences, GKVK Campus, Bangalore-560 065, Karnataka, India.

Nagaraja, N. and Rajagopal, D. Foraging and brood rearing activity of rock bee, *Apis*. *Journal of Entomological Research* (2000) 24 (3) 243–248 [En, 14 wf]

The foraging and brood rearing activity of *A. dorsata* was studied in Bangalore, India. Foraging activity was low around midday. The number of pollen foragers and pollen load size were highest from 09.00 to 11.00 hours, and during October–April. Number of nectar foragers and nectar load size were maximum from 10.00 to 12.00 hours, and during December. Maximum brood and pollen area were also recorded during the same period; the death period was from May to July.

Dept of Apiculture, College of Agriculture, Univ. of Agricultural Sciences, GKVK Campus, Bangalore-560 065, Karnataka, India.

Naik, D.G., Banhatti, P., Chawda, S.S. and Thomas, D. *Fagara budrunga* fruit extract as an attractant for *Apis cerana*. *Journal of Apicultural Research* (2003) 42 (3) 48–49 [En, B]

Sugar syrup containing extract of dried fruits of this plant were more attractive than plain sugar syrup.

Chemistry Group, Agharkar Research Inst., G G Agarkar Rd, Pune 4 004, India.

Naim, M. Field behaviour of honeybee foragers. *Indian Journal of Entomology* (1984) 46 (3) 335–339 [En, Bc]

The foraging behaviour of honeybees is discussed. The factors which affect the number of trips per day and weight of pollen loads (temperature, light intensity, wind and rain), and their influence on crop yields, are considered. *J.M. Gedye*

Div. Entomology, Indian Agric. Res. Inst., New Delhi 110 012, India.

Naim, M. Future prospects of the imported honey bee *Apis mellifera* L. in India. *Indian Bee Journal* (1988) 50 (1) 18–20 [En, B]

Naim, M. and Bisht, D.S. A simple method of disinfection of honeybee combs against wax moth. *Indian Bee Journal* (1972) 34 (3/4) 70–71 [En, B]

Thermal treatment to kill *Achroia grisella* in combs can be carried out by the beekeeper. This method was tested by assembling a super and a brood chamber on a floorboard, to which was fixed a 100 watt bulb. The temperature could be raised to 55°C in 1 hour, and then seven broodless frames, heavily infested, were put in for 1 hours. All *A. grisella* larvae and pupae were killed. Similar results were obtained when the treatment was carried out in the dark, in contrast to the results of Ramchandran and Mahadevan. *P. Walker*

Div. Entomology, Indian Agric. Res. Inst., New Delhi 12, India.

Naim, M. and Bisht, D.S. The life span and the egg-laying potential of a queen bee *Apis cerana indica*. *Indian Journal of Entomology* (1984) 46 (3) 380–382 [En, Bc]

An *A. cerana* queen in Delhi, India, began to lay eggs 14 days after emergence and continued for about two years, until she was superseded by another queen. A total of 353 662 eggs was laid, including 7139 drone eggs. The rate of laying varied from 0 to 980 per day. The most active period of egg laying was during April–June at temperatures of 37–42°C. *J.M. Gedye*

Div. Entomology, Indian Agric. Res. Inst., New Delhi 110012, India.

Naim, M. and Bisht, D.S. Fidelity and time spent on flowers by *Apis cerana* F. foragers. *Indian Journal of Entomology* (1989) 51 (2) 222–223 [En, Ba]

Individual nectar (N) and pollen (P) foragers were marked with different colours. Observations confirmed that they continued with the same activity throughout the day, i.e. there was no switching between nectar and pollen foraging. An individual P collected pollen of the same colour throughout the day; no mixed loads were seen. *P. Walker*

Division of Entomology, Indian Agriculture Research Institute, New Delhi 110012, India.

Naim, M., Bisht, D.S. and Sinha, R.B.P. Percentage of honeybee visitation to mustard fields. *Entomologists' Newsletter* (1976) 6 (2) 5–6 [En, B]

In counts on a field of brown sarson (HB-1) *Apis cerana* was 10 times as numerous as *A. florea* in the morning; the proportion of *A. florea* was slightly higher in the afternoon. *A. cerana* visited the field continuously for 4–5 days, showing a high degree of flower constancy. *A. dorsata* was not present in this area. *P. Walker*

Indian Agric. Res. Inst., New Delhi, India.

Naim, M. and Phadke, K.G. Observations on the frequency of extraction and the honey yield. *Indian Bee Journal* (1972) 34 (1/2) 24–26 [En, B]

Colonies of *A. cerana indica* were studied during the *Nephelium litchi* flow in February and March (four in 1966, three in 1967, two in 1968). The colonies were requeened every year and were provided with pollen or syrup during periods of dearth. Honey was removed from one set of colonies (A) only once, at the end of the flow season (they were provided with a number of supers). In other colonies (B), honey was extracted from two supers when these were full and the supers replaced. Results for all three years showed that more honey was obtained from B. Mean honey yields for the 3-year period were 8.925 kg/colony for A and 12.845 kg/colony for B. *A.S. Attwood*

Indian Agricultural Res. Inst., New Delhi, India.

Naim, M. and Phadke, K.G. Bee flora and seasonal activity of *Apis cerana indica* at Pusa (Bihar). *Indian Bee Journal* (1976) 38 (1–4) 13–19 [En, B]

Bee forage was surveyed around an apiary at distances up to 1.6 km from the hives; 44 species are listed, with flowering periods, and whether a major or minor pollen and/or nectar source. Colonies are most active from January to mid-March when pollen and nectar are abundant; surplus

honey is stored up to the end of April, the main source being *Nephelium litchi*. P. Walker
Div. Entomology, Indian Agric. Res. Inst., New Delhi, India.

Naim, M., Prasad, S. K. and Singh, P. B. Role of Indian honeybee, *Apis cerana* F. in pollination of *Brassica napus* L. (*Gobi sarson*). Shashpa (1994) 1 (1) 89–90 [En, Ba]

B. napus plants were grown (A) under a net, with an *A. cerana* colony, or (B) under a net, without honey bees, or (C) in the open. The mean percentage pod formation was 85.4, 64.5 and 73.2% in A, B and C, respectively; the differences were statistically significant. The mean number of seeds/pod and weight of 1000 seeds were also highest in A, but differences between treatments were not significant. D. G. Lowe

Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India.

Naim, M. and Singh, P. B. Recent advances in apiculture. Recent advances in Indian entomology [edited by Lal, O. P. J.]. New Delhi, India; APC Publications Pvt. Ltd. (1996) 346–352 ISBN 81-86580-17-4 [En, Bc]

Recent research on honey bees (*Apis* spp.) in India is reviewed, with 29 references.

Nair, P. K. K. and Chaturvedi, M. Studies in pollen biology. Progress in plant research. Vol. 1. Lucknow, India; National Botanical Research Institute. (1979) 161–183 [En, B]

Review; includes pollen analysis studies of Indian honeys and of pollen loads of honeybees.

Nandi, N. C. and Mahabal, A. Nesting behaviour of *Apis dorsata* F. (Hymenoptera: Apidae) in relation to local wind directions around Poona, India. Indian Bee Journal (1974) 36 (1–4) 19–20 [En, B]

Of 144 nests surveyed, 113 were on buildings, and these probably give more protection from strong winds than open trees do. The directions in which the combs were constructed are tabulated. On open trees 68% of the combs were parallel to main wind directions (E, W); on buildings 41% of nests were north–south, possibly showing an effect of the earth's magnetic field. P. Walker
Western Regional Stn., 1182/2, FC Rd., Poona 411 005, India.

Narayana, N. Studies in Indian honeys and bees waxes. Poona, India, Central Bee Research Institute. (1970) 13 pp. [En, B]

The composition of 80 samples of multifloral apiary honeys (produced by *Apis cerana indica*) from many parts of India was investigated. Some significant differences between honey from four main areas of India were found. Samples of apiary beeswax from *A. cerana indica* and of wild beeswax from *A. dorsata*, *A. florea* and *Trigona* were analysed in detail. Standards are suggested for refined beeswax.

MACS, Research Inst., Poona 4, India.

Natarajan, R. and Yesuvadian, M. S. Project report for a honey concentration equipment. Indian Honey (1978) 1 (1) 15–21 + 1 pl. [En, B]

The properties and composition of honey, and also the

specifications of the Indian Standards Institution and Agmark are discussed. Honey with a high moisture content is common in India; for example, in Kerala and Tamilnadu more than half the honey contains at least 23% moisture. The heating equipment designed for treating such honey is described briefly with a flow diagram. P. Walker
Indian Inst. Honey, Kuzhithurai PO, Kanyakumari District, Tamilnadu, India.

Narendran, T. C., Jobiraj, T. and Mohandas, K. A remarkable new species of the bee genus *Halictus* Latreille (Hymenoptera: Apoidea: Halictidae) from India. Journal of Advanced Zoology (2000) 21 (1) 48–50 [En, X]

Halictus tectonae sp. nov., a pollinator of teak flowers in Kerala, India, is reported.

Systematic Entomology Lab., Dept of Zoology, Univ. of Calicut, Kerala-673635, India.

Nath, S., Roy, P., Leo, R. and John, M. Keystone. Honey-hunters and beekeepers of Tamil Nadu. A survey document. Pondicherry, India; Keystone. (1994) 86 pp. [En, Bdo]

This document describes the findings of a survey team which visited the mountainous region of Tamil Nadu in southeastern India in 1994. In many areas beekeeping is no longer practised because of colony losses due to diseases and an increased development of cash crop cultivation. It is concluded that beekeeping in Tamil Nadu is still rudimentary and that beekeepers lack knowledge and skills. The market for honey is regarded as highly disorganised and fragmented, giving low economic rewards to beekeepers. The final chapter describes present constraints on beekeeping and sets out recommendations. D. G. Lowe

Naug, D. and Gadakgar, R. The role of age in temporal polyethism in a primitively eusocial wasp. Behavioral Ecology and Sociobiology (1998) 42 37–47 [En, Bc]

Centre for Ecological Sciences, Indian Inst. of Science, Bangalore 560 012, India.

Neeraj Kumar, Hari Chand and Ramashrit Singh. Effect of method of grafting on queen production in *Apis mellifera* and *Apis cerana indica*. Shashpa (2001) 8 (1) 47–49 [En, X]

Artificial queen wax cups were primed with royal jelly (RJ), or RJ + water (1:1), or were left without RJ, and then 24-hour-old larvae were grafted into them; cup diameter was 9 mm for *Apis mellifera* and 7 mm for *A. cerana indica*. Cups primed with pure RJ gave the highest larval acceptance (86.7% and 80.0%, respectively), queen emergence (76.7% and 75.5%) and queen body weight (184.4 and 136.40 mg). Cups without RJ resulted in the lowest larval acceptance (20.0% and 25.6%), queen emergence (13.3% and 23.3%) and queen body weight (136.9 and 118.53 mg). Dept of Entomology and Agricultural Zoology, Rajendra Agricultural Univ., Bihar Pusa (Samastipur) 848 125, India.

Nehru, C. R., Thankamani, S., Jayarathnam, K. and Joseph, P. M. L. Nectar and pollen plants for extending the flow period in rubber-growing areas of India. Bee World (1989) 70 (3) 118–119 [En, Bj]

Antigonon leptopus, *Callistemon lanceolatus*, *Manihot glaziovii*, *Pongamia glabra*.

Nowicke, J. W. and Meselson, M. **Yellow rain – a palynological analysis.** *Nature*, UK (1984) 309 205–206 [En, B]

About 20 types of pollen from at least 15 families were found in 11 samples of 'yellow rain' collected in 1981–1982 at sites of alleged chemical warfare in Laos. It is concluded that the yellow rain samples examined were probably honey-bee faeces; the variation in pollen composition between spots would not have been likely if they had originated from an artificial source. *D. G. Lowe*

Botany Dept., Natn. Museum Natural History, Smithsonian Inst., Washington, DC 20560, USA.

Olsson, J. ***Apis cerana*: management methods for prevention of absconding. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.** London, UK; International Bee Research Association. (1989) 453–457 ISBN 0-86098-196-7 [En, Bdo]

A study of absconding by *A. cerana* in Karnataka, southern India, in 1980–82, showed that the main causes were starvation, disturbance by the beekeeper, pests (beetles, wasps, ants, martens, etc.), and general stress caused by old combs, poor location, too much foundation in the brood-nest and insufficient colony strength. The management practices developed to counteract these included feeding sugar syrup, renewal of old comb, restricting colony inspections to times when the bees are busy and to a total of four or five per year, excluding certain pests by restricting entrances, securing hives on stands with sticks and steel wire, and uniting small healthy colonies and swarms with colonies having poor queens (which are then destroyed). *D. G. Lowe*

Frederiksvej 52/2, 2000 Frederiksberg, Denmark.

Olsson, J. **Honey bee disease in south India.** *Beekeeping & Development* (1992) (No. 23) 6 [En, Bj]

The present situation regarding Thai sac brood disease in southern India is described. Beekeeping with *Apis cerana* in Kerala, Karnataka and Tamil Nadu is now seriously threatened. *D. G. Lowe*

Frederiksvej 52/2, 2000 Frederiksberg, Denmark.

Padmanabhan, P. **Development of beekeeping in forestry and agro-forestry plantations in Kerala.** *Indian Bee Journal* (97) 59 (3) 172–174 [En, Bj]

Kerala Forest Research Inst., Peechi, Thrissur, Kerala, India.

Padmanabhan, V. **The sting in the honey and the nectar in the pollen.** *Indian Bee Journal* (1980) 42 (1) 11–14 [En, B]

Observations on honeybee pollination of lemon, sunflower and gingelly (*Sesamum indicum*), in India.

Palanichamy, P. S., Baskaran, S. and Mohandoss, A. **Insect pollination of the moringa plant *Moringa concanensis* Nimmo Linn.** *Environment and Ecology* (1995) 13 (1) 47–51 [En, 15 ref.]

Post-Graduate Department of Zoology, Ayya Nadar Janaki Ammal College, Sivakasi 626124, India.

Panchabhavi, K. S., Devaiah, M. A. and Basavanna, G. P. C. **The effect of keeping *Apis cerana indica* F. colonies on the**

seed set of sunflower, *Helianthus annuus* Linn. *Mysore Journal of Agricultural Sciences* (1976) 10 (4) 631–636 [En, B]

In a study near Bangalore, India, seed set on plots where colonies had been introduced just before flowering was about 27% higher than that on control plots. The increase was higher in the largest sunflower heads. The weight of 100 seeds was lowest in the smallest head, and highest in the largest head, but the relationship between seed weight and head size was not uniform. *P. Walker*

Dept. Entomology, Univ. Agric. Sci., Hebbal, Bangalore-560024, India.

Panda, P., Sarangi, P. K., Padhi, J. and Panda, S. K. **Thai sacbrood – prevention is the only cure.** *Indian Bee Journal* (97) 59 (1) 32 [En, Bj]

Panda, P., Nanda, U. K., Mohapatra, H. and Padhi, J. **Insect pollination in some oilseed crops in Orissa, India.** *Indian Bee Journal* (1989) 51 (3) 97–98 [En, Bj]

The main visitors to flowering mustard, niger, sesame, sunflower and safflower in Orissa are listed. These include the honey bees *Apis dorsata*, *A. florea* and *A. cerana*, together with various species of wild bees. Seed yields on plots of mustard and of sesame caged with *A. cerana* were, respectively, 11 and nearly twice as high as on plots caged to exclude insects. On niger plots the presence of bees made little difference to yield, although bees increased seed set. *P. Walker*

Department of Entomology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar, India.

Panda, P. and Padhi, J. **Beekeeping in Orissa [India].** *Indian Bee Journal* (1995) 57 (1) 20–22 [En, Bj]

Department of Entomology, Orissa University of Agriculture and Technology, Bhubaneswar 751 003, India.

Panda, P., Padhi, J., Nanda, U. K. and Mohanty, N. C. **Record of *Varroa jacobsoni* and *Euvarroa sinhai* on *Apis cerana indica* Fabr. at Bhubaneswar, Orissa, India.** *Indian Bee Journal* (1989) 51 (2) 59 [En, Bj]

V. jacobsoni was recorded in Orissa for the first time in December 1988, when low infestation levels were found in 10 colonies. Mite populations became maximal in February 1989, and caused heavy losses in colonies. *E. sinhai* was identified in 10 of 30 colonies at another apiary. *P. Walker*

Dept. Entomology, Coll. Agric., Bhubaneswar, Orissa, India.

Panda, P., Panda, B. and Sontakke, B. K. **Foraging behaviour of honey bees on sunflower (*Helianthus annuus* L.) sown on different dates.** *Indian Bee Journal* (1991) 53 (1–4) 44–49 [En, Bj]

Department of Entomology, Orissa University of Agriculture and Technology, Bhubaneswar 751 003, India.

Panda, P., Rath, L. K., Padhi, J. and Panigrahi, D. **Relative abundance and foraging behaviour of common bee species on niger in Phulbani District, Orissa, India.** *Indian Bee Journal* (1995) 57 (1) 10–14 [En, Bj]

Department of Entomology, College of Agriculture, Orissa

University of Agriculture and Technology, Bhubaneswar 751 003, India.

Panda, P., Sontakke, B.K. and Sarangi, P.K. Preliminary studies on the effect of bee (*Apis cerana indica* Fabr.) pollination on yield of sesamum and niger. *Indian Bee Journal* (1988) 50 (3) 63–64 [En, Bj]

Honeybees were the main pollinators of both these crops. Their population density on open plots of sesame was 2.6–5.8 bees/m²/min, and a single bee visited 23–30 flowers/minute. On niger, values were 1.8–8.1 bees/m²/minute and 7.2–10.6 flowers/minute. On plots caged with honeybees, the bee population was higher on both crops, but the flower visiting rate was lower. For sesame, mean seed yield per plot was 2.4 kg on open plots, 2.6 kg on plots caged with bees and 1.6 kg on plots caged without bees. For niger, mean yields were 1.1, 1.2 and 0.9 kg/plot, respectively. *P. Walker*

Dept. Entomology, Agric. Coll., Orissa Univ. Agric. & Technol., Bhubaneswar 751 003, India..

Pande, Y.D. and Bandyopadhyay, S. The foraging behaviour of honey bees on flowers of pigeon pea (*Cajanus cajan*) in Agartala, Tripura. *Indian Bee Journal* (1985) 47 (1–4) 13–15 [En, Bj]

In this study *Apis cerana* and *Trigona* sp. were the most common visitors to pigeon pea flowers; both collected mainly nectar, the former being the more effective pollinator. Some *A. dorsata* also visited the flowers to collect nectar and pollen. Mean time spent on a flower was: *A. cerana* 4 seconds, *Trigona* sp. 5.33 seconds, *A. dorsata* 4.66 seconds. Foraging by honeybees began at about 08.00 hours and ceased at about 16.00 hours, with a peak from 10.00 to 14.00 hours. Foraging activity was reduced on cloudy days. Five marked *A. cerana* workers were observed foraging in the same 4 x 3 m area for up to three days. *P. Walker*

Dept. Life Science, Post-Graduate Centre, Calcutta Univ., Agartala 799 004, India.

Pandey, R.S. Honey collection in relation to migration schedules of wild honey bees in U.P. (India). *American Bee Journal* (1974) 114 (10) 379 [En, B]

Apis dorsata and *A. florea* are migratory, moving to new locations according to nectar flow. A table summarises the principal sources of nectar during five periods from November to July in the forested regions of Kumaon and Garwhal. (New plantations of Eucalyptus in the Tarai area of Nainital are important both to wild and domestic honeybees.) Honey is taken from wild colonies five or six times a year, but methods of collection and extraction are crude, and the honey is not very clean. It is estimated that the annual honey harvest from *A. dorsata* in Uttar Pradesh is about 2000 kg. *J.D. Hitchcock*

Div. Entomology, UP Inst. Agric. Sci., Kanpur 2, India.

Pandey, R.S. Behavior of the Indian honey bee in double brood chamber hives. *American Bee Journal* (1977) 117 (10) 627 [En, B]

Some colonies of particularly prolific strains of *Apis cerana*, which swarmed repeatedly, were housed with an extra brood chamber above that in the Jeolikote villager-size hive. Bees could move freely between the two brood chambers. In the upper one workers drew out combs in which

they stored honey; the queen remained in the lower one. If the queen was put in the upper chamber, workers repeatedly built queen cells in the lower one, and filled brood cells with nectar and pollen. These and other problems were not successfully overcome, but there was no swarming. Honey could be extracted from only one colony in a double brood chamber. *P. Walker*

Dept. Entomology, Univ. Agric. & Technol., Kanpur, India.

Pant, D.D., Nautiyal, D.D. and Chaturvedi, S.K. Insect pollination in some Indian Glumiflorae. *Beitrage zur Biologie der Pflanzen* (1982) 57 (2) 229–235 [En, B]

Insect behaviour was observed on a grass, *Dichanthium annulatum*, and on two sedges, *Cyperus rotundus* and *Scirpus lacustris*, in Allahabad, India. Insects (A), which collected pollen grains on their hind legs, included *Apis cerana*, *A. florea*, *A. dorsata* and *Melipona laeviceps*. Several other species (B), including two *Nomia* species, also collected pollen on the thorax and abdomen. Pollen grains of various plants were found on these bees, in contrast to those of type A which tended to be constant to one plant species. Small bees spent some time on each inflorescence, crawling from flower to flower. Larger bees made the stems bend so they were only able to collect pollen momentarily. It was confirmed by the use of pollen grains stained with methylene blue that bees effectively pollinate these plants. *P. Walker*

Dept. Botany, Univ. Allahabad, Allahabad, Uttar Pradesh, India.

Partap, U. and Partap, T. Warning signals from the apple valleys of the Hindu Kush-Himalayas. Productivity concerns and pollination problems. Kathmandu, Nepal; International Centre for Integrated Mountain Development (2002) 104 pp. ISBN 92-9115-605-1 [En, Bd]

This book contains the results of surveys carried out as part of the project to promote the sustainable management of *Apis cerana* and other indigenous bees by mountain communities in order to increase productivity and to conserve biodiversity. The surveys were carried out in apple-producing areas in India (Himachal Pradesh), China (Maonian valley), Pakistan, Bhutan and Nepal. Decreasing yields and quality are due to inadequate pollination, the reasons for which are discussed. Suggestions are made for the type of beekeeping that would improve apple yields in each area. *P. Walker*

Partap, T. Honey plant sources in mountain areas: some perspectives. Honeybees in mountain agriculture [edited by Verma, L.R.]. New Delhi, India; Oxford & IBH Publishing Co. (1992) 91–110 ISBN 81-204-0650-8 [En, Bdo]

This paper includes tables of tree species and multi-purpose shrubs found in a survey of different climatic regimes in the Hindu Kush-Himalaya region. Their use for honey source plantations on wasteland, public land and roadsides is recommended. *D.G. Lowe*

Mountain Farming Systems, International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Partap, U. Bee flora of the Hindu Kush-Himalayas: inventory and management. Kathmandu, Nepal; International

- Centre for Integrated Mountain Development (ICIMOD). (1997) xi + 297 pp. ISBN 92-9115-662-0 [En, Bd]
This book is intended to be a practical guide to the main bee forage resources of the Hindu Kush-Himalayan region, for the use of beekeepers, farmers, extension workers and scientists.
- Partap, U. and Partap, T. *Managed crop pollination. The missing dimension of mountain agricultural productivity.*** Kathmandu, Nepal; International Centre for Integrated Mountain Development (ICIMOD). Discussion Paper Series – Mountain Farming Systems, ICIMOD (1997) (No. 97/1) 26 pp. [En, Bb]
This review, with 56 references, discusses the need for managing honey bees and other insects for crop pollination in the Hindu Kush-Himalayan region. Relevant research results are summarised. The foraging (and pollinating) behaviour of the local honey bee (*Apis cerana*) is compared with that of the introduced *A. mellifera*. A strong case is made for the conservation and increased use of *A. cerana* in mountain areas, where (in the lower temperatures) it is a better pollinator than *A. mellifera*. P. Walker
- Parvathi, C., Shadakshari, Y.G., Belavadi, V.V and Chandrappa, H.M. *Foraging behaviour of honeybees on cardamom (Elettaria cardamomum Maton). Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G.K., Shaanker, R. U. and Ganeshiah, K.N.]*** Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 99–103 [En, Bd]
University of Agricultural Sciences, Regional Research Station, Mudigere 577.132, India.
- Patel, B.H., Upadhyay, V.R., Muralidharan, C. M. and Judal, G.S. *Effect of various insecticides on honey bee, Apis florea Fabricius in 'ber' (Zizyphus mauritiana Lamk).*** *Current Science* (1988) 57 1199–1200 [En, Bb]
The effects of nine insecticides on *Apis florea* were investigated in Gujarat, India. The insecticides were applied to *Z. mauritiana* trees immediately after flowering and then twice more at 3-week intervals. Populations of *A. florea* were recorded 24 hours before each spraying and then at 24, 48, 72 and 168 hours after. Populations were highest 24 hours before and 7 days after spraying of the insecticides, and lowest at 24 hours after spraying, for all treatments (including controls). Populations increased steadily until, at 1 week after spraying, they were roughly on a par with control populations. D.G. Lowe
Dept. Entomology, Coll. Agric., Gujarat Agric. Univ., Sardar Krushinagar 385 506, India.
- Pathak, K. A. and Rao, K.R. *Foraging activity of Apis mellifera on mustard in Meghalaya.*** *Insect Environment* (99) 5 (1) 13–14 [En, X]
Div. of Entomology, ICAR Research Complex for NEH Region, Umroi Road, Barapani 793 103, Meghalaya, India.
- Pathak, K. A. and Rao, R. K. *Foraging activity of Apis mellifera in sunflower in Meghalaya.*** *Insect Environment* (99) 5 (1) 14 [En, X]
Div. of Entomology, ICAR Research Complex for NEH Region, Umroi Road, Barapani 793 103, Meghalaya, India.
- Patil, B.S. and Shashidhar Viraktamath. *Pollinator fauna of sesamum in Dharwad.*** *Insect Environment* (2000) 5 (4) 171–172 [En, X]
Dept of Agricultural Entomology, Univ. of Agricultural Sciences, Dharwad 580 005, Karnataka, India.
Mainly *Apis dorsata*.
- Patil, B.S. and Shashidhar Viraktamath. *Foraging behaviour of two species of honey bees on sesamum.*** *Karnataka Journal of Agricultural Sciences* (2001) 14 (3) 796–798 [En, wf]
Dept of Agricultural Entomology, College of Agriculture, Dharwad-580 005, India.
- Patil, B.S., Shashidhar Viraktamath, Lingappa, S., Giraddi, R. S., Parameshwarappa, K. and Bhat, A. R. S. *Effect of Bee-Q and Bee-here on pollinators and yield of sesamum.*** *Insect Environment* (2000) 5 (4) 151–152 [En, X]
Studies carried out in Karnataka, India, showed that spraying sesame plants with these bee attractants was effective in attracting higher numbers of pollinators (*Apis* spp.), and resulted in higher yields, germination and shoot length than on caged plants. The best results were obtained at the highest rates applied (12.5 g Bee-Q/l and 4 ml Bee-here/l). Univ. of Agricultural Sciences, Dharwad-580 005, India.
- Pawar, D.B., Warade, S.D., Patil, S.K. and Barve, H.S. *A note on foraging activity of honey bees in onion.*** *Insect Environment* (2000) 6 (2) 61 [En, X]
Vegetable Improvement Project, Dept of Horticulture, MPKV, Rahuri 413 722, Maharashtra, India.
- Percy, A.P. *Throat irritation due to rubber honey.*** *Indian Bee Journal* (1986) 48 (1–4) 70–71 [En, Bjj]
Honeybee colonies are usually taken to rubber estates a day or two before the rubber leaf nectaries are mature, and in an effort to obtain nectar the bees bite the immature nectaries. Latex which oozes from the resulting small wound mixes with the nectar, and the mixture is collected by the bees. It is suggested that latex in the honey may cause the throat irritation that has been reported in some people after eating Hevea honey. The first honey taken from the Hevea flow is more viscous than that taken later, though it tastes the same. P. Walker
Central Bee Res. Inst., Khadi & Village Industries Commission, Pune 411 016, India.
- Percy, A.P. *Division of Trigona iridipennis Smith colony.*** *Indian Bee Journal* (1989) 51 (4) 149 [En, Bjj]
T. iridipennis colonies were kept in wooden boxes at Pune, India; the box, 10 x 12.5 x 10 cm, had a glass top covered by a wooden lid. When queen cells were observed in a strong colony, it could be divided by transferring about half the brood cells, queen cells, food stores and bees to another box. The old queen was either left with the original colony or put with the new one. Brood was subsequently reared in both colonies. P. Walker
Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Phadke, K. G. and Naim, M. Observations on the honeybee visitation to the litchi (*Nephelium litchi*) blossoms at Pusa (Bihar, India). *Indian Bee Journal* (1974) 36 (1-4) 9-12 [En, B]
Most of the insect visitors to Litchi flowers were honeybees, particularly *Apis florea*; fewer *A. cerana* were counted, and hardly any *A. dorsata*. During the flowering period, the average amount of honey obtained from *A. cerana* hives was 7-10 kg/hive. On branches bagged to exclude insects, fruit set was one quarter (or less) of that obtained on open trees. *P. Walker*
Div. Entomology, IARI, New Delhi 110 012, India.

Phadke, R. P. Sac brood disease in India. *Indian Bee Journal* (1983) 45 (2/3) 43-44 [En, B]

Phadke, R. P. Beekeeping in India – present status, constraints and plan of action for future development. *Indian Bee Journal* (1986) 48 (1-4) 29-33 [En, B]

The following subjects are covered: organisation of beekeeping; research and extension work; management of *Apis cerana*; equipment; constraints to beekeeping; the introduction of *A. mellifera*; diseases, pests and enemies of *A. mellifera*. *P. Walker*

Central Bee Res. Inst., Khadi & Village Industries Commission, Pune 411 016, India.

Phadke, R. P. Improvement of management practices for increase in colony number and honey production. *Indian Bee Journal* (1987) 49 (1-4) 33-37 [En, B]
Hives and seasonal management in India.

Phadke, R. P. History of establishment of Central Bee Research and Training Institute, Khadi and Village Industries Commission. *Indian Bee Journal* (1996) 58 (1) 21-24 [En, B]

Central Bee Research and Training Institute, KVIC, Pune, India.

Phadke, R. P. and Nair, K. S. Studies on Indian honeys. 5. Distinguishing characteristics of the apiary honey from the wild variety. *Indian Bee Journal* (1973) 35 (1-4) 36-39 [En, B]

In India 2,500 t of apiary honey are produced annually and 7,500 t from wild *Apis dorsata* colonies. A method for distinguishing these honeys was developed, based on optical density at 600 nm and pollen content; 13 samples of apiary honey and 11 of wild honey were tested. The maximum number of pollen grains were 28,666 and 136,800 per g respectively. Optical densities were 0.4-1.0 and 0.05-0.28, respectively. An optical density not less than 0.3 and a pollen count below 50,000 per g are suggested as feasible criteria for identifying apiary honey. *J. M. Gedy*
Central Bee Res. Inst., Poona 4, India.

Prasad, D., Hameed, S. F., Singh, R., Yazdani, S. S. and Singh, B. Effect of bee pollination on the quantity and quality of rai crop (*Brassica juncea* Coss). *Indian Bee Journal* (1989) 51 (2) 45-47 [En, B]

On open plots, seed set was 75.8%; on plots caged with *Apis cerana* it was 72.3%, and on plots caged to exclude insects, only 48.3%. Seed yields per ha were 13.4 q, 11.3 q and 10.0 q, respectively [1 q = 100 kg]. Oil content of

seeds, and seed germination, were higher on plants pollinated by honeybees. *P. Walker*

Dept. Entomology, Rajendra Agric. Univ., Pusa (Samastipur), Bihar, India.

Priti. Abundance and pollination efficiency of insect visitors of onion bloom. *Indian Bee Journal* (98) 60 (2) 75-78 [En, B]

All India Coordinated Project on Honey Bee Research and Training, ICAR CCS Haryana Agricultural Univ., Hisar 125 004, India.

Priti, Mishra, R. C. and Sihag, R. C. Role of insect pollination in seed production of radish (*Raphanus sativus* L.). *Seed Research* (2001) 29 (2) 231-234 [En, X]

All India Coordinated Project on Honeybee Research & Training, CCS Haryana Agricultural Univ., Hisar-125 004, India.

Priti and Sihag, R. C. Diversity, visitation frequency, foraging behaviour and pollinating efficiency of insect pollinators visiting cauliflower (*Brassica oleracea* L. var. *botrytis* cv. *Hazipur Local*) blossoms. *Indian Bee Journal* (97) 59 (4) 230-237 [En, B]

CCS Haryana Agricultural Univ., Hisar 125 004, India.

Priti and Sihag, R. C. Diversity, visitation frequency, foraging behaviour and pollinating efficiency of different insect pollinators visiting carrot, *Daucus carota* L. var. *HC-1* blossoms. *Indian Bee Journal* (98) 60 (1) 1-8 [En, B]

CCS Haryana Agricultural Univ., Hisar 125 004, India.

Pundir, R. S. Hiving *Apis florea*. *Indian Bee Journal* (1971) 33 (3/4) 63 [En, B]

A colony of *Apis florea* captured in August was successfully kept in a 4-frame nucleus box. The original comb was tied to one frame and kept between two other frames, one empty and one containing an empty *A. cerana* indica comb. The colony was strong and eventually occupied all the three frames. An inspection in September showed eight queen cells, built on the side edge of the comb and in October swarming took place. The queen could not be located, and as no fresh eggs were present it was thought that the queen might have left on a mating flight and failed to return. Later in October the colony absconded leaving a little drone brood. *A. S. Attwood*

K & VI Commission, Ranipokhari, India.

Purohit, V. V. Management accounting of honey processing plant. *Indian Bee Journal* (97) 59 (3) 169-172 [En, B]

Purohit Compressor Engineering Co., 100/876 Maharshi Nagar, Pune 411 037, India.

Putatunda, B. N., Aggarwal, K. and Mathur, R. B. Honey bee mites (*Acarina*), a challenge to beekeeping industry – a review. *Agricultural Reviews* (2001) 22 (3/4) 205-214 [En, X]

Acarology Section, Dept. of Zoology, Haryana Agric. Univ., Hisar-125 004, India.

Raakhee, Mohan and Devanesan, S. Dammer bee, *Trigona iridipennis* Smith (*Apidae: Meliponinae*) in Kerala. *Insect Environment* (99) 5 (2) 79 [En, X]

This species was recorded visiting a number of important crops.

Dept of Entomology, College of Agriculture, Kerala Agricultural Univ., Vellayani 695 522, Kerala, India.

Rabindra, Prasad, Hari Chand and Singh, R. Effect of honey-bee, *Apis mellifera*, pollination on the yield and germination of onion, *Allium cepa* seeds. *Shashpa* (2000) 7 (1) 53–55 [En, X]

Seed production (seeds/plant) was higher on plants caged with honey bees (max. 2.1) and on open-pollinated plants (1.6) than on plants caged or bagged to exclude insects (min. 0.34). Seed set was 70.7%, 58.3%, 50.9% and 21.7%, respectively, and wt of seed (g)/umbel was 3.2, 2.8, 1.6, 0.6. Germination was highest in seed from plants pollinated by honey bees.

Dept of Entomology and Agricultural Zoology, Rajendra Agricultural Univ., Bihar, Pusa, Samastipur-848 125, India.

Rahman, A. and Rahman, S. Effect of honeybee (*Apis cerana indica*) pollination on seedset and yield of buckwheat (*Fagopyrum esculentum*). *Indian Journal of Agricultural Sciences* (2000) 70 (3) 168–169 [En, X]

In a trial in Assam, buckwheat spikes/plant, seeds/spike, percentage of filled seed and 1000-grain weight were higher on a plot caged with *A. cerana* than on open-pollinated plots or on a plot caged to exclude insects. Yield was 1.42, 0.93 and 0.64 t/ha, respectively. Foraging activity of the honey bees was maximal between 15.00 and 16.00 hours.

Assam Agricultural Univ., Jorhat 785 013, India.

Rahman, A. Bee forage plants of Jorhat (Assam, India). *Indian Bee Journal* (1990) 52 (1–4) 47–50 [En, Bj]

A total of 122 plant species were classed as bee plants; 81 provided both pollen and nectar, 24 pollen only and 17 nectar only.

Department of Entomology, Assam Agricultural University, Jorhat 785 013, India.

Rahman, A. Management and control of Thai sacbrood disease of *Apis cerana indica* F. in Assam. *Indian Bee Journal* (1992) 54 (1–4) 33–36 [En, Bj]

Infected colonies were dequeened and then fed at weekly intervals with sugar syrup containing 250 mg terramycin [oxytetracycline]/4 litres. At dequeening, infection levels averaged 75% larvae and 79% pupae infected; when colonies were requeened 6 weeks later, levels were 24% and 15%, respectively, and these quickly decreased to zero. There was slight reinfection a month later, which quickly disappeared. *P. Walker*

Department of Entomology, Assam Agricultural University, Jorhat 785 013, India.

Rahman, A. and Chopra, N.P. Three new species of bee pollinators of the genus *Megachile* Lat. (Hymenoptera: Apoidea: Megachilidae) together with their foraging plants and period of activity. *Journal of Entomological Research* (1994) 18 (4) 369–376 [En, Ba]

Three new species of *Megachile*, discovered in India, are described and named as *M. haryanaensis*, *M. hisarensis* and *M. dentata*. *M. haryanaensis* was found foraging on *Medicago*

sativa, *Luffa aegyptiaca* and *Trifolium alexandrinum* from March to April and on *Cucurbita maxima* and *Citrus sinensis* from July to November. *M. dentata* was found foraging on *M. sativa*, *Helianthus annuus* and *T. alexandrinum* from March to May and on *Gossypium* spp., *Psidium guajava* and *C. sinensis* during October and November. *M. hisarensis* was found on *M. sativa* during April. *Author*

Department of Entomology, Assam Agricultural University, Jorhat-785013, Assam, India.

Rahman, A. and Rahman, S. Diagnosis and control of nosema disease of *Apis mellifera* L. in Assam, India. *Indian Bee Journal* (1996) 58 (3) 122–124 [En, Bj]

Nosema disease was diagnosed in *A. mellifera* colonies in an apiary at Jorhat in 1994–95. Infected colonies were treated with Entakon-M (a hydroxyquinoline product) at different doses (22.75, 45.50 and 68.25 ppm) in sugar syrup; digestive tracts of bees were examined regularly. Initial infection levels in late July were high (89–92%), so colonies were treated at frequent intervals; by mid-August levels had fallen to 33–56% and by mid to late September colonies were free of Nosema apis spores. The highest dosage rate of Entakon-M was the most effective. A second trial using Entakon-M at 45.50 ppm produced 100% healthy bees after 10–11 weeks of treatment. *P. Walker*

Department of Entomology, Assam Agricultural University, Jorhat 785 013, India.

Rahman, S. and Rahman, A. Comparative pollen gathering activity of *Apis cerana indica* F. and *Apis mellifera* L., under Jorhat conditions of Assam (India). *Indian Bee Journal* (1993) 55 (3/4) 42–46 [En, Bj]

In *A. cerana* colonies, the maximum area of stored pollen was present in February and the minimum in October; in *A. mellifera* colonies the maximum and minimum quantities were recorded in March and October, respectively. Throughout the year, the average number of pollen-collecting bees/day was significantly higher in *A. cerana* colonies than in *A. mellifera*. *P. Walker*

Department of Entomology, Assam Agricultural University, Jorhat 785 013, India.

Rai, D.S. Punjab State Beekeepers Federation. *Indian Bee Journal* (1995) 57 (2) 88–89 [En, Bj]

Honey Collection and Processing Centre, Kharar Road, Bassi Pathanan, Dist. Fategarh Sahib, Ludhiana, India.

Rai, K.M. and Gupta, B.P. Role of honey bees and other insects as pollinators in apple and pear. *Indian Bee Journal* (1983) 45 (2/3) 56–57 [En, B]

At Chaubattia, India, honeybees constituted 39–84% of insects visiting apple, and 48–76% of those visiting pear.

Rai, K.M., Hamid, M.T, Joshi, R. and Tewari, H.C. Honey bee and pollination in apple. *Progressive Horticulture* (1988) 20 (3/4) 353–354 [En, Bc]

Honey bees [species not stated, presumably *Apis cerana*] were the commonest (64% of all visitors) insects on apple trees during a trial at Chaubattia, Uttar Pradesh, India. Compared with flowers bagged to exclude pollinators, fruit set in four varieties of apple visited by honey bees was greater by up to 63.2% and fruit yields were higher by up

to 4.825 kg per 100 flowers. One strong honey bee colony was found to be sufficient to pollinate one hectare of orchard. J.M. Gedye

Horticultural Experiments and Training Centre, Chaubattia (Ranikhet), Almora, U.P., India.

Rai, K.M., Hamid, M.T. and Tewari, H.C. Introduction of *Apis mellifera* Linn. (Italian honeybees) in Uttar Pradesh. *Progressive Horticulture* (1987) 19 (3/4) 308–311 [En, Ba]

A. mellifera colonies from Ludhiana, Punjab, were brought to Chaubattia in April 1985, and later moved to Chorgalia for the period November–March. At both sites, colonies performed well with regard to brood rearing and nectar and pollen foraging.

Horticultural Experiments and Training Centre, Chaubattia (Almora), Uttar Pradesh, India.

Rai, K.M., Tewari, H.C. and Hamid, M.T. A note on the nectar sugar and its concentration in apple (*Malus sylvestris*) variety, Benoni and early Shan Burry with special reference to visits by honey bees. *Progressive Horticulture* (1993) 25 (1/2) 120–122 [En, 7 ref.]

Horticultural Experiments and Training Centre, Chaubattia, Ranikhet (Almora), India.

Raj, D. and Rana, V.K. Foraging behaviour of *Apis mellifera* L. and *Apis cerana indica* F. at the hive entrance during rapeseed bloom. *Journal of Entomological Research* (93) 17 (2) 105–110 [En, X]

Dept. Entomology, Himachal Pradesh Krishi Vishva Vidyalaya, Palampur 176062, HP, India.

Raj, D., Rana, V.K., and Devi, N. Comparative studies on pollen loads and pollen constancy of *Apis mellifera* L. and *Apis cerana indica* F. on rapeseed. *Journal of Entomological Research* (93) 17 (1) 43–48 [En, X]

Dept. Entomol., Himachal Pradesh Krishi Vishwavidyalaya, Palampur 176062, HP, India.

Raj, D., Sharma, S.D., Sharma, O.P. and Singh, M. Apparent symptoms of tracheal mite infestation in the colonies of *Apis mellifera* L. *Indian Bee Journal* (1991) 53 (1–4) 78–79 [En, Bj]

Department of Entomology, Himachal Pradesh Krishi Vishwavidyalaya, Palampur 176 062, India.

Raj, J. and Basavanna, G.P.C. Beeswax coated paper comb foundations for the honeybee. *Current Research*, University of Agricultural Sciences, Bangalore (1980) 9 (5) 77–78 [En, B]

Paper sheets (6.5 x 21.5 cm) were passed through comb foundation rollers and then coated thinly with wax; some paper was coated first and then imprinted. Eight sheets of paper could be covered with the amount of wax needed to make one all-wax foundation sheet. The wax-coated paper was accepted by bees in two colonies; after seven days perfect cells had been drawn and honey was being stored. Uncoated paper was not accepted. The main advantage of wax-coated paper is cheapness. [The weight of paper used is not stated, it is described as 'stationary paper'.] P. Walker
Dept. Entomology, Univ. Agric. Sci., Hebbal, Bangalore 560024, India.

Raj, J., Nanda Kishore, T.G. and Gopala Gowda, H.S. Influence of fermented cane juice syrup on activities of the honeybee (*Apis cerana indica*). Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G.K., Shaanker, R.U. and Ganeshaiah, K.N.]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 246–247 [En, Bd]

Department of Agricultural Microbiology, University of Agricultural Sciences GKVK, Bangalore 560,065, India.

Rajagopal, D., Veeresh, G.K., Chikkadevaiah, Nagaraja, N. and Kencharaddi, R.N. Potentiality of honeybees in hybrid seed production of sunflower (*Helianthus annuus*). *Indian Journal of Agricultural Sciences* (99) 69 (1) 40–43 [En, 11 ref.]

Univ. of Agricultural Sciences, GKVK, Bangalore 560 065, India.

Rajashekharappa, B.J. Elevating technique for swarm prevention in honey bees. *American Bee Journal* (1972) 112 (2) 48, 51 [En, B]

After removal of three of the seven combs from the brood nest [of *Apis cerana indica*] to an upper hive-body separated off by a double queen excluder, and caging a second laying queen on the upper brood, the bees discontinued rearing drone brood and did not rear queen cells. After a month, more brood was raised to the upper brood nest, and swarming was prevented. J.D. Hitchcock

UAS, Hebbal, Bangalore, India.

Rajashekharappa, B.J. and Channabasavanna, G.P. Queen rearing and occurrence of broodless cells in larger colonies of honeybees (*Apis cerana Fabricius*). *Current Research*, University of Agricultural Sciences, Bangalore (1978) 7 (6) 93–95 [En, B]

Occurrence of worker and queen cells were studied in *Apis cerana* by altering brood-chamber size, by caging queens with and without brood, and by varying intervals between the queen's visits. It is concluded that with a smaller brood chamber a higher percentage of cells are filled with brood, and that restriction of queen movement in colonies with brood induced queen rearing. M. Nixon

Univ. Agric. Sci., Bangalore 560–024, India.

Rajashekharappa, B.J., Raj B.J. and Channa Basavanna, G.P. Importance of mated queen in comb expansion by the honeybee *Apis cerana*. *Mysore Journal of Agricultural Sciences* (1979) 13 51–54 [En, B]

Comb building and the type of cells built were studied in colonies without queens, with virgin queens or with mated queens. In queenless colonies and those with virgin queens, comb building continued for only a short period, and some of the cells produced were intermediate in size between those of workers and drones. Comb building began again with the reintroduction of a mated queen. No drone cells were built in any of the colonies. In queenless colonies comb construction appeared to be limited by the cessation of wax production. Bees attempted to draw foundation into comb but were prevented by the lack of fresh wax. J.M. Gedye

Univ. Agric. Sci., Hebbal, Bangalore, India.

Rajendra Singh. Economics of beekeeping in U.P. Allahabad, Uttar Pradesh, India. Adhoc Study – Agro-Economic Research Centre, University of Allahabad (1996) (No. 99) 124 pp. [En]

Using simple mathematical and statistical analysis the study: (1) examines trends in honey production in various regions of Uttar Pradesh state, India; (2) estimates the costs and returns of beekeeping; (3) determines the potentials and marketing aspects of honey in the state; and (4) identifies problems associated with beekeeping, thereby suggesting measures for improvement. The study suggests the need for improving storage facilities, providing an outlay for research and development, and creating the required infrastructural facilities in order to improve the quality of the product.

Rajesh Tandon, Shivanna, K.R. and Ram, H.Y.M. Pollination biology and breeding system of *Acacia senegal*. Botanical Journal of the Linnean Society (2001) 135 (3) 251–262 [En, X]

Observations on 12 trees in Delhi and Rajasthan, India, showed that, although the mass of fragrant flowers attracted many insects, fruit set was low as a result of insufficient pollination. *Apis dorsata* is the most effective pollinator.

Dept of Botany, Univ. of Delhi, Delhi 110 007, India.

Rajpal Singh and Garg, R. Streptococcus pluton White on Apis mellifera Linnaeus in Paonta valley of Himachal Pradesh. Insect Environment (2000) 6 (2) 64 [En, X]

A serious outbreak of EFB occurred in winter 1999–2000; this is the first report of the disease in India.

Regional Horticultural Research Station, Dr YS Parmar Univ. of Horticulture and Forestry, Dhaulakuan, Sirmour 173 001, HP, India.

Raju, A.J.S. Bee pollination in *Azadirachta indica* (Meliaceae). Indian Bee Journal (98) 60 (2) 86 [En, B]

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, Andhra Pradesh, India.

Raju, A.J.S. and Naidu, S.A. Foraging activity of *Apis cerana indica* on *Mimosa pudica* L. Insect Environment (99) 5 (1) 13 [En]

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, AP, India.

Raju, A.J.S. and Naidu, S.A. Floral biology and *Apis cerana* F. pollination in *Acacia concinna* Dc. Insect Environment (2000) 6 (3) 141 [En, wf]

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Raju, A.J.S., Raju, V.K. and Naidu, S.A. *Antigonon leptopus* Linn. (Polygonaceae): a potential food plant for bees. Insect Environment (99) 5 (1) 42–43 [En, X]

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, Andhra Pradesh, India.

Raju, A.J.S., Raju, V.K. and Naidu, S.A. Floral ecology, breeding system and pollination in *Antigonon leptopus* L.

(Polygonaceae). Plant Species Biology (2001) 16 (2) 159–164 [En, X]

The flowers of this tropical climber are foraged by bees (*Apis*, *Trigona*, *Ceratina* and *Pithitis binghami*), which are the main pollinators, and other insects.

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003 A.P., India.

Raju, A.J.S. and Rao, S.P. Pollination ecology and fruiting behaviour in *Acacia sinuata* (Lour.) Merr. (Mimosaceae), a valuable non-timber forest plant species. Current Science (2002) 82 (12) 1466–1471 [En, X]

Acacia sinuata [A. *concinna*] flowers are foraged by bees and other insects; they pollinate the flowers, but the pod-set rate is only 2%. It is suggested that pod and seed yields might be increased by introduction of managed bees.

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Raju, A.J.S. and Vergara-Santana, M.I. Bee pollination in *Hyptis suaveolens* (L.) Poit. (Lamiaceae). Indian Bee Journal (97) 59 (3) 180–181 [En, B]

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Raju, S.V.S. and Dhaliwal, H.S. Impact of chemical pest control measures on *Apis mellifera* L. population foraging on Brassica seed crop: effect of time of spray. Journal of Recent Advances in Applied Sciences (1995) 10 (1/2) 31–36 [En, 12 ref.]

Honeybees play an important role in the cross-pollination of Brassica seed crops for an optimal seed set. In field studies conducted in Himachal Pradesh, India, when the Brassica variety 'Toria' was treated in bloom with endosulfan, fenthion, dimethoate and fenitrothion for the control of insect pests, the insecticides reduced the numbers of foraging *Apis mellifera* in the field and high mortality was observed in the apiary. The toxicity of insecticides applied in the field as evening sprays was lower to foraging honeybees than when applied as morning and noon sprays. Among the insecticides, foraging activity was significantly low in fenitrothion-treated plots followed by fenthion, dimethoate and endosulfan. The post-treatment dead bee counts in the apiary showed that noon sprays caused the highest mortality followed by morning sprays: mortality was lowest after evening sprays.

Department of Entomology & Agril. Zoology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi-221005, U.P., India.

Ram Kumar and Kumar, N.R. Management of sac brood inflicted honeybee colonies. Journal of Applied Zoological Researches (2001) 12 (2/3) 164–167 [En, X]

Colonies of three ecotypes of *Apis cerana* (high hill, mid hill and plains) were taken to the plains to build up the colonies and to harvest honey during winter 2000 in Solan, Himachal Pradesh. After 15 days bees started absconding, and Thai sacbrood virus was found in colonies. Half the affected colonies were saved by careful colony management, medication and requeening.

Dept of Entomology and Apiculture, Y.S. Parmar Univ. of Horticulture & Forestry, Nauni, Solan-173 230 H.P., India.

Ramakrishnan, C., Rajamohan, N. and Subramaniam, T.R. *Effect of insecticidal sprays on the pollinators of sun-flower*. *Madras Agricultural Journal* (1974) 61 (6) 175–177 [En, B]
The effects of 0.05% fenthion, 0.1% carbaryl, 0.07% endosulfan or 0.05% parathion on honeybees [species not named] visiting *Helianthus annuus* were investigated in Tamil Nadu, India. The mortalities in groups of bees collected from flowers that had been sprayed with the above pesticides were 100, 100, 33.2 and 100% respectively, after 1 hours; 58.1, 74.7, 16.6 and 58.1% after six hours; 8.3, 16.6, 0 and 16.6% after 24 hours. No significant differences were found in the seed set and yield of plots sprayed with the different insecticides. *P. Walker*
Dept. Entomology, Tamil Nadu Agric. Univ., Coimbatore 641003, India.

Ramanan, R.V. and Ghai, S. *Observations on the mite Neocypholaepus indica Evans and its relationship with the honey bee Apis cerana indica Fabricius and the flowering of Eucalyptus trees*. *Entomon* (1984) 9 (4) 291–292 [En, B]
N. indica mites were observed on inflorescences of *Eucalyptus globulus*, *E. eugenoides* and *E. ficifolia*. Adult mites laid eggs on opening inflorescences and the life cycle appeared to be completed during the week that the flower lasted. Emerging adults fed on pollen grains. Mites were also found on the thoraces and abdomens of foraging *Apis cerana*. Most mites were females but larvae, deutonymphs and males were also observed. Within hives, mites roamed about on the floor and on brood combs but were rarely found on combs in supers. Their presence appeared to have no effect on the honeybee colony. Maximum numbers of mites occurred during July–August and January–February when there were fewest *Eucalyptus* flowers. *N. indica* probably feeds on stored pollen in the hive. Predation on mites in hives by pseudoscorpions was observed. *J.M. Gedye*
Lawrence School, Lovedale, Ootacamund, Tamil Nadu 643-003, India.

Ramanujam, C.G.K., Fatima, K., Kalpana, T.P. *Nectar and pollen sources for dammer bee (Trigona iridipennis Smith) in Hyderabad (India)*. *Indian Bee Journal* (1993) 55 (1/2) 25–28 [En, B]
About 50 ml honey and 430 pollen loads were taken from a *T. iridipennis* nest in crevices in a wall. Pollen analysis of the honey showed that the main source was *Prosopis juliflora* (81% of total pollen); minor amounts of pollen came from *Peltophorum pterocarpum*, *Cocos nucifera* and several other less important species. The dense, dark honey contained 75% reducing sugars (43% fructose, 32% glucose) and 1.5% sucrose, and 21.2% water. It did not granulate. Of the pollen loads, 367 (85%) were unifloral: 196 came from *Peltophorum pterocarpum*, 143 from *Prosopis juliflora*, 21 from *Bombax malabaricum* and seven from other sources. The same pollens were found in most of the 60 bifloral loads. *P. Walker*
Palaeobotany-Palynology Lab., Dept. of Botany, P.G. College of Science, Saifabad, Hyderabad 500 004, India.

Ramanujam, C.G.K. and Kalpana, T.P. *Summer pollen sources for honey bees in the coastal belt of East Godavari*

District, Andhra Pradesh. *Geophytology* (1994) 23 (2) 249–252 [En, Bc]

Pollen analyses of 546 pollen loads collected from combs of *Apis cerana* and *A. florea* in east Godavari, India, in April 1992, showed that *Borassus flabellifer* and *Cocos nucifera* were the major sources of pollen. Minor sources were *Guazuma ulmifolia*, *Syzygium cumini* and *Mollugo cerviana*. *Author*

Palaeobotany-Palynology Laboratory, Department of Botany, P.2G. College of Science, Saifabad, Hyderabad 500 004, India.

Ramireddy, P.V. and Jacob, T.K. *Queen caging – a technique to manage TSBV disease in Indian honeybee*. *Insect Environment* (99) 5 (2) 90 [En, X]
Central Horticultural Experiment Station (IIHR), Chettalli, Karnataka 571 248, India.

Rana, B.S. and Goyal, N.P. *Present status of migratory beekeeping with Apis mellifera in Pabbar valley, Himachal Pradesh*. *Journal of Insect Science* (94) 7 (2) 213–215 [En, Bb]
A survey carried out in 1989 found that most of the 20 beekeepers in the Annu-Chirgaon area (Shimla) migrated their colonies to Naraingarh (Haryana) for the winter and spring flows. Average weights of honey and beeswax harvested per colony were 45 kg and 553 g, respectively. Also, 602 migrated colonies were increased to 1269. *Dept. Entomology, Dr. Y.S. Parmar Univ. Horticulture & Forestry, Nauni, Solan 173 230, India.*

Rana, B.S. and Gupta, J.K. *Pollination studies on plum, Prunus salicina Lindl., cv. Santa Rosa at Nauni, Himachal Pradesh, India*. *Indian Bee Journal* (97) 59 (4) 214–217 [En, B]
Two *Apis mellifera* and two *A. cerana* colonies were put in the orchard; these species and *Eristalis* (syrphid flies) were the most common visitors to the flowers (each 23–24% of total). For each bee species, bee density was similar at different distances from the hives (10–100 m); also, fruit set and fruit quality did not vary significantly with distance from hives. It is concluded that this cultivar is self-fertile and the introduction of additional honey bee colonies is not necessary for pollination. *P. Walker*
Dept of Entomology and Apiculture, Dr Y.S. Parmar Univ. of Horticulture and Forestry, Nauni, Solan 173 230, Himachal Pradesh, India.

Rana, B.S., Gupta, J.K. and Goyal, N.P. *Survey of bee flora and beekeeping in Himachal Pradesh*. *Indian Bee Journal* (97) 59 (3) 144–149 [En, B]
The 427 beekeepers in this state keep a total of 20,000 *Apis mellifera* colonies and (in traditional and modern hives) 4300 *A. cerana* colonies. Migratory beekeepers have an average honey yield of 30–35 kg/colony/yr. and others get 5–10 kg. The important forage plants in the different seasons are given for each district. *P. Walker*
Dept of Entomology and Apiculture, Dr Y.S. Parmar Univ. of Horticulture and Forestry, Nauni, Solan 173 230, Himachal Pradesh, India.

Rana, B.S., Kumar, A. and Gupta, J.K. *Influence of environmental factors on the population of predatory*

wasps of honeybees and evaluation of methods for controlling the wasps. *Indian Bee Journal* (2000) 62 (1-2) 47-54 [En, Bj]

If temperatures were low during March-April and rainfall was high during emergence and establishment of the queen *Vespa auraria* (April-May), wasp attack on *Apis mellifera* colonies in the following season were delayed. Fitting a wire mesh cage on the hive entrance and use of bird-scaring ribbons were ineffective in reducing wasp predation on bees, and wasps were not successfully controlled by traps containing fermented honey or honey solution or ether extract of wasps/bees + fermented honey. However, fresh fish was found to be an effective bait, attracting an average of 61.5-65.5 wasps/trap/d. *Author*

Dept of Entomology and Apiculture, Dr Y.S. Parmar Univ. of Horticulture & Forestry, Nauni-Solan, 173230 (HP), India.

Rana, B.S. and Goyal, N.P. Field toxicity of methyl demeton and dimethoate to the foragers of honeybee (*Apis cerana indica* Fab.) visitors to *Brassica chinensis* L. *Indian Bee Journal* (1991) 53 (1-4) 73-77 [En, Bj]

In field tests, 0.025% demeton-methyl or 0.03% dimethoate was sprayed on fields of *B. chinensis* where colonies of *A. cerana* were present. Compared with colonies on unsprayed fields, test colonies had reduced brood area, less frames covered with bees, and more dead bees in or near the hive. It is concluded that both insecticides are toxic to *A. cerana*; dimethoate is the more toxic. *P. Walker*

Department of Entomology and Apiculture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan 173 230 (H.P.), India.

Rana, B.S. and Goyal, N.P. Abscending and associated behaviour of Indian honey bee (*Apis cerana indica* Fab.). *Indian Bee Journal* (1992) 54 (1-4) 28-32 [En, Bj]

Colonies in hives in an area of low hills in Himachal Pradesh, India, were regularly examined from June to early September, which is the dearth and absconding period. In colonies that absconded (A), the average weight of honey stores fell from 956 g to 237 g, whereas colonies that did not abscond (B) always had more honey (falling from 1760 g to 890 g). Pollen stores decreased in A from 93 g to 21 g, and in B from 560 g to 322 g. Foraging activity (pollen collectors/5 min) in A was consistently lower (10 in June, 2 in September) than in B (20, 41). It is recommended that colonies with absconding characteristics, i.e. those shown by the A colonies, should be fed during the dearth, and weak colonies united. Colonies could be migrated to areas with good forage. *P. Walker*

Department of Entomology and Apiculture, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni, Solan 173 230 (H.P.), India.

Rana, B.S., Verma, L.R. and Mattu, V.K. Aggressive behaviour of the Indian and European honey bees in Shimla hills. *Indian Bee Journal* (1992) 54 (1-4) 37-44 [En, Bj]

Department of Bio-sciences, Himachal Pradesh University, Shimla 171 005, India.

Rana, R.S., Verma, L.R. and Mattu, V.K. Behavioural responses in *Apis mellifera* L. and *Apis cerana* F. to alarm pheromones. *Pest Management and Economic Zoology* (98) 6 (2) 143-146 [En, wf]

Behavioural responses of these species to four alarm pheromones (isobutyl acetate, isoamyl acetate, 2-heptanone, n-amyl alcohol) were studied in the laboratory. *A. mellifera* responded to these compounds more quickly, for a longer period, in greater numbers and with greater intensity than *A. cerana* did at the same temperature. At higher temperatures, both species became significantly more aggressive than at lower temperatures.

Dept of Bio-Sciences, Himachal Pradesh Univ., Shimla, HP 171 005, India.

Rana, V.K., Kapoor, K.S. and Desh Raj. Comparative pollinating activities of *Apis cerana indica* F. and *Apis mellifera* L. on cauliflower (*Brassica oleracea* var. botrytis). *Journal of Entomological Research* (99) 23 (2) 141-148 [En, 10 wf]

Dept of Entomology and Apiculture, Dr Y.S. Parmar Univ. of Horticulture & Forestry, Nauni, Solan-173 230, HP, India.

Rana, V.K., Raj, D. and Devi, N. Comparative hive performance of *Apis mellifera* L. and *A. cerana indica* F. on rapeseed. *Journal of Entomological Research* (93) 17 (1) 61-63 [En, Bb]

The studies described were carried out at Palampur, India, at an altitude of 1290 m. Three colonies each of *A. mellifera* and *A. cerana* were located in flowering rapeseed crops (*Brassica* sp.) from the last week of January to the end of March. *A. mellifera* colonies increased in size from seven frames of bees to 11.67, whereas those of *A. cerana* increased from 7 to 9.67 frames. The brood area increased from 325 cm² to 5052 cm² in *A. mellifera* colonies and from 340 cm² to 2950 cm² in *A. cerana* colonies. Increases in pollen and honey stores were also greater in *A. mellifera* colonies than in *A. cerana*, although amounts of surplus honey remained small in all colonies. It is concluded that, in this area, rapeseed is an important source of forage for colony build-up.

Dept. Entomology, Himachal Pradesh Krishi Vishwavidyalaya, Palampur-176 062, H.P., India.

Rana, V.K., Raj, D. and Kaushik, R. Comparative foraging activity of *Apis mellifera* L. and *Apis cerana indica* F. on rapeseed bloom. *Journal of Entomological Research* (97) 21 (1) 59-64 [En, Ba]

Dept. Entomology, Himachal Pradesh Krishi Vishwavidyalaya, Palampur-176 062, H.P., India.

Rangarajan, A.V. Occurrence of the mite, *Varroa jacobsoni* Oudemans on the Indian honey bee in South India. *Science and Culture* (1971) 37 (6) 292 [En, B]

Rani, U. and Jain, K.L. *Apis mellifera* colony performance and foraging of worker bees on some forage crops. *Forage Research* (1996) 22 (2/3) 147-154 [En, Ba]

Colonies at Haryana, India, were monitored from February to the end of June. Several crops offering nectar and/or pollen were in flower during this period including *Medicago sativa*, *Trifolium alexandrinum* (berseem) and

Brassica spp. Brood rearing peaked from mid-March to early May, coinciding with pollen flows. Stores of pollen and unsealed honey in hives were greatest during April and early May; the proportion of sealed honey increased after this. Foraging activity was highest in early March and early May. P. Walker

Department of Zoology, CCS Haryana Agricultural University, Hissar-125 004, India.

Rao, A.R. and Shukla, P. Indian pollen-spore floras. Vol. 1. Pollen flora of Upper Gangetic Plain. New Delhi, India; Today & Tomorrow's Printers. (1975) x + 130 pp. [En, B]

This is the first in a series intended to cover the whole of India. The pollen grains of plant species belonging to 80 families are described, and 140 palynograms show a surface view magnified 1500 times, and other views (polar, equatorial or lateral) of the grain X 375. The 177 photomicrographs are at various magnifications. There is a bibliography consisting of 95 references, and an index to families and genera. P. Walker

Dept. Botany, Lucknow Univ., Lucknow, India.

Rao, G.M. Bee pollination of crops – the Indian scenario. *Indian Bee Journal* (97) 59 (2) 91–94 [En, B]

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Rao, G.M. and Lakshmi, K. Pigeon pea – a bee forage crop. *Indian Bee Journal* (98) 60 (3) 171–172 [En, B]

Cajanus cajan.

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Rao, G.M., Singh, T.S.M.S. and Rao, K.S. Top ventilation helps *Apis mellifera* L. colonies during rubber nectar flow. *Indian Bee Journal* (98) 60 (2) 108–110 [En, B]

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Rao, G.M., Singh, T.S.M.S., Rao, K.S. and Singh, U.K. Suitability of polyurethane box for rearing *Apis mellifera* in India. *Indian Bee Journal* (98) 60 (3) 159–162 [En, B]

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Rao, G.M. and Singh, T.S.M.S. Current trends in beekeeping in South India. *Indian Bee Journal* (97) 59 (1) 33–36 [En, B]

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Rao, G.M. Studies on the floral biology and pollination requirement of scented methi (*Trigonella corniculata* Linn.). *Indian Bee Journal* (1991) 53 (1–4) 39–43 [En, B]

This leguminous species is cultivated in N. India. On plots studied at Pune, honey bees constituted 92.4% of all insect visitors, with *Apis cerana* predominant, except at the

end of flowering when *A. florea* was more numerous. The average number of pods/inflorescence and weight of 1000 seeds were higher in open-pollinated plants than on plants in plots caged to exclude insects.

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Rao, G.M. Lakshmi, K. African milkbush [*Synadenium grantii*]. *Bee World* (1997) 78 (1) 12–14 [En, Ba]

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Rao, G.M. and Lazar, M. Studies on bee behaviour and pollination in onion (*Allium cepa* L.). *Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980.* (1983) 580–589 [En, B]

Rao, G.M., Lazar, M. and Suryanarayana, M.C. Foraging behaviour of honeybees in sesame (*Sesamum indicum* L.).

Indian Bee Journal (1981) 43 (4) 97–100 [En, B]

Central Bee Res. Inst., Khadi and Village Indus. Commission, Pune 411 004, India.

Rao, G.M., Mujumdar, S.M., Rao, K.S. and Dhas, J.R.K. Studies on management of *Apis cerana* Fabr. colonies in the coastal area of Orissa, India. *Indian Bee Journal* (1996) 58 (3) 117–121 [En, B]

Beekeepers in this mainly cultivated area have 5–20 colonies near the house. Forage is available from December and honey is collected during February–April. There are long dearth periods, especially during the rainy season in June–September, and many colonies abscond or get very weak. In an experimental apiary a method was developed for the rapid multiplication of colonies in January–March; up to four divisions could be obtained from each parent colony. Colony development was recorded and a seasonal management calendar was introduced. This included feeding during the rainy season. Old combs were replaced in October–November and colonies were requeened after the flow. A table lists sources of nectar and pollen; the most important nectar plants are *Brassica juncea*, *Coriandrum sativum*, *Leucas lavandulaefolia* and *Anacardium occidentale*. P. Walker

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Rao, G.M., Mujumdar, S.M., Singh, T.S.M.S. and Rao, K.S. Studies on *Apis cerana* Fabr. for Thai sacbrood disease resistance stock at Neyyattinkara, Kerala, India. *Indian Bee Journal* (1996) 58 (2) 64–66 [En, B]

Out of 51 *A. cerana* colonies kept in ISI 'A' type boxes, 21 absconded after 1–10 months. Of the remaining colonies, 11 were tolerant to Thai sac brood disease (A) and 13 were moderately tolerant (B). A had the disease for only about two months, and B showed symptoms for 8–19 months. Both groups developed well and divisions could be made, and both produced honey (5.1 and 4.6 kg, respectively). Overall, A gave better results. P. Walker

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Rao, G. M., Nadre, K. R. and Suryanarayana, M. C. Studies on pollination of male sterile line for foundation seed production in hybrid sunflower. *Indian Bee Journal* (1995) 57 (4) 170–173 [En, Bj]

Male-sterile (MS) and male-fertile (MF) sunflower lines (ratio 2:1) were grown in experimental plots which were open-pollinated (by insects), or hand-pollinated, or hand+ insect-pollinated, or netted to exclude insects. The main insect visitors were *Apis dorsata* and *Trigona iridipennis*, with some *A. cerana* and a few *A. florea*. *A. dorsata* transferred pollen efficiently from the male to the female line; only nectar foragers visited both lines on the same foraging trip. Seed set was higher on insect-pollinated plants (MS 78.75%, MF 76.42%) than on hand-pollinated plants (MS 15.43%, MF 16.86%), and seed yields were about three times as high. Additional hand-pollination of insect-pollinated plants had no significant effect. Seed yields of enclosed plants were negligible. *P. Walker*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, Pune, India.

Rao, G. M., Nadre, K. R. and Suryanarayana, M. C. Studies on the utility of honey bees on production of foundation seed of cotton cv. NCMHH-20. *Indian Bee Journal* (1996) 58 (1) 13–15 [En, Bj]

Gossypium hirsutum cv. NCMHH-20 is normally produced by labour-intensive hand-pollination of the male-sterile line CMS-NS-15A and the maintainer line CMS-NS-15B. Results of hand-pollination (HP) were compared with those of pollination by *Apis cerana* on caged plots (BP). Open plants were visited by *A. dorsata*, *A. cerana* and *A. florea*, which foraged only for nectar, and solitary bees which foraged for nectar and pollen; *Trigona iridipennis* collected only extrafloral nectar. *A. dorsata* and *A. cerana* foraged on both A and B lines. Inside the net, *A. cerana* collected pollen and nectar from A-line plants and nectar from B-line plants. On the A-line, number of bolls set/plant, total seed cotton yield/plant and seeds/boll were greater for HP than for BP, but BP resulted in a higher 100-seed weight. On the B-line, bolls set/plant was greater for HP than BP, but the other results were greater for BP. *P. Walker*

Central Bee Research and Training Institute, KVIC, Pune, India.

Rao, G. M. and Suryanarayana, M. C. Potentialities for bee pollination of crops in U.P. [Uttar Pradesh]. *Indian Bee Journal* (1983) 45 (2/3) 58–62 [En, B]

Rao, G. M. and Suryanarayana, M. C. Studies on pollination of watermelon (*Citrullus lanatus* (Thunb.) Mansf.). *Indian Bee Journal* (1988) 50 (1) 5–8 [En, Bj]

During observations on two water melon plots in Andhra Pradesh, India, *Apis cerana* constituted 87% of all flower visitors and was the most efficient pollinator. *A. florea* (2%) and *Trigona* sp. (2%) were also recorded. Individuals of *A. cerana* foraged for pollen or nectar; the total number of foragers, and the number of pollen foragers, were both

greatest around 09.00 hours. Pollen foraging ceased at about noon, but nectar foraging continued until about 13.00 hours. Mean total fruit weight on an open plot (4 x 8 m) was 89 kg, and on a plot caged with honeybees 135 kg. On plots caged to exclude insects, no fruit was obtained. *P. Walker*

Central Bee Res. Inst., Khadi & Village Industries Commission, 1153 Ganeshkhind Rd., Pune 411 016, India.

Rao, G. M. and Suryanarayana, M. C. Effect of honey bee pollination on seed yield in onion (*Allium cepa* L.). *Indian Bee Journal* (1989) 51 (1) 9–11 [En, Bj]

Two onion cultivars were grown on (A) plots caged to exclude insects, (B) plots with introduced *Apis cerana* (10 colonies on 2.4 ha of Nasik Red; and four colonies on 1.4 ha of Agrifarm), and (C) control plots without introduced colonies. On B, honeybees constituted 96% of flower visitors; *A. cerana* foraged mainly for nectar, *A. florea* for both pollen and nectar. *A. dorsata* was not seen. *Trigona iridipennis* foraged for pollen, and some flies were observed. Foraging rates for the three bee species are reported. The average percentage fruit sets were 7.33, 72.07 and 16.88 on A, B and C respectively. Average seed yields for both cultivars were almost twice as high on B as on C. *P. Walker*

Central Bee Res. & Training Inst., Khadi & Village Industries Commission, Pune 411016, India.

Rao, G. M. and Suryanarayana, M. C. Studies on the foraging behaviour of honey bees and its effect on the seed yield in niger. *Indian Bee Journal* (1990) 52 (1–4) 31–33 [En, Bj]

Honey bees constituted 91.3% of insect visitors observed on plots of flowering *Guizotia abyssinica* at Pune, India; *Apis dorsata*, *A. cerana* and *A. florea* made up 29.5%, 10.3% and 51.5% of the total, respectively. Other insects recorded were butterflies, flies, solitary bees and beetles; only a few *Trigona iridipennis* visited the crop and worked rather slowly on it. The foraging patterns of the three *Apis* species are reported; although *A. florea* was the most common species, the other two were also efficient pollinators. On open-pollinated plots, seed set was 73%, but on plots caged to exclude insects it was only 3%; seed yield by weight was four times higher. On plots caged with *A. cerana*, the yield was three times higher than on plots without insects. *P. Walker*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Rao, G. M., Suryanarayana, M. C. and Thakar, C. V. Bees can boost oilseed production. *Indian Farming* (1980) 29 (11) 25–26 [En, B]

The pollination requirements of the following oil crops grown in India are discussed: *Brassica* spp. (toria, brown sarson, black mustard, Indian mustard or rai, yellow sarson), taramira (*Eruca sativa*), sesame (*Sesamum indicum*), safflower (*Carthamus tinctorius*), niger (*Guizotia abyssinica*), sunflower (*Helianthus annuus*). In trials during 1974–1978, crops were (A) caged with honeybees and (B) caged to exclude insects. A gave markedly higher yields of sunflower and niger, and slightly higher yields of mustard, sesame and safflower. In farm demonstrations, pollination was

improved by introducing honeybees to fields of sunflower and of sesame. A planned bee pollination programme for oilseed crops is proposed. The Khadi and Village Industries Commission could assist in such a programme. Brief notes are included on measures that can be taken to avoid destroying pollinators. *P. Walker*
Central Bee Res. Inst., Pune, India.

Rao, H. R. *Beekeeping in tribal areas of Andhra Pradesh.* *Indian Bee Journal* (1971) 33 (3/4) 60–61 [En, B]

Rao, S. P., Atluri, J. B. and Subba Reddi, C. *Crataeva magna* (Lour.) DC as a pollen source for the honey bees. *Indian Bee Journal* (97) 59 (2) 85–87 [En, B]

Apis cerana and *Trigona iridipennis* were observed foraging actively on the flowers, but did not pollinate them.
Dept of Botany, Andhra Univ., Visakhapatnam 530 003, India.

Rao, S. P. C., Atluri, J. B. and Rao, C. S. *Sterculia foetida* as a pollen source for the Indian honey bee, *Apis cerana indica*. *Indian Bee Journal* (1995) 57 (1) 18–19 [En, B]

On the coast of Andhra Pradesh, India, this tree flowers for 9–36 days in January–March. Floral biology is described. *A. cerana* was one of 15 insect species recorded on the flowers. The honey bees were collecting mainly pollen, between 6.00 and 9.00 hours. On average, a bee visited 12 flowers per minute, and on each flower collected 80% of the pollen on each anther. On average, a fresh pollen load weighed 1.6 mg and contained 46,520 grains; in addition a bee carried 910 pollen grains on its body. This economically useful tree (seeds contain edible oil) is therefore also a good pollen source for bees and could be used in planting programmes. *P. Walker*

Department of Botany, Andhra University, Visakhapatnam 530 003, India.

Rao, S. R. K. *Bee flora of Chintipalli, Andhra Pradesh.* *Indian Bee Journal* (98) 60 (3) 162–164 [En, B]

A total of 45 species are listed, with flowering period and value to bees.

Dept Entomology, Regional Agricultural Research Station, Chintapalli 531 111, Andhra Pradesh, India.

Rathi, A., Kumari, B., Gahlawat, S. K., Sihag, R. C. and Kathpal, T. S. *Multiresidue analysis of market honey samples for pesticidal contamination.* *Pesticide Research Journal* (97) 9 (2) 226–230 [En, B]

Honey samples from three locations in Haryana, India, were analysed by capillary column GC to determine the quantities of organochlorine, synthetic pyrethroid, organophosphate and carbamate residues present. All 27 samples contained one or more pesticide types; average contents of individual pesticides in each location are tabulated. Contents of organochlorine compounds were low, but those of organophosphates were high. A few samples from Hisar had very high contents of carbaryl and cypermethrin. *Author*

Dept of Zoology, Choudhary Charan Singh Haryana Agricultural Univ., Hisar 125 004, Haryana, India.

Rathore, M. S. and Verma, L. R. *Economics of beekeeping in Hindu Kush-Himalayan (HK-H) region. Honeybees in mountain agriculture* [edited by Verma, L. R.]. New Delhi, India; Oxford & IBH Publishing Co. (1992) 221–233 ISBN 81-204-0650-8 [En, Bdo]

The economics of beekeeping are discussed, using previously published figures for Bangladesh, Pakistan, Himachal Pradesh (India) and Nepal. *D. G. Lowe*
International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Rathore, R. R. S., Reddy, M. L. K. and Sachan, G. C. *Effect of insecticidal sprays on the visits of Indian honey bee, *Apis cerana indica* Fab. on radish crop.* *Cruciferae Newsletter* (1987) (No. 12) 93 [En, Bc]

The effects of pesticides, used to control mustard aphid (*Lipaphis erysimi*) on radish crops, on the foraging behaviour of *Apis cerana indica* were studied. The numbers of honeybees hovering over crops treated with 0.025% phosphamidon, 0.025% methyl-O-demeton and 0.05% monocrotophos were significantly reduced for up to 13 days after application. Quinalphos at 0.025%, 0.03% dimethoate and 0.015% permethrin had a repellent effect for up to 10, 11 and 8 days, respectively, whereas 0.033% fenvalerate and 0.01% cypermethrin affected honeybee activity for up to nine days. Endosulfan at 0.035% lost its repellent effect after six days. *J. M. Gedye*

G. B. Pant University of Agriculture & Technology, Pantnagar 23145, India.

Rauala, T. S. *Pollination studies in cauliflower (Brassica oleracea var. botrytis L.).* *Journal of Research*, Punjab Agricultural University (1972) 9 (4) 580–585 [En, B]

Cross-pollination by hand and open pollination gave better seed set (97.3 and 91.5% respectively) than self-pollination by hand or bagging (23.4% and 11.1% respectively). Cross-pollination by hand also resulted in a longer seed-bearing portion of pod and more seeds per pod. The chief pollinating agents in open pollination were *Apis florea* (33.0%), *A. dorsata* (18.4%) and *A. cerana* (15.3%). Enclosing plants with *A. cerana* inside a muslin cage gave 68.2% seed set; without bees there was 8.8% seed set. *D. G. Lowe*

Punjab Agricultural College, Punjab, India.

Ravinder Sharma and Ranjeet Bhatia. *Economics of stationary and migratory beekeeping in Himachal Pradesh.* *Agricultural Science Digest* (2001) 21 (3) 196–197 [En, X]

Data were collected from 60 beekeepers in 1997–98. The study revealed that average honey yield was higher from migrated colonies (41.60 kg/colony) than from colonies left in the same apiary (15.66 kg/colony). The cost differences were not statistically significant, but the net returns from migratory beekeeping were higher.

Regional Horticultural Research Station, Dr Y. S. Parmar Univ. of Horticulture and Forestry, Jachh, Teh. Nurpur, Distt. Kangra (HP)-176 201, India.

Rawat, B. S. *Beekeeping – questions and answers.* Ranikhet, India; Sarvashri Rawat Apiaries (Himalayas). (1978) 146 pp. [Hindi, B]

Rawat, B.S. Elementary beekeeping. Ranikhet, India; Rawat Apiaries. (1981) 63 pp. [Hi, B]

Rawat, B.S. Bee farming in India. Ranikhet, India; Rawat Apiaries. (1982) xiv + 258 pp. [En, B]

Reddi, C.S., Raju A. J. S. and Atluri, J. B. Bee pollination in tamarind trees. *Indian Bee Journal* (97) 59 (3) 178–179 [En, B]
Bees constituted over 90% of flower visitors; *Apis cerana* and *A. florea* were the most common.
Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Reddi, C.S., Reddi, E. U. B. and Reddi, N. S. Floral reward and honeybee visitation rates in the soapnut tree. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980. (1983) 600–608 [En, B]
Flowers of the soapnut tree (*Sapindus emarginatus*) growing in the Visakhapatnam area, Andhra Pradesh, India, were observed to be more attractive to honeybees than other plant species in the area.
Dept. Environmental Sci, Andhra Univ., Waltair-230003, India.

Reddi, E.U.B. Under-pollination: a major constraint of cashewnut production. Proceedings, Indian National Science Academy, B (1987) 53 (3) 249–251 [En, Bb]
Pollination and fruit yields were studied in cashew tree (*Anacardium occidentale*) populations near Visakhapatnam, India, in 1983–86.
Dept. Environmental Sci., Andhra Univ., Waltair, India.

Reddy, C.C. Biochemical and physiological studies on the effects of pesticides on honeybee *Apis cerana indica*. Ph.D. Thesis, Bangalore University, India. (1977) 158 pp. [En, B]
A study of foraging and brood rearing in *A. cerana* showed that, as in *A. mellifera*, foraging depends closely on the availability of forage and brood rearing depends closely on pollen supplies. The contact and residual toxicities of 16 pesticides used in India were tested in the laboratory, and generally results were similar to those for *A. mellifera*.
Dept. Zoology, Bangalore Univ., Bangalore 560 001, India.

Reddy, C.C. Observations on the annual cycle of foraging and brood rearing by *Apis cerana indica* colonies. *Journal of Apicultural Research* (1980) 19 (1) 17–20 [En, B]
Two years' field study of foraging and brood rearing in the Indian honeybee *Apis cerana indica* showed that the proportion of bees in a colony that foraged for pollen, the pollen stores in the hive, and the amount of brood reared, followed a similar seasonal pattern. The proportion of flying bees collecting pollen showed greater seasonal variations than the proportion collecting nectar, and than the proportion that collected water (or nothing). *Author*
Dept. Vertebrate Biology, Univ. Agric. Sci., Bangalore 560 065, India.

Reddy, C.C. Studies on the nesting behaviour of *Apis dorsata* F. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980. (1983) 391–397 [En, B]
The nesting behaviour of *A. dorsata* was studied in the Bangalore district, India, in January–December 1979. Of the 340 colonies studied, 200 built nests on isolated buildings, water tanks, sheds or other 'terrestrial' supports, whilst 140 built nests in tall, well-branched trees. Nests were built at a height above the ground of 1–25 m, but most (49%) were at 10–15 m.
Dept. Vertebrate Biology, Univ. Agric. Sci., GKVK Campus, Bangalore-560065, India.

Reddy, C.C., Reddy, S. and Ramesh, S.P. Studies on the colony population of *Apis dorsata* Fabr. *Indian Bee Journal* (1986) 48 (1–4) 57–58 [En, B]
A. dorsata nests were examined four times a month for three years at the following four sites in the Bangalore area: (1) many nests at 7–28 m from the ground in a banyan tree (*Ficus* sp.) 14 km from the city, with plentiful forage; (2) nests at 15–25 m from the ground in an *Alstonia scholaris* tree in a garden in the city centre; (3) a row of nests 25 m from the ground on a stadium in the city centre with forage nearby; (4) a row of nests 13 m from the ground on a building facing a garden. In every year the number of nests was highest at each site in March–April and lowest in June–August (monsoon rain period), but there were always some colonies present. Colony populations were highest in early summer when much forage was available. *P. Walker*
Dept. Zoology, Bangalore Univ., Bangalore 560 056, India.

Reddy, M.S. and Reddy, C.C. Rates of colonization and de-colonization in rockbee *Apis dorsata* Fabr. *Indian Bee Journal* (1987) 49 (1–4) 3–4 [En, B]
The numbers of colonies present and of deserted nests was recorded monthly from 1984 to 1986 at four nest sites near Bangalore, India (two in trees and two on 'terrestrial supports'). The pattern varied between the four sites, and there were more arrivals and departures at the tree sites, probably because these colonies were more exposed to the weather. The seasonal patterns at the two 'terrestrial' sites showed similarities. At each site the seasonal pattern was similar in the two years. *P. Walker*
Dept. Zoology, Bangalore Univ., 560 056, India.

Reddy, P.V.R. and Jacob, T.K. Foraging behaviour of honey bees in guava. *Insect Environment* (98) 4 (3) 96 [En, wf]
Central Horticultural Experiment Station, Chettalli 571 248, Kodagu, India.

Reddy, P.V.R. and Jacob, T.K. Comparative foraging behaviour of Indian honey bee, *Apis cerana* F. and European bee, *Apis mellifera* L. *Insect Environment* (2001) 6 (4) 165 [En, X]
Central Horticultural Experiment Station, Chettalli, Karnataka, India.

Reddy, P.V.R. and Jacob, T.K. Floral calendar for European bee, *Apis mellifera* L. in Kodagu, Karnataka. *Insect Environment* (2001) 6 (4) 166–167 [En, X]

Central Horticultural Experiment Station, (Indian Inst. of Horticultural Research), Chettalli-571 248, Karnataka, India.

Reddy, S.M. and Reddy, C.C. *Studies on the distribution of nests of giant honey bee (Apis dorsata F.).* *Indian Bee Journal* (1993) 55 (1/2) 36–39 [En, Bj]
Department of Zoology, Bangalore University, Bangalore 560 056, India.

Rembold, H. *Environmental factors which influence development of the honey bee, Apis mellifera. Proceedings, International Symposium on Environmental Pollution and Toxicology, Nov. 28–30, 1977, Haryana Agricultural University and Indian National Science Academy.* New Delhi, India; Today and Tomorrow's Printers and Publishers. (1979) 335–341 [En, B]
Particularly poisoning of larvae by pesticides.

Roy, K.M. and Hamid, M.T. *Hilly tracts of Uttar Pradesh are rich in bee pasturage.* *Indian Bee Journal* (1987) 49 (1–4) 44–46 [En, Bj]
Plants are listed with their nectar and/or pollen values and flowering times.

Sabato, B.C. *Utilization of rockbee resource in Orissa for honey production.* *Indian Bee Journal* (97) 59 (1) 47–48 [En, Bj]
Suggestions for the improvement and development of honey collection from *Apis dorsata*.

Sadakathulla, S. *Evaluation of honey bee visits on coconut genotypes.* *COCOS* (1991/1993) 9 47–50 [En, 8 ref.]
Forty-seven coconut (*Cocos nucifera*) genotypes (28 varieties and 19 hybrids) were evaluated for numbers of bees of each of three species (*Apis cerana indica*, *Apis florea* and *Melipona iridipennis*) visiting inflorescences between 0700 and 0730 over a period of 11 days. The number of *A. cerana indica* visits was 2.5 times greater than number of *M. iridipennis* visits. The number of bees visiting the hybrids was 36% greater than those visiting the varieties.
Coconut Research Station, Veppankulam 614906, India.

Sadrudin and Tripathi, R.N. *Palynological analysis of honey samples from Eastern Uttar Pradesh.* *Indian Bee Journal* (1985) 47 (1–4) 44–45 [En, Bj]
Twenty-seven pollen types were identified in 10 honeys collected at different times of year; results are tabulated. Ten of the pollens have been reported to be allergenic to humans. *P. Walker*
Post Graduate Dept. Botany, Shibli Natn. Coll., Azamgrah 276 001, India.

Sagar, P. *Role of insects in cross pollination of fennel crop at Ludhiana.* *Journal of Research, Punjab Agricultural University* (1981) 18 (4) 388–392 [En, B]
In March, *Apis florea* was the most frequent visitor to flowering fennel (*Foeniculum vulgare*) crops in the Punjab, India; other visitors were syrphid flies, and rather few *A. mellifera*, *A. cerana* and *A. dorsata*. However in April, the number of syrphids was higher than that of *A. florea*. The mean weight

of seed produced by 1000 umbels was 31.2 g on plants visited by insects, but only 15.6 g from plants caged to exclude them. *P. Walker*
Dept. Entomology, Punjab Agric. Univ., Ludhiana, Punjab, India.

Salvi, S.R. *Seasonal management of the Indian hive bees at Pathankot, Punjab: a preliminary report.* *Indian Bee Journal* (1975) 37 (1–4) 10–14 [En, B]
At two experimental apiaries, *A. cerana* was successfully managed throughout the year, although temperatures were very high in July–September; migration to the hills was beneficial. A schedule of seasonal operations is outlined. The main nectar flow in the Pathankot area is in April–May; the most important bee forage plants are berseem and litchi, and also fruit trees and mustard. Average honey yields from the apiaries were 6.75 and 15.0 kg/colony. A selective bee breeding programme is in progress. *P. Walker*
Regional Bee Res. Centre, Kangra, Himachal Pradesh, India.

Sanjivan Kumar, Hari Chand and Singh, R. *Increasing the attractiveness of sunflower to honeybees for pollination.* *Shashpa* (2000) 7 (2) 151–154 [En, X]
Four attractants were tested: (A) feeding the colony with sugar syrup containing scent of sunflower; (B) spraying sugar syrup on the flowers; (C) spraying trionic acid; (D) spraying Bee Q. All of them increased bee visits (no. bees/5 flowers/min) from 11.88 on untreated flowers to 15.10–20.74 on treated flowers. B attracted the most bees (20.74), followed by Bee Q (18.10). The flowers sprayed with C gave max. seed set (82.31 seed/head), 1000 seed weight (76.78 g.), yield (24.16 g/ha.) and oil content (39.87%).
Dept of Entomology, Rajendra Agricultural Univ., Bihar, Pusa, Samastipur-848 125, India.

Santwani, M.T. *Standardization and quality control of bee products. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980.* (1983) 685–693 [En, B]
Discusses Indian Standards for honey, beeswax and bee-keeping equipment.

Saraf, S.K. *Bee flora of Kashmir.* *Indian Bee Journal* (1972) 34 (1/2) 1–10 [En, B]
The author gives data on 110 species of plants useful to honeybees in Kashmir, including flowering periods, and botanical and local names. Foraging starts in February–March. July–August is a dearth period followed by the major flow, from *Plectranthus (Labiatae)*. *A.S. Attwood*
Entomology Section, Agriculture Dept., Lalmandi, Srinagar, India.

Saraf, S.K. *Beekeeping in Gurez, Jammu and Kashmir, India.* *Indian Bee Journal* (1985) 47 (1–4) 36–37 [En, Bj]
Agric. Dept., Baramulla, Kashmir, India.

Saraf, S.K. *Pollen gathering by honey bees in the Kashmir Valley.* *Indian Bee Journal* (1987) 49 (1–4) 47–48 [En, Bj]

Saraf, S.K. and Wali, J.L. Preliminary studies on the egg laying capacity of the queen bee of *Apis indica* F. (hill strain) in Kashmir. *Indian Bee Journal* (1972) 34 (1/2) 27–31 [En, B]

The egg-laying rate of an *A. cerana indica* queen was calculated by measurement of the brood area every three weeks. Laying began in February and rose to a maximum of 700 eggs/day in the last week of May and early June (related to good forage and optimum temperatures, 21–22°C); it declined sharply in October. A temperature range of 28–32°C retarded egg laying, as did the very low temperatures from November to January. This hill strain has a higher laying rate than the South Indian strain (reported as 300–500/day), but is far behind *A. mellifera*. A.S. Attwood

Entomology Section, Agricultural Dept., Agricultural Res. Stn., Lalmandi, Srinagar, Kashmir, India.

Sattigi, H.N. and Kulkarni, K.A. Abundance of rock bee colonies during different months in Dharwad. *Karnataka Journal of Agricultural Sciences* (2001) 14 (3) 656–659 [En, wf]

The total number of nests (occupied and unoccupied) was recorded weekly at 21 nest sites in this area in Karnataka, India.

Dept of Agricultural Entomology, College of Agriculture, Dharwad-580 005, India.

Sattigi, H.N. and Kulkarni, K.A. Nesting behaviour of rock bee, *Apis dorsata* F.: preference of nesting structure and nest supports. *Karnataka Journal of Agricultural Sciences* (2001) 14 (3) 650–655 [En, wf]

During observations at 11 terrestrial (T) and 10 arboreal (A) nest sites, it was found that the bees preferred to nest at T (84.1% of total) rather than at A. All types of nest supports were used by the bees; horizontal supports were preferred at T and slanting supports at A. The number of colonies on each type of support increased with increasing size (width or diameter) of the support. The minimum size of support used was 5 cm wide and 4 cm diameter, at T and A, respectively.

Dept of Agricultural Entomology, College of Agriculture, Dharwad-580 005, India.

Sattigi, H.N., Kulkarni, K.A. and Lingappa, S. Studies on wax recovery from natural combs of rockbee *Apis dorsata* Fabricius. *Karnataka Journal of Agricultural Sciences* (1994) 7 (4) 481–484 [En, Ba]

Forty whole combs which *A. dorsata* colonies had deserted were collected and the wax was extracted. Combs weighed on average 786.5 g (405–1377 g) and wax recovery was 49.5% (40.8–66.7%). The wax fetches a good price, so collection and recovery are worthwhile. P. Walker

Department of Entomology, College of Agriculture, Dharwad 5, India.

Sattigi, H.N., Kulkarni, K.A. and Lingappa, S. A survey on the colony distribution of rock bees, *Apis dorsata* Fab. on different colour backgrounds. *Karnataka Journal of Agricultural Sciences* (1995) 8 (1) 89–90 [En, Ba]

Department of Entomology, College of Agriculture, Dharwad 5, India.

Tall buildings which might provide suitable nest sites for *A. dorsata* were surveyed in three areas of Karnataka, India. Of the 343 nesting colonies recorded, 217 were on ivory-coloured buildings, 70 on light grey, 31 on brick-red and 25 on light blue buildings; none were on dark red or black buildings. P. Walker

Sattigi, H.N. and Lingappa, S. Foraging activities of Indian honeybee, *Apis cerana* Fabricius under Dharwad conditions. *Karnataka Journal of Agricultural Sciences* (1993) 6 (4) 352–354 [En, Ba]

Department of Agric. Entomology, College of Agriculture, Dharwad 580 005, India.

Sattigi, H.N., Lingappa, S. and Kulkarni, K.A. Management of greater wax moth, *Galleria mellonella* (L.) by using lime sulphur. *Karnataka Journal of Agricultural Sciences* (1993) 6 (3) 301–303 [En, 5 ref.]

Lime sulfur [calcium polysulfide] was tested for the control of *Galleria mellonella* in apiaries in Karnataka, India. During 1989 and 1990, treatment provided 90 and 78% protection, respectively, against *G. mellonella*. The effectiveness of each treatment lasted for 5–6 months. Treated hives were also free from infestation by *Acarapis woodi*. No effect of calcium polysulfide on bees was observed.

Dept. of Agril. Entomology, UAS, Dharwad 5, India.

Savoor, R.R. Pollinator management: an eco-friendly green revolution eludes India. *Current Science* (98) 74 (2) 121–125 [En, Bc]

A51, Defence Colony, Hastinapur 250 404, India.

Seethalakshmi, T.S. and Percy, A.P. *Borassus flabellifer* (Palmyrah palm) – a good pollen source. *Indian Bee Journal* (1979) 41 (1/2) 20–21 [En, B]

About one-third of 900 pollen loads of bees examined in 1975 and 1976 in Tamilnadu (Madras), India, contained *B. flabellifer* pollen. It grows wild, and is also cultivated on the plains; its leaves, trunk, sap and fruit are all made use of. It was previously thought to be poisonous to bees, which often drown in the pots used to collect the sweet sap. Results suggest that the tree is a useful pollen source for much of the year, although earlier records state that the flowering period is March–April. P. Walker

Central Bee Res. Inst., Khadi & Village Ind. Commission, 839/1 Deccan Gymkhana, Pune-411004, India.

Sethi, P.S. and Mavi, P.S. Development of a steam-operated uncapping knife. *Apiacta* (99) 34 (2) 56–60 [En, Bj]

The design of the uncapping knife is described and illustrated. Using steam from a domestic pressure cooker, it can uncap one frame every 2 minutes. The cut is clean, and the honey and wax are not damaged. P. Walker

Dept. of Processing and Agricultural Structures, Punjab Agricultural Univ., Ludhiana 141004, India.

Shah, A.M. All Kashmir Beekeepers Federation. *Indian Bee Journal* (1988) 50 (1) 24 [En, Bj]

It is reported in this letter that 13,000 *Apis cerana* colonies in Kashmir have been destroyed by Thai sac brood.

Shah, F.A. Wintering of bees in Kashmir. *Indian Bee Journal* (1974) 36 (1–4) 13–15 [En, B]
Presumably *Apis cerana indica*.

Shah, F.A. Some notes on beekeeping in Kodai Hills, Tamilnadu. *Indian Bee Journal* (1975) 37 (1–4) 25–30 [En, B]

Shah, F.A. Beekeeping. Srinagar, Kashmir, India; Shah Beekeepers. (1977) 312 pp. + 40 pl. [Urdu, B]

This is a practical guide for both small- and large-scale beekeepers, by an author who comes from a family of leading beekeepers in Kashmir, India. In 26 chapters the book covers the various aspects of beekeeping. Bee management is described for the *Apis cerana* in Kashmir, using Langstroth hives. The section on diseases and pests concentrates on those that affect *Apis cerana* (wherever it occurs), and that on bee plants deals with those in Kashmir and other parts of India. E. E. Crane
Shah Beekeepers, Kursu, Rajbagh, Srinagar, Kashmir 190008, India.

Shah, F.A. Beekeeping in Kashmir v/s South India. *Indian Honey* (1981) 4 (13) 7–8 [En, B]

Shah, F.A. Fundamentals of beekeeping. Srinagar, Kashmir, India; Shah Beekeepers. (1983) viii + 63 pp. + 1 pl. [En, B]
Beekeeping with *Apis cerana*, with particular reference to Kashmir.

Shah, F.A. The origin of beekeeping in Kashmir. *Bee World* (1984) 65 (1) 12–18 [En, B]

Methods of traditional beekeeping are virtually the same throughout Kashmir, indicating that they were introduced everywhere at the same time, and that they originated in a region where only one system of operation was used. Types of traditional hives are illustrated and similarities with traditional beekeeping in the Middle East are pointed out. It is suggested that beekeeping methods were introduced into Kashmir in the reign of Zain-ul-Abidin (1420–1470), when relationships between Kashmir and Persia, Egypt and various Arab countries first became close. D. G. Lowe
Shah Beekeepers, Kursu, Rajbagh, Srinagar 190008, Kashmir, India.

Shah, F.A. and Shah, T.A. A note on the bee activity and bee flora of Kashmir. *Indian Bee Journal* (1976) 38 (1–4) 29–33 [En, B]

Frequent honey crop failures in this area have resulted from the heavy dependence by beekeepers on one main nectar source, *Plectranthus*. A table lists 50 nectar and/or pollen sources, with flowering periods and colour of pollen. Details are also given of the seasonal activity of *Apis cerana*, and a calendar of colony manipulations is included. P. Walker

Shah Beekeepers, Kursu, Rajbagh, Srinagar, Kashmir, India.

Shah, F.A. and Shah, T.A. Flight range of *Apis cerana* from Kashmir. *Indian Bee Journal* (1980) 42 (2) 48 [En, B]

Apis cerana flew 3.75 km to forage on *Crocus sativus* pollen.

Shah, F.A. and Shah, T.A. *Apis iridescent virus*. *Indian Bee Journal* (1981) 43 (2) 44–45 [En, B]

Isolated from *Apis cerana* in Kashmir and Himachal Pradesh, India.

Shah, F.A. and Shah, T.A. Egg-laying capacity of Kashmir *Apis cerana*. *Bee World* (1981) 62 (3) 114–115 [En, B]

Average daily egg-laying rate was calculated from the total brood area measured every 21 days from mid-January to early October in seven *A. cerana* colonies in Kashmir. Highest levels were reached in May, with an average of 2033 eggs/day in one colony, and an overall average for the colonies of 1603 eggs/day. These rates are higher than for southern Indian or north Indian (Punjab) *A. cerana* (300–500 and 830 eggs/day, respectively). P. Walker
Shah Beekeepers, Kursu, Rajbagh, Srinagar, Kashmir 190008, India.

Shah, F.A. and Shah, T.A. Multiple queen system in *Apis cerana* in Kashmir. *Indian Bee Journal* (1982) 44 (1) 11–12 [En, B]

Shah, F.A. and Shah, T.A. Thai sacbrood disease of *Apis cerana*. *British Bee Journal* (1987) 115 (4502) 237–240 [En, B]

The first outbreak of this disease occurred in northern Thailand in 1976, and it subsequently appeared in various parts of northern India, killing up to 100% of colonies. Four experimental groups of infected colonies in Kashmir, India, were subjected to different management regimes for 75 days and the course of the disease in each group was compared with that in untreated controls.

Shah, F.A. and Shah, T.A. *Tropilaelaps clareae* not a threat to *Apis mellifera* in temperate climates. *Indian Bee Journal* (1989) 51 (3) 120–121 [En, B]

From observations on *A. mellifera* colonies in Kashmir, it is concluded that *T. clareae* can not survive in overwintered colonies, but during brood rearing periods the mite can cause serious damage. Infestation of mite-free colonies occurs when infested colonies are moved near them. Certain precautions are recommended for the introduction of *A. mellifera* from tropical/subtropical areas. P. Walker

Shah Beekeepers, Kursu, Rajbagh, Srinagar 190008, India.

Shah, F.A. and Shah, T.A. *Vespa velutina*, a serious pest of honey bees in Kashmir. *Bee World* (1991) 72 (4) 161–164 [En, B]

V. velutina is a serious pest of *Apis mellifera* colonies in Kashmir, catching and eating bees in front of the hive and scraping wood to use as a nest-building material. *A. cerana* workers defend their colonies far more effectively than *A. mellifera*, by balling and stinging the hornets, and their flight behaviour makes them better at avoiding attacks. Control measures include killing hornet queens in early spring, destroying hornet nests and swatting hornets at hive entrances; none of these are very effective. Traps baited with meat, fish, honey or rotting fruit appear to give varying results. In a small trial using 12 glass jars half-filled with a mixture of fermenting honey and water, placed on the tops of hives, 11,483 hornets were trapped in 10 days. The number of hornets observed at hive entrances fell from 1–25 to 0–3 per hive. D. G. Lowe

Shah Beekeepers, Kursu, Rajbagh, Srinagar, 190 008 Kashmir, India.

Shah, N.K. *Hisalu (Rubus ellipticus Linn.) a potential source of nectar to hive bees (Apis cerana indica Fabr.) in northwestern Himalayas*. Indian Bee Journal (1986) 48 (1–4) 70 [En, Bj]

Apis cerana was the most frequent visitor to the flowers of this dominant shrub, followed by *A. dorsata*.

Shah, N.K. and Melkania, N.P. *Apiculture in the Himalayas: its practices, ecology and development*. Indian Bee Journal (1982) 44 (3) 65–68 [En, B]

Traditional beekeeping is described, and possibilities for its development are discussed. The area is rich in bee forage: a table lists 73 cultivated and 26 wild plant species which produce nectar and/or pollen. For each species the following information is given: abundance, local name, flowering period, and whether it is a major/minor source of pollen and/or nectar (but separate pollen and nectar ratings are not given). *P. Walker*

District Horticulture Office, Uttarkashi, Uttar Pradesh, India.

Shah, T.A. 'Hazel nut' – an early pollen source in the Kashmir valley, India. *Indian Bee Journal* (1981) 43 (3) 67 [En, B]

Shah, T.A. *Seasonal incidence of Apis iridescent virus and internal parasites in Apis cerana in Kashmir, India*. *Indian Bee Journal* (1985) 47 (1–4) 43–44 [En, Bj]

Samples were collected from 694 colonies (33 apiaries) at 13 locations during 1983–84. *Apis iridescent virus* was found in 27 samples (three in spring, none in summer, 14 in autumn, 10 in winter), and *Acarapis woodi* in 64 samples (27, 2, 20 and 15, respectively). *Nosema apis* was not found in any of the samples. Results are also analysed by area. *P. Walker*

Dept. Agric., Lalmandi, Srinagar 190 008, India.

Shahid, M. *Beekeeping in the North West Frontier Province of Pakistan. Honeybees in mountain agriculture [edited by Verma, L.R.]*. New Delhi, India; Oxford & IBH Publishing Co. (1992) 193–209 ISBN 81-204-0650-8 [En, Bdo]

Includes a table of 109 bee forage plants.

Department of Entomology, NWFP Agricultural University, Peshawar, Pakistan.

Shankar Reddy, M., Reddy, C. C. and Devaiah, P.B. *Impact of Thai sacbrood disease of honeybees on pollination. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G. K., Shaanker, R. U. and Ganeshiah, K. N.]*. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 244–245 [En, Bd]

Department of Zoology, Bangalore University, Bangalore 560 056, India.

Sharma, H. K. and Gupta, J. K. *Impact of bee pollination on sustainable production in apple orchards*. *Pest Management*

and Economic Zoology (2001) 9 (1) 45–48 [En, wf]

Foraging of *Apis cerana* (C) and *A. mellifera* (M) in an apple orchard was observed. C was more active than M in poor weather. The average fruit set obtained up to 75 m from the hives was similar for both species (27.3–29.3%), and differed significantly from that recorded at 100 m (18.4%). When hives were placed in groups, fruit set did not differ significantly up to 75 m from a group of two colonies and up to 100 m in a group of four colonies.

Dr Y.S. Parmar Univ. of Horticulture and Forestry, Beekeeping and Horticulture Research Sub-station, Katrain, Kullu, HP 175 129, India.

Sharma, H. K. and Gupta, J. K. *Diversity and density of bee flora of Solan region of Himachal Pradesh (India)*. *Indian Bee Journal* (1993) 55 (1/2) 9–20 [En, Bj]

During observations on flowering plants in an area near an apiary containing both *Apis mellifera* and *A. cerana* colonies, a total of 119 species were visited by these bees. Of the 72 species that were visited regularly, 41 provided both nectar and pollen, 22 nectar (only) and nine pollen (only). Peak flow was in February–March; fewest species were in flower in July–August. The forage was sufficient for colony build-up and maintenance, but was inadequate for surplus honey production. A table lists all 119 species with flowering period and value to bees.

Department of Entomology and Apiculture, University of Horticulture and Forestry, Nauni, Solan 173 230 (H.P.), India. *P. Walker*

Sharma, I. K. *The carpenter bee (Xylocopa fenestra) in the Indian Thar desert*. *Journal of the Bombay Natural History Society* (1981) 78 (2) 408–409 [En, B]

This species damages timber, but is also a useful pollinator. It makes nesting tunnels in the dry stems of *Calotropis procera*, and was also found in *Capparis* and *Prosopis cineraria*. In the wild it forages mainly on *Calotropis procera* and *Tephrosia purpurea*, but it was seen on several other species, and it visited many garden flowers. In the Jodhpur district this species hibernated from late November to early February, but was occasionally seen hovering during warm spells in the winter. *P. Walker*

Bhagwati Bhavan, Ratanada Road, Jodhpur 342 020, India.

Sharma, M. *An analysis of pollen loads of honey bees from Kangra, India*. *Grana* (1970) 10 35–42 [En, B]

During the period 1 June–26 August 1968, only eight of 39 pollen loads were mixed, all occurring during June and early July, indicating that this was a poor time for foraging. Twenty pollen types were recognised. Bees showed a preference for pollen of *Gramineae* and also collected from other anemophilous plants (*Cyperaceae*, *Palmae*, *Chenopodiaceae*, *Urticaceae*). *J. M. Gedy*

Palynology Lab., Natn. Botanic Gardens, Lucknow, India.

Sharma, O. P., Garg, R. and Dogra, G. S. *Efficacy of formic acid against Acarapis woodi (Rennie)*. *Indian Bee Journal* (1983) 45 (1) 1–2 [En, B]

Three honeybee (*Apis mellifera*) colonies infested with *A. woodi* at Nagrota-Bagwan, India, were treated with 85% formic acid which was allowed to evaporate from a cotton wick in a container on the bottom board. The container

was filled with 5 ml formic acid every day for 21 days. Samples of 20 bees were inspected daily; 76.6% were infested on day 1, 16.3% on day 14, 0% from day 16 onwards. *A. woodi* eggs were not found in samples taken after day eight. No effects on honeybee brood mortality or adult lifespan were observed. *D. G. Lowe*
Bee Res. Stn., Himachal Pradesh Agric. Univ., Nagrota Bagwan, Kangra, HP, India.

Sharma, O. P. and Raj, D. Diversity of bee flora in Kangra Shivaliks and its impact on beekeeping. *Indian Bee Journal* (1985) 47 (1-4) 21-24 [En, B]

Results of a survey made in this area of Himachal Pradesh, India, are presented. A total of 41 plants important to bees are listed with the following information: local and botanical names, flowering period, nectar and/or pollen source, and its value to honeybees. The data are discussed in relation to the seasonal cycle of colonies in the area and climatic variations. *Apis mellifera* was established in the Kangra valley in 1964 and there are now about 3000 colonies there. In some years there has been insufficient forage but recent introductions of certain crops have counteracted this, and generally there is good scope for beekeeping. *P. Walker*

Bee Res. Stn., Himachal Pradesh Krishi Vishva Vidyalaya, Nagrota-Bagwan 176 047, Kangra, India.

Sharma, O. P., Raj, D. and Garg, R. Toxicity of nectar of tea (*Camellia thea* L.) to honeybees. *Journal of Apicultural Research* (1986) 25 (2) 106-108 [En, B]

Honeybee (*Apis mellifera*) colonies at Darang, India, have suffered brood mortality in October, when tea bushes are in flower, in each year since 1977. It is concluded that the presence of poorly-managed small tea estates in the foothills of the Dhauladhar range of the Himalayas renders the area unsuitable for *A. mellifera* colonies in autumn.

Bee Res. Stn., Himachal Pradesh Agric. Univ., Nagrota Bagwan 176047, Kangra, Himachal Pradesh, India.

Sharma, O. P. and Thakur, A. K. Beekeeping in Kangra Valley. *Indian Farming* (1982) 31 (12) 33, 35 [En, B]

In Himachal Pradesh, India; gives estimated expenditure and income for a 50-colony apiary of *Apis cerana* or *A. mellifera*.

Sharma, O. P., Thakur, A. K. and Garg, R. Control of wasps attacking bee colonies. *Indian Bee Journal* (1985) 47 (1-4) 27-29 [En, B]

Vespa mandarinia, *V. tropica*, *V. velutina* and *V. basalis* were observed attacking colonies of *Apis mellifera* and *A. cerana* in Kangra, Himachal Pradesh, especially during the monsoon. They kill many foragers and bee colonies tend to abscond. The behaviour of these hornets is described in detail. A control method was tested: powdered aluminium phosphide was fixed to the abdomen of captured hornets so that they would take it into their nest. It was partially successful, but further modifications to the method are needed. Another method successful against *V. mandarinia* was to fit over the hive entrance a box with a 1-cm diameter entrance hole. *P. Walker*

Bee Res. Stn., Himachal Pradesh Krishi Vishva Vidyalaya, Nagrota-Bagwan 176 047, Kangra, India.

Sharma, S. D. and Desh Raj. Efficacy of amitraz strips against *Tropilaelaps clareae*, an ectoparasitic mite of *Apis mellifera*. *Agricultural Science Digest (Karnal)* (99) 19 (2) 89-92 [En, 9 wf]

Dept of Entomology, HPKV, Palampur-176062, India.

Sharma, S. D. and Desh Raj. Evaluation of different methods of using formic acid against *Acarapis woodi* Rennie infesting *Apis mellifera* L. *Agricultural Science Digest (Karnal)* (99) 19 (3) 167-171 [En, 10 wf]

Dept of Entomology, HPKV, Palampur-176 062, India.

Sharma, S. D., Desh Raj, and Sharma, O. P. Effect of formic acid treatment on the control of tracheal mite infestation and colony build up in honey bees (*Apis mellifera* L.) during winter. *Advances in Agricultural Research in India* (97) 8 63-67 [En, 10 wf]

During severe winter months, formic acid utilisation and penetration was found to be very low in colonies infested with *Acarapis woodi*. The treatment was also found to disturb winter clusters and the reduction in clusters of diseased bees was attributed to the mortality of field bees infested with the mite. Two treatments of formic acid (August-September and early spring), each at a rate of 5 ml per colony on five combs per day for three weeks have been suggested.

Dept of Entomology, HP Krishi Vishvavidyalaya, Palampur 176062 HP, India.

Sharma, S. D., Kashyap, N. P., Raj, D. and Kumar, A. Control of ectoparasitic mite *Tropilaelaps clareae* infesting *Apis mellifera* with fluvalinate. *Indian Journal of Plant Protection* (1996) 24 (1/2) 6-9 [En, 12 ref.]

Three concentrations of fluvalinate (5, 10 and 15 p.p.m.) were tested against *T. clareae* and it was found that the higher concentrations (15 and 10 p.p.m.) were quite effective in eliminating *T. clareae* from *A. mellifera* colonies. The infested colonies became mite-free in 23-24 days after application of these concentrations. However, the lower concentration could be used as a prophylactic measure against the mite.

Department of Entomology, Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H. P.), India.

Sharma, S. D., Raj, D., Sharma, O. P. and Singh, M. Effect of tracheal mite infestation on colony condition and foraging activity of *Apis mellifera* Linn. *Journal of Entomological Research* (1991) 15 (3) 197-202 [En, Bc]

Foraging activity was recorded three times a day in three colonies infested with *Acarapis woodi* (over 40% infestation) and in three healthy colonies. During the 20-day study, the activity of pollen collectors and other foragers increased markedly in the healthy colonies but decreased in infested colonies. *P. Walker*

Department of Entomology, Himachal Pradesh Krishi Vishvavidyalaya, Palampur-176062, H. P., India.

Sharma, S. K., Singh, J. R. and Kaushik, H. D. Efficiency of two wild honey bees (*Apis* spp.) as pollinators of onion (*Allium cepa* L.). *Haryana Journal of Horticultural Sciences* (2001) 30 (1/2) 134-135 [En, wf]

During observations on plots of flowering onion, *Apis*

dorsata (1.19 bees/umbel/5 minutes) was more abundant than *A. florea* (0.76). The total number of bees was highest from 12.00–13.00 hours. No. loose pollen grains sticking to the bodies of individual foraging bees was 10,187 and 5625 for *A. dorsata* and *A. florea*, respectively. These results suggest that *A. dorsata* is the more efficient pollinator.

Dept of Entomology, CCS Haryana Agricultural Univ., Hisar-125 004, India.

Sharma, S. K., Singh, J. R. and Mahla, J. C. Foraging behaviour of *Apis* spp. in semi-arid sub-tropical climate. 3. On flowers of mustard, onion, carrot, berseem and sunflower. *Crop Research (Hisar)* (2001) 21 (3) 332–334 [En, wf]

Dept of Entomology, CCS Haryana Agricultural Univ., Hisar-125 004, India.

Sharma, S. K., Singh, J. R. and Ombir. Comparative pollination efficiency of three *Apis* spp. on *Brassica campestris* var. 'sarson' B. S. H. 1. *Crop Research (Hisar)* (2000) 19 (1) 125–127 [En, wf]

In a study in Hisar, India, abundance of the different bee species (*Apis florea*, *A. dorsata* and *A. mellifera*) on the crop and the numbers of loose pollen grains on their body surfaces were used as the main criteria for determining the pollination index. The index was highest for *A. dorsata* (121 852) which was therefore the most efficient pollinator; the index was lowest for *A. florea* (25 983), and intermediate for *A. mellifera*.

Dept of Entomology, CCS Haryana Agricultural Univ., Hisar-125 004, India.

Sharma, S. P., Buche, S. D., Pillai, V. P. R., Adinarayanaiah, C. L. and Mathew, T. V. Detection of *Clostridium botulinum* toxin in honey. *Indian Journal of Veterinary Pathology* (1993) 17 (2) 151–152 [En, 5 ref.]

Sheikh, M. S. and Chetry, G. Distribution of honey bees in Assam. *Environment and Ecology* (2000) 18 (1) 236–240 [En, wf]

Five different species of *Apidae* were observed during the survey. The distribution, migration, nest sites and seasonal variation in the number and size of colonies were studied in detail. The survey included wild and managed *Apis dorsata* and *A. florea* colonies. Some 'bee trees' and other popular nest sites were recorded.

Dept of Zoology, Nabajyoti College, Kalgachia 781319, India.

Shelar, D. G. and Suryanarayana, M. C. Preliminary studies on pollination of coriander (*Coriandrum sativum* L.). *Indian Bee Journal* (1981) 43 (4) 110–111 [En, B]

Apis florea was the most frequent visitor to coriander flowers; *A. cerana* and *Trigona iridipennis* also foraged on them. The number and weight of seeds per plant were higher on uncaged plots, and on plots caged with *A. cerana*, than on plots caged to exclude insects. P. Walker

Central Bee Res. Inst., Khadi and Village Indus. Commission, Poona 411 004, India.

Shelar, D. G. and Suryanarayana, M. C. Effect of pollination by honey-bee (*Apis cerana indica* Fabricius) on the yield of lucerne. *Indian Journal of Agricultural Sciences* (1983) 53 (3) 190–191 [En, B]

Mean number of seeds per *Medicago sativa* plant caged without insects, or caged with a 5-frame colony of *Apis cerana*, or growing in open plots, was 22.7, 48.2 and 121.6, respectively. Bees in the cage collected nectar and pollen vigorously throughout the day. On the open plots, *A. cerana*, *A. dorsata*, *A. florea* and *Trigona iridipennis* also collected nectar and pollen through the day. *Megachile flavipes* and some butterflies and flies were also seen. It is thought that for effective pollination by *A. cerana*, 12–25 colonies/ha would be needed. D. G. Lowe

Central Bee Res. Inst., Khadi and Village Indus. Commission, Pune, Maharashtra 411 004, India.

Shende, S. G. Beekeeping development in India: history, present status, constraints and future strategies including a proposal for setting up of 'National Bee Board'. *Indian Bee Journal* (1992) 54 (1–4) 1–18 [En, B]

The development of beekeeping in India during this century is described and discussed. Although there is great potential for further development of beekeeping among rural populations, this is at present restricted; the constraints to development are discussed. It is concluded that an organisation responsible for beekeeping is needed, and a proposal is made for the setting up of a National Bee Board, together with a Board in each state. Suggested constitutions and objectives are set out. P. Walker

All India Beekeepers' Association, 1325 Sadashiv Peth, Poona 411 030, India.

Shende, S. G. and Phadke, R. P. Beekeeping in India – history, present status and future. *Indian Bee Journal* (1995) 57 (1) 31–37 [En, B]

Shruti Chaudhary, Gupta, J. K. and Rana, B. S. Variations in worker brood survival of *Apis mellifera* L. *Pest Management and Economic Zoology* (98) 6 (1) 65–67 [En, X]

Dept of Entomology & Apiculture, Dr Y. S. Parmar Univ. of Horticulture & Forestry, Solan, HP 173 230, India.

Siddappaji, C. and Channabasavanna, G. P. Role of honeybees in the pollination of cardamom *Elettaria cardamomum* (L.) Maton. *Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980*. (1983) 640–648 [En, B]

Observations were made on a 1-ha plot of *E. cardamomum* at Mudigere, India, in 1974–75. An out-apiary of 22 *Apis cerana* colonies was located nearby, and 98% of insect visitors to cardamom were honeybees. The maximum foraging activity of *A. cerana* (up to 17 visits/clump/hours) was during the morning. When cardamom panicles were completely enclosed in polythene, none of the flowers set fruit; in those left open to all insects 64% of flowers set fruit. Some panicles were covered with mosquito netting, thus allowing access to smaller insects; fruit set on these was 18%, indicating that large insects such as honeybees are necessary for adequate pollination. D. G. Lowe

Dept. Entomology, Univ. Agric. Sci., Bangalore-560024, India.

Sihag, R. C. Problem of wax moth (*Galleria mellonella* L.) infestation on giant honey bee (*Apis dorsata* Fab.) colonies in Haryana. *Indian Bee Journal* (1982) 44 (4) 107–109 [En, B]

Combs were collected from *A. dorsata* nests in 20 localities during June and July, which is a dearth period and also the time of maximum wax moth infestation. In the dry western half of the state infestations are very severe in the drought period, except in colonies nesting in orchards. In the north-east, which is fairly temperate, colonies are strong and the number infested is generally low. In the central belt, with an intermediate climate, less than one-third of colonies are infested. At present, there is little beekeeping with either *Apis cerana* or *A. mellifera* in Haryana. If it is developed, colonies in the western or central parts must be kept strong to reduce the risk of wax moth attack, or during drought periods they must be moved to the north-east. *P. Walker*
Dept. Zoology, Haryana Agric. Univ., Hissar 125 004, India.

Sihag, R. C. Life cycle pattern, seasonal mortality, problem of parasitisation and sex ratio pattern in alfalfa pollinating megachilid bees. *Zeitschrift für Angewandte Entomologie* (1983) 96 368–379 [En, de, B]

Observations were made on the emergence pattern of three species of megachilid bees (*Megachile flavipes*, *M. lantana* and *M. cephalotes*) at Hissar, India. The bees completed up to five generations per year, two in summer and three after the rainy season.

Lab. Animal Behaviour and Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Sihag, R. C. Prospects of beekeeping in Haryana. *Indian Bee Journal* (1983) 45 (1) 8–11 [En, B]

Sihag, R. C. Influence of environmental factors on the pollination activity of bees. *Environment and Ecology* (1984) 2 149–152 [En, Bb]

Studies with *Apis dorsata*, *A. florea*, four *Megachile* species and two *Andrena* species, in Hissar, India, showed that temperature acted as a trigger for the start and end of foraging activity in winter for social bees, whereas light was the stimulus in summer. Solitary bees showed similar behaviour in winter, but during the summer their foraging activity was stimulated by increasing temperature in the morning and was stopped by decreasing light intensity in the evening. *J. M. Gedye*

Dept. Zoology, Haryana Agric. Univ., Hissar 125004, India.

Sihag, R. C. Insect pollination increases seed production in cruciferous and umbelliferous crops. *Journal of Apicultural Research* (1986) 25 (2) 121–126 [En, B]

The effect of insect visits on seed production was studied in nine cruciferous and four umbelliferous crop species at Hissar, India, by comparing several yield parameters in open-pollinated plants and plants in cages or with stems bagged. Bees (*Apis dorsata*, *A. florea*, *A. mellifera* and six solitary species) were the dominant flower visitors, and were the only species which collected pollen and acted as potential pollinators. The management of bees for seed production in cruciferous and umbelliferous crop species is recommended.

Dept. Zoology, Haryana Agric. Univ., Hissar 125 004, India.

Sihag, R. C. Why does the alfalfa pollinating sub-tropical bee *Megachile flavipes* make false nesting? *Zoologische Anzeiger* (1986) 217 (3/4) 228–233 [En, Ba]

M. flavipes females, besides showing normal nest construction, also construct 'false nests' in which the excavated tunnel is closed without nest cells being made or oviposition taking place. Laboratory studies of this behaviour in India showed that it occurred in females deprived of nectar and pollen and simply fed 40% sucrose solution. The basal oocyte of the right ovary in these bees was in a resorption phase (the left ovary was in normal vitellogenic phase), and the concentration of blood proteins was much lower (48.3 microg/ml) than in bees fed normally (69.1 microg/ml). It is concluded that a switch to false nesting occurs in times of nutritional stress. *M. flavipes* is used as a pollinator of lucerne (*Medicago sativa*) and the results show that it is necessary to provide adequate forage for the bees to build up their populations. *D. G. Lowe*
Dept. Zoology, Haryana Agric. Univ., Hissar 125 004, India.

Sihag, R. C. Incidence of *Varroa*, *Eugarroa* and *Tropilaelaps* mites in the colonies of honey bee *Apis mellifera* L in Haryana (India). *American Bee Journal* (1988) 128 (3) 212–213 [En, Bj]

Hive debris was collected from eight apiaries in different parts of the state, from October to May 1987, and examined for the presence of mites. The incidence of *Tropilaelaps clareae* was high in all areas (more than 2000 mites/g debris); the original host of this mite, *Apis dorsata*, is present throughout the state. Small numbers of *Varroa jacobsoni* (5–6 mites/g debris) were found in samples from the north and north-east where *Apis cerana* colonies are kept, but in only two of the apiaries in the south-west (and their colonies had come from the north). This is said to be the first report of *V. jacobsoni* in *A. mellifera* colonies in India, although its presence in *A. cerana* colonies was first reported in the mid-1960s. *Eugarroa* mites were also found in the same areas (12–14 mites/g debris); they resembled *E. haryanensis* rather than *E. sinhai*. The low levels of *Varroa* and *Eugarroa* may have been because they are new infestations, or because *T. clareae* has some sort of adverse effect on them. It is essential that *Varroa* is controlled in Haryana in view of the Indian Council of Agricultural Research programme for introducing *A. mellifera* to many parts of India. *P. Walker*

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hissar 125 004, India.

Sihag, R. C. Ecology of European honeybee *Apis mellifera* L. in semi-arid subtropical climates. 1. Association with melliferous flora and over seasoning of the colonies. *Korean Journal of Apiculture* (1990) 5 (1) 31–43 [En, ko, Bj]

In Hissar, India, five periods in the seasonal cycle of *A. mellifera* colonies were established: early summer, late summer, monsoon, autumn and winter. Late summer and monsoon combined formed a dearth period, whereas early summer and autumn were favourable for honeybees. *A. mellifera* formed clusters during winter when the temperature fell below 5°C. Of the 125 plant species foraged on by *A. mellifera*, 75% represented major pollen and/or nectar sources; these are listed with their names, flowering periods and apicultural value. A viable system of growing crops

to give continuous forage throughout the year was identified. There are two build-up periods in this region, from mid-September to late November (post-monsoon) and from late February until mid-May (early summer), with honey storage periods following each. Various management practices are suggested. *D.G. Lowe*

Lab. Animal Behaviour & Simulated Ecology, Dept. Zoology, Haryana Agric. Univ., Hisar 125004, Haryana, India.

Sihag, R. C. Seasonal management of honey bee (*Apis mellifera* L.) colonies in Haryana (India). *Indian Bee Journal* (1990) 52 (1-4) 51-56 [En, Bj]

The following information is given: climate in different areas, the major forage plants (mainly agricultural crops) and their flowering periods, seasonal incidence of important predators and pests of honey bees. Seasonal management of *A. mellifera* in the different areas is described, and is summarised in a table. *P. Walker*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, Haryana Agricultural University, Hisar 125 004, Haryana, India.

Sihag, R. C. Behaviour and ecology of the sub-tropical carpenter bee, *Xylocopa fenestrata* F. 3. Provisioning and foraging activity patterns. *Indian Bee Journal* (1991) 53 (1-4) 23-29 [En, Bj]

The behaviour of *X. fenestrata* was observed at Hisar, Haryana, India. Bees provisioned nest cells from early or mid-March until the end of October. They collected pollen from 13 species of cultivated crops, and nectar from most of them, and were thus pollinators of these crops. The bees were particularly active in late summer and autumn, so crops then in flower benefited most. Other bee species active during March-October, when temperatures were sometimes very high, were *Megachile bicolor*, *Chalicodoma lanata*, *Apis dorsata* and *A. florea*. Only *A. florea* visited the same crops as *X. fenestrata*, but its pollinating efficiency was not established. *P. Walker*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, Haryana, India.

Sihag, R. C. Ecology of European honeybee (*Apis mellifera* L.) in semi-arid sub-tropical climates. 2. Seasonal incidence of diseases, pests, predators and enemies. *Korean Journal of Apiculture* (1991) 6 (1) 16-26 [En, Bb]

The seasonal incidence of diseases, pests, predators and enemies of the recently introduced European honey bee *A. mellifera* in Hisar, India, was studied in 1982-89. Colonies were found to be free from major viral, bacterial, fungal and protozoal diseases, and *Acarapis woodi* was found only in 1984, but *Tropilaelaps clareae* and *Galleria mellonella* were serious pests. Infestations of *Varroa jacobsoni* and *Euvarroa sinhai* were also observed for the first time in *A. mellifera* colonies in India. The wasp *Vespa orientalis*, and the birds *Nectarina asiatica* and *Merops orientalis*, were major predators of *A. mellifera*. Colonies were sometimes robbed by various species of ants and by the rock bee *A. dorsata*. Vertebrates such as lizards and toads were also found inside hives. *Author*

Laboratory of Animal Behaviour & Simulated Ecology, Department of Zoology, Haryana Agricultural University, Hisar 125004, India.

Sihag, R. C. Methods of domiciling and beekeeping with alfalfa pollinating sub-tropical megachilid bees. *Korean Journal of Apiculture* (1991) 6 (2) 81-88 [En, Bj]

The methods suggested in this paper are based on studies of artificial domiciles for *Megachile haryanaensis*, *Chalicodoma rubripes*, *C. cephalotes* and *C. lanata*, made in Haryana, India, during the period 1976-1991. The domiciles entailed the provision of nesting tunnels and bee shelters. Tunnels were made from easily-procured materials such as hollow stems of castor (*Ricinus communis*), drinking straws or drilled wooden (or particleboard) boards, which were packed together in boxes or frames and placed in shelters constructed from metal and asbestos sheets or in a simple mud hut. The bees can be procured originally from the wild in the form of diapausing larvae; after emergence, mating and nesting, populations build up in the domiciles provided. *D.G. Lowe*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, Haryana Agricultural University, Hisar 125004, India.

Sihag, R. C. Some economic estimates of use of pesticides and bee pollination for crop yield. *Korean Journal of Apiculture* (1991) 6 (2) 89-94 [En, Bj]

Estimates are given for economic returns due to the use of pesticides and/or bee [honey bee?] pollination on various crops under Indian conditions. The crops include toria (*Brassica campestris* var. toria), turnip (*B. rapa*), cauliflower (*B. oleracea* var. botrytis), raya (*B. juncea*), rock cress (*Eruca sativa*), radish (*Raphanus sativus*), carrot (*Daucus carota*), fennel (*Foeniculum vulgare*), coriander (*Coriandrum sativum*), cumin (*Cuminum cyminum*) and lucerne (*Medicago sativa*). The results indicate that the use of pesticides and bee pollination are both essential if high economic returns are to be made. *Author*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, Haryana Agricultural University, Hisar 125004, Haryana, India.

Sihag, R. C. Utilization of waste stems of sarkandas and castor as nesting tunnels for culturing/keeping wild bee pollinators of some crops. *Bioresource Technology* (1992) 42 (2) 159-162 [En, Bc]

Trials in India showed that hollow stems of sarkandas (*Arundo* sp. and *Saccharum* sp.) and castor (*Ricinus communis*) were readily accepted by *Megachile haryanaensis*, *Chalicodoma rubripes*, *C. cephalotes*, *C. lanata*, *Xylocopa fenestrata* and *X. pubescens*. All species nested together in a single 'hive', each selecting the stems with a diameter appropriate to their size. All six species occupied 'hives' placed near lucerne (*Medicago sativa*) but only *C. lanata* was present near pigeon peas (*Cajanus cajan*), and the *Xylocopa* species near cucurbit crops. Occupation rates of the stems increased with successive years. *J.M. Gedye*

Laboratory of Animal Behaviour and Simulated Ecology, Dept. Zoology, Haryana Agricultural University, Hisar 125 004, Haryana, India.

Sihag, R. C. *The green bee-eater Merops orientalis orientalis Latham I. Seasonal activity, population density, feeding capacity and bee capture efficiency in the apiary of honey bee, Apis mellifera L. in Haryana (India).* Korean Journal of Apiculture (1993) 8 (1) 5–9 [En, Bj]

The green bee-eater *Merops orientalis orientalis* was found to prey upon foraging honey bees (*Apis mellifera*) in Haryana, India. The birds congregated in large numbers near an apiary during the dearth period and were seen near the foraging sites of the bees in the flowering period. The prey capture efficiency of the bird was exceptionally high near the apiary, very high at the foraging sites of honey bees and moderately high elsewhere, in the air. On the basis of its foraging behaviour, density, feeding capacity and prey capture efficiency, the bee-eater seems to be a serious predator of honey bees. *Author*

Laboratory of Animal Behaviour & Simulated Ecology, Department of Zoology, Haryana Agricultural University, Hisar-125004, Haryana, India.

Sihag, R. C. *Management of some sub-tropical megachilid bees for pollination of alfalfa (Medicago sativa L.) and pigeon pea (Cajanus cajan L. Millsp.). Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G. K.; Shaanker, R. U.; Ganeshaiah, K. N. (eds)].* Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 229–232 [En, Bd]

The nesting habits and temperature preferences of *Megachile haryanaensis* and *Chalicodoma rubripes*, specialist pollinators of alfalfa, and *C. lanata* and *C. cephalotes*, pollinators of pigeon pea, are outlined. The use of hollow stems of *Ricinus communis* and *Arundo* spp. and soda-pipe straws to construct artificial nests is discussed. Details are given for constructing a shelter to protect nests from sun and rain. Bees are either brought in as diapausing larvae during the winter or can be acquired by trap nesting at other locations. *J.M. Gedye*

Laboratory of Animal Behaviour and Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, India.

Sihag, R. C. and Kaur, G. *Colony foraging: an overview.* Indian Bee Journal (1994) 56 (1/2) 1–7 [En, Bj]

This review, with 54 references, discusses the relationships between foraging and the following factors: colony strength, presence or absence of sealed and/or unsealed brood, food stores in the colony, colony management. *D. G. Lowe*

Laboratory of Animal Behaviour & Simulated Ecology, Department of Zoology, CCS Haryana Agricultural University, Hisar 125 004, India.

Sihag, R. C. and Mishra, R. C. *Crop pollination and Apis cerana. The Asiatic hive bee: apiculture, biology, and role in sustainable development in tropical and subtropical Asia [edited by Kevan, P. G.].* Cambridge, Canada; Enviroquest Ltd. (1995) 135–141 ISBN 0-9680123-0-2 [En, Bdo]

This review, with 81 references, deals with *A. cerana* pollination of the following categories of crops: fruit trees, vegetables and pulses, oilseed crops, condiment and spice

crops, fibre crops, forage and fodder crops, crops producing dyes. The favourable pollinating characteristics of *A. cerana* are discussed. *D. G. Lowe*

All India Co-ordinated Research Project on Honeybee Research and Training, Haryana Agricultural University, Hisar 125 004, India.

Singh, A. P. *Nectar feeding insects on Paulownia fortunei blossoms: evaluating potential nototribic pollinators.* Indian Forester (2000) 126 (11) 1179–1186 [En, hi, X]

Observations on flowering trees in an area in Uttar Pradesh, India, showed that potential pollinators are *Xylocopa fenestrata* and *Bombus haemorrhoidalis*.

Entomology Div., Forest Research Inst., Dehra Dun, India.

Singh, B. P., Phadke, R. P. and Mittal, M. C. *Beekeeping potential and pattern of management in Uttar Pradesh.* Indian Bee Journal (1983) 45 (2/3) 35, 37 [En, B]

Singh, D. and Gatoria, G. S. *Beekeeping research (Apis mellifera) Punjab Agricultural university.* The Hague, Netherlands; NMCP (2001) 20 pp. [En, Bc]

Singh, G., Kashyap, R. K., Kumar, P. and Khan, M. S. *Yield and quality of hybrid seeds: influence of honeybee visitations on various sterile male rows in sunflower.* Seed Science and Technology (2001) 29 (1) 163–170 [En, 8 wf]

In trials on *Helianthus annuus* in Haryana, India, bee activity and hybrid seed were compared on the eight male-sterile rows in a 1:8 planting ratio. Significant variation was observed between the eight rows for the abundance of both *Apis dorsata* and *A. mellifera*, loose sunflower pollen grains/bee, pollination efficiency index (PEI)/bee, hybrid seed yield and seed quality. Rows up to fifth row from the male parent gave higher total hybrid seed yield/capitulum, as a result of higher bee abundance and increased PEI. These values were lower for the sixth, seventh and eighth rows, but plants in these rows had maximum no. filled and least unfilled seeds, and also maximum wt of 100 seeds, and better quality seed.

Seed Technology Centre, CCS Haryana Agricultural Univ., HISAR-125 004, India.

Singh, H. B., Kapila, R. K., Sharma, J. K. and Lata, S. *Effect of insect pollination on seed yield and its quality in turnip (Brassica rapa L.).* Seed Research (1996) 24 (1) 48–50 [En, 6 ref.]

Seed Production Unit, H.P. Krishi Vishvavidyalaya, Palampur-176062, India.

Singh, I. J. and Singh, U. B. *Economic aspects of Apis mellifera beekeeping in Haryana, India.* Indian Bee Journal (97) 59 (2) 88–90 [En, Bj]

Academy of Agricultural Research and Education Management, Haryana Agricultural Univ., Hisar 125 004, India.

Singh, J. P. and Dharamwal, S. S. *The role of honey bees in seed setting on onion at Plant Narar, Dist. Nainital, Uttar Pradesh, India.* Indian Bee Journal (1970) 32 (1/2) 23–27 [En, B]

Honeybees constituted more than 70% of the total insect

pollinators of the Patra-red variety of onion (*Allium cepa*). *Apis cerana indica* was the commonest, and *Apis dorsata* the least frequent, visitor. Uncaged (insect-pollinated) plants showed 72–79% higher seed set than caged or bagged plants. *Author*

Dept. Entomology, Coll. Agric., UP Agric. Univ., Pant Nagar, Dist. Nainital, UP, India.

Singh, M.P. *Melissopalynology and survey of the bee plants in north-eastern Hill region.* Indian Journal of Hill Farming (99) 12 (1/2) 79–83 [En, X]

Pollen analyses were carried out on 21 honey samples extracted during summer and early winter, 1989, from 10 localities of the north-eastern hill region of India; a survey of the bee plants in the area was also made. Twelve major sources of nectar and pollen, 32 minor and 60 other sources are listed.

Dept of Entomology, College of Agriculture, Central Agricultural Univ., Imphal-795001, India.

Singh, M.P., Singh, K.M. and Singh, K.I. *Efficacy and economics of some insecticides against mustard aphid, Lipaphis erysimi on rapeseed and their safety to predator and foraging bee.* Indian Journal of Entomology (99) 61 (1) 11–18 [En, X]

Of the six insecticides tested, phosphamidon (0.03%) was the most effective against the pest and it was moderately safe to honey bees (*Apis cerana*). Phosalone and endosulfan were also safe for the bees.

Dept of Entomology, College of Agriculture, Central Agricultural Univ., Imphal-795001, India.

Singh, M.P. and Singh, K.I. *Effect of bee pollination on the yield of sunflower. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G.K., Shaanker, R.U. and Ganeshiah, K.N. (eds)].* Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 226–228 [En, Bd]

Pollinating insects visiting a crop of sunflowers in north-east India included the bees *Apis cerana* (51.33%), *A. dorsata* (24.0%), *Bombus* sp. (21.9%) and *Nomia curvipes* (2.6%). *A. cerana* began foraging earlier and ceased foraging later than the other species, with peaks of activity from 06.00 to 10.00 hours and from 16.00 to 18.00 hours. Peak foraging for the other species was between 09.00–15.00 hours. *Bombus* sp. visited most flowers per minute (3.00) but *A. cerana* spent longest at each flower (50.03 seconds). Maximum seed yield per head was obtained with open pollination (13.40 g). Bagging heads to exclude insects reduced the yield to 2.24 g. Heads sprayed with endosulfan to remove pests yielded 9.76 g. *J. M. Gedy*

Department of Entomology, Manipur Agricultural College, Iroisemba, Imphal 795 001, India.

Singh, M.P., Verma, L.R. and Mattu, V.K. *Pollen spectrum of some honeys of the north-east Himalayas as determinant of honey bee forage.* Indian Bee Journal (1994) 56 (1/2) 37–52 [En, Bj]

Pollen analysis of 21 honey samples from 10 areas showed

that dominant pollens came from several plants including *Brassica* sp., *Wendlandia* sp., *Solanum* sp., *Ageratum* sp., *Clematis* sp., *Adhatoda* sp., *Mussaenda* sp. and *Helianthus* sp. Most of the honeys were unifloral. A table of bee forage plants lists 83 species belonging to 46 families together with flowering period for each, value as a source of nectar and/or pollen, and other uses. *P. Walker*

Department of Bio-Sciences, Himachal Pradesh University, Shimla 171 005, India.

Singh, N., Singh, L., Gatoria, G.S. and Jhaji, H.S. *Effect of pollination by Apis mellifera L. on some yield parameters of sunflower hybrids.* Indian Bee Journal (97) 59 (3) 176–177 [En, Bj]

Dept of Entomology, Punjab Agricultural Univ., Ludhiana 141 004, India.

Singh, N. and Bath, P.K. *Quality evaluation of different types of Indian honey.* Food Chemistry (1997) 58 (1/2) 129–133 [En, Bc]

Physicochemical properties are reported for samples of (A) *Trifolium* spp. honey, (B) *Brassica juncea* honey and (C) *Eucalyptus lanceolatus* honey, taken from hives. C had the highest lactone content (21.5 meq/kg) and the highest electrical conductivity (1.04 ohms). A had the highest diastase number (32.5) and B the lowest (8.5). When the honeys were kept at 65°C HMF formation in A was 30 times faster, and in C 12 times faster, than in B; at 95° the rates were six and two times faster, respectively. The flow behaviour of the honeys was also investigated and results are reported. *P. Walker*

Department of Food Science and Technology, Guru Nanak Dev University, Amritsar-143005, India.

Singh, P.B. and Sinha, S.N. *Effect of Bee-Q on honeybee visit and seed yield of hybrid sunflower.* Seed Research (96) 24 (2) 151–153 [En, Bb]

Bee-Q, a product claimed to attract honey bees to some flowering crops, was sprayed at different concentrations on plots of flowering sunflower at Karnal where all four *Apis* species visit the crop. Compared with unsprayed plots, there was no increase in the number of honey bee visits or in percentage seed set, no. filled seeds/head or weight of 1000 seeds. *P. Walker*

Indian Agricultural Research Inst., Regional Station, Karnal-132001, India.

Singh, P.B. and Sinha, S.N. *Evaluation of different methods of pollination on seed setting and yield of hybrid sunflower seed.* Indian Bee Journal (97) 59 (3) 161–163 [En, Bj]

Different treatments applied to plots of two parental lines at Karnal were compared: open-pollination, cage with *Apis mellifera* colony, hand-pollination, open- + hand-pollination at 1–4 day intervals. All treatments gave almost the same results for: per cent seed set, number of seeds/head, seed weight. Numbers of honey bee visits to flowers were similar in open-pollinated and caged plots. It is concluded that honey bee populations (all *Apis* species) are sufficient in this area for sunflower pollination. *Author*

Indian Agricultural Research Inst., Regional Station, Karnal 132 001, India.

Singh, P.N. and Singh, R.P. Bee forage plants of Gorakhpur [Uttar Pradesh, India]. *Indian Bee Journal* (1987) 49 (1-4) 41-43 [En, B]

Plants are listed with nectar and/or pollen values and flowering times.

Singh, R.P., Singh, P.N. and Singh, N.B. Bee forage and bee pollinated plants of Allahabad. *Proceedings of the National Academy of Sciences of India, B* (1988) 58 (3) 437-442 [En, B]

The value of a plant as a nectar source was assessed by determining its nectar sugar concentration. A total of 96 species belonging to 39 families are listed as useful sources of nectar and/or pollen in this area of Uttar Pradesh; common name and flowering time for each are included. Over 60% of species yield both nectar and pollen, nearly 30% yield only pollen and 8% yield only nectar.

Botany Department, University of Allahabad, Allahabad 211 002, India.

Singh, T.S.M.S and Suryanarayana, M.C. Melittopalynological investigations on the honeys of Karnataka. *Indian Bee Journal* (97) 59 (2) 76-79 [En, B]

Results are given for 12 honey samples collected from four *Apis cerana* apiaries in the south of the state. The honeys were pale yellow to light amber and contained 74-82% dissolved solids. Absolute pollen count ranged from 10 600 to 400,000. Important honey sources in the four areas were: *Hevea brasiliensis*; *Sapindus emarginatus*; *Syzygium cumini* and *Coffea* sp.; *Coriandrum sativum* and *Guizotia abyssinica*. Other species are also listed. *Author*

Central Bee Research and Training Inst., Khadi and Village Industries Commission, 1153 Ganeshkhind Rd, Pune 411 016, India.

Singh, W.J.K., Singh, R., Hameed, S.F. and Singh, B. Field toxicity of some insecticides to *Apis cerana indica* Fabr. *Indian Bee Journal* (1989) 51 (4) 137 [En, B]

After spraying plots of flowering mung (*Vigna radiata*) with insecticides at the recommended application rates, the numbers of dead honey bees (*A. cerana*) from 10 hives near the plots were counted for the next eight days. Dimethoate caused the highest mortality (125 dead bees), followed by DDVP (113); however, the latter killed more bees on the day of treatment. The numbers of dead bees on plots treated by malathion, endosulfan and phosalone were 81, 59 and 39, respectively. Some dead bees were found for up to five days after spraying dimethoate, malathion or endosulfan, but only for up to four days after spraying DDVP or phosalone. *P. Walker*

Department of Entomology, Rajendra Agricultural University, Pusa 848 125, Bihar, India.

Singh, Y. Role of honey bees in farm production, agricultural growth and rural reconstruction in India. *Indian Bee Journal* (97) 59 (1) 24-30 [En, B]

Apart from honey and beeswax harvested from *Apis cerana*, *A. mellifera* and *A. dorsata*, these bees are valuable pollinators of many crops. Other benefits of the inclusion of bee-keeping in the development of agriculture in India are set out and discussed, and the considerable employment opportunities are examined. *P. Walker*

Plant Protection, Dept Agriculture, Uttar Pradesh, India.

Singh, Y. Nosema in Indian honey bee (*Apis cerana indica*). *American Bee Journal* (1975) 115 (2) 59 [En, B]

Nosema apis has been confirmed in two apiaries in Uttar Pradesh, India.

Singh, Y. Honeybee poisoning and their safety for higher crop production. *Indian Bee Journal* (1985) 47 (1-4) 63-68 [En, B]

This review, with 73 references, covers the importance of honeybees as pollinators, the toxicity of pesticides to honeybees and other bees, and symptoms of bee poisoning, with a discussion of methods of pest control that avoid or reduce damage to bees. *P. Walker*

Government Beekeeping Stn., Jeolikote, Nainital, India.

Sinha, S.N. and Atwal, S.S. Pollination requirement in sunflower hybrid seed production: I. Studies on honeybee foraging behaviour on parental lines. *Seed Research* (96) 24 (2) 105-109 [En, B]

Honey bee visits to parental lines of four sunflower hybrids were observed; data obtained at 10 hours and 14 hours were not significantly different. The hybrid LSH-3 was more attractive to honey bees than the other hybrids. *A. mellifera* was the most abundant of all three honey bee species, but *A. dorsata* and *A. florea* also visited the flowers. Female parents of two hybrids (APSH-11 and LSH-3) attracted twice as many honey bees as their male parents, but the male parent of BSH-1 attracted four times as many bees as the female parent. *A. mellifera* and *A. florea* collected both pollen and nectar, but *A. dorsata* collected only pollen. *Author*

Indian Agricultural Research Inst., Regional Station, Karnal 132-001, India.

Sinha, S.N. and Atwal, S.S. Pollination requirements in sunflower hybrid seed production: II. Effect of date of sowing and fertilizer on honeybee foraging behaviour and parental lines. *Seed Research* (96) 24 (2) 110-115 [En, B]

Honey bee foraging behaviour was studied on parental lines of sunflower hybrid APSH-11 sown at monthly intervals (September-January). Bee visitation was not influenced by nitrogen levels or time of observation (morning vs. afternoon). Maximum bee visitation occurred on a crop sown in December which flowered in March when mean air temperature was 22.9°; crops sown in October and flowering in January with mean air temperature of 12.0° received fewest bee visits. *Apis mellifera* was the most abundant honey bee species observed on the flowers; 60% of bees collected nectar, and 40% collected both nectar and pollen, though this ratio varied with the season, and pollen-collection was limited in December. *Author*

Indian Agricultural Research Inst., Regional Station, Karnal 132-001, India.

Sinha, S.N. and Atwal, S.S. Pollination requirement in sunflower hybrid seed production: III. Effect of methods of pollination on seed setting and yield. *Seed Research* (2000) 28 (2) 113-118 [En, X]

Seed set and seed yield in three sunflower hybrids sown in February were higher (approx. 50% and 25%, respectively)

than in plants sown in December. *Apis mellifera*, *A. florea* and *A. dorsata* were predominant during flowering, with max. activity in March–April at a mean air temperature of 23 °C. In the hybrid LSH-3 sown in February, open-pollinated plants gave significantly higher seed yields than hand-pollinated plants did, indicating that the available honey bee population is adequate for pollination of the hybrid seed plots.

Indian Agricultural Research Inst., Regional Station, Karnal-132 001, India.

Sinha, S.N. and Chakrabarti, A.K. Studies on pollination by honey bees on early cauliflower and its effect on seed yield and quality. *Seed Research* (85) 13 (1) 115–119 [En, Bc]

In a 2-year study *Apis* species constituted 70% and 82.4% of flower visitors to cv 'Pusa Deepali' and 83.8% to cv. '328-5-10-5-1'; with *Apis florea* the most abundant flower visitor to the former and *A. dorsata* to the latter. Pollinator activity was greatest between 12h and 14h. Pollinator visits increased the seed and pod yield per plant, compared with plants caged to exclude pollinators. Average weight of 1000 seeds was higher on the caged plants; there was no difference in seed germination. *Author*

Indian Agricultural Research Inst., Regional Station, Karnal 132-001, India.

Sinha, S.N. and Singh, P.B. Effect of solar eclipse on honeybee, *Apis mellifera* activity. *Journal of Applied Zoological Researches* (97) 8 (2) 125–127 [En, Bc]

The effect of a solar eclipse (24 October 1995) on honey bee activity was observed at Karnal, India, where the peak magnitude of the eclipse reached 90%.

Indian Agricultural Research Inst., Regional Station, Karnal 132-001, India.

Sinha, S.N. and Chakrabarti, A.K. Insect pollination in carrot seed crop. *Seed Research* (1992) 20 (1) 37–40 [En, Ba]

Observations on the insect visitors to carrot seed crops in Karnal, India, were carried out for two years. *Diptera* constituted 90% and 85% of the insect population in the two years, and the honey bee *Apis florea* 7.7% and 10.9%. Seed yields were 25–33% higher on open-pollinated plants than on plants caged to exclude insects. *D.G. Lowe*

Indian Agricultural Research Institute, Regional Station, Karnal-132001, Haryana, India.

Sinha, S.N. and Vaishampayan, S. Jr. Pollination requirement in sunflower hybrid seed production: effect of caging on bee behaviour and pollination. *Indian Bee Journal* (1995) 57 (2) 71–73 [En, Bj]

On a field of *Helianthus annuus* in Haryana, the microclimate inside nylon mosquito-net cages (20 x 20 x 3 m) was determined during the flowering period. RH was higher and light intensity was lower than on uncaged plots, but air temperatures were similar. Each cage contained a small *Apis mellifera* colony, but flowers in cages received fewer bee visits than other flowers. Seed set and number of filled seeds/head were similar on plants inside and outside cages, but lower on hand-pollinated plants. However, the weight of seeds/head was significantly lower on caged plants than on open-pollinated plants. Reduced

light intensity in the cages seemed to reduce bee activity: bees tended to collect in corners of the cages and did not start to visit flowers until noon, whereas bees visited flowers in the open from 07.00 hours. *P. Walker*

I. A. R. I. Regional Station, Karnal 132 001, Haryana, India.

Sivaram, V. and Reddy, C.C. Effective utilization of bee pollinators for sustaining pollination requirements of horticultural crops in Karnataka [India]. *Honeybee Science* (2001) 22 (3) 97–99 [Ja, en, Bj]

A wide variety of crops is grown in this area, but there are too few honey bee colonies for good pollination. The number of colonies decreased from 158,000 in 1990–91 to 41,315 in 1996–97, mainly due to infections of Thai sacbrood disease.

Dept of Botany, Bangalore Univ., Bangalore, India.

Sivaram, V., Anita, M. and Reddy, C.C. The preservation and management of wild honeybees for pollination. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G.K., Shaanker, R.U. and Ganeshaiah, K.N.J]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 251–253 [En, Bd]

A study of the Mysore district [Karnataka], India, revealed 5,982 wild colonies of *Apis dorsata*, mostly located in trees. Tribal people in the district collected 13,450 kg of honey from about 665 of the colonies during 1992–1993. Combs were cut down at night and honey was extracted by squeezing and filtering through a thin cloth. The queen and most of the workers were destroyed by this method. The use of smoke or brushing bees away are suggested as better methods of collecting honey. *J.M. Gedy*

Department of Botany, Bangalore University, Bangalore 560 056, India.

Sivaram, V. and Reddy, C.C. Bee forage plants and their flowering duration in and around Bangalore, India. *Indian Bee Journal* (1994) 56 (3/4) 152–157 [En, Bj]

The honey bees in the plains of Bangalore (Karnataka) are *Apis dorsata*, *A. cerana* and *A. florea*. From a preliminary survey of plants visited by the bees throughout one year, a list of 40 bee forage species has been compiled. Flowering period is given for each, together with value as a source of nectar and pollen (nine species), nectar only (seven) or pollen only (24). Pollen and nectar are available throughout the year. *P. Walker*

Department of Botany, Bangalore University, Bangalore 560 056, India.

Snelling, R.R. New bees of the genus *Hylaeus* from Sri Lanka and India (Hymenoptera: Colletidae). *Natural History Museum of Los Angeles County Contributions in Science* (1980) (No. 328) 1–18 [En, B]

Solomon Raju, A.J. National conference on pollination ecology and its contribution to conservation of biodiversity. *Bulletin of Andhra University Research Forum* (2000) 6 (2) 8 pp. [En, Bj]

Summaries of selected papers presented at the conference held at Andhra University, 22–24 February 2000.

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Solomon Raju, A.J. and Subba Reddi, C. Foraging behaviour of carpenter bees (genus *Xylocopa*: *Xylocopidae*: *Hymenoptera*) and the pollination of some Indian plants. *Journal, Bombay Natural History Society* (2000) 97 (3) 381–389 [En, Bj]

The different types of foraging behaviour of these bees and their role in pollination of 15 flowering plants in Andhra Pradesh are described; the plants include *Tamarindus indica* and *Cochlospermum religiosum*, *Gliricidia sepium* and *Moringa oleifera*.

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530 003, India.

Soman, A.G. and Chawda, S.S. A contribution to the biology and behaviour of the dwarf bee, *Apis florea* F. and its economic importance in Kutch, Gujarat, India. *Indian Bee Journal* (1996) 58 (2) 81–88 [En, Bj]

There are large populations of *A. florea* in this area, where rainfall is low and mean maximum temperatures range from 5–50°C or more. Forest areas are dominated by *Prosopis juliflora*, which grows with several other tree species. A survey established that *A. florea* nests in shrubs and trees, especially *P. juliflora* and *Azadirachta indica*, and on a few man-made structures. In the forests, nests were 1–4 m from the ground. Comb sizes ranged from 10 x 12 cm to 45 x 60 cm. At ambient temperatures of 11–47.5°, brood temperatures in 109 nests were maintained at 33.0–33.5°. The number of queen cells, counted on 26 combs, was on average 12–15. Forage sources are listed, including some cultivated crops. The main nectar source is *P. juliflora*; *Euphorbia nivulia* is also important. The local people collect honey from nests during the major flow period (March–May) and in one area also November–December; they take only the parts of the comb containing honey. In 1995–96 a total of 167 t honey was collected (more than in previous years), and in 1994–95 a total of 1107 kg beeswax. *P. Walker*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Soman, A.G. and Kshirsagar, K.K. Preliminary survey on the rockbee (*Apis dorsata* F.) and some observations on the traditional methods of honey hunting. *Indian Bee Journal* (1991) 53 (1–4) 17–22 [En, Bj]

With the assistance of local honey collectors, numbers of *A. dorsata* nests were counted within 2.5-km² squares in forests in Nainital district (Uttar Pradesh) and North Karnara district (Karnataka). Counts during the summer totalled 1297 and 410, and in the monsoon period only 120 and 13, respectively. The estimated summer population in Nainital is almost 23,500 and in North Karnara 14,300 [areas not stated]. Annual honey production is recorded as 44.6 t and 23.0 t, respectively, but is probably more than this. In Maharashtra, many colonies are found at sugar factories during the cane crushing season; 333 were counted at nine factories. Methods of honey hunting in the three areas are compared; smoke is usually used to drive off the bees. In Uttar Pradesh, honey combs (only)

are removed in daylight from nests 20–30 m up in Bombax trees. In Karnataka, whole combs are harvested at night. In Maharashtra, honey combs are taken from nests 100 m above ground, on cliffs, by a honey hunter who climbs down a ladder from above, in daylight. The operation involves 35–70 people, organised into groups with different tasks. *P. Walker*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Soroja Devi, C.S. PhD Thesis, Department of Life Sciences, School of Sciences, Manipur University, India. Studies on the foraging behaviour, pollination requirements and pesticide toxicity of honey bees in relation to rapeseed production. (96) 160 pp. [En, Bt]

The studies described were carried out at Imphal, India, in 1992–94. Observations at 20 oilseed rape-growing areas in Manipur showed that *Apis cerana* and *Episyrphus balteatus* constituted 71.6% and 26.3%, respectively, of the total pollinator population, and these two species were also the main pollinators at the experimental site; *A. dorsata* and *Pieris brassicae* were also observed. *A. cerana* workers started foraging at about 08.00 hours and ceased at about 16.00 hours. The average duration of a foraging trip was 6.6 minutes. The peak population of *A. cerana* was observed between 09.00 and 11.00 hours; foraging showed a significant negative correlation with temperature and relative humidity. On average, an *A. cerana* forager spent 6.3 s on a flower, whereas *A. dorsata* spent 9.1 seconds. It was also observed that *A. dorsata* moved longer distances between one flower and another than *A. cerana*. *A. cerana* nectar foragers outnumbered pollen foragers in December, however a reverse trend was observed during January and February. During the day, the number of nectar foragers increased from morning to evening, whereas the reverse was true for pollen foragers. Pollen loads on *A. cerana* foragers were at a maximum size (9.6 mg) at 12.00 hours. *A. cerana* preferred to visit partially open flowers whereas *A. dorsata* foraged more frequently on fully-opened flowers. Flowers pollinated by *A. cerana* gave 586.2% and 8.7% higher yields than controls (pollinators excluded) and open-pollinated plants, respectively. Siliqua set, siliqua length, seeds/siliqua, seed weight and seed oil content were higher on bee-pollinated plants than on control and open-pollinated plants; germination of seeds from bee-pollinated plants was also higher. Of seven insecticides used to control *Lipaphis erysimi*, dimethoate was the most effective, closely followed by phosphamidon and cypermethrin. Carbaryl was the least effective in reducing aphid populations. Malathion, cypermethrin and quinalphos were safer to bees than carbaryl, dimethoate and phosphamidon. Moreover, the highest populations of *A. cerana* were on cypermethrin-treated plots and the lowest were on carbaryl-treated plots. The results indicate that it is preferable to use the safer cypermethrin in aphid-infested fields where the honey bee population is high.

Sorthia, B.K. and Chari, M.S. Toxicity of some insecticides to honey bees *Apis florea* F. and *Apis mellifera* L. *Journal of Entomological Research* (1985) 9 (2) 195–197 [En]

The toxicity of fenvalerate, endosulfan, quinalphos and etrimfos was determined. Quinalphos and etrimfos were found to be highly toxic to bees – care should be taken in their use.

Entomology Dept., Gujarat Agric. Univ., Anand Campus, 388 110 Gujarat, India.

Sreeramulu, K.R. and Gavi Gowda. Thai sac brood virus (TSBV) and its management. *Insect Environment* (98) 4 (3) 99 [En]

Colonies of *Apis cerana indica* infected by Thai sacbrood virus were observed in Bangalore, India. The virus was spread as a result of unhygienic conditions, overcrowding, drifting, trophallaxis, swarming and robbing. The youngest workers were the most susceptible. Of five treatment substances fed in syrup once a week for four weeks, zovirax was the most effective in controlling the virus; oxytetracycline was also beneficial.

Dept of Apiculture, Univ. of Agricultural Sciences, GKVK, Bangalore 560 065, Karnataka, India.

Srimathi, P., Vijaya, J., Ananthakalaiselvi, A. and Krishnasamy, V. Bee-Q effect on honey bee visit and seed yield of hybrid sunflower KBSH-1. *Madras Agricultural Journal* (99) 86 (4/6) 338–339 [En, X]

Dept of Seed Technology, Tamil Nadu Agricultural Univ., Coimbatore 641 003, India.

Srivastava, S., Kumar, A., Kashyap, N.P., Chandel, Y.S. and Raj, D. A new device to protect honey bees from the predatory wasps at the hive entrance of *Apis mellifera* L. colonies. *Uttar Pradesh Journal of Zoology* (1995) 15 (3) 165–171 [En, 18 ref.]

The predatory behaviour of *Vespa mandarinia*, *V. velutina auraria* [*V. auraria*], *V. tropica*, *V. basalis* and *V. orientalis* at the hive entrance of *Apis mellifera* is described on the basis of studies in Himachal Pradesh, India. *V. mandarinia* and *V. auraria*, which cause serious damage to *A. mellifera* colonies took 3.9 +/- 1.2 and 21.2 +/- 15.3 seconds to catch a bee, respectively. A new barrier device, named 'Bee-Wasp Protector' effectively protected bees from wasp attack at the hive entrance.

HPKV Bee Research Station, Nagrota-Bagwan, 176 047, India.

Subba Reddi, C. and Aluri, R.J.S. Reproductive biology of three mangrove plant species. *Indian Journal of Forestry* (97) 20 (2) 153–157 [En, Bb]

Acanthus ilicifolius has a peculiar floral mechanism adapted to pollination by insects such as the bees *Xylocopa latipes* and *X. pubescens*, and certain birds. *Avicennia officinalis* is pollinated mainly by flies, or self-pollinated. The third species is bird-pollinated. *Author*

Dept of Environmental Sciences, Andhra Univ., Visakhapatnam 530003, India.

Subrahmanyam, M. Honey dressing for burns – an appraisal. *Annals of Burns and Fire Disasters* (96) 9 (1) 33–35 [En, Bc]

Dept. of Surgery, Dr Vaishampayan Memorial Medical College, Solapur 413 003, Maharashtra, India.

In a randomised study over a 6-year period, honey was used as a dressing for partial-thickness burns (<40% TBSA)

for 450 patients, and conventional methods were used in a second similar (control) group. The honey-treated wounds healed earlier than those in the control group (8.8 days vs. 13.5 days). Residual scars were noted in 28 patients (6.2%) treated with honey and in 89 patients (19.7%) treated with conventional methods. *Author*

Subrahmanyam, M. Topical application of honey in treatment of burns. *British Journal of Surgery* (1991) 78 (4) 497–498 [En, Bc]

A total of 104 cases of superficial burn injury were studied to assess the efficiency of honey as a dressing in comparison with silver sulfadiazine gauze dressing. In the 52 patients treated with honey, 91% of wounds were rendered sterile within seven days. In the 52 patients treated with silver sulfadiazine, 7% showed control of infection within seven days. Healthy granulation tissue was observed earlier in patients treated with honey (mean 7.4 versus 13.4 days). Of the wounds treated with honey 87% healed within 15 days as against 10% in the control group. Relief of pain, a lower incidence of hypertrophic scar and post-burn contracture, low cost and easy availability make honey an ideal dressing in the treatment of burns. *Author*
Department of Surgery, Dr V. M. Medical College, Solapur 413 003, Maharashtra, India.

Subrahmanyam, M. Honey impregnated gauze versus polyurethane film (OpSite) in the treatment of burns – a prospective randomised study. *British Journal of Plastic Surgery* (1993) 46 322–323 [En, Bc]

A group (A) of 46 patients with partial skin thickness burns (average 23% of body surface) was treated with honey-impregnated gauze; a second group (B) of 46 was treated with OpSite, a polyurethane film. Healing was quicker in group A (average 10.8 days, maximum 16 days) than in B (average 15.3 days, maximum 24 days). Eight days after the start of treatment, eight patients in A and 17 patients in B had infections in their wounds; the bacteria found were *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella* and *Escherichia coli*. *P. Walker*

Department of Surgery, Dr V. M. Medical College, Solapur, Maharashtra, India.

Subrahmanyam, M. Storage of skin grafts in honey. *Lancet* (British edition) (1993) 341 (8836) 63–64 [En, Ba]

Skin grafts were stored in undiluted, unprocessed, sterile honey kept at room temperature and at 4°C. Subsequent grafting was done 2–12 weeks later. The grafts were firm and yellow-brown when taken out of the honey. After reconstitution in normal saline the texture became normal and the colour improved. There was no autolysis of the grafts after storage at either room temperature or at 4°C; histology of the grafts was normal. Acceptance of the grafts was 100% in patients in whom grafts stored for up to six weeks were used and 80% when grafts had been stored for 7–12 weeks. *D. G. Lowe*

Department of Surgery, Dr. V. M. Medical College, Solapur 413 003, Maharashtra, India.

Subramaniam, K. The role of Forest Department in developing beekeeping in Western Ghat areas of Maharashtra. *Indian Bee Journal* (1979) 41 (3/4) 91–93 [En, B]

Includes a list of nectar- and pollen-yielding trees and shrubs suitable for afforestation programmes.

Sumangala, K. and Haq, M.A. Incidence of honeybee parasite, *Acarapis externus* from south India. *Insect Environment* (1996) 2 (2) 39–40 [En, Ba]

Acarapis externus was found in 11 of 18 *Apis mellifera* colonies examined in three districts of Kerala, India. Infestations ranged from 3% to 62%. This is the first record of *A. externus* from India. D.G. Lowe

Division of Acarology, Department of Zoology, University of Calicut, Kerala 673 635, India.

Suryanarayana, M.C. A visit to Martandam in Kanyakumari district, Tamil Nadu. *Indian Bee Journal* (1982) 60 (2) 116–119 [En, Bj]

D3-10, Suryaprabha Gardens, 572/C Bibvewadi-Kondhwa Rd, Pune 411 037, India.

Suryanarayana, M.C. Indian beekeeping during the 25 years of the Bee Research Association. *Indian Bee Journal* (1974) 36 (1–4) 51–56 [En, B]

Suryanarayana, M.C. Bee plants of India. 1. *Carvia callosa* (Nees) Brem. *Indian Bee Journal* (1978) 40 (1) 7–10 [En, B]

Suryanarayana, M.C. Role of beekeeping in Western Ghats development. *Indian Bee Journal* (1986) 48 (1–4) 34–37 [En, Bj]

Discusses beekeeping as a village industry, with some specific advice for this area.

Suryanarayana, M.C. The story before and after the formation of the Beekeeping Development Board, Ministry of Agriculture, Government of India. *Indian Bee Journal* (1995) 57 (1) 38–47 [En, Bj]

Suryanarayana, M.C. Revival of *Apis cerana* beekeeping in Karnataka. A tour report. *Indian Bee Journal* (1996) 58 (1) 25–30 [En, Bj]

7 Gurukrupa, 365/2 Ekbote Colony, Pune 411 042, India.

Suryanarayana, M.C. Revival of *Apis cerana* beekeeping in Tamil Nadu: a tour report. *Indian Bee Journal* (1996) 58 (3) 157–168 [En, Bj]

7 Gurukrupa, 365/2 Ekbote Colony, Pune 411 042, India.

Suryanarayana, M.C. and Mohana Rao, G. Role of honey bees in the pollination biology of tropical crop plants. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G.K., Shaanker, R.U. and Ganeshiah, K.N.]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 310–320 [En, Bd]

In a review of research carried out over 25 years in India, with 58 references, some case studies are described to illustrate different pollen/nectar presentation mechanisms of crop plants, their pollination requirements and the foraging behaviour adopted by honey bees. The crops studied include oil seeds, pulses, vegetables, spices, fruits, plantation crops and forage legumes. The importance of

honey bees in hybrid seed production is discussed. The effects of the introduction of *Apis mellifera* on managed colonies of *A. cerana* and wild colonies of *A. dorsata* and *A. florea* are considered. J.M. Gedye

Central Bee Research Training Institute, Khadi and Village Industries Commission, Pune 411 016, India.

Suryanarayana, M.C. and Mujumdar, S.M. *Tropilaelaps clareae* on *Apis mellifera* in Uttar Pradesh, India. *Indian Bee Journal* (1988) 50 (4) 100–101 [En]

Suryanarayana, M.C. and Rao, G.M. Studies on ornamental garden plants as bee forage. II. *Dombeya mastersii* Hk.f. *Indian Bee Journal* (1982) 44 (1) 12–13 [En, B]

In India, all four *Apis* species forage on *Dombeya* for nectar and pollen.

Suryanarayana, M.C., Rao, G.M. and Lakshmi, K. The sandal tree: a nectar source for *Apis cerana* and *Apis mellifera*. *Bee World* (1993) 74 (3) 108–110 [En, Bj]

The white sandalwood tree (*Santalum album*) is a small evergreen tree which is found in dry regions of peninsular India. It flowers profusely from May to August and provides a source of nectar for honey bees (*Apis cerana*, *A. mellifera*) in what can be a dearth period. Pollen analysis of honeys derived from *S. album* nectar revealed seven pollen types in *A. cerana* honey from Tamil Nadu, and 20 pollen types in *A. mellifera* honey from Latur, Maharashtra. *A. florea*, *A. dorsata* and *Trigona iridipennis* have also been observed foraging for nectar on *S. album*. D.G. Lowe

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Suryanarayana, M.C., Rao, G.M. and Phadke, R.P. Plant propagation, beekeeping and pollination. *Indian Bee Journal* (1983) 45 (2/3) 64–66 [En, B]

Includes a list of 16 bee plants useful in forestry.

Suryanarayana, M.C., Rao, G.M. and Singh, T.S.M.S. Coconut palm – a pollen and nectar source to honey bees. *Indian Bee Journal* (1990) 52 (1–4) 41–43 [En, Bj]

The value of *Cocos nucifera* to honey bees was studied at five locations (four states) in India. *A. cerana* nests in trunk cavities of the coconut palm, and *A. dorsata* builds nests down from the rachis of the leaf. *A. florea* may also nest in the palm. P. Walker

Central Bee Research & Training Institute, Khadi & Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Suryanarayana, M.C., Rao, G.M. and Singh, T.S.M.S. Studies on pollen sources for *Apis cerana* Fabr. and *Apis mellifera* L. bees at Muzaffarpur, Bihar, India. *Apidologie* (1992) 23 (1) 33–46 [En, fr\ de, Bj]

Pollen sources in this area, in 1987–1989, were identified by botanical surveys, observations on foraging bees and analyses of pollen loads brought back to hives. A total of 55 pollen sources were identified to species, genus or family; 48 of these sources were visited by *A. mellifera* and 40 by *A. cerana*. For both honey bee species the most important pollen source was *Zea mays*; the value of each pollen

source is estimated. Each bee species collected pollen from 13 anemophilous plant species. Peaks in pollen availability occurred from January to May and in November; July–August was a dearth period. *P. Walker*
Khadi and Village Industries Commission, Central Bee Research and Training Institute, 1153 Ganeshkhind Road, Pune 411 016, India.

Suryanarayana, M.C. and Singh, T.S.S. *Parthenium hysterophorus* – a pollen source to *Apis mellifera*. *Bee World* (1989) 70 (3) 127–129 [En, Bj]
A common weed in India.

Swaminathan, R. and Bhardwaj, S.C. *Bee pollinators of sunflower and their foraging behaviour*. *Indian Bee Journal* (1982) 44 (2) 32–34 [En, B]

On sunflower fields in Udaipur, India, the most frequent visitor to flower heads was *Apis dorsata* (81% of all visits observed). Other bee species recorded on the flowers included *A. florea* (8%), *Pithitis smaragdula* (2%), *Trigona fuscobalteata* (2%), *Bombus mixta* (2%), and two *Lasioglossum* species. Bees foraged on the crop from 06.00–20.00 hours. *A. dorsata* was most active during the first two hours and the last two hours of the day. In the morning, a bee spent 75 s on each flower, but afternoon visits (14.00–16.00 hours) lasted only 48 seconds (mean values). One reason may be that *A. florea*, which was most active during this afternoon period, may have been in competition with *A. dorsata*. *P. Walker*
Dept. Entomology, Rajasthan Coll. Agric., Udaipur, India.

Tanda, A.S. *Assessing the role of honey bees in a field of Asiatic cotton (Gossypium arboreum L.)*. *American Bee Journal* (1983) 123 (8) 593–594 [En, B]

Insect visitors to this important crop in Punjab, India, included honeybees, other bees, butterflies and *scoliids* wasps. For honeybees, the average numbers of flowers visited per foraging trip were: *Apis cerana*, 124; *A. mellifera*, 87; *A. dorsata*, 94. The maximum numbers of flowers visited per minute by these bees were 4.6, 5.7 and 5.5 respectively. Boll retention on flowers known to have been pollinated by honeybees was 57–62%, on flowers pollinated by other insects it was 50%, and on self-pollinated flowers 30%. Cotton quality was significantly higher in bee-pollinated bolls. *P. Walker*
Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Tanda, A.S. and Goyal, N.P. *Preliminary observations on the effect of intervarietal bee pollination of desi cotton (Gossypium arboreum Linn.)*. *Indian Journal of Entomology* (1979) 41 (3) 281–282 [En, B]

Honeybees (*Apis mellifera* or *A. cerana*) were introduced to cages containing 20 flowering plants of the variety G27 and 20 of LD133; the number of bolls set on 20 plants was 193 (*A. mellifera*) and 191 (*A. cerana*) compared with 160 on plants caged without bees, and 164 on uncaged plants. Seed yields were also higher on plants caged with bees. *P. Walker*

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Tanda, A.S. and Goyal, N.P. *Some observations on the behavior of *Apis mellifera* Linn. and *Apis cerana indica**

***Fabr. workers in a field of desi cotton (Gossypium arboreum Linn.)*.** *American Bee Journal* (1979) 119 (2) 106 [En, B]

Of marked foragers observed from 9 hours until 17 hours, *A. cerana* individuals made more trips (average 14) than *A. mellifera* foragers (average 12). The latter were inactive for about two hours in the middle of the day. Both species collected pollen in the morning and nectar in the afternoon, presumably because the flower dehisces only in the morning. The sugar concentration of the nectar rose from 24% at nine hours to 33% at 15 hours, then dropped to 30%. *P. Walker*

Dept. Entomology, Punjab Agric. Univ., Ludhiana, India.

Tanda, A.S. and Mann, G.S. *Honeybees (Apis mellifera) as pollinators of egg plant in Punjab, India. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 138 [En, B]

Honeybees improved pollination, thus increasing fruit set; the flowers were also visited by bumble bees, butterflies, *scoliids* and *syrphid* flies.

Tewari, G.N. and Kirti Singh. *Role of insect pollinators in vegetable seed production*. *Indian Bee Journal* (1983) 45 (2/3) 51 [En, B]

Pollination by honeybees and other insects of various *Cruciferae*, *Liliaceae*, *Chenopodiaceae* and *Solanaceae*.

Tewarson, N.C., Singh, A. and Engels, W. *Reproduction of Varroa jacobsoni in colonies of Apis cerana indica under natural and experimental conditions*. *Apidologie* (1992) 23 (2) 161–171 [En, fr\ de, Bj]

In the Allahabad area in northern India, *Varroa* infestation of drone and worker brood in *A. cerana* colonies was checked monthly. Natural reproduction of the mite occurred only in drone brood and in the spring (which starts in late January). When worker brood was artificially infested with mites, adult bees recognised and eliminated any mites introduced from other colonies, and even removed 75% of mites transferred within the same colony. Of the *Varroa* females left in the worker brood, about 90% were infertile. The significance of factors involved in resistance to *Varroa* in relation to reproduction is discussed with regard to a balanced host-parasite relationship. *P. Walker*

Department of Zoology, Ewing Christian College, Allahabad 211 003, India.

Thakar, C.V. *Experiments on pollination of sunflower*. *Indian Bee Journal* (1974) 36 (1–4) 36–38 [En, B]

In preliminary trials, seed yields on open plots with a high density of bees were 4–6 times as high as yields from plants caged to exclude bees. *P. Walker*

Central Bee Res. Inst., Khadi & Village Industries Commission, Poona 4, India.

Thakar, C.V. *The beekeeping development and research programme of the Khadi and Village Industries Commission, India. Apiculture in tropical climates, editor E. Crane*. London, UK; International Bee Research Association. (1976) 125–134 [En, B]

Accounts are given of the organisation of the Commission, and of the beekeeping industry in India. The beekeeping development programme operates through local sub-stations, model apiaries, assistance towards migration, honey house construction, comb foundation mills, training, seminars and exhibitions. Starting in 1953, modern beekeeping had been established in 37,000 villages by 1974, and the annual honey production thereby increased from 1280 kg to 2,321,000 kg. The research programmes reported include one on honey production using *Apis dorsata*. E. E. Crane

Khadi and Village Indus. Commission, Bombay 400 056, India.

Thakar, C.V. Beekeeping technology: its pace and plans. *Indian Bee Journal* (1976) 38 (1-4) 23-28 [En, B]
Reprinted from Jagriti 1 December 1975.

Thakar, C.V. Practical aspects of bee management in India with *Apis cerana indica*. Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 51-59 [En, B]

Four main regions of India (shown on a map) are described from the beekeeping point of view; also beekeeping equipment; diseases and enemies and their control; honey characteristics; and the work of the All-India Khadi and Village Industries Commission. Annual honey yields are mainly 4-20 kg per hive. In India there are 143,065 beekeepers, with 545,068 modern hives (of *Apis cerana*), yielding 2345 tonnes of honey a year. E. E. Crane

Khadi and Village Indus. Commission, Bombay 400 056, India.

Thakar, C.V., Garg, R. and Sharma, O.P. Vertebrate enemies of bees and their control in Dhauladhar mountains (Himachal Pradesh, India). *Indian Bee Journal* (1981) 43 (4) 112-113 [En, B]

Apis cerana colonies are kept in apiaries at altitudes up to 2500 m, but damage is caused by bears and pine martens particularly in the autumn and winter. Of various control methods tested, the best for small apiaries (up to 16 hives) was the erection of a cheap 4-walled roofed enclosure; for beekeepers with very few colonies the use of hives in a wall of the dwelling house is recommended. P. Walker
Bee Res. Stn., Himachal Pradesh Agric. Univ., Nagrota Bagwan (Kangra) 176 047, India.

Thakar, C.V., Kashyap, N.P and Dogra, G.S. Relative toxicity of some pesticides against Italian bees, *Apis mellifera*. *Indian Bee Journal* (1981) 43 (4) 101-103 [En, B]

Laboratory toxicity of 5 organophosphates was tested by exposing honeybees to residue films in a petri dish (based on a method proposed by Gaitonde (1979), with slight modifications). Compared with endosulfan (LC50 1178 ppm), fenitrothion 50EC and fenthion were highly toxic with LC50 values of 46 and 50 ppm respectively; trichlorfon (573) and hinosan (310) were moderately toxic. P. Walker

Dept. Entomology, Himachal Pradesh Agric. Univ., Palampur 176 062, India.

Thakur, A.K. and Sharma, O.P. The spider as bee enemy. *Journal of the Bombay Natural History Society* (1984) 81 (1) 208-211 [En, B]

Webs belonging to *Nephila kuhlii* became very numerous in an Indian apiary during the monsoon and autumn period. The webs were located amongst shrubs at a height of 5 m and up to 13 m in surrounding trees. They were either round, square or pentagonal and about 1 m across. An average of ten foraging honeybees (*Apis mellifera*) were trapped in each web every day. This represented a loss of 5% of the total bee population. The problem was effectively controlled by spraying webs with water-spray jets once in August and again in late autumn, and by increasing the distance between shrubs and bushes. J.M. Gedye
Dept. Entomology-Apiculture, H.P. Agric. Univ., Palampur, Himachal Pradesh 176 062, India.

Thakur, A.K., Sharma, O.P., Garg, R. and Dogra, G.S. Comparative studies on foraging behaviour of *Apis mellifera* and *A. cerana indica* on mustard. *Indian Bee Journal* (1982) 44 (4) 91-92 [En, B]

Foraging bees were counted as they returned to three hives of *A. mellifera* and three of *A. cerana* on a field of *Brassica campestris* var. sarson (also called sarson) in Himachal Pradesh, India, in the third week of February, 1981. During the morning, counts of *A. cerana* were higher than those of *A. mellifera*, but in both species a similar peak (over 300 bees returning in 5 minutes) was reached at around noon. After 14.00 hours counts of *A. mellifera* were higher than those of *A. cerana*; both species had smaller peaks of foraging activity at about 14.00 and 15.30 hours. The latter peak may have been caused by water foragers. In both species there were more pollen foragers in the morning than in the afternoon; for *A. mellifera* they constituted a maximum of 29% of total foragers at 10.30 hours, and for *A. cerana* 27% at 10.00 hours. P. Walker

Dept. Entomology, Himachal Pradesh Agric. Univ., Palampur 176 062, India.

Thakur, R.K., Dogra, G.S. and Gupta, J.K. Investigation on factors influencing queen rearing success in honey bee, *Apis mellifera* L. *Pest Management and Economic Zoology* (98) 6 (1) 61-63 [En, X]

Dept of Entomology & Apiculture, Dr Y.S. Parmar Univ. of Horticulture & Forestry, Solan, HP 173 230, India.

Thakur, S.S, Goel, A.K, and Kashyap, N.P. Plastic thermo-col bee hive. *Insect Environment* (2000) 5 (4) 158 [En, X]

Dept of Entomology and Agricultural Engineering, HPKV, Palampur (HP), India.

The hive was designed for *Apis mellifera* in Himachal Pradesh, India.

Thakur, S.S, Singh, H.B. and Kashyap, N.P. Comparative foraging efficiency of insect pollinators visiting turnip bloom. *Insect Environment* (2000) 5 (4) 168-169 [En, X]

The most frequent visitors were two *Eristalis* species, followed by *Apis cerana*

Dept of Entomology, HPKV, Palampur, Himachal Pradesh, India.

Thakur, S.S., Dhaliwal, H.S. and Kumar, J. Studies on pollen foraging behaviour of *Apis cerana* and *Apis mellifera* under mid-hill conditions of Himachal Pradesh. *Indian Bee Journal* (1995) 57 (2) 77–79 [En, Bj]

In April and May, the activities of marked pollen foragers were recorded. *A. cerana* made about 10 trips/day, each lasting 9.5–11.0 minutes on average; *A. mellifera* made only about seven trips/day, each lasting 15–17 minutes. *A. cerana* also spent about nine periods in the hive, averaging seven minutes, whereas *A. mellifera* had about six periods, each of 8–9.5 minutes. In a second experiment to determine the age of *A. cerana* pollen foragers, the range was found to be 25–46 days old, with a peak at 32 days of age. *P. Walker*

Department of Entomology and Apiculture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, India.

Thakur, S.S. and Kashyap, N.P. Wasp control by lure trap in apiary. *Insect Environment* (1996) 2 (1) 6–7 [En, 1 ref.]

Studies in Himachal Pradesh, India, showed that bait traps containing sucrose or fermented honey, followed by traps containing an insecticidal bait (Baygon [propoxur]) were effective in protecting *Apis cerana* against predation by *Vespa magnifica* [*V. mandarina magnifica*].

Department of Entomology Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062 (H.P.), India.

Thangaraja, A., Kumar, N. S. and Ganesan, V. Pollinators of a mimosoid legume, *Acacia nilotica*. *Insect Environment* (99) 5 (3) 119 [En, X]

Flower visitors included *Apis mellifera*.

Postgraduate Dept of Botany, Ayya Nadar Janaki Ammal College (Autonomous), Sivakasi, 626 124, India.

Thangaraja, A., Senthilkumar, N. and Ganesan, V. Foraging dynamics of floral visitors of *Tectona grandis* L.f. (Verbenaceae). *Insect Environment* (2001) 7 (3) 133–134 [En, X]

In a study in teak plantations in Western Ghats, India, nine flower visitors were observed including *Apis cerana indica*, *A. mellifera* and *Xylocopa* sp.

Centre for Research & PG Studies in Botany, Ayya Nadar Janaki Ammal College (Autonomous), Sivakasi, Tamil Nadu, India.

Tidke, J. A. and Patil, G. V. Floral biology and pollination of *Crotalaria sericea* Retz. *Environment and Ecology* (2000) 18 (4) 1020–1022 [En, X]

Bees are cross-pollinators.

Dept of Botany, Vidya Bharati Mahavidyalaya, Amravati 444602, India.

Towne, W. F. Acoustic and visual cues in the dances of four honey bee species. *Behavioral Ecology and Sociobiology* (1985) 16 185–187 [En, Bc]

Dances were studied in observation colonies of *Apis cerana*, *A. dorsata* and *A. florea* at Pune, India, and of *A. mellifera* in the USA. *A. cerana* foragers produced sounds during the waggle run with a frequency of 290 Hz and an amplitude modulation rate of 30 bursts/s. These results are similar to those obtained for *A. mellifera*. In contrast, *A. florea* and *A.*

dorsata did not produce sounds during the waggle run, although about 1 in 10 *A. florea* dancers produced sounds with a frequency of 250 Hz between waggle runs. When dancing, *A. cerana* (like *A. mellifera*) waggles from side-to-side with the abdomen depressed; in contrast *A. florea* and *A. dorsata* elevate the abdomen during wagging and superimpose a pronounced dorso-ventral motion on the side-to-side wagging. It is possible that in these open-nesting species, the dance is detected tactilely and/or visually. In *A. dorsata* there is a poor tactile contact, and these bees may use only vision. 'Stop signals', previously reported for *A. mellifera* (*Apicultural Abstracts* 111/66), have now been recorded in the other 3 species at the following frequencies: *A. cerana*, 445 Hz; *A. florea*, 475 Hz; *A. dorsata*, 375 Hz (*A. mellifera* 300 Hz). These signals, produced by workers following a dancer, induce the dancer to pause and give nectar samples. *P. Walker*

Dept. Biology, Princeton Univ., Princeton, NJ 08544, USA.

Tripathi, K. L. Bee-keeping in West Bengal. *Indian Bee Journal* (1971) 33 (1/2) 23–28 [En, B]

Tripathi, K. L. Bee-keeping in West Bengal. *Indian Honey* (1980) 3 (9) 24–28 [En, B]

Underwood, B. A. Impact of human activities on the Himalayan honeybee, *Apis laboriosa*. *Honeybees in mountain agriculture* [edited by Verma, L. R. J. New Delhi, India; Oxford & IBH Publishing Co. (1992) 51–57 ISBN 81-204-0650-8 [En, Bdo]

The effects of honey hunting and the destruction of the forest habitat on *A. laboriosa* in Nepal are discussed. *D. G. Lowe*

Department of Entomology, Cornell University, Ithaca, NY, USA.

Usha, K. and Kandasamy, C. Comparative toxicity of certain pesticides to the honeybee *Apis indica* F. *Pest Management* (1986) (No. 1) 31–35 [En]

The toxicity of various insecticides to *A. cerana* was studied in the laboratory. Bees were exposed to surfaces treated with 0.15% carbaryl, 0.1% chlorpyrifos, 0.15% endosulfan, 0.06% methomyl, 0.13% monocrotophos, 0.1% phosalone, 0.15% triazophos, 0.003% deltamethrin, 0.02% fenvalerate and 0.015% cypermethrin for 30 minutes. Endosulfan and phosalone caused the lowest mortality 24 hours after exposure (56.7 and 60%, respectively) compared with the other treatments, which caused 93.3–100% mortality. Tests with other, newer insecticides revealed that after exposure for 90 min diflubenzuron was the safest, giving no mortality even at 10,000 ppm, followed by cartap (LC50 183.9 ppm), endosulfan (28.55 ppm), triazophos (14.38 ppm) and methomyl (0.58 ppm). It is suggested that diflubenzuron and cartap would be ideal for use in integrated pest management.

Fredrick Inst. Plant Protection & Toxicology, Padappai 601 301, Chingleput District, Tamil Nadu, India.

Vaidya, D. N. and Kumar, S. Toxicity of some insecticides to *Apis cerana* Fabr. foragers on treated bloom of rape-seed, *Brassica campestris* L. var. brown sarson. *Indian Bee Journal* (97) 59 (3) 141–143 [En, Bj]

Toxicities of eight insecticides applied to separate plots at recommended doses were determined. All insecticides killed all bees on day 1, and some killed all on day 2, but toxicity gradually decreased. Residual toxicity periods were: phosphamidon seven days; dimethoate, monocrotophos up to six days; endosulfan, quinalphos, methyl-demeton up to five days; malathion, fenvalerate up to four-days. *P. Walker*

Dept of Entomology, Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062, Himachal Pradesh, India.

Vaidya, D.N., Kumar, S. and Mehta, P.K. Repellency of some insecticides to *Apis mellifera* F. foragers on treated bloom of sarson, *Brassica campestris* L. var. brown sarson. *Annals of Biology* (Ludhiana) (1996) 12 (1) 134–138 [En, 13 ref.]

Field studies were conducted in India to determine the repellent effect of eight insecticides to *Apis mellifera* foraging on sprayed blooms of sarson. Malathion (0.05%) was repellent for five days and fenvalerate (0.01%) for three days, whereas endosulfan (0.06%), quinalphos (0.05%), dimethoate (0.03%), methyl-demeton [demeton-methyl] (0.025%), monocrotophos (0.036%) and phosphamidon (0.03%) repelled bees for up to four days. Persistence Repellency values indicated that fenvalerate, phosphamidon and monocrotophos were the least repellent insecticides.

Department of Entomology, Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 002, India.

Varadhrajan, M., Thiyaagesan, K., Selvakumar, R. and Srinivas, G. Common herbs, *Justicia simplex* and *Oldenlandia umbellata*, nectar sources for *Apis florea* F. *Indian Bee Journal* (2000) 62 (3–4) 29–33 [En, B]

A. florea visited both species to collect nectar; numbers of bees were higher on *J. simplex*, with a peak between 10.00 and 13.00 hours. On average, a bee visited 16.9 flowers of this species/min., and 19.4 flowers of *O. umbellata*/min. *P. Walker*

Dept of Zoology and Div. of Wildlife Biology, AVC College, Mannampandal 609305, Tamil Nadu, India.

Varadhrajan, M., Thiyaagesan, K., Selvakumar, R. and Srinivas, G. Common herbs, *Justicia simplex* and *Oldenlandia umbellata*, nectar sources for *Apis florea* F. *Indian Bee Journal* (2000) 62 (3–4) 29–33 [En, B]

A. florea visited both species to collect nectar; numbers of bees were higher on *J. simplex*, with a peak between 10.00 and 13.00 hours. On average, a bee visited 16.9 flowers of this species/min., and 19.4 flowers of *O. umbellata*/min.

Dept of Zoology and Div. of Wildlife Biology, AVC College, Mannampandal 609305, Tamil Nadu, India.

Vasanthi, G. Pollen of the South Indian hills. [Pollen des montagnes du sud de l'Inde.]. *Travaux de la Section Scientifique et Technique*, Institut Francais de Pondichery (1976) 15 74 pp. + 36 pl. [Fr, en, B]

Pollen grains of 124 dicotyledonous species, some of them bee forage plants, are described.

Vasudeva Rao, M.K. and Chakrabarty, T. Two more plants used in gathering honey. *Journal of Economic and Taxonomic Botany* (1985) 7 (3) 643–644 [En, Bb]

Knowledge of the use of plant saps to repel honeybees during honey hunting is reviewed, and a brief account of the use of *Amomum fenclii* for this purpose by the Shompen people of the Nicobar Islands is given. *D. G. Lowe*

Botanical Survey of India, Andaman-Nicobar Circle, Port Blair 744102, India.

Veeresh, G.K. Importance of bees in pollination of crops. Thai sacbrood disease of the Indian honey bee and problems and prospects of establishing the European bee (*Apis mellifera*) in Karnataka. *Proceedings of a workshop, 15th June, 1994, Bangalore, India* [edited by Veeresh, G. K.]. Bangalore, India; Institution of Agricultural Technologists. (1994) 14–16 [En, Bd]

This review mentions some of the important crops grown in India that are pollinated by honey bees. It also refers to some comparative studies of the pollinating behaviour of *Apis mellifera* and *A. cerana*. *P. Walker*

UAS, GKVK, Bangalore 560 065, India.

Veeresh, G.K., Shaanker, R.U. and Ganeshaiah, K.N. (eds). Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) xv + 359 pp. [En, Bd]

The proceedings are divided into the following seven sections: flower biology in relation to pollination (23 papers); insect behaviour in relation to pollination (37 papers); insect pollination in commercial production of seeds and fruits (23 papers); pollination problems and conservation and management of pollinators (12 papers); population dynamics of pollinators (five papers); pollination biology – an Indian perspective (eight papers). Of the 108 contributions, 43 concern honey bees (*Apis* spp.) and 20 deal with other species of bees (*Apoidea*). The papers vary in length from short abstracts to reviews of several pages. There is an author index. *D. G. Lowe*

Veeresh, G.K. (ed.). Thai sacbrood disease of the Indian honey bee and problems and prospects of establishing the European bee *Apis mellifera* in Karnataka. *Proceedings of a workshop, 15th June, 1994, Bangalore, India*. Bangalore, India; Institution of Agricultural Technologists. (1994) v + 18 pp. [En, Bd]

This booklet was prepared for delegates at the workshop. It reviews the history and present status of Thai sac brood disease of Indian honey bees (*Apis cerana indica*) and discusses the possibilities of establishing *A. mellifera* in southern India. There is also an article on the Bangalore Beekeepers' Association. *D. G. Lowe*

Venkatesh, G. and Kumar, B.S.S. Adaptive strategies of giant honeybee *Apis dorsata* F. (Hymenoptera: Apidae) to some environmental conditions. *Environment and Ecology* (1996) 14 (4) 920–925 [En, Bb]

A. dorsata was studied in several habitats in and around Bangalore (359 colonies) and Patiala (106 colonies) during the period 1988–1995. Foraging behaviour was

affected by ambient temperature (T), RH, visibility and colony requirements. The number of water foragers was related to T. Certain types of flight pattern between nest site and food source were identified; they depended on the difference in height between the two sites. Colonies at urban nest sites were less aggressive than those in forest and wasteland areas. When disturbed by people, most colonies moved to a nearby site: 80% remained within the same habitat, and usually on the same support. If a colony was disturbed again, comb-building activity decreased in varying degrees. Nest sites were recorded on 20 different tree species and on various urban structures. Where streets were lit, bees foraged at fruit and sweet stalls as late as 21.30 hours. It is concluded that the bees are able to adapt to changes in their habitat, such as deforestation. *P. Walker*

Department of Zoology, Bangalore University, Bangalore 560056, India.

Venkatesh, G. and Raj, D. Distribution of bee flora, their abundance and blooming period with special reference to *Apis dorsata* F. Current Researches in Plant Sciences [edited by Sarma, T. A., Saini, S. S., Trivedi, M. L. and Sharma, M.]. Dehra Dun, India; Bishen Singh Mahendra Pal Singh (BSMPS). (1994) 191–196 [En, Bc]

Observations of foraging by *A. dorsata* in an area of Bangalore district, India, and examination of bees' pollen loads and honey sac contents, showed that 93 species of plants from 38 families provided nectar and/or pollen. These are listed, with their flowering periods. *D. G. Lowe*

Department of Zoology, Punjabi University, Patiala-147 002, India.

Venkatesh, G. and Reddy, C.C. Rates of swarming and absconding in the giant honey bee, *Apis dorsata* F. Proceedings of the Indian Academy of Sciences, Animal Sciences (1989) 98 (6) 425–430 [En, Bb]

Weekly counts of occupied and deserted *A. dorsata* nests were made at five nest sites in and around Bangalore during a 2-year study. The sites were monitored daily for the emergence and settling of swarms, and weekly for colonies that had absconded. The percentages of colonies swarming or absconding from a site during a year were very high. Swarming occurred during most of the year, with peaks in October–November and in April, but absconding was observed only in the period May–July. *P. Walker*

Department of Zoology, Bangalore University, Bangalore 560 056, India.

Venkatesh, G. and Reddy, C.C. Influence of comb age on migratory behaviour of *Apis dorsata* F. Social insects: an Indian perspective [edited by Veeresh, G. K., Kumar, A. R. V. and Shivashankar, T.]. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1990) 64–66 [En, Ba]

The migratory behaviour of *A. dorsata* colonies was recorded at eight nest sites (four in trees and four other) in and around Bangalore. The maximum number of colonies (362) was present in April and the minimum (80) in August. The main migration period was May–August. No migration occurred in colonies whose nests were less than

eight months old; migration was most frequent from 10-month-old nests. *P. Walker*

Department of Zoology, Bangalore University, Bangalore-560 056, India.

Venkatesh, G., Sharma, R., Raj, D. and Sehgal, J. Enumeration of plant species providing forage resources and resting site for *Apis dorsata* F. (Hymenoptera: Apidae). *Environment and Ecology* (1995) 13 (2) 344–347 [En, Bb]

Observations of plants foraged by *A. dorsata* in an area of Haryana, northern India, and examination of trapped foragers, showed that 104 species of plants from 37 families provided nectar and/or pollen. The species are listed, with their flowering periods; 50% of the species flower in April. Fifteen tree species on which *A. dorsata* built combs are also listed. *D. G. Lowe*

Department of Zoology, Punjabi University, Patiala 147002, India.

Verma, J.S., Kumar, N.R. and Ram Kumar. Brood rearing activities of *Apis cerana* Fabr. populations: effect of seasonal variations. *Pest Management and Economic Zoology* (97) 5 (1) 21–24 [En, 11 wf]

In a study at an apiary in a mid-hill region of Himachal Pradesh, India, high-hill (H) and mid-hill (M) *A. cerana* populations differed significantly from foothill (F) colonies in rate of egg laying by the queen, comb area with eggs and sealed brood area. H maintained max brood area during the summer (average 2340.7 cm²), followed by M (2000.5 cm²) and F (1590.5 cm²). During the winter, average brood area decreased to 732.0, 704.0 and 468.0 cm², respectively. Results are discussed in relation to climate and bee forage.

Dept of Entomology & Apiculture, Dr Y.S. Parmar Univ. of Horticulture & Forestry, Solan, HP 173 230, India.

Verma, L.R. Biological and economic characters of *Apis cerana indica* F. Honeybee Science (1986) 7 (4) 151–157 [Ja, en, Bj]

Morphological characteristics were measured in samples of *A. cerana* workers from three regions: Kashmir, Himachal Pradesh and Manipur. For 35 of the 55 measurements, significant differences were found between the samples, and it is therefore concluded that they belong to three distinct races or ecotypes. The foraging behaviours of *A. cerana* and *A. mellifera* on apple flowers were similar (time of beginning and ending of foraging activity, number of stigmas touched in one visit, time spent on a flower, flowers visited per minute, flight range). Both species were equally effective pollinators of self-sterile commercial cultivars. The mating behaviour of the two species was also compared. The absconding rate in *A. cerana* varied from 30% to 40% (a level comparable with that of Africanised bees); Kashmir bees were less prone to abscond than Himachal Pradesh bees. Thai sac brood disease is present in Nepal, Burma, China and northern India as well as Thailand; in affected areas, 90% of colonies have been killed. Efforts to control the spread have not been effective. *Author*

Dept. Bio-Sciences, Himachal Pradesh Univ., Shimla-171005, Himachal Pradesh, India

Verma, L. R. *Beekeeping and pollination ecology of mountain crops. Honeybees in mountain agriculture [edited by Verma, L. R.]*. New Delhi, India; Oxford & IBH Publishing Co. (1992) 69–89 ISBN 81-204-0650-8 [En, Bdo]

The effects of honey bee (*Apis mellifera*, *A. cerana*) pollination are discussed and previous work on the pollination of apple in the Shimla Hills of Himachal Pradesh, India, is summarised. Recommendations for apple pollination in the Hindu Kush-Himalayan region (200,000 ha are grown) are made. *D. G. Lowe*

International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Verma, L. R. *Potentials of Apis cerana as pollinator for increasing global food production. Pollination in tropics: Proceedings of the International Symposium on pollination in tropics, August 8–13, 1993, Bangalore, India [edited by Veeresh, G. K., Shaanker, R. U. and Ganeshiah, K. N.]*. Bangalore, India; International Union for the Study of Social Insects, Indian Chapter. (1993) 296–301 [En, Bd]

The advantages and disadvantages of keeping colonies of the native *Apis cerana* and imported *A. mellifera* in India are discussed. Pollination studies in apple orchards showed that *A. cerana* was active for longer than *A. mellifera* each day (13.10 hours compared with 12.28 hours) but had shorter foraging trips and did not collect pollen and nectar at the same time. There were no differences in the number of stigmas contacted per minute, time spent per flower or numbers of flowers and trees visited per foraging trip. The larger size of *A. mellifera* gave it a flight range double that of *A. cerana*. This might have the advantage of keeping *A. cerana* within the limits of the crop to be pollinated. *A. cerana* also foraged at lower temperatures. It is suggested that competition from the more aggressive and prolific *A. mellifera* could displace *A. cerana*. *J. M. Gedye*
International Centre for Integrated Mountain Development, P.O. Box 3226, Kathmandu, Nepal.

Verma, L. R. and Dulta, P. C. *Foraging behaviour of Apis cerana indica and Apis mellifera in pollinating apple flowers. Journal of Apicultural Research* (1986) 25 (4) 197–201 [En, Bb]

The foraging behaviour of *A. mellifera* and *A. cerana* on apple flowers was studied at three altitudes in the north-west Himalayas (1350, 1875 and 2400 m above sea level). Foragers of *A. mellifera* carried significantly heavier pollen loads, touched more stigmas and remained longer on individual apple flowers than those of *A. cerana*. Altitude affected the times of initiation and termination of foraging activity and the duration of a foraging trip but not other behavioural parameters such as preference for nectar or pollen, peak time of foraging, pollen load, number of stigmas touched or average time spent in visiting a flower.

Dept. Bio-Sciences, Himachal Pradesh Univ., Shimla 171005, India.

Verma, L. R., Rana, B. S. and Mattu, V. K. *Economic and biological characters of the Indian honey bee, Apis cerana Fabr.: effect of seasonal variations. Indian Bee Journal* (1988) 50 (2) 33–35 [En, Bj]

In 21 healthy *A. cerana* colonies studied in Himachal Pradesh, India, foraging and brood rearing continued for

almost the whole year, but with some seasonal variations. Honey and pollen stores in the hives were greater in summer (May–June) and autumn (September–October) than in other seasons. During spring (March–April) and summer and autumn, more brood was reared, and foraging activity was greater, than in winter (November–February) and in the rainy season (July–August). Honey and pollen flows were good in summer and autumn. *P. Walker*

Dept. Bio-Sci., Himachal Pradesh Univ., Shimla 171 005, India.

Verma, L. R., Rana, B. S. and Mattu, V. K. *Mating behaviour of Apis cerana Fab. and Apis mellifera Linn. in the Shimla hills of the northwest Himalayas. Journal of Insect Science* (1990) 3 (2) 130–132 [En]

Studies on the mating behaviour of honey bees at Shimla revealed that the number of pre-mating flights and age at the time of mating and at oviposition were higher in *A. mellifera* (7.67; 8.8 and 11.8 days) than in *A. cerana* queens (1.8; 6.6 and 9.87 days). However, duration of pre-mating flights and atmospheric temperature at the time of pre-mating and mating flights showed higher values for *A. cerana* (7.89 minutes; 24.2 and 24.3°C) as compared to those for *A. mellifera* (3.93 minutes; 21.2 and 21.1°C). Mating flights occurred a little earlier in the day in *A. mellifera* (12.45–14.00 hours) than in *A. cerana* queens (13.00–16.00 hours). Peak activity of drones occurred between 12.00 and 16.00 hours in *A. cerana*, whereas it was between 12.00 and 14.30 hours in *A. mellifera*. Drones of *A. cerana* took flight at higher temperatures (22.2°C) than those of *A. mellifera* (18.3°C).

Dept. Bio-Sciences, Himachal Pradesh University, Shimla-171 005, India.

Verma, L. R., Rana, B. S. and Verma, S. *Observations on Apis cerana colonies surviving from Thai sacbrood virus infestation. Apidologie* (1990) 21 (3) 169–174 [En, fr\ de, Bj]

Colonies that had recovered from Thai sac brood virus (TSBV) disease were collected in Himachal Pradesh, India, and fed with a suspension of TSBV in sugar syrup. Three colonies developed such severe disease symptoms that they had to be destroyed; 22 colonies with typical disease symptoms were reared through five generations, each of which was fed with TSBV. Parent colonies showed more severe symptoms, and took longer to recover, than subsequent generations; parent colonies also had a higher percentage of dead brood and showed some abnormal behaviour. No disease symptoms were observed in control *A. cerana* colonies fed only on sugar syrup, or in *A. mellifera* colonies fed with TSBV. *P. Walker*

Dept. Bio-Sci., HP Univ., Shimla 5, India.

Verma, L. R. and Rana, B. S. *Further studies on the behaviour of Apis cerana and Apis mellifera foraging on apple flowers. Journal of Apicultural Research* (1994) 33 (3) 175–179 [En, Bb]

Studies on the foraging behaviour of *Apis mellifera* and *A. cerana* on apple flowers were conducted in four orchards in the north-west Himalayan region, using marked bees. *A. mellifera* visited significantly more flowers (mean, 164–193) than *A. cerana* (mean 129–172) during single foraging trips at each site. There was no significant difference

between the species for number of flowers visited per minute. More bees of both species and at all sites foraged for pollen as 'top workers' in the morning than later in the day, when 'side working' (for nectar) was more prevalent. *A. mellifera* and *A. cerana* did not differ in the proportions of top or side worker bees at the three observation times, 09.00, 12.00 and 15.00 hours. On average, more bees were seen foraging on sunny than on shady sides of trees but these differences were not significant at all sites. Both species at each location preferred to forage on trees nearer to their hives. Bees tended to move to trees located in different rows rather than in same rows, presumably because rows were oriented up and down slopes. Both species showed the same floral fidelity during pollination: bees in all orchards carried pollen loads that were more than 95% apple pollen. *Author*

International Centre for Integrated Mountain Development (ICIMOD), GPO Box 3226, Kathmandu, Nepal.

Verma, L.R. (ed.). *Honeybees in mountain agriculture*. New Delhi, India; Oxford & IBH Publishing Co. (1992) viii + 274 pp. ISBN 81-204-0650-8 [En, Bdo]

This book contains the proceedings of the International Expert Meeting on Beekeeping Development in the Hindu Kush-Himalayan Region, held in Kathmandu, Nepal, on 21–23 June 1989. The main theme of the meeting was the role of apiculture in sustainable mountain agriculture. The general index includes names of authors and there is a separate index of scientific names. *D.G. Lowe*

International Centre for Integrated Mountain Development, GPO Box 3226, Kathmandu, Nepal.

Verma, S. and Sharma, A. *Effect of various parameters on queen rearing in *Apis cerana* F. in Himachal Pradesh, India*. *Indian Bee Journal* (97) 59 (3) 150–153 [En, Bj]

Beeswax queen cells (depth 8.9 mm, diameter 6.4 mm at base and 8.8 mm at top) were suitable for queen rearing. Acceptance of larvae 12 and 24 hours old was better than for older larvae. Acceptance levels were highest if cells were primed with pure or, preferably, diluted royal jelly, and if cells were grafted in groups of 6–12 in the spring. *Author*

Dept of Bio-Sciences, Himachal Pradesh Univ., Shimla 171 005, India.

Verma, S.C., Raj, D., Devi, N. and Srivastava, S. *Efficacy of *Apanteles galleriae* against wax moths in *Apis cerana* and *Apis mellifera* colonies*. *Indian Bee Journal* (97) 59 (4) 211–213 [En, Bj]

At three locations in Himachal Pradesh, *A. galleriae*, a parasite of wax moths, was released in colonies at a rate of one pair per seven wax moth larvae; after 15 days the percentage parasitisation of larvae was determined. It varied somewhat between locations, but was higher in *A. mellifera* than in *A. cerana* colonies. *P. Walker*

Dept of Entomology, Himachal Pradesh Krishi Vishwavidyalaya, Palampur 176 062, Himachal Pradesh, India.

Verma, S. *Studies on the foraging behaviour of *Apis cerana indica* Fab. in Jeolikote (Nainital, India)*. *Indian Bee Journal* (1983) 45 (1) 5–7 [En, B]

Foraging honeybees returning to four hives were observed from dawn to dusk at weekly intervals in 1980–81. The bees gathered pollen and nectar throughout the year, irrespective of climatic conditions. The numbers of pollen foragers returning to the hive were highest between 09.00 and 12.00 hours; the numbers of nectar foragers were highest between 10.00 and 15.00 hours. There was little foraging before 06.00 hours and little after 18.00 hours. Pollen foraging was highest in February–March and July–October, nectar foraging in February–April and October–November. Bee forage plants within a 2-km radius of the apiary were identified, and a table gives common/local name, botanical name, blossoming period and nectar/pollen source for 58 species. There is a pollen dearth in May–June and a nectar dearth in May–September and December–January. *D.G. Lowe*
Government Beekeeping Stn., Jeolikote, Nainital, Uttar Pradesh, India.

Verma, S. and Phogat, K.P.S. *Seasonal incidence of *Apis iridescent virus* in *Apis cerana indica* Fab. in Uttar Pradesh, India*. *Indian Bee Journal* (1982) 44 (2) 36–37 [En, B]

Verma, S. and Phogat, K.P.S. *Studies on the effect of water soluble vitamin 'C' on brood rearing and comb building activities of worker honey bees (*Apis cerana indica* F.)*. *Indian Bee Journal* (1982) 44 (3) 73 [En, B]

Groups of three colonies were fed with 50% sugar syrup containing 0%, 0.75%, 1.0% or 1.5% vitamin C. They were fed every five days from mid-September to late October. After 40 days, the greatest increases in brood and comb area were recorded in colonies given syrup with 0.75% vitamin C. Compared with control colonies (no vitamin C), test colonies foraged more actively and guarded the hive more vigorously against predatory wasps. *P. Walker*
Government Beekeeping Stn., Jeonkote, Nainital, Uttar Pradesh, India.

Verma, S.K. *Studies on the control of greater wax moth, *Galleria mellonella* L. in *Apis cerana* F. colonies with the biological insecticide, Dipel*. *Indian Bee Journal* (1995) 57 (3) 121–123 [En, Bj]

Dipel, a commercial formulation containing *Bacillus thuringiensis*, was tested in *A. cerana* colonies in Uttar Pradesh, India, which were experimentally infested with *G. mellonella*. Among six different treatments used, the highest wax moth mortality (98.7%) was recorded in colonies given fully drawn combs that had been sprayed with a suspension of 10 g Dipel in 1 litre of water. The insecticide remained effective for 5.5 months. A more economical method, which was almost as effective (94.7%), was to provide colonies with foundation that had been impregnated with Dipel by dipping in a suspension containing 100 g/litre. The insecticide was effective for 13 months. The mortality of bee brood was not increased by any of the Dipel treatments. During the study, *Achroia grisella* larvae caused some damage to combs, and it is concluded that Dipel is not effective against this species. *P. Walker*
Government Beekeeping Station, Jeolikote, District Nainital, India.

Verma, S.K. and Joshi, N.K. Intensity of bee diseases in Indian hive bee (*Apis cerana indica* Fabr.) in Uttar Pradesh. *Indian Bee Journal* (1985) 47 (1-4) 24-26 [En, Bj]

The incidence of *Acarapis woodi* and *Apis iridescent* virus were both highest in March, April and November, and lowest in February. The incidence of nosema disease was highest in September and October and lowest in February. Sac brood was present throughout the year, with highest levels during December, January and February, and lowest in October. *P. Walker*

Government Beekeeping Stn., Nainital, India.

Verma, S.K. and Joshi, N.K. Immunity to Thai sacbrood virus in *Apis cerana indica* Fabr. *Indian Bee Journal* (1988) 50 (1) 12 [En, Bj]

In January 1983 severe colony losses were caused in Uttar Pradesh by Thai sac brood. However, some colonies survived and from 16 of these a further 21 colonies were made by division. During a 2-year study, sac brood was found in all 37 colonies and 30 of them died. However, the others continued to develop, and it is concluded that these colonies had an immunity to the virus. *P. Walker*

Government Beekeeping Stn., Jeolikote, District Nainital, Uttar Pradesh, India.

Verma, S.K. and Phogat, K.P.S. Impact of pollination by honeybee (*Apis cerana indica*) on the yield gain of radish under valley conditions of Himalayan hills of U.P. (India). *Indian Bee Journal* (1994) 56 (3/4) 183-186 [En, Bj]

Govt. Beekeeping Station, Jeolikote Nainital, U.P., India.

Vidano, C. Bees and beekeeping in India [*Api e apicoltura in India*]. *Apicoltura Moderna* (1987) 78 (3) 91-101 [It, en, Bj]

Viraktamath, S., Lingappa, S., Kallesha, G.R., Holi, K.S. and Hunur, S. Comparative studies on pollen sources to *Trigona* sp., *Apis mellifera* L. and *Apis cerana* F. in Dharwad, Karnataka, India. *Indian Bee Journal* (99) 61 (1-4) 71-73 [En, Bj]

Pollen loads removed from returning foragers at regular intervals were analysed, and results showed that in each week of the 4-month study *Trigona* used different pollen sources from the two *Apis* species. Pollen sources used by *A. mellifera* and *A. cerana* overlapped a little, but overall it is concluded that there was no competition between the three species.

Dept of Agricultural Entomology, Univ. of Agricultural Sciences, Dharwad 580005, Karnataka, India.

Viraktamath, S. Incidence of greater wax moth *Galleria mellonella* (L.) in three species of honey bees. *Indian Bee Journal* (1989) 51 (4) 139-140 [En, Bj]

Apis cerana colonies in a small apiary in Karnataka, India, were inspected every 8-10 days for the presence of *G. mellonella*. Its eggs were found from March until August, with a maximum of 312 eggs (total in three colonies) in July; four colonies were still uninfested. Larvae were present in some colonies throughout the year, with a maximum during May-August (dearth period for honey bees). Six colonies, some of which were infested with wax moth, absconded during this period. Combs of wild colonies of *A. cerana*, *A. dorsata* and *A. florea* were also examined imme-

diately after colonies had left them. All 15 *A. dorsata* combs examined were infested, with a mean of 23 larvae and 0.8 pupae per 225 cm² of comb. In *A. cerana* and *A. florea* combs, the numbers of larvae present were lower (eight and two on average, respectively), and no pupae were found. *P. Walker*
Section of Zoology, College of Agricultural Engineering, University of Agricultural Sciences, Raichur Campus, 584 101 Karnataka, India.

Viraktamath, S. Nesting behaviour of rockbees, *Apis dorsata* Fabr. in Raichur, Karnataka. *Indian Bee Journal* (1989) 51 (4) 133-134 [En, Bj]

In a 142-ha study site, one *Ficus* sp. tree had 22 *A. dorsata* nests in 1987 and 25 in 1988; other nests were seen on *Cocos nucifera* (1), *Pithecellobium dulce* (2), *Delonix* sp. (3), *Syzygium cumini* (2), *Psidium guajava* (1). Comb size ranged from 110 x 60 x 4 cm to 45 x 32 x 3.5 cm. Although the trees had well spread branches in all directions, 95% of the nests were constructed in north-west and south-west directions. Colonies started to arrive at the site during early October and numbers increased until March. Queen cells (up to eight per comb) were constructed on the edge of the comb in February-March. Many colonies left the site during the first half of May, and all had gone by June. Wax moths (*Galleria mellonella*) were found in 15 nests in 1987 and 19 in 1988, before the colonies left; after desertion all combs were found to be infested. There was no brood, and no stored honey or pollen left in the combs. It is suggested that wax moth infestation may be an important contributory cause of desertion. *P. Walker*

Section of Zoology, College of Agricultural Engineering, University of Agricultural Sciences, Raichur Campus 584101, India.

Vishwakam. Honey and mushroom: supplementary source of food and nutrition in Arunachal Pradesh. *Resource management perspective of Arunachal agriculture* (2002) 277-280 [En, X]

The three species of honey bees found in the Adi area of Arunachal Pradesh, India, are described, together with another group of bees that do not produce honey but are eaten raw by the children of the Adi tribe.

ICAR Research Complex for NEH Region, Arunachal Pradesh Centre, Basar-791 101, West Siang, India.

Wakhle, D.M., Pais, D.V.E. and Phadke, R.P. Design for honey processing unit. Part III. Testing of honey processing-cum-moisture-reduction unit. *Indian Bee Journal* (96) 58 (4) 193-195 [En, Bj]

The unit, described in Parts I and II [*Indian Bee Journal* (1995) 57 (3) 144-146 and (1996) 58 (1) 5-9], has been designed to reduce the water content of honey and to inactivate yeasts; a flow chart is included here. Results are reported of trials carried out on honeys of (A) *Apis mellifera*, (B) *A. dorsata* and (C) *A. cerana*. Initial water contents of 21.5% in A and 22.5% in C were reduced to 18.5%, and from 24.5% in B to 19.5%. Yeast counts of 2, 26 and 12 x 10⁶/g in A, B and C, respectively, were reduced to zero. Changes in HMF content and amylase number were insignificant. The unit can process 300 kg honey in eight hours. During the trials almost 71,000 kg were handled; costs of processing 100 t are set out.

Central Bee Res. & Training Inst., Khadi & Village Industries Commission, 1153 Ganeshkhind Rd., Pune 411 016, India.

Wakhle, D.M., Nair, K.S. and Phadke, R.P. Reduction of excess moisture in honey – I. A small scale unit. *Indian Bee Journal* (1988) 50 (4) 98–100 [En, B]

A simple small-scale unit was developed to reduce the water content of honey by causing water to evaporate from a thin film of honey. The honey from an overhead tank runs down onto a rotating stainless steel cone enclosed in an insulated chamber. Hot air (67–70°C) blown into the chamber heats the honey to 60–65°. In a trial with honey flowing at 15 kg/hours, water content was reduced from 25.5 to 22.5%. Yeasts present at a level of 15–16 million cells/g were destroyed by the treatment. The HMF level was increased from 6.0 to 13.0 mg/kg, i.e. well within the Codex Alimentarius Commission limit. *P. Walker*
Central Bee Res. & Training Inst., Khadi & Village Industries Commission, Pune 411 016, India.

Wakhle, D.M. and Phadke, R.P. Design for honey processing unit – Part I. *Indian Bee Journal* (1995) 57 (3) 144–146 [En, B]

The honey processing unit described comprises a pre-heating tank to raise the honey to 40°C, a stainless steel honey pump (40–100 l/hours), a filtering unit with a 80-microm mesh polypropylene microfilter, a processing unit in which the honey is passed through a spiral heating coil immersed in water at 65–70°, a cooling tank with a spiral coil immersed in cold water, and a stainless steel settling tank. Materials and specifications for the components are given. *D.G. Lowe*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411016, India.

Wakhle, D.M. and Phadke, R.P. A note on 'Expiry Date' for honey under Agmark grading. *Indian Bee Journal* (1995) 57 (3) 135–137 [En, B]

Under the Agmark system for guaranteeing purity and quality of product, honey has to be given an expiry date of 18 months from the date of packing. The author discusses the changes that take place in honey during storage and argues that this requirement for an expiry date is unjustified. *D.G. Lowe*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Wakhle, D.M., Phadke, R.P., Pais, D.V.E. and Nair, K.S. Design for honey processing unit. Part II. *Indian Bee Journal* (1996) 58 (1) 5–9 [En, B]

The honey processing unit described includes a falling film evaporator, condenser, condensate collector and vacuum pump, in addition to the components described in Part I of this paper [*Indian Bee Journal* (1995) 57 (3) 144–146]. A figure shows the layout of the unit and a table gives the materials and specifications of the individual components. After pre-heating and microfiltering, honey passes through a heat exchanger (60–65°C) to destroy osmophilic yeasts. The honey then enters another heat exchanger (60°) where thin films of honey fall under vacuum and water is

removed. Water content is reduced by 3–5%; in different conditions, it could be reduced by up to 7%. Construction and operating costs of the unit are low. *P. Walker*

Central Bee Research and Training Institute, Khadi and Village Industries Commission, 1153 Ganeshkhind Road, Pune 411 016, India.

Williams, I.H. Behaviour of insects foraging on pigeon pea (*Cajanus cajan* (L.) Millsp.) in India. *Tropical Agriculture* (1977) 54 (4) 353–363 [En, B]

Of the 48 insect species (of seven orders) captured on *C. cajan* flowers on four plots, *Megachile* species accounted for 31% of the total number of insects caught, and *Apis dorsata* for 4.5%; a single *Apis florea* was caught. Bees collected both nectar and pollen from the flowers. The foraging behaviour of *A. dorsata*, *A. florea*, *Megachile* spp. and *Xylocopa* spp. was observed on a fifth plot, and is described in detail. *A. dorsata* and *Megachile* spp. discriminated between a cultivar with flowers of normal structure (preferred by *Megachile*) and one with flowers of a modified structure (preferred by *A. dorsata*). Although most insects carried some *C. cajan* pollen, it is thought that *Megachile* spp. are responsible for most of the cross-pollination which occurs. The *Apis* species obtained nectar and pollen only with difficulty from normal flowers. *D.G. Lowe*
Rothamsted Exper. Stn., Harpenden, Herts., UK.

Williams, I.H. The pollination of pigeon pea (*Cajanus cajan* (L.) Millsp.) in India. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February–4 March 1980. (1983) 661–666 [En, B]

Observations were made on *C. cajan* growing near Hyderabad, India, in 1975 and 1977. Many insects visited the flowers, but because of their foraging behaviour and high populations bees were regarded as particularly important visitors and potential pollinators. More flowers visited by *Apis dorsata* set pods than those not visited, but attempts to increase the number of pollinators on a plot by introducing *A. cerana* colonies were not successful. Rothamsted Exp. Stn., Harpenden, Herts. AL5 2JA, UK.

Williams, P.H. The bumble bees of the Kashmir Himalaya (Hymenoptera: Apidae, Bombini). *Bulletin of the British Museum (Natural History), Entomology* (1991) 60 (1) 1–204 ISBN 0-565-06041-4 [En, Bd]

Bumble bees (*Bombus* spp.) from Kashmir have been listed previously under 80 names, but for the broadest interpretations of these species, more than 500 names have been published for differing individuals from throughout their distributions. In this review, all of the available voucher material from Kashmir (6,312 museum specimens from 78 sites) is assigned to 29 species. The reduction in the number of nominal taxa that are inferred to represent separate species depends on two factors. First, variation was examined among the larger samples of new material. Second, current species concepts require a reassessment of this evidence for the limits of reproductive cohesion in space and time. A particular study was made of the variation in male mate-searching behaviour and of its relationship to different kinds of habitat. For *Bombus asiaticus*, patterns of colour variation across the Great Himalaya are compared

with those expected from simple genetic models. Type material was examined for 103 of the nominal specific and subspecific taxa. Seventeen lectotypes are designated and 80 new synonyms and provisional new synonyms are established. Keys to the species are accompanied by diagrams of the colour patterns and by distribution maps. *Author*
c/o Department of Entomology, British Museum (Natural History), Cromwell Road, South Kensington, London SW7 5BD, UK.

Woyke, J. *Work of the Central Bee Research Institute in India.* *Indian Bee Journal* (1973) 35 (1-4) 55-59 [En, B]

Yadav, A.R. and Balasubrahmanyam, N. *Some studies on suitability of plastics for honey packaging.* *Indian Bee Journal* (99) 61 (1-4) 11-18 [En, B]

Honey samples were stored in glass or one of two other rigid containers, or in one of four flexible packages. At 38° and 30-40% RH, honey kept its quality when stored for 90 days in glass, HDPE, PET or PET/foil/poly, but for only 60 days in the other materials; at 27° and 65% RH, shelf life was more than 240 days in glass, HDPE or PET, but only up to 120 days in other materials. *Author*
Food Packaging Technology Dept, CTFRI, Mysore, Karnataka, India.

Yesuvadian, M.S. *Scope of a honey concentration equipment.* *Indian Honey* (1978) 1 (1) 6-10 [En, B]

The Indian Standard for honey and the Agmark specification allow a moisture content of up to 25% for the standard grade, but traders are unwilling to buy such honey as it is likely to ferment. There is also much honey produced in India with a moisture content of 25-30%. The saleability of this honey can be improved by treating it in equipment developed by the Indian Institute of Honey. The honey is heated, e.g. to 140°F [60°C] for 30 minutes, to destroy any yeasts present; excess water is afterwards removed under vacuum. *P. Walker*
Central Bee Res. Inst., Khadi and Village Indus. Commission, Poona 411 004, India.

Yesuvadian, M.S. *New dimensions for beekeeping in North India.* *Indian Honey* (1982) 4 (14) 1-4 [En, B]

Yesuvadian, M.S., Aruldas, G. and Christopher, M. *Strategy for apicultural extension in tropical climates.* *Indian Honey* (1980) 2 (5/6) 15-33 [En, B]

India, with its wide range of climate, is used as an example. Beekeeping statistics for tropical and non-tropical coun-

tries are compared; in 1977 the former produced 29% of the world's honey. Climate and natural vegetation are indicated for the following regions: equatorial (e.g. rubber production in Malaysia); tropical; savanna or Sudan type; hot desert. Methods and factors that should be considered when creating a strategy for apicultural extension are then considered, again with examples for India. *M. Nixon*
Indian Inst. Honey, Kuzhithurai-629163, Kanyakumari District., Tamil Nadu, India.

Yesuvadian, M.S. and Joshi, R.M. *Indian beekeeping: 25 years and hence.* *Indian Honey* (1982) 5 (15) 1-6 [En, B]

Yogeshwar Singh. *Nosema in Indian honey bee.* *Indian Bee Journal* (1974) 36 (1-4) 16 [En, B]

This appears to be the first report of the disease in *Apis cerana* (1974, in Pithoragarh, Uttar Pradesh).

Yogeshwar Singh. *Beekeeping in Uttar Pradesh – a review. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, 29 February – 4 March 1980.* (1983) 211-226 [En, B]

This review covers the following aspects: geography and climate; bee forage; honeybees (*Apis dorsata*, *A. cerana*, *A. florea*) and their seasonal cycles; traditional beekeeping; modern beekeeping, including hives, migratory beekeeping, diseases, enemies, pollination; honey types; development programmes; beekeeping potential and problems. *D.G. Lowe*

Dept. Horticulture & Fruit Utilization, Jeolikote, Uttar Pradesh, India.

Yogeshwar Singh and Verma, S.K. *Occurrence of acarine disease in Apis cerana indica in Uttar Pradesh (India).* *Indian Bee Journal* (1981) 43 (2) 37-39 [En, B]

Yogeshwar Singh. *Pollination activity on strawberry at Jeolikote (District Nainital, India).* *Indian Bee Journal* (1979) 41 (1/2) 17-19 [En, B]

The commonest visitor to flowering strawberry (vars. Jeolikote Local and Red Coat) was *Apis cerana*; some bumble bees and other insects were also observed. The honeybees visited Jeolikote Local from 7.00 hours and Red Coat from 8.00 hours; on both there was maximum activity at 9.00 hours and at 14.00 hours, but few bees were seen after 16.00 hours. Jeolikote Local was more attractive to *A. cerana* than Red Coat. *P. Walker*

Government Bee Keeping Stn., Jeolikote, District Nainital, Uttar Pradesh, India.

Jamaica

Bianco, J.K. *Beekeeping in Jamaica.* Kingston, Jamaica; Peace Corps. (1985) 108 pp. [En, B]
Simple textbook for Jamaican beekeepers.

Cobey, S. *Jamaican beekeepers hope to improve their beekeeping industry with an eye on the international market.* *American Bee Journal* (1989) 129 (11) 714-716, 744 [En, B]

Free, J.B. *Observations on the pollination of papaya (Carica papaya L.) in Jamaica.* *Tropical Agriculture* (1975) 52 (3) 275-279 [En, B]

Hand pollination failed to increase the fruit set by papaya flowers in January and February, indicating that set was not limited by lack of pollination. Bagging pistillate flowers to prevent pollination did not diminish set greatly, if at all. Bagging hermaphrodite flowers also failed to provide

evidence that pollination is necessary, although more experiments are needed. Trees with pistillate flowers only had a greater set and carried more developing fruits than trees with hermaphrodite flowers. At dusk the flowers were visited by many skipper butterflies, *Perichares philetes* philetes. *Author*

Rothamsted Exp. Stn., Harpenden, Herts., UK.

Free, J.B. Pollination of *Capsicum frutescens* L. *Capsicum annum* L. and *Solanum melongena* L. (Solanaceae) in Jamaica. *Tropical Agriculture* (1975) 52 (4) 353–357 [En, B]

Evidence was obtained that fruit set and flower production by these plants are largely determined by the amount of fruit developing. Set occurred by auto self-pollination, and external agents did not appear to increase it greatly. The bee *Exomalopsis pulchella* visited all three species and was responsible for any cross-pollination that occurred. *E.E. Crane*

Rothamsted Exp. Stn., Harpenden, Herts., UK.

Free, J.B., Raw, A. and Williams, I.H. Pollination of coconut (*Cocos nucifera* L.) in Jamaica by honeybees and wasps. *Applied Animal Ethology* (1975) 1 213–223 [En, B]

Numerous wasps (*Polistes crinita*) visited male and female flowers for nectar, but carried little pollen on their bodies, especially when visiting female flowers. Many wasps foraged for several hours on only one or two female flowers, repelling other wasps and honeybees; hence their behaviour discouraged cross-pollination. Most honeybees visited male flowers, from which they usually collected pollen as well as nectar. The proportion of honeybees collecting pollen loads did not vary much with time of day. Few of the honeybees visiting female flowers had pollen loads, and, although they had less pollen on their bodies than honeybees visiting male flowers, they had more than wasps, and so were more likely to pollinate the flowers. *Author*

Rothamsted Exper. Stn., Harpenden, Herts., UK.

Free, J.B. and Williams, I.H. Insect pollination of *Anacardium occidentale* L., *Mangifera indica* L., *Blighia sapida* Koenig and *Persea americana* Mill. *Tropical Agriculture* (1976) 53 (2) 125–139 [En, B]

Flowers of these tropical crops (cashew, mango, akee and avocado) in Jamaica were visited by many *Polistes* wasps and by honeybees, which were less numerous but more efficient as pollinators than the wasps. In Jamaica and also in Kenya it was observed that mango and cashew were often less attractive to honeybees than other nearby crops. In Kenya, no wasps were seen on these two crops, but numerous ants visited them. When insect pollination of mango and cashew was prevented, fruit set was lower. The proportion of hermaphrodite flowers, yield and set of cashew, mango and akee, varied greatly from tree to tree. *Author*

Rothamsted Exp. Stn., Harpenden, Herts., UK.

Freeman, B.E. The distribution in Jamaica of the mud wasp *Sceliphron assimile* Dahlbom (*Sphecidae*) and its associates. *Caribbean Journal of Science* (1974) 14 (3/4) 115–124 [En, B]

S. assimile is usually found at altitudes below 1000 feet

[300 m]; it becomes progressively more common with decreasing altitude, except in humid areas. Various *Hymenoptera* nest in abandoned *S. assimile* cells, including the sphecid *Trypoxylon texense* and the bee *Megachile concinna*, which are found only in dry situations, and *Pachodynerus nasidens* (*Eumenidae*) and *Chalicodoma lanata* (*Megachilidae*), which are generally distributed. *Melittobia chalybii*, a eulophid, attacks all these aculeates. The mortality of *Sceliphron* caused by *Melittobia* is greater in western regions. *Author*

Dept. Zoology, Univ. West Indies, Mona, Jamaica.

James, O.B.O., Segree, W. and Ventura, A.K. Some anti-bacterial properties of Jamaican honey. *West Indian Medical Journal* (1972) 21 (1) 7–17 [En, B]

Six Jamaican honey samples were each incorporated in concentrations of 2, 10 or 20% into nutrient agar plates. Sixteen bacterial strains (Gram-positive and Gram-negative) were grown on the plates. After 48 hours there were no colonies on plates containing 10 or 20% honey, whereas plates without honey showed much growth. Other types of test (e.g. tube turbidity; settle plates) were not so satisfactory. The honeys varied in their antibacterial effect, which appeared to depend not only on high osmotic pressure, but also on other factors, including an enzyme-substrate system. *P. Walker*

Univ. West Indies, Mona, Kingston 7, Jamaica.

Jay, S.C. Sun position as a possible factor in the disorientation of honey bees (*Apis mellifera*) (Hymenoptera: Apidae). *Canadian Entomologist* (1971) 103 1111–1114 [En, B]

Rows of hives were arranged in squares with their entrances facing outwards (N S E W) within the temperate zone in Canada (at 49° 38' N, 97° 09' W) and within the tropical zone in Jamaica (at 18° 00', 76° 45' W). Bees tended to drift southward along rows facing east and west in the temperate zone during July and August, but not in the tropical zone during the period when the path of the sun passed through the zenith at midday (2 August 1969). In rows facing north or south, bees showed a greater tendency to drift westward in the tropical than in the temperate zone. It is suggested that sun position may influence the direction in which bees drift from one hive to another. *Author*

Dept. Entomology, Univ. Manitoba, Winnipeg, Manitoba, Canada.

Jayasingh, D.B. and Freeman, B.E. The comparative population dynamics of eight solitary bees and wasps (*Aculeata*; *Apocrita*; *Hymenoptera*) trap-nested in Jamaica. *Biotropica* (1980) 12 (3) 214–219 [En, B]

Over 9000 trap nests (hollow bamboo canes, and holes drilled in blocks of pinewood) were placed at suitable nesting sites; cells were built by solitary wasps or bees in over 2000 of them. The bee species were *Megachile zapitana*, *M. concinna* and *Chalicodoma rufipennis*. Mortality before emergence and the causes of it were studied; for the three bee species, mortality during development in trap nests was 58, 49 and 58%, respectively. In most of the bee and wasp species examined, the ratio of males to females in the cells was about 1:1, but in the two *Megachile* species it was about 2.5:1. Fecundity in the *Megachile* species was about

12 eggs per female, but for *C. rufipennis*, less than six eggs per female. P. Walker
Dept. Zoology, Univ. West Indies, Kingston 7, Jamaica.

Jayasingh, D.B. and Freeman, B.E. *Trap-nesting solitary aculeates (Insecta, Hymenoptera) in St. Catherine, Jamaica*. *Caribbean Journal of Science* (1980) 15 (3/4) 69–78 [En]
Of 9,158 trap-nests placed in St. Catherine, Jamaica, from January 1973 to January 1975, 2,705 of 6,083 recovered were used by 11 species, including the bees *Megachile zaptlana*, *M. concinna*, *Chalicodoma lanata*, *C. rufipennis* and *Centris crassipes*. Of aculeate Hymenoptera, *Pachodynerus nasidens* (Eumenidae), *Trypoxylon texense* (Sphecidae) and the megachilid bees *M. zaptlana* and *M. concinna* were the most numerous species. Although most species preferred the warm dry lowlands, several were also trapped in cool mountainous areas.
Dept. Zoology, Univ. West Indies, Mona 7, Jamaica.

Kay, E. *Observations on the pollination of Passiflora penduliflora*. *Biotropica* (2001) 33 (4) 709–713 [En, Bb]
The most frequent visitors observed on flowers in Jamaica were bats and hummingbirds, but one *Apis mellifera* was recorded collecting pollen without touching the stigmas. P. Walker
Dept of Biology, St Louis Univ., 3507 Laclede Ave, St Louis, Mo 63103, USA.

Keeler, K.H. *Distribution of plants with extrafloral nectaries and ants at two elevations in Jamaica*. *Biotropica* (1979) 11 (2) 152–154 [En]

Linsley, E.G. *Defensive behavior of male bees about plants not visited by their females (Hymenoptera, Apoidea)*. *Pan-Pacific Entomologist* (1976) 52 (2) 177–178 [En, B]
Male bees were observed during 1975 in defensive territories about plants not visited by the females: in Jamaica, *Centris crassipes* was seen protecting rose bushes 4–5 ft high [1.5 m]; *C. trigonoides subtarsata* was seen protecting a vine with blossoms 6–8 ft [1.8–2.4 m] above ground; in Arizona, *Ptiloglossa jonesi* was observed protecting *Cucurbita foetidissima* and driving away the usual pollinators of the flower. This behaviour may be affected by the conformation of the plant. E.G. Linsley
Div. Entomology & Parasitology, Univ. California, Berkeley, CA 94720, USA.

Matheson, A.G. *Options for beekeeping development: a Jamaican case study. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 104–108 [En, B]
The present state of Jamaican beekeeping is described, and proposals for development put forward in a recent feasibility study are discussed.

Parvin, K.B. and Woodruff, R.W. *Experiences with women beekeepers in Jamaica. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 317–321 ISBN 0-86098-196-7 [En, Bdo]

Percival, M. *Floral ecology of coastal scrub in southeast Jamaica*. *Biotropica* (1974) 6 (2) 104–129 [En, B]
Species flowering during the dry season (late December to early April) attracted three main pollinating agents: butterfly, solitary bee and hummingbird. The daily and seasonal rhythms of flower opening were synchronised with the activity of the pollinators. Butterflies and bees, which were active chiefly in the morning, visited flowers which bloomed only for half a day. The number of seeds per fruit and the pollen carrying capacity of the pollinator were correlated. Bees, which carried large amounts of pollen, tended to pollinate flowers with many seeds per fruit. Honeybees were present in the area although the whereabouts of the colony was unknown. They visited 21 species, mostly for nectar. When forage was scarce, the presence of honeybees appeared to be detrimental to native pollinators. J.M. Gedy
Dept. Botany, Univ. Coll., Cardiff, UK.

Raw, A. *Territoriality and scent marking by Centris males (Hymenoptera, Anthophoridae) in Jamaica*. *Behaviour* (1975) 54 (3/4) 311–321 [En, B]
C. dirrhoda males hovered little around food plants, and they marked their territories with scent from their (large) mandibular glands. *C. decolorata* males (among which a dominance hierarchy exists) behaved in a similar manner, though they performed less marking. *C. fasciata* males have small mandibular glands; they did not deposit scent, but hovered often around food plants. Males of *C. (Hemisiella) crassipes* marked their territories with a secretion, probably from the hind femoral glands. P. Walker
Dept. Biologia Vegetal, Univ. Brasilia, 70000 Brasilia, Brazil.

Raw, A. *Centris dirrhoda (Anthophoridae), the bee visiting West Indian cherry flowers (Malpighia punicifolia)*. *Revista de Biologia Tropical* (1979) 27 (2) 203–205 [En, es, B]
The flowers of members of the *Malpighiaceae* are pollinated by specialist pollinators: anthophorid bees with forelegs developed to collect oils from the flowers. In a Jamaican orchard of *M. punicifolia*, where fruit set was high, the most frequent visitors were *C. dirrhoda* females. They foraged from 09.00 to 13.00 hours, collecting both pollen and oils on the same trip. From observations on 20 individuals, it was calculated that on average a bee collected pollen from 26 flowers and oils from 41.8 flowers per minute. Pollen loads of *C. dirrhoda* females contained nearly 85% cherry pollen; pollen on honeybees foraging in the orchard was almost entirely from *Emilia* spp. and *Vernonia cinerea*, with none from cherry. Honeybees were not observed on the cherry flowers. P. Walker
Zoology Dept., Univ. West Indies, Kingston, Jamaica.

Raw, A. *Four new species of bees from Jamaica, West Indies (Hymenoptera)*. *Revista Brasileira de Entomologia* (1984) 28 (4) 491–496 [En]
Colletes montefragus, *Chelostomoides pedalis*, *C. jamaicae*, *Hyaleus royesi*.

Raw, A. *The nesting biology of nine species of Jamaican bees (Hymenoptera)*. *Revista Brasileira de Entomologia* (1984) 28 (4) 497–506 [En, Bb]

Biological data are presented on the following nine species of solitary bees from Jamaica: *Colletes montefragus*, *Halictus ligatus*, *Megachile concinna*, *M. zaplana*, *Chalicodoma lanata*, *Melissodes foxi*, *Paratetrapedia swainsonae*, *Centris fasciata* and *C. decolorata*. The data include the names of predators and of the flowers visited. Nests of eight species are illustrated and life tables are given for four species. *Author*
Lab. Ecologia, Univ. Brasilia, Brasilia, DF, Brazil.

Raw, A. *The ecology of Jamaican bees (Hymenoptera)*. *Revista Brasileira de Entomologia* (1985) 29 (1) 1–16 [En, Ba]
An attempt is made to explain the foraging strategies of the bees in Jamaica, which is an isolated, tropical ecosystem with a well documented flora and bee fauna. Of the 69 species of bees known from Jamaica, data are presented on the ecology of 42 which were observed visiting 63 genera of plants. Four aspects are considered to be important in the bees' ecological strategies: bee size, diet, seasonality and altitudinal distribution. Effects of mortality and recently introduced species are also taken into consideration. The Jamaican bee fauna is compared with that of Costa Rica studied by Heithaus. *Author*
Lab. Ecologia, Dept. Biologia Vegetal, Uni. Brasilia, Brasilia DF, Brazil.

Raw, A. and Free, J.B. *The pollination of coffee (Coffea arabica)* by honeybees. *Tropical Agriculture* (1977) 54 (4) 365–370 [En, B]

Coffee bushes in full sun, or partially shaded, were enclosed in nylon mesh cages 2.3 m high with or without honeybee colonies, and berry set and yields were com-

pared with those of uncaged bushes. The percentage of flowers that set beans initially differed little between treatments, but caging with bees increased the total crop of ripe berries by an average of 52% compared with caging without bees; yields from non-caged bushes were intermediate. These effects were more marked on bushes in full sun. Of the numerous insects captured from the flowers of non-caged bushes, honeybees were the most abundant.

P. Walker

Plant Protection Div., Min. Agric., Kingston, Jamaica.

Tanner, E.V.J. *Species diversity and reproductive mechanisms in Jamaican trees*. *Biological Journal of the Linnean Society* (1982) 18 (3) 263–278 [En, B]

The flowering of 56 species of trees growing in the forests at c. 1550 m in the western Blue Mountains in Jamaica was studied. Of these species 36 are hermaphrodite, 12 dioecious and eight dioecious, monoecious or polygamous. Pollination syndromes were also studied; 46 species are generalist, six wind-pollinated, one (perhaps two) bird-pollinated, and possibly two moth-pollinated. Generalist-type flowers are visited by a wide range of potential pollinators. Little is known about the insect pollinators in this habitat, except that honeybees are known to visit the tree species *Clusia havetioides*, *Cyrilla racemiflora*, *Eugenia virgul-tosa*, *Schefflera sciadophyllum*, *Vaccinium meridionale* and *Pittosporum undulatum*, the shrubs *Bocconia frutescens*, *Miconia theaezans* and *Palicourea alpina*, and also the herb *Phytolacca* sp. and the sedge *Rhyncospora jamaicensis*. *D.G. Lowe*

Botany School, Downing Street, Cambridge CB2 3EA, UK.

Kenya

Kenya, Ministry of Agriculture National Beekeeping Station. *The beekeepers guide book*. Nairobi, Kenya; Ministry of Agriculture, Kenya (98?) 82 pp. [En, Bdo]

This is a handbook written for use by agricultural extension staff and farmers in Kenya. Equipment is described and illustrated, including the Kenya top-bar hive. Other topics include: management of colonies; pests and diseases; hive products and processing; marketing and distribution. Each of the 16 short chapters gives basic information, clearly set out, with a few line drawings. *P. Walker*

Kenya, Ministry of Agriculture. *Top bar hive*. Leaflet, *Animal Production Division, Kenya Ministry of Agriculture*. (1973) 224 (No. 224) 4p pp. [En, B]

Kenya, Ministry of Agriculture National Beekeeping Station. *Annual report 1997*. Nairobi, Kenya; Ministry of Agriculture, Kenya (97) 49 pp. [En, Bdo]

Kenyan Ministry of Agriculture and Livestock Development *Nyuki Newsletter*. *First issue ever*. *Nyuki Newsletter* (1984) 1 (1) 31 pp. [En, B]

This is the first issue of a bulletin distributed free and requesting suggestions and criticisms from readers. Publication frequency, subscription rate, and details of

contents have yet to be decided. This issue includes letters to the editor, articles on the Kenya top-bar hive and bee-keeping co-operatives in Kenya, and stories and poems. *D.G. Lowe*

Beekeeping Branch, Min. Agric. & Livestock Development, PO Box 68228, Nairobi, Kenya.

International Conference on Apiculture in Tropical Climates, 3rd. *Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. London, UK; International Bee Research Association. (1985) 270 pp. ISBN 0-86098-117-0 [En, B]

This book contains the 50 papers presented at five conference sessions: apiculture and bee management problems in African countries; apiculture and bee management problems in tropical Asia, America and the Pacific; bees as pollinators, and their protection from insecticides and from diseases; hive products in the tropics, and their processing and marketing; apiculture in integrated rural development, and the special role of women. Most of the papers are reported separately in *Apicultural Abstracts*. The proceedings also include the texts of six addresses delivered at the opening and closing sessions, reports on round table discussions, and the 25 resolutions passed by the Conference. Participants, with addresses, are listed by

country, and the book has an author index and a country index. *P. Walker*

Food and Agriculture Organization of the United Nations, Agricultural Industries Division. *Tropical and sub-tropical apiculture*. Rome, Italy; Food and Agriculture Organization of the United Nations. *FAO Agricultural Services Bulletin* (1986) (No. 68) xiii + 283 pp. ISBN 92-5-102444-8 [En, Bdo]

The aim of this book is to provide a general introduction to beekeeping, but it is confined to those aspects necessary for an understanding of the problems of apiculture which are specific to the developing countries of the tropics and sub-tropics. It will be especially valuable to beekeepers in tropical countries, both those just beginning and those with more experience, and to apicultural and agricultural planners involved in development programmes. The contribution of many world experts to this comprehensive, well-illustrated FAO Bulletin, and the involvement of the International Bee Research Association during its preparation, are acknowledged. The plan of the book, and the subjects it covers, are outlined in the introductory chapter. Chapter 2 describes the species, races and strains of honeybees, their biology in the tropics, and the plants they forage on. The value of bees in pollination is emphasised. Chapter 3 describes the enemies of bees – diseases, parasites, predators, and man himself through his effects on the environment. Chapter 4 deals with honey hunting and traditional methods of beekeeping, including the construction and use of various hives. Transitional hives (the Kenya top-bar hive and the modified African long hive) are described in this chapter. Chapter 5 gives details of modern techniques for beekeeping with *Apis mellifera* and *A. cerana*; the aspects which are discussed include types of movable-frame hive, comb foundation, disease and pest control, colony management, and protective clothing and equipment. Honey, beeswax, and other hive products are the subject of Chapter 6, whilst Chapter 7 is devoted to a study of beekeeping economics in developing countries. A 'Bangladesh case study' is used to illustrate the principles involved. Chapter 8 considers the case history of a long-term programme for national beekeeping development in Tanzania, and discusses education, training, extension work, research, and their organisation. The final chapter describes technical assistance projects with examples of FAO schemes in Burma, El Salvador, and Tunisia. The four appendices give information on world honey plants, European Codex honey standards, beekeeping in the Kalahari (by B. Clauss), and pesticide toxicities. All the chapters include a guide to further reading, and there is a 12-page bibliography. *D. G. Lowe*

Kenya, Ministry of Agriculture, Livestock Development and Marketing. *Marketing of hive products: proceedings of the workshop held at the National Beekeeping Station Lenana, Nairobi on 9th April 1997*. Nairobi, Kenya; Ministry of Agriculture. (1997) 70 pp. [En, Bdo]

This workshop was held in order to increase awareness of beekeeping and the marketing of hive products. The nine papers which were presented covered beekeeping in Kenya, activities of the National Beekeeping Station, production and marketing of honey and beeswax in Kenya,

and the role of the Kenya Bureau of Standards in quality control of honey and beeswax. Recommendations and resolutions of the meeting concerning research, training, dissemination of information and marketing are listed.

West Virginia Department of Agriculture, Plant Pest Control Division. *The Kenya hive*. Charleston, WV, USA; Department of Agriculture. (1975?) 1 p. [En, B]

A detailed plan shows materials and measurements of the Kenya top-bar hive, and the text explains its advantages and its use in West Virginia.

Adams, J. *The long box hive and its operation in America*. Ashland, VA, USA; American-Kenya Research and Developing Corporation. (1984) iv + 129 pp. [En, B]

Anam, O. O. and Gathuru, E. M. *Melting point and saponification cloud point of adulterated beeswax. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 222–223 [En, B]

Results are given for the depression of melting point of beeswax by the addition of paraffin wax; for example, a beeswax sample melted at 65°C when pure, but at just above 60°C when it contained 8% paraffin wax (mp 59°C). Saponification cloud point of beeswax (temperature at which liquid beeswax becomes cloudy when cooled) was increased by the admixture of paraffin wax, e.g. from 63°C when pure to 70°C when adulterated with 8.8% paraffin wax (cloud point 54°C). It is suggested that both melting point and saponification cloud point should be measured in analyses to detect beeswax adulteration. *P. Walker*
Beekeeping Branch, Min. Agric. & Livestock Development
PO Box 30028, Nairobi, Kenya.

Andersson, E. and Pettersson, B. *Beekeeping in Taita Taveta [Kenya]*. Uppsala, Sweden; Sveriges Lantbruksuniversitet (Swedish University of Agricultural Sciences) International Office (2000) (No. 93) 65 pp. [En, swahili, wfi]
A survey of 22 beekeepers in this district (1999) provided information on constraints to beekeeping, including pests and predators, the market situation, and social and traditional aspects. Two types of hive are used: Kenya top-bar hives and log hives. Over 60 hives were examined for bee diseases.

Baumer, M. C. *Apiculture and agroforestry. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 238–240 [En, B]

Explains, with examples, how provision of bee forage can be incorporated into land-use systems for woody perennials, and discusses the selection and planting of suitable trees and shrubs.

Berube, C. Jr. *The Kenya top-bar hive as a better hive in developing countries*. *American Bee Journal* (1989) 129 (8) 525–528 [En, B]

Bradbear, N. *Honey production and trade, with reference to developing market economies: FAO figures 1962–1982. Proceedings of the Third International*

Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 171–174 [En, B]

The figures show that, although developing countries have doubled their honey production in 20 years, the full potential of tropical and subtropical areas is not being achieved.

Bradbear, N. (ed.). [Kenya Conference issue]. *Newsletter for Beekeepers in Tropical & Subtropical Countries* (1985) (No. 6) 12 pp. [En, B]

This printed newsletter supersedes the typed, duplicated *Newsletter for Tropical Apiculture*, first produced in August 1981. It is sent free of charge to individuals and institutions in developing countries who are involved in beekeeping, and is funded by the UK Overseas Development Administration. Besides a report on the 3rd International Conference on Apiculture in Tropical Climates, this issue has articles on cardboard bait hives, honey harvesting, barrel hives, and an FAO Expert Consultation on Beekeeping held in Bangkok. There are also news items from various countries, and a book review section. It is hoped to publish two issues of the newsletter per year. *D. G. Lowe*

International Bee Research Association, Cardiff, CF10 3DT, UK.

Brenzinger, M. Trees and grasses as rudiments of life. Use of wild plants in Kenya. [Baume und Graser als Lebensgrundlage. Wildpflanzennutzung in Kenia]. *Forschung, Mitteilungen der Deutschen Forschungsgemeinschaft* (1990) (No. 1) 10–14 [De, Bc]

In this paper 'trees' includes shrubs and herbs. The peoples of Kenya have a very good knowledge of the multi-purpose uses of the plants in their area; some examples are given. An important indirect use of flowering plants is in beekeeping and honey hunting. Yaaku and Mukogodo beekeepers know 93 nectar sources, and can recognise the taste of honey from them. In the Mukogodo district, 48 pollen sources are known, and here honey is used to make beer, or is eaten as a food; pollen combs, brood and wax are also eaten. These beekeepers have observed that bees are more aggressive when working some plants, e.g. *Dombeya rotundifolia* and *Teclea simplicifolia*. Both beekeepers and honey hunters smoke bees with smoke from smouldering plants, and they use various plant materials to make ropes. Protective layers are wrapped round log hives to insulate the bees from excessive heat or cold. *P. Walker*

Brokensha, D., Mwaniki, H.S.K. and Riley, B.W. Beekeeping in Embu district, Kenya. *Bee World* (1972) 53 (3) 114–123 [En, B]

Beekeeping methods and equipment used by various tribes are described, as well as uses of the honey for nutritional and ritual purposes. Some modern developments and prospects are discussed. *A. S. Attwood*
University of California, Santa Barbara, USA.

Carroll, T. Beekeeping: a beginner's guide. Nairobi, Kenya; Association for Better Land Husbandry, Report no. 30 (97) 37 pp. [En, Bdo]

Written for small-scale beekeepers in Kenya, and includes top-bar hives.

Carroll, T. Mau Forest beekeeping review April 1993–April 1994. Nairobi, Kenya; KIFCON (Kenya Indigenous Forest Conservation Programme). (1994) 15 pp. [En, Bc]

The main objectives of the 2-year project which is described in this report were to minimise damage to the Mau Forest in Kenya caused by current beekeeping practices and to maximise beekeeping incomes through the sustainable use of forest nectar resources. A number of hive designs were tested, including the Kenya top-bar hive (KTBH), African long hive and a mud-bamboo hive. A number of improvements to the traditional log-hives were also tested, including hanging on-farm using wires and using tin coverings instead of bark. The education of beekeepers and the role of the Ministry of Livestock are discussed, and the beekeeping situation in April 1994 is summarised. Problems in getting bees to occupy KTBH are described (at this time only 40–50% of the 130 hives in the project were occupied). Constraints to the continuation of the project include lack of funding/support and instability of the situation within the Mau Forest. *D. G. Lowe*

Chandler, M.T. The African honeybee – *Apis mellifera adansonii*: the biological basis of its management. Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 61–68 [En, B]

On the premise that the African honeybee, *Apis mellifera adansonii*, has important characteristics making it indispensable for the development of modern commercial beekeeping in the tropics, this review discusses the important biological differences distinguishing it from the widely adopted European races. The alarm and defence system of the bee is analysed in some detail, in order to emphasise the special care necessary when handling African bees. Swarms are not considered dangerous. Swarming is divided into three categories: reproductive, migratory and absconding, and the prevention or exploitation of each is proposed. Less important aspects briefly discussed are biometrics, build-up of colony populations, foraging behaviour, and disease resistance. It is concluded that the African bee offers great potential for selection of ecotypes suitable for commercial beekeeping in the tropics, if a new outlook to management is developed. *Author*
IDRC, P.O. Box 30677, Nairobi, Kenya.

Coleman, C.J. Pollination services by African bees. In Raina, S.K., Kioko, E.N. and Mwanycky, S.W. (eds). Proceedings of the first international workshop on the conservation and utilisation of commercial insects, Kenya, 18–21 August 1997. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 107–114 [En, Bd]

In Africa there is a shortage of honey bee pollination units, and suitable hives and training are needed to improve pollination services and thus increase crop yields. Methods are described briefly, and examples from Zimbabwe show how the introduction of honey bee colonies can benefit crops. *P. Walker*

Corner, J. Apiculture and bee management problems in African countries. Proceedings of the Third International

Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 41–44 [En, B]
General summary of the problems common to African countries, and recommendations for improvements.

Crane, E. Some multipurpose trees that are important honey sources in the tropics and subtropics. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 192–197 [En, B]

The important honey sources discussed are 82 of the 457 included in the *Directory of Important World Honey Sources*. They are all trees growing in the tropics and subtropics that are recorded as sources of other food and/or fodder. Most also provide fuel and timber, and some give good shelter from wind and/or shade from the sun. A table lists the species by botanical name, and their economic uses are indicated; over a quarter belong to the *Leguminosae* family. Fifteen of the tree honey sources discussed here have been recommended for planting for honey production in certain countries. A summary is given of the background of the 'Survey of World Honey Sources', Phase II of which led to the publication of the Directory mentioned.

P. Walker

International Bee Research Association, Cardiff, CF10 3DT, UK.

Crane, E. Tropical apiculture and the need for a global strategy. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 27–32 [En, B]

A discussion of the features common to beekeeping in the tropics, and examples of some that are specific to certain continents, together with arguments in favour of a global strategy for beekeeping.

Dietz, A. and Krell, R. Survey for honeybees at different altitudes in Kenya. [Abstract]. *American Bee Journal* (1986) 126 (12) 829–830 [En, B]

Samples of honeybees were collected from feral and managed colonies, and from roadside flowers, in the mountains of Kenya at altitudes between 3500 and 11,000 ft (1200–3700 m), and especially at 5000–7000 ft (1600–2500 m). The subspecies present in this area is *Apis mellifera monticola*, which has been described as a gentle bee. In the present study, wide variations in aggressive behaviour were found; many colonies, especially at lower altitudes, were considered aggressive or very aggressive. Some colonies at Mt. Elgon and Mt. Kenya were similar to aggressive colonies of Africanised bees studied in Brazil and Argentina. Colonies at altitudes above 8000 ft (2600 m) appeared to be gentler, but insufficient results were obtained for general conclusions to be drawn.

P. Walker

Dept. Entomology, Univ. Georgia, Athens, GA 30602, USA.

Eisikowitch, D. and Dafni, A. The use and abuse of introducing honey plants. Bee World (1988) 69 (1) 12–14 [En, B]
The introduction into new habitats of species such as *Prosopis juliflora* [see previous abstract] is discussed, and attention is drawn to some potential hazards of this practice. The introduced species may achieve such rapid growth and dispersal that it attains pest status. Introduced

species may also attract native pollinators away from the native flora. It is suggested that local plants (e.g. in Kenya, *Acacia* and *Ziziphus* species) would serve most purposes equally well, but that if it is necessary to use introduced species then these must be checked for growth characteristics, genetic relationships with native species, toxicity to man and animals, and host – disease relationships.

El-Banby, M.A. Cheap movable-frame hives for honeybees. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 71–74 [En, B]

Instructions, with diagrams, for converting palm-leaf baskets and palm-rib crates into movable-frame hives, and also for making wooden frames.

Fert, G. [The production of royal jelly.] La production de gelée royale. Bulletin Technique Apicole (99) 26 (3) 109–120 [Fr, B]

Methods used in the production and storage of royal jelly are described, with examples from Taiwan (using imported *Apis mellifera ligustica*), China, Kenya (with top-bar hives) and Latin America (using hybrids of Africanised queens and *A. m. ligustica* drones).

P. Walker

'La Chesnaie', 64300 Argagnon, France.

Free, J.B. and Williams, I.H. Insect pollination of *Anacardium occidentale* L., *Mangifera indica* L., *Blighia sapida* Koenig and *Persea americana* Mill. Tropical Agriculture (1976) 53 (2) 125–139 [En, B]

Flowers of these tropical crops (cashew, mango, akee and avocado) in Jamaica were visited by many *Polistes* wasps and by honeybees, which were less numerous but more efficient as pollinators than the wasps. In Jamaica and also in Kenya it was observed that mango and cashew were often less attractive to honeybees than other nearby crops. In Kenya, no wasps were seen on these two crops, but numerous ants visited them. When insect pollination of mango and cashew was prevented, fruit set was lower. The proportion of hermaphrodite flowers, yield and set of cashew, mango and akee, varied greatly from tree to tree.

Author

Rothamsted Exp. Stn., Harpenden, Herts., UK.

Fries, I. Techniques for identification and prevention of honey bee diseases and pests. In Raina, S. K., Kioko, E. N. and Mwanyiky, S. W. (eds) Proceedings of the first international workshop on the conservation and utilisation of commercial insects, Kenya, 18–21 August 1997. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (1997) 75–79 [En, Bd]

Swedish Univ. of Agricultural Sciences, Dept of Entomology, S750 07 Uppsala.

Gatere, K., Kasolia, J.D. and Mwangeka, R. Production and marketing of honey and beeswax in Kenya. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 175–178 [En, B]

Covers production and domestic consumption of honey,

and constraints which limit domestic and export trade in honey and beeswax.

Gentry, C. *Small scale beekeeping*. Washington, DC, USA; Peace Corps Information Collection and Exchange. (1982) viii + 214 pp. [En, B]

This manual will be a useful aid to those involved in setting up small-scale beekeeping projects, particularly in developing countries where the use of high technology equipment is not yet viable. The first chapter outlines the history of man's relationship with bees, and this is followed by a chapter on basic planning for beekeeping beginners. 'Bee basics' describes types of bees, the effects of climate, honeybee castes and life cycle, and social characteristics such as superseding, swarming and absconding. 'The essence of beekeeping' emphasises seasonal aspects. The chapter on bee space and hives gives some of the advantages and disadvantages of fixed-comb and movable-comb hives. The longest section of the manual, 'Intermediate technology beekeeping', describes the Kenya top-bar hive (KTBH), the Johnson hive, the East African hive, apiary layout, protective clothing, simple equipment, sources of bees (which should be local), and management practices (using KTBH). A short chapter describes beekeeping with movable-comb hives, but it emphasises the problems that may be encountered. Simple methods are given for harvesting, processing and selling honey, beeswax, pollen and bee brood. The final chapter describes the diseases, pests and problems with insecticides which might be encountered. The six appendices given details of available resources (including a bibliography), hive plans, equipment plans, uses for beeswax, making an artificial swarm, and honeybee anatomy. The manual is illustrated by line drawings and simple diagrams and contains much useful, easily-assimilated information. It is available free to Peace Corps Volunteers, and to other bona fide enquirers involved in development programmes. *D.G. Lowe*
Peace Corps, 806 Connecticut Avenue, Washington, DC 20526, USA.

Gnagi, A. *Beekeeping developments in Africa. [Entwicklungsprojekte mit Bienenhaltung in Afrika]*. Bern, Switzerland; Universitat Bern. (1988) vi + 90 pp. [De, Bdo]

The present state of beekeeping in Africa is summarised. Reasons for encouraging beekeeping in developing countries are discussed, and examples are given of successful projects in Kenya, Botswana, Upper Volta and Tanzania, and of some that failed. Views differ on the type of hive suitable for such projects; experiences with modern hives are discussed and a case is presented for the use of traditional hives. Recommendations are made for future projects. *P. Walker*

Inst. Ethnologie, Univ. Bern, Schwanengasse 7, CH-3011 Bern Switzerland.

Hassan, L.A.M. and Svenssön, B. *Current success in field trials of improved top bar hives in Tanzania. In Raina, S.K., Kioko, E.N. and Mwanjyky, S.W. (eds). Proceedings of the first international workshop on the conservation and utilisation of commercial insects, Kenya, 18–21 August 1997*. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 87–93 [En, Bd]

Colonies in hives with straight sides attached 13.4% combs to the side, but those in hives with a 10° slope attached only 8%. In northern Tanzania a top-bar hive with 20 top bars is large enough for most nectar flows; hive dimensions are given. In trials with different entrance holes it was found that the most suitable arrangement was a series of 16–20 holes of 8-mm diameter made in a zig-zag pattern in the short wall of the hive at a distance of 2 cm above the floorboard. Simple methods for making the hives have been developed.

Njiro Wildlife Research Centre, PO Box 661, Arusha, Tanzania.

Heinrich, B. *Thermoregulation of African and European honeybees during foraging, attack, and hive exits and returns*. *Journal of Experimental Biology* (1979) 80 217–229 [En, B]

While foraging, attacking, or leaving or returning to their hives, African honeybees (*Apis mellifera adansonii*) in Kenya, and European honeybees (*A. m. mellifera*) in California, USA, maintained their thoracic temperature (Tth) at 30°C or above, independent of ambient temperatures (TA) from 7–23°. Tth was not significantly different between the subspecies. Tth was significantly different for different activities. The average Tth was lowest (30°) in bees returning to the hive. It was 31–32° during foraging, and 36–38° in bees leaving the hive, and in those attacking. Thus, bees in the hive (Tth 32°) increased their temperature before leaving the colony. In both subspecies attack frequency increased as TA (and thus Tth) increased. In the laboratory, honeybees (European) did not maintain the minimum Tth (27°) necessary for continuous flight at a TA of 10°. When forced to remain in continuous flight for at least 2 minutes at TA from 15 to 2°, Tth averaged 15° more than TA. The Tth was regulated only at high TA (30–40°). It is suggested that honeybees regulate their temperature by behavioural and physiological means, and that the smaller size of African bees, which facilitates more rapid heat loss, is compensated for by their higher metabolic rate than the European bees, resulting in a similar Tth. *D.G. Lowe*
Div. Entomology & Parasitology, Univ. California, Berkeley, CA 94720, USA.

Hepburn, H.R. and Radloff, S.E. *Beeswax exports and rainfall in the savanna woodlands of east central Africa*. *Apidologie* (1996) 27 (6) 473–478 [En, fr\de, Bj]

Records of beeswax exports from Tanzania, Zambia and Kenya in 1936–1961, and the corresponding rainfall records, were subjected to time-series and regression analyses. Data were plotted in 'bee-years' (July–June) as this is the seasonality of the annual cycle of honey bee colonies in savanna woodland areas below the equator. Figures for honey production and beeswax exports for Tanzania in 1906–1985 were also analysed. The results show that beeswax exports and rainfall are most significantly and highly correlated when phase-lagged by one bee-year. Rainfall and honey production are also highly significantly correlated when lagged by one bee-year. However, honey and wax production are highly correlated on a same bee-year basis. Thus, the beeswax harvest of any one year depends on the rainfall of the previous bee-year. This is consistent with general effects of climate on vegeta-

tion and specifically with the fact that the trees of the miombo on which honey bees depend tend to flower in the dry season. *D. G. Lowe*

Department of Zoology and Entomology, Rhodes University, PO Box 94, 6140 Grahamstown, South Africa.

Ichikawa, M. *Traditional beekeeping of the Suiei Dorobo in northern Kenya*. Kikan-jinruigaku (1980) 11 (2) 117–152 [Ja, B]

In Mathew's Range, northern Kenya, the vegetation consists of montane forest, riverine forest, intermediate bushland, wooded grassland and dry bushland. Flowering seasons vary from place to place, and it is common for honeybees to migrate from highland to lowland areas and vice versa. The Suiei Dorobo set up cylindrical hives in trees to attract migrating honeybees. The types of hive used, beekeeping methods, honey yield, and use of honey for various social purposes are described and compared with data on other traditional beekeeping systems in Africa. *M. Matsuka*

Lab. Human Evolutionary Studies, Fac. Sci., Kyoto Univ., Sakyo, Kyoto 606, Japan.

Isack, H. A. and Reyer, H.-U. *Honeyguides and honey gatherers: interspecific communication in a symbiotic relationship*. Science, USA (1989) 243 1343–1346 [En, Bc]

The Boran people, a nomadic tribe in northern Kenya, routinely hunt for honey from wild honeybee nests by using greater honey guides (Indicator indicator) to locate the nests. The honey hunter may even try to attract one of these birds by whistling. On reaching a nest, the bird produces a few final calls and then perches close to the nest. Most nests are inaccessible to the birds until the honey hunters have smoked and opened them. The honey hunters can deduce the direction and the distance of a nest from the bird's flight pattern, perching height, and calls. *P. Walker*

Dept. Ornithology, Natn. Museum of Kenya, P.O. Box 40658, Nairobi, Kenya.

Jackson, A. *The utilisation of honey in south west Mau and Transmara Forest reserves – management issues*. Nairobi, Kenya; KIFCON (Kenya Indigenous Forest Conservation Programme). (1992) 30 pp. [En, Bc]

The management issues discussed in this report followed a study of traditional beekeeping practices at seven sites around and within the Mau Forest complex, Kenya, conducted in June–November 1992. The use of log-hives involves the felling of trees and removal of bark from others, and the effects of this on forest conservation, and possible improvements which might be introduced, are discussed. The introduction of Kenya top-bar hives (KTBH) is considered. The report discusses traditional resource tenure, the possible establishment of beekeeping wards, the role of foresters, the involvement of beekeepers in forest management, the relationship of honey management zones to biodiversity protection zones and a proposed community zone, and the management of honey hunting from wild honey bee colonies. In all, 47 recommendations are made. *D. G. Lowe*

Jay, S. C. and Jay, D. H. *Wax production by caged worker*

***honeybees of European and tropical African origin*. Journal of Apicultural Research (1983) 22 (4) 229–231 [En, B]**

The effects were assessed of the presence of a queen, and of beeswax foundation, and of feeding honey, sucrose solution, or a honey and pollen mixture, on the production of wax by worker honeybees of European and tropical African origin during a 7-day confinement in laboratory cages in Nairobi, Kenya. The European bees produced significantly more wax than the African bees, but the two kinds of bees could not be shown to differ in their responses to the various treatments, although experiments on a larger scale might do so. Queenless bees in cages produced significantly less wax than did those with queens; variation in wax production among the queenless treatments was not significant.

Author

Dept. Entomology, Univ. Manitoba, Winnipeg, Man., Canada R3T 2N2.

Jones, R. *IBRA's role in promoting beekeeping, sustainable economic growth and biodiversity in Africa*. In Raina, S. K., Kioko, E. N. and Mwanycky, S. W. (eds). *Proceedings of the first international workshop on the conservation and utilisation of commercial insects, Kenya, 18–21 August 1997*. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 63–69 [En, Bd]
IBRA, UK.

Kahenya, A. W. and Gathuru, E. M. *Identification of honey plants in Kenya by pollen analysis*. *Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 203–204 [En, B]

Includes a table of the plant families and genera most commonly represented in honeys from six localities.

Kalinganire, A., Harwood, C. E., Slee, M. U. and Simons, A. J. *Pollination and fruit-set of Grevillea robusta in western Kenya*. *Austral Ecology* (2001) 26 (6) 637–648 [En, wf]

Probable pollinators are seven bird species. Nectar is the major floral reward for pollinators, but it is probably depleted by ants and honey bees, which were observed to be nectar-robbers; they hardly ever touched stigmas during their visits.

Dept of Forestry, Australian National Univ., Canberra, Australian Capital Territory, Australia.

Kamau, D. N. et al. *Beekeeping in Kakamega core target area: a rapid participatory appraisal of beekeeping activities*. (Report No. 15) Nairobi, Kenya; (1996) unpaginated Unpublished report]

Kigatiira, K. I., Beament, J. W. L. and Free, J. B. *Factors inducing whole colony movement and reproductive swarming in the African honeybee*. *Apiacta* (98) 33 (3/4) 83–90, 97–106 [En, Bj]

Studies were made on *Apis mellifera scutellata* colonies in two hill apiaries and three apiaries on the plains. In the hills, bees were active throughout the year; they had a low rate of reproductiveswarming, and some colonies migrated during periods with poor forage. On the plains, population growth and swarming were higher during the wet seasons, and colonies migrated during dearths. Colonies also

absconded if they were disturbed by pests, predators or being transported. The success rate for hiving bees in empty hives was highest in conditions that favoured colony growth. During a particular period of time, reproductive swarms and also migrating and absconding colonies all tended to leave an apiary in the same direction and continued in that direction. *Author*
Egerton University, PO Box 536, Njoro, Kenya.

Kigatiira, I.K. *Aspects of the ecology of the African honey-bee*. PhD Thesis, Cambridge University, United Kingdom. (1984) [En]

Three experimental apiaries were established on the plains in Kenya, and two in the hills, and one in the Rift Valley. The floral ecology around each was mapped, with the availability of nectar and pollen both on a daily and seasonal basis, together with climatic information. These were correlated with the pattern of foraging by bees, and with the times when reproductive swarming, absconding and migration occurred. A detailed study of bee behaviour, including use of an observation hive, revealed at least three kinds of behaviour which may be predictive of when swarming or migration will follow. The environmental and in-hive conditions which may cause whole colonies to migrate were investigated. Colonies were followed for many kilometres and the direction of flight and behaviour at overnight stops were recorded. Particular elements of pre-migration behaviour may be communicated to adjacent colonies and initiate them also into migrating. Dances which appear to communicate direction and distance of migration are described. From each of the study sites there was a preferred direction depending on the season in which colonies migrated. Temperature regulation of colonies in a hive and in a swarm was recorded. Experiments in which colonies of various sizes and states of nutrition were made to amalgamate, provided information on what may be important factors when this process occurs naturally. The mechanism whereby bees eliminate unwanted queens from amalgamated clusters is described in detail. The author discusses how some of these characteristics may have evolved and concludes with suggestions for improving the efficiency and economics of beekeeping in Kenya. *Author*

Kigatiira, I.K. *Apiculture and apicultural research in Kenya. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5-9 November 1984*. (1985) 33-38 [En, B]

Summary of apicultural development in Kenya, and a discussion of types of research that should be undertaken.

Kigatiira, I.K., Beament, J. W. L., Free, J. B. and Pickett, J. A. *Using synthetic pheromone lures to attract honeybee colonies in Kenya*. *Journal of Apicultural Research* (1986) 25 (2) 85-86 [En, B]

Nasonov pheromone lures, either with or without (E)-9-oxo-2-decenoic acid (9O2), were hung inside empty Kenya top-bar hives in each of four apiaries in Kenya. Of the 48 hives with lures, 24 were occupied by honeybee swarms, although at one site all hives, with or without lures, remained unoccupied. At the other three sites, 56, 78 and 17% of hives with Nasonov lures, with Nasonov + 9O2 lures, and without lures, respectively, were occupied. The difference

between hives with Nasonov lures and with Nasonov + 9O2 lures was not significant. It is concluded that lures should be placed in hives only at those times of year when migrating colonies usually settle in the area concerned.

Author

Beekeeping Section, Min. Livestock Dev., Nairobi, Kenya.

Kigatiira, K.I. *Hive designs for beekeeping in Kenya. Proceedings of the Entomological Society of Ontario* (1974) 105 118-128 [En, B]

Kenya beekeeping needs a hive that is reasonable in cost, meets the specific requisites of African beekeeping, and promotes the production of both honey and beeswax from movable combs. Two types of hives, and several bar and frame designs, were compared with standard Langstroth equipment under northern temperate conditions. The results indicate that, where top-bars only are used, the hive should have sloping sides. The most suitable hive for all situations appears to be an African Long Hive with vertical sides, furnished with frames which are fitted with a median cross bar and a starter strip of masonite. Comb foundation or foundation starter appeared to be neither necessary nor advisable. *Author*

Beekeeping Section, Natn. Agric. Lab., Box 30028, Nairobi, Kenya.

Kigatiira, K.I. *Beekeeping development programmes in Kenya. Apiculture in tropical climates, editor E. Crane*. London, UK; International Bee Research Association. (1976) 143-146 [En, B]

Kigatiira, K.I. *Keeping bees in fixed-comb and movable-comb frameless hives. Apiculture in tropical climates, editor E. Crane*. London, UK; International Bee Research Association. (1976) 9-13 [En, B]

Refers mostly to Kenya.

Kigatiira, K.I. *Improved Kenya hives. Proceedings of the XXVth International Apicultural Congress, Adelaide*. Bucharest, Romania; Apimondia Publishing House. (1977) 223-227 [En, B]

Kigatiira, K.I. *Behaviour of East African bees (Apis m. scutellata, littorea and monticola races). Proceedings of the XXVIIth International Congress of Apiculture, Athens, 1979*. Bucharest, Romania; Apimondia Publishing House. (1980) 267-272 [En, B]

The behaviour of East African honeybees includes: swarming due to overcrowding in the hive, or within the foraging area; migratory swarming in a dearth period; absconding ('prepared' or 'emergency'); 'nervous' erratic foraging, greatly affected by ambient temperature; very rapid flight patterns; vigorous defence of the home, or hive. *D. G. Lowe*
Ministry of Agric., PO Box 30028, Nairobi, Kenya.

Kigatiira, K.I. *Kenya beekeeping equipment development. Proceedings of the XXVIIth International Congress of Apiculture, Athens, 1979*. Bucharest, Romania; Apimondia Publishing House. (1980) 456-458 [En, B]

Kenya top-bar and long hives, catcher box (for trapping swarms), smoker, bicycle-mounted extractor, solar honey warmer.

Kigatiira, K.I. *Bees and beekeeping in Kenya*. *Bee World* (1984) 65 (2) 74–80 [En, B]

Kigatiira, K.I. *Amalgamation in tropical honey bees. Africanized honey bees and bee mites [edited by Needham, G.R., Page, R.E., Jr., Delfinado-Baker, M. and Bowman, C.E.]*. Chichester, UK; Ellis Horwood. (1988) 62–71 ISBN 0-7458-0319-9 [En, Bd]

This study was carried out in Kenya in November 1983. Wooden crosses were prepared, each having a queen cage containing a queen fixed to its centre. The colony from which the queen had been taken was shaken out of its hive and allowed to form a cluster around its queen. A group of 12 such crosses, with clusters, was arranged at each end of a 100-m long air strip. One group (L) was supplied with honey in flat dishes, the other (U) was left without food. After six days the colonies were artificially amalgamated. When single U or L colonies were moved to L colonies they were not accepted, and fighting lasted for more than 50 minutes. Single U or L colonies moved to single U colonies amalgamated after a short period of fighting. When large, amalgamated clusters of U or L bees were moved to single L or U clusters there was little or no fighting. Casualties were usually L bees irrespective of whether they were from 'recipient' or 'invading' colonies. There was a rise in cluster temperature (1–3°C) when amalgamation took place. Natural, successful amalgamations (hunger amalgamations and absconding amalgamations) are also described, and it is suggested that this behaviour is a normal part of the survival strategy of tropical African honeybees. *D.G. Lowe*

Beekeeping Branch, Ministry of Livestock Dev., P.O. Box 30028, Nairobi, Kenya.

Kigatiira, K.I. *Beekeeping for beginners*. Nairobi, Kenya; K.I. Kigatiira. (1988) vi + 33 pp. [En, Bd]

Kigatiira, K.I., Beament, J. and Free, J.B. *Communication movements and dances performed by African honeybee clusters after vacating a nest. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 404–409 ISBN 0-86098-196-7 [En, Bdo]

Observations of movements and dances performed by tropical African honeybees in exposed clusters are described. These include 'jerking' movements (possibly a threat display), 'settling dances' involving some tail wagging but without any consistent pattern or direction, and 'long-distance' dances which may communicate the direction and site of a new home. Long-distance dances resemble foraging dances but differ from them in (1) variation in the completeness of the crescent run, (2) the wagging usually lasts longer and varies widely in duration between different bees (from 1 to 19 seconds), and (3) wagging is repeated for long periods without the dancing bees leaving the cluster. Variations in wagging tempo and duration are described, and the observations indicate that a continuous spectrum from a 'foraging-like dance' to a 'wagging-only dance' can be displayed during preparations for a long distance flight. Possible relationships between wagging duration and flight distances are discussed. *D.G. Lowe*

Ministry Livestock Dev., Beekeeping Branch, PO Box 34188, Nairobi, Kenya.

Kigatiira, K.I., Kahenya, W.A. and Townsend, G.F. *Prosopis spp. as multi-use trees in dry zones*. *Bee World* (1988) 69 (1) 6–11 [En, Bj]

Prosopis species flower twice in a year, producing abundant nectar. The trees yield an average 100 kg of beans, and both pods and beans are high in protein. The pods also have a high sugar content. The trees are also used as firewood, the leaves for animal forage, the bark contains tannin, and gum from the trees can be used as a varnish. *Prosopis* species are adapted to dry conditions and can be used to control desertification. In the Garissa district of Kenya, *P. juliflora* plantings are being used to restore deforested areas, and a preliminary report of this project is given. *D.G. Lowe*

Beekeeping Branch, Ministry of Livestock Development, PO Box 34188, Nairobi.

Kigatiira, K.I. and Morse, R.A. *The construction, dimensions and siting of log hives near Nairobi, Kenya. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) 53–58 [En, B]

Kigatiira, K.I. and Wamurwa, J.M. *Status of beekeeping in Kenya. Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980*. (1983) 150–160 + 8 pl. [En, B]

Details of equipment, honey production and marketing, training facilities.

Kihwele, D.V.N. *Constraints responsible for the low quality of honey and beeswax in Tanzania: a case study of miombo woodlands. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 182–188 [En, B]

Actual and potential figures for honey production are discussed. Some of Tanzania's major honey plants are listed. Most beekeepers keep bees in log or bark hives hung in trees; data collected by interviewing beekeepers in Chunya and Tabora Districts shows that there are several reasons for the low quality and quantities of honey and beeswax produced. These are: clearing of bee forage to provide land for tobacco growing (required by law in some areas); scarcity of young beekeepers; lack of protective clothing; difficulty in assessing the best time to harvest honey from traditional hives; swarming; shortage of wire for hanging hives out of reach of honey badgers; poisoning of bees by insecticides; destruction of bee forage by caterpillars; scarcity of appropriate honey extractors, beeswax processing equipment and appropriate honey containers; lack of transport and the poor marketing system for honey and beeswax. Recommendations are made for dealing with these problems. *P. Walker*

Serengeti Wildlife Res. Inst., PO Box 661, Arusha, Tanzania.

Krell, R. *Kenya top bar hive or top bar hive for developing countries?* *American Bee Journal* (1990) 130 (2) 133–134 [En, B]

In a previous article [*American Bee Journal* (1989) 129 (8) 525–528] by C. Berube, Jr., it was not made clear that the Kenya top-bar hive (KTBH) is just one of several top-bar hive designs. The present paper mentions some shortcomings of the KTBH, and stresses that other types may often be more suitable in developing countries. It is recommended that equipment size should be chosen to allow eventual interchange with Langstroth equipment. Top-bars should be 32 or 35 mm wide, for African and European honeybees, respectively, and 480 mm long. *P. Walker*

Kumar, N.R. *The special role of women in beekeeping in developing countries.* *Bee World* (1993) 74 (3) 153–155 [En, B]

Women as beekeepers in India, Kenya and Malaysia.

Department of Entomology, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni-Solan 173-230 (HP), India.

Kumar, N.R., Kumar, R., Mbaya, J. and Mwangi, R.W. *Tropilaelaps clareae found on Apis mellifera in Africa.* *Bee World* (1993) 74 (2) 101–102 [En, B]

T. clareae was found on *A. m. scutellata* in Nairobi, Kenya, in December 1991. The mites were found on newly emerged adults with deformed wings and legs during laboratory examinations of honey bees and hive debris for pests and parasites. This is the first record of *T. clareae* on *A. mellifera* in Africa, but the extent of the infestation is not known. *D. G. Lowe*

Faculty of Science, University of Nairobi, Nairobi, Kenya.

Mangum, W.A. *Building a regular or observation Kenya top bar hive.* *Gleanings in Bee Culture* (1987) 115 (11) 646–648 [En, B]

The author keeps his colonies in top-bar hives which are 3 ft [90 cm] long internally; each holds 24 1.5-in [3.8-cm] top-bars. The procedure for examining colonies is described. For queen rearing, larvae are grafted into 16 (two rows of 8) queen cell cups on a specially designed top-bar, and put into a small glass hive holding 10 top-bars. Eleven days after grafting, the queens are transferred to mating nuclei (each with eight top-bars). For introduction to a colony, a modified queen introduction cage is used. To observe colony behaviour, the author has constructed glass-sided hives with 10 top-bars or with a single top-bar. *P. Walker*

120 Forestwood Drive, Durham, NC 27707, USA.

Mann, I. *Bees are wealth. [Nyuki ni mali].* Nairobi, Kenya; East African Literature Bureau. (1973) (Ed. 2) 115 pp. [En\Swahili, B]

Mbae, R.M. *Overview of beekeeping development in Kenya.* In Raina, S.K., Kioko, E.N. and Mwanjy, S.W. (eds). *Proceedings of the first international workshop on the conservation and utilization of commercial insects, Kenya, 18–21 August 1997.* Nairobi, Kenya; International

Centre of Insect Physiology and Ecology (99) 103–105 [En, B]

National Beekeeping Station, Kenya.

Mbaya, J.S.K. *The distribution of African honeybees in Kenya, and some aspects of their behaviour. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 56–60 [En, B]

Ten morphological characters were measured in 55 honey-bee samples from eight ecological zones of Kenya. Analysis of the data showed that for certain characteristics there were significant differences between bees from coastal, grassland, north-eastern dry and highland regions. The following races were found: *A. m. litorea* along the coast, *A. m. monticola* in mountain areas, *A. m. nubica* in northern Kenya, and *A. m. scutellata* in grassland areas. In experiments with colonies from highland and coastal areas, the latter (*A. m. litorea*) were more active pollen foragers and were also more active in colony defence than *A. m. monticola*. *P. Walker*

Beekeeping Branch, Min. Agric. & Livestock Development, PO Box 30028, Nairobi.

Meixner, M.D., Arias, M.C. and Sheppard, W.S. *Mitochondrial DNA polymorphism in honey bee subspecies from Kenya.* *Apidologie* (2000) 31 (2) 181–190 [En, de, fr, B]

A total of 39 samples of *Apis mellifera monticola* and *A. m. scutellata* from three different regions of Kenya were analysed for mtDNA variation using 6-base and 4-base restriction enzymes. Restriction with HpaII and AluI resulted in distinct patterns that together produced three different haplotypes. While haplotypes 2 and 3 were restricted to samples from the mountain forest, haplotype 1 was found in *A. m. scutellata* and all samples from the Ngong Hills. No introgression of *A. m. scutellata* mtDNA was detected in bees collected in mountain environments, but a few samples from the savanna had *A. m. monticola* morphology, or mtDNA, or both. These results support the hypothesis that *A. m. monticola* is a distinct subspecies and not an ecotype of *A. m. scutellata*. The polymorphic restriction sites were mapped. Ten samples of *A. m. litorea* from the Kenyan coast were analysed using polymerase chain reaction amplification and subsequent restriction analysis; all these samples shared the *A. m. scutellata* haplotype.

Author

Institut für Bienenkunde, J.-W. Goethe Universität Frankfurt am Main, Karl-von-Frisch Weg 2, 61440 Oberursel, Germany.

Meixner, M.D., Sheppard, W.S., Dietz, A. and Krell, R. *Morphological and allozyme variability in honey bees from Kenya.* *Apidologie* (1994) 25 (2) 188–202 [En\De, fr, B]

Institut für Bienenkunde (Polytechnische Gesellschaft), J.-W. Goethe Universität, Karl-von-Frisch-Weg 2, 61440 Oberursel, Germany.

Morphometric characteristics and electrophoretic variation were determined in 43 samples of *Apis mellifera* collected in three areas of Kenya. Discriminant analysis of the morphometric values classified most of the samples from altitudes above 2000 m as *A. m. monticola* and those from

below as *A. m. scutellata*. Some samples from about 2000 m were intermediate. All five enzyme loci studied were polymorphic, with esterase and hexokinase sharing the highest degree of polymorphism. New alleles are reported for malate dehydrogenase, phosphoglucosmutase and malic enzyme, but they occurred rather rarely. There was significant heterogeneity between members of the two subspecies, but analysis of the allozyme data resulted in two main clusters: (A) *A. m. monticola* from Mt Elgon and Mt Kenya, and (B) all other populations. Savanna and mountain bees from the region at 2000 m formed a separate subcluster; this supports the hypothesis of hybridisation between the races in this area. *P. Walker*

Moeller, T. Coordinating Centre for Regional Information Training. Seminar. Specialized agricultural information services. Apiculture/beekeeping, 6th to 8th February, 1980, Nairobi, Kenya. Report, Coordinating Centre for Regional Information Training (1980) (No.19/80) 26 pp. [En, B]

This report describes the aims and proceedings of a seminar held to coincide with the opening of a new branch of the IBRA Library for Africa (located at the Inter-African Bureau of Animal Resources, Nairobi, Kenya). The text is given of an introductory lecture by E. Crane entitled 'The special value of good information services to beekeeping in tropical countries'.

P.O.Box 47288, Nairobi, Kenya.

Mogaka, H. Household use of honey and wild meat around Mau Complex and Arabuko-Sokoke Forest Reserves. In Crafter, S.A., Awimbo, J. and Broekhoven, J (eds). Non-timber forest products: value, use and management issues in Africa, including examples from Latin America. Gland, Switzerland; International Union for Conservation of Nature and Natural Resources (IUCN) (97) 57-60 ISBN 2-8317-0317-4 [En, X]

Kenya Forestry Research Inst., PO Box 20412, Nairobi, Kenya.

Muheto, R.N. and Wix, P. Remote sensing for natural resources evaluation: its value to apiculture. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5-9 November 1984. (1985) 224-228 [En, B]

The development of techniques for remote sensing is described briefly. The application of the method to the evaluation of natural resources can be useful when combined with ground surveys, using special techniques for interpreting results. Several types of vegetation were differentiated by aerial photography of an area in England. In Tanzania, space-borne imagery, combined with some knowledge of the area studied, allowed identification of certain vegetational characteristics, e.g. miombo woodlands and fire-burnt areas, thus helping in the evaluation of the area from a beekeeping viewpoint. Further development of the techniques is needed. *P. Walker*

Min. Lands, Natural Resources & Tourism, PO Box 9372, Dar-es-Salaam, Tanzania.

Munalula, B.P. Forest conservation and beekeeping. In Raina, S.K., Kioko, E.N. and Mwanjyky, S.W. (eds).

Proceedings of the first international workshop on the conservation and utilization of commercial insects, Kenya, 18-21 August 1997. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 115-120 [En, Bd]

Mutungi, E.M., Farah, K.O. and Musimba, N.K.R. Factors affecting honey production in South Kenya rangelands: a case study of Kibwezi Division, Makueni District. Working Paper Series - African Pastoral Forum (1996) (No. 9) 22 pp. [En, Ba]

Questionnaires and informal discussions showed that the Wakamba people have a good knowledge of bees and are expert in making and using traditional hives. Their many uses of honey, beeswax, pollen, propolis and brood are listed. The honey is multifloral. In a survey of flowering plants, 187 species belonging to 32 families were recorded and, of these, 94 species (24 families) are important in honey production. Analysis of the morphometric characteristics of bee samples collected in the Kibwezi area showed that the main race is *Apis mellifera litorea*; *A. m. scutellata* is also present and, least common, *A. m. monticola*. The main constraint to beekeeping is the scarcity of land. Several recommendations are made for making beekeeping more productive. *P. Walker*

PINEP, University of Nairobi, Department of Range Management, P.O Box 29053, Nairobi, Kenya.

Mwangi, R.W. Reasons for the low occupancy of hives in Kenya. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5-9 November 1984. (1985) 61-63 [En, B]

Monthly field observations were made at five locations from 1975 to 1985, and records were kept of the total numbers of Kenya top-bar hives (KTBH) and traditional hives (TH) at each location, and the numbers of each type occupied by feral swarms of bees. In all areas, bees preferred TH hung in trees to KTBH, and in 1983 percentage occupancy of TH ranged from 36% in the arid north-east to 98% in the cultivated Kisumu region. Values for KTBH were lower, ranging from 16% to 87%. It is suggested that one reason for the low occupancy of hives may be the introduction of large numbers of KTBH into some areas. Arid areas, where there is limited bee forage, may not be able to sustain any more colonies. TH are generally hung higher on tree branches than KTBH, at a level which may more nearly coincide with the flight path of scout bees searching for nest sites. *P. Walker*

Dept. Zoology, Univ. Nairobi, PO Box 30197, Nairobi, Kenya.

Mwangi, R.W. Geographical distribution and biological characteristics of *Apis mellifera* varieties in Kenya. Proceedings of the XXXth International Congress of Apiculture, Nagoya, 1985. Nagoya, Japan; Apimondia. (1986) 115-118 [En, Bd]

Samples of worker honeybees were taken from Kenya top-bar hives, traditional hives, or feral colonies, using a sweep net. Bees from north-eastern Kenya were extremely light-coloured, bees from the coast were also light-coloured, grassland plateau bees were darker and the darkest of all were from the highlands. Measurements of percentage yellowness and wing breadth indicated that these bees

were *A. m. nubica*, *A. m. litorea*, *A. m. scutellata* and *A. m. monticola* respectively. The foraging and defensive behaviour of the four races was very similar. Absconding was most prevalent in the dry season, when forage was scarce, but it also occurred during the honey flow. Black ants were the major cause of absconding, followed by honey badgers, small rodents, and poor management. Unexplained absconding was probably caused by forage scarcity. *D. G. Lowe*
PO Box 30197, Nairobi, Kenya.

Ndiritu, D.W., Mutugi, N. and Ndung'u, S. Variation in malate dehydrogenase allozymes among honeybee populations in Kenya. *Journal of Apicultural Research* (1986) 25 (4) 234–237 [En, Bb]

Polyacrylamide gel electrophoresis was used to analyse phenoxethanol extracts from 1020 samples of honeybees for malate dehydrogenase activity. Nine natural populations in Kenya consisting of the subspecies *Apis mellifera litorea*, *A. m. nubica*, *A. m. monticola* and *A. m. scutellata* were sampled. Allozyme variation in the three Mdh alleles found was quite uniform in all the populations. There were small differences among the populations in allele frequencies and in levels of enzyme activity as indicated by intensity of bands. Genetic variation was lower in honeybees than in samples of five *Zaprionus* species (Diptera, Drosophilidae) taken earlier from the same localities. *Author*
Botany Dept., Kenyatta Univ., PO Box 43844, Nairobi, Kenya.

Ndiritu, D.W. and Mwangi, R.W. Possible use of state lands for apiculture in Kenya. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 235–237 [En, B]

The case is put for beekeeping to be permitted in Kenyan National Parks and Game Reserves (58,000 km²) and State-owned Forests (17,700 km²), many of which offer good bee forage. A honey and hive products authority, which could co-ordinate and control beekeeping on state-owned land, is proposed. *P. Walker*
Dept. Botany, Kenyatta University Coll., PO Box 43844, Nairobi, Kenya.

Ngethe, J.C. Honey production from natural vegetation in Kitui District, Kenya. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 205–208 [En, B]

This is a brief survey of the main nectar and pollen sources (though only a few are distinguished as producing pollen) of this district; characteristics, and distribution in Kenya, of some genera and species are mentioned. The most important families are: *Leguminosae* (including 13 *Acacia* species), *Labiatae*, *Acanthaceae* (14 species), *Compositae*, *Combretaceae* and *Malvaceae*. *P. Walker*
Dept. Range Management, Kenyatta Univ., PO Box 43844, Nairobi, Kenya.

Nightingale, J.M. Lifetime's recollections of Kenya tribal beekeeping. London, UK; International Bee Research

Association. (1983) 37 pp. + 1 map ISBN 0-86098-130-4 [En, Bdo]

The late Jim Nightingale had a unique knowledge of the traditional methods and customs of Kenyan beekeeping tribes. In this transcription of a tape-recorded interview with him by Eva Crane, assisted by Peter Paterson, he gives much information about the following tribes: Kikuyu and Dorobi, Kamba, Tugen, Pokot, Tharaka. There is an index to places and tribes, and their locations are shown on a map. Two brief annexes describe Jim Nightingale's methods for opening and inspecting a Kenya top-bar hive, and for producing high quality honey from primitive hives. *P. Walker*

Nightingale, J.M. Traditional beekeeping among Kenya tribes, and methods proposed for improvement and modernisation. Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 15–22 [En, Bc]

Odén, A.C. Honeybee *Apis mellifera* L. subspecies and apiflora in Taita Taveta District, Kenya. Uppsala, Sweden; Minor Field Studies – International Office, Swedish University of Agricultural Sciences, Report No. 172 (2001) 45 pp. [En, wf]
From March to August 1999, surveys of honey bees and flowers were conducted at 21 sites. A total of 386 plant species were found; the most common species, *Lantana camara* and *Ocimum gratissimum* occurred at 15 and 14 of the sites, respectively. Seven different groups of honey bees were identified by cubital index and the discoidal angle of forewing; five were: *A. m. monticola* dark and light, *A. m. scutellata*, *A. m. litorea* and *A. m. unicolor*. The other two were not fully elucidated, but seem to belong to other separate subspecies or geographical ecotypes. Distribution of subspecies seems to be related to altitude, even though it is not statistically significant in this case.

Ogetonto, S.O. and Gathuru, E.M. Effect of apiary management and honey processing on the quality of Kenyan honey. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 189–191 [En, B]

Describes methods used in Kenya for harvesting, storing and processing honey, and recommends ways for improving quality.

Onim, J.F.M. Influence of insect pollinators on the degree of outcrossing in pigeon pea in Kenya. *Zeitschrift für Pflanzenzüchtung* (1981) 86 (4) 317–323 [En, de, B]

Using green and purple stems as genetic markers, the influence of availability and activity of insect pollinators on the degree of cross-pollination in *Cajanus cajan* was studied at six sites in Kenya. The highest insect population was on a plot situated near a 30-hive apiary, but the identities of the insect species are not given. The degree of cross-pollination varied from 25.2% to 94.5% and was directly related to the population density of pollinators (3–22/4m² in five minutes). Altering the quantity of pollen by planting 50 purple-stemmed plants for each green-stemmed plant did not affect the level of cross-pollination in green-stemmed plants. *J.M. Gedy*
Fac. Agric., Univ. Nairobi, Nairobi, Kenya.

Onim, J. F. M., Eijnatten, C. L. M. van and Pathak, R. S. **Some factors which encourage outcrossing in pigeon pea. Proceedings of the Fourth International Symposium on Pollination, Maryland, 1978.** (1979) 219–225 [En, B]

Two inbred lines were studied in glasshouse and field conditions in Kenya. The stigma was receptive 12 hours before dehiscence; pollen grains were present on the anthers soon after dehiscence, but did not start germinating for 24–28 hours. During this period foreign pollen could be introduced to the stigma by insect visitors, resulting in outcrossing. Pollen fertility was low in several plants, but this did not appear to affect cross-pollination. Of the 323 seedlings produced, there were 196 hybrids, which suggests that there were more foreign pollen grains than self pollen deposited on the stigma, or that foreign pollen had a faster germination and tube growth rate. The main pollinators of pigeon pea were *Apis mellifera adansonii* (which was not very efficient, but was present in large numbers), 10 species of *Chalicodoma*, five of *Megachile* and five *Xylocopa* spp. were very slow foragers. P. Walker Dept. Crop Sci., Univ. Nairobi, Nairobi, Kenya.

Onim, J. F. M., Pathak, R. S. and Eijnatten, C. L. M. van. **Influence of insect pollinators on the degree of outcrossing in pigeon pea in Kenya. Proceedings of the Fourth International Symposium on Pollination, Maryland, 1978.** (1979) 211–218 [En, B]

Suitability of genetic markers, and methods of estimating outcrossing in *Cajanus cajan*, are discussed. The degree of outcrossing at six test sites was between 25.20 and 94.50%; it was related directly to the number and activity of insect pollinators at each site, but was not related to the quantity of pollen from plants with the marker gene. Author Dept. Crop Sci., Univ. Nairobi, Nairobi, Kenya.

Osterlund, E. **Exploring monticola – efforts to find an acceptable Varroa-resistant honey bee.** *American Bee Journal* (1991) 131 (1) 49–56 [En, Bj]

Describes the collection of *Apis mellifera monticola* eggs and semen in Kenya, and their use in Sweden for breeding daughter queens and hybrids.

Osterlund, E. **The Elgon bee – hobbyist and commercial bee with African genes.** *American Bee Journal* (1993) 133 (7) 504–507 [En, Bj]

Eggs and semen of *Apis mellifera monticola*, taken from Kenya to Sweden in 1989, were used to develop a strain of *A. mellifera*, given the name Elgon. The strain results from crossing *A. m. monticola* with hybrids of Buckfast bees with *A. m. sahariensis* (from Morocco). Elgon bees have been bred with different percentages of *A. m. monticola* genes, and the characteristics of the colonies are being compared. Preliminary results on some Elgon colonies suggest that the new strain is promising, and may have some tolerance to *Varroa jacobsoni*. P. Walker P1 5062B, 69400 Hallsberg, Sweden.

Paterson, P. D. Constraints in transforming traditional to modern beekeeping in Kenya. In Raina, S. K., Kioko, E. N. and Mwanjyky, S. W. (editors) *Proceedings of the first international workshop on the conservation and utilization of commercial insects, Kenya, 18–21 August 1997.*

Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 95–102 [En, Bd]

Paterson, P. D. **Review of Kenyan agricultural research: vol. 37 insects and sericulture.** Nairobi, Kenya; Kenya Agricultural Research Institute (KARI). (1997) viii + 16 pp. ISBN 0-90-4567-66-4 [En, Do]

This booklet provides a review of research in Kenya (and elsewhere in Africa) on apiculture (including classification, physiology, biology, breeding, products, marketing and pests and diseases of honeybees (*Apis mellifera*) and the control of these natural enemies), sericulture (including mulberry cultivation, feeding of silkworms [*Bombyx mori*], breeding and husbandry, and processing of the silk) and termites and other beneficial insects (including termite mounds as building material, and insects as food).

Paterson, P. D. **Appropriate technology for bee hives in tropical Africa. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.** (1985) 52–55 [En, B]

Discussion of the advantages and disadvantages of fixed-comb hives, movable-comb hives and movable-frame hives for beekeepers in Africa.

Paterson, P. D. **A Langstroth hive with top-bars instead of frames, for tropical African bees.** *Bee World* (1988) 69 (2) 63–68 [En, Bj]

The hive described is a standard top bee space Langstroth type using top-bars instead of frames, with no queen excluder. No inner cover is used and the hive is fitted with a simple lid. A standard-size brood box is used, and the floorboard may be attached or separate. The supers are 168 mm deep, but shallower ones are also satisfactory. Each top-bar has a saw-cut along the centre of the bottom of the bar into which a starter strip of foundation is fitted. The bees build parallel combs attached to the top-bars and rarely attach them to the side walls. Methods for colony management and for handling the honey crop are described, and the advantages and disadvantages of this type of hive in comparison with hives with frames and the Kenya top-bar hive are listed. D. G. Lowe PO Box 24909, Karen, Nairobi, Kenya.

Raina, S. K., Kioko, E. N. and Mwanjyky, S. W. (eds). **Proceedings of the first international workshop on the conservation and utilization of commercial insects, Kenya, 18–21 August 1997.** Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 252 pp. [En, Bd]

Three of the six sessions were devoted to bees and beekeeping: II Behavioural ecology of tropical honey bee races; III Beekeeping in African countries and their roles as pollinators; V Queen bee rearing and beehive products. Session VI was concerned with local and international market opportunities for silk and honey bee products. Four of the papers are abstracted separately and seven others are listed by title. P. Walker

Ricciardelli d'Albore, G. C. and Monaco, R. **Pollen spectrum of some Somalian honeys. [Lo spettro pollinico di alcuni mieli della Somalia.].** *Apicoltura*, Italy (1986) (No. 2) 1–24 [It, en, Bj]

Results are presented of pollen grain analyses of 18 honey samples collected in various parts of Somalia. Pollens from the following genera and families were the most frequent (though in two samples the dominant pollen could not be identified): *Casuarina*, *Cyathula*, *Acacia*, *Lannea*, *Sapindaceae*, *Triumfetta*, *Ceiba*, *Dombeya*, *Combretum*, *Terminalia*, *Acanthus*, *Hypoestes*, *Justicia*, *Sesamum*, *Eupatorium*, *Vernonia*, *Palmae* (?), *Cyperaceae*. Their pollen grains are shown in photographs. It is concluded that the pollen spectra of the honeys are geographically characteristic, but they show some similarities to those of honeys from neighbouring countries (Kenya, Burundi, Tanzania, etc.). *P. Walker*

Istituto di Entomologia Agraria, Univ. degli Studi, 06100 Perugia, Italy.

Robinson, W.S. Keeping the 'Kali' bees of Kenya. *American Bee Journal* (1982) 122 (11) 745–748 [En, B]
Beekeeping with *Apis mellifera adansonii* in Kenya top-bar hives.

Rolling, M. A novel inexpensive hive for teaching. *Gleanings in Bee Culture* (1986) 114 (1) 22–24 [En, B]
Based on the Kenya top-bar hive and made from a plastic pail cut in half.

Rueppel, T. Ethnological aspects of beekeeping in East Africa. [Ethnologische Aspekte der Bienenhaltung in Ostafrika]. Hausarbeit zur Erlangung des Magistergrades, Georg-August-Universität, Göttingen, Germany. (1982) iii + 97 pp. [De, B]

This is a detailed comparative study of the Okiek (Dorobo) tribe in Kenya, the Chaga in north-east Tanzania and the Hamar in south Ethiopia. For each tribe an account is given of the environment, food, social and political organisation, hives where used and honey collection methods. The uses of honey in food, in beer making, in rituals, marriage ceremonies, etc., and in trade, are also described. Ownership rights of beekeepers are dealt with, and the extent of knowledge about bees. The report is well illustrated, mostly with photographs. *E.E. Crane*
Philosophisches Fakultät, Georg-August-Universität, Göttingen, Germany.

Ruttner, F. and Kauhausen, D. Honeybees of tropical Africa: ecological diversification and isolation. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 45–51 [En, B]

In each of 180 samples of honeybees from 24 African countries (south of the Sahara), 40 characters were determined; analysis of the data showed that there was a high degree of variability. The distribution of honeybee races in tropical Africa shows a geographical distribution pattern, although no geographical barriers exist; ecological factors appear to be responsible for this diversification and isolation. Each of the following races has distinct morphological characteristics, as well as specific physiological and behavioural ones: *Apis mellifera litorea* in the east (from Somalia to Mozambique); *A. m. adansonii* along the entire west coast; *A. m. scutellata* in the savannah of East and South Africa; *A. m. monticola* on Mt. Kilimanjaro and other

mountains of East Africa from Ethiopia to Burundi; *A. m. jemenitica* in arid zones of Chad, Sudan and Somalia. *P. Walker*
Inst. Bienenkunde, Univ. Frankfurt, 6370 Oberursel 1, Germany.

Seeley, T.D. What we do and do not know about the nest-site preferences of African honey bees. Africanized honey bees and bee mites [edited by Needham, G.R., Page, R.E., Jr., Delfinado-Baker, M. and Bowman, C.E.]. Chichester, UK; Ellis Horwood. (1988) 87–90 ISBN 0-7458-0319-9 [En, Bd]
This paper summarises present knowledge of the nest site preferences of *Apis mellifera scutellata*, gained from observations in Uganda, Kenya, Tanzania, South Africa, Zambia, French Guiana, Venezuela and Panama. The results indicate that a cavity of 40–80 litres is preferred to one of 10–20 litres, but experimental evidence about other variables is limited. *D.G. Lowe*
Section of Neurobiology & Behavior, Mudd Hall, Cornell Univ., Ithaca, NY 14853, USA.

Shi Wei. Genetic variation and colony development of honey bees (Apis mellifera) in Kenya. Thesis, Uppsala; Sveriges Lantbruksuniversitet Acta Universitatis Agriculturae Sueciae – Agraria, No 291 (2001) 22 pp. [En, wf]
This thesis presents genetic data obtained for honey bees sampled in different ecological regions of Kenya; mtDNA analysis and microsatellite investigations demonstrate considerable variability, with no consistent pattern except for a large genetic differentiation (Rst value) of bees between one mountain forest sampling site and all other sampling sites. Population dynamics, which are reported for honey bee colonies at one site, were affected by the weather, as was the acceptance of grafted queen cells in queenless and queenright queen-rearing colonies. Honeys from Kenya and some other parts of sub-Saharan Africa were examined for the presence of *Paenibacillus* larvae; preliminary data indicate that it may not be established in colonies in large regions of Africa.

Sithanantham, S., Otieno, Z.N. and Nyarko, K.A. [Conférence Internationale sur les Ravageurs en Agriculture. Montpellier 6–8 janvier 1997.] Preliminary observations on effects of neem sprays on some on target arthropods in cowpea ecosystems. In ANPP – Fourth International Conference on Pests in Agriculture. Montpellier 6–8 January 1997. (97) 2 643–648 [En, fr, Bc]
The day after plots of *Vigna unguiculata* were sprayed with 5, 10 or 20 % neem seed kernel extract, fewer honey bees visited the flowers than on control plots. Honey bee visits returned to normal on days 3–5, except on plots sprayed with the highest dose. Honey bee foraging was affected less by neem spray than by cypermethrin. No adverse effects of neem were seen on other non-target arthropods (spiders and ants) caught in pitfall traps for two weeks. *Author*
International Centre of Insect Physiology and Ecology, Bow 30772, Nairobi, Kenya.

Skinner, M. Bee brood consumption: an alternative explanation for hypervitaminosis A in KNM-ER 1808 (Homo erectus) from Koobi Fora, Kenya. *Journal of Human Evolution* (1991) 20 493–503 [En, Bc]

A *Homo erectus* individual from Koobi Fora, Kenya, dated at 1.6 $\pm$ 0.1 million years, exhibits pathological apposition of bone on long bone shafts. This was originally attributed to hypervitaminosis A from the consumption of carnivore livers, but it is now postulated that the condition might have resulted from the protracted ingestion of honey bee brood (*Apis mellifera*). Available evidence suggests that the brood content of wild honey bee nests, and the density of nests within the foraging area of early *H. erectus*, would have yielded an ample and reliable energy source with a deleteriously high vitamin A content. Reasons for the absence of hypervitaminosis A in present-day collectors of honey and honey bee brood are put forward. The potential role of honey collecting and insect larvae consumption in hominine behavioural and physical evolution is discussed. *P. Walker*

Department of Archaeology, Simon Fraser University, Burnaby, BC V5A 1S6, Canada.

Sperling, D. and Caron, D.M. *The movable-comb frameless hive: 'appropriate technology' alternative to the Langstroth hive?* *American Bee Journal* (1980) 120 (4) 284–289 [En, B]

Includes 'Kenya-modified Langstroth supers'.

Thackray, G.D. *Fossil nest of sweat bees (Halictinae) from a Miocene paleosol, Rusinga Island, western Kenya*. *Journal of Paleontology* (1994) 68 (4) 795–800 [En, Bc]

A fossilised nest found in a 17-Ma paleosol on Rusinga Island is similar in many respects to those constructed by bees. The nest consists of subellipsoidal cells arranged in paired, parallel rows, which are themselves arranged in clusters. Typical cells average approximately 6 mm by 3.5 mm, and have curved dorsal surfaces and nearly flat ventral surfaces. The nest is here referred to a new ichnospecies: *Celliforma habari*. The cell shape and nest architecture are most like those of modern bees of the subfamily Halictinae, and probably were constructed by bees with a societal structure that was at least communal and quite possibly more highly social. The nest suggests a subhumid to humid climate and angiosperm-dominated vegetation for Rusinga Island during Early Miocene time. *Author*
Department of Geological Sciences, University of Oregon, Eugene, OR 97403, USA.

Townsend, G.F. *Honey processing and collecting centres in East Africa. Apiculture in tropical climates*, editor E. Crane. London, UK; International Bee Research Association. (1976) 85–92 [En, B]

Requirements of these centres are set out, and two are dealt with in detail, with layout diagrams: (1) a simple building on the side of a hill, using gravity flow, and (2) a more sophisticated unit at Thika, Kenya, with weighing, refining and bottling rooms, and with filter-press and seeding equipment. *E.E. Crane*
Dept. Environmental Biology, Univ. Guelph, Guelph, Ont., Canada.

Townsend, G.F. *Transitional hives for use with the tropical African bee Apis mellifera adansonii*. *Apiculture in tropical climates*, editor E. Crane. London, UK; International Bee Research Association. (1976) 181–189 [En, B]

Hives described, illustrated in dimensioned drawings, and set in perspective for development programmes, are: Mount Meru log hive (fixed-comb), Kenya top-bar hive (movable-comb frameless), modified African long hive (movable-frame), and ten-frame Langstroth-type hive. *E.E. Crane*

Dept. Environmental Biology, Univ. Guelph, Guelph, Ont., Canada.

Townsend, G.F. *Tropical apiculture*. Guelph, Canada; University of Guelph. (1984) iii + 34 pp. + 2 fiches + 1 cassette [En, B]

This audiovisual study course is based on the author's experiences in directing beekeeping development programmes in Kenya and Sri Lanka and on his consulting experiences in the Americas and elsewhere. It covers the following topics: African bee behaviour, management and pests; Africanised bees in South and Central America; behaviour, management and pests of *Apis cerana*; processing and marketing hive products; beekeeping equipment for the tropics; protective equipment; tropical honey-producing trees and plants. The text is accompanied by two microfiches containing 120 colour photographs, which can be examined using the hand viewer supplied or a reader with a x24 magnification. The cassette gives a commentary to, and additional information on, the photographs (sets of individual slides are also available). *D.G. Lowe*

Dept. Environmental Biol., Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Townsend, G.F. *Beekeeping for women in integrated rural development. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 244–246 [En, B]

In Asia and Africa, beekeeping may gradually change from being traditionally a man's occupation to a woman's, particularly if it is included in integrated programmes involving the growing of multipurpose trees such as *Prosopis* spp.

Tybirk, K. *Flowering, pollination and seed production of Acacia nilotica*. *Nordic Journal of Botany* (1989) 9 (4) 375–381 [En, Bc]

Acacia nilotica, which flowers during the rainy season in Kenya, sheds its pollen between 07.30 and 12.00 hours. The average pollen production is 1.1×10^6 grains per inflorescence. The top third of each inflorescence has hermaphrodite flowers but the lower ones are functionally male. No nectar is produced. Ovaries contain 16 ovules and one tree can produce more than 30,000 seeds in a season. Pollination at the study site in western Kenya was carried out by solitary bees of the genera *Creightoneilla*, *Chalicodoma*, *Megachile*, *Anthophora*, *Nomia* and *Xylocopa*. This was confirmed by examination of their pollen loads and by observations of their pollen foraging behaviour. *J.M. Gedy*
Botanical Institute, University of Aarhus, Nordlandsvej 68, 8240 Risskov, Denmark.

Tybirk, K. *Pollination, breeding system and seed abortion in some African acacias*. *Botanical Journal of the Linnean Society* (1993) 112 (2) 107–137 [En, Bc]

Studies of four species of Acacia in Senegal and Kenya showed that they were visited by a high diversity of insects (118 taxa). The most important pollinators were megachilid and halictid bees and scoliid and eumenid wasps. Beetles, flies and butterflies were secondary pollen vectors. *D. G. Lowe*

Institute of Biological Sciences, Department of Systematic Botany, Aarhus University, Nordlandsvej 68, DK-8240 Risskov, Denmark.

Villieres, B. African apiculture in western tropical and equatorial regions. [L'apiculture africaine en regions tropicales et equatoriales de l'Ouest]. *Bulletin Technique Apicole* (1987) 14 (4) 193–220 [Fr, Bj]

In the first part of this paper, the author discusses the vegetation, bees and beekeepers of this area. The characteristics of *Apis mellifera adansonii*, especially its pronounced defensive behaviour and tendency to swarm, are described. A tradition of beekeeping exists among various peoples of Benin, Togo, Niger, Guinea-Bissau, Senegal and Kenya. In Part 2, the techniques of beekeeping with traditional hives, and the harvesting and extraction of honey and wax, are described. Part 3 discusses the objectives of beekeeping development programmes and, in particular, the use of various types of hive; traditional hives and Kenya top-bar hives are compared. There is a short bibliography and a list of useful addresses. *D. G. Lowe*
17100 Saintes, France.

Vollrath, F. and Douglas Hamilton, I. African bees to control African elephants. *Naturwissenschaften* (2002) 89 (11) 508–511 [En, X]

A study in Kenya demonstrated that African bees deter elephants from damaging the vegetation and trees which contain their hives. It is suggested that bees can be used in this way to protect selected trees, and even particular areas, from elephant damage.

468/04 Mpala Research Centre, Nanyuki, Box 555, Kenya.

Vorwohl, G. Honeys from tropical Africa: microscopical analysis and quality problems. Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 93–101 [En, B]

Lists are given of pollen grains common in honeys from Tanzania and Kenya. A table lists characteristics (sediment, water, HMF, diastase and invertase contents) of 59 honey samples, from Kenya, Tanzania, Burundi, Madagascar, Ivory Coast and Upper Volta. The honeys are discussed, and their characteristics compared with German import requirements. *E. E. Crane*

Landesanstalt für Bienenkunde, Univ. Hohenheim, 7000 Stuttgart 70, Germany.

Vorwohl, G. Pollen spectra of African honeys. Proceedings of the IVth International Palynological Conference, Lucknow, India, 1976–77. (1981) 499–502 + 1 pl. [En, B]
Honeys from the following countries have been analysed

and the results are discussed: Tanzania (33 samples), Kenya (1), Burundi (11), Upper Volta (1), Ivory Coast (1), Madagascar (12), Rhodesia, now Zimbabwe (1). Eucalyptus pollen was dominant in the samples from Burundi, Zimbabwe and Madagascar. Previously published analyses for honeys from northern Africa are also summarised; these honeys have rather different pollen spectra. *P. Walker*

Dept. Apiculture, Univ. Hohenheim, 7000 Stuttgart 70, Germany.

Weiss, E. Guide to plants tolerant of arid and semi-arid conditions: nomenclature and potential uses. Wiekersheim, Germany; Margraf Scientific Publishers. (1989) ix + 543 pp. ISBN 3-8236-1145-3 [En, Bd]

This volume is Range Management Handbook III/1 of the Ministry of Livestock Development, Kenya. It presents basic information on about 800 plants tolerant to arid and semi-arid conditions, most of which are found in Kenya. The first section is an alphabetical list of botanical names, which also gives, for each species, its family, common names, potential uses (industrial, food, fodder, firewood, timber, afforestation, amenity, soil reclamation, erosion control) and a reference to its drawing in the final section. The second section is a similar list, but in alphabetical order of common names. The third section lists 128 references to sources used in compiling this handbook. The final section of the book contains line drawings of about 500 of the species mentioned in the first two sections. There is no mention of honey in the book, nevertheless many of the species described are potential honey sources and for anyone involved in planting food plants for bees in arid areas this book will be a useful source of information and an aid to identification. *D. G. Lowe*

White, B. Beehive products and income generation using European races of Apis mellifera. In Raina, S. K., Kioko, E. N. and Mwanjy, S. W. (eds). Proceedings of the first international workshop on the conservation and utilisation of commercial insects, Kenya, 18–21 August 1997. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 173–203 [En, Bd]

Each hive product, as well as queen bees and package bees, is discussed separately; information is given on methods of production, markets, prices and uses. The use of bees for pollination services in Australia is also dealt with. *P. Walker*

NSW Agriculture, Locked Bag 11, Windsor, NSW 2756, Australia.

Woyke, J. A T-shaped frame for queen rearing in Kenya top-bar hives. *Newsletter for Beekeepers in Tropical & Subtropical Countries* (1990) (No. 17) 7 [En, Bj]

Yeoman, G. H. The Dorobo honey hunters. *Swara* (1980) 3 (4) 24–26 [En, B]

Traditional honey-hunting tribe in Kenya.

Kiribati

Walton, G.M. *Beekeeping development programmes in the tropical and subtropical Pacific. Apiculture in tropical climates*, editor E. Crane. London, UK; International Bee Research Association. (1976) 159–164 [En, B]

The area dealt with is perhaps the least well known of all from the point of view of beekeeping development. The report covers New Zealand aid programmes in Papua New

Guinea, Niue, Tonga, Gilbert Islands, Western Samoa; other aid projects in Rarotonga and Fiji; beekeeping activities in the Hawaiian Islands, American Samoa, French Polynesia, Micronesia, New Caledonia, Wake Island. E.E. Crane

Min. Agric. and Fisheries, Private Bag, Palmerston N., New Zealand.

Lesotho

Johnson, S.D. *The pollination of Disa versicolor (Orchidaceae) by anthophorid bees in South Africa. Lindleyana* (1994) 9 (4) 209–212 [En, 15 ref., 3 pl., 1 map]

Amegilla natalensis [*Anthophora natalensis*], a large anthophorid bee, was the sole observed pollinator of the orchid *Disa versicolor* at several sites in South Africa and Lesotho. The orchid has a sharply decurved nectar-containing spur which neatly accommodates the long curved tongue of *A. natalensis*. Pollinaria are ventrally attached to the mouthparts of the bee. Flowers of *D. versicolor* undergo a colour change from pink to brown during anthesis. This change in flower colour appears to function as an orientation cue for bees to locate newly opened flowers on the tall, densely packed inflorescence.

Department of Botany, University of Cape Town, Rondebosch 7700, South Africa.

Mahalefele, L. *Comparison between Lesotho and South African bee-botany*. MPhil Thesis, University of Wales College of Cardiff, UK. (1991) ii + 189 pp. [En, Bdo]

Pollen analyses were carried out on pollen loads, honey samples and known flower specimens from Lesotho, and also on honey samples from South Africa. From Lesotho, there were 17 potential bee plants. These were *Wahlenbergia*, *Helichrysum*, *Eucalyptus*, *Phaseolus*, *Sutherlandia*, *Melolobium*, *Pyrus/Prunus*, *Buddleja*, *Opuntia*, *Symphoricarpus*, *Corylus*, *Euphorbia*, *Rosa*, *Heteromera*, *Sopubia*, unknown species number 120 and *Polygonum*. From South African honey samples there were 68 identified important bee plants. Ten of these were found in Lesotho, and seven were found in areas which are climatically similar to Lesotho and could be grown in Lesotho. Seven could easily be encouraged in Lesotho due to their economic importance, these being *Vicia faba*, *Trifolium repens*, *T. pratense*, *Medicago sativa*, *Aloe mutans*, *A. davyana* and *Helianthus annuus*. They would enrich the Lesotho bee flora and make apiculture in Lesotho more successful.

Author

School of Pure and Applied Biology, University of Wales College of Cardiff, Cardiff, UK.

Mahalefele, L. *Beekeeping initiative in Lesotho. South African Bee Journal* (1995) 67 (2) 51–52 [En, Bj]

Beekeeping Section, Soil and Water Conservation and Agroforestry Programme, Ministry of Agriculture, Lesotho.

Mahalefele, T. *Beekeeping in Lesotho. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H. and Buys, B.]*. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 154–155 ISBN 0-620-15132-3 [En, Bd]

Tefobale Bee Research, P.O. Box 46, Mafeteng 900, Lesotho.

Pager, H. *Honeycombs, ladders and bees in the rock art of Africa*. Unpublished report prepared for the Bee Research Association. (1975) 79 pp. [En, B]

The author has collected together evidence he has uncovered in Algeria, Lesotho, Libya, Malawi, Morocco, Rhodesia, South Africa, South West Africa, Spanish Sahara, Tanzania, Tunisia, Uganda and Zambia. There are large numbers of published and unpublished drawings (see also *Apicultural Abstracts* 163/73, 191/74), together with documented extracts from books and other publications, and perceptive notes by the author. E.E. Crane

P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Robertson, M. and Johnston, G. *The honeybees of the mountain kingdom of Lesotho. South African Bee Journal* (1997) 69 (2) 20–23 [En, Bj]

There is no tradition of beekeeping in Lesotho, but under a recent project a number of people in the lowlands have started to keep honey bees in Langstroth hives. Samples of bees were collected from wild colonies in the area. In the mountains, it was more difficult to find and sample wild nests, but some samples were collected. The colonies were generally small and weak, probably due to the harsh climate and limited forage. However, one colony was found at an altitude of 2865 m, the highest so far reported, and others were at 1828–2743 m. An analysis of morphological characteristics will be carried out to establish what race the bees belong to. P. Walker

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Werger, M.J.A. (ed.). *Biogeography and ecology of Southern Africa*. Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part

of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first six chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation e.g. the afromontane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16–31 each cover a major taxonomic group of animals. Chapter 27, by A. J. Prins, covers the *Hymenoptera*. In a book with such a wide scope as this one, little space can neces-

sarily be allotted to bees; pages 853–857 briefly describe the *Apoidea* known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. *D. G. Lowe*

Malawi

Banda, A. S. M. *Determining sources of forage for bees in Malawi through the identification of pollen in Malawian honeys*. MPhil Thesis, University of Wales, Cardiff, UK. (1989) vii + 185 pp. [En, Bdo]

Pollen analyses were carried out on 39 honey samples from Malawi. Pollen grains from flowers collected from the same areas and at the same time as the honey samples were mounted on 130 reference slides. Of the 143 pollen types identified in the honeys, the most common were from the following families: *Combretaceae* (*Combretum* sp.), *Leguminosae* (*Brachystegia* sp.), *Euphorbiaceae* (*Pseudolachnostylis maprouneifolia*), *Rubiaceae* (*Crossopteryx febrifuga*) and *Verbenaceae* (*Vitex payos*). Others, such as *Proteaceae* (*Protea* sp.), *Euphorbiaceae* (*Croton* sp.), *Leguminosae* (*Acacia* sp.), *Myrtaceae* (*Syzygium crodatum*) and *Sterculiaceae* (*Dombeya rotundifolia*) were well distributed but had low frequencies of occurrence in all samples. The number of pollen types identified in each honey sample ranged from six (five samples) to 23. The average number of pollen types per sample was 11.97 ± 0.70 . The total number of pollen grains counted in a 10-g sample ranged from 80 to 13,889. The average pollen content per sample was 4650 ± 6.34 . Twelve of the 39 honeys were dominated by one pollen type which contributed more than 80% of the total pollen grains in the sample. *Author*
School of Pure and Applied Biology, College of Cardiff, Univ. Wales, Cardiff, UK.

Franck, P., Koeniger, N., Lahner, G., Crewe, R. M. and Solignac, M. *Evolution of extreme polyandry: an estimate of mating frequency in two African honeybee subspecies, *Apis mellifera monticola* and *A. m. scutellata**. *Insectes Sociaux* (2000) 47 (4) 364–370 [En, X]

Mating frequencies were compared in the two species using five microsatellite loci. Queens of eight colonies of *A. m. monticola*, collected in Malawi, mated 5–19 times producing an average relatedness among workers of 0.328. Six colonies of *A. m. scutellata* collected in South Africa displayed a significantly higher degree of polyandry. The difference in the degree of polyandry observed between the populations suggests that socially based selective pressures are not of primary importance in the evolution of extreme polyandry, but ecological selective pressures play a more significant role.

Laboratoire de Modélisation et de Biologie Evolutive, CBGP-INRA, 488 rue de la croix Lavit, F-34090 Montpellier, France.

Kawa, M. N. *For better bee-farming in Malawi*. Maputo, Mozambique; Programa Nacional de Apicultura. (1987) 12 pp. [En, Bc]

In recent decades, beekeeping in Malawi has contracted, although there is potential for development. In an effort to improve the situation, a 23-day beekeeping workshop, funded by the Peace Corps, was organised; 58 participants were taught basic beekeeping techniques, using simple equipment. They were also told how to teach these methods to village beekeepers. As a result of the workshop, two new posts were created in the Ministry of Wildlife and Natural Resources: a beekeeping officer and a teacher at the Natural Resources College. It is stressed that beekeepers must be given an incentive to produce good quality honey and beeswax for sale. The recommendations of this report include: the training of beekeeping extension staff, the introduction of top-bar hives, and the construction of a medium-sized honey processing plant. *P. Walker*

Klinger, R. *Rural small-scale beekeeping in northern Malawi. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 185–186 ISBN 0-86098-196-7 [En, Bdo]

Krell, R., Persano Oddo, L. and Ricciardelli d'Albore, G. *The influence of harvesting and processing methods on honey quality in Zambia and Malawi. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 268–273 ISBN 0-86098-196-7 [En, Bdo]

Of 33 honey samples collected from Zambia and Malawi, four contained more than 21% moisture, 10 were too dirty to be acceptable under international standards, and four had an HMF content above 40 mg/kg. Five of the darker honeys had a mineral content of above 0.6% and some had a bad odour. Many of the honeys were of excellent quality. The honeys investigated were harvested from traditional bark and log hives as well as from top-bar and frame hives by beekeepers of various training backgrounds. The honeys had also been processed by different methods, from boiling in tin cans, dripping through fine mesh screens, to pressing and various centrifugal extraction methods. The various methods and their influence on honey quality are discussed in detail. Pollen analysis indicated that the most

important nectar sources were *Brachystegia*, *Julbernadia* and various *Compositae*, *Myrtaceae* and *Proteaceae*. D.G. Lowe
Dept. Entomology, Univ. Georgia, Athens, GA 30602, USA.

Mkanda, F.X. and Munthali, S.M. Public attitudes and needs around Kasungu National Park, Malawi. *Biodiversity and Conservation* (1994) 3 (1) 29–44 [En, Bc]

Answers to a questionnaire by 141 people in selected sample areas showed that, while 11 subsistence farmers and two commercial farmers kept bees already, a further 38 and 36, respectively would like to, as well as 11 town dwellers. This is the most popular of 11 activities in which respondents would like to participate. Some information is also given about the consumption and sale of honey P. Walker
Department of National Parks and Wildlife, PO Box 30131, Lilongwe 3, Malawi.

Moriarty, A. Wild flowers of Malawi. Cape Town, South Africa; Purnell. (1975) 166 pp. SBN 360-00174-2 [En, B]
With colour reproductions of 360 species; many are bee plants.

Mwale, V.G.D. An examination of pests and pathogens of the honeybee (*Apis mellifera* L) in Malawi. M. Phil Thesis, University of Wales College of Cardiff, UK. (1992) xiii + 143 pp. [En, Bdo]

In Malawi, 343 hived *Apis mellifera* colonies in 36 apiaries at 19 locations were examined between October 1991 and February 1992. Specimens were taken of dead and healthy larvae and of dead and live bees. Visual symptoms of diseases and pest infestation, and damage from predators, were also noted. Pathogens and parasites found were *Nosema apis* (1% of colonies), *Melissococcus pluton* (8%) and *Acarapis woodi* (1%). Serological tests and EM examination showed no viruses [except for small numbers of chronic paralysis virus, bee virus X and bee virus Y in two samples]. *Bacillus* larvae, *Malpighamoeba mellificae*, sacbrood virus, *Varroa jacobsoni* and *Tropilaelaps clareae* were not found. Pests noted were honey badger, *Mellivora capensis*, (17% of colonies), human vandalism (8%), army ants, *Dorylus* spp., (7%) and wax moths, *Galleria mellonella* and *Achroia grisella*, (22%). In a survey of 163 beekeepers and extension workers (42% response rate) the replies indicated that wax moths affected 18% of their colonies, honey badgers 40%, army ants 37%, and human vandals 25%. Detailed data on the distribution of pests and diseases in Malawi are given. A.G. Matheson

School of Pure and Applied Biology, University of Wales College of Cardiff, Cardiff, UK.

Pager, H. Honeycombs, ladders and bees in the rock art of Africa. Unpublished report prepared for the Bee Research Association. (1975) 79 pp. [En, B]

The author has collected together evidence he has uncovered in Algeria, Lesotho, Libya, Malawi, Morocco, Rhodesia, South Africa, South West Africa, Spanish Sahara, Tanzania, Tunisia, Uganda and Zambia. There are large numbers of published and unpublished drawings, together with documented extracts from books and other publications, and perceptive notes by the author. E.E. Crane
P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Pasteels, J.J. A new species of *Pachyanthidium* (Hymenoptera: Megachilidae). *Journal of the Kansas Entomological Society* (1968) 41 (4) 481–483 [En]

The morphology of *Pachyanthidium michenieri* from Malawi, and Natal in South Africa, is described.

Persano Oddo, L., Krell, R. and Ricciardelli d'Albore, G. Contribution to the identification of the geographical and botanical origin of honeys produced in Zambia and Malawi. *Apicoltura* (1988) (No. 4) 113–138 [En, it, Bj]

The 70 pollen types identified in 28 honeys from Zambia and 10 from Malawi are listed. Honeys harvested in Zambia after the April–May nectar flow were characterised by the presence of *Julbernadia* pollen associated with *Compositae* (*Vernonia* and *Bidens* in particular), *Myrtaceae*, and pollens from nectarless plants (*Gramineae* and *Cyperaceae*). These were probably unifloral *Julbernadia* honeys. Samples collected in Zambia in November and December showed an association of *Brachystegia*, *Rhamnus* type, *Myrtaceae* and *Combretaceae*, together with *Anacardiaceae*, *Oleaceae* type and *Sapindaceae*. The honeys from Malawi were more varied and they contained a greater variety of pollen types, of which *Vernonia*, *Synedrella*, *Eucalyptus*, *Macadamia* and *Faurea* were dominant. Certain samples contained honeydew elements. The main types of pollen grain are illustrated in 14 plates. Author

Sezione di Apicoltura, Istituto Sperimentale per la Zoologia Agraria, 00156 Rome, Italy.

Pettersson, B. Pollination in the African species of *Nervilia* (Orchidaceae). *Lindleyana* (1989) 4 (1) 33–41 [En, Bb]

The terrestrial orchid genus *Nervilia* is divided into four sections: *Nervilia*, *Vinerlia*, *Linervia* and *Kyimbilaea*. Field studies of 10 species in Malawi and Madagascar support a distribution into three groups corresponding to three of these sections. The bicarinata-group (section *Nervilia*) has several-flowered inflorescences of large to medium unspurred flowers. This group has no nectar and uses deceit to effect pollination by solitary wasps (*Eumenidae*). The one-flowered petraea-group (section *Linervia*) has medium-sized unspurred flowers with small amounts of nectar. Pollen vectors are small bees; *Ceratina nyassensis*, *Lasioglossum emirnense* and *Nomioides* sp. were observed on *N. petraea* and *C. nyassensis*, *L. moderatum* and *Lasioglossum* sp. on *N. crocififormis*. The one-flowered stolziana-group (section *Kyimbilaea*) has medium-sized spurred flowers with large amounts of nectar. *Micromeriella rhodesiae* (*Scoliidae*) was a pollen vector on *N. stolziana*. J.M. Gedyé
Dept. Systematic Botany, Box 541, 751 21 Uppsala, Sweden.

Ricciardelli d'Albore, G., Persano Oddo, L. and Krell, R. Pollen spectrum of some honeys produced in Zambia and Malawi. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988. London, UK; International Bee Research Association. (1989) 279–283 ISBN 0-86098-196-7 [En, Bdo]

The 28 samples of honey analysed were collected from different areas of Zambia and Malawi, and a table lists the 70 pollen types which were identified. The 10 samples collected after the April–May nectar flow in Zambia were fairly homogeneous and were characterised by the pre-

dominance of *Julbernadia* pollen associated with *Compositae* (particularly *Vernonia* and *Bidens*), *Myrtaceae* and pollens from nectarless plants (*Gramineae* and *Cyperaceae*). The eight Zambian samples collected after the November–December flow were also fairly homogeneous and no one pollen predominated, although there was a constant association of *Brachystegia* with *Rhamnus*-type, *Myrtaceae* and *Combretaceae*, accompanied by *Anacardiaceae*, *Oleaceae*-type and *Sapindaceae*. The 10 honeys from Malawi were considerably varied and contained a greater number of pollen types. Predominant pollens in different samples were *Vernonia*, *Synedrella*, *Eucalyptus*, *Macadamia* and *Faurea*, and honeydew elements were also present in several samples. D. G. Lowe
Istituto di Entomologia Agraria, Univ. Perugia, 06100 Perugia, Italy.

Schulten, G. G. M. *Megachilidae (Hymenoptera, Apoidea) from Malawi (Central Africa). The genera Creightonella, Megachile (s.str.) and Chalicodoma.* Beaufortia (1977) 26 (331) 43–76 [En, B]

A collection of *Hymenoptera*, made in Malawi between 1968 and mid-1975, consisted of 113 specimens (10 species) of the genus *Creightonella*, 408 specimens (38 species) of the genus *Megachile* (s. str.) and 348 specimens (12 species and six subspecies) of the genus *Chalicodoma*. Their distribution in Malawi is indicated. Seven new species are described, viz. *M. nigrimanus* (male + female); *M. feijeni* (male + female); *M. horrida* (female); *M. nigra* (female); *M. zombae* (female); *M. mlunguziensis* (female and *M. puncto-marginata* (male). Author

Entomology Section, Royal Tropical Inst., Amsterdam, Netherlands.

Stange, M. *Malawi German beekeeping development project. Baseline survey 1992.* Mzuzu, Malawi; MGBDP. (1993) 125 pp. [En, Bd]

A German beekeeping development project in the north of Malawi has introduced top-bar hives to new and traditional beekeepers formed into clubs. This socio-economic survey of 70 clubs which had been established for at least one year was based on group and individual interviews,

inspection of equipment and records, and analysis of project data. It reports on the demographic characteristics of the beekeepers, functioning of the beekeeping clubs, technical skills of beekeepers, condition of beekeeping equipment, and financial viability of clubs; and makes recommendations. A. G. Matheson

Vicidomini, S. [*Systematics and distribution of the Xylocopini (Insecta, Hymenoptera, Apidae, Xylocopinae): new and rare records for Africa. II.*] *Sistematica e distribuzione degli Xylocopini (Insecta, Hymenoptera, Apidae, Xylocopinae): nuove e rare segnalazioni per l'Africa. II.* Atti Mus. civ. Stor. nat. Morbegno (98) 9 73–76 [It, en, Ba]

Five *Xylocopa* species were recorded for the first time in central East Africa, one in Malawi and four in Uganda.

via Velardi 10, 84014 Nocera Inferiore (SA), Italy.

Werger, M. J. A. (ed.). *Biogeography and ecology of Southern Africa.* Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first six chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation e.g. the afromontane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16–31 each cover a major taxonomic group of animals. Chapter 27, by A. J. Prins, covers the *Hymenoptera*. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853–857 briefly describe the Apoidea known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. D. G. Lowe

Malaysia

Philippines, United Coconut Association, Manila. *Research advances in insect pollination of oil palm and its impact on lauric oils (palm kernel/coconut) market: executive summary.* Cocomunity – Quarterly Supplement (1982) (No. 41) 21–24 [En]

Studies in Malaysia showed that *Elaeodobius* sp. (West African weevil) pollinated more flowers per bunch than conventional assisted pollination. Yields in 1982 [due to their introduction] were estimated to be 35% more than in 1981. This was equivalent to 150 000 t more kernel oil, at lower production costs.

Food and Agriculture Organization of the United Nations. *Proceedings of the Expert Consultation on Beekeeping with Apis mellifera in Tropical and Sub-Tropical Asia,*

***Bangkok/Chiang Mai, Thailand, 9–14 April 1984.* Rome, Italy; Food and Agriculture Organization of the United Nations. (1984) v + 250 pp. [En, B]**

The proceedings include nine technical papers on various aspects of beekeeping in Asia, including: constraints caused by parasitic mites; bee forage; pollination; honey production; beekeeping in rural economies. Of these papers, four are abstracted or listed individually in *Apicultural Abstracts*. There are also 'status reports' for the following: Afghanistan, Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Western Samoa. The proceedings also contain a list of participants, list of apiaries visited, and the resolutions of the meeting. D. G. Lowe

Thailand, Department of Agricultural Extension; International Development Research Centre. *The consultation of beekeeping development on Apis cerana, 16–17 January 1986, Phuket, Thailand*. Bangkok, Thailand; Department of Agricultural Extension. (1986) xi + 105 pp. [En, lost in mail 1999]

The proceedings of this meeting (photocopied from typed manuscripts) include the texts of 13 papers that were presented (three are in Thai). Several papers deal with various aspects of *Apis cerana* beekeeping in Thailand, and three discuss the research programmes of Kasetsart University, Chulalongkorn University, and the Entomology and Zoology Division of the Department of Agriculture. Other contributions describe beekeeping in Malaysia, Sri Lanka and China. There is also one paper on Africanised honeybees (*A. mellifera*). D.G. Lowe

Malaysian Beekeeping Research and Development Team. *Beekeeping: Malaysia research and development. Summary report 1983–1986. A final report submitted to the International Development Research Centre*. Malaysia; Malaysian Beekeeping Research and Development Team. (1987) iii + 77 pp. [En, Bd]

The results of this 4-year research and development programme are summarised under the following nine headings: introduction, research highlights, hive management (hive design, bee selection, beekeeping under rubber), bee botany (flowering periods, pollen atlas, pollen in honey, pollination of cashew nut), bee nutrition, pests and diseases, honey analysis and pasteurisation, extension, studies on *Apis dorsata* and pheromones. The objectives of the programme were to promote modern movable-comb beekeeping, to provide an effective extension service for promoting beekeeping as a subsistence industry of coconut and rubber smallholders, and to provide a nucleus of research support. An extension of the project is planned. D.G. Lowe

Beenet Asia. *Proceedings of the Beenet Asia workshop on priorities in R & D on beekeeping in tropical Asia*. Penang, Malaysia; Beenet Asia, Universiti Pertanian Malaysia and Southbound. (1993) xii + 149 pp. ISBN 983-9054-05-8 [En, Bd]

The proceedings of this workshop, held in Kuala Lumpur in 1992, comprise a series of country reports and a number of research proposals. The reports describe aspects of beekeeping in Thailand (especially *Apis cerana* queen rearing), Vietnam, Indonesia, South Sulawesi (including bee hunting), Philippines, China, Sabah and Malaysia. Research which is proposed includes selection for high honey production in *A. cerana*, studies on biodiversity of *A. cerana* in Vietnam, quality improvement and marketing of hive products in Sulawesi, and establishment of *A. cerana* in coconut-growing areas of the Philippines. The objectives of organisations in Beenet Asia are also described and a number of resolutions are listed. D.G. Lowe

Apidologie. [Asian honeybee species]. *Apidologie* (1996) 27 (5) 329–432 [En, fr\de, Bj]

This special issue of *Apidologie* is devoted to Asian honey bee (*Apis*) species, including two species confirmed as distinct species by research reported here. These are *A. nuluensis* (Sabah, Borneo, Malaysia) and *A. nigrocincta*

(Sulawesi, Indonesia). The nine papers and three scientific notes also deal with *A. laboriosa*, *A. cerana*, *A. koschevnikovi* and *A. dorsata*. P. Walker

Anderson, D.L. and Trueman, J.W.H. *Varroa jacobsoni (Acari: Varroidae) is more than one species*. *Experimental & Applied Acarology* (2000) 24 (3) 165–189 [En, Ba]

The studies reported here on genotypic, phenotypic and reproductive variation among *V. jacobsoni* (VJ) infesting *Apis cerana* throughout Asia demonstrate that VJ is a complex of at least two different species. In a new classification VJ is redefined as encompassing nine haplotypes (mites with distinct mtDNA CO-I gene sequences) that infest *A. cerana* in the Malaysia-Indonesia region; these include a Java haplotype, specimens of which were used to first describe the species at the beginning of the 20th century. A new name, *Varroa destructor* n. sp., is given to six haplotypes that infest *A. cerana* in mainland Asia. Adult females of *V. destructor* are significantly larger and less spherical in shape than those of VJ, and they are also reproductively isolated from VJ females. The taxonomic positions of a further three unique haplotypes that infest *A. cerana* in the Philippines are uncertain and require further study. Other studies reported here also show that only two of the 18 different haplotypes concealed within the complex of mites infesting *A. cerana* have become pests of *A. mellifera* worldwide. Both belong to *V. destructor*; the most common is a Korea haplotype, so-called because it was also found parasitising *A. cerana* in South Korea. It was identified on *A. mellifera* in Europe, the Middle East, Africa, Asia, and the Americas. Less common is a Japan/Thailand haplotype, so-called because it was also found parasitising *A. cerana* in Japan and Thailand. It was identified on *A. mellifera* in Japan, Thailand and the Americas. Our results imply that the findings of past research on VJ refer mostly to *V. destructor*. Our results will also influence quarantine protocols for bee mites, and may present new strategies for mite control.

CSIRO Entomology, PO Box 1700, Canberra, ACT 2601, Australia.

Appanah, S., Willemstein, S.C. and Marshall, A.C. *Pollen foraging by two Trigona colonies in a Malaysian rain forest*. *Malayan Nature Journal* (1986) 39 (3) 177–191 [En, Bb]

From June 1977 to July 1978, at about 10-day intervals, samples of pollen were removed from foragers returning to nests of *Trigona erythrogastra* and *T. geisslerii* in the Pasoh Forest Reserve, Malaysia. The diurnal foraging patterns were also monitored, and the behaviour of *T. erythrogastra* foragers at an artificial feeder (sugar solution) was observed. There was a continuous supply of pollen throughout the observation period, and both species foraged on a wide variety of plants belonging to at least 16 families. There were two particularly active foraging seasons, in August–November and March–April, with coincident peaks in pollen gathering in September–November and March–May. Foraging began at about 07.00 hours and ended shortly after 18.00 hours. Foragers of *T. erythrogastra* followed the artificial feeder as it was moved further away from the nest, until the experiment ended with the feeder at 63 m from the nest. Individual bees were capable of visiting the feeder throughout the day, for several days. It

was estimated that a single bee could have made 141 trips to the feeder in a single day. The bees displayed a sense of time and visited the feeder when food was available. The foraging ability of trigonid bees in relation to the rain forest environment is discussed. *D. G. Lowe*
Forest Res. Inst., Kepong, Selangor, Malaysia.

Atim, A. B., Daud, M. N. and Yaakob, A. M. Relationship of nectar flow on colony development and honey yield of *Apis cerana* under *Hevea brasiliensis* in Malaysia. *Journal of Natural Rubber Research* (1986) 1 (3) 176–186 [En, Bb]

Studies of three *H. brasiliensis* clones in Sungai Buloh, Malaysia, showed that nectar produced by glands on trifoliate leaves was available for about one month, with peak flow occurring during the second and third weeks of March. The volume of nectar flow was negatively correlated with rainfall but there was no correlation between nectar volume and its sugar content. Colonies of *A. cerana* kept under trees of one of the rubber clones (but not the other two) showed correlations between numbers of brood, pollen stores, honey yield and new cells. Honey production by bees foraging on the different clones was not significantly different (1.73–2.97 kg/colony) but it reflected differences in the nectar flows of the clones. *J. M. Gedy*

Rubber Res. Inst., P.O. Box 10150, 50908 Kuala Lumpur, Malaysia.

Atim, A. B. and Yaakob, A. M. Nectar dynamics of *Hevea brasiliensis* and its application to beekeeping management under rubber in Malaysia. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988. London, UK; International Bee Research Association. (1989) 249–258 ISBN 0-86098-196-7 [En, Bde]

The petiolar nectary glands of *H. brasiliensis* are described and anatomical details revealed by light and electron microscopy are illustrated. All the 1-year-old seedlings studied produced very small amounts of nectar and production was not significantly different between the 10 clones studied. Analysis of nectar flow from older, tapped trees indicated that there were no significant differences between the clones RRIM 701, RRIM 600 and PR 255 in the amount of nectar produced per season, but the mean nectar volume per leaflet was higher in RRIM 701 than in the other two clones. Untapped RRIM 600 produced a significantly higher volume of nectar than tapped RRIM 600, but there was no significant difference in sugar content. At hive densities of 4, 8, 16 and 32 hives per 0.4 ha, the total yield of Hevea honey was 1.5, 2.6, 11.6 and 13.0 kg respectively. Rainfall reduced yields by restricting honeybee foraging activity and washing nectar droplets from the leaves. Beekeeping management practices in relation to nectar phenology of Hevea clones is discussed. *D. G. Lowe*
Crop Protection & Microbiology Div., RRIES, 4700 g Buloh, Selangor, Malaysia.

Bakar, A. A., Napi, D. M. and Malik, Y. A. Relationship of nectar flow on colony development and honey yield of *Apis cerana* under *Hevea brasiliensis* in Malaysia. *Journal of Natural Rubber Research* (1986) 1 (3) 176–186 [En, Bb]

H. brasiliensis is an important source of (extrafloral) nectar

in many tropical countries. In the three clones studied, nectar was available for about four weeks, with the maximum flow during the second and third weeks of March. Nectar volume was highly negatively correlated with rainfall (rain washed the nectar from the leaflets). Nectar volume was not correlated with its sugar content in any clone. Honey was harvested in mid-March and at the end of April; mean total yields from the three clones (four colonies/clone) were 2.97, 2.13 and 1.73 kg/colony. Differences between clones were not significant. Some factors related to management of *A. cerana* colonies working this flow are discussed briefly. *P. Walker*

Rubber Res. Inst. Malaysia, PO Box 10150, 50908 Kuala Lumpur, Malaysia.

Baker, E. W. and Delfinado-Baker, M. An unusual new species of *Neocyphophylax* (Acari: Ameroseiidae) from the nests of stingless bees (Apidae: Meliponinae). *International Journal of Acarology* (1985) 11 (4) 227–232 [En, B]

This new species, which was found in nests of *Trigona nr. itami* and *T. thoracica* in Malaysia, is named *Neocyphophylax phooni* Baker and Delfinado-Baker. It is described and illustrated, and is compared with other *Neocyphophylax* species, all of which are believed to be pollen feeders; the mites use bees and other insects as a means of dispersal. An identification key to the 11 known species is given, together with their distribution and the names of the insects and flowers from which they were collected. *P. Walker*

Systematic Entomology Lab., USDA-ARS, Beltsville, MD 20705, USA.

Delfinado-Baker, M. and Baker, E. W. New mites (Acari: Laelapidae) from the nests of stingless bees (Apidae: Meliponinae) from Asia. *International Journal of Acarology* (1988) 14 (3) 127–136 [En, Bc]

Two new mite species found in *Trigona* nests from Sumatra, Malaysia and the Philippines are described and illustrated. They belong to the genus *Eumellitiphis*, hitherto known only from a single species described from *Lestrimelitta* nests from the West Indies. A key is provided for *Eumellitiphis* females. A list of known laelapid commensals inhabiting the nests of meliponine bees is given, with distribution and host relationships. *Author*

Beneficial Insects Lab. & Systematic Entomology Lab., ARS, USDA, Plant Sciences Inst., BARC, Beltsville, MD 20705, USA.

Eltz, T., Brühl, C. A., Imiyabir, Z. and Linsenmair, K. E. Nesting and nest trees of stingless bees (Apidae: Meliponini) lowland dipterocarp forests in Sabah, Malaysia, with implications for forest management. *Forest Ecology and Management* (2003) 172 301–313 [En, Bc]

A total of 275 nests of 12 *Trigona* species were located, mostly (91.5%) in living trees, and the rest in dead trees. Nests were often aggregated (mean 1.94 nests/tree). Possible effects of logging were examined. *Author*
Dept of Animal Ecology and Tropical Biology, Theodor-Boveri-Institut for Biosciences, Am Hubland, 97074 Würzburg, Germany.

Eltz, T., Brühl, C. A., Kaars, S. van der and Linsenmair, K. E. **Determinants of stingless bee nest density in lowland dipterocarp forests of Sabah, Malaysia.** *Oecologia* (2002) 131 (1) 27–34 [En, X]

A study indicated that the abundance of stingless bees in these forests is chiefly dependent on the local availability of food resources. Bee populations strongly benefit from edge effects and increased foraging habitat diversity.

Lehrstuhl für Tierökologie und Tropenbiologie (Zoologie III) der Universität Würzburg, Biozentrum, Am Hubland, 97074 Würzburg, Germany.

Fain, A., Lukoschus, F.S. and Nadchatram, M. **Two new species of Cheletophyes Oudemans, 1914 (Prostigmata: Cheyletidae) from the nest of a carpenter bee in Malaysia.** *International Journal of Acarology* (1980) 6 (4) 309–312 [En, B]

Fain, A., Lukoschus, F.S. and Nadchatram, M. **Ceroglyphus malaysiensis n. sp. (Acaridae) from the nest of a carpenter bee in Malaysia.** *Malayan Nature Journal* (1982) 36 (2) 113–121 [En]

Freeman, C.E., Worthington, R.D. and Jackson, M.S. **Floral nectar sugar compositions of some south and southeast Asian species.** *Biotropica* (1991) 23 (4b) 568–574 [En, Bb]
Samples of floral nectar were collected in 1987–88, as the opportunity arose, from 62 plants, mainly in Malaysia. Their sugar compositions, determined by HPLC, are now reported for the first time. Sucrose content was 80–100% of total sugars in more than half of the nectars; sucrose was absent or its content low (less than 4%) in only 14 nectars. The results are discussed in relation to the type of pollinators likely to visit the flowers; for the few plants where pollinators are known, the sugar composition is consistent with the type of pollinator. P. Walker

Laboratory for Environmental Biology, University of Texas at El Paso, El Paso, TX 79968, USA.

Habibullah, M. S. and Ismail, M.M. **Production frontier and technical efficiency: the case for beekeeping farms in Malaysia.** *Bangladesh Journal of Agricultural Economics* (1994) 17 (1/2) 31–43 [En, 41 ref.]

The paper presents a study examining the level of technical efficiency of a sample of beekeepers in Malaysia. A Cobb-Douglas production frontier equation is used to assess the level of efficiency. Beekeeping is labour intensive, but is usually done on a part-time basis using family labour. Data were collected in 1989 from 116 beekeepers (from which the data of 52 beekeepers were used) in eight areas of four states in Peninsular Malaysia. The technical efficiency index produced from the frontier production function suggests that the sample of Malaysian beekeepers are highly technical inefficient. There is considerable potential to increase output using available inputs and technology. It is also noted that technical inefficiency decreases with increasing farm size.

Faculty of Economics and Management, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Ho, Y.F. **Xylocopa latipes, the carpenter bee.** Kuala Lumpur, Malaysia; Forest Research Institute Malaysia – Institut Penyelidikan

dikan Perhutanan. *FRIM Technical Information (Forest Research Institute Malaysia)* (1993) (No. 45) 4 pp. [En, 5 ref.]

Xylocopa latipes (Xylocopidae) is a timber pest often noticed at the Forest Research Institute Malaysia. It is commonly known as the carpenter bee and is found in warm tropical climates. Carpenter bees are large, robust, black and shiny. Their wings are fuscous with metallic blue-green and purple reflections. They make deep tunnels in timbers, roofing rafters, beams, wooden transmission poles and fallen trees but are not found on living trees.

Forest Research Institute of Malaysia, Kepong, 52109 Kuala Lumpur.

Ibrahim, R. and Yusoh, M.R. **Control of wasps and weaver ants in Apis cerana apiaries in West Malaysia. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.** London, UK; International Bee Research Association. (1989) 377–378 ISBN 0-86098-196-7 [En, Bdo]

Jaafar, A.S. Bin Uda. **Experiments on selection of Apis cerana colonies for honey yield. [Ujian-ujian di makmal untuk pemilihan baka lebah madu Apis cerana Fabr.].** Thesis, University Pertanian Malaysia. (1987) [My, en]

Measurements of corbicular area, pupal weight, hoarding behaviour and lifespan of local honeybees, *Apis cerana*, were made in the laboratory. Three full-strength field colonies from the same apiary were also investigated. None of the individual parameters measured in the laboratory was significantly correlated with honey yields from the colonies at the end of a nectar flow. The use of the laboratory methods (with greater replication) in breeding programmes to select for honey production is discussed.

Author

Univ. Pertanian, Serdang, Selangor, Malaysia.

Kang, L.C. **Honey bees in Malaysia.** *Nature Malaysiana* (1980) 5 (3) 26–33 [En, B]

Illustrated account of bee foraging and beekeeping with *Apis cerana*.

Kevan, P. G. (ed.). **The Asiatic hive bee: apiculture, biology, and role in sustainable development in tropical and subtropical Asia.** Cambridge, Canada; Enviroquest Ltd. (1995) vii + 315 pp. ISBN 0-9680123-0-2 [En, Bdo]

This book is based on the 'Advanced Course in beekeeping with *Apis cerana* in tropical and subtropical Asia', held on 7–14 February 1988, at the Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia. It is regrettable that there were set-backs in its production which delayed its publication for so long. Inevitably, in some areas where there has been much research since the mid-1980s, the information it contains is now out of date. However, the book contains a lot of useful contributions, particularly those on the basic biology of *Apis cerana* and the principles and practice of beekeeping with this species of honey bee, and it has been well edited and is well organised. The 38 chapters, some in the form of reviews, are divided into seven sections, the first of which describes the history of *A. cerana* beekeeping and the place of bees (Apoidea) in the natural ecosystem. Section II contains chapters on biology, genetics, taxonomy and behavioural aspects of *A. cerana*;

two chapters are specifically on the Japanese race, *A. cerana japonica*. The four chapters in section III deal with genetics, queen production and mating manipulation. Section IV, with nine chapters, deals with bee botany, floral calendars, foraging and pollination, with some specific examples (apple, sarson, toria). Eight chapters on pests, diseases and pesticide poisoning comprise Section V, with bee viruses and parasitic mites receiving special attention; general accounts are given for China and Malaysia. The section on management, economics and honey production (VI) includes chapters on migratory beekeeping, removing water from honey, and the marketing of honey. The final section deals with the development of beekeeping, including funding and examples of inter-institutional cooperation. The book ends with an address list for the 37 contributors, and a good, combined author and subject index. The book will be of interest to beekeepers, students and development personnel in tropical countries; on the whole, it succeeds in its stated goal 'to promote the Asiatic hive bee as an interesting species with great potential for apiculture and development throughout tropical and sub-tropical Asia'. *D. G. Lowe*

Department of Environmental Biology, University of Guelph, Guelph, Ontario N1G 2W1, Canada.

Kiew, R. and Muid, M. *Bees and palms in Peninsular Malaysia*. *Principes* (1989) 33 (2) 74–77 [En, Ba]

The following palms are known to be foraged on by *Apis cerana*: coconut, sago (*Metroxylon sagu*), Manila palm (*Veitchia merrillii*), MacArthur palm (*Ptychosperma macarthuri*), betel nut (*Areca catechu*), royal palm (*Roystonea regia*), sugar palm (*Arenga pinnata*), princess palm (*Dictyosperma album*), *Arenga westerhoutii*, oil palm (*Elaeis guineensis*). *Apis dorsata* and *Trigona* species also forage on a wide range of palms. *D. G. Lowe*

Dept. Biology, Univ. Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Kiew, R. and Muid, M. *Beekeeping in Malaysia: pollen atlas*. Serdang, Selangor, Malaysia; Malaysian Beekeeping Research and Development Team. (1991) vi + 186 pp. ISBN 967-960-023-8 [En, Bd]

This book describes the pollens of 95 species in 84 genera and 43 families, of which 11 are major sources of both pollen and nectar, 22 are major sources of nectar and 16 are major sources of pollen (the remaining species are minor sources or are plants rarely visited by honey bees). The atlas aims to include most of the pollens found in *Apis cerana* honey, but it does not include all the species honey bees visit in Malaysia, excluding, for example, montane plants because beekeeping is not commonplace at higher altitudes. Preliminary chapters of the book give details of the methods used for pollen analysis, photographs of the pollen grains, the flower preferences of *A. cerana*, seasonality of flowering, migratory beekeeping and pollination. In the atlas itself the plants are arranged alphabetically by species. For each species there are photographs of the whole plant, the flower and the pollen grain. Information is given on pollen colour and size, plant habit, distribution and status (crop, weed, forest plant) in Malaysia, importance for beekeeping, and details of pollinators and the honey where known. There is a list of 42 references and a

subject index. The book will be of use to beekeepers and research workers in Malaysia and adjoining regions with a similar flora. *D. G. Lowe*

Malaysian Beekeeping Research and Development Team, Fakulti Pertanian, Universiti Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Koeniger, G., Mardan, M. and Ruttner, F. *Male reproductive organs of Apis dorsata*. *Apidologie* (1990) 21 (2) 161–164 [En, fr\ de, Bj]

The endophalli of 75 drones, collected in Selangor, Malaysia, were everted by manual compression before storage in ethanol. After an examination of these endophalli, a drawing was made to show the characteristics of the *A. dorsata* endophallus. The drawing differs in some respects from those of Simpson [*Proceedings of the Royal Entomological Society of London*, A (1970) 45, 169–171] and McEvoy and Underwood [*Journal of the Kansas Entomological Society* (1988) 61, 246–249]. However, the differences can be explained by difficulties in preparing the long thin sticky cornua for examination. This finding must be taken into account when endophalli of different *Apis* species are compared. *P. Walker*

Inst. Bienenkunde, Polytechnische Gesellschaft, Fachbereich Biologie, J.-W. Goethe-Univ, Karl-von-Frisch-Weg 2, 6370 Oberursel, Germany.

Kumar, N.R. *The special role of women in beekeeping in developing countries*. *Bee World* (1993) 74 (3) 153–155 [En, Bj]

Women as beekeepers in India, Kenya and Malaysia.

Department of Entomology, Dr. Y.S. Parmar University of Horticulture & Forestry, Nauni-Solan 173 230 (HP), India.

Lee, S.S., Norsham Suhaina, Y., Boon, K.S. and Chua, L.S.L. *The role of selected animals in pollination and dispersal of trees in the forest: implications for conservation and management*. *Journal of Tropical Forest Science* (2002) 14 (2) 234–263 [En, in, X]

Includes a list of insect pollinators in forest areas of Peninsular Malaysia and the plant species they visit. Forest Research Inst. Malaysia, 52109 Kepong, Kuala Lumpur, Malaysia.

Leong, C.T. Apiculture. *Annual Report of the Research Branch, Department of Agriculture for the year 1986*. Sarawak, Malaysia; Ministry of Agriculture and Community Development. (1987) 160 [En]

Research on beekeeping with *Apis cerana* in Sarawak is reported. A major problem is absconding due to wax moth (*Galleria mellonella*) infestations, and attacks by *Vespa tropica leefmansi*, *Bombus melanocholica* and *Oecophylla smaragdina*. A list of 14 nectar and/or pollen plants is presented. Res. Branch, Dept. Agric., Sarawak, Malaysia.

Lim, A.L. *Citrus and citroids: recent biological findings*. *Malayan Nature Journal* (2001) 55 (1/2) 221–229 [En, X]

Pollination of the six species studied in Malaysia is mainly by bees and butterflies.

Inst. of Biological Sciences, Univ. of Malaya, 50603 Kuala Lumpur, Malaysia.

Liow LeeHsiang, Sodhi, N. S. and Elmqvist, T. *Bee diversity along a disturbance gradient in tropical lowland forests of south-east Asia*. *Journal of Applied Ecology* (2001) 38 (1) 180–192 [En, wf]

Bee communities of eight forested sites in Johor (Malaysia) and Singapore were surveyed at the below-canopy level; the sites ranged from relatively undisturbed primary lowland dipterocarp forests to late secondary forests and exotic forests, including an oil palm plantation. Bee abundance, in particular that of *Apidae*, was significantly higher in larger primary forests than in other types of forest. However, bee species richness was higher in disturbed forests. The distribution of bees was apparently influenced by variables closely related to forest disturbance and resource abundance, such as the density of large trees, temperature, and flowering intensity of trees and shrubs. More stingless bees (*Trigona* spp.) were found where trees were larger and ambient conditions more constant but flowering intensities lower. The differences between the bee communities in forests of urban Singapore and primary forests in Johor indicate that ecological processes in the forests of Singapore, in particular pollination, could be changing. However, pollination may not be totally intact in the primary forests surveyed, as their bee communities seemed impoverished.

The Swedish Biodiversity Centre, CBM, Box 7007, 750 07 Uppsala, Sweden.

MaiShihah, A. and Kiew, R. *The pollen spectrum as a means of characterising Malaysian honeys*. *Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 274–278 ISBN 0-86098-196-7 [En, Bdo]

Analysis of the pollen types in 10 honey samples from different areas of Malaysia was carried out using standard methods of melissopalynology. Pollen spectra gave consistent results for the same type of honey from different areas. Honey from coconut-growing areas was unifloral, with coconut pollen (*Cocos nucifera*) forming 70–98% of pollen present. Honey from starfruit-growing areas was characterised by a combination of starfruit pollen (*Averrhoa carambola*), represented by 40–50% of total pollen, and *Mimosa pudica* with 34–35%. The more highly priced Malaysian honeys could be distinguished from six samples of cheaper honeys from Australia and China; there was no single pollen type in common between Australian, Chinese and Malaysian honeys. Australian samples had six pollen types of which *Eucalyptus* sp. predominated (70% of total pollen). Chinese honeys contained five pollen types of which *Tilia* sp. predominated (55% of total pollen). Malaysian honeys had between five and 14 (mean eight) pollen types. Coconut pollen was present in all samples examined and could be used as a marker pollen type. Other common pollens were starfruit and *Mimosa* (present in 75% of samples examined) and *Asystasia intrusa* and *Cleome rutidosperma* (present in 50% of samples). D. G. Lowe
Dept. Biology, Univ. Pertanian Malaysia, 43400 UPM, Serdang, Selangor, Malaysia.

Makhdzir, M. and Osman, M. S. *Beekeeping in coconut smallholdings in Pontian, Johor, West Malaysia*.

Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 179–186 [En, B]

Mardan, M. and Kevan, P. G. *Critical temperatures for survival of brood and adult workers of the giant honeybee, Apis dorsata (Hymenoptera: Apidae)*. *Apidologie* (2002) 33 (3) 295–301 [En, de, fr, Bj]

Capped brood and adult workers were removed from colonies and kept in incubated cages. At temperatures above 36°, the brood died; below 30°, emerging adults tended to be deformed. Optimal temperature for complete emergence of healthy adult workers was 34°. At temperatures from approx. 26° to 36° adults survived well; at 38° they died within five days, and at 45°, within 48 hours. Syrup consumption did not change with temperature, but water consumption rose rapidly above 38° to over 3 ml/bee at 45°. Author

Dept of Agroteknologi, Fakulti Pertanian, Universiti Putra Malaysia, Serdang 43400, Selangor D. E., Malaysia.

Mardan, M. *Development and honey gathering ecotourism*. *Bee World* (1994) 75 (4) 157–159 [En, Bj]

The incorporation of environmental conservation aspects into beekeeping development programmes, and projects to develop traditional honey hunting from *Apis dorsata* nests as tourist attractions ('ecotourism'), are discussed. D. G. Lowe

Universiti Pertanian Malaysia, 43400 UPM Serdang, Selangor Darul Ehsan, Malaysia.

Mardan, M., Hamid, A. H., Emby, Z., Marasidi, A. R. and Ismail, M. M. *Some aspects of honey collecting from colonies of Apis dorsata in Peninsular Malaysia*. *Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 442–448 ISBN 0-86098-196-7 [En, Bdo]

Honey hunters in Peninsular Malaysia can be categorised as 'Camuk' honey hunters, who are amateurs who hunt *A. dorsata* colonies nesting low down in ones or twos in accessible areas, and the 'Tualang' professional honey gatherers, who gather honey from aggregates of up to 20–150 colonies high up on a single tree. The 'bee trees' are 'owned' by groups of 5–8 honey gatherers. The honey gatherers climb up simply constructed wooden ladders of a fish-bone design, or rungs of connected bamboo pegs on the trees. The choice of cattle-bone, cow-hide and other non-metal material as harvesting equipment, and the strict adherence to taboos reflect the influence of Animism and Hinduism in the culture. In the last few centuries there has been little or no progress towards commercialism in honey harvesting, despite the bountiful reward in terms of honey and beeswax collected per tree. Reasons can be attributed to the dangerous nature of the practice, the aggressive nature of *A. dorsata*, social norms and beliefs, logistic problems and the combined effect of honey quality and marketing outlets. Behavioural characteristics and comb architecture of *A. dorsata*, and ecological and environmental cues, are used to locate colonies and to determine the appropriate times to harvest the honey. Honey gathering is now threatened by lumbering

activities which indiscriminately destroy 'bee trees' and foraging areas in virgin forest. D.G. Lowe
Plant Protection Dept., Fac. Agric., Univ. Pertanian Malaysia, 43400 Serdang, Selangor, Malaysia.

Mardan, M. and Kevan, P.G. *Honeybees and 'yellow rain'*. Nature, UK (1989) 341 191 [En, Bc]

Nineteen mass flights from *Apis dorsata* nests were studied. At least half of a colony's bees flew for 5–6 minutes in gentle arcs up to 20 m from the nest, and they defaecated during flight. On average, a bee lost 18.3 µl faeces, weighing 24.6 mg, i.e. about 20% of total body weight. The mass specific heat of the faeces was 1.85 cal per g °C. It is suggested that this loss of heat and weight is a means of increasing the bee's thermoregulatory capacity. 'Gobbling' (cooling a drop of regurgitated nectar on the mouthparts) always occurred before and after a mass flight. Defaecation flights occurred when thermal stress in the nest was greatest, i.e. when it was necessary to avoid lethal temperatures in the curtain of bees and in the brood nest. About 60% of mass flights took place between 09.00 hours and 12.00 hours, when ambient temperature was rising rapidly, and 20% between 16.00 and 18.00 hours, when it was often windless. P. Walker
Plant Protection Dept., Univ. Pertanian Malaysia, Serdang, Selangor 43400, Malaysia.

Mardan, M. and Kiew, R. *Flowering periods of plants visited by honeybees in two areas of Malaysia. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 209–216 [En, B]

Flowering calendars, based on field observations, are presented for seasonally flowering species visited by honeybees (*Apis cerana* and/or *A. dorsata*) in two areas of Malaysia: an agricultural area (1983, 1984, 1985), and a forest area (1983). A table of plants in alphabetical order of botanical name includes the 46 species represented on the calendars, as well as 25 species that flower throughout the year, and six species that flower frequently. The value of each plant as a nectar or pollen source is indicated, and English and/or Malay names are given. P. Walker
Dept. Plant Protection, Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia.

Mardan, M., Rahman, H.A. and Wong, M.L. *A new technique for mass rearing carpenter bees on dry wood logs. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.* Cardiff, UK; International Bee Research Association. (1994) 149–155 ISBN 0-86098-215-7 [En, Bdo]

A technique for rearing *Platynopoda latipes* is described. This bee is indigenous to Malaysia and is an effective pollinator of passion fruit. The nesting substrate described consists of a slice of dry wood, 3 cm thick and 15 cm wide, to which a dummy entrance is attached. The entrance consists of a wooden block containing a drilled hole, 2.1 cm in diameter and 3 cm deep, which is meant to entice and guide a bee to construct galleries in specific locations of the dry wood slice. A number of slices, separated from each other by 1-cm-wide pieces of wood, are held together to

make a 'log' by a rod which passes through them at the top. The wood used in the construction of the artificial nesting devices must contain less than 21% moisture. Methods for establishing the rearing 'logs' and for splitting them to introduce new substrate slices are described. D.G. Lowe
Malaysian Bee Research and Development Team, Universiti Pertanian Malaysia, Serdang, 43400 Selangor, DE, Malaysia.

Mathew, K.P. *Tropical beekeeping manual, Sabah, Malaysia. Sabah, Malaysia; Department of Agriculture.* Leaflet, Department of Agriculture, Sabah, Malaysia (1990) (No. 135) iv + 52 pp. [En, Bd]

This publication aims to provide basic guidance on practical beekeeping for anyone interested in keeping hive bees indigenous to Malaysia (*Apis cerana*, *A. koschevnikovi*). Topics covered include: honey bee species and castes; the honey bee colony; bee forage, including a list of cultivated and wild species found in Sabah; equipment, including modern hives and traditional log hives (gelodogs); apiary sites; management techniques, including migratory beekeeping; hive products; pollination management; diseases, pests and chemicals. There is a short glossary. D.G. Lowe
Department of Agriculture, Sabah, Malaysia.

Mohamad, B.M. and Mardan, M. *Effect of the presence of Apis cerana colonies on cashew fruit set. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 140–144 [En, B]

In a cashew [*Anacardium occidentale*] orchard, one large or two small *A. cerana* colonies were introduced to each of the trial plots consisting of two adjacent trees; fruit set on each was compared with that on its control plot – two adjacent trees 10 rows away (60 m). In the first two weeks of the trial the mean fruit set was 11.2% on control trees (without bees), and 9.2% on trial trees (with bees); in the second period, values were 6.2% and 11.7%. During the first period, an *Apis dorsata* colony settled near one control plot, and percentage fruit set on this plot was twice that on the corresponding trial plot with *A. cerana*. (This result was excluded from the means quoted above.) The *A. cerana* colonies introduced for these trials had almost no pollen stores two weeks later, and few bees were observed foraging for pollen. Cashew growers who want to improve pollination of their crop by introducing honeybee colonies are recommended to grow a good pollen source nearby; maize (*Zea mays*) is suggested. A suitable colony for introduction is considered to be one in which the bees cover eight frames of a 10-frame hive. P. Walker

Dept. Plant Protection, Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia.

Nagamitsu, T. and Inoue, T. *Foraging activity and pollen diets of subterranean stingless bee colonies in response to general flowering in Sarawak, Malaysia.* Apidologie (2002) 33 (3) 303–314 [En, de, fr, Bj]

General flowering, a type of supra-annual mast flowering at community level in south-east Asia, occurred in 1996 in Sarawak after a 4-year interval. Foraging by five *Trigona* species was compared during three periods in 1994 and 1996. Frequency of forager returns was significantly

higher in 1996. The proportion of nectar foragers did not differ between the years, but did differ significantly between different periods within a year. None of the pollen diet breadth variables measured differed significantly between years or between periods of a year. Pollen diet of colonies did not differ between 1994 and 1996, but differed between periods of a year. *Author*

Hokkaido Research Center, Forestry and Forest Products Research Inst., Hitsujigaoka 7 Toyohira, Sapporo 062-8516, Japan.

Nazeeb, M., Letchumanan, A. and Loong, S. G. A study of ablation of oil palms in Peninsular Malaysia after the introduction of the pollinating weevils (*E. kamerunicus*). *Planter* (1988) 64 245–251 [En, Bb]

Ablation (disbudding) at the immature stage is commonly practiced in Malaysia on the assumption that more nutrient will be available for vegetative growth, and in order to prevent rotting of the poorly pollinated early bunches. Since the introduction of the pollinating weevil, *Elaeidobius kamerunicus*, fruit set has improved and early bunches no longer tend to rot. In a trial in 1982–83, palms were ablated at monthly intervals from 12 months to 18, 22, 26 and 30 months after field planting. Weevils were generally well established at the time of the trial. A non-ablated control was used. Data on leaf nutrient levels, and on fruit bunch yields and individual weights in successive seasons, show that ablation up to 18 months was marginally economic and it is recommended that no change should be made in current practice.

Ebor Res., Sime Darby Plantations, Locked Bag 202, Batu Tiga, 40000 Shah Alam, Selangor, Malaysia.

Oldroyd, B. P., Osborne, K. E. and Mardan, M. Colony relatedness in aggregations of *Apis dorsata* Fabricius (Hymenoptera, Apidae). *Insectes Sociaux* (2000) 47 (1) 94–95 [En, Bc]

Microsatellite genotype analysis of seven adjacent *A. dorsata* colonies sampled from a single branch of a tree (in northern peninsular Malaysia) containing over 120 colonies were not related as mother/daughter. Thus the hypothesis that aggregations arise through splitting of the first-arriving colonies can be rejected.

School of Biological Sciences A12, Univ. of Sydney, Sydney NSW 2066, Australia.

Otis, G. W. Malaysian bees and beekeeping. Part 1: The bees of Asia. *Canadian Beekeeping* (1989) 14 (9) 204–205 [En, Bj]

Otis, G. W. Malaysian bees and beekeeping. Part 2: Beekeeping with the Eastern hive bee, *Apis cerana*. *Canadian Beekeeping* (1989) 14 (10) 224–226 [En, Bj]

Malayan *A. cerana* are reported to be more defensive than the species is over most of its range.

Otis, G. W., Patton, K. and Tingek, S. Piping by queens of *Apis cerana* Fabricius 1793 and *Apis koschevnikovi* v *Buttel-Reepen* 1906. *Apidologie* (1995) 26 (1) 61–65 [En, fr\de, Bj]

Piping queens of *A. cerana* and *A. koschevnikovi* were recorded in Sabah, Malaysia. The tooting calls of the two

species were similar and consisted of a single continuous call lasting 2–5 seconds (*A. mellifera* queens give a 1–2 second tone followed by several shorter tones). Quacking by an *A. koschevnikovi* queen in a queen cell was very similar to the quacking reported for *A. mellifera* except that the tempo was more rapid (4.39 quacks/second vs 3.0 quacks/second). *Author*

Department of Environmental Biology, University of Guelph, Guelph, Ontario, N1G 2W1, Canada.

Perlin, C. Beekeeping in Malaysia. [Bienenzucht in Malaysia]. *Allgemeine Deutsche Imkerzeitung* (1977) (No.10) 303–304 [De, B]

Phoon, A. C. G. Beekeeping in Malaysia. *Pertanika* (1983) 6 (Rev. Suppl.) 3–17 [En, B]

The history of beekeeping in Malaysia is reviewed, and the management of *Apis cerana* is described briefly. The most important nectar sources are coconut (*Cocos nucifera*), carambola (*Averrhoa carambola*), rubber (*Hevea brasiliensis*), rambutan (*Nephelium lappaceum*), cashew (*Anacardium occidentale*) and forest trees, especially *Dipterocarpaceae*. Honeybee diseases are unknown, but various pests and predators attack colonies. In 1982 there were 33 beekeepers in Peninsular Malaysia, and of these only four had more than 60 colonies. Honey yields are low; the most efficient colonies may produce 7 kg/yr, but many do not produce any surplus honey. The honey is of poor quality, with a high moisture content, but it is sold locally at a high price. The future development of beekeeping in Malaysia is discussed. *D. G. Lowe*

Biology Dept., Fac. Sci. & Environmental Studies, Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia.

Phoon, A. C. G. Pollination and fruit production of carambola, *Averrhoa carambola*, in Malaysia. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 129–133 [En, B]

Carambola flowers, which are distylous (pin and thrum flowers on separate trees), were visited by many *Apis cerana* and *Trigona thoracica* at Serdang, Malaysia. Both species preferred pin trees in the early morning, and thrum trees during the rest of day. The level of natural pollination was high for both morphs, but the number of thrum flowers bearing germinated pollen grains was negligible compared with the number of pin flowers which did so. During the 12 months after the introduction of a polleniser cultivar and four *A. cerana* colonies to one orchard, fruit production was 5.6 times as great as in the previous year. In another orchard, an increase in the number of colonies from two to four resulted in a 2-fold increase in the year's fruit production. *P. Walker*

Dept. Biology, Univ. Pertanian Malaysia, Serdang, Selangor, Malaysia.

Rao, A. N. and Tian, O. E. Pollen morphology of certain tropical plants [Malaysia]. *Journal of Palynology* (1974) 10 (1) 1–37 [En]

Reyes, S. G. and Michener, C. D. Observations on a parasitic allodapine bee and its hosts in Java and Malaysia

(*Hymenoptera, Anthophoridae, Allodapini*). *Tropical Zoology* (1990) 3 (2) 139–150 [En]

Braunsapis breviceps was found in nests of *B. hewitti* and *B. puangensis* in Java and Malaysia. *B. breviceps* is probably a social parasite – a female probably functionally replaces the egg-layer in a host nest. Morphological characteristics of the adult and larva of *B. breviceps* are described.

Snow Entomological Museum, Department of Zoology, University of Kansas, Lawrence, KS 66045, USA.

Richards, A.J. *Studies in Garcinia, dioecious tropical forest trees: the phenology, pollination biology and fertilization of G. hombroniana Pierre*. *Botanical Journal of the Linnean Society* (1990) 103 251–261 [En, Bb]

G. hombroniana, a tropical forest tree of Malaysia, was observed to be a facultative agamosperm pollinated by *Trigona* bees. Female flowers secrete nectar from their large discoid stigmas; this not only attracts the bees but also sticks pollen to the stigmas and promotes pollen germination. The nectar is secreted early in the morning on three or four successive days. Male flowers also secrete nectar, but only when the anthers dehisce on the second morning after anthesis. *Trigona* workers also collect pollen from the male flowers. Pollination of *Garcinia* by *Trigona* is thought to be rather unreliable. *J.M. Gedy*

Department of Biology, Ridley Buildings, University of Newcastle upon Tyne, Newcastle upon Tyne, NE1 7RU, UK.

Sahadevan, N. *Green fingers: a total commitment to the development of farming*. Seremban, Malaysia; Sahadevan Publications Sdn Bhd. (1987) xvi + 527 pp. [En, Bdo]

This superbly produced volume, with over 1200 colour illustrations (many whole-page), has been written with the intention of introducing to the people of Malaysia the importance of farming. It contains details of how to produce 33 vegetables, 22 fruits, 10 field crops and six spices. There are also sections on floriculture, apiculture, aquaculture, livestock and poultry. In the general section, information is provided on soils and their management, nutrients, fertilisers, compost, disease control etc. Informative articles on harvesting, handling and packaging of fruits and vegetables are provided by the DSIR, New Zealand. A comprehensive feasibility study is also included. This sets out all material and labour costs for each stage of the crop development process, together with the gross revenue likely at today's wholesale prices. In a publication of this type it is impossible to cover every aspect of a crop's management, or a type of husbandry. The section on beekeeping, for example, occupies only six pages (with 20 colour photographs). The book should succeed in its main objective, however, by providing an attractive introduction to farming so that interested readers will be encouraged to seek further information. *D.G. Lowe*

Sahadevan Publications, 13 Jalan Dato Lee Fong Yee, 70000 Seremban, Malaysia.

Sakagami, S.F., Ebmer, A.W. and Tadauchi, O. *A review of the bionomic studies on the Indomalayan halictine bees (Hymenoptera: Halictidae)*. *Esakia* (98) (38) 85–88 [En, Bb]

Sakagami, S.F. and Khoo, S.G. *Taxonomic status of the Malesian stingless bee Trigona reepeni, with discovery of Trigona pagdeni from northern Malaya*. *Kontyu* (1987) 55 (2) 207–214 [En, Bb]

Singh, K.G. (ed.). *Exotic plant quarantine pests and procedures for introduction of plant materials*. Serdang, Malaysia; ASEAN Plant Quarantine Centre and Training Institute. (1983) viii + 333 pp. ISBN 967-9965-00-7 [En, B]

This book, which contains 23 chapters written by many different authors, is concerned with a wide range of topics related to plant quarantine in the ASEAN (Association of South-East Asian Nations) region. The seven sections cover: pests of food crops; pests of plantation crops; pests in containers; pest of honeybees; nematodes; pests of ornamentals; quarantine developments in the ASEAN area, and the requirements of a model plant quarantine station. Most chapters discuss the damage potential of pests and the quarantine risks involved. *D.G. Lowe*

ASEAN Plant Quarantine Centre and Training Inst., Post Bag 209, UPM Post, Serdang, Selangor, Malaysia.

Start, A.N. and Marshall, A.G. *Nectarivorous bats as pollinators of trees in West Malaysia*. *Linnean Society Symposium Series* (1976) (No. 2) 141–150 [En, B]

Three species are common, but there is little overlap in their roosting habits and/or food sources. *Eonycteris spelaea* forages on a wide variety of plants; the major food sources of *Macroglossus minimus* and *M. sobrinus* are *Sonneratia* and *Musa*, respectively. The bats are successful pollinators of the plants they visit. *Author*

Dept. Zoology, Univ. Aberdeen, Aberdeen, UK.

Stauffer, P.H. *A fossilised honeybee comb from late Cenozoic cave deposits at Batu Caves, Malay Peninsula*. *Journal of Paleontology* (1979) 53 (6) 1416–1421 [En, B]

A specimen of well cemented ferruginous cave earth from quarry rubble at Batu Caves, a limestone hill near Kuala Lumpur, Malaya, included a structure of white secondary calcite in the shape of a honeybee comb. Fossilisation of the comb was by initial coating of the cell walls with calcite, followed by removal of the wax and its partial replacement by additional calcite. This process probably took place under water. The age of the specimen is not known, but on geomorphic reasoning may be late Tertiary or early Quaternary. The average cell diameter was 4.8 mm, with a depth of 9.1 mm. Based on these measurements, and using Maa's classification, the author identified the bee concerned as *Apis* (*Apis*) *javana* [= *Apis cerana* ?]. *D.G. Lowe*

Dept. Geology, Univ. Malaya, Kuala Lumpur, Malaysia.

Syed, R.A., Law, I.H. and Corley, R.H.V. *Insect pollination of oil palm: introduction, establishment and pollinating efficiency of Elaeidobius kamerunicus in Malaysia*. *Planter* (1982) 58 547–561 [En, B]

After undergoing quarantine procedures, the weevil was released in Peninsular Malaysia and in Sabah in 1981. It spread rapidly on oil palm estates, and after 2–3 months the weevil density was 40–233 per spikelet. Fruit set and fruit yield of oil palms has increased. The mean oil content per bunch has increased only slightly or not at all, and there have been difficulties in bunch stripping at the

factories, but the total oil yield in the first seven months of 1982 was 20% higher in Peninsular Malaysia, and 53% higher in Sabah, than the mean for the same period over the previous five years. *P. Walker*
Pamol Plantations Sdn. Bhd., Kluang, Malaysia.

Tay, K. C. *Observations on insects visiting oil palm inflorescences*. Planter (1981) 57 (659) 62–81 [En]

Large numbers of thrips (*Thrips hawaiiensis*) and moderate numbers of moths (*Pyroderces* sp.) were trapped on greased slides placed near the base of receptive female and male inflorescences at anthesis. The thrips were most active during daylight hours and moths after dark. Insects collected near young palms are also listed. In a trial in which cotton wads saturated with DDVP [dichlorvos] were placed around inflorescences during their period of receptivity, fruit set, bunch weight and oil yields were markedly reduced, compared with untreated controls.

H & C Oil Palm Res. Stn., Banting, Selangor, Malaysia.

Tealdi, C. *Beekeeping in Malaysia*. [L'apicoltura in Malaysia]. Ape Nostra Amica (1989) 11 (3) 19–23 [It, en, Bj]

Tealdi, C. *Bees [Apis dorsata] in Malaysia*. [Api in Malesia.]. Ape Nostra Amica (1989) 11 (4) 15–19 [It, en, Bj]

Turner, P. D. *Some aspects of natural pollination in oil palm (Elaeis guineensis)*. Planter, Malaysia (1978) 54 (627) 310–328 [En, B]

Pollination is by insects, and by airborne pollen.

Vogel, S. *Abdominal oil-mopping: a new type of foraging in bees*. Naturwissenschaften (1981) 68 627–628 [En, B]

Michener and Greenberg reported that bees of the genus *Ctenoplectra* (*Ctenoplectridae*) collect oil from *Momordica* and *Thladiantha* (*Cucurbitaceae*), and this behaviour is now described from observations in Malaysia. *Macropis* species (*Melittidae*) collect plant oils with their legs, but the *Ctenoplectra* female has an abdominal brush with which she mops up the oil from the flower. She walks across the elaiophors, swinging her abdomen, and after each swing uses her specialised hind legs to remove the oil from the brush. The oil is transported pure, or (mixed with pollen) as a paste. Storage of the loads in brood cells has not yet been observed. *P. Walker*

Inst. Botanik, Univ. Wien, A-1030 Vienna, Austria.

Vries, R. de. *Bees and beekeeping in the former Dutch East Indies with some references to Brunei, Serawak and Peninsular Malaysia*. Kathmandu, Nepal; R. de Vries. (1994) 49 pp. [En, Bd]

A number of studies have been published in Dutch on honey hunting and beekeeping with various species of honey bees and stingless bees in islands (now in Indonesia) which were part of the Dutch East Indies. The author, who worked on a beekeeping project in Java has now made this material available in English, together with studies in parts of Borneo and peninsular Malaysia. The bees are *Apis cerana*, *A. dorsata*, *A. florea* and introduced *A. mellifera*, and also *Trigona* spp. Appendices list races of bees, bee trees, forage plants and harvesting tools, with names in local languages. There is an 8-page bibliography. *E. Crane*

Yesuvadian, M. S., Aruldas, G. and Christopher, M. *Strategy for apicultural extension in tropical climates*. Indian Honey (1980) 2 (5/6) 15–33 [En, B]

India, with its wide range of climate, is used as an example. Beekeeping statistics for tropical and non-tropical countries are compared; in 1977 the former produced 29% of the world's honey. The climate and natural vegetation are indicated for the following regions: equatorial (rubber production in Malaysia as an example); tropical; savanna or Sudan type; hot desert. Methods and factors that should be considered when creating a strategy for apicultural extension are then considered, again with examples for India. *M. Nixon*

Indian Inst. Honey, Kuzhithurai-629163, Kanyakumari District., Tamil Nadu, India.

Yusof, M. R. and Ibrahim, R. *Current status of pests and diseases of the honeybee, Apis cerana F. in peninsular Malaysia. The Asiatic hive bee: apiculture, biology, and role in sustainable development in tropical and subtropical Asia* [edited by Kevan, P. G.]. Cambridge, Canada; Enviroquest Ltd. (1995) 185–190 ISBN 0-9680123-0-2 [En, Bdo]

The major pests of *A. cerana* in Malaysia are *Varroa jacobsoni*, the wax moths *Galleria mellonella* and *Achroia grisella*, the predatory wasps *Vespa tropica tropica* and *V. affinis indonesiensis*, and red ants, *Oecophylla smaragdina*. No disease has so far been confirmed [1988]. *D. G. Lowe*
Central Research Laboratories, Malaysian Agricultural Research and Development Inst., Serdang, Selangor, Malaysia.

Maldives

No entries

Malta

Commonwealth Secretariat; International Bee Research Association (eds). *Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) viii + 196pp. ISBN 0-85092-160-0 [En, B]

The papers selected for this book present widely differing examples of achievements and difficulties in various parts of the developing world. There are 11 original contributions, and these are abstracted or listed separately. The remainder are reprinted extracts from various sources, which have already been reported in *Apicultural Abstracts*

[54L/65; 57L/66; 1168, 1169, 1250L, 1251L, 1359/77; 131L, 132, 139, 432/78]. Appendix I (pp. 190–194) lists the common nectar sources in Malta, Sri Lanka, the Guianas and Belize, which form part of articles on these countries. Appendix II (pp. 195–196) is a conversion table of non-metric into SI units. *P. Walker*
Marlborough House, London SW1Y 5HX, UK.

Cutajar, J. P. *The life history of the honeybee. [L-istorja ta' hajjiet in-nahal.]*. Valletta, Malta; Mitbugh fil-Union Press. (1973) 55 pp. [Maltese, B]

Describes beekeeping in Malta.

Farrugia, V. *Beekeeping in the Maltese Islands. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) 41–46 [En, B]

Jaccarini, C. *Giren and imgiebah of Mellieha. In Mellieha throughout the tides of time*. Malta; Mellieha Local Council (2002) 169–196 [En, Bc]

The second half of this report contains a detailed description of three bee houses and 13 cave apiaries in a small area of north-west Malta. In the past, traditional hives (horizontal earthenware jars) were kept inside on shelves, and bees had access to the outside through flight holes in the walls. The largest cave apiary probably held up to 84 hives. Dates of construction are not known. *P. Walker*

Longo, S. *The traditional Maltese hive. [L'arnia tradizionale maltese]*. *Apicoltore Moderno* (1990) 81 (4) 147–150 [It, en, B]

This is a cylindrical pottery hive (tubo) used horizontally. Externally the hive length is 55 cm and diameter 28 cm. One end narrows to a neck which is fitted with flight entrances. The back is closed with a wooden lid, but during a flow it is removed and a honey extension (a cylindrical tube) is pushed on. Traditionally, the hives are/were

housed in a bee house which accommodates about 24 hives and allows space for the beekeeper to work behind them. The hives are arranged in three rows along one wall, and each hive has a flight hole through the wall. In Malta, there are about 7000 colonies, of which 300 are kept in traditional hives. *P. Walker*
Istituto di Entomologia Agraria, Univ. Catania, Catania, Italy.

Masetti, L. N. [*Malta: island of knights and honey bees.*] *Malte: l'île des chevaliers et des abeilles*. *Abeille de France* (2002) (No. 887) 583–287 [Fr, B]

Describes cave apiaries.

Route de Berghe, 06540 Fontan, France.

Masetti, L. N. *Malta, isle of the Knights, island of honey*. *American Bee Journal* (2003) 143 (6) 468–471 [En, B]

Traditional stone apiaries, and the hives used in them, are described and illustrated.

Route de Berghe, 06540 Fontan, France.

Sheppard, W. S., Arias, M. C., Grech, A. and Meixner, M. D. *Apis mellifera ruttneri, a new honey bee subspecies from Malta*. *Apidologie* (1997) 28 (5) 287–293 [En, fr, de, B]

Based on discriminant morphological analysis, the endemic honey bees of Malta are described as a distinct geographical race, *Apis mellifera ruttneri*, named after Professor Friedrich Ruttner. Mitochondrial DNA and behavioural characteristics support a closer relationship of *A. m. ruttneri* to *A. m. intermissa* of North Africa than to European subspecies (similar to the situation with endemic island honey bees of Sicily, *A. m. sicula*). These findings suggest a shared evolutionary history among bees populating the islands of the central Mediterranean region. Recent importations of non-native honey bee subspecies present a clear threat to conservation of this unique honey bee of limited distribution. *Author*

Department of Entomology, 166 FSHN Building, Washington State University, Pullman, WA 99164, USA.

Mauritius

Association Francaise des Volontaires du Progres. Beekeeping. [Apiculture]. *Revue de l'Association Francaise des Volontaires du Progres* (1983) (No. 36) 48 pp. [Fr, B]

This special number is devoted to the apicultural work of members of the French voluntary service in developing countries. Apiculture projects are or have been in operation in Central African Republic, Gabon, Cameroon, Togo, Niger, Senegal, Rwanda, Haiti, Seychelles, and are planned also for Benin, Burundi, Guinea Bissau, Mali and Mauritius. Traditional methods of honey hunting and beekeeping in various countries are described and illustrated, together with various top-bar hives and other applications of appropriate technology. Production and use of honey, beeswax and pollen are dealt with on a similar level. *E. Crane*

Bappoo, D. R. and Ramanah, D. *The state of beekeeping in Mauritius and other Mascarene Islands. Proceedings of the*

Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988. London, UK; International Bee Research Association. (1989) 500–503 ISBN 0-86098-196-7 [En, Bdo]

Bor, J. *Pollen morphology and the bireticulate exine of the Phyllanthus spp. (Euphorbiaceae) from Mauritius and Reunion*. *Review of Palaeobotany and Palynology* (1979) 27 (2) 149–172 [En]

'Campeche' [Brouard], J. *The introduction of bees to the Mascarene Islands. [L'introduction des abeilles aux Mascareignes.]*. *L'Express, Mauritius* (1973) (20 July) 1 p. [Fr, B]

Crane, E. *Honey sources of some tropical and subtropical countries*. *Bee World* (1973) 54 (4) 177–186 [En]

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented:

Africa – Botswana, Cameroon, Ethiopia, Mauritius, Morocco, Mozambique, Nigeria, Somalia, Zanzibar. America (South) – Ecuador, Guyana, Venezuela. Asia – Afghanistan, India, Iran Pakistan. D.G. Lowe
Reprinted as B.R.A. Reprint M73, price pounds-sterling 0.25 or \$0.80, B] Bee Research Association, Cardiff, UK.

Duggan, M. and Draper, M.R. *Craft Aid in Rodrigues: bees and disabled people*. *Beekeeping & Development* (2001) (No. 58) 6–7 [En, Bj]

Duggan, R.M. *Bees and their predators in far-away places*. Teddington, UK; Central Association of Bee-Keepers (2000) 11 pp. [En, Ba]

The natural hazards and predators present in four Caribbean islands and three islands in the Indian Ocean are described.

Duggan, R.M. *Beekeeping on the island of Rodrigues*. Surrey, UK; published by the author. (1993) 26 pp. [En, Bdo]
Rodrigues Island is in the Indian Ocean, about 400 miles north-east of Mauritius, and has an area of about 42.5 square miles. In 1993 there were over 120 beekeepers with 616 colonies (expected to rise to 750 by December 1993). The author describes various aspects of the island's beekeeping, including management methods, pests and diseases (no brood diseases or *Acarapis woodi* have been found), bee forage, honey production and marketing. D.G. Lowe

Duggan, R.M. and Vorwohl, G. *Preliminary field observations on honey sources in Mauritius and the Seychelles, and microscopical examination of the honeys. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 198–202 [En, B]

The Mauritius Ministry of Agriculture's list of honey plants includes seven species described as important and 45 less important species. Microscopical analysis of nine honeys from Mauritius confirmed the presence of pollen grains from several of these genera or species. A list of 36 species of honey plants and other plants visited by bees is also provided for the Seychelles, based on field observations. Pollen grains of several of these genera or species were identified in 10 Seychelles honeys. The lists give plants in alphabetical order of their botanical names, with local names alongside. P. Walker
Redstone Wood Cottage, Philanthropic Lane, Redhill, Surrey RH1 4DF, UK.

Ficart, F. *Attempts to characterize propolis. [Essais de caractérisation de la propolis]*. *Memoire Ingenieur Industriel, Institut Supérieur Industriel, Huy, Belgium*. (1991) 214 pp. [Fr, Bdo]
This review, with 138 references, covers the following aspects of propolis: consideration of theories concerning its origin; histological, botanical and geographical origin; collection and use by honey bees; harvesting by the beekeeper; the market for propolis; physicochemical properties; standardisation. Propolis specimens from various areas of Wallone (southern part of Belgium) and from China, Poland and Mauritius were analysed in order to determine qualitatively and quantitatively the presence of phenolic compounds in the aromatic fraction of propolis obtained by ethanol extraction. Fourteen benzoic and coumaric acid derivatives, two benzaldehyde derivatives and coumarin were detected by GC and TLC. Three flavonoids (chrysin, quercetin, galangin) were also detected, by TLC only. Antioxidative properties were investigated by a kinetic method (determination of the mean oxidation index of dry propolis following Vakhonina's process) and a potentiometric method, but these methods gave no satisfactory results. Author
Institut Supérieur Industriel, Laboratoire de Biotechnologie, Rue Saint-Victor 3, 4500 Huy, Belgium.

Hansen, D.M., Olesen, J.M. and Jones, C.G. *Trees, birds and bees in Mauritius: exploitative competition between introduced honey bees and endemic nectarivorous birds?* *Journal of Biogeography* (2002) 29 (5/6) 721–734 [En, B CD1]

Visitation rates of two species of nectarivorous endemic birds and of introduced *Apis mellifera* to two endemic species of flowering trees (*Sideroxylon* spp.) were recorded, as well as diurnal variation in nectar standing crop and nectar production. The results indicate that honey bees could be interfering with endemic interactions between the *Sideroxylon* trees and the birds: the latter foraged on the flower early in the morning but when honey bee activity increased, causing a depletion in the available nectar, the birds moved to other plants. However, there was no control study site without honey bees. Bagging and caging experiments showed that the bees were less efficient pollinators of the flowers than the birds. It is pointed out that island ecosystems are especially vulnerable to the effects of introduced honey bees.

Dept of Ecology and Genetics, Building 540, Inst. of Biology, Univ. of Aarhus, 8000 Aarhus C, Denmark.

Isola, A. *Beekeeping in Mauritius. [Apicultura a Mauritius]*. *Ape Nostra Amica* (1987) 9 (4) 25–29 [It, Bj]

Mozambique

Alcobia, J.J. *Beekeeping in Mozambique*. *Apiacta* (1987) 22 (2) 62–64 [En, Bj]

Alcobia, J.J.F. *Rearing bees (beekeeping). [Criacao de abelhas (apicultura)]*. Maputo, Mozambique; Ministerio da Agricultura. (1985) 80 pp. [Pt, B]
Basic textbook for beekeepers in Mozambique.

Alcobia, J.J.F. *A movable horizontal hive in Mozambique. [A colmeia movel horizontal em Mocambique]*. *Apicultura no Brasil* (1987) (No. 23) 4–5 [Pt, Bj]
Dimensioned drawings are given.

Alcobia, J.J.F. *Rearing bees (beekeeping). [Criacao de abelhas]*. Maputo, Mozambique; Ministerio da Agricultura. (1987) (Ed. 2) 100 pp. [Pt, Bd]

Larger, revised edition for beekeepers in Mozambique.

Alcobia, J.J.F. *The horizontal moveable frame hive of Mozambique. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H.; Buys, B.]*. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 156 ISBN 0-620-15132-3 [En, Bd]

Used in beekeeping with *Apis mellifera scutellata*.
Program Nacional de Apicultura, P.O. Box 1011, Maputo, Mozambique.

Alcobia, J.J.F. and Miranda, A. *Beekeeping in Mozambique. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H.; Buys, B.]*. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 148–149 ISBN 0-620-15132-3 [En, Bd]
Program Nacional de Apicultura, P.O. Box 1011, Maputo, Mozambique.

Bemer, D. [*War and beekeeping. Beekeeping in reconstruction.*] *Guerre et apiculture. L'apiculture au service de la reconstruction. Fruits et Abeilles* (2002) (December) 386–387 [Fr, Bj]

Campos, M. da G.R. *Detection of melibiose in the sugars of honey using high performance liquid chromatography. [Detecção de melibiose nos glucidos do mel por cromatografia liquida de alta pressão]*. *Revista Portuguesa de Farmacia* (1989) 39 (3) 101–103 [Pt, en, Bc]

Normal-phase HPLC was used for the analysis of sugars in honey. A mobile phase of acetonitrile + water (75:25) at a flow rate of 2 ml/min eluted disaccharides rapidly, and melibiose could be determined in about 10 minutes. Melibiose content in some honeys from the Beira area of Mozambique ranged from 0.68 to 2.71% (compared with 37.05–42.79% fructose and 2.89–4.46% sucrose). P. Walker
Laboratorio de Farmacognosia, Centro de Estudos Farmaceuticos do INIC, Faculdade de Farmacia da Universidade de Coimbra, Coimbra, Portugal.

Crane, E. *Honey sources of some tropical and subtropical countries*. *Bee World* (1973) 54 (4) 177–186

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented: Africa – Botswana, Cameroon, Ethiopia, Mauritius, Morocco, Mozambique, Nigeria, Somalia, Zanzibar. America (South) – Ecuador, Guyana, Venezuela. Asia – Afghanistan, India, Iran Pakistan. D.G. Lowe
International Bee Research Association, Cardiff, UK.

Guy, R. *Mocambique*. *South African Bee Journal* (1971) 43 (5) 11–19 [En, Bee forage, hives, beekeeping, B]

Harun, M.A.S. and Veeneklaas, R.J. *Organizational assistance and educational support of the apiculture programme in Mozambique. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London,

UK; International Bee Research Association. (1989) 305–309 ISBN 0-86098-196-7 [En, Bdo]

Kanfi, F., Miranda, A. and Alcobia, J. *Beekeeping in Africa: Mozambique. [Apicultura en Africa: Mozambique]*. Colmenar (1994) (No. 2) 31–34 [Es, Bj]

Kawa, M.N. *For better bee-farming in Malawi*. Maputo, Mozambique; Programa Nacional de Apicultura. (1987) 12 pp. [En, Bc]

In recent decades, beekeeping in Malawi has contracted, although there is potential for development. In an effort to improve the situation, a 23-day beekeeping workshop, funded by the Peace Corps, was organised; 58 participants were taught basic beekeeping techniques, using simple equipment. They were also told how to teach these methods to village beekeepers. As a result of the workshop, two new posts were created in the Ministry of Wildlife and Natural Resources: a beekeeping officer and a teacher at the Natural Resources College. It is stressed that beekeepers must be given an incentive to produce good quality honey and beeswax for sale. The recommendations of this report include: the training of beekeeping extension staff, the introduction of top-bar hives, and the construction of a medium-sized honey processing plant. P. Walker

Kawa, M.N. *Bees and beekeeping activities in southern Africa. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 511–516 ISBN 0-86098-196-7 [En, Bdo]
Particularly in Mozambique.

Radloff, S.E., Hepburn, H.R. and Villet, M.H. *The honeybees, Apis mellifera Linnaeus (Hymenoptera: Apidae), of woodland savanna of southeastern Africa*. *African Entomology* (1997) 5 (1) 19–27 [En, Bc]

The morphometric characters and sting pheromones of worker honeybees, *A. mellifera*, were analysed by multivariate methods to identify discrete populations in the southeastern woodland savanna of Africa. A discrete population in Mozambique is classified as *A. m. litorea*, a second in Zimbabwe as *A. m. scutellata* and a third group in southwestern Zambia as *A. m. adansonii*. A zone of introgression between the last two subspecies occurs in south-central Zambia and in the Zambezi Valley.
Department of Statistics, Rhodes University, Grahamstown, 6140, South Africa.

Werger, M.J.A. (ed.). *Biogeography and ecology of Southern Africa*. Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first six chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation e.g. the afro-montane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters

16–31 each cover a major taxonomic group of animals. Chapter 27, by A.J. Prins, covers the *Hymenoptera*. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853–857 briefly describe the Apoidea known to occur in southern Africa. The majority of the remaining chapters cover the ecology of

special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. D.G. Lowe

Namibia

Griswold, T.L. *A review of Ochreidae (Hymenoptera: Megachilidae: Osmiini)*. *Pan-Pacific Entomologist* (1994) 70 (4) 318–321 [En, Ba]

A new species, *O. rozeni*, is described from Namibia. The only other species of *Ochreidae* known, *O. fasciatus*, is restricted to the eastern Mediterranean.

Bee Biology & Systematics Lab, USDA-ARS, Utah State University, Logan, UT 84322, USA.

Loutit, R. *Bradfield's swift Apus bradfieldi feeding on bees*. *Madoqua* (1980) 12 (2) 125 [En, B]

Honeybees were taken in flight near a hive in Namibia.

Radloff, S.E., Hepburn, H.R., Robertson, M.P., Hille, R. van, Davidson, Z. and Villet, M.H. *Discriminant analysis of the honeybee populations of southwestern Africa*. *African Entomology* (1996) 4 (1) 1–6 [En, Ba]

Samples of worker honey bees were collected from seven locations between 29°S and 20°; several morphological characteristics were measured and sting pheromones were analysed. Multivariate statistical analyses of the data established two distinct homogeneous populations: in northern South Africa and southern Namibia, *Apis mellifera scutellata*; in northern Namibia, *A. m. adansonii*. In between, there is a hybrid population. P. Walker

Department of Mathematical Statistics, Rhodes University, Grahamstown 6140, South Africa.

Rozen, J.G. Jr. *The relationships of the bee subfamily Ctenoplectrinae as revealed by its biology and mature larva (Apoidea: Melittidae)*. *Journal of the Kansas Entomological Society* (1978) 51 (4) 637–652 [En, B]

Information on the nesting habits of *Ctenoplectra armata* in Namibia is compared with that for other species in the subfamily. All species in the genus nest in existing galleries in wood, and *C. armata* builds in abandoned *Chalicodoma* nests. (All other *Melittidae* are ground-nesting.) The cocoons spun by *Ctenoplectra* are of semi-transparent celophane-like material and are less opaque than those of other *Melittidae*. The larva of *C. armata* is described and illustrated for the first time; similarities to, and differences from, other melittids are discussed. Relationships between taxa based on larval characters are discussed. P. Walker
American Museum of Natural History, New York, NY 10024, USA.

Tribe, G.D. and Johannsmeier, M.F. *Bees and quiver trees*. *South African Bee Journal* (1996) 68 (4) 111–115 [En, B]

Information is given about four Aloe species which grown in South Africa. *A. bainesii* occurs in humid subtropical summer rainfall areas; *A. dichotoma*, *A. pillansii* and *A. ramosissima* grow in rocky outcrops in arid desert to semi-desert in the north-west Cape and southern Namibia. *A. dichotoma* is the commonest species, and in several areas forms dense stands. Honey bees (*Apis mellifera scutellata*) are probably the main pollinators; the bees nest in rock crevices and cavities in the aloe trees. In years when *A. dichotoma* has a heavy nectar flow, it is probably an important nectar and pollen source for the bees. The nectar is very dilute, thus also providing a valuable source of water for bees. P. Walker

Plant Protection Research Institute, Ryan Road, Rosebank, Cape Town 7700, South Africa.

Werger, M.J.A. (ed.). *Biogeography and ecology of Southern Africa*. Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first 6 chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation e.g. the afro-montane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16–31 each cover a major taxonomic group of animals. Chapter 27, by A.J. Prins, covers the *Hymenoptera*. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853–857 briefly describe the Apoidea known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. D.G. Lowe

Nauru

No entries

New Zealand

New Zealand. Laws and Statutes. Act No. 61. An Act to amend the Apiaries Act 1969. Wellington, New Zealand; New Zealand Government. (1980) 6 pp. [En, B]
Includes control measures for a number of honeybee diseases.

New Zealand. Laws and Statutes. Act No. 87. An Act to amend the Apiaries Act 1969. Wellington, New Zealand; New Zealand Government. (1978) 2 pp. [En, B]
Increases the controls over imports of hive products.

New Zealand. Laws and Statutes. 163. Honey; 164. Labelling of carbohydrate foods. *Food and Drug Regulations* 1973. (1973) 57 [En, B]

New Zealand, Ministry of Agriculture and Fisheries. Kiwifruit pollination seminar proceedings. Tauranga, New Zealand; Ministry of Agriculture and Fisheries. (1986) 90 pp. [En, Bdo]

The seven main contributions to this volume deal with : payment for kiwifruit [*Actinidia deliciosa*] by count, factors which influence fruit size, growing export kiwifruit, male vine selection, spray pollination, and honeybee pollination. M.E. Hopping and J.A.K. Martyn describe recent research on spray pollination which showed that fruit set from either honeybee or hand pollination was similar, but that the overall success of bee pollination depended on the weather; in some years the percentage of fruit reaching export weight averaged 31% less than those from hand pollination. Spray pollination is recommended as a supplement to normal bee pollination. M. Goodwin describes research which emphasises that it is important for the grower to determine if there are enough bees in the orchard to ensure that each flower receives the maximum number of visits each day. If there is a pollen surplus, introducing extra bees should improve pollination. Feeding sugar syrup inside the hives is recommended as a way of changing the foraging behaviour of bees, so that more kiwifruit pollen is collected. T.G. Bryant discusses the relationships between kiwifruit flowers and honeybees, and describes management techniques for ensuring adequate pollination. There are three appendices, comprising a suggested pollination contract, a list of useful contacts for growers in New Zealand, and the MAF Aglink leaflet 'Honey bees – pollination of crops: economic significance and management'. D.G. Lowe

New Zealand. Ministry of Agriculture and Fisheries. Beekeeping. Toxic honey from tutu honeydew. Wellington, New Zealand; Information Services, Ministry of Agriculture and Fisheries (1984) 3 pp. [En, Bc]

New Zealand, Ministry of Agriculture and Fisheries. Papers presented at the honeydew seminar, 10 August 1978, Christchurch. Christchurch, New Zealand, Ministry of Agriculture and Fisheries. (1978) 80 pp. [En, B]

Of the nine papers presented, six covered various aspects of beech honeydew honey production in South Island, New Zealand. Also D. A. Briscoe reported on the toxic honey-

dew of North Island, and B.J. Donovan gave a paper on the wasp *Vespula germanica* which builds large nests in the beech forests, and which is a major enemy of honeybees there. P. Walker

New Zealand, Ministry of Agriculture. Honey bee exotic diseases and pests. Tauranga, New Zealand; Ministry of Agriculture. (1996) 4 pp. [En, Bc]

The six overseas pests and diseases which could threaten New Zealand beekeeping are named as: European foul brood (*Melissococcus pluton*), varroa (*Varroa jacobsoni*), the Asian bee mite (*Tropilaelaps clareae*), the tracheal mite (*Acarapis woodi*), Africanised honey bees (*Apis mellifera scutellata*), and the bee louse (*Braula coeca*). Distinguishing features of these are described and precautions which can be taken by the Ministry of Agriculture and by beekeepers are outlined. D.G. Lowe

New Zealand Beekeeper. Exotic bee disease. *New Zealand Beekeeper* (2000) 7 (3) 3–4 [En, Bj]

Varroa jacobsoni was confirmed in three colonies in South Auckland, and a full-scale survey was started.

New Zealand Beekeeper. World sugar situation. *New Zealand Beekeeper* (2000) 7 (4) 13–16 [En, Bj]

World centrifugal sugar production has increased in each of the last five years. It is forecast to reach a record level of 133.9 million tonnes in 1999/2000, with increased production in Brazil, EU, India and Australia. World sugar consumption is forecast to be 130.5 million t, with increases in almost every region, especially Asia and Africa. World trade is expected to total about 36.7 million t. In early 1999 raw sugar prices were less than half of the peak value in January 1998. The situation in 17 individual countries is reported. P. Walker

New Zealand Beekeeper. Declarations for honey and bee products – managing toxic honey and chemical residues. *New Zealand Beekeeper* (2001) 9 (11) 10–11 [En, Bj]

Beekeepers in New Zealand are required by a notice which came into force on 1.12.01 to fill in a form for every sale of bee products for human consumption. The form is reproduced here. P. Walker

New Zealand Beekeeper. Varroa mite slips through buffer zone. *New Zealand Beekeeper* (2002) 10 (1) 4–5 [En, Bj]

New Zealand Beekeeper. Damage to nectar resources by opossum and deer. *New Zealand Beekeeper* (1973) 35 (3) 75 [En, B]

New Zealand Beekeeper. Effect of feeding dry refined and raw cane sugar to honey bee colonies. *New Zealand Beekeeper* (1976) 38 (1) 7 [En, B]

New Zealand Beekeeper. Beekeeper ballotee for Chathams? *New Zealand Beekeeper* (1981) 42 (1) 11 [En, B]

New Zealand Beekeeper. Capping for the small-scale beekeeper. *New Zealand Beekeeper* (1981) 42 (1; 2) 25; 25 [En, B]

Processing cappings from honey combs.

New Zealand Beekeeper. Pollination services [kiwifruit]. *New Zealand Beekeeper* (1982) 43 (4) 17–19 [En, B]

New Zealand Beekeeper. The beekeeping industry can meet pollination needs. *New Zealand Beekeeper* (1983) (No. 177) 13–16 [En, B]

Summary of seminars on kiwifruit (*Actinidia chinensis*) pollination in New Zealand.

New Zealand Beekeeper. Four colonies in one palletised hive. *New Zealand Beekeeper* (1983) (No.180) 27 [En, B]

Advantages and disadvantages found during five years' use are discussed.

New Zealand Beekeeper. Conference '84. Apiculture Section, Wallaceville Animal Research Centre Annual Report to 1984 Conference. *New Zealand Beekeeper* (1984) (No. 183) 22 [En, B]

Effect of pollen trapping on kiwifruit pollen foraging by honeybees; competing forage; wind pollination.

New Zealand Beekeeper. Sticky problems in [New Zealand] South Island beech forests. *New Zealand Beekeeper* (1986) (No. 190) 28–29 [En, B]

Honeydew is collected not only by honeybees, but also by birds.

New Zealand Beekeeper. MAF quality management report. *New Zealand Beekeeper* (1993) (No. 219) 14–19 [En, B]

This report includes New Zealand statistics for numbers of beekeepers, apiaries and hives (1992, 1993), honey production by area (1988–1993), exports of honey, beeswax (1992) and live bees (to June 1993), incidence of American foul brood (to June 1993). *P. Walker*

New Zealand Beekeeper. 1080 must have IVA, Pesticide Board says. *New Zealand Beekeeper* (1994) 1 (10) 4 [En, B]

The pesticides licensing authority in New Zealand now requires poison bait used for control of the marsupial possum, active ingredient 1080 [monosodium fluoroacetate], to contain 1% of the bee repellent isovaleric acid (IVA). The use of IVA will remove the requirement for poison baits not to be laid within 400 m of beehives. Previous trials using oxalic acid as a repellent gave inconsistent results. *A.G. Matheson*

New Zealand Beekeeper. 1994–95 pollen yields & returns from the Apiculture Unit Telford Rural Polytechnic. *New Zealand Beekeeper* (1995) 2 (5) 10–11 [En, B]

The contents of pollen traps on 37 hives were monitored from October 1994 until March 1995 at Telford Rural Polytechnic near Balclutha, South Island, New Zealand. Collections were lowest in March (average 0.03 kg/hive, 'bush/clover' pollen) and January (0.4 kg/hive, 'bush/clover' pollen), and highest in October (1.20 kg/hive, 'willow' pollen) and February (1.30 kg/hive, 'bush/clover' pollen). Total production during the study

period was 188.24 kg, giving a return of \$73.77/hive for cleaned pollen. *P. Walker*

New Zealand Beekeeper. MAF Quality Management (MQM) Report to the Annual Conference of the National Beekeepers' Association of New Zealand, Christchurch 13–14 July 1995. *New Zealand Beekeeper* (1995) 2 (7) 16–18 [En, B]

Statistics are reported for the year ending 30 June 1995. The 8409 registered beekeepers had a total of just over 293,000 colonies; total honey production was 8047 t (27.5 kg/colony). Incidence of AFB is also reported. Work under the Honey Bee Exotic Disease Surveillance Programme is summarised; no exotic diseases were found in inspections of 338 apiaries, and in tests of other bee samples. *P. Walker*

New Zealand Beekeeper. MAF Quality Management (MQM) Report to the Annual Conference of the National Beekeepers' Association of New Zealand, Wanganui 17–18 July 1996. *New Zealand Beekeeper* (1996) 3 (8) 18–20 [En, B]

Statistics for the year ended 30 June 1996 showed that there were 5306 registered beekeepers owning 286,806 colonies, which yielded 8610 t honey (average yield 30 kg/colony). In a disease control programme, 8% of the country's apiaries were inspected; many were in areas where AFB might be expected. This disease was found in 17.7% of apiaries and 6.1% of hives inspected. These levels are slightly lower than in 1994/95 when they were 18.9% and 6.8%, respectively. *P. Walker*

Apiarist. Chatham Island honey for sale. *Apiarist* (1987) (No. 52) 4 [En, B]

Beekeeping in the New Zealand Island Territories.

Apiarist. Is the thyme right for diversification? *Apiarist* (1980) (No. 11) 1, 3 [En, B]

Thymus in New Zealand.

Australasian Beekeeper. Potential for the introduction of chalkbrood disease into Australia in imported honey. *Australasian Beekeeper* (1989) 91 (2) 75, 80 [En, B]

Chalk brood is absent from Australia, although present in New Zealand, and some concern has been expressed that the disease may be introduced by means of fungal spores in imported honey, but there is little information in the literature about the likelihood of this occurring. In 1986–87, Australia imported about 100 t honey, and double this in 1987–88. Honey imports are expected to increase, especially from New Zealand. The Australian Quarantine and Inspection Service has recently started to inspect containers of bulk honey. It is considered that pre-packaged honey is probably safe to import, but 'home-produced' honey from small scale beekeepers should be prohibited. *P. Walker*

New Zealand, National Beekeepers' Association. National pest management strategy – American foulbrood eradication. Public discussion document. Hastings, New Zealand; National Beekeepers' Association of New Zealand, Inc. (1995) 74 pp. [En, Bdo]

The New Zealand Beekeepers' Association has proposed a

strategy for eradicating AFB, caused by *Bacillus* larvae [*Paenibacillus* larvae], and this discussion document deals with measures by which this might be achieved. Aspects discussed include inspection and diagnosis, registration of apiaries, treatment of colonies and destruction of equipment, management and funding of the strategy, and the statutory powers required to implement the strategy. D.G. Lowe

Speedy Bee. APHIS [USDA's Animal and Plant Health Inspection Service] proposes to OK New Zealand bee imports. *Speedy Bee* (1990) 19 (2) 1–2 [En, Bj]

Speedy Bee. New Zealand imports OK'd, but only for transshipments. *Speedy Bee* (1995) 24 (1) 1–2 [En, Bj]

In a final rule published in the Federal Register, the USDA has permitted the trans-shipment of honey bees (*Apis mellifera*) from New Zealand through the USA to another country, subject to specified conditions. This restores the situation which prevailed before a recent legal opinion which barred New Zealand honey bees from transiting Hawaii, USA. A.G. Matheson

AQIS Bulletin. Leaf-cutter bees fly in from NZ. *AQIS Bulletin* (1996) 8 (10) 5 [En, Bj]

The Australian Quarantine and Inspection Service has approved the importation of 2500 leafcutter bees (*Megachile rotundata*) from New Zealand. This is the first importation of *M. rotundata* since 100,000 bees were imported from New Zealand in 1987. The bees will be imported as prepupae, screened for a variety of diseases and reared in quarantine on arrival, and will be used as pollinators of lucerne in South Australia. D.G. Lowe

Bee Biz. New Zealand commercial beekeeping at a glance. *Bee Biz* (1996) (No. 2) 29 [En, Bj]

Aballay F.E., Ruiz, M., Maraboli, A. and Arretz V.P. Analysis of the establishment in Chile of *Bombus ruderatus* (F.) introduced for red clover (*Trifolium pratense* L.) pollination. [Análisis del establecimiento en Chile de *Bombus ruderatus* (F.) introducido para la polinización del trebol rosado (*Trifolium pratense* L.)]. *Investigación Agrícola* (1986) 9 (1) 31–36 [Es, en, Bb]

Fertilised queens of *Bombus ruderatus* were introduced into the Coipue and Cunco region from New Zealand to improve red clover pollination. The evaluation of this bumble bee establishment started in 1983 and it was performed during three seasons. These bees are now becoming established, as is shown by their progressive population increase and distribution. During 1982–83, they were occasionally detected only in Coipue, and in 1983–84 they were frequently observed in both localities but were not abundant enough for their population density to be measured. In 1984–85 there were 17.5/ha and 10.0/ha on red clover at Coipue and Cunco respectively. *B. ruderatus* was also observed in gardens, fields and woods during 1984–85. Plants which, besides red clover, supplied nectar and pollen to *B. ruderatus* were identified. Author
Fac. Ciencias Agrarias y Forestales, Univ. Chile, Casilla 1004, Santiago, Chile.

Allen, K.L. and Molan, P.C. The sensitivity of mastitis-causing bacteria to the antibacterial activity of honey. *New Zealand Journal of Agricultural Research* (1997) 40 (4) 537–540 [En, Ba]

Honey Research Unit, Dept of Biological Sciences, The University of Waikato, Private Bag 3105, Hamilton, New Zealand.

Allen, K.L., Molan, P.C. and Reid, G.M. A survey of the antibacterial activity of some New Zealand honeys. *Journal of Pharmacy and Pharmacology* (1991) 43 (12) 817–822 [En, Bj]

A survey of the antibacterial activity of honey was carried out using 345 samples of honey obtained from commercial beekeepers in New Zealand. Most of the honeys were unifloral, from 26 plant sources. The honeys were tested against *Staphylococcus aureus* in an agar well diffusion assay, and the results are tabulated. The variation between flower types is discussed and it is concluded that the best honeys for medicinal use are derived from kanuka (*Leptospermum ericoides*), manuka (*L. scoparium*), ling heather (*Calluna vulgaris*) or kamahi (*Weinmannia racemosa*). When antibacterial activity was assayed with catalase added to remove hydrogen peroxide, most of the honeys showed no detectable antibacterial activity. Only manuka and vipers bugloss (*Echium vulgare*) honeys showed this type of activity in a significant proportion of the samples. The high antibacterial activity of manuka honey was in many cases due entirely to this non-peroxide component. D.G. Lowe
Department of Biological Sciences, University of Waikato, Hamilton, New Zealand.

Alspach, P.A., Pyke, N.B., Morgan, C.G.T. and Ruth, J.E. Influence of application rates of bee-collected pollen on the fruit size of kiwifruit. *New Zealand Journal of Crop and Horticultural Science* (1991) 19 19–24 [En, Bc]

Pollen, from pellets gathered by honey bees, was used to pollinate kiwifruit flowers artificially. Pollen was applied at a number of rates after suspending in an aqueous medium or mixing with one of three different diluents to get a powder formulation. Resulting fruit size was less at lower rates of pollen application. At such low rates (generally less than 1.0 mg/flower), a linear relationship was detected between pollen application rate and final fruit size, in some seasons. Some powder formulations (e.g. that using Lycopodium spores) seemed less effective than the aqueous suspension. The best formulation for pollination of kiwifruit was made with an inert powder. This formulation effectively set fruit at rates of pollen application as low as 0.037 mg/flower, although at this rate fruit size was reduced as a result of inadequate seed set. Author
DSIR Fruit and Trees, Riwaka Research Station, R.D. 3 Motueka, New Zealand.

Anderson, D. Viruses of New Zealand honey bees. *New Zealand Beekeeper* (1985) (No. 188) 8–10

Anderson, D.L. Half-moon disorder of the honey bee (*Apis mellifera* L.) in New Zealand. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988

[edited by Rhodes, J.W.]. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 77–79 ISBN 0-86774-011-6 [En, Bdo]

In this disorder (HMD), first described in 1982, larvae die while still in the coiled stage after first turning yellow. They dry into crescent or 'half-moon' shaped brown scales half-way up or around the lip of their cells. So far no causative organism has been isolated. In the studies described, no viruses were detected in dead larvae, and the only bacteria isolated were *Bacillus coagulans* (two colonies) and *B. larvae* (two colonies). There was no evidence that a bacterium is the sole causative agent of the disorder, nor was there any evidence of protozoan, rickettsial or fungal infections. Darkened fat-bodies and dark flecks on the ovaries were found in queens from colonies with HMD. Colonies into which brood combs containing HMD were introduced did not develop HMD, but when queens from affected colonies were introduced into healthy colonies, these also developed the disorder. It is concluded that HMD is probably due to a queen disorder. Additional symptoms for HMD are described. D.G. Lowe
DSIR, Private Bag, Auckland, New Zealand.

Anderson, D.L. Kashmir bee virus – a relatively harmless virus of honey bee colonies. *American Bee Journal* (1991) 131 (12) 767–768, 770 [En, Bj]

Two hypotheses are discussed: (A) Kashmir bee virus (KBV) may be present in many countries and may have a broad insect host range; (B) KBV may be endemic in honey bees in North America from where it may have been taken in live bees to Australia and New Zealand. Beekeepers in the last two countries have not reported problems or losses caused by this virus alone, and KBV does not appear to be harmful to *Apis cerana* colonies in Papua New Guinea. It has been reported that KBV normally replicates at low levels in the gut of honey bees, and generally produces no symptoms. However, there are occasional reports that in a colony infected with *Nosema apis* or *Melissococcus pluton*, KBV appears to escape from the (damaged) gut and replicates more rapidly in other tissues, with lethal effect. The normal inapparent infection by KBV is compared with the similar widespread infection of honey bees in England and continental Europe with acute bee paralysis virus. P. Walker

CSIRO Division of Entomology, P.O. Box 1700, Canberra, ACT 2601, Australia.

Andrews, P.H. Wax build-up on queen excluders – a matter of bee space. *New Zealand Beekeeper* (1980) 41 (4) 14 [En, B]
Prevented by distancing the queen excluder only one bee space from frames above and those below.

Arretz, P.V. and Macfarlane, R.P. The introduction of *Bombus ruderatus* to Chile for red clover pollination. *Bee World* (1986) 67 (1) 15–22 [En, B]

In Chile, *Trifolium pratense* is pollinated by honeybees, solitary bees (*Colletidae*), and a long-tongued bumble bee, *Bombus dahlbomi*. *B. dahlbomi* is not numerous enough for it to be a major pollinator, and its nesting habits make it unsuitable for artificial rearing and development. As the life cycles of *Bombus* queens in New Zealand match the

seasonal development of the main floral sources of food in Chile, the possibility of importing them into Chile was investigated. In 1982–83, 391 *B. ruderatus* queens were collected in New Zealand and transported to Chile in insulated plastic containers at 10–15°C. The 314 queens which survived the journey were released at two sites near the centre of the red clover seed producing zone. Initial observations indicated that the chances of establishment were good. Further observations will be made in 1986. D.G. Lowe

Dept. Sanidad Vegetal, Fac. Ciencias Agrarias y Forestales, Univ. Chile, Casilla 1004, Santiago, Chile

Austin, P.T., Hewett, E.W., Noiton, D.A. and Plummer, J.A. Cross pollination of 'Sundrop' apricot (*Prunus armeniaca* L.) by honeybees. *New Zealand Journal of Crop and Horticultural Science* (1996) 24 (3) 287–294 [En, Bb]

Pollinator foraging activity on Sundrop apricots in Hawkes Bay, New Zealand was investigated to see if restricted pollen transfer reduced fruit production. Honey bees (*Apis mellifera*) were the only significant floral visitors. Most bees collected pollen and therefore contacted the stigma. Pollen foragers worked flowers faster than nectar foragers (5.3 vs. 2.7 flowers/minute). Forager densities varied widely between days but under good weather conditions reached nine bees/tree for up to six hours a day. Neither nectar volume nor its composition appeared likely to reduce foraging activity. Sundrop flowers held up to 20 micro l of nectar at an initial concentration of approx 5% sugar. Data gathered were used to estimate forager numbers needed for cross pollination of Sundrop. The calculations indicated that adequate cross pollination is feasible under Hawkes Bay conditions with hive densities of approx 5.0 hives/ha, within the range normally recommended for stonefruit crops.

Department of Plant Science, Massey University, Private Bag 11 222, Palmerston North, New Zealand.

Barrett, P. William Charles Cotton Grand Bee Master of New Zealand 1842 to 1847. Springwood, NSW, Australia; Banjo Bee Books (97) 160 pp. ISBN 0 646 29300 1 [En, Bd]

This is a detailed account of the life of W.C. Cotton from the year in which he published *My bee book* until 1847 when he left New Zealand. During his time there he did much to advance beekeeping, and to improve methods used by both European settlers and Maoris. In 1848 he published *A manual for New Zealand beekeepers*, and in 1849 *Ko uga pi*, a treatise on bees in Maori. P. Walker

Barrett, P. The immigrant bees 1788 to 1898: Volume II. An update on the introduction of European honeybees into Australia and New Zealand. Springwood, NSW, Australia; Peter Barrett (99) 164 pp. ISBN 0 9586146 0 1 [En, Bd]

This book provides additional records to those in Volume I.

Barrett, P. The immigrant bees 1788–1898: a cyclopaedia on the introduction of European honey bees into Australia and New Zealand. Springwood, Australia; Peter Barrett. (1995) 200 pp. ISBN 0-646-25812-5 [En, Bd]

This is a well-documented account of the very earliest bee-keeping history of Australia and New Zealand, based on extensive research into the available literature.

Barron, M.C., Wratten, S.D. and Donovan, B.J. A four-year investigation into the efficacy of domiciles for enhancement of bumble bee populations. *Agricultural and Forest Entomology* (2000) 2 (2) 141–146 [En, wf]

Eighty 4-unit domiciles for introduced *Bombus* spp. were placed in 16 field margins at Lincoln, New Zealand, in summer; 55 were beside intensively managed fields (M), and the rest were in less disturbed habitats which had more spring/summer floral resources. The number of nests founded over the 4-year study period increased from one to 27. *B. hortorum* was a much more frequent colonist than was *B. terrestris*, with *B. ruderatus* colonising only in the fourth year. In the M sites, mean 4-year occupancy was only 2%, but in the others it was 13%. There was a positive association between bumble bee occupancy of the domicile compartments in the previous year and occupancy in the current year. No association was found between previous occupancy by mice and subsequent occupancy by bumble bees. The potential for adding *Bombus* nest sites to agricultural land to enhance local populations, and, potentially, pollination of seed crops, is discussed; adding domiciles in M may not be very effective unless spring floral resources are also enhanced.

Ecology and Entomology Group, Div. of Soil, Plant and Ecological Sciences, PO Box 84, Lincoln Univ., Canterbury, New Zealand.

Benard, H., Bolger, P., Stone, M. and Thornton, R. The outbreak of *Varroa destructor* in New Zealand bees: delimiting survey results and management options. *Surveillance* (Wellington) (2001) 28 (3) 3–5 [En, X]

A survey was conducted from April 12 to early June 2000 to determine the geographical distribution of mite infestations, as well as to obtain information on the timing and means of introduction of the species into New Zealand.

EpiCentre, Massey Univ., Palmerston North, New Zealand.

Berkhout, R. van. The story of kiwicomb. *New Zealand Beekeeper* (1987) (No.195) 38 [En, Bj]

The concept of the half-comb originated in the USA and has been developed in New Zealand. A half-comb is a clear polystyrene box, 1 inch [2.5 cm] deep, with a cell pattern moulded in the base; the inside of the box is waxed. The half-comb sections are supplied in rows of 10, taped together; four such rows fill a half-depth super and are simply fixed in position. The bases are vertical and the open ends all face in the same direction. Bees readily build cells from the base, filling the box to the edges and corners. When full of sealed honey, a half-comb contains 350 g of honey; a lid is put on and it is ready for sale.

P. Walker

Kiwicomb, Omaha Rd., R.D. 5, Hastings, New Zealand.

Berry, I. Palletised hives for orchard pollination. *New Zealand Beekeeper* (1982) 43 (4) 14–15 [En, B]

Berry, R. No long term commitment by kiwifruit barons. *New Zealand Beekeeper* (1982) 43 (3) 32–33 [En, B]

Pollination of *Actinidia chinensis* in New Zealand.

Berry, R. Radical new package for long distance transportation of honey bees. *Gleanings in Bee Culture* (1987) 115 (9) 542–543 [En, Bj]

The author has designed the Arataki tube for transporting package bees. The long narrow tube (dimensions not given; possibly 150 cm long) with a circular cross-section provides a large surface area for the bees to hold on to. The tube is carried vertically, and closures at each end allow cool fresh air to enter at the bottom and warm air to escape at the top. Food is provided by filling a synthetic mesh 'sock' with sugar syrup jelled with agar. A total of 704 Arataki tube packages (each containing 2 lb [0.9 kg] bees) can be fitted into an airline pallet 125 x 88 inches [317 x 223 cm]. A pallet of this size holds 432 conventional 2-lb packages. To hive the bees, the gauze cap is removed, the feed sock (to which the queen is attached) is taken out, the tube is turned upside down and, with the open end in the hive, it is knocked once to empty it of bees. The successful transport of one pallet of bees (704 tubes) from New Zealand to Canada is described.

P. Walker

Arataki Honey Ltd., R.D. 3, Rotorua, New Zealand.

Berry, R. 128 Frame tangential honey extractor. *New Zealand Beekeeper* (1994) 1 (5) 24–25 [En, Bj]

Describes the construction and operation of an extractor of novel design: a horizontal-axis, tangential machine comprising two drums each holding 64 frames. The extractor is loaded and unloaded mechanically, and can process in excess of 1000 kg of honey per hour.

A.G. Matheson

Bettesworth, D. Surveillance for exotic disease of honey bees. *New Zealand Beekeeper* (99) 6 (6) 6 [En, Bj]

In New Zealand the beekeeping industry has established a pest management strategy to control American foul brood; in addition, the new MAF Regulatory Authority Standard for surveillance of diseases of honey bees was published in Nov. 1998. 'Approved' beekeepers sign an agreement to be responsible for controlling and eliminating AFB, and to recognise and report symptoms of exotic diseases.

P. Walker

AgriQuality New Zealand Ltd, Whangarei, New Zealand.

Bettesworth, D. A bee stock improvement programme for New Zealand? *New Zealand Beekeeper* (1989) (No. 202) 14–16 [En, Bj]

At a meeting of queen producers and other interested beekeepers at the New Zealand Beekeepers' Association conference, in July 1988, it was agreed that New Zealand strains of honeybees should be identified and evaluated, and that a breeding programme should be set up. The present paper briefly discusses several points that must be considered, and puts forward five options for the breeding programme with advantages, disadvantages and costs.

P. Walker

Bolger, P. Varroa update: South Island remains varroa free. *Biosecurity* (2001) (No.32) 5–6 [En, X]

An extensive surveillance programme was conducted in the South Island of New Zealand [date not given]; individual apiaries were tracked. Recognising that swarms travelling on ships are a potential means of spreading varroa, a swarm trapping programme was also trialled at three South Island seaports to check for the presence of varroa.

Results showed that all 1737 apiaries and 24 737 hives checked were negative for *Varroa destructor*. Also, two swarms found at ports tested negative. It is concluded that the South Island was free from varroa at the levels the survey could detect. Another round of surveillance in 2002 is recommended.

Bosch, J. van den, Woodfield, D.R., Clifford, P.T.P. and Caradus, J.R. White clover breeding, flowering, and farm management as it relates to beekeeping. *New Zealand Beekeeper* (1996) 3 (9) 24–25 [En, Bj]

Many cultivars of white clover (*Trifolium repens*) have been bred for different purposes in New Zealand. In some areas, fields grown for seed are important nectar sources for bees. As a result of changes in farming practices, fewer white clover flowers are being grown, but honey yield/colony does not seem to have decreased; climate/weather seems to be the main factor affecting honey production. Variations in nectar secretion by flowers indicate that suitable selection could result in plants with greater honey potential. *P. Walker*

Brady, N. Report on the research project: finding New Zealand honeys with outstanding antibacterial and anti-fungal activity. *New Zealand Beekeeper* (1997) 4 (10) 20–26 [En, Bj]

During 1995–1997, 179 samples of unifloral honeys from 27 different plant sources (other than manuka, *Leptospermum scoparium*) were collected from throughout New Zealand. They were tested for antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans* and *Trichophyton mentagrophytes* var. *mentagrophytes*, using agar well diffusion assay or a turbidimetric assay. No honey showed any non-peroxide antimicrobial activity, but three types showed outstanding hydrogen peroxide antibacterial properties: pennyroyal, *Mentha pulegium* (Lamiaceae), rewarewa, *Knightia excelsa* (Proteaceae) and honeydew honey from *Nothofagus solandri* (Fagaceae). The possible use of such honeys for therapeutic purposes is discussed. *A.G. Matheson*

Briggs, L. Importation of leafcutter bees from New Zealand. *Australasian Beekeeper* (1983) 85 (2) 28–29 [En, B] Endorsement of Animal Quarantine proposals for testing *Megachile rotundata* as a pollinator in Australia.

Briggs, L. Megachile (leaf cutter bee) importation from New Zealand. Notes on some recent developments. *Australasian Beekeeper* (1984) 85 (10) 185–186 [En, B] Discusses evidence that these bees could carry *Ascosphaera* infections; *A. apis* may be present in New Zealand.

Briscoe, D.A. Toxic honeydew of the North Island [New Zealand]. *Apiarist* (1979) (No. 7) 3–5 [En, B] From the plant *Coriaria arborea*.

Brown, B., Scott, R.R. and Macfarlane, R.P. An assessment of Vicia faba and Trifolium pratense as forage crops for Bombus hortorum. *New Zealand Entomologist* (1992) 15 42–47 [En, Bb] Department of Entomology, P. O. Box 84, Lincoln University, Lincoln, New Zealand.

Brown, R. Report from New Zealand. *Home Farm* (1987) (No. 69) 17–19 [En, Bc]

Bryant, T. New super-holder jig. *New Zealand Beekeeper* (1977) 39 (1) 10 [En, B] To hold hive boxes (shallow or deep) for nailing.

Bryant, T. A realistic approach to kiwifruit pollination. *New Zealand Beekeeper* (1983) (No. 179) 27–29 [En, B]

Bryant, T. Slipshod pesticide practices put pollination services at risk. *New Zealand Beekeeper* (1983) (No. 178) 12 [En, B]

Pesticide damage is estimated to have cost beekeepers in the Bay of Plenty area NZ\$160 000 in 1982–1983.

Bryant, T. Honey filtration unit. *New Zealand Beekeeper* (1987) (No. 196) 25–26 [En, Bj]

Honey is pumped by a Mono CP 1600 pump from holding tanks and is put under pressure before passing through a heat exchange unit where it flows through 30 10-mm diameter stainless steel tubes surrounded by water at 45°C. Finally, the honey is filtered through an Arkal 4900 filter with blue rings (40 mesh) to remove pollen, wax and propolis. The system is fully automated and is simple to operate. A pressure switch is incorporated in the system to turn off the pump if the filter becomes blocked. The heat exchange unit can be dismantled for cleaning and maintenance. *P. Walker*

Bryant, T. Recycling frames used for producing cut comb honey. *New Zealand Beekeeper* (1987) (No. 193) 12–13, 16–17 [En, Bj]

Dimensioned drawings are published for a frame-cleaning unit designed by a commercial beekeeper. It is an insulated bath (rectangular cross-section), filled with water which is heated to boiling by a coal-fired firebox below one end (A). A frame clamp holds the frames from one super, and they are lowered into the bath at the opposite end (B). The bath holds the frames from four supers. The process is continuous – the frames are gradually moved towards A and then removed. Two men can clean 400 frames in a day. Wax, froth and other debris runs off at the top of end B into a collecting tank and the wax is recycled. *P. Walker* Min. Agric. & Fisheries, Gore, New Zealand.

Bryant, T. Kiwifruit pollination in the Bay of Plenty using honey bees, conditions of supply, standards and quality control. *New Zealand Beekeeper* (1988) (No. 199) 36–38 [En, Bj]

Factors involved in the pollination of kiwifruit (*Actinidia deliciosa*) are listed, and ways of improving pollination when using honeybees are discussed; 10 orchard requirements are given. The number of hives used in kiwifruit orchards has increased from 1660 in 1975 to 47,589 in 1986 (2043 orchards), with NZ\$3.6 million being earned in pollination fees. The Kiwifruit Pollination Association (KPA) was set up in 1984, and its links with growers, beekeepers and the Ministry of Agriculture and Fisheries are described. The KPA has been involved in setting quality standards and fixing pollination fees. The future needs of the industry are discussed. *D.G. Lowe*

Bryant, T. *Kiwifruit pollination: a synthesis of four years' endeavour.* *New Zealand Beekeeper* (1991) (No. 212) 7–11 [En, B]

For good pollination by honey bees, at least 4.5 kg pollen/ha are needed if yields are to be more than 6000 trays/ha. Many orchards would benefit from a combination of honey bee and artificial pollination. It is emphasized that a flexible approach is necessary, and a carefully planned strategy may have to be altered according to the weather and other factors. Four case studies are given.

P. Walker

Bryant, T.G. *Pollen substitute: soya bean flour mixture.* *New Zealand Beekeeper* (1974) 36 (2) 27–30 [En, B]

Bryant, T.G. *Tail-gate loader helps southern beekeeper.* *New Zealand Beekeeper* (1977) 39 (4) 10–11 [En, B] For moving hives that are not on pallets.

Bryant, T.G. *Thyme honey – liquid gold.* *New Zealand Journal of Agriculture* (1977) 135 (2) 19, 21 [En, B]

Over 600 colonies on the verge of starvation were moved from Southland to an area of *Thymus vulgaris* in Otago in spring, when beekeepers in Southland usually feed sugar to their colonies to build them up for the white clover flow. They produced a thyme honey surplus of 17 kg per colony, even after some honey had been taken to feed other colonies that remained in Southland. Thyme honey has a strong dominant flavour, so it was removed and stored in the comb, to be fed back to colonies later in place of sugar. This enabled all the (more commercially valuable) white clover honey to be extracted. The marketing of thyme honey is being contemplated. J.M. Gedyne
Min. Agric. & Fisheries, Gore, New Zealand.

Bryant, T.G. *Honey extraction – the costs involved.* *New Zealand Beekeeper* (1978) 39 (4) 18–19 [En, B]

Bryant, T.G. *Spring pollen feeding.* *New Zealand Beekeeper* (1982) 43 (2) 23–24 [En, B]

Bryant, T.G. *Kiwifruit (*Actinidia deliciosa*) pollination in the Bay of Plenty, New Zealand, using honey bees – conditions of supply, standards and quality control. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.].* Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 127–129 ISBN 0-86774-011-6 [En, Bdo]

Bryant, T.G. and Hook, P.J. *Bulk suppliers put producer/packers in the shade.* *New Zealand Beekeeper* (1977) 39 (4) 7–8 [En, B]

This article compares the average producer-packer with the average bulk producer and analyses their economic strengths and weaknesses.

Butz Huryn, V.M. *Use of native New Zealand plants by honey bees (*Apis mellifera* L.): a review.* *New Zealand Journal of Botany* (1995) 33 (3) 497–512 [En, Ba]

A review of the literature indicated that honey bees collect pollen or nectar from 224 native New Zealand plant taxa, including 188 species, 119 genera, and 67 families. However, the majority of honey bee forage sources are contained in only 12 families. Plant taxa providing surplus quantities of honey and taxa with most citations were used to indicate intensity of honey bee use and revealed that only a very small proportion is used intensively. Potential effects on animal species overlapping in resource use with honey bees in the few known specialised plant-pollinator relationships in New Zealand are discussed, as well as potential impacts on the native flora. Forage sources used by honey bees are compared with those plants known or suspected to be threatened or rare. Author
Department of Zoology, University of Otago, PO Box 56, Dunedin, New Zealand.

Butz Huryn, V.M. and Moller, H. *An assessment of the contribution of honey bees (*Apis mellifera*) to weed reproduction in New Zealand protected natural areas.* *New Zealand Journal of Ecology* (1995) 19 (2) 111–122 [En, Ba]

In a literature survey (79 references) it was found that 43% of weeds recorded in Protected Natural Areas in New Zealand are visited by honey bees, including half the weeds classified as 'problem'. The bees may be important in the pollination of some weeds, but not, in general, of the problem weeds which have plastic reproductive mechanisms and/or simple pollination mechanisms. Thus, honey bees probably do not contribute substantially to weed problems. P. Walker

Department of Zoology, Box 56, University of Otago, Dunedin, New Zealand.

Casey, G. and Rij, A. van. *Manuka honey and leg ulcers.* *New Zealand Medical Journal* (97) 110 (1045) 216 [En, Bc]

Some aspects of the study reported in *Apicultural Abstracts* 311/98 are criticised. First, the author points out that it is important to distinguish between bacterial contamination and infection of a wound. Second, she suggests that the honey dressing may actually interfere with the wound healing process. Third, she criticises the lack of a control group in the study. P. Walker

Otago Centre for Wound Healing, Dunedin School of Medicine, Dunedin, New Zealand.

Chapman-Taylor, R. and Davey, I. *Beekeeping for fun: a handbook for New Zealand amateurs.* Milford, New Zealand; published by the authors. (1981) xv + 222 pp. ISBN 0-473-00074-1 [En, B]

Chapman-Taylor, R. and Davey, I. *Practical beekeeping: handbook for Australia and New Zealand.* Melbourne, Australia; Inkata Press. (1988) (Ed. 2) xii + 168 pp. ISBN 0-909605-00-0 [En, Bd]

The principles of hive management for the amateur beekeeper.

Clapperton, B.K., Alspach, P.A., Moller, H. and Matheson, A.G. *The impact of common and German wasps (*Hymenoptera: Vespidae*) on the New Zealand beekeeping industry.* *New Zealand Journal of Zoology* (1989) 16 (3) 325–332 [En, Bb]

Ecology Division, Department of Scientific and Industrial Research, Private Bag, Nelson, New Zealand.

Clare, G. Colour change protects bees. *The Hothouse* (2000) (No. 1) 3 [En, Bc]

Bees (*Apis mellifera* and *Bombus*, *Lasioglossum* and *Hylaeus* spp.) were attracted to the pheromone traps being used in orchards to kill pests. However, when the colour of the traps was changed to red or green – instead of white, blue or yellow – few bees were killed.

HortResearch, Mt Albert Research Centre, Private Bag 92 169, Auckland, New Zealand.

Clarke, R. Grading queen pupae by weight. Guide to equipment and technique. *New Zealand Beekeeper* (1992) (No. 214) 9 [En, Bj]

Weighing of queen pupae is done in a room at 25–30°C, RH 50% (same conditions as for grafting). Plastic queen cell cups are used and the cell is cut at the plastic-wax joint. The pupa is gently tipped on to a handling device such as a modified plastic spoon, then weighed rapidly on an electronic scale accurate to ± 1 mg. After examination the pupa, if healthy and of suitable weight, is slid back into the wax end of the cell, head first, and the cell is gently resealed with adhesive tape. *P. Walker*

Clarke, R. Starting queen cells: a variation of the queen-right free-flight hive. *New Zealand Beekeeper* (1992) (No. 213) 13–15 [En, Bj]

The author describes the method he has developed. The starter colonies are kept in hives with two full-depth boxes and the queen is restricted to the lower box by a queen excluder. On the morning when queen cells are to be started, the top box is first made temporarily queenless by replacing the excluder with a split board. About 3–4 hours later, 96 queen cell cups with grafted larvae are placed in the top box and after 20–24 hours they are transferred to finisher colonies (10–12 cells/colony). The queen excluder is replaced and the colony is left for 3–7 days before repeating the process. While the cells are being started, foragers are encouraged to return to the top box by providing a wide entrance to it, and by leaving a wide board against the hive (below the upper entrance) to obscure and shade the lower entrance. This ensures that there are plenty of bees in the top box and that pollen is brought into it. On average a colony starts rearing queen larvae in 72–83% of the cells. Advice on how to deal with problems and on seasonal management is given. *P. Walker*

Clarke, R.J. Queen physiological quality. A discussion paper for N.Z. queen producers. Blenheim, New Zealand; Sunflora Apiaries. (1989) 10 pp. [En, Bc]

A literature survey with 27 references covers queen weight, ovariole number, volume of the spermatheca and number of spermatozoa it contains. The reported ranges of values are discussed in relation to queen quality, and standards are suggested. The importance of nutrition in queen rearing is discussed. Finally, guidelines for queen rearers are presented. The discussion is focused mainly on *Apis mellifera ligustica*, the typical New Zealand commercial honey-bee. *P. Walker*

Sunflora Apiaries, Blenheim, New Zealand.

Clifford, P.T.P. Increasing bumble bee densities in red clover seed production areas. *New Zealand Journal of Experimental Agriculture* (1973) 1 (4) 377–379 [En, B]

Queens of the long-tongued *Bombus ruderatus* and *B. subterraneus* were brought to 500 ha of land in South Island, New Zealand, containing approximately 100 ha of red clover. The numbers introduced in each of three successive years were 115, 85 and 114, and after four months the average peak population density each season was about 6000 bees/ha compared with about 2000 bees/ha in earlier years. There was no apparent carry-over effect from year to year, and in the season after queen introduction ceased the population fell to less than 3000 bees/ha. *J.M. Gedy* Grasslands Div., DSIR, Private Bag, Christchurch, New Zealand.

Clinch, P. Kiwifruit. *New Zealand Beekeeper* (1982) 43 (3) 17 [En, B]

Report on research into pollination of *Actinidia chinensis* by honeybees, and on effects of pesticides.

Clinch, P. Replacement for Cyanogas. *New Zealand Beekeeper* (1982) 43 (3) 17 [En, B]

A hydrogen cyanide generator is used to destroy bees e.g. to prevent spread of diseases, Cyanogas being no longer available.

Clinch, P.G. Vacuum collecting of bees in polystyrene queen cages. *New Zealand Beekeeper* (1973) 35 (2) 52–53 [En, B]

A new adaptor for the battery-operated vacuum device is described and illustrated. It simplifies the removal of bees from polystyrene queen cages that have sliding lids. *A.S. Attwood*

Wallaceville Animal Res. Centre, Upper Hutt, New Zealand.

Clinch, P.G. A rapid method of examining honey bees individually for Nosema spores. *New Zealand Journal of Experimental Agriculture* (1976) 4 125–126 [En, B]

A bee was placed in a 2.5 x 11 cm polythene pocket with 0.5 ml water; 12 such pockets formed a unit, and when all had been prepared the tops were fastened. After macerating the bees with a rubber roller the unit was placed on a sheet of glass and the bottom of each pocket was examined microscopically for *Nosema* spores. It took approximately 15 min to prepare and examine 24 bees. This was twice as long as pooled spore counting, which however gives only the average severity of the disease within a sample. The plastic unit is disposable. *P. Walker*

Wallaceville Animal Res. Centre, PB, Upper Hutt, New Zealand.

Clinch, P.G. Emergency grids for [pollen] traps assist pollination research. *New Zealand Beekeeper* (1981) 42 (3) 11 [En, B]

Clinch, P.G. Kiwifruit pollination by honey bees 1. Tauranga observations, 1978–81. *New Zealand Journal of Experimental Agriculture* (1984) 12 29–38 [En, B]

Observations for three seasons during the flowering period of *Actinidia chinensis* cv. *Hayward* showed that honeybees were by far the most numerous visitors to flowers in

orchards to which honeybee colonies had been introduced. Colletid bees (*Leioproctus* spp.) were observed on flowers in some orchards but their numbers were generally so low that, except in one orchard in 1978–79, and two in 1979–80, their effect on pollination was probably insignificant. Bumble bees (*Bombus* spp.) and other insects were also too few to be of importance at the sites observed. Visits by honeybees to kiwifruit flowers in 1978–79 were reduced by competition from other pollen sources, and fruit size was poor. Competition was minimal, and there was good bee visitation in 1979–80, when fruit size was generally good, and in 1980–81, when it was unsatisfactory. In 1980–81 there were more flowers and consequently more fruits, in all orchards compared with the 1979–80 season, and this physiological load probably caused some of the reduction in weight. In 1980–81, 32.7% of fruit weighed less than 72 g, even though fruit less than 93 g contained significantly more seed than in the previous two seasons. This suggests that pollination was satisfactory, but that adverse weather conditions may have retarded fruit growth. Factors such as position of male vines relative to females, cultural methods, and orchard microclimates may also have been important.

Author

Wallaceville Animal Res. Centre, Min. Agric. and Fisheries, Private Bag, Upper Hutt, N Z.

Clinch, P.G. and Faulke, J. Observations on the role of the honey bee in the pollination of blackcurrants variety 'Magnus'. *New Zealand Journal of Experimental Agriculture* (1976) 4 399–402 [En, B]

Stems from which honeybees and bumble bees were excluded yielded 30% fewer berries than control stems. Bushes caged with honeybees did not bear significantly more fruit than uncaged controls ('running off'). Honeybees were the most frequent visitors, the ratio of pollen-gatherers to nectar-collectors being one to 26 in the first season and one to 50 in the second. In the first year the mean density of honeybees in the open was 12 bees per 10,000 flowers; that of bumble bees was less than 0.1. In the second year the honeybee density was considerably lower, probably due to the proximity of alternative nectar sources. It is suggested that in localities where hives are scarce yields may be increased by adding up to three hives per hectare. *P. Walker*

Wallaceville Animal Res. Centre, Min. Agric. & Fisheries, PB, Upper Hutt, N Z.

Clinch, P.G. and Palmer-Jones, T. Effect on honey bees of dicotophos applied as a pre-blossom spray to raspberries (*Rubus idaeus* L.). *New Zealand Journal of Agricultural Research* (1971) 14 927–930 [En, B]

Dicotophos, applied at the rate of 0.43 lb/acre [or kg/ha] of active ingredient to raspberries six days before flowering, continued to kill foraging bees for 16 days after spraying, but had little or no effect 21 days after spraying. Differences in the persistence and toxic effect on bees of dicotophos residues for various flowering crops are discussed. *Author*

Wallaceville Animal Research Centre, Dep. Agriculture, Private Bag, Wellington, New Zealand.

Clinch, P.G. and Palmer-Jones, T. Effect on honey bees of azinphos-methyl applied as a pre-blossom spray to Chinese gooseberries. *New Zealand Journal of Experimental Agriculture* (1974) 2 205–207 [En, B]

Azinphos-methyl sprays were applied to *Actinidia chinensis* orchards before flowering. Pollen-gathering bees were collected from the flowers when they opened 14–23 days later, and dead bees counted after 24 hours. Apparently no deaths were caused by the insecticide, indicating that it did not have a delayed toxic action. However, care must be taken during flowering when using this spray in neighbouring orchards. *P. Walker*

Wallaceville Animal Res. Centre, Res. Div., Ministry Agric. and Fisheries, PB, Upper Hutt, New Zealand.

Clinch, P.G. and Palmer-Jones, T. Effect on honey bees of pirimicarb applied as a spray to chou moellier. *New Zealand Journal of Experimental Agriculture* (1974) 2 209–211 [En, B]

Pirimicarb, applied at the rate of 0.28 kg active ingredient/ha to fully flowering chou moellier (*Brassica oleracea* L.) in the morning before bees had commenced flying, caused bee mortality for four days after spraying. The compound cannot be recommended for application to flowering crops. *Author*

Wallaceville Animal Res. Centre, Res. Div., Min. Agric. Fisheries, P.B., Upper Hutt, New Zealand.

Clinch, P.G., Palmer-Jones, T. and Forster, I.W. Effect on honey bees of nectar from the yellow kowhai (*Sophora microphylla* Ait.). *New Zealand Journal of Agricultural Research* (1972) 15 (1) 194–201 [En, B]

Toxicity tests showed that the nectar frequently had a narcotic effect on honeybees. Only adults were affected; some died, especially those exposed to the low temperatures common in spring. Extracts of *S. microphylla* seeds were toxic to mice. Feeding bees on extracts of the seeds and wood led to results similar to those caused by nectar. Narcosis and mortality of bees appear to be due to alkaloids which reach the nectaries. *Author*

Wallaceville Bee Laboratory, Wellington, New Zealand.

Clinch, P.G., Palmer-Jones, T. and Forster, I.W. Effect on honey bees of dicotophos and methomyl applied as sprays to white clover. *New Zealand Journal of Experimental Agriculture* (1973) 1 (1) 97–99 [En, B]

The systemic insecticides dicotophos and methomyl were applied in the evening (0.5kg a.i./ha) to flowering white clover. The effects on nearby hives were monitored. Toxicity persisted for seven days after the dicotophos application and eight days after the methomyl one. Hives returned to normal three days after the dicotophos application, but the methomyl had more serious effects, and the whole apiary was disorganised; nectar collection ceased for four days and drifting occurred. Dicotophos and methomyl showed no repellency to bees. *A. S. Attwood*

Wallaceville Animal Res. Centre, PB, Upper Hutt, New Zealand.

Clinch, P.G. and Turner, J.C. Estimation of tutin and hye-nanchin in honey: 3. Toxicity of honey samples from test hives, 1968–74. *New Zealand Journal of Science* (1975) 18 (3) 323–328 [En, B]

The toxins tutin and hyenanchin were detected in honey samples collected during the period 1968–1974 from test hives in the northern districts of the North Island of New Zealand. Of 335 samples, 78 were toxic to mice; thin-layer chromatography showed them to contain a toxin concentration (expressed as tutin equivalent) equal to or less than 4.0 mg/100 g honey. Samples of honeydew excreted by the passion-vine hopper (*Scolypopa australis*) feeding on tutu (*Coriaria arborea*) were also tested, and all were found to contain tutin and hyenanchin. *Author*
Wallaceville Animal Res. Centre, Upper Hutt, New Zealand.

Cook, V.A. Puff ball control of bees. *New Zealand Journal of Agriculture* (1970) 120 (5) 72–73, 75 [En, B]

A method of making up very small queen-mating nuclei is described. Smoke from the giant puff ball (*Calvatia gigantea*) is used to stupefy the bees during the operation.
M. D. Seager
Dept. Agriculture, Oamaru, New Zealand.

Cook, V.A. Beekeeping. 2. Tank to handle big honey crops. *New Zealand Journal of Agriculture* (1971) 122 (2) 79, 81 [En, B]

Cook, V.A. Bulk honey barrow. *New Zealand Journal of Agriculture* (1971) 122 (6) 29 [En, B]

Cook, V.A. The carrying capacity of beekeeping areas. *New Zealand Beekeeper* (1972) 34 (4) 16–18; 20–21 [En, B]
Number of colonies per apiary and per unit area of land.

Cook, V.A. Honey bee pollination of legumes, brassicas and sunflowers in North Otago. *New Zealand Beekeeper* (1972) 34 (4) 24–27 [En, B]

Cook, V.A. Protecting bees from insecticides. *New Zealand Journal of Agriculture* (1972) 123 61–62 [En, B]

Cook, V.A. Potential for honey production. *New Zealand Journal of Agriculture* (1973) 126 (5) 53–54 [En, B]
Honey production in South Island, New Zealand, increased from 11 800 tons in 1963–1967 to 13,700 tons in 1968–1972. There might be scope for 20,000 additional hives, producing 800 tons, largely by increasing the size of existing apiaries. Yields in the Canterbury area have decreased recently, but a new market is being now established with beech honeydew honey. *J. M. Gedy*
Horticulture Div., Ministry Agric. and Fisheries, Oamaru, New Zealand.

Cook, V.A. New beehive loader. *New Zealand Journal of Agriculture* (1974) 129 26–27 [En, B]

Cook, V.A. Pollination in North Otago. *New Zealand Journal of Agriculture* (1974) 128 (1) 32–33 [En, B]
The main entomophilous seed crops grown in the North Otago area of New Zealand are white clover, red clover, lucerne, kale and sunflower. The crops are effectively pollinated by the 4000 colonies of bees in 300 permanent apiaries which are fairly evenly distributed throughout the area. The value of the seed grown is estimated at

NZ\$200,000; the honey the bees produce is worth about NZ\$135,000. *V. A. Cook*
Min. Agric. & Fisheries, Oamaru, New Zealand.

Cook, V.A. Protecting honey bees by controlling pesticide applications to cruciferous and leguminous seed crops in New Zealand. *Proceedings of the XXVth International Apicultural Congress, Adelaide.* Bucharest, Romania; Apimondia Publishing House. (1977) 448–451 [En, B]

Cook, V.A. A honey production colony for producing queen cells. *British Bee Journal* (1980) 108 (4418) 193–195 [En, B]
A method developed in New Zealand was used successfully in England.

Cook, V.A. New Zealand honeydew from beech [Nothofagus]. *Bee World* (1981) 62 (1) 20–22 [En, B]
At present 10 000 colonies work this flow, but it is still much underexploited.

Corbet, S.A. Pollination of crops imported to new countries. *Bulletin of the British Ecological Society* (1987) 18 (1) 22–23 [En, Ba]

In New Zealand, growers of kiwifruit (*Actinidia deliciosa*), a native of China, hire honey bees for pollination during the brief flowering period, but honey bees do not thrive on the nectarless crop and the use of bumble bees as an alternative is being considered. Workers and queens of the imported British bumble bee, *Bombus terrestris*, buzzed flowers but their wingbeat frequency during buzzing poorly matched the optimal frequency for pollen discharge. *P. Walker*
Dept. Applied Biology, Univ. Cambridge, Pembroke St., Cambridge CB2 3DX, UK.

Costa, G., Testolin, R. and Vizzotto, G. Kiwifruit pollination: an unbiased estimate of wind and bee contribution. *New Zealand Journal of Crop and Horticultural Science* (1993) 21 (2) 189–195 [En, 31 ref., 1 fig.]

The roles of wind and honeybees in kiwifruit pollination were investigated using large cages enclosing 80 mature vines (one male cv. Matua plant for every seven female cv. Hayward plants) and assembled to prevent insects entering without reducing wind flow within the cages. Cages with or without hives, open pollination with hives and hand pollination were compared during 1990 and 1991. Wind pollination led to fruit set of 81 and 98% in the first and second year, respectively, but fruit weight was low, averaging 61 and 66 g, respectively. The use of hives resulted in 98–100% fruit set, but fruit size did not improve significantly, remaining far below that achieved by hand pollination (66 vs. 108 g in the first year and 78 vs. 119 g in the second year). The short flowering period, the frequent adverse weather conditions and the unpredictable foraging efficiency of bee colonies made both wind and bees inadequate for pollination. Only hand pollination guaranteed maximal fruit size in each year.
Dipartimento di Produzione Vegetale e Tecnologie Agrarie, University of Udine, 33100 Udine, Italy.

Craig, J.L. and Stewart, A.M. A review of kiwifruit pollination: where to next? *New Zealand Journal of Experimental Agriculture* (1988) 16 (4) 385–399 [En, Bb]

Current knowledge of kiwifruit (*Actinidia deliciosa*) pollination is reviewed, with 50 references. It is concluded that there is as much evidence for wind pollination as there is for insect pollination. Evidence for the effectiveness of honeybees is not clear. Recent studies suggest that individual bees tend to work flowers of one sex of vine or the other. Existing methods of measuring pollination effectiveness and the understanding of incompatibility responses are questioned. An experiment is proposed which could help to resolve the uncertainties about pollination. *J.M. Gedy*
Zoology Dept., Univ. Auckland, Private Bag, Auckland, New Zealand.

Crane, E. Beekeeping as a sustainable practice: past, present and future. *New Zealand Beekeeper* (2000) 7 (8) 9–12 [En, Bj]

Woodside House, Woodside Hill, Gerrards Cross, Bucks. SL9 9TB, UK.

Crane, E. Prevention and treatment of diseases and pests of honey bees: the world picture. *New Zealand Beekeeper* (2000) 7 (10) 5–8 [En, Bj]

Crane, E. and Walker, P. Pollination directory for world crops. London, UK; International Bee Research Association. (1984) 183 pp. ISBN 0-86098-143-6 [En, B]

This book contains information on more than 400 important crop plants grown in tropical, subtropical or temperate zones. In the main section entries are arranged alphabetically under the common name of the crop. Each entry gives a synopsis of available information: brief description of the type of plant, main areas of cultivation, crop product(s), methods of propagation if relevant, reproductive characteristics, pollination mechanism and requirements and, for most crops, pollinating agents.

Cross, D.J. Preservative treatments of wood used in hives. *Bee World* (1983) 64 (4) 169–174 [En, B]

Methods are given for the prophylactic treatment of wood either intended for, or already shaped (and perhaps assembled) as hives. In order of increasing effectiveness they are: (1) paints; (2) envelope treatment with a water repellent e.g. paraffin wax; (3) envelope treatment with fungitoxic materials e.g. pentachlorophenol; (4) full impregnation with soluble preservatives e.g. water-soluble metallic salts. Methods 1 and 2 may also be used to renovate old hives. The economic aspects of protecting wooden hives in both the tropics and temperate zones are emphasized. *D.G. Lowe*

Preservation Section, Forest Res. Inst., Rotorua, New Zealand.

Dalzell, K.W. and Singers, W.A. A survey of some South Island honeydew honeys. *New Zealand Journal of Science* (1975) 18 (3) 329–332 [En, B]

Of eight samples, two complied fully with both the Japanese standard and European Codex (CAC). Two samples conformed except for marginally high acidity in one,

and high water-insolubles content in the other. Of four samples with a high sucrose content, three (with 6–8%) conformed with the CAC but not with the Japanese standard; the other had 13% sucrose and failed both standards. *P. Walker*

Chemistry Div., DSIR, Petone, New Zealand.

Dawson, C. Waitangi treaty had links with first beekeeper. *New Zealand Beekeeper* (1979) 40 (1) 19, 21–22 [En, B]

Mary Anna Bumby sailed from England to New Zealand, arriving in March 1839; she had with her some skeps of bees which were the first honeybees to be taken to New Zealand. This article, quoting from various diaries and biographies, gives some information about Mary Bumby's life, though none of the quotations mention her beekeeping. *P. Walker*

Dawson, C. New Zealand Beekeepers Technical Library: how it started and Foundation Life Members. *New Zealand Beekeeper* (1996) 3 (3) 11 [En, Bj]

Delfinado, M.D. and Baker, E.W. A new record for the bee mite *Mellitiphis* in New Zealand. *Bee World* (1974) 55 (4) 148–149 [En, B]

Found in wax scraped from a hive; details of the life history

Dixon, G. Compensation issues and the biosecurity act. *New Zealand Beekeeper* (2002) 10 (3) 4–6 [En, Bj]

Dobson, J. NZ bee genetic improvement group – a unique response to the challenge. *New Zealand Beekeeper* (1995) 2 (2) 7–9 [En, Bj]

A honey bee (*Apis mellifera*) stock improvement programme in New Zealand is operated by a private company owned by 25 beekeepers. The shareholders evaluate over one season 7–10 selected queens for brood viability and colony performance. The best queen from each group is returned to the programme manager in autumn to be used for rearing more than 10,000 drones, and more than 250 queens which are inseminated with semen pooled from drones reared from all the best queens. Queens thus produced are evaluated during the next season. With shareholders conducting evaluations the annual programme budget is only c. NZ\$ 15,000. *A.G. Matheson*

Donovan, B.J. Calculated value of nests of the long-tongued bumblebee *Bombus hortorum*, for pollination of tetraploid red clover, *Trifolium pratense*. *Acta Horticulturae* (2001) (No.561) 293–296 [En, 4 wf.]

Trap-nested colonies of bumble bees were moved to flowering crops of during early bloom. The ideal size at which a colony should be moved to red clover is thought to be about 6–8 cm across, with a fecund queen and 25–35 workers. The flowering period lasts for 10 weeks or more, during which time a colony grows to about 20 cm across. At the end of colony activity, for 14 colonies a mean 628 workers/males and 125 new queens had emerged from cells. Using actual data and making some assumptions, a model estimates the value of seed obtained as a result of pollination by one colony.

Donovan Scientific Insect Research, Canterbury Agriculture and Science Centre, Lincoln, New Zealand.

Donovan, B.J. Laboratory tests show that some new spray adjuvants are benign to honey bees. *Orchardist* (2001) 74 (5) 38–39 [En, 1 wf.]

Donovan Scientific Insect Research, Private Bag 4704, Christchurch, New Zealand.

Donovan, B. Chalk brood in New Zealand. *Australian Bee Journal* (1984) 65 (9) 6 [En, B]

Ascosphaera aggregata and *A. proliperda*, causative agents of chalk brood in *Megachile rotundata*, have not been found in New Zealand.

Donovan, B. and Read, P. Is leafcutting bee investment warranted? The answer is clearly 'yes'! *New Zealand Journal of Agriculture* (1984) 149 (4) 2–3 [En, B]

Economic aspects of rearing *Megachile rotundata* in New Zealand for the pollination of *Medicago sativa*.

Donovan, B.J. Bees of the world; bees of New Zealand. *New Zealand Beekeeper* (1974/1975) 36; 37 (2;3;4;1;2) 44–51; 53; 49–55; 46–48; 33–39; 46; 43–50 [En, B] Native and introduced species.

Donovan, B.J. Introduction of new bees species for pollinating lucerne. *Proceedings of the New Zealand Grassland Association* (1975) 36 (1) 123–128 [En, B]

Report on *Megachile pacifica* and *Nomia melanderi*.

Donovan, B.J. Vitex negundo incisa, its potential for bee forage in New Zealand (Verbenaceae). *Proceedings, Conference on alternative land uses in New Zealand with emphasis on temperate tree crops, Lincoln College, Canterbury, New Zealand.* (1979) 189–192 [En, B]

Donovan, B.J. Interactions between native and introduced bees in New Zealand. *New Zealand Journal of Ecology* (1980) 3 104–116 [En, B]

There are about 40 species of native bees in New Zealand, 36 of which belong to the *Colletidae* family, and the rest to the *Halictidae*. Introduced species include *Apis mellifera*, four *Bombus* species, and *Nomia melanderi* and *Megachile rotundata*. Honeybees in commercial apiaries, and other introduced species, forage mainly on introduced plants, but some honeybees do compete with native bees on native plants. The peak of foraging by native bees occurs at the season of the main honey flow, when there is most food. It is thought that competition for nest sites does not occur. It is concluded that the introduced species do not have a deleterious effect on native species; much more information on the latter is needed. *P. Walker*
Entomology Div., DSIR, Private Bag, Christchurch, New Zealand.

Donovan, B.J. Selection and importation of new pollinators to New Zealand. *New Zealand Entomologist* (1990) 13 26–32 [En, Ba]

This paper, with 30 references, reviews the use of imported species for pollination of crops in New Zealand. The honey bee was introduced for honey production, but it provides adequate pollination for most of the introduced flowering crops that require insect pollination for fruit and seed production. The shortage of indigenous pollinators led to

the importation of long-tongued bumble bees for pollination of red clover. This was the first introduction anywhere of bees especially for pollination. Following this success, two species of bees (*Megachile rotundata*, *Nomia melanderi*) were introduced to pollinate lucerne. The importation of further specialist pollinators for selected crops could improve yields and quality. Criteria for selection of additional pollinators are suggested, which include minimising disturbances to the existing flora and fauna, and the safeguarding of current crop yields. *Osmia cornifrons* appears to comply with all these criteria and could be considered for importation into New Zealand for fruit pollination.

Author

DSIR Plant Protection, Canterbury Agriculture and Science Centre, Lincoln, Private Bag, Christchurch, New Zealand.

Donovan, B.J. and Macfarlane, R.P. A nest of *Bombus hortorum* (Hymenoptera) in a fur coat in New Zealand. *New Zealand Entomologist* (1971) 5 (1) 83–84 [En, B]

Donovan, B.J. and Macfarlane, R.P. Bees and pollination. New Zealand pest and beneficial insects [edited by Scott, R.R.]. New Zealand; Lincoln University College of Agriculture. (1984) 247–270 [En, B]

Donovan, B.J. and Read, P.E.C. The alfalfa leafcutting bee, *Megachile rotundata* (Megachilidae), does not pollinate kiwifruit, *Actinidia deliciosa* var. *deliciosa* (Actinidiaceae). *Journal of Apicultural Research* (1988) 27 (1) 9–12 [En, Bb]

The disruption to pollination of kiwifruit in New Zealand that might occur if new honeybee diseases or enemies become established prompted an examination of the potential use of *Megachile rotundata* as a kiwifruit pollinator. These bees were evaluated at three field sites under three management regimes, and in one cage test. Only four male bees were seen to visit kiwifruit flowers under normal field conditions. Bees caged with lucerne (*Medicago sativa*) and kiwifruit flowers foraged only on lucerne. Pollen of the colour of kiwifruit pollen collected by bees was entirely *Lotus* spp. *M. rotundata* is thus considered to have no potential for the pollination of kiwifruit.

Author

Entomology Div., DSIR Lincoln, Christchurch, New Zealand.

Donovan, B.J. and Read, P.E.C. Pollination of kiwifruit by honey bees. *New Zealand Beekeeper* (1992) (No. 216) 7–11 [En, B]

In trials on a 0.5-ha plot of Hayward kiwifruit with colonies of Italian honey bees [*Apis mellifera ligustica*] a quarter of the bee visits to flowers resulted in the production of fruits of export weight (72 g). A model was developed showing that, for sufficient pollination for all fruits to grow to this weight, only 148 bees need to be visiting female flowers for six hours a day for five days. If a colony has 4000 pollen foragers in the field at any one time, and assuming that male flowers need to be visited as much as female flowers, 13.5 ha could be pollinated by one colony. However, in reality, some kiwifruit flowers would be visited several times and some not at all; also, some of the foraging bees would visit flowers of other species. It is concluded

that an earlier recommendation of eight colonies/ha is excessive and that 1.3 colonies/ha may be sufficient. [A preliminary report of this study was published in the proceedings of the Sixth International Symposium on Pollination (*Acta Horticulturae* (1991) No. 288, 220–224)]. P. Walker

Donovan, B. J. and Wier, S. S. *Development of hives for field population increase, and studies on the life cycles of the four species of introduced bumble bees in New Zealand.* *New Zealand Journal of Agricultural Research* (1978) 21 733–756 [En, B]

In 1971–1973, of 340 field nest boxes and hives, 84 were occupied by the four introduced *Bombus* species in New Zealand. Nests of *B. hortorum* and *B. terrestris* produced 2–5 times as many individuals as did nests in Europe, probably because of a relative freedom from enemies and from competitors for food. Nests of *B. ruderatus* and *B. subterraneus* were similar in production to European nests and may have been limited by competition from the other two species for food. The life cycles of the four species are described and compared; only 32 nests produced new queens. In the three seasons, the number of new queens produced was 12.4 times as great as the number of queens involved in founding the 84 nests. The tendency of some new queens to return to the vicinity of the maternal nest the following season, and the increased number of foundress queens present in subsequent years because of the presence of hives, will possibly lead to greater acceptance rates from season to season. The hives were acceptable for all stages of nest development, but recommendations are made for improving drainage and durability. J. M. Gedy

Entomology Div., DSIR, C/-Crop Res. Div., PB, Christchurch, New Zealand.

Eaton, C. van. *An automatic de-boxer.* *New Zealand Beekeeper* (1983) (No. 178) 26–27 [En, B]

The frames are lifted from the box by a metal plate attached to an air ram; the device is controlled by a foot lever with a pneumatic control.

Eaton, C. van. *Amenity and farm shelter trees for bees, Southland/South Otago.* Gore, New Zealand; Ministry of Agriculture & Fisheries. (1984) (Ed. 2) 19 pp. [En, B]

This pamphlet gives details of over 100 species which provide forage for honeybees, including planting requirements, uses, climatic tolerances, etc.

Eaton, C. van. *Commercial queen production in New Zealand.* *American Bee Journal* (1987) 127 (11) 773–774, 785 [En, B]

In New Zealand there are 22 commercial and semi-commercial queen producers; about 75,000 queens are produced annually for the domestic market. In 1986, over 41,000 queens, as well as packages of bees, were exported to 13 countries in North America, Europe, Asia and the Pacific. Many honey producers also rear their own queens. Most New Zealand queen producers use free-flying starter/finishers, which are variations of the Doolittle system. For grafting, plastic cups and a sable-hair brush are used, and no more than 20–30 cells are finished per

colony. The organisation of the industry, and the advisory services provided, are described. P. Walker
Ministry Agric. & Fisheries, Whangarei, New Zealand.

Ecroyd, A. K. *Metrication of beekeepers' equipment and its problems.* *New Zealand Beekeeper* (1973) 35 (4) 40–42 [En, B]

Falconer, B. *Alternatives to honey production.* *New Zealand Beekeeper* (1981) 42 (3) 9–10 [En, B]

Fisher, R. M. and Pomeroy, N. *Pollination of greenhouse muskmelons by bumble bees (Hymenoptera: Apidae).* *Journal of Economic Entomology* (1989) 82 (4) 1061–1066 [En, B]

Musk melons, *Cucumis melo*, have been grown for export in recent years in New Zealand, but hand pollination is expensive and honeybees do not appear to work effectively in overcast conditions – a critical factor during the short pollination period. In studies at Rewa, Manawatu, New Zealand, nine laboratory-reared bumble bee (*Bombus terrestris*) colonies in 10-litre plastic buckets with ventilation grilles were placed inside a 1500 m² greenhouse for seven days (the shortened pollination period required for melon export) to pollinate *C. melo* cv. *Derishi*. Bumble bee workers foraged on the melon flowers from dawn until dusk. They collected only nectar from male and female flowers. Female flowers offered a greater volume of nectar, but did not appear to be more attractive to workers. Up to 32% of the bees left the greenhouse through ventilation gaps and foraged elsewhere for nectar and pollen. The number of bees that worked the crop ranged from two to eight per 100 plants after the melon flowers had opened. Bagging flowers showed that bees were essential for fruit development, but the time of day that visits to the flowers were made was not important. Pollination by the bees was associated with 90% of the melon crop attaining the minimum exportable weight. It is concluded that using bumble bees is an effective method of pollinating greenhouse melons. D. G. Lowe

Dept. Botany & Zoology, Massey Univ., Palmerston North, New Zealand.

Floyd, B. *Marketing [honey].* *New Zealand Beekeeper* (2000) 7 (7) 7–10 [En, B]

Strategies for marketing New Zealand honey.

Floyd, B. *Some highlights from honey marketing file.* *New Zealand Beekeeper* (1996) 3 (3) 20–23 [En, B]

This article includes New Zealand honey marketing strategies and objectives for 1996.

Forster, I. W. *The effect of air or surface mailing of queen bees on subsequent breeding, honey production, and queen supersedure.* *New Zealand Journal of Agricultural Research* (1971) 14 951–953 [En, B]

There was some evidence that the transport of queens by air or surface mail may increase their supersedure rate during the first year. Neither honey nor brood production was affected. Author
Wallaceville Animal Res. Centre, Private Bag, Wellington, New Zealand.

Forster, I.W. Requeening honey bee colonies without dequeening. *New Zealand Journal of Agricultural Research* (1972) 15 (2) 413–419 [En, B]

Two groups of 86 colonies were used to compare two methods of requeening that involve dividing the colony into two parts. Group A reared a queen in a queenless top storey, and Group B did so in a queenless bottom storey. Subsequently the two storeys were united, by replacing the board dividing them with newspaper; at this stage, in both groups, the storey with the young queen was placed above that with the original queen (she was not removed). The two methods gave very similar results, but method B required less skill and only 40% as much time as A, and it could be carried out in more adverse weather. The average survival rate of the young queens was 93%. *M. D. Seager* Wallaceville Animal Res. Centre, Dept. Agric., P.B., Upper Hutt, New Zealand.

Forster, I.W. Behaviour and effectiveness of bees in pollinating legumes. *Proceedings of the New Zealand Grassland Association* (1974) 36 (1) 105–110 [En, B]

Adequate pollination of white or red clover was obtained when the foraging honeybee population was 10 000/ha. This could be ensured with one hive per 3 ha. Bumble bees were equally effective as pollinators. In a survey of 32 lucerne crops, honeybee populations ranged from 2250/ha to 16 250/ha, and bumble bee populations up to 4250/ha were also present, but the average seed set was only 10%. When a hive that was short of stored pollen was enclosed on lucerne inside a cage, a 30% seed set was obtained, but attempts to obtain similar results in the field (by removing pollen from hives and using pollen traps) failed. *D. G. Lowe* Min. Agric. & Fisheries, PO Box 96, Oamaru, New Zealand.

Forster, I.W. An all-season beehive entrance. *New Zealand Beekeeper* (1976) 38 (1) 9 [En, B]

A simple bottom board, providing a shallow tunnel entrance (8 mm high x 360 mm wide) and some clustering space, was constructed and tested. The entrance was small enough to prevent the entry of mice, but still allowed sufficient ventilation. In a hive fitted with such an entrance, honey production, brood rearing and amount of nosema were not significantly different from a hive with a direct deep entrance, 20 X 360 mm in summer and 10 X 60 mm in winter. *P. Walker*

Wallaceville Animal Res. Centre, Private Bag, Wellington, New Zealand.

Galimberti, P. [Pollination of kiwifruit in New Zealand] L'impollinazione dell'actinidia in Nuova Zelanda. *Informatore Agrario* (2002) 58 (36) 47–51 [It, X]

Gatehouse, H. and Malone, L. Surprising uniformity in New Zealand's nosema disease. *New Zealand Beekeeper* (99) 6 (9) 8 [En, B]

DNA fingerprints of 15 *Nosema apis* samples from 10 countries showed marked differences between countries and also between two samples from the same country (e.g. Switzerland, Finland). In contrast, DNA fingerprints of 10 samples from nine areas of New Zealand showed great similarity and only a few minor variations. Possible reasons are mentioned. *P. Walker*

Hort Research, Palmerston North and Auckland, New Zealand.

Giacon, H. and Malone, L. Testing imported bee products for European foul brood. *New Zealand Beekeeper* (1995) 2 (8) 8–9 [En, B]

In New Zealand, samples of imported materials containing bee products are tested for EFB by attempting to culture *Melissococcus pluton*. Over a year, a total of 325 kg of royal jelly in various formulations and 180 litres of various products containing honey were tested, and all results were negative. The lower limit of detection has not been determined. *P. Walker*

HortResearch, Mt. Albert Research Centre, Private Bag 92169, Auckland, New Zealand.

Gill, R.A. Pollination services: an overview. *Australasian Beekeeper* (1989) 91 (4) 168–170, 186–187 [En, B]

From a literature survey, over 60 tropical and temperate-zone crops are rated according to their degree of dependence on pollinating insects and to the effect of removing bees from them. The use of pollination services is illustrated by examples from the USA and New Zealand. The market in Australia is not as fully developed, but could be profitable for many commercial beekeepers. *P. Walker* Dept. Agric. Economics & Business Management, Univ. New England, Armidale, NSW, Australia.

Goodman, M., ten Houten, A., Perry, J. and Blackmann, R. Cost benefit analysis of using fumagillin to treat nosema. *New Zealand Beekeeper* (1990) (No. 208) 11–12 [En, B]

In trials in New Zealand a single spring treatment of 20 *Apis mellifera* colonies with fumagillin (100 mg/4.5 litres syrup) reduced the incidence of nosema disease and levels of infection. One month after treatment, the average number of *Nosema apis* spores in bees in the 20 treated colonies was 620,000/bee compared with 2,220,000/bee in untreated colonies. Treated colonies produced on average 13.9% more honey, but differences were not significant except at one apiary. In 80 colonies treated in both autumn and spring, honey production was 23.2% higher than in untreated colonies. In a further 100 colonies that were treated twice, the average spore level one month after the spring treatment was 1,830,000 spores/bee (4,010,000 spores/bee in untreated controls). The treated colonies produced 28.6% more honey. It is concluded that fumagillin treatment is cost-effective. However, many New Zealand beekeepers do not realize the significance of nosema disease because colonies do not show obvious symptoms. *P. Walker*

Goodwin, M. Elimination of American foulbrood from New Zealand. *New Zealand Beekeeper* (99) 6 (5) 8–10 [En, B]

History of the incidence and control of the disease in New Zealand is summarised. In 1991, 1.2% of honey bee colonies were infected, the highest level for 30 years. A control programme achieved a reduction in incidence to a reported level of 0.38% in 1998, although this is considered to be an underestimate. Average incidence is approximately 0.8% in colonies belonging to beekeepers with fewer than five colonies and 0.25% for those of beekeepers with over 1000 colonies; commercial beekeepers own most of the colonies in New Zealand. *P. Walker*

Ruakura Apicultural Research and Advisory Unit, Hort Research, Hamilton, New Zealand.

Goodwin, M. *Law shifts for toxic honey management*. New Zealand Beekeeper (2002) 10 (1) 10–11 [En, Bj]
HortResearch Ruakura, New Zealand.

Goodwin, M. *Inspecting honey bee colonies for American foulbrood disease*. New Zealand Beekeeper (2003) 11 (9) 6–7 [En, Bj]

Goodwin, M. and Eaton, C. van Napier. *New Zealand; National Beekeepers' Association of New Zealand, Inc. Elimination of American foulbrood without the use of drugs* (99) 78 pp. ISBN 0-473-05776-X [En, Bd]

Early chapters describe the symptoms, development, spread and diagnosis of the disease. Chapters 8 and 9 set out methods of dealing with infected colonies and equipment, and of eliminating AFB from apiaries. Chapter 10 gives six case studies. Chapter 11 provides management plans for eliminating AFB from operations of up to 10 and of 10–350 hives, and with incidence levels of 1% and 10%. Results of recent research, especially that done in New Zealand, are included; there are 36 references. There is also a glossary, but no index. *P. Walker*

Goodwin, M., Taylor, M., McBrydie, H. and Cox, H. *Control of varroa using formic acid, oxalic acid and thymol*. New Zealand Beekeeper (2003) 11 (6) 7–8, 10 [En, Bj]

Autumn treatments were carried out at a cold site (below 0° for 25% and above 10° for 24% of the time) and a warm site (below 0° for 1% of the time). Formic acid (65%) was applied in four different ways, and other colonies were treated with thymol crystals on a dish or by trickling oxalic acid in syrup between the combs. At the cold site, efficacy was 57.8–87.6%, 80.3% and 58.7%, respectively; at the warm site, values were 29.5–44.0%, 83.0% and 39.9%. At both sites, formic acid was most effective when applied to absorbent pads placed on the top bars of the top super. *P. Walker*

Apicultural Research unit, Ruakura Research Centre, New Zealand.

Goodwin, M. and Van Eaton, C. *Control of varroa. A guide for New Zealand beekeepers*. Wellington; New Zealand Ministry of Agriculture and Forestry (2001) 120 pp. ISBN 0 478 07958 3 [En, Bd]

Chapters include: detection and evaluation of infestations; chemical control; chemical resistance; biotechnical control; breeding for varroa tolerance; integrated pest management; timing of varroa control. Appendices give information on methods of application and testing for resistance, and on relevant legislation and regulations. *P. Walker*

Goodwin, M., Perry, J., ten Houten, A., Haine, H. and Brown, P. *A comparison of pollinators*. New Zealand Kiwifruit (1992) (September) 12 [En, Bc]

Various kiwifruit pollination devices were tested in two orchards in New Zealand which were also stocked with honey bees [*Apis mellifera*] (8 hives/ha). Measurements of fruit set, percentage of undersized fruit, mean fruit weight and average value of fruit, showed that there was little dif-

ference between vines receiving only honey bee pollination and those receiving supplementary artificial pollination. *J.M. Gedy*

Ruakura Apicultural Research Unit, HortResearch, Hamilton, New Zealand.

Goodwin, R.M. *Counting varroa costs into hive profits might turn business around*. New Zealand Beekeeper (2002) 10 (5) 12–14 [En, Bj]

Goodwin, R.M. *Increased kiwifruit pollen collection after feeding sugar syrup to honey bees within their hive*. New Zealand Journal of Experimental Agriculture (1986) 14 (1) 57–61 [En, Bb]

Hives were brought into an orchard of kiwifruit (*Actinidia deliciosa*) in three groups (100 hives in total) as flowering progressed, until they were spread evenly around the orchard at a density of eight hives/ha. Twelve selected hives (Group B) had 900 ml of 2-M sucrose solution supplied to a feeder in the top super on one day, whilst 12 unfed colonies (Group A) acted as controls. In a second trial, Group A was fed 900 ml sucrose on three successive days, whilst Group B colonies acted as controls. The amounts of pollen collected by traps fitted to the hives increased after the colonies had been fed. The greatest difference between colonies was on the third day that Group A was fed, when they collected 2.14 times as much kiwifruit pollen as Group B colonies. There was no significant increase in the collection of other types of pollen. *D.G. Lowe*

Dept. Zoology, Univ. Auckland, Private Bag, Auckland, New Zealand.

Goodwin, R.M. *Feeding sugar syrup to honey bee colonies to improve pollination: a review*. Bee World (1997) 78 (2) 56–62 [En, Bj]

This review, with 32 references, deals with the following aspects: attracting bees to a crop by spraying it with sugar syrup; directing bees to a crop by feeding scented syrup either inside or outside the hive; feeding syrup inside the hive to increase the number of pollen foragers. *D.G. Lowe*
Apiculture Research Unit, The Horticulture & Food Research Institute of New Zealand Ltd., Ruakura Research Centre, Private Bag 3123, Hamilton, New Zealand.

Goodwin, R.M. and ten Houten, A. *Poisoning of honey bees (Apis mellifera) by sodium fluoroacetate (1080) in baits*. New Zealand Journal of Zoology (1991) 18 (2) 45–51 [En, Ba]

Some high honey bee mortalities have been reported in areas (in New Zealand) where sodium fluoroacetate (1080) + jam baits are used to kill opossums. Of four samples of dead bees, three contained 1080 (3.1, 3.8 and 10 mg/kg). In trials, baits placed near hives were consumed within eight hours; bees started to die after 1.5–2 hours, but during this time a forager could make up to four visits to the bait and also recruit other foragers. Black strap molasses added to the bait had a repellent effect on honey bees. Foragers could detect differences in concentration as small as 5%; the addition of 20% molasses strongly repelled inexperienced foragers, but did not repel opossums. The addition of 2% oxalic acid (a component of

molasses) to sugar syrup or to the bait also repelled foraging honey bees. *P. Walker*

Ruakura Apicultural Research and Advisory Unit, Ministry of Agriculture and Fisheries, Agricultural Centre, Private Bag, Hamilton, New Zealand.

Goodwin, R.M., ten Houten, A. and Perry, J.H. Effect of feeding pollen substitutes to honey bee colonies used for kiwifruit pollination and honey production. *New Zealand Journal of Crop and Horticultural Science* (1994) 22 (4) 459–462 [En, 16 ref.]

Feeding pollen substitutes to honey bee colonies in kiwifruit orchards had no significant effect on the amount of kiwifruit pollen collected, but caused a decline in the amount of pollen collected from other sources. Pollen substitutes had no significant effect on honey production from colonies used for kiwifruit pollination or colonies managed solely for honey production.

Horticulture and Food Research Institute of New Zealand, Apicultural Research Unit, Ruakura Research Centre, Private Bag 3123, Hamilton, New Zealand.

Goodwin, R.M., Perry, J.H. and Brown, P. American foulbrood disease part III: Spread. *New Zealand Beekeeper* (1993) (No. 219) 7–10 [En, Bj]

In New Zealand 80 honey bee (*Apis mellifera*) colonies were assembled in one apiary: 20 were removed within two days, and 20 more two weeks later. Of the remaining 40 colonies, 88% contracted American foul brood (AFB) within three months. None of the first 20 colonies to be removed developed AFB, while 80% of the second group did. These events were assumed to have been caused by exposure to robbing of material infected with *Bacillus larvae* (BL). Trials were conducted to determine factors influencing the spread of AFB. A total of 48 colonies were placed in pairs: one in each contained a light (less than 50 larvae with symptoms) infection of AFB and the other was uninfected. The level of drifting reached the equivalent of 50% of the colony population after 20 days. After 103 days only two (8%) of the uninfected colonies had developed AFB, so drifting may not be a significant cause of AFB spread when infection levels are light. Between 61% (incoming foragers, A) and 98% (brood combs before shaking, B) of adult worker bees in infected colonies carried detectable BL spores: the average number of BL colonies cultured per bee ranged from 0.5 (A) to 24 (B). Honey harvested from colonies with very light AFB infections (less than five larvae with visible symptoms) contained BL spores. The empty honey supers were placed after extraction on uninfected colonies: bees collected two days later from those and all other colonies in that apiary all carried BL spores. Clinical symptoms of AFB began to develop two months after the supers were added. Extracted honey supers (and robbing) are important factors in spreading AFB. *A.G. Matheson*

Goodwin, R.M., Perry, J.H. and Haine, H. American foulbrood disease. Part 1. The incidence of American foulbrood disease in New Zealand. *New Zealand Beekeeper* (1993) (No. 217) 19–20 [En, Bj]

AFB incidence was surveyed by taking samples of honey bees from 355 randomly selected colonies belonging to

hobbyist beekeepers (A), 1681 colonies belonging to commercial beekeepers with a history of high AFB incidence (B), and 106 feral colonies (C). *Bacillus larvae* spores were found in 11.1%, 8.3% and 6.0% of A, B, and C respectively. Spores were also found in eight of 32 packs of retail honey examined. The results suggest that *B. larvae* spores are more common than the national AFB statistics suggest. *A.G. Matheson*

Apicultural Research Unit, Ruakura, New Zealand.

Goodwin, R.M., Perry, J.H. and Haine, H.M. American foulbrood disease. Part II. Subclinical infections. *New Zealand Beekeeper* (1993) (No. 218) 7–9 [En, Bj]

In a survey in New Zealand, 26.2% of adult honey bee (*Apis mellifera*) samples taken from colonies belonging to commercial beekeepers with a history of high AFB incidence contained *Bacillus larvae* spores, but when the colonies giving positive samples were inspected only 26.4% displayed clinical symptoms of AFB. One colony with clinical symptoms was monitored for nearly one year: for much of that time no symptoms showed even though adult bee samples were positive, but after 300 days from the beginning of the trial the number of diseased larvae increased dramatically. Another diseased colony monitored for nearly two years showed very few diseased larvae. Adult bee samples from nearly 3000 colonies showed a positive correlation between the number of *B. larvae* spores present in each sample and the likelihood of the colony showing AFB symptoms. The implications for disease inspection methods are discussed. *A.G. Matheson*

Apicultural Research Unit, Ruakura, New Zealand.

Griffin, R.P., Macfarlane, R.P. and Ende, H.J. van den. Rearing and domestication of long tongued bumble bees in New Zealand. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [edited by Heemert, C. van and Ruijter, A. de].

Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 149–153 ISBN 90-6605-384-4 [En, Bd]

A reliable method has been developed and used in New Zealand for rearing pocket-making bumble bee species such as *Bombus hortorum*. Most queens were fed, mated and overwintered in screen cages. In autumn, 50–88% of the new queens of *B. hortorum* collected from colonies entered hibernation. During winter only 3–5% of the queens died. In spring, emerging queens were put into rearing boxes and fed on sugar or honey solutions and pollen collected by honeybees. *B. hortorum* was more easily reared than *B. subterraneus*. One person reared up to 107 colonies per season. Further research is needed to maximise the productivity of the rearing system and to induce more consistent and rapid egg laying to increase colony size. *Author* DSIR Plant Protection, Private Bag, Christchurch, New Zealand.

Curr, L. The introduction of bumblebees into North Island, New Zealand. *New Zealand Journal of Agricultural Research* (1972) 15 635–638 [En, B]

Bombus terrestris and *B. ruderatus* have been sent from South Island to North Island at intervals from 1888 onwards and have established and spread throughout the

island. Because of the efficiency of *B. hortorum* and *B. subterraneus* in pollinating red clover, an attempt was made to introduce these species to North Island in 1965. In November, 87 *B. hortorum* queens were released at Palmerston North; 38 *B. subterraneus* queens were released at the same site a month later. Regular checks showed that by 1968 *B. hortorum* was firmly established. *B. subterraneus* was seen only in the season of its liberation, and no males were observed. It is likely that the nests formed failed to produce sexual castes or, if they did, that the young queens failed to survive the winter. J. M. Gedy
Massey Univ., Palmerston North, New Zealand.

Gurr, L. *The role of bumblebees as pollinators of red clover and lucerne in New Zealand: a review and prospect.* *Proceedings of the New Zealand Grassland Association* (1974) 36 (1) 111–122 [En]

Bombus hortorum, *B. ruderatus*, *B. subterraneus* and *B. terrestris* have been introduced to New Zealand, and are now widespread. The three long-tongued species are effective pollinators of red clover, whereas the short-tongued *B. terrestris* is the most efficient in pollinating lucerne. Prospects for further increasing seed yields of red clover and lucerne by using populations of *Bombus* species are discussed. D. G. Lowe
Massey Univ., Palmerstone North, New Zealand.

Hammond, J. *Honey poisoning.* *Journal of the New Zealand Dietetic Association* (1976) 30 (1) 27–28 [En, B]

The Ministry of Agriculture and Fisheries has the power to order the removal of hives from certain areas where conditions favour the production of toxic honey, from honeydew containing hyenanchin from *Scolypopa australis* (passion vine hopper) which feeds on *Cariara arborea* (tutu). P. Walker
Dept. Health, Wellington, New Zealand.

Hansen, L. *New wax press on the market.* *New Zealand Beekeeper* (1978) 39 (1) 8 [En, B]

Water in a wheelbarrow tyre provides the energy for this economic device, shown in three photographs.

Harman, A. *Half-moon.* *Gleanings in Bee Culture*. (1989) 117 (5) 288–290 [En, B]

The causes of half-moon disorder were studied in affected colonies in New Zealand. The queens in such colonies appear to be failing: they lay clumps of eggs in cells, and drone brood develops. Many larvae are neglected and die, drying into half-moon-shaped brown scales, and eventually the population of nurse bees becomes depleted. Experiments showed that the premature aging of the queen was not due to genetic factors, or to a pathogen. However, it was demonstrated that if workers do not feed young virgin queens with sufficient protein, premature aging occurs. It is possible that when queens are being reared on a large scale, insufficient protein is being supplied in the mating nuclei. P. Walker

Harris, R.J. *An entrance trap to sample foods of social wasps (Hymenoptera: Vespidae).* *New Zealand Journal of Zoology* (1989) 16 (3) 369–371 [En, Ba]

The design of an entrance trap to enable sampling of food from foragers returning to nests of common and German

wasps (*Vespula vulgaris* and *V. germanica*) is presented. Author
Department of Zoology, University of Canterbury, Christchurch, New Zealand.

Hayes, G.W. Jr. *The Hopkins method of queen rearing.* *American Bee Journal* (1991) 131 (5) 294–296 [En, B]

The method of queen rearing described was developed by I. Hopkins in New Zealand [see *The illustrated Australasian bee manual* (1911)]; in the USA it is known as the Case method. A frame of brood filled with eggs and just-hatching larvae is prepared by destroying two rows of worker cells and then leaving one row, starting this procedure at the top of the frame and continuing down the comb, thus leaving isolated rows of cells running lengthwise across the comb. Then, in each row of cells, every third cell is left intact whilst the others are destroyed. The prepared comb is laid flat with cells facing down over the broodnest of a queenless colony. It is necessary to support the comb in some way in order to allow enough room for large queen cells to be drawn. In favourable conditions, 75–100 mature queen cells can be obtained. D. G. Lowe
Dadant and Sons, Inc., Hamilton, IL, USA.

Hernandez Salgado, J.C. *Yearly output behaviour in pumpkin, using the honey-bee (Apis mellifera) as pollinating insect.* *New Zealand Beekeeper* (2000) 7 (10) 12 [En, B]

In trials in Cuba, a hive of honey bees was placed near one of 12 plots of *Cucurbita moschata*. The bees foraged on the flowers from about 07.00 to 10.30 hours, with a peak at about 10.00 hours. Crop yield and quality decreased slightly with increasing distance from the hive. P. Walker
Yasi Lemu Isla, Cuba.

Hobson, J.V. Jr. *Concrete hives have role to play in tropical islands.* *New Zealand Beekeeper*. (1982) 43 (3) 11–12 [En, B]

Hogg, J.A. *Comb honey in the halfcomb: the modular half-comb cassette & super.* *New Zealand Beekeeper* (1990) (No. 205) 23–30 [En, B]

These plastic cassettes have already been described in some detail [*American Bee Journal* (1984) 124 (4) 265–272, 311–312]. Several improvements are now reported, including the use of a taped hinged cover for filled cassettes instead of the rotating cover; the cassettes are now 1.375 inches deep inside (35 mm). Instructions are given for installing the super conversion unit which accommodates 40 cassettes in a super, and there are many other useful hints for beekeepers starting to use these cassettes. P. Walker

Holmes, N. *Bee forage trees; a valuable alternative.* *New Zealand Journal of Agriculture* (1982) (July) 37–38 [En, B]
Species suitable for growing in shelter belts.

Holmes, N. *Bee forage trees: a valuable alternative.* *New Zealand Journal of Agriculture* (1982) 145 (1) 37–38 [En]

Hopping, M.E. *80,000 honeybee hives not needed; spray pollination of kiwifruit possible by 1990.* *New Zealand Agricultural Science* (1982) 16 (1) 46–48 [En, B]

Since it is unlikely that the 80,000 honeybee colonies estimated to be required by 1990 for kiwifruit pollination

in the Bay of Plenty, New Zealand, will be available, an alternative pollination method has been developed which involves harvesting staminate flowers.

Div. Horticulture and Processing, DSIR, New Zealand.

Hoyo, M. del, Torres, J., Basualdo, M. and Figini, E. Sterilization of hives: use of 'DHT' equipment. [Esterilizacion de colmenas: utilizacion del DHT]. *Boletin del Colmenar* (1995) 2 (14) 10–11 [Es, Bj]

The equipment is similar to that used in New Zealand, but adapted for conditions in Argentina. Frames (without combs) or other hive parts are put inside and submerged in the heated sterilising substance. Best results are obtained using paraffin of linseed oil at 160°C for 10 minutes, or linseed oil at 120°C for 20 minutes. After treatment with linseed oil equipment should be allowed to dry in the air for at least three days before use. *P. Walker*

Jay, D. and Jay, C. Observations of honeybees on Chinese gooseberries ('kiwifruit') in New Zealand. *Bee World* (1984) 65 (4) 155–166 [En, B]

The cultivation of *Actinidia chinensis* in New Zealand is described, including orchard establishment, use of windbreaks, pests and diseases, flowering and pollination. The behaviour of honeybees in blocks of kiwifruit in the Bay of Plenty area was studied in 1982. Of the bees observed visiting male or female flowers, most attempted to collect pollen, and 96% carried *A. chinensis* pollen loads. Pollen from female flowers is white, whereas that from male flowers is creamy or off-white. Pollen trap analyses indicated that about 75% of loads were 'mixed'. On average, honeybees visited 7.5 flowers/male vine and 7.7 flowers/female vine. They spent 18.6 seconds/male flower and 19.5 seconds/female flower. The results suggest that most flowers are visited 4–6 times/hour in ideal conditions. Most bees foraged between 08.00 and 14.00 hours, with peak activity at 12.00 hours. The bees flew freely round, over or through windbreaks, and through or above the dense canopies rather than underneath them; they preferred the sunny sides of the vines. Most bees moved along rows, thus male vines should be grown in each row. Observations indicated that bees from small groups of hives at the ends of blocks disperse throughout adjacent blocks without hives, thus pallets with three or four hives would be an efficient way of transporting and using honeybees for kiwifruit pollination. [Available as IBRA Reprint] *D. G. Lowe*

Dept. Entomology, Univ. Manitoba, Winnipeg, Man. R3T 2N2, Canada.

Jay, S. C. and Warr, D. Sun position as a possible factor in the disorientation of honeybees in the southern hemisphere. *Journal of Apicultural Research* (1984) 23 (3) 143–147 [En, B]

Rows of single-chamber Langstroth hives were arranged in squares, five to a side with their entrances facing outwards (N, S, E, W), in the south temperate zone (at Tauranga, New Zealand, 37°40'S, 176°12'E). A significant number of marked bees (*Apis mellifera*) of various ages moved (drifted) westward from the central hives of north- and south-facing rows during January and February 1983 when the zenith angles of the sun were 17°10'N, 21°49'N at solar noon.

Marked bees in hives facing east showed a significant tendency to drift northward along the rows by the time they were 17–18 days old. This movement of marked bees was not evident in rows that faced west. These data are compared with those obtained in the north temperate zone (at 49°38'N, 97°09'W) and in the tropical zone (at 18°00'N, 76°45'W). It appears that the sun's position, and its apparent movement, influence the direction that most bees drift from their parent hives. *Author*

Dept. Entomology, Univ. Manitoba, Winnipeg, Man. R3T 2N2, Canada.

Johansson, T. S. K. Kiwi beekeeping. *Gleanings in Bee Culture* (1981) 109 624–627; 667–670 [En, B]

Factual account of beekeeping in New Zealand, with many details.

Johansson, T. S. K. and Johansson, M. P. Dyce process patent revocation. *New Zealand Beekeeper* (1989) (No. 201) 24–26 [En, Bj]

The Dyce process for granulation of honey was patented in Canada in 1933, in Great Britain in 1934 (British Patent 392,009) and in USA in 1935 (USP 1,987,893). The British Patent was, however, revoked in 1935 as the result of an application by the New Zealand Honey Control Board which claimed prior use. The wording of the revocation decision and the background to it, are documented here. *P. Walker*

Kemp, R. New Zealand bees ... disease-free alternative? *Skeptic* (1985) 4 (6) 9 [En, B]

Discusses possibility of importing queens and package bees to Canada from New Zealand.

King, M. J. and Ferguson, A. M. Collection and use of dry pollen for pollination of kiwifruit. *New Zealand Journal of Crop and Horticultural Science* (1991) 19 (4) 385–389 [En, Bb]

Natural pollination of *Actinidia deliciosa* involves the transference of dry pollen by wind and insects, especially bees. This paper describes mechanical systems which were developed and evaluated for the collection and application of dry *A. deliciosa* pollen to flowers on an extensive basis. *D. G. Lowe*

DSIR Industrial Development, PO Box 20028, Christchurch, New Zealand.

Ledgard, N. and Simes, W. Honey production at 900 m in Craigieburn Forest Park. *New Zealand Beekeeper* (1983) (No. 177) 25–27 [En, B]

In 1980–81 and 1981–82, scale-hive records were kept for six hives sited close to a meteorological station. The mean annual yield was 80 kg/colony. Early in the season the main sources were *Hieracium lachenalii*, followed by Lotus [species not named], and only when the latter had finished flowering did the bees start collecting beech honeydew, which then became the main source for the rest of the season. In comparing hive weight gains with weather records, it was found that almost all of the gains occurred when the mean daily maximum temperature was 19°C (or above). *P. Walker*

Forest Res. Inst., Craigieburn Forest Park, Craigieburn, New Zealand.

Ledgard, N.J. and Simes, W. High country beekeeping. *New Zealand Beekeeper* (1984) (No. 184) 27–29 [En, B]

In the 1982–83 (third) season of this study [see previous abstract], four hives were weighed weekly and one daily. From early December to the end of April the mean weight gain was only 48 kg/hive; the cool wet season was probably responsible for this low yield compared with previous seasons. The relationship between hive weight gain and temperature was confirmed, and 19°C was again the threshold. It is recommended that hives should be sited in a warm position, especially at high altitudes where night temperatures are low *P. Walker*

Forest Res. Inst., Craigieburn Forest Park, Craigieburn, New Zealand.

Lewis, D.H. and Considine, J.A. Pollination and fruit set in the tamarillo (*Cyphomandra betacea* (Cav.) Sendt.). 1. Floral biology. *New Zealand Journal of Crop and Horticultural Science* (99) 27 (2) 101–112 [En, X]

Honey bees and bumble bees were observed to visit and pollinate tamarillo flowers, cv. 'Oratia Round'.

Dept of Botany, Univ. of Auckland, Private Bag 92 019, Auckland, New Zealand.

Lockhart, P.J. and Cameron, S.A. Trees for bees. *Trends in Ecology & Evolution* (2001) 16 (2) 84–88 [En, wf]

The complex arguments regarding the origins and evolution of social behaviour in the major groups of social corbiculate bees are discussed; disagreements have been attributed to varying hypotheses made following analyses of morphological and molecular data forms. Efforts to resolve the controversy over the origins of social behaviour in bees must be made by both molecular systematists and morphologists. Inst. of Molecular BioSciences, Massey Univ., Palmerston North, New Zealand.

Lorence, C. and Lorence, K. Beekeeping down under in New Zealand and Australia. *American Bee Journal* (2003) 143 (7) 545–548 [En, Bj]

Macfarlane, R.P. and Gurr, L. Distribution of bumble bees in New Zealand. *New Zealand Entomologist* (95) 18 29–36 [En, Bb]

The introduction and redistribution of bumble bee species throughout New Zealand is summarised and distribution maps are given. *Bombus terrestris* was found in all areas of the North and South Islands. It is the only species known from Stewart Island and 27 other offshore islands. *B. ruderatus* was also widespread, except for the southwest of South Island. *B. hortorum* had been confined to the east and south of South Island until successful releases were made in 1965 to Manawatu, in 1981 to Nelson and in 1983 to Marlborough. It has since spread at least 105 km in southern North Island. *B. subterraneus* is mainly found in the drier colder inland part of South Island. Differences in the ecological and economic significance of bumble bees between the islands within New Zealand are discussed. 36/99 Buzzuniversal, 33 Woodside Common, Christchurch 3, New Zealand.

Macfarlane, R.P. Bees, bee forage and pollination on the Chatham Islands. *New Zealand Beekeeper* (1980) 41 (1) 5–6 [En, B]

In 1976 there were 24 honeybee colonies on the islands. Around the apiaries white clover was well pollinated, but the introduction of more colonies would improve pollination of larger areas of this crop, and of lotus and garden fruits. Queens of *Bombus ruderatus* were introduced in 1976, and some bees of this species were observed in 1979. The bee plants of the islands are described; some of the common nectar and pollen species of New Zealand do not grow there. Extensive planting of tree lucerne, gums, honey locust and black locust is recommended. *P. Walker* Dept. of Sci. & Industrial Res., Lincoln, New Zealand.

Macfarlane, R.P. An initial assessment of blueberry pollinators in New Zealand. *New Zealand Journal of Crop and Horticultural Science* (1992) 20 (1) 91–95 [En, Ba]

The short-tongued bumble bee, *Bombus terrestris*, followed by the honey bee, *Apis mellifera*, were the commonest blueberry (*Vaccinium corymbosum*) pollinators at Lincoln, New Zealand. At most, 7% of honey bee visits and 24% of *B. terrestris* visits to blueberry flowers could have resulted in pollination. Honey bees visited flowering shelter belts adjacent to the blueberries more often than the bumble bees did. The long-tongued bumble bees, *B. hortorum* and *B. ruderatus*, consistently pollinated blueberry flowers, but low populations restricted their value in pollination. There were no other effective insect pollinators of blueberries.

Author

DSIR Plant Protection, Private Bag, Christchurch, New Zealand.

Macfarlane, R.P. and Donovan, B.J. Bees and pollination. New Zealand insect pests (D. N. Ferro ed.). (1976) 221–240 [En, B]

The significance of native and introduced bees in the pollination of crops in New Zealand is outlined. The introduction, present distribution, biology and management of bumble bees (*Bombus terrestris*, *B. ruderatus*, *B. hortorum*, *B. subterraneus*), and of *Nomia melanderi* and *Megachile pacifica*, are described. *D.G. Lowe*

Entomology Div., DSIR, Lincoln, New Zealand.

Macfarlane, R.P., Griffin, R.P. and Read, P.E.C. Bumble bee management options to improve 'Grasslands Pawera' red clover seed yields. *Proceedings of the New Zealand Grassland Association* (1983) 44 47–53 [En, B]

Honeybees are not effective pollinators of this tetraploid clover, therefore methods of increasing bumble bee populations were sought. Introduction of queens or of colonies (nests) of *Bombus hortorum* to small fields in New Zealand increased seed yield by up to threefold in that season, but the yield decreased in the following years. In another trial, 60 hives for bumble bees were permanently sited near a 3-ha field of Pawera red clover; 21 colonies of *B. ruderatus* developed, and built up on nearby spring forage, mainly broad beans. The seed yield of 250 kg/ha was lower than that expected (based on the number of pollinating bees), but was much higher than the average of 90 kg/ha for the previous four seasons. Suitable hives for bumble bees, and their placement, are described, with some information on colony management. *P. Walker*

Entomology Div., DSIR, Private Bag, Lincoln, Christchurch, New Zealand.

Macfarlane, R.P., Griffin, R.P. and Read, P.E.C. *Hives for management of bumble bees in New Zealand. Proceedings of the 5th International Symposium on Pollination, Versailles, 1983 [edited by Tasei, J.N.]*. (1984) 435–441 [En, fr, B]

Of 6558 artificial domiciles used in 1975–82, 39% were accepted by queen bumble bees of three species; 27 designs were tested. *Bombus hortorum* was the least selective of design; *B. ruderatus*, and especially *B. terrestris*, were more selective and they preferred domiciles with one wooden tunnel. The location had a strong influence on acceptance of the domiciles and colony development. Other factors contributing to variation in the occupation of domiciles are considered together with the application of this research in a programme of bumble bee management. D.G. Lowe

Entomology Div., DSIR, Private Bag, Christchurch, New Zealand.

Macfarlane, R.P. and Patten, K.D. *Food sources in the management of bumblebee populations around cranberry marshes. Proceedings of the 7th International Symposium on Pollination, Lethbridge, Alberta, Canada, 23–28 June 1996 [edited by Richards, K.W.]*. Leiden, Netherlands; International Society for Horticultural Science. (1997) 239–244 ISBN 90-6605-978-8 [En, Bd]

In the USA, the most effective pollinators of cranberries (*Vaccinium*) are short-tongued bumble bees (*Bombus* spp.). Manipulating feral populations to achieve reliable foraging levels has been difficult. Perennial plants growing adjacent to farms were evaluated for their attractiveness to bees from early spring to autumn. From early spring for early emerging species and from mid-summer to autumn for large colony species were the periods with the most shortages in food resources. In the Pacific Northwest emerging queens (February–March) found *Erica carnea* and *E. x darleyensis* very attractive, followed by dewberry and evergreen huckleberry in March and April. Late summer forage was provided by *Lotus corniculatus* and *E. cinerea*. In Wisconsin, the short-tongued *Bombus* complex used a wide assortment of flowers, most of which were of poor quality, were uncommon, or had a short flowering period. Author

Buzzuniversal, 33 Woodside Common, Christchurch, New Zealand.

Maclaren, P. *Trees and bees. New Zealand Beekeeper* (1984) (No. 181) 24–25 [En, B]

Wood for hives, trees for pollen and nectar; see also next item.

Malone, L., Stefanovic, D. and Gatehouse, H. *Why is nosema such a common bee disease? New Zealand Beekeeper* (99) 6 (8) 5–6 [En, Bj]

Levels of *Nosema apis* spores were determined on the internal surfaces of three hives that had contained infected colonies some months earlier; all colonies had died in the winter. In a 2-storey hive where the infection had been absent in the summer, but present a low to medium level in June, spores were found only on the bottom board (1.6 x 106). In the other hives the colonies had been heavily infected in the summer and autumn; spore levels were

found on almost all hive surfaces and frames, with the highest levels on the frames: 21.5 x 106 in a single-storey hive and 4.2 x 106 in a 2-storey hive. Three spore samples from different surfaces were fed to healthy bees which became infected. Thus, spores continue to be present and viable after a colony has died, and it is recommended that hive parts, especially frames and bottom boards, are regularly replaced or disinfected. P. Walker

HortResearch, Auckland and Palmerston North, New Zealand.

Malone, L., Gatehouse, H. and Tregidga, E. *Genetically modified crops – issues for beekeepers. New Zealand Beekeeper* (99) 6 (9) 18–21 [En, Bj]

The possible effects of GM crops on bees and their products are discussed and recent research is mentioned. The transfer by bees of pollen from GM to non-GM plants is also considered.

Hort Research, Palmerston North and Auckland, New Zealand.

Malone, L., McIvor, C. and Giacon, H. *A simple test for nosema disease. New Zealand Beekeeper* (1993) (No. 218) 10–11 [En, Bj]

Worker honey bees (*Apis mellifera*) are killed by freezing and their abdomens pulled off and placed in separate plastic 1.5-ml microcentrifuge tubes. Water is added to each tube to make a volume of 0.75 ml and the abdomen is broken up by grinding with a teflon pestle. More water (0.75 ml) and two drops of nigrosin stain are added and the tube left to stand overnight. A grey deposit (of unstained spores) in the tube indicates that the bee had a *Nosema apis* infection, with the degree of infection indicated by the size of the deposit. A sample of 10 bees from each colony gives an idea of the level of infection present. A design is given for a simple centrifuge rotor to fit a power drill, which speeds up the diagnosis. A.G. Matheson

Malone, L., McIvor, C. and Giacon, H. *A visual test for Nosema apis infections in honey bees. Journal of Apicultural Research* (1993) 32 (3/4) 143–146 [En, Bb]

A simple test for diagnosing *Nosema apis* infections in honey bees, which does not require a microscope, is described. Bee abdomens are crushed in water in plastic 1.5 ml microcentrifuge tubes, nigrosin stain is added and the tube left to stand vertically overnight. Centrifugation of the tubes eliminates the need for an overnight wait. The nigrosin stains any bee tissues and most pollen a dark blue/black and the *N. apis* spores settle to form a pale grey, unstained pellet at the bottom of the tube. Eight million or more spores per bee can be detected and the size of the pellet gives an indication of the magnitude of the spore load. Pooled samples of bees crushed in a plastic bag may be similarly assessed, although some accuracy is lost. Author

Horticulture and Food Research Institute of New Zealand Ltd, Mt Albert Research Centre, Private Bag 92169, Auckland, New Zealand.

Martin, S. *Beekeeping: honey and other hive products. Wellington, New Zealand; Development Finance Corporation.* (1982) 60 pp. [En, B]

This study examines commercial aspects of the production and sale of hive products and pollination services in New Zealand. It concludes that although the majority of beekeeping operations in New Zealand are geared to honey production, the marketing of honey is in a state of flux as a result of the demise of the Honey Marketing Authority, and future price stability depends on the annual export of 1000–3000 t, or a significant increase in domestic consumption. A financial analysis, based on a number of assumptions, indicates that the profitability of producing and processing extracted honey is marginal. Slightly better returns can be made from comb honey production. Marketing prospects for beeswax appear sound, and pollen collection in home-aparies, although management-intensive, can increase income by 50% per hive. Queen rearing, especially for export, offers very good prospects for groups of professional, highly-experienced beekeepers. Propolis, royal jelly and bee venom production are at present of little significance to New Zealand's beekeeping industry. Hiring out colonies for pollination, especially of kiwifruit [*Actinidia chinensis*], can be lucrative, but the development of an artificial method for kiwifruit pollination would have serious effects. *D. G. Lowe*

Small Business Development Div., Development Finance Corporation, PO Box 3090, Wellington, New Zealand.

Martindale, G. *Application of the Food Hygiene Regulations to honey houses [in New Zealand]*. Wellington, New Zealand; National Beekeepers' Association. (1979) 2 pp. [En, B]

Matheson, A. (3rd edition) Wellington, New Zealand; **G. P. Publications.** *Practical beekeeping in New Zealand*. (97) 145 pp. ISBN 1-86956-206-2 [En, Bd]

Previous editions of this book were published in 1984 and 1993 (see *Apicultural Abstracts* 844/85, 136/94). This edition has been fully revised to take into account changes in scientific knowledge and in the organisation and regulation of the New Zealand beekeeping industry.

Matheson, A. *Managing risks in world trade in bees and bee products*. *Apiacta* (2000) 35 (1) 1–12 [En, Bj]

The World Trade Organization agreement on sanitary and phytosanitary measures (SPS) is explained, and in particular its effect on trade in bees and bee products. A country can now restrict imports only on the grounds that the product may carry an identifiable health risk. The bee health standards developed by the Office International des Epizooties are therefore important, and these are summarised. The probable effects of the SPS agreement on international trade associated with beekeeping are discussed.

Biosecurity Authority, Ministry of Agriculture and Forestry, PO Box 2526, Wellington, New Zealand.

Matheson, A. *Easily-constructed paraffin-wax dipper*. *New Zealand Beekeeper* (1980) 41 (4) 11–12 [En, B]

Takes hive bodies and other hive parts.

Matheson, A. *Do it yourself cappings spinners on the West Coast*. *New Zealand Beekeeper* (1981) 42 (3) 16–17 [En, B]

Matheson, A. *Pollinating blackcurrants with the honey bee*. *New Zealand Farmer* (1982) 103 (21) 96–97, 99 [En, B]
For adequate pollination of blackcurrants five colonies/ha are recommended; advice on siting hives is given.

Matheson, A. *Simple wax rendering without boiler or press*. *New Zealand Beekeeper* (1982) 43 (1) 15–16 [En, B]
Cappings or combs.

Matheson, A. *Practical beekeeping in New Zealand*. Wellington, New Zealand; Government Printing Office. (1984) v + 185 pp. ISBN 0-447-01158-6 [En, B]

This is a comprehensive, well illustrated book, written to replace the New Zealand Ministry of Agriculture and Fisheries Bulletin 267 (last edition was *Apicultural Abstracts* 506L/77). It gives a general picture of beekeeping in this country, as well as much practical advice for the beekeeper. The topics covered include: New Zealand's beekeeping industry and its history; bee biology; nectar and pollen sources; hive design and construction; starting beekeeping; management, including queen rearing; hive products; pests and diseases; using honeybees for pollination. Chapter 20 covers laws affecting beekeepers in New Zealand, and Chapter 21 lists selected sources of further information. The book has both a glossary and a subject index. *P. Walker*

Min. Agric. and Fisheries, Nelson, New Zealand.

Matheson, A. *Colony standards for kiwifruit pollination*. *New Zealand Beekeeper* (1986) (No. 189) 20–22 [En, B]

In New Zealand demand is rapidly increasing for honeybee colonies to be used for pollinating kiwifruit (*Actinidia deliciosa*, previously known as *A. chinensis*). Over 50,000 colonies were rented out to growers in 1985. Until now there has not been agreement on the best type of colony to use for pollinating kiwifruit. The author reviews general pollination research and New Zealand studies on kiwifruit pollination, and proposes the following criteria for pollination colonies for this crop: at least 7000 cm² of brood; at least a quarter of the brood unsealed; most of the brood in the lower box; a young queen; at least 12 full-depth frames of bees; empty combs for the queen to continue laying; at least three frames of honey; no AFB. *A. Matheson*
Min. Agric. and Fisheries, Nelson, New Zealand.

Matheson, A. *Hot news from Sydney*. *New Zealand Beekeeper* (1987) (No. 194) 25–27 [En, Bj]

Early trials of the use of gamma radiation (at a plant in Victoria, Australia) to kill *Bacillus* larvae spores in hive parts have been reported. A plant has now been constructed in Sydney, mainly for sterilising medical equipment, and beekeeping equipment is also treated. The procedure is described. Hives must be free of bees and honey. Afterwards, sterilised hives can be immediately restocked with bees, which remove the irradiated AFB scales. Provided a beekeeper has paid a registration fee, the cost of irradiation is paid for by the state government bee diseases compensation scheme. *P. Walker*
Min. Agric. and Fisheries, Nelson, New Zealand.

Matheson, A. *The value of honey bees to New Zealand*. *New Zealand Beekeeper* (1987) (No. 194) 29 [En, Bj]

It is estimated that the value of pollination benefits is 113 times as much as the value of bees, honey and beeswax.

Matheson, A. *Beekeeping: leading agricultural change in New Zealand*. *Bee World* (1991) 72 (2) 60–73 [En, Bj]

This article, with 32 references, is the first part in a 2-part review of New Zealand beekeeping. In particular it describes the honeybees (*Apis mellifera*) and hives used, and emphasises the active and innovative nature of the beekeeping industry. European black honeybees were first introduced to New Zealand in 1839, and Italian bees in 1880. No importation of bees (except for semen) has been allowed since the 1950s. Beekeeping is permitted only with movable-frame hives and Langstroth hives are now universal. The adoption of the metric system in 1969–76 gave an opportunity for the standardisation of hive dimensions to be carried out. The number of hives has increased by over 60% in the last 20 years and by 31 May 1990 there were over 318,000, owned by 6210 beekeepers. Honey is the main commercial product, with a trend towards niche marketing of unifloral honeys and imaginative packaging; 31 important sources of surplus honey are tabulated. Honey processing and storage equipment, types of honey, threats to honey production and honey marketing are described. The provision of pollination services, particularly to growers of kiwifruit (*Actinidia deliciosa*), is now an important component of the beekeeping industry. Other products include queens, package bees, pollen, beeswax, propolis and royal jelly. *D. G. Lowe*

International Bee Research Association, 18 North Road, Cardiff CF1 3DY, UK.

Matheson, A. *Beekeeping: leading agricultural change in New Zealand, Part 2*. *Bee World* (1991) 72 (3) 117–130 [En, Bj]

This is the concluding part, with 40 references, of a 2-part review of New Zealand beekeeping. It deals with the infrastructure supporting the beekeeping industry, the composition of which was described in part 1 [*Bee World* (1991) 72 (2) 60–73]. The extension and regulatory work of the Ministry of Agriculture, research, training and education, and industry organisations, particularly the National Beekeepers' Association, are described. Legislation is dealt with briefly. The article also deals with the pests and diseases of honey bees in New Zealand. AFB is the most serious disease, followed by nosema. Chalk brood, amoeba disease, and nine bee viruses, including sac brood virus, acute bee paralysis virus and Kashmir bee virus, are also present. Wax moths and wasps are significant pests, but *Acarapis woodi* and *Varroa jacobsoni* have not yet been found in New Zealand. Half-moon disorder, probably caused by a queen abnormality, was first described as a disease of honey bee brood in New Zealand. *D. G. Lowe*

International Bee Research Association, 18 North Road, Cardiff CF1 3DY, UK.

Matheson, A. *Beekeeping: leading agricultural change in New Zealand*. Cardiff, UK; IBRA. Reprint, International Bee Research Association (1992) (No. M123) 30 pp. ISBN 0-86098-204-1 [En, Ba]

Available as a reprint of a 2-part article which was published in *Bee World* (1991). *D. G. Lowe*

International Bee Research Association, 18 North Road, Cardiff CF10 3DT, UK.

Matheson, A. *Practical beekeeping in New Zealand*. Wellington, New Zealand; GP Publications. (1993) (Ed. 2) 144 pp. ISBN 1-86956-054-X [En, Bd]

This fully revised edition of a practical beekeeping manual incorporates advances in bee science since the first edition (1984) was published, as well as changes in beekeeping management and in the New Zealand beekeeping industry. Information on some subjects not covered in the first edition has also been added. *D. G. Lowe*

International Bee Research Association, 18 North Road, Cardiff, CF1 3DY, UK.

Matheson, A. and Simpson, K. *Shedding the hobbyist mentality*. *New Zealand Beekeeper* (1982) 43 (2; 3) 31–32; 43–44 [En, B]

Matheson, A. and Wallingford, N. *New Zealand beekeeping – an industry profile*. Wellington, New Zealand; National Beekeepers' Association of New Zealand. (1988) 29 pp. ISBN 0-473-00652-9 [En, Bdo]

Profiles of three 'typical' New Zealand beekeepers preface an analytical description of the New Zealand beekeeping industry. The industry's chief products and services are: honey, with 10,091 t produced in 1986–87; pollination – crops reliant on bee pollination are worth over NZ\$500 million p.a.; and bees, with exports of packages and queens worth over NZ\$600,000 in 1986–87. Over 70 t of beeswax were exported in 1987–88, but only small quantities of pollen, royal jelly and propolis are produced, mainly to supply local market requirements. Statistics are given for the size of the industry and categories of beekeepers, and the names, functions and activities of various organisations are described. Relevant legislation is also listed. The eight appendices give apiary and hive statistics by district, honey production, honey exports, production of other hive products, AFB incidence, overseas 'threats', contact names and addresses, and further sources of information. *D. G. Lowe*

Ministry Agric. & Fisheries, Private Bag, Tauranga, New Zealand.

Matheson, A. and Wallingford, N. *New Zealand beekeeping – an industry profile*. Wellington, New Zealand; National Beekeepers' Association of New Zealand. (1990) (Ed. 2) 29 pp. ISBN 0-473-00652-9 [En, Bdo]

Updated to include figures for 1989.

Matheson, A. G. *Breakthrough in wax moth control in bee combs and comb honey*. *New Zealand Beekeeper* (1980) 41 (4) 15–18 [En, B]

Fumigation with ethylene oxide.

Matheson, A. G. *How to handle cappings*. *New Zealand Beekeeper* (1981) 42 (2) 16–17 [En, B]

Matheson, A. G. *Wax moths – life history and control*. Farm Production and Practice, Ministry of Agriculture and Fisheries, New Zealand (1981) (No. 536) 3 pp. [En, B]

Matheson, A. G. *Beeswax – production and processing*. *Farm Production and Practice*, Ministry of Agriculture and Fisheries, New Zealand (1982) (No. 534) 3 pp. [En, B]

Matheson, A. G. *Nectar and pollen sources – summer/autumn/early winter*. *Farm Production and Practice*, Ministry of Agriculture and Fisheries, New Zealand (1982) (No. 529) 4 pp. [En, B]

Matheson, A. G. *Nectar and pollen sources – winter/spring/early summer*. *Farm Production and Practice*, Ministry of Agriculture and Fisheries, New Zealand (1982) (No. 530) 4 pp. [En, B]

Matheson, A. G. *Beekeeping. Apiary sites: how to prevent drifting*. *Farm Production and Practice*, Ministry of Agriculture and Fisheries, New Zealand (1983) (No. FPP 535) 3 pp. [En, B]

Matheson, A. G. *Beekeeping. Urban areas: management to prevent nuisance*. *Farm Production and Practice*, Ministry of Agriculture and Fisheries, New Zealand (1983) (No. FPP 538) 2 pp. [En, B]

Matheson, A. G. and Schrader, M. *The value of honey bees to New Zealand's primary production*. Nelson, New Zealand; Ministry of Agriculture and Fisheries. (1987) 5 pp. [En, Bc]
This paper attempts, for the first time, a detailed analysis of the economic importance of honeybee pollination in New Zealand. The contribution made by honeybee pollination to New Zealand's primary production is made up of several components: nitrogen fixation by legumes which are dependent on bee pollination; fruit and vegetable crops which rely on bee pollination for economically viable production; and crops which require bee pollination to produce their seed. A conservative estimate of the value of the honeybee's contribution to New Zealand agriculture is NZ\$2275 million per year (NZ\$2255 million from pollination activities and nearly NZ\$20 million from bees and hive products). Thus, in New Zealand, the honeybee's pollinating activities are worth approximately 113 times as much as the value of bees and bee products sold by beekeepers. A. Matheson

McChesney, I. *Beekeepers are big fuel users*. *New Zealand Beekeeper* (1982) 43 (1) 7–8 [En, B]
Deals with the cost of transporting hives and distances travelled.

McGlone, M. S. *Pollen structure of the New Zealand members of the Stypheliaceae (Epacridaceae)*. *New Zealand Journal of Botany* (1978) 16 (1) 91–101 [En, B]

McGlone, M. S. *Pollen wall structure of the New Zealand species of Epacris (Epacridaceae)*. *New Zealand Journal of Botany* (1978) 16 (1) 83–89 [En, B]

McLaren, G. F., Fraser, J. A. and Grant, J. E. *Pollination of apricots*. *Orchardist of New Zealand* (1992) 65 (8) 20–23 [En, Bc]

The cultivar Sundrop is grown in New Zealand for apricot exports, but fruit set varies widely. In a survey in two districts the average number of fruits was 2–28 per 30 cm of

branch. The cultivar is self-incompatible; in hand-pollination trials in the field, selfing produced 9.1% fruit set, and cross-pollination with pollen of 14 other cultivars 17–90% set. A comparison of flowering dates of 40 cultivars showed that only 25 of them synchronised with the flowering of Sundrop, and only two of these were commercial cultivars (CluthaGold and CluthaStar). The frequency of honey bee visits required for satisfactory pollination was studied for three years; the results suggest that the minimum needed in a 30-second search is two bees/tree (tree spacing 5 x 2 m). Bee Scent, a bee attractant, failed to increase the number of bee visits to a tree, or fruit set. P. Walker
HortResearch, Clyde Research Orchard, Alexandra, New Zealand.

McShean, G. *Massey joins the bumblebee brigade*. *New Zealand Beekeeper* (1983) (No. 178) 14–15 [En, B]
Describes research at Massey University on domestication of bumble bees for use as pollinators of *Actinidia chinensis*.

Moar, N. T. *Pollen analysis of honey*. *New Zealand Beekeeper* (1985) (No. 187) 27–29 [En, B]
Gives information on pollen types found in 200 samples of New Zealand honeys.

Molan, P. *The limitations of the methods of identifying the floral source of honeys*. *Bee World* (98) 79 (2) 59–68 [En, B]
The use of pollen analysis of honey (melissopalynology) to give information about its botanical and geographical origins is discussed and factors which could lead to misleading results are described. The identification of the source of a honey by multivariate analysis of its amino acid composition is also discussed.
Honey Res. Unit, Dept. Biological Sci., Univ. Waikato, Private Bag 3105, Hamilton, New Zealand.

Molan, P. *Why honey is effective as a medicine. 1. Its use in modern medicine. 2. The scientific explanation of its effects*. *Bee World* (2001) 80; 82 (2; 1) 79–92; 22–40 [En, B]
These comprehensive reviews (97 and 155 references) cite and discuss results of recent scientific studies on the following subjects: Part 1 – treatment of wounds; gastroenteritis; peptic ulcers; ophthalmology; Part 2 – antibacterial activity; boosting the immune system; anti-inflammatory activity; antioxidant activity; stimulation of cell growth; harmlessness of honey; mechanisms of action in therapeutic applications. P. Walker
Honey Research Unit, Dept of Biological Sciences, Univ. of Waikato, Hamilton, New Zealand.

Molan, P. and Betts, J. *Using honey dressings: the practical considerations*. *Nursing Times* (2000) 96 (December) 36–37 [En, Bc]
Honey Research Unit, Univ. of Waikato, Hamilton, New Zealand.

Molan, P. C. *Establishing honey as a respectable medicine*. *New Zealand Beekeeper* (98) 5 (11) 16–18 [En, B]
Honey Research Unit, Univ. Waikato, New Zealand.
It is important to establish a rational basis for the use of honey in medical and veterinary treatment, and then to

carry out clinical trials. This procedure has not been followed, for example, with 'mei bao' ('moist burn ointment'), a Chinese herbal ointment containing honey. Although claimed to be very effective, evidence is only anecdotal, and in some tests it actually showed adverse effects.
P. Walker

Molan, P.C. *Honey as a clinical dressing*. *New Zealand Beekeeper* (99) 6 (8) 8–16 [En, Bj]

Molan, P.C. and Cooper, R.A. *Honey and sugar as a dressing for wounds and ulcers*. *Tropical Doctor* (2000) 30 (4) 249–250 [En, X]
Univ. of Waikato, Hamilton, New Zealand.

Molan, P. *The antibacterial activity of honey*. Cardiff, UK; IBRA. Reprint, International Bee Research Association (1992) (No. M124) 42 pp. ISBN 0-86098-207-6 [En, Ba]
Available as a reprint of a 2-part review which was published in *Bee World* (1992). *D.G. Lowe*
Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton, New Zealand.

Molan, P. *Honey for the treatment of infections*. *Bee Informed* (1996) 3 (2) 6–7, 9 [En, Bj]
Recent research on differences in the antibacterial activity of different honeys is discussed. One antibacterial substance in honey is hydrogen peroxide, but it was found in tests on 26 honeys that two, from viper's bugloss [*Echium* sp.] and manuka [*Leptospermum scoparium*], had antibacterial properties even when hydrogen peroxide had been removed.
Honey Research Unit, Department of Biological Sciences, University of Waikato, Hamilton, New Zealand.

Molan, P.C. *Selection of honey for medical use*. *New Zealand Beekeeper* (1985) (No. 188) 29–30 [En, B]

Molan, P.C. *The antibacterial activity of honey. 1. The nature of the antibacterial activity*. *Bee World* (1992) 73 (1) 5–28 [En, Bj]
The first part of this 2-part review deals with historical aspects of the medicinal uses of honey, published reports of the antimicrobial activity of honey, microorganisms that have been found susceptible (summarised in a table), and explanations of the antibacterial activity of honey (osmotic effect, acidity, hydrogen peroxide, other factors).
D.G. Lowe
Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton, N Z.

Molan, P.C. *The antibacterial activity of honey. 2. Variation in the potency of the antibacterial activity*. *Bee World* (1992) 73 (2) 59–76 [En, Bj]
This is the concluding part of a 2-part review, the first part of which was published in *Bee World* (1992) 73 (1) 5–28. This part discusses the variation in the antibacterial activity of honey that has been reported, particularly its association with floral source and the level of hydrogen peroxide produced by glucose oxidase in honey. The question of whether honey is bactericidal or bacteriostatic is also discussed. Factors which affect the stability of honey's anti-

bacterial activity include its exposure to heat and light, which can inactivate the glucose oxidase. Some honeys contain substances which destroy the hydrogen peroxide produced by this enzyme. Some non-peroxide antibacterial factors are also light-sensitive. It is concluded that the number of variable factors involved make it impossible to predict with any certainty that any particular honey will have a high antibacterial activity. Honey intended for medical use should be assayed for antibacterial activity and consideration should be given to the way that it is processed. Exposure to heat and light should be avoided. The use of certain filtration aids may also decrease the level of glucose oxidase. The review ends with a list of 135 references. *D.G. Lowe*

Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton, N Z.

Molan, P.C. *Honey as an antimicrobial agent. Bee products: properties, applications, and apitherapy* [edited by Mizrahi, A.; Lensky, Y.J.] New York, USA; Plenum Publishing Corporation. (1997) 27–37 ISBN 0-306-45502-1 [En, Bd]
The mechanisms involved in the antibacterial effects of honey are explained, and possible reasons for differences in the activities of different honeys are discussed. Reported and potential uses of honey as an antimicrobial agent are considered in turn: as antiseptic dressing; in the treatment of mastitis (in dairy animals); in the treatment of peptic ulcers, gastroenteritis and tineas in humans.
P. Walker

Honey Research Unit, Department of Biological Sciences, University of Waikato, Hamilton, New Zealand.

Molan, P.C. and Allen, K.L. *The effect of gamma-irradiation on the antibacterial activity of honey*. *Journal of Pharmacy and Pharmacology* (1996) 48 (11) 1206–1209 [En, Bc]

There is increasing usage of honey as a dressing on infected wounds, burns and ulcers, but there is some concern that there may be a risk of wound botulism from the clostridial spores sometimes found in honey. Therefore an investigation was carried out to assess the effect on the antibacterial activity of honey of a commercial sterilisation procedure using gamma-irradiation (25 kGy). Two honeys with antibacterial activity due to enzymically-generated hydrogen peroxide and three manuka honeys with non-peroxide antibacterial activity were investigated. The honeys were tested against *Staphylococcus aureus* in an agar well diffusion assay. There was no significant change found in either type of antibacterial activity resulting from this form of sterilisation of honey, even when the radiation was doubled to 50 kGy. Testing of honey seeded with spores of *Clostridium perfringens* and *C. tetani* (10,000 and 1000 spores/g honey, respectively) showed that 25 kGy of gamma-irradiation was sufficient to achieve sterility.
Author

Honey Research Unit, Department of Biological Sciences, University of Waikato, Hamilton, New Zealand.

Molan, P.C. and Russell, K.M. *Non-peroxide antibacterial activity in some New Zealand honeys*. *Journal of Apicultural Research* (1988) 27 (1) 62–67 [En, Bb]
A range of New Zealand unifloral honeys was assayed for antibacterial activity with and without the hydrogen

peroxide present (inactivated by the addition of catalase). It was found that in the honeys with high antibacterial activity a large part of this activity was due to a factor other than hydrogen peroxide. The test microorganism used, *Staphylococcus aureus*, was not inhibited by the osmolarity or the acidity of the honey. The association of high antibacterial activity with particular floral sources suggests that the non-peroxide antibacterial activity is of floral origin. The activity of manuka honey was tested and found to be heat-stable. *Author*

Dept. Biological Sciences, Univ. Wakato, Hamilton, New Zealand.

Moller, H. Honeydew – a South Island beekeepers' bounty. *New Zealand Beekeeper* (1987) (No.195) 31–33 [En, Bj]

The beech scale insect lives within a wax capsule in the bark of [mountain] beech which grows in forests on South Island, New Zealand. In their first and second growth stages, the insects produce honeydew; this splashes onto the tree trunks and the ground below, which eventually turns black because of the growth of sooty moulds. The honeydew is also an important energy source for several species of birds that normally feed on nectar, and for ants, small beetles, flies, bumble bees and, in particular, wasps and honeybees. The wasps, comparative newcomers to these forests, are more successful than solitary bees and honeybees in collecting honeydew. *P. Walker*

Murphy, C. and Robertson, A. Preliminary study of the effects of honey bees (*Apis mellifera*) in Tongariro National Park. Wellington, New Zealand; Department of Conservation Science for Conservation (2000) (No. 139) 18 pp. [En, X]

The effects of *A. mellifera* on reproduction in heather and flax (*Phormium tenax*) were investigated. It was concluded that heather is capable of autonomous self-pollination. Flax is visited by honey bees and other insects, but fruit and seed set were significantly higher at sites visited by birds. In a third study, competition between native flower visitors and honey bees was examined for two common alpine shrubs, *Leptospermum scoparium* and *Hebe stricta*. The abundance and diversity of insect visitors varied considerably between sites, and between observational periods. The abundance and diversity of *Diptera* appeared to be strongly negatively influenced by levels of honey bee activity.

Dept of Conservation, PO Box 10–420, Wellington, New Zealand.

Nichols, G. An improved honey knife. *New Zealand Beekeeper* (1988) (No. 200) 26–28 [En, Bj]

The author describes how he made a honey knife from two thin sheets of stainless steel (welded together at the edges); between them is a heating element (low voltage, high current) encased in insulating material, and a tiny thermistor is inserted in a slot in the thin edge of the blade. The electronic circuit is shown. The temperature of the resulting honey knife is maintained at 80°C (+/–1°) and it reaches the operating temperature from cold in 4 seconds. *P. Walker*

Nichols, G. A tank-full warning. *New Zealand Beekeeper* (1989) (No. 202) 23 [En, Bj]

This article describes a simple switch and a circuit which operate a warning light and a buzzer when a honey tank is nearly full during the extraction process. *P. Walker*

Oldroyd, B.P. Genetic improvement for New Zealand bee-keeping. *New Zealand Beekeeper* (1988) (No. 198) 12–15 [En, Bj]

This article, which is based on a short series of lectures, explains first the aims and principles of honeybee breeding. Problems that have to be overcome include inbreeding, and the difficulty of controlling mating. The use of discriminant function analysis to classify races of honeybees is explained, as well as the effect of crossing two races of bees. The advantages and disadvantages of importing new races or lines of honeybees into New Zealand is discussed briefly. *P. Walker*

Plant Res. Inst., Dept. Agric. & Rural Affairs, Burnley Gardens, Richmond 3121, Australia.

Palmer-Jones, T. and Clinch, P.G. Effect on honeybees of BTS 27419 applied as a spray to apple trees. *New Zealand Journal of Experimental Agriculture* (1973) 1 195–196 [En, B]

A new acaricide, BTS 27419 (1,5-di-(2,4-dimethylphenyl)-3-methyl-1,3,5-triaza-penta-1,4-diene) was applied as a high-volume spray to half of a block of 216 flowering apple trees on which honeybees were foraging; the unsprayed half provided a control area. Honeybees were collected from the trees with a battery-operated vacuum bee collector (Clinch *Apicultural Abstracts* 365L/72), and kept at 30°C in small cages with feeders. Mortalities were noted after 24 hours. Collections were made on three separate days. Results indicated that the spray had no repellent effect; mortality in the sprayed area (1%) was not significantly greater than in the control area (0.75%). *A. S. Attwood*
Wallaceville Animal Res. Centre, Private Bag, Upper Hutt, New Zealand.

Palmer-Jones, T. and Clinch, P.G. Honey bees essential for kiwifruit pollination. *Orchadist of New Zealand* (1975) 48 (10) 347 [En, B]

On sleeved branches from which honeybees were excluded, only 20% of the fruit was of a satisfactory size, compared with 98% on unsleeved controls. From observations in 10 plantations it was concluded that there were too few bumble bees and other wild bees to effect good pollination, and that hoverflies did not move actively from flower to flower. However, honeybees gathered pollen, with some difficulty, from both male and female flowers. Kiwifruit (*Actinidia chinensis*) [Chinese gooseberry] produces no nectar, and nearby citrus and white clover flowers were more attractive to honeybees. To ensure pollination of kiwifruit, eight hives per hectare of orchard are recommended. *P. Walker*

Wallaceville Animal Res. Centre, PB, Upper Hutt, New Zealand.

Palmer-Jones, T. and Forster, I.W. Measures to increase the pollination of lucerne (*Medicago sativa* Linn.). *New Zealand Journal of Agricultural Research* (1972) 15 (1) 186–193 [En, B]

Elimination of competing pollen sources encouraged honeybees to pollinate lucerne, but was found to be uneconomic. Moving successive batches of hives, with a

large population of young bees, to lucerne crops to promote tripping, proved to be of no practical value under New Zealand conditions. A study of honeybee visitation to lucerne flowers showed that bee visitation was apparently sufficient to give adequate seed set if the bees could be induced to gather pollen rather than nectar. The authors consider that improvement in lucerne pollination may be possible by introducing species such as *Nomia melanderi* and *Megachile rotundata*, which are very efficient lucerne pollinators in the United States. A. S. Attwood
Wallaceville Animal Research Centre, P.B., Upper Hutt, New Zealand.

Palmer-Jones, T. and Forster, I. W. Observations on the pollination of sunflowers. *New Zealand Journal of Experimental Agriculture* (1975) 3 95–97 [En, B]

Sunflower plots were caged with or without honeybees, or were left open. Counts showed an average of 120 bees per 100 flowers in cages compared with 22 per 100 flowers in open plots. In cages, 20–30% of bees collected pollen, but only 10% in the field. Measurements of seed-set indicated that an average of one honeybee per head would provide adequate pollination. This density may be achieved if about 20 hives/ha of the crop are within 3 km. Sunflowers were not fully dependent on honeybees for pollination, since a low yield of seeds, with a germination rate of 99%, was obtained in the cage excluding bees. Very few bumble bees were observed on sunflowers. J. M. Gedy
Wallaceville Animal Res. Centre, Res. Div., Ministry Agric. and Fisheries, P.B., Upper Hutt, New Zealand.

Payton, I. Westland's rata-kamahi forests – here today, gone tomorrow? *New Zealand Beekeeper* (1984) (No. 184) 24–26 [En, B]

Browsing by possums may be a factor in mortality of rata (*Metrosideros umbellata*) and kamahi (*Weinmannia racemosa*).

Pomeroy, N. Use of natural sites and field hives by a long-tongued bumble bee *Bombus ruderatus*. *New Zealand Journal of Agricultural Research* (1981) 24 (3/4) 409–414 [En, B]

Features of the sites of 12 natural *Bombus ruderatus* colonies are reported; most were subterranean. This species (and *B. terrestris*) occupied 8–32% of 23–25 surface hives of bricks or pumice concrete, and 93% of 45 underground hives with earth floors and plastic roofs. High colony mortality, apparently caused by excessive condensation, occurred in plastic underground hives, but was remedied by replacing the plastic-roofed nesting cavities with partly buried pumice-concrete hives. The mean cocoon count in 16 completed *B. ruderatus* colonies was 418. A method for calculating a 'productivity index' based on mean sizes and numbers of worker or male and queen cocoons is described. Author

Dept. Botany and Zoology, Massey Univ., Palmerston North, New Zealand.

Pyke, N.B. and Alspach, P.A. Variability in the performance of bee collected kiwifruit pollen. Second international symposium on kiwifruit, Vol. I., Palmerston North, New Zealand, 18–20 Feb., 1991 [edited by Warrington, I.J., Greer, D.H., Snowball, A.M. and Woolley, D.J.]. *Acta*

Horticulturae (1992) (No. 297) 291–297 ISBN 90-6605-085-3 [En, 14 ref.]

Experiments were conducted in British Columbia, Canada and New Zealand to determine whether the in-vitro germination of bee-collected pollen pellets (BCP) could predict its in-vivo performance when used for pollination in the field. A positive linear or asymptotic relationship was found between percentage in-vitro germination and fruit weight at harvest, the relationship depending on the amount of pollen applied. There was little relationship between moisture content and pollen viability at the time of collection, but viability following storage declined with increasing moisture content at collection.

MAF Technology, Riwaka Research Station, RD3 Motueka, New Zealand.

Quinn, P. Survey of native bees (Hymenoptera: Colletidae and Halictidae) in the Mackenzie Basin. *New Zealand Entomologist* (1984) 8 41–44 [En, B]

Descriptions are given for 10 native bee species in the Mackenzie Basin, South Canterbury, New Zealand. In the family Colletidae six species of *Leioproctus* and two *Hylaeus* were found, and in the family Halictidae two species of *Lasioglossum* were found. Nests were located for five species (three *Leioproctus* species, one *Hylaeus* species, and one *Lasioglossum* species). Author

51 Murray Place, Lake Tekapo, S. Canterbury, New Zealand.

Raloff, J. Bee-friendly mistletoe gets needed help. *Science News* (96) 150 390 [En, Bc]

A short description of the work reported by D. Kelly et al. (1996).

Read, P.E.C., Donovan, B.J. and Griffin, R.P. Use of bumble bees, *Bombus terrestris*, as pollinators of kiwifruit and lucerne in New Zealand. *New Zealand Entomologist* (1989) 12 19–23 [En, Ba]

In 1983 four nests and in 1985 twelve nests of *B. terrestris* (in artificial 'hives') were taken to flowering kiwifruit orchards. The nests, which each contained an estimated 50–200 workers, were transported 350 km without any adverse effects on colony growth and bee foraging. Growers liked bumble bees as pollinators because they were active in conditions that prevented flight by other bees. Hire fees were comparable with those paid for honey bee colonies. Most of the nests were later hired out for lucerne pollination. P. Walker

Entomology Division, DSIR Lincoln, Private Bag, Christchurch New Zealand.

Reid, G.M. Drones: the forgotten caste. *New Zealand Beekeeper* (1973) 35 (2/3) 37–40; 62–64 [En, B]

Reid, G.M. New ideas in processing of honey. *New Zealand Beekeeper* (1975) 37 (3) 66–69 [En, B]

Processes for uncapping honey are being tested in New Zealand where difficulties have been found in handling the large amounts of cappings from automatic uncapping machines. In one process, which is simple to operate, the cappings are broken up by a steel auger and carried into wire baskets containing cheese-cloth strainers. The baskets are wheeled on to the draining base of the thermo-

statically controlled oven and left overnight. The next day the wax and honey are separated in a water-jacketed separator. In a second plant, processing 6 tonnes of honey daily, an American centrifugal separator is being used. *P. Walker*

Reid, G.M. Requeening honey bee colonies without dequeening using protected queen cells. *Proceedings of the XXVth International Apicultural Congress, Adelaide.* Bucharest, Romania; Apimondia Publishing House. (1977) 249–253 [En, B]

Each queen cell, produced in a plastic queen cell cup by the Doolittle method, is slipped into a length of 17-mm diameter plastic hosepipe until the tip of the cell is just protruding. The protected cell is placed between two frames in the centre of the brood nest in the upper box of an overwintered colony in two boxes. In two years of trials this method of requeening was successful in 75% of colonies with 2-year-old queens, and in 58% of colonies with 1-year-old queens. The main advantage of the method is its cheapness and simplicity; the disadvantages include the need for mating in out-apiaries, and the need to maintain nuclei to 'patch up' any colonies that fail. *P. Walker*
Min. Agric. and Fisheries, Hamilton, N.Z.

Reid, G.M. Chalkbrood and half-moon in N.Z. *Australasian Beekeeper* (1984) 85 (12) 232–234 [En, B]

Reid, G.M. Feeding drugs to honey bees to control diseases – some of the issues. *Ruakura, New Zealand; MAF Quality Management.* (1990) 26 pp. [En, Bdo]

This review, with 30 references, covers the following topics: AFB, particularly its development and present level in New Zealand; AFB-resistant strains of honey bees (*Apis mellifera*); controlling AFB by management methods and by antibiotics; antibiotic-resistant strains of *Bacillus* larvae; costs, benefits and availability of antibiotics; contamination of honey with oxytetracycline residues; EFB and drug feeding. *D.G. Lowe*

Reid, G.M., Matheson, A.G. and Walton, G.M. *Bibliography of New Zealand apiculture (1842–1986).* Tauranga, New Zealand; Ministry of Agriculture & Fisheries. (1988) xxxi + 140 pp. ISBN 0-477-08016-2 [En, Bdo]

Over 1350 items published in the period 1842–1986 are cited in this Bibliography. All research articles concerned with honeybees and beekeeping in New Zealand are included, and extension literature is also covered, except for material that has become completely outdated. Newspaper articles and most localised pamphlets have been excluded. Significant items on non-*Apis* bees and pollination are included. The full references are grouped under subject headings which follow the arrangement used in *Apicultural Abstracts*. Within each subject grouping publications are listed alphabetically by author, and those which have been mentioned in *Apicultural Abstracts* include the relevant AA reference number. There is an author index which lists articles under the name of the first author only, giving a page reference and a shortened form of the title for each article. This will be a valuable reference book for anyone interested in New Zealand beekeeping, particularly research workers, teachers, librarians and others needing access to the published literature. *D.G. Lowe*

Min. Agric. & Fisheries, Private Bag, Tauranga, New Zealand.

Reid, M. *Beekeepers responsible for controlling American foulbrood. Surveillance* (Wellington) (98) 25 (4) 8–9 [En, 1 wf]

The granting of regulatory powers to the National Beekeepers' Society of New Zealand to control AFB under a pest management strategy (PMS) is discussed. Components of the PMS are considered, including the legal duties of beekeepers and the emphasis of PMS on educating beekeepers to recognise and deal with diseased bees. Disease elimination conformity agreements, the hive inspection and audit programme, certificates of inspection, annual disease return, counselling and methods for the control of AFB are outlined.

AgriQual, Private Bag 3080, Hamilton, New Zealand.

Reid, M. *The inside story of feeding sugar to bees.* *New Zealand Beekeeper* (1974) 36 (2) 41–43 [En, B]
Discusses processes in the hive after feeding.

Reid, M. *Peppermint [Mentha piperita] honey.* *New Zealand Beekeeper* (1974) 36 (2) 16 [En, B]

Reid, M. *New hive cracker and lifter.* *New Zealand Beekeeper* (1976) 38 (4) 9 [En, B]

Designed by P. Pearson for moving the honey supers, as a unit, off the brood chamber.

Reid, M. *Palletised beehives speed site changing.* *New Zealand Journal of Agriculture* (1976) 133 (4) 15, 17–18 [En, B]
Each pallet is about 100 X 120 cm, constructed mostly of tanalised timber, and holds 4 hives. The pallets with their hives are loaded onto a truck by a modified farm tractor, equipped with forks on the rear hydraulics capable of lifting 1 t. For travelling, the tractor is towed behind the truck on a trailer. *M. Reid*

Min. Agric. and Fisheries, Hamilton, New Zealand.

Reid, M. *Shifting pallets of beehives by tractor.* *New Zealand Beekeeper* (1976) 38 (4) 23–25 [En, B]

Reid, M. *Canterbury beekeeper uses Hiab loader for handling beehives on pallets.* *New Zealand Beekeeper* (1977) 39 (1) 13, 15–16 [En, B]

The Hiab 550 boom loader lifts about 3 t[onnes], and has an electronic control system; one man rides on the fork.

Reid, M. *Requeening honeybee colonies without dequeening using protected queen cells.* *New Zealand Beekeeper* (1979) 40 (3) 15–17 [En, B]

Min. Agric. and Fisheries, Hamilton, New Zealand.

This technique was reported in *Apicultural Abstracts* 209/79. The method used is now described in detail, and results are given, with special reference to management in New Zealand. *P. Walker*

Reid, M. *Helping our queen bees reach their full potential.* *New Zealand Beekeeper* (1980) 41 (3) 3–5 [En, B]

A chart is given for colony preparation with regard to honey flow in New Zealand; plenty of food and a young queen are considered essential.

- Reid, M. Push-through hot water bath for cleaning bee frames.** *New Zealand Beekeeper* (1980) 41 (2) 19–20 [En, B]
A plan and construction details are given for a large steel water-bath, built over a firebox. The frames to be cleaned are loaded into a super, which is pushed down the chute under the guide rails and into the water; as one super is pushed in, a treated one emerges at the other end of the bath. Two people can clean 1200–1600 frames/day. For old brood frames 1 kg caustic soda is added, and a further 2 kg during the day. The scum which forms should be removed regularly; the wax cannot be recovered. After cleaning, wet frames must be stacked flat, or put into supers. *P. Walker*
Min. Agric. and Fisheries, Hamilton, New Zealand.
- Reid, M. Removing bees from honey houses.** *New Zealand Beekeeper* (1981) 42 (2) 11 [En, B]
- Reid, M. A Waikato spinner.** *New Zealand Beekeeper* (1981) 42 (3) 17–18 [En, B] For cappings.
- Reid, M. Water-jacketed cappings reducer.** *New Zealand Beekeeper* (1982) 43 (4) 27–28 [En, B]
- Reid, M. Diseases of honey bees in New Zealand.** *Surveillance* (1988) 15 (5) 15–17 [En, Bc]
- Reid, M. MAF quality management report.** *New Zealand Beekeeper* (1990) (No. 207) 22–25 [En, Bj]
This report gives beekeeping statistics (as at 31 May 1990) and honey production (from 1985 to 1990) for districts of New Zealand. Export figures for honey and beeswax, and for the incidence of AFB, are also given. *D. G. Lowe*
- Reid, M. MAF quality management report.** *New Zealand Beekeeper* (1991) (No. 211) 10–13 [En, Bj]
Statistics for numbers of beekeepers, apiaries, hives, honey production, exports of honey, beeswax, queens and package bees, and incidence of AFB, in New Zealand, are updated to 30 June 1991.
- Reid, M. Chalkbrood disease: the NZ experience.** *Australasian Beekeeper* (1993) 94 (12) 497,499,503,505,508 [En, Bj]
The discovery of chalk brood caused by *Ascosphaera apis* in Northland, New Zealand, in 1983 prompted an emergency response and extensive inspection of apiaries. The disease was found to be well established and was declared endemic. This review covers the development of a policy on chalk brood by the government and beekeeping industry, and the spread of the disease throughout the country. New Zealand and international studies on levels of chalk brood infection, factors affecting its spread, control measures and interactions with other diseases are reviewed. Suggestions for the Australian beekeeping industry are given. *A. G. Matheson*
Ministry of Agriculture & Fisheries, Private Bag 3080, Hamilton, New Zealand.
- Reid, M. and Matheson, A. Making your own honey extractor.** *New Zealand Beekeeper* (1978) 39 (4) 10–12 [En, B]
- Reid, M. and Matheson, A. Waikato version of a paraffin wax dipper.** *New Zealand Beekeeper* (1978) 39 (2) 27–28 [En, B]
For preservative treatment of hive parts.
- Rope, C. G. New Zealand honey: quality standards.** *New Zealand Beekeeper* (1978) 39 (4) 25–27 [En, B]
- Rowarth, J. S. Lead concentration in some New Zealand honeys.** *Journal of Apicultural Research* (1990) 29 (3) 177–180 [En, Bb]
The concentration of lead in 59 samples of New Zealand honey taken from several enterprises in three localities in the North Island, and from different stages in processing, was analysed. No samples had lead concentrations higher than the legal limit of 2 micro g/g – 1. Department of Agronomy, Massey University, Palmerston North, New Zealand.
- Sale, P. and Briscoe, D. Chinese gooseberry pollination service.** *New Zealand Journal of Agriculture* (1972) 125 (3) 49–51 [En, B]
- Sanford, M. T. Honey and healing: not all honey may be therapeutic.** [Abstract] *Apis* (2000) (8) 3–4 [En, wf]
It has been reported that manuka honey from New Zealand and, possibly, honeydew honey from central Europe are more effective than other honeys for treating infections. The author considers that supermarket honey (heated and heavily filtered to increase shelf life) may not be as therapeutic as honey taken directly from the comb. *Author*
- Schrader, M. and Reid, M. Control of honey bee diseases and pests in New Zealand.** *American Bee Journal* (1986) 126 (11) 742–745 [En, Bj]
There are nearly 7000 registered beekeepers in New Zealand with a total of 330,000 colonies in Langstroth hives. The Apiaries Act (1969) gives wide powers for the control of AFB; hives must be inspected annually and, if AFB is present, combs, bees and frames must be destroyed and other hive parts sterilised. The incidence of AFB is kept to about 0.6%. The incidence of nosema disease may be similar; the only drug permitted for treatment is fumagillin. Chalk brood, paralysis virus and sacbrood are present in New Zealand, but strict import controls ensure that EFB, *Braula* and parasitic mites are absent. *P. Walker*
Ministry of Agriculture & Fisheries, Oamaru, New Zealand.
- Showler, K. William Charles Cotton and the first bees in New Zealand.** *New Zealand Beekeeper* (1978) 39 (2) 20–21 [En, B]
- Simpson, K. Bees and plants [New Zealand].** *Small Farmer* (1982) (No. 19) 9, 11, 13 [En, B]
Includes a short list of spring-flowering plants.
- Simpson, K. One stage wax processing.** *New Zealand Beekeeper* (1982) 43 (1) 17–18 [En, B]
Cappings or combs.
- Simpson, K. The Robins wax processing system.** *New Zealand Beekeeper* (1982) 43 (3) 29–30 [En, B]
Press for obtaining wax from old combs.

- Simpson, K.W and Matheson, A.G. *Steam rendering of wax – some actual figures.* New Zealand Beekeeper (1982) 43 (3) 31 [En, B]**
- Smith, A.W., Ballinger, J.P. and Reid, G.M. *Raspberry pollination in Canterbury [New Zealand].* New Zealand Journal of Agriculture (1973) 127 (4) 50–51 [En, B]**
- Smith, J. *The value of honey bees. Proceedings, Conference on alternative land uses in New Zealand, with emphasis on temperate tree crops.* Canterbury, New Zealand; Lincoln College. (1979) 8 pp. [En, B]**
As pollinators; lists about 150 crops dependent on, or benefited by, insect pollination.
- Smith, J. *Saga of Chatham non-beekeeping.* New Zealand Beekeeper (1981) 42 (2) 9 [En, B]**
- Somal, N.A., Coley, K.E., Molan, P.C. and Hancock, B.M. *Susceptibility of Helicobacter pylori to the antibacterial activity of manuka honey.* Journal of the Royal Society of Medicine (1994) 87 (1) 9–12 [En, Bc]**
The antibacterial effect of honey was tested on *H. pylori* using isolates from biopsies of gastric ulcers. The minimum inhibitory concentration of manuka honey was determined as 5% (vol/vol).
Department of Biological Sciences, University of Waikato, Private Bag 3105, Hamilton, New Zealand.
- Stark, A.H. *Bees' role in improving lucerne pollination.* New Zealand Journal of Agriculture (1975) 131 (1) 27, 29, 57, 59 [En, B]**
Describes attempts to establish *Nomia melanderi* and *Megachile pacifica* in New Zealand.
- Stephens, J.M.C and Molan, P.C. *Accurate honey samples show correct UMFTM ratings of manuka honey.* New Zealand Beekeeper (2003) 11 (2) 16–17 [En, Bj]**
Layering of honey may occur if a large container, such as a drum, is filled from sequential extractions, if the honeys have different densities, or if granulation starts; it is then difficult to obtain representative samples. Methods for obtaining suitable samples are described. Regular sampling during the filling process is preferred. P. Walker
Honey Research Unit, Dept of Biological Sciences, Univ. of Waikato, Hamilton, New Zealand.
- Stevenson, B. *New Zealand's first beekeeper arrives home.* New Zealand Beekeeper (1991) (No. 210) 10–12 [En, Bj]**
On 9–20 March 1991, a group of beekeepers marked the 150th anniversary of the arrival of honey bees in New Zealand (on 20 March 1839) by retracing the last stage of the voyage of the ship that carried two skeps of North European bees brought from England by Mary Anna Bumby. This article describes historical aspects of New Zealand beekeeping, including a record of the transport of skeps within New Zealand in early 1840. P. Walker
- Stevenson, B. *In search of Father Petitjean's bees: early history of New Zealand beekeeping.* New Zealand Beekeeper (1996) 3 (4) 12–13 [En, Bj]**
This article discusses the introduction, by French Roman Catholic priests, of European honey bees to the Bay of Islands area, in the North Island of New Zealand, in 1842.
- Stevenson, M. *Artificial pollination for kiwifruit.* Orchardist of New Zealand (1990) 63 (8) 24–25 [En]**
Honey bees are the major pollinators of kiwifruit (4–8 hives or more/ha being required) but artificial pollination may also be necessary where weather or orchard conditions are not conducive to good bee pollination. Dry and spray methods are discussed. Machines for collecting and transferring dry pollen from male to female flowers include the Airflo, Roll-on and Turbo Bee (all developed by growers). The Ruakura sprayer (suitable for pergola-trained vines) and the air-shear nozzle sprayer (hand-held) apply pollen suspended in a liquid medium; an advantage of spray methods is that they can be used during light rain or while free water is present on the canopy.
Fruitful Supplies, New Zealand Fruitgrowers Federation, PO Box 2175, Wellington N Z.
- Suhayda, J. and Nichols, C. *Grafting eggs for queen rearing.* New Zealand Beekeeper (1995) 2 (3) 16 [En, Bj]**
A Staedler 78900 drawing instrument (pencil-lead holder) was sharpened with a dentist's tool (Egg Bur T 7408 dental burr) rotated at high speed in an electric drill. The resulting wax punch cutting cylinder is used to remove a disc of wax bearing a honey bee (*Apis mellifera*) egg from the base of a worker cell. The disc with egg attached is placed on the royal jelly in the base of another cell, from which a worker larva grafted 24 hours previously is removed. Cell-raising colonies will build 60–80% of the cells into queen cells. A.G. Matheson
- Syrett, P. *Status of broom in New Zealand.* Plant Protection Quarterly (2000) 15 (4) 148 [En, X]**
Cytisus scoparius is classified as a noxious weed in New Zealand, but it is a useful pollen source for bees.
Landcare Research, Private Bag 92170, Auckland, New Zealand.
- Tane, H. *Big hive potential limited by access and land tenure.* New Zealand Beekeeper (1982) 43 (3) 9–10 [En, B]**
- Taylor, M. *Varroa destructor not thwarted by smaller sized cells, study finds.* New Zealand Beekeeper (2002) 10 (10) 7–8 [En, Bj]**
Ten infested nucleus colonies were each given two frames containing a mosaic of comb pieces with cell sizes of 4.7, 4.8, 5.0, 5.1 and 5.4 mm. When the pupae in these frames were 19–20 days old, individual cells were examined for mites. When the results were assessed by foundation size, the 4.8-mm cells had the highest infestation level (46.6%) and the highest proportion of adult mites/cell (1.92). However, the colonies – which are normally given 5.4-mm foundation – did not draw out the small cells evenly, and in a comparison of actual cell sizes, there were no significant differences in infestation. P. Walker
- Todd, J. and Ball, B.V. *Viruses in New Zealand honey bees.* New Zealand Beekeeper (2003) 11 (2) 8–9 [En, Bj]**
Dead and live bees and mites were collected from 32 colonies from November 2001 to April 2002, by which

time many of the colonies had collapsed. The infection most frequently detected in adult bees was cloudy wing virus, but it is known that this is not transmitted by *Varroa destructor*. Other viruses detected were: black queen cell virus, chronic paralysis virus and its associate particle, Kashmir bee virus and slow paralysis virus. Three other viruses, including deformed wing virus, were not detected.

P. Walker

HortResearch, Mt Albert Research Centre, Auckland, New Zealand.

Toor, R. van. *Determining the importance of the bee mite in honey bees*. New Zealand Beekeeper (1990) (No. 206) 11–13 [En, Bj]

Impending regulations for the import of honeybees into Canada require the bees to be free of mites, including *Melittiphis alvearius*. This mite is commonly seen in hives throughout New Zealand, but has not been regarded as a honeybee parasite. An examination of mite gut contents, using the highly sensitive immuno-dot blot technique, showed that mites scavenge on processed pollen in the hive and that they are not parasitic on bees. Three acaricides (bromopropylate, cyhexatin and fluvalinate) were tested for mite control. The only effective treatment, over a range of humidities, was with fluvalinate at 0.1 g/m²; this acaricide was not toxic to honeybees. Further tests on package bees are necessary. P. Walker

Van Eaton, C. *Pan-Pacific bees*. Bee Biz (99) (10) 15–18 [En, Bj]

The production of package bees in New Zealand is described. For transport of a consignment of 1-kg packages to Canada, careful packing and handling are necessary to ensure that the bees survive the flight of 11,000 km which includes a change of planes at Honolulu. At every stage, precautions are taken to prevent any bees escaping. P. Walker

Tauranga, New Zealand.

Van Eaton, C. *American foulbrood and beekeeping sustainability*. Bee Biz (2000) (No. 12) 7–10 [En, Bj]

AFB control methods in New Zealand.

Tauranga, New Zealand.

Van Eaton, C. *The development of the Kiwifruit Pollination Association*. Bee Biz (2002) (No. 13) 39–41 [En, Bj]

Van Eaton, C. and Law, R. *Marketing apitherapy products and the challenge of government regulation*. Bee World (2000) 81 (3) 109–115 [En, Bj]

Comvita NZ Ltd, Private Bag 1, Te Puke, New Zealand.

Van Eaton, C. *A comparison of standards for New Zealand organic honey*. Wellington, New Zealand; National Beekeepers Association. (1991) 30 pp. [En, Bc]

The first four chapters of this study paper define what is meant by organic production and assess the potential market for organic produce and the need for production standards. International and New Zealand organisations involved in organic production are described, with their aims and functions. Chapter 5, the main part of the paper, describes the various standards for the production of

organic honey in New Zealand, including standards which are under development as well as standards currently in use by certifying organisations. The standards are compared by topic and strengths and weaknesses are identified. The topics discussed are isolation, residue testing, residue levels, chemicals used in management, supplemental feeding, artificial insemination, extraction and processing, processing control procedures, retail packaging, sampling, and certification and inspection. The New Zealand organic honey standards are summarised in a table. Six contacts involved in organic certification are listed and 13 references are given. D. G. Lowe

MAF Quality Management, Private Bag, Tauranga, New Zealand.

Van Eaton, C. *Kiwifruit: pollination and production*. Gleanings in Bee Culture (1992) 120 (9) 494–497 [En, Bj]

This article describes the situation and standards used in New Zealand, which produces 39% of the world's kiwifruit. Ministry of Agriculture and Fisheries, Tauranga, New Zealand.

Van Eaton, C. *New developments in the control of honey bee diseases in New Zealand*. Surveillance (1992) 19 (1) 8–9 [En, Bc]

In August 1991 the New Zealand government announced that it would no longer fund the endemic honey bee disease programme, which concentrated mainly on the control of AFB. The National Beekeepers' Association's funding of disease inspection has also been reduced, and it was forecast that in 1991/92 only 4% of apiaries would be inspected. An increased hive levy is being proposed to pay for more inspections. The changes in the government funding have necessitated reorganisation of procedures for certification of bees for export. The government will continue to fund active surveillance for exotic bee diseases and the Emergency Disease and Pest Response (EDPR) programme. Work already carried out under these programmes is described, and possible changes are discussed. P. Walker

MAF Quality Management, Tauranga, New Zealand.

Van Eaton, C. *Cost-efficient, quality honey melting by the drum*. Bee Biz (1995) (No. 1) 4–5 [En, Bj]

Barrows were constructed of steel pipe to hold a 200-litre drum of honey horizontally above a thermostatically-controlled 1.2 kw electric heater. Three barrows can fit inside a light, insulated cover: overnight heating at an air temperature of 50°C will empty the drums. Because the honey flows out of the drums via a trough to a tank at room temperature, it is heated for only a short time and never exceeds approximately 30°. This device, with integral safety features, preserves the quality characteristics even of delicate honeys. A. G. Matheson

MAF Quality Management, Private Bag, Tauranga, New Zealand.

Van Toor, R. F. *Commercial production, storage, packaging and marketing of royal jelly in New Zealand*. Mosgiel, New Zealand; Ministry of Agriculture and Fisheries, Invermay Agricultural Research Centre. (1990) 30 pp. ISBN 0-477-08114-2 [En, Bd]

Trials in three regions of New Zealand have shown that an average of 10 g of royal jelly (RJ) per honey bee colony can be harvested every three days during spring and autumn, though at the expense of surplus honey production. Using 30 production and 15 support colonies, one operator working for two days out of every three can produce 2.6 kg of RJ per month. Feeding protein supplements can increase yields by up to 57%, but only at pollen-deficient sites. This publication reviews the equipment and colony management needed for RJ production, and details harvesting methods, composition of and therapeutic claims for RJ, packaging, sales and marketing. There is an economic analysis of RJ production, a full reference list, and colour illustrations of production techniques. A.G. Matheson

Invermay Agricultural Centre, Mosgiel, New Zealand.

Vanneste, J.L., Cornish, D.A., Voyle, M.D., Haine, H.M. and Goodwin, R.M. *Honey bees to distribute beneficial bacteria to apple and Asian pear flowers. In Momol, M. T. and Saygili, H. (eds). Proceedings of the Eighth International Workshop on Fire Blight, Kusadasi, Turkey, 12–15 October, 1998. Acta Horticulturae* (99) (No. 489) 615–617 ISBN 90-6605-921-4 [En, Bc]

It was shown that honey bees could distribute beneficial bacteria that prevent the development of fireblight caused by *Erwinia amylovora* in apples and pears. In a trial in New Zealand, *Apis mellifera* successfully vectored Eh252R, which controlled the disease.

HortResearch, Ruakura Research Centre, Private Bag 3123, Hamilton, New Zealand.

Vardy, C. *The right equipment for the job. New Zealand Beekeeper* (1985) (No.186) 23–24 [En, B]

The truck-mounted Palfinger PC 2400 compact boom loader for moving hives, honey drums etc.

Wallingford, N. *To feed or not to feed. New Zealand Beekeeper* (1976) 38 (3) 13–16 [En, B]

Discusses feeding of syrup, dry sugar, honey: methods and timing.

Wallingford, N. *Making wax queen cell cups. New Zealand Beekeeper* (1978) 39 (1) 19–21 [En, B]

With seven photographs.

Wallingford, N. *Care of queen bees before introduction. New Zealand Beekeeper* (1982) 43 (3) 38 [En, B]

Deals with the period between arrival of queens and their introduction.

Wallingford, N. *Destroying wasp nests. New Zealand Beekeeper* (1982) 43 (2) 14–15 [En, B]

Wallingford, N. *Artificial pollination of kiwifruit – some history and observations. New Zealand Beekeeper* (1986) (No. 191) 7–9 [En, B]

The author believes that the case for artificial pollination of kiwifruit [*Actinidia deliciosa*] has been based on incorrect assumptions, e.g. that there are insufficient honeybee colonies available for pollination of this crop in New Zealand. He asserts that publicity for artificial pollination

has been misleading and has not been backed up by results. If the costs of the two methods are compared, that of artificial pollination (which is labour-intensive) is four times that of hiring the maximum of eight colonies/ha. Even if more hives have to be brought in to problem areas, the latter method is still more economical, assuming that suitable planting plans for male and female vines have been followed. P. Walker

Walsh, R.S. *Can anything be done to reduce queen losses after caging? New Zealand Beekeeper* (1969) 31 (4) 10–12 [En, B]

Tests in 1967–68 led to the following recommendations. Caged queens should be provided with water before despatch, and given water when they are received. Smoking them before caging ensures that they will 'fill up' with honey. If there is delay before mating, or introducing the queens to colonies, they should be kept warm and dry and at a temperature not exceeding 90°F [36°C] and RH less than 60%. Candy made from invert and starch-free icing sugar is considered suitable. The survival rate of queens caged without attendants compared favourably with that of queens with attendants. A.S. Attwood
Horticulture Div., Dept. Agric., Auckland, New Zealand.

Walsh, R.S. *Nectar and pollen sources of New Zealand. Wellington, New Zealand; National Beekeepers' Association of New Zealand.* (1978) 59 pp. [En, B]

Walsh, R.S. and Rope, C.G. *Producing section honey for export. New Zealand Journal of Agriculture* (1971) 122 (2) 83–87, 89, 91, 93, 95, 97 [En, B]

The four parts of this paper deal with materials and equipment for section storeys (supers), management systems, positioning storeys, and finishing the sections. E.E. Crane.

Dept. Agric., Auckland, New Zealand.

Walton, G. *New Zealand, Ministry of Agriculture and Fisheries, Advisory Services Division. Beech honeydew honey – a vast potential. New Zealand Beekeeper* (1979) 40 (4) 6–9 [En, B]

Many of the 30 or so scale insects found on southern beech (*Nothofagus* spp.) in New Zealand secrete honeydew; the most important is *Ultracoelostoma assimile* (sooty beech scale). The resulting beech honeydew honey produced by bees is sometimes misleadingly called beech honeydew, birch honey or bush honey. From the results of a survey of Canterbury lowland forest, actual and potential honeydew honey yields are assessed. It is estimated that in 20,000 ha of forest there is a potential for 60,000 hives, producing at least 3000 t of honeydew honey annually. At present there are less than 7000 colonies there. Peak honeydew flows occurred in the spring and early summer, and again in late summer and autumn. Shortage of pollen sources in these forests could be overcome by feeding pollen supplements. P. Walker

Advisory Serv. Div., Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

Walton, G. *The prospects for boosting queen bee production. New Zealand Beekeeper* (1980) 41 (3) 30–31 [En, B]

For export, especially to countries with import restrictions, e.g. UK, Canada.

Walton, G. M. *Beekeeping. 1. Productive colony management.* *New Zealand Journal of Agriculture* (1971) 122 (2) 75–77 [En, B]

Walton, G. M. *The economics of the single-queen and two-queen systems of colony management.* Palmerston North, New Zealand, Ministry of Agriculture and Fisheries. (1972) 32 pp [En, B]

The two-queen method of colony management was initiated by partitioning some standard single-queen colonies eight weeks before the predicted start of nectar flow in the Southern Hawke's Bay area of New Zealand. Honey yields in all colonies were much higher in 1971/72 than in 1970/71 when nectar flow was poor, but in both seasons honey yields from two-queen colonies were 60–75% higher than from single-queen colonies. The two-queen system required more beekeeping skill, but less equipment and less apiary working time per unit quantity of honey produced. Making certain assumptions about methods of management, an economic analysis is made for a 2-man, 1000-colony beekeeping unit, in which the colonies are either single-queen or two-queen. A similar budget can be made for a 1-man (owner), 500-colony unit. For a holding of either size, the cost of producing the same amount of honey is less with the two-queen system. *P. Walker*
Ministry of Agric. and Fisheries, Palmerston North, New Zealand.

Walton, G. M. *Metric measurements for the Langstroth hive.* *New Zealand Beekeeper* (1974) 36 (4) 12–16 [En, B]

Walton, G. M. *1974 queen bee utilisation survey.* *New Zealand Beekeeper* (1975) 37 (3) 45–48 [En, B]
Covers 21 545 queens introduced in 1972 and 21 775 in 1974; 57% of beekeepers reared their own queens.

Walton, G. M. *Weather factors influencing the production of white clover (*Trifolium repens* L.) honey in southern New Zealand. Proceedings of the XXVth International Apicultural Congress, Adelaide.* Bucharest, Romania; Apimondia Publishing House. (1977) 429–432 [En, B]

Daily hive weights were recorded from November to March; this period included the full flowering period of *T. repens*, the major nectar source. Results for 1973–1977 are examined in relation to daily weather recordings. Average daily weight gain in January was 2.0 kg, but the range was –5.4 to +11.8 kg. The daily weight variation (Wv) in January was strongly and inversely correlated with wind force; Wv was usually also correlated with solar radiation, maximum temperature, temperature range and atmospheric pressure. Some additional correlations were found in some Januarys. Multiple correlations were derived between Wv and a combination of eight meteorological variables. *P. Walker*
Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

Walton, G. M. *Honeybees, overseas diseases and pests. Features and potential damage.* *Farm Production & Practice*,

Ministry of Agriculture and Fisheries, New Zealand (1980) (No. FPP 428) 4 pp. [En, B]

Walton, G. M. (ed.). *New Zealand, Ministry of Agriculture and Fisheries. Honey: its production, processing, packaging and promotion. Beekeepers' seminar, 13–15 August 1974, Taupo.* (1974) 137 pp. [En, B]

This full report includes a number of papers that are of interest to beekeepers in the world at large. Aspects of honey houses include: design, by G. M. Walton (pp. 18–22); flooring, by R. H. Hobbs (pp. 23–26); shifting (moving heavy weights) by D. A. Briscoe (pp. 27–30); hygiene and the Health Department, by C. L. Barber (pp. 43–48). Aspects of honey disposal include: marketing (pp. 70–77), within New Zealand (pp. 78–89), and overseas (pp. 90–99); packaging and labelling (pp. 100–101), and the housewife's action and reaction to the honey pack (pp. 102–110). Special problems covered include: utilising bush areas (pp. 49–56), handling manuka honey (pp. 57–64), and toxic honeys (pp. 122–125). *E. E. Crane*
Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

Ward, A. B., Wicht, C., Ward, D., Stuckey, M., Poole, R. F. and Berry, P. *Marketing of honey.* *New Zealand Beekeeper* (1974) 36 (4) 22–36 [En, B]

Divided into three sections on marketing within New Zealand, and three sections on exports.

Webby, R. *Study identifies bees' pollen preferences.* *New Zealand Beekeeper* (2001) 8 (3) 9–10 [En, B]

HPLC analysis of pollens is being used to determine flavonoid contents of pollen extracts, and thus the plant source of a pollen. A preliminary list of pollen sources used by honey bees in New Zealand includes 17 plants that are important sources and 28 others; the common names of plants are used. *P. Walker*
Industrial Research Ltd, PO Box 31310, Lower Hutt, New Zealand.

Wedde, S. *Seizure of bee products at the border.* *New Zealand Beekeeper* (2003) 11 (4) 13–14 [En, B]

Bee products, which are seized when they do not comply with the NZ Import Health Standard, constitute 4–6% of all seizures from air passengers and 2–6% of international mail seizures. Seizures of bee products have increased since January 2000. Of the items seized, honey was the most common, constituting 63% of bee products taken from mail. Figures are given for individual products. *P. Walker*

Williams, D. *The honey house.* *New Zealand Beekeeper* (1977) 39 (1) 25–27, 29–30 [En, B]

Williams, D. *Preserving beehive timber.* *New Zealand Beekeeper* (1980) 41 (4) 13 [En, B]

Describes diffusion and pressure methods of applying chemical preservatives.

Williams, D. *Plantings for bees.* *New Zealand Beekeeper* (1983) (No. 180) 25–26 [En, B]

Willix, D.J. *The marketing of honey as a medicine. A report for the Beekeepers' Association [of New Zealand]*. (1991) iii + 48 pp. [En, Bdo]

This report [a case study for an industrial technology course] covers a wide range of aspects of the New Zealand honey industry. The first part describes the industry structure – producers, packers, National Beekeepers' Association, Ministry of Agriculture and Fisheries, and others – and the marketing of honey. Part 2 gives official regulations on the advertising of medicines, and Part 3 is a survey of health food manufacturers. Part 4 reviews the literature on medicinal uses of honey, particularly the treatment of wounds, eye ailments, stomach and bladder ulcers, and gastroenteritis. Laboratory studies on animals are also covered. The niche marketing of honey as a health food is discussed and recommendations are made. There is a bibliography of 128 references. *D.G. Lowe*

Winter, T.S. *New Zealand, Ministry of Agriculture and Fisheries. Bee-keeping in New Zealand*. Bulletin, Ministry of Agriculture and Fisheries, New Zealand (1975) (No.267) iv + 155 pp. [En, B]

Wood, B., Rademaker, M. and Molan, P. *Manuka honey, a low cost leg ulcer dressing*. *New Zealand Medical Journal* (1997) 110 (1040) 107 [En, Bc]

In a pilot study involving 10 patients, 11 leg ulcers were treated for eight weeks with a daily application of a smear of manuka [*Leptospermum*] honey covered by a gauze dressing. There was significant healing in four of the ulcers, but little change in the bacterial flora over the study period. The honey dressings were uncomplicated and it is considered that further studies are warranted. *D.G. Lowe*
Waikato Hospital and University of Waikato, Hamilton, New Zealand.

Wood, C.J. *Pollination trial on blackcurrants*. *New Zealand Commercial Grower* (1975) 30 (7) 17 [En, B]

Bushes that had been sprayed against Botrytis and that were open to honeybee pollination yielded 4.90 kg/bush; bushes sprayed but caged to exclude bees yielded 0.68 kg/bush; controls (no treatment) gave 4.45 kg/bush. An increase in the honeybee population to two hives/acre [4+/ha] increased yields substantially. *D.G. Lowe*
Dunedin, New Zealand.

Ying, D. *Beeswax bolus*. *New Zealand Beekeeper* (2003) 11 (3) 7 [En, Bj]

Beeswax is used in the coating of controlled-release veterinary remedies.

Nigeria

Adekunle, A.A., Adeleye, O., Ojeleye, O. and Obembe, O. *Participatory assessment of honey extraction methods in the savanna belt of Nigeria*. *Food Reviews International* (2002) 18 (2/3) 209–221 [En, X]

In an evaluation of four honey extraction methods by local beekeepers, efficiency of honey recovery from the comb, taste, appearance and viscosity were assessed. Honey extracted using a honey press was better than that obtained by the other methods (basket, solar extractor, kneading). International Inst. of Tropical Agriculture (IITA) P.M.B. 5320, Ibadan, Nigeria.

Agwu, C.O.C. and Abaeze, C.C. *Palynological study of honey from Anambra, Enugu and Kogi states of Nigeria*. *Journal of Agriculture Science and Technology* (1991) 1 (2) 125–130 [En, Bc]

Pollen analyses of four honey samples from these areas of Nigeria revealed the presence of 73 pollen types belonging to 40 families; individual honeys contained from 15 to 34 pollen types. *Elaeis guineensis*, *Mitragyna ciliata* and *Lycopersicon esculentum* were the dominant pollens in different samples, but the pollen types found varied widely between the samples. *D.G. Lowe*

Palynology Research Laboratory, Department of Botany, University of Nigeria, Nsukka, Nigeria.

Agwu, C.O.C., Obuekwe, A.I. and Iwu, M.M. *Pollen analytical and thin-layer chromatographic examination of Nsukka (Nigeria) honey*. *Pollen et Spores* (1989) 31 (1–2) 29–43 [En, Ba]

Analysis of eight honey samples from wild honey bee

colonies revealed 56 pollen types from 29 families. Thirteen were identified at genus level and 33 at species level. The most important honey plants were *Elaeis guineensis*, *Lophira lanceolata* and *Syzygium guineense*. Thin-layer chromatography showed that the only sugars in the samples were fructose and glucose. *J.M. Gedy*

Palynology Research Laboratory, Department of Botany, University of Nigeria, Nsukka, Nigeria.

Aminu, S.R., Hassan, A.W. and Babayo, U.D. *Another use of honey*. *Tropical Doctor* (2000) 30 (4) 250–251 [En, X]

The use of honey in managing enterocutaneous fistulas and stomas (e.g. ileostomy) is discussed.

Dept of Surgery, Univ. of Maiduguri Teaching Hospital, PMB 1414, Maiduguri, Nigeria.

Ayoade, J.A.A. *Beekeeping among the Tiv. Nigerian Field* (1977) 42 (1) 31–36 [En, B]

The Tiv inhabit the country on both sides of the River Benue. Their knowledge of bees is indicated, and the preparation of hives (perforated pots or gourds) is described. Hives are sited in the farmsteads; access to water is important. Honey is harvested at night, precautions being taken against stinging, and stings are treated. Beeswax is used as an adhesive. The Tiv use bees to protect sacred and precious objects, and also claim to use them in fighting; for this purpose bees are kept in a horn containing powdered poison, which serves as a 'poison dispenser', the bees being shaken from it in the direction of the enemy.

Inst. African Studies, Univ. Ibadan, Nigeria.

Bassey, I.H. *Beekeeping: digest of selected literature on beekeeping, honey and beeswax processing*. Lagos, Nigeria; Libriservice. (1986) 203 pp. ISBN 978-2372-12-9 [En\ Af, Bd]

The Digest contains abstracts of the information contained in 36 books, journals, reports and monographs that is applicable to beekeepers in Nigeria. The aim of the book is to stimulate and encourage readers who wish to keep bees as a hobby or for profit. It provides do-it-yourself guidelines and includes detailed descriptions of beekeeping equipment. The text is supplemented by over 40 pages of drawings. *D.G. Lowe*

Boyles, P. *Jos Plateau Environmental Resources Development Programme. Interim report No. 24. Possibilities for the development of honeybee, honey and wax resources of the Jos Plateau [Nigeria]*. Durham, UK; University of Durham and University of Jos (Nigeria). (1991) v + 64 pp. [En, Bdo]

This report gives a brief historical background to beekeeping in Nigeria, and gives details of current beekeeping practices in the Jos Plateau area. These range from simple honey hunting to elaborate traditional methods of beekeeping. There are five types of indigenous hive in northern Nigeria, but on Jos Plateau bees are kept mainly in a number of different containers adopted as hives. Organisations involved in beekeeping are described briefly. Honey is harvested by squeezing it from the comb or by warming combs in a container over a fire. Honey is used as a food and medicine, or in brewing beer, or it is sold at local markets. There is little or no use of beeswax at present, and the potential market for beeswax is discussed. Recommendations for the development of beekeeping in the Jos Plateau area are made. These include training, improving techniques, developing a top-bar hive, promoting the saving and use of beeswax, and conducting surveys and research on floral resources. *D.G. Lowe*

Bradbear, N. (ed.). *Proceedings of a scientific workshop for West African bee researchers: the First West African Bee Research Seminar, Bakau, Gambia, 25–28 November 1991*. Monmouth, UK; Bees for Development. (1993) 86 pp. ISBN 1-898807-00-0 [En, Bdo]

The texts are given for the 22 papers presented at the seminar, together with the addresses given at the opening and closing ceremonies. The subjects covered include beekeeping in Gambia, Nigeria, Cameroon, Mali and Ghana, descriptions of beekeeping development projects in western Africa, and the biology and management of the indigenous honey bee, *Apis mellifera adansonii*. The conclusions and recommendations of the seminar are presented in 'The Banjul Bee Declaration of 1991'. *D.G. Lowe*

Crane, E. *Honey sources of some tropical and subtropical countries*. *Bee World* (1973) 54 (4) 177–186 [En]

Lists of honey-yielding plants are published for the following countries, most of them previously undocumented: Africa – Botswana, Cameroon, Ethiopia, Mauritius, Morocco, Mozambique, Nigeria, Somalia, Zanzibar; America (South) – Ecuador, Guyana, Venezuela; Asia – Afghanistan, India, Iran Pakistan. *D.G. Lowe*
International Bee Research Association, Cardiff, UK.

Dukku, U.H. *Acacia ataxacantha: a nectar plant for honey bees between two dearth periods in the Sudan savanna of northern Nigeria*. *Bee World* (2003) 84 (1) 32–34 [En, Bj]
Biological Sciences Programme, Abubakar Tafawa Balewa Univ., PMB 0248, Bauchi 740004, Nigeria.

Efem, S.E.E. *Clinical observations on the wound healing properties of honey*. *British Journal of Surgery* (1988) 75 679–681 [En, Bc]

Fifty-nine patients with wounds and ulcers, most of which (80%) had failed to respond to conventional treatments, were treated with daily applications of 15–30 ml of fresh honey taken from hives. One case, diagnosed as a Buruli ulcer, failed to respond but the other 58 cases showed remarkable improvement. Wounds that were sterile at the outset remained sterile until healed, whilst infected wounds and ulcers became sterile within one week of applications of honey. The eight types of bacteria isolated from these wounds were all susceptible to honey in laboratory tests, but *Mycobacterium ulcerans*, isolated from the Buruli ulcer, was not. Necrotic tissues were gradually replaced by healthy granulation tissue, and honey also promoted rapid epithelialisation and absorption of oedema. Foul-smelling wounds were rendered odourless within 1 week of treatment with honey and early burn wounds healed quickly and were not colonised by bacteria. No allergies or other adverse reactions were observed. It is concluded that honey is an ideal dressing agent for almost every type of wound or ulcer except those infected by mycobacteria. *D.G. Lowe*

Dept. Surgery, Univ. Teaching Hospital, Calabar, Nigeria.

Efem, S.E.E. *Recent advances in the management of Fournier's gangrene; preliminary observations*. *Surgery* (1993) 113 (2) 200–204 [En, Bb]

Twenty cases of Fournier's gangrene managed conservatively with systemic antibiotics and topical application of unprocessed honey (group A) were compared with 21 similar cases managed by the orthodox method (group B) during the same period. Group A received oral amoxicillin/clavulanic acid and metronidazole in addition to daily topical application of honey to the gangrenous scrotum, whereas group B underwent wound debridement, wound excision, secondary suturing, and in some cases scrotal plastic reconstruction in addition to receiving a mixture of systemic antibiotics dictated by culture and sensitivity results. The organisms cultured in both groups were similar. Even though the average duration of hospitalisation was slightly longer in group A (4.5 weeks) as opposed to group B (4 weeks), topical application of honey showed distinct advantages over the orthodox method. Three deaths occurred in group B, whereas no deaths occurred in group A. The need for anaesthesia and expensive surgical operation was obviated. Response to treatment and alleviation of morbidity were faster in group A. Honey may therefore revolutionise the treatment of this disease. *Author*
University Department of Surgery, University Teaching Hospital, Calabar, Nigeria.

Efem, S.E.E., Udoh, K.T. and Iwara, C.I. *The antimicrobial spectrum of honey and its clinical significance*. *Infection* (1992) 20 (4) 227–229 [En, de, Bc]

The antimicrobial spectrum of honey was investigated by placing two drops into each of the wells made on culture media on which pure cultures of various organisms obtained from surgical specimens were grown. The organisms were grown under both aerobic and anaerobic environments. Fungal cultures of common fungi causing surgical infections or wound contaminations were mixed with 100, 50 and 20% unprocessed honey. Growth inhibition was complete in the media containing 100%, partial in media containing 50% and no inhibition was produced by 20% honey. Unprocessed honey inhibited most of the fungi and bacteria causing wound infection and surgical infection except *Pseudomonas aeruginosa* and *Clostridium oedematiens*. Apart from *Streptococcus pyogenes*, which is only moderately inhibited, golden syrup, a sugar syrup with similar physical properties as honey, did not inhibit any of the bacteria or fungi tested, demonstrating that honey is superior to any hypertonic sugar solution in antimicrobial activity. Honey is thus an ideal topical wound dressing agent in surgical infections, burns and wound infections. *Author*

University Department of Surgery, University Teaching Hospital, Calabar, Nigeria.

Egenti, L.C. Nigeria, Federal Department of Forest Research. Preliminary studies on pollinators of teak (*Tectona grandis* L.). Research Paper (Forest Series), Federal Department of Forest Research, Nigeria (1975) (No.29) 7 pp. [En, B]

Insect pollinators which were present on teak only during its flowering period (late April to mid-August) were: the bees *Nomia tridenta* and six other (unidentified) *Nomia* species; three *Nymphalidae* (*Lepidoptera*); one lygaeid species (*Hemiptera*). Insect populations were highest between 11 and 13 hours, although *Nomia* spp. were still seen at 18 hours. *P. Walker*

Federal Dept. Forest Res., Ibadan, Nigeria.

Eze, C.A., Chah, F.K. and Ubah, S.A. Clinical observations on antibacterial effect of honey as a surgical wound dressing agent. *Journal of Natural Remedies* (2002) 2 (2) 150–154 [En, X]

The antibacterial effect of honey as a wound dressing agent was assessed using *Staphylococcus aureus* isolate as an experimental wound contaminant in rabbits; some wounds were treated with penicillin/streptomycin for comparison. Honey did not prove to be an effective dressing agent.

Dept of Veterinary Surgery & Obstetrics, Univ. of Nigeria, Nsukka, Nigeria.

Green, J.H. Notes on the use of flies [*Chrysomya putoria* and *Musca* spp.] for onion pollination under arid conditions in Nigeria. *Tropical Agriculture* (1973) 50 (2) 165–167 [En]

Komolafe, K. Medicinal value of honey in Nigeria. Perspectives for honey production in the tropics: proceedings of the NECTAR symposium held in Utrecht, 18 December 1995 [edited by Sommeijer, M.J., Beetsma, J., Boot, W.-J., Robberts, E.-J. and Vries, R. de]. Bennekom, Netherlands; Netherlands Expertise Centre for Tropical

Apicultural Resources. (1997) 139–148 ISBN 90-801204-3-X [En, Bd]

Mutsaers, M. Bees in their natural environment in south-western Nigeria. *Nigerian Field* (1991) 56 (1/2) 3–18 [En, Bb]

Observations were made of the nest structure, brood rearing, division of labour, food sources, communication and defence behaviour of natural colonies of *Apis mellifera adansonii* in south-west Nigeria. Nests are constructed in cool, dark places such as holes in trees or undersides of branches, at any height up to 30 m. In Ibadan, the main nectar flow is from July to February with a peak in January when the forest trees are in flower; a table gives details of 55 bee forage plants. During the rainy season, from May to July, food is scarce and pests (the hive beetle *Aethina tumida* and the wax moth *Galleria mellonella* are the most important) are more common. At this time abandoning of nests occurs. An increase in food sources from July to September causes rapid growth in colonies, with subsequent swarming (absconding). Reproductive swarming occurs in September–November. Various native stingless bees (*Meliponinae*) are important as pollinators of crops and locally their honey is also collected and eaten, although yields are only 0.5–2.0 kg/colony annually. *J.M. Gedy*
International Institute of Tropical Agriculture, PMB 5320 Ibadan, Nigeria.

Mutsaers, M. Honeybee husbandry in Nigeria: traditional and modern practices. *Nigerian Field* (1993) (No. 58) 2–18 [En, Bb]

This review, with about 60 references, first describes the wide variety of traditional hives used for keeping honey bees (*Apis mellifera adansonii*); they include hives of plant and of earth materials, some used upright, some horizontally, and kept either on the ground or in trees. Movable-frame hives have been introduced, but the author prefers top-bar hives; the bee space is 3 cm. The uses of honey, beeswax and propolis are described. *P. Walker*

Trichilia apiaries, c/o I.I.T.A., Oyo Road, P.M.B. 5320, Ibadan, Nigeria.

Mutsaers, M. Absconding of honey bee (*Apis mellifera adansonii*) colonies in south-western Nigeria, related to the seasonal weight of colonies and combs. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 3–9 ISBN 0-86098-215-7 [En, Bdo]

Hive weights were measured monthly in apiaries in Ibadan and Ayepe, Nigeria, from April 1990 to July 1992. In Ibadan, in 1990, eight of 38 newly established colonies absconded, and in 1991, 32 of 74 colonies (72 new, two 'old'). In Ayepe, only five of 29 colonies absconded between April 1989 and July 1992. Only a few colonies absconded as a result of being disturbed. The undisturbed colonies which absconded were small, weighing less than 3 kg (bees + combs), and flight activity had been low before the colony absconded. These colonies contained little honey and many empty combs, flattened and bitten-off combs, little or no brood, and no drones or drone brood. It is concluded that colonies swarm in a decreasing

nectar flow, when there is no brood, a 'swarmable' number of bees, a 'carryable' amount of food, and many empty combs. Measures to reduce the incidence of absconding are discussed. *D.G. Lowe*

Trichilia Apiaries, c/o International Institute of Tropical Agriculture, Oyo Road, PMB 5320, Ibadan, Nigeria.

Mutsaers, M. Honey harvesting and processing techniques in relation to beekeeping methods and types of hive (*Apis mellifera adansonii*) in Nigeria. Perspectives for honey production in the tropics: proceedings of the NECTAR symposium held in Utrecht, 18 December 1995 [edited by Sommeijer, M. J., Beetsma, J., Boot, W.-J., Robberts, E.-J. and Vries, R. de]. Bennekom, Netherlands; Netherlands Expertise Centre for Tropical Apicultural Resources. (1997) 37–52 ISBN 90-801204-3-X [En, Bd]

Many honey types are found in Nigeria, both from traditional and modern hives and honey hunting. The very dark amber black African honey is valued for its medicinal qualities, mainly in traditional rural communities. White or light amber honeys are valued as a foodstuff or sweetener, mainly in modern urban society. The first factor to affect honey characteristics and quality is the source of nectar. Tropical multifloral honeys should be classified according to their vegetational zone as forest, savanna and sahel honey; their tastes are not necessarily determined by a single nectar source. Differences are caused by the air humidity which affects nectar secretion and bee behaviour. The quality of the honey is affected by the type of comb in which the honey is stored. Honey stored in combs that previously contained brood and pollen is darker and has a stronger taste. During harvesting, the quality of the honey is affected by the amount of smoke used and the type of hive. Honey from top-bar and traditional hives often contains much pollen. Honey quality is also affected by extraction method – hand-pressing, mechanical pressing or centrifugal extraction. Some pollen counts for West African honeys are tabulated. *Author*

Obaseiki-Ebor, E. E., Afonya, T. C. A. and Onyekweli, A. O. Preliminary report on the anti-microbial activity of honey distillate. *Journal of Pharmacy and Pharmacology* (1983) 35 (11) 748–749 [En]

A yellowish-brown oil which was distilled from Nigerian and imported honeys had a bp 123–126°C and a pH 4.8. It showed broad spectrum antimicrobial activity against a wide range of microorganisms, with a minimum inhibitory concentration of 0.5% v/v. At this concentration the oil was fungicidal to *Candida albicans* and fungistatic to *Penicillium* spp. and *Aspergillus niger*. The antimicrobial activity at 0.5% v/v compared favourably with that of phenol 0.5% w/v, streptomycin 2 mg/ml, and nystatin 30 U/ml.

Dept. Pharmaceutical Microbiol., Univ. Benin, Benin City, Nigeria.

Qamar Majeed. Evaluation of some natural products for controlling mites of *Varroa* sp. parasitizing honeybees in Sokoto. *Shashpa* (2000) 7 (1) 49–52 [En, X]

Extracts of *Ricinus communis*, *Majorana hortensis* [*Origanum majorana*], *Eucalyptus rostrate*, *Azadirachta indica*, *Piper guineense*, *Datura anoxia* and *Nicotiana tabacum*, each used as

a 5% spray or a dust, were effective in controlling varroa mites infesting *Apis mellifera adansonii* in northern Nigeria. Tannic acid (the standard) also gave an effective level of control. Honey production increased in treated colonies. Extracts of *Calotropis procera* caused increased bee mortality.

Zoology Unit, Dept of Biological Sciences, Usmanu Danfodiyo Univ., Sokoto, Nigeria.

Rawal, K. M., Bryant, P., Rachie, K. O. and Porter, W. M. Cross pollination studies of male-sterile genotypes in cowpeas. *Crop Science* (1978) 18 (2) 283–285 [En, B]

In cross-pollination studies in Ibadan, Nigeria, male-sterile plants of *Vigna unguiculata* were classified according to growth habit (six classes) and pigmentation of open flowers (six classes). Three blocks of the 45 pollen donors were planted as border rows to the male-sterile block. Wild *Apis mellifera* acted as pollinating agents. A statistical analysis showed that growth habit 6 (prostrate, indeterminate) led to significantly more pod set than growth habit 1 (acute erect, determinate), possibly because plants with this habit produced more flowers. Flowers with pigmentation patterns 2 (pigmented wing, light V-shaped pattern at top centre of standard petal) or 6 (completely pigmented) produced significantly fewer pods than class 1 (colourless) flowers. Relatively few plants had pigmentation patterns 3, 4 or 5, so these results were inconclusive. It is concluded that the presence of any flower pigmentation may make this plant less attractive to honeybees. *D.G. Lowe*
Univ. Colorado, Boulder, CO 80309, USA.

Sowunmi, M. A. Pollen grains of Nigerian plants. 1. Woody species. *Grana* (1973) 13 145–186 [En, B]

Pollen grains from 150 plants, comprising over 60% of the recognised climatic indicator species of the forest and savanna zones, are described, many of them for the first time; 73 are also illustrated. Some of the observations made are compared with those of earlier investigators. Intraspecific variations are noted. *Author*
Dept. Archaeology, Univ. Ibadan, Ibadan, Nigeria.

Sowunmi, M. A. The potential value of honey in palaeopalynology and archaeology. *Review of Palaeobotany and Palynology* (1976) 21 171–185 [En, B]

Honey samples were obtained from eight localities in southern Nigeria, where villagers collect honey either from natural honeybee nests in hollow trees, or from hives in trees or on the ground. In six of the samples, a total of 50 pollen types were positively identified; eight more were classified tentatively and about 20 could not be identified. One sample contained 42 types of pollen. The most important honey plants are considered to be: *Ageratum conyzoides*, *Aspilota latifolia*, *Emilia sonchifolia*, *Synedrella nodiflora*, *Tridax procumbens* (Compositae); *Butyrospermum paradoxum* (Sapotaceae); *Parkia clappertoniana* (Mimosaceae); *Elaeis guineensis* (Palmae); *Syzygium guineense* (Myrtaceae); *Spondianthus preussii*, *Alchornea cordifolia* (Euphorbiaceae); *Terminalia macroptera*, *T. superba* (Combretaceae). The results reflected the diverse botanical and geographical origins of the honeys. The possible value of pollen analysis of honeys found in archaeological investigations is mentioned. *P. Walker*

Dept. Archaeology, Univ. Ibadan, Ibadan, Nigeria.

Sowunmi, M.A. Pollen of Nigerian plants. II. Woody species. *Grana* (1995) 34 (2) 120–141 [En, 16 ref.]

Pollen grains of 40 Nigerian woody species which are among the ecological indicator species of forest and savanna vegetation communities are described and illustrated with both LM and SEM micrographs. Where appropriate, observations made here were compared with those of some earlier investigators. Eight species were di- or polymorphic with respect to aperture number. The use of

SEM greatly enhanced the characterisation and interpretation of pollen morphological features, particularly where these features were indistinct or not detectable in LM. The second part of the series on the pollen flora of Nigeria, as was the first, is expected to be useful in plant taxonomy, Quaternary palaeoecology and petroleum exploration as well as in archaeological research and the honey industry. Department of Archaeology and Anthropology, University of Ibadan, Ibadan, Nigeria.

Pakistan

Food and Agriculture Organization of the United Nations. Proceedings of the Expert Consultation on Beekeeping with *Apis mellifera* in Tropical and Sub-Tropical Asia, Bangkok/Chiang Mai, Thailand, 9–14 April 1984. Rome, Italy; Food and Agriculture Organization of the United Nations. (1984) v + 250 pp. [En, B]

The proceedings include nine technical papers on various aspects of beekeeping in Asia, including: constraints caused by parasitic mites; bee forage; pollination; honey production; beekeeping in rural economies. Of these papers, four are abstracted or listed individually in *Apicultural Abstracts*. There are also 'status reports' for the following: Afghanistan, Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Western Samoa. The proceedings also contain a list of participants, list of apiaries visited, and the resolutions of the meeting. *D. G. Lowe*

Abbas, T., Hasnain, A. and Ali, R. Black gram as a pollen substitute for honey bees. *Animal Feed Science and Technology* (1995) 54 (1–4) 357–359 [En, Ba]

Four honey bee (*Apis mellifera*) colonies, each with four frames of bees, were fed during the rainy season with a pollen substitute containing 55% soya bean flour (also 25% sugar, 5% yeast, 5% milk powder, 10% water); another four colonies were fed with a diet containing the flour of *Phaseolus mungo* [= *Vigna mungo*] instead of soya bean flour. After three months, the first group contained an average of 4.75 frames/colony and 7.12 kg honey/box, whereas colonies on the black gram diet had 5.75 frames and 8.62 kg/box. Four colonies which received no pollen substitute had only 2.5 frames/colony and 1.87 kg honey/box. In Pakistan, black gram flour could be used as a cheaper alternative to soya bean flour, which has to be imported. *P. Walker*

Department of Food Science and Technology, University of Karachi, Karachi-75270, Pakistan.

Ahmad, R. A note on insect pollinators of alfalfa in Pakistan. *New Zealand Entomologist* (1976) 6 (2) 190–191 [En]

Ahmad, R. Rearing honeybees. *Miscellaneous Publication, Pakistan Agricultural Research Council* (1979) 15 pp. [Urdu, B]

Ahmad, R. Beekeeping. *Miscellaneous Publication, Pakistan Agricultural Research Council* (1980) 20 pp. [Urdu, B]

Ahmad, R. A guide to honeybee management in Pakistan. *Miscellaneous Publication, Pakistan Agricultural Research Council* (1981) iv + 38 pp. [En, B]

This is a straightforward guide to beekeeping in movable-frame hives in Pakistan. There are some 30,000 to 35,000 colonies of native *Apis cerana* in traditional hives, 6300 in modern hives, and 850 colonies of introduced *Apis mellifera* in modern hives. Annually, 55–65 tonnes of honey are produced from *Apis cerana*, and 68–78 tonnes are harvested from the 45,000 to 55,000 wild colonies of *Apis dorsata*. Most of the management section of the book relates to *A. mellifera*. *E. Crane*

Honeybee Management Project, Pakistan Agric. Res. Council, L-13 Al-Markaz, F-7/2 Islamabad, Pakistan.

Ahmad, R. Some honeybee flora for forest plantations, erodible lands, landscapes and agriculture farms. *Progressive Farming* (1984) 4 (1) 19–23 [En, B]

Details of uses, characteristics, nectar/pollen source, distribution, for 25 plants grown in Pakistan.

Ahmad, R. Economics of beekeeping in Pakistan. *Progressive Farming* (1985) 5 (6) 24–29 [En, Bc]

The possibility of developing beekeeping in Pakistan by introducing modern methods of management was investigated. More than 700 plant species are known to be visited by bees in Pakistan but most are minor sources of nectar and pollen. It is estimated that agricultural crops and the natural flora could support 0.4–0.5 million colonies throughout Pakistan, producing 6,000–10,000 t honey/year, and providing employment for 30,000–40,000 people. The investment needed for part-time and full-time beekeeping (with up to 500 hives) and their potential incomes are estimated. *J. M. Gedy*

National Agric. Res. Cent., Islamabad, Pakistan.

Ahmad, R. Honeybee pollination of important entomophilous crops. Islamabad, Pakistan; Pakistan Agricultural Research Council. (1987) vi + 103 pp. ISBN 969-409-034-2 [En, Bd]

The first 11 short chapters of this book (pp. 1–15) deal with basic topics such as flowering, nectar production, ecological relationships, insect-pollinated crops in general, requirements for honeybee-pollinated crops and management of honeybee colonies for pollination. The remaining five chapters deal, respectively, with fruits, fodder seed crops, vegetable crops, melon crops and oilseed

crops grown in Pakistan that are known to require honeybee pollination or pollination by other insects. The entry for each crop gives information about its production in Pakistan, floral characteristics, flowering, and pollination requirements including the necessary stocking density of honeybee colonies/ha where known. There are over 20 pages of references, and the book is illustrated with 46 black-and-white figures. It will provide a useful source of reference for farmers and growers, particularly in Pakistan. D.G. Lowe
Pakistan Agric. Res. Council, PO Box 1031, Islamabad, Pakistan.

Ahmad, R. *Beekeeping in Pakistan: present status and economics.* Progressive Farming (1988) 8 (2) 32–37 [En, Bc]

Ahmad, R. *Competition between *Apis mellifera* and other *Apis* species in Pakistan.* Honeybee Science (1988) 9 (4) 150–151 [Ja, en, Bj]

Competition between *A. mellifera* and Pakistan's three native honeybee species (*A. cerana*, *A. dorsata*, *A. florea*) is described. Competition between drones occurs as the main components of the sex pheromone are identical in the four species. The introduction of the tracheal mite, *Acarapis woodi*, on imported *A. mellifera* has been responsible for serious damage to *A. cerana* colonies. It is feared that the further development of *A. mellifera* beekeeping will lead to a reduction in numbers of the native species. Author

Pakistan Agric. Res. Council, Islamabad, Pakistan.

Ahmad, R. *Honeybee parasitic mites and their control in Pakistan.* Progressive Farming (1988) 8 (1) 34–36 [En, Bc]

Ahmad, R. *Low-cost comb foundation press for oriental and occidental honeybees.* Progressive Farming (1988) 8 (6) 30–32 [En, Bc]

Each of the two plates for the press is made by taking a cement or plaster cast of a sheet of high quality embossed comb foundation with cell sizes suitable for *Apis cerana* or *A. mellifera*. Details of suitable mixtures, and of the procedure, are given. When using the press to make sheets of comb foundation from melted beeswax, a releasing agent is first applied to both plates; it is made from 1 tablespoon [15 ml] honey in 1 litre warm water and 0.125 litre methylated spirit. P. Walker

Natn. Agric. Res. Centre, Islamabad, Pakistan.

Ahmad, R. *Studies on management of the rock bee, *Apis dorsata* F., in Pakistan. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.].* Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apirists' Associations. (1988) 187–188 ISBN 0-86774-011-6 [En, Bdo]

Two *A. dorsata* colonies which stayed in a forested area in Punjab, Pakistan, throughout the year (instead of migrating) were used for queen production and management studies. Larvae from these colonies were grafted into selected *A. mellifera* colonies for queen rearing. Most *A.*

mellifera colonies did not accept *A. dorsata* larvae but a few, with a large proportion of young bees, did so and reared them to the pupal stage. Resulting queen cells were introduced into the two *A. dorsata* colonies, which had been made queenless. The colonies, attached to sawn-off branches, were then placed in cages made from wooden frames and 16-mesh wire gauze. Each cage had a movable lid and two 5.8-mm entrances. The caged colonies were moved to various sites throughout the year to take advantage of different flows, and were fed with 12 kg sugar and 1 kg pollen during dearth periods. The two colonies produced 27 and 22.9 kg honey during the period from April 1986 to June 1987. D.G. Lowe

National Agric. Res. Centre, Islamabad, Pakistan.

Ahmad, R. *Methods to control migration by *Apis dorsata* colonies in Pakistan.* Bee World (1989) 70 (4) 160–162 [En, Bj]

Preliminary trials to control *A. dorsata* migrations by a combination of requeening with superior queens and feeding colonies in times of dearth are reported. *A. dorsata* larvae in queen cups were grafted into *A. mellifera* colonies. Those that survived until pupation were introduced into *A. dorsata* colonies as sealed queen cells. The queens that emerged were 1.5 times as large as normal queens, indicating that they had benefited from the abundant supply of royal jelly produced by the *A. mellifera* colonies. Three colonies headed by such queens in 1986, when there was a serious dearth, were fed sugar syrup. One colony migrated in August, another in September, and the third died due to severe cold in November. All other colonies in the area migrated much earlier, by the end of May or in June. In 1987, 3 *A. dorsata* colonies, headed by large queens produced naturally, were fed sugar syrup, but two migrated due to wax moth infestations. The third colony did not migrate, but there was an adequate supply of forage in the area. D.G. Lowe

Honeybee Res. Programme, Agric. Res. Council, Natn. Agric. Res. Centre, Islamabad, Pakistan.

Ahmad, R. *Present status of beekeeping in Pakistan. Honeybees in mountain agriculture [edited by Verma, L.R.].* New Delhi, India; Oxford & IBH Publishing Co. (1992) 211–219 ISBN 81-204-0650-8 [En, Bdo]

A brief description is given of honey bee species, bee forage, beekeeping equipment, pests and predators, and the economics of honey production. A table shows expenditure and income for beekeepers with 5, 80, 250 or 500 hives. D.G. Lowe

Honeybee Research Laboratory, National Agricultural Research Centre, Agricultural Research Council, Islamabad, Pakistan.

Ahmad, R. and Ahmad, M. *Introduction of *Apis mellifera* (L) and factors affecting its establishment in Pakistan.* Apiacta (1986) 21 (1) 9–14, 20 [En, Bj]

A total of 2200 colonies of European honeybees were distributed to various parts of Pakistan. Colony losses were high in the first two years, but, after establishing some of the causes, management methods were modified and annual losses were reduced to 10% of colonies. Nectars of several plants seemed to be toxic to the bees. Also,

Plectranthus rugosus, from which *Apis cerana* produces good honey crops, was not attractive to *A. mellifera*. In hot weather European bees clustered outside the hive; they were thus easy prey for predators, and many bees were left behind when hives were moved. Clustering was reduced when an empty honey super or brood chamber was added below the brood chamber. Mortality increased when ambient temperatures rose above 42°C. Measures that were successful in reducing hive temperature included: shading hives; placing them on a canal bank so that the bees could collect plenty of water; covering hives with wet sacks. Colonies became infested with *Tropilaelaps clareae*, and *Varroa jacobsoni* and/or *Acarapis woodi*. A method was developed for killing Varroa by exposing brood-free colonies to high temperatures (up to 47°C) for short periods, when the mites fell off the bees into a tray of sulphur. Several *Vespa* spp. preyed on the bees; a lure was developed using moist raw sugar syrup. In hot areas, colonies produced insufficient drones in May when queens were ready to mate. When colonies were provided with drone combs in January, queens produced in April mated successfully. P. Walker
Pakistan Agric. Res. Council, L-13 Al-Markaz, F-7/2 Islamabad, Pakistan.

Ahmad, R., Camphor, E. and Ahmad, M. Migration of the Eastern bee (*Apis cerana*) colonies and its effect on honey yield. *Pakistan Journal of Agricultural Research* (1984) 5 (1) 65–68 [En, B]
Four groups, each of five *A. cerana* colonies ('hill' strain), were migrated to locations in: (1) Rawalpindi, Islamabad, Haripur and Swat; (2) Rawalpindi and surrounding localities; (3) Swat; (4) Islamabad. Schedules were prepared for migrations to various nectar flows, the floral sources of which are listed in a table, with duration of flow, and honey production per colony. Average annual honey yields per colony in areas 1, 2, 3 and 4 were 16.08, 4.6, 3.3 and 2.8 kg, respectively. Two colonies in group 2 died, and three in each of groups 3 and 4, due to a dearth in late summer, autumn and winter. D. G. Lowe
Natn. Agric. Res. Centre, Honeybee Res. Programme, PO NIH, Islamabad, Pakistan.

Ahmad, R., Camphor, E. and Ahmed, M. Factors affecting honey yield of the oriental bee, *Apis cerana* in Pakistan. *Pakistan Journal of Agricultural Research* (1983) 4 (3) 190–197 [En, B]
Observations were made at several sites in Pakistan on *Apis cerana* colonies from Swat (hills) and Margalla (foot-hills). Average annual honey yield of the Swat strain was 8.17 kg/colony; of the Margalla strain, 7.75 kg. The highest honey production of the Swat strain during any nectar flow was 17.41 kg from shain (*Plectranthus rugosus*); that of the Margalla strain, 6.77 kg from berseem (*Trifolium* spp.). A third strain, named PARC, produced good yields from both these nectar sources; its average annual honey yield was 8.30 kg/colony. The highest honey production from a PARC colony was 6.8 kg during a flow from shain. Swat colonies with young and one-year-old queens produced 1.4–1.5 and 1.4–1.7 times as much brood as Margalla colonies with young and one-year-old queens, respectively. In the Murree area, the average weight of a colony

remained almost the same, and on average 18 546 and 13 885 bees, respectively, collected pollen and nectar daily. In Rawalpindi, colonies fed on sugar syrup at 10-day intervals showed marked development during the dearth period (July–August), thus such feeding was useful in building up colony strength for the next nectar flow. Queens reared during the flowering period of *P. rugosus* in autumn at Madyan either failed to mate properly or they laid few eggs, possibly due to the low temperatures. Most weak colonies absconded in July–August. Sudden storms and heavy rainfall reduced the foraging strength of some colonies. Bees foraging on *Ranunculus muricatus* suffered high mortality due to some unknown toxin in the nectar. *Galleria melonella*, *Acarapis woodi* and *Varroa jacobsoni* occasionally caused high losses. D. G. Lowe
Natn. Agric. Res. Centre, Honeybee Res. Programme, PO NIH, Islamabad, Pakistan.

Ahmad, R., Muzaffar, N. and Ali, Q. Biological control of the wax moths *Achroia grisella* (F.) and *Galleria mellonella* (L.) (Lep., *Galleridae*) by augmentation of the parasite *Apanteles galleriae* Wilk. (Hym., *Braconidae*) in Pakistan. *Apiacta* (1983) 18 (1) 15–20 [En, B]
Wax moths cause heavy losses in *Apis cerana* colonies in northern Pakistan; in an examination of 41 colonies kept in earthenware pitchers in house walls, *Achroia grisella* was present in nearly a fifth, and *G. mellonella* in nearly a third of the colonies. It was found that *Apanteles galleriae* parasitises third and fourth instar larvae of *A. grisella* and third instar larvae of *G. mellonella* but populations in apiaries were very low. A rearing method for the parasite was designed using wax moth larvae that had been raised on an artificial diet. Four *A. cerana* colonies, artificially infested with both wax moths, were placed near to a rearing chamber that incorporated a Langstroth brood box as its outer cover, and the parasites were released on alternate days. During the next five months, honeybee populations increased whilst wax moth populations decreased. A control colony, 4 km away, became increasingly heavily infested with wax moths and died out after four months. P. Walker
Pakistan Agric. Res. Council, L-13 Al-Markaz, F-7/2 Islamabad, Pakistan.

Ahmad, R. and Waghchoure, E. S. Studies on migration of honeybee colonies and its effect on honey yield. *Pakistan Journal of Zoology* (1984) 16 (2) 113–117 [En, Bb]
The average honey yield of one set of five colonies migrated within an area between sites at Rawalpindi, Islamabad, Haripur and Swat, was 16.08 kg/colony. Another set of five colonies migrated between sites at Gujar Khan, Islamabad, Rawalpindi and Haripur suffered 40% mortality and produced an average yield of 4.7 kg/colony. The average yields of groups of five colonies kept permanently in Swat and Islamabad were 3.3 and 2.8 kg/colony, respectively, with a 60% loss of colonies. The major and minor nectar sources at each locality are listed in a table with details of honey production and the periods when colonies were present. The data were used to develop schedules for the migration of colonies between various floral belts in the Punjab and NWFP. D. G. Lowe
Pakistan Agric. Res. Council, Islamabad, Pakistan.

Ahmed, R. and Muzaffar, N. *Modern beekeeping*. Islamabad, Pakistan; Pakistan Agricultural Research Council. (1984) 350 pp. [Urdu, B]

Ahmed, S. *Nectar and pollen plants of Pakistan*. Pakistan Journal of Forestry (1984) 34 (2) 75–78 [En, Ba]

Some of the most important bee forage species are described. In the submontane region these include: the trees *Acacia modesta* (phulai), *Robinia pseudoacacia*, *Liriodendron tulipifera*, *Ailanthus glandulosa* (tree of heaven), *Vitex negundo*, *Cercis* sp. (redbud), fruit trees, and *Eriobotrya japonica* (loquat, which flowers in winter). On the plains, Eucalyptus is very important; about 12 species grow well in Pakistan including some which flower in the winter. Winter forage is also provided by *Zizyphus jujuba* and loquat. Among agricultural crops valuable to bees are Brassica crops (toria, sarson, raya), cotton, lucerne (*Medicago sativa*) and clovers. Citrus trees are grown in many gardens, as are the climber *Tecoma grandiflora*, and also *Dombeya* sp., a tree which *Apis dorsata* favours for nesting in; it also nests in *Kigelia pinnata* (gul-i-fanoos), *Dalbergia sissoo* (shisham), *Azadirachta indica* (neem) and *Bombax ceiba* (silk-cotton tree or semal). Some of the honeys produced from these plants are described very briefly. In Changa Manga plantation, *Apis dorsata* produces two crops of honey in the spring, both from shisham, but the second crop is dark blue because it contains mulberry juice. Another well-known honey is produced by *Apis mellifera* foraging on roses, loquat and phulai (in the Salt Range). P. Walker

Ahmed, T., Sarwar, G.R., Ali, T. and Qaiser, M. *Buzz-pollination in Trichodesma indicum* (L.) R. Br. (Boraginaceae). Pakistan Journal of Botany (1995) 27 (1) 93–99 [En, 10 ref.] *Trichodesma indicum* flowers throughout the year. In this study, the protandrous flowers remained in bloom for about three days. Buzz-pollination was carried out sterotribically by two species of *Anthophora* (Apidae). Pollen-ovule ratio and breeding experiments (hand-pollination treatments) revealed *T. indicum* to be a facultative xenogamous species. Its non-apomictic nature was demonstrated by normal fruit and seed set following all hand pollination treatments except emasculation treatment for apomixis. Department of Botany, University of Karachi, Karachi 75270, Pakistan.

Ali, T. and Ali, S.I. *Pollination biology of Calotropis procera subsp. hamiltonii* (Asclepiadaceae). Phytos (1989) 29 (2) 175–188 [En, de, Ba]

In studies at three sites around Karachi, Pakistan, the main pollinators of *Calotropis procera* subsp. *hamiltonii* were males and females of *Xylocopa pubescens* and females of *X. fenestrata* (82.75% of pollinaria-bearing visitors). Numerous other insects were seen visiting the flowers to collect nectar, but *Apis florea* workers were the only other species that carried pollinaria. Each flower contained 10 pollinia and two ovaries, with a pollen to ovule ratio of 6.14:1. Pollinia were more easily inserted into stigmatic chambers flanked by intact pollinaria than into those from which the pollinaria had been experimentally removed. The presence of one pollinium in a flower was sufficient to effect fertilisation. J.M. Gedy

Dept. Botany, Univ. Karachi, University Rd., Karachi 75270, Pakistan.

Arshed Makhdoom Sabir, Anjum Suhail, Ashiq Hussain, and Asif Saeed. *Insecticidal mortality, foraging behaviour and pollination role of honey bee (Apis mellifera L.) on Brassica (Brassica campestris L.)*. Pakistan Journal of Zoology (2000) 32 (4) 369–372 [En, X]

Groups of 25 worker honey bees were released into caged plots 0–120 hours after application of insecticide (Polo 500 EC or Primor 50 W; a.i. not stated) at a rate of 617.5 ml/ha. On Polo-treated plots, mortality ranged from 4.0–9.0 bees/group, and on Primor-treated plots 9.7–24.7. Average foraging activity was maximal (25.2 bees/flower/10 minutes) between 10.00 and 11.00 hours. Plots visited by honey bees gave good seed yield, wt of seed and percentage seed germination.

Beekeeping and Hill Fruit Pests Research Station, Rawalpindi, Pakistan.

Crane, E. *Bibliography of tropical apiculture. Part 3. Beekeeping in the Indian sub-continent (with Afghanistan and Iran)*. London, UK; International Bee Research Association. (1978) 14 pp. ISBN 0-86098-033-2 [En, B] Annotated list of 171 publications, grouped under country, with an introduction.

Crane, E. *Beekeeping with Apis florea in the Indus basin and some other areas*. Bee World (1997) 78 (2) 63–66 [En, B]

In this part of Pakistan a beekeeper who finds an *A. florea* nest built on a branch supports its single comb (at a point above the brood area, but below the honey storage area) between the two halves of a split stick. After brushing the bees off the honey area on to the brood area, the beekeeper cuts the comb, just above the stick, and also the original branch; the honey comb can then be removed. It is possible to move sticks holding brood nests to a convenient site where the bees will build more comb and store more honey (later harvested by the beekeeper). 'Apiaries' of such colonies are sometimes taken to work flows from sources such as *Zizyphus mauritiana*. D.G. Lowe Woodside House, Woodside Hill, Gerrards Cross, Bucks SL9 9TE, UK.

Delfinado-Baker, M. *New records for Tropilaelaps clareae from colonies of Apis cerana indica*. American Bee Journal (1982) 122 (5) 382 [En, B]

The samples came from Burma and Pakistan.

Delfinado-Baker, M. and Knox, D. *Infestations of Apis cerana indica colonies by Acarapis woodi and Varroa jacobsoni*. American Bee Journal (1982) 122 (8) 592 [En, B]

Samples of bees and brood collected from two apiaries in Pakistan [specific locality not known] in May 1982 were examined. Female mites of *V. jacobsoni* were found in the brood cells. *Acarapis woodi* was identified in the tracheae of adult bees. This mite was also identified in a sample of bees collected at Rawalpindi. This is the first report of acarine disease in Pakistan. P. Walker Bioenvironmental Bee Lab., USDA-SEA, Beltsville, MD 20705, USA.

- Dhuyo, A.R., Munshi, G.H., Naqvi, S.M.S.H., Rizvi, S.N.H. and Rustamani, M.A. *Insect pollinator complex of cotton crop Gossypium hirsutum L. at Tandojam*. Pakistan Cottons (1988) 30 (3) 45–47 [En, Ba]
Apis florea was the most frequent visitor to cotton flowers in this area of Pakistan (65% of total insect visitors). Other pollinators were four species of *Xylocopa* (26% of total), two *Anthophora* species and *Megachile menticola*. P. Walker
 Sind Agric. Univ., Tandojam, Pakistan.
- Gondal, S.M.A. and Hashmi, A.A. *Brood rearing in relation to the age of the queen in Apis cerana indica*. Journal of Apicultural Research (1976) 15 (3/4) 128–129 [En, B]
 Four young queens produced more brood during spring and summer than four queens one year old. Author
 Dept. Entomology, Univ. Agric., Lyallpur, Pakistan.
- Huda, I.A. *Some new records of species of genus Xylocopa based on the collections in the Zoological Survey of Pakistan*. Agriculture Pakistan (1975) 26 (2) 213–218 [En, B]
- Iltishamulhaq. *Variation in the honey composition with geographical locations*. Sarhad Journal of Agriculture (99) 15 (2) 145–148 [En, 8 ref.]
 Honey samples were collected from 14 different locations in Pakistan in order to examine the effect of geographical location on physicochemical properties. The samples were analysed for contents of reducing sugars, total reducing sugars, sucrose, glucose, fructose, total soluble solids and proline, and for water activity, refractive index, specific gravity, and ratios of glucose:water, fructose:glucose, sucrose:fructose-glucose, glucose-water: fructose and others. Total soluble solids, specific gravity, glucose:water ratio and sucrose:fructose-glucose ratio varied significantly with geographical location.
 Dept of Food Science and Technology, NWFP Agricultural Univ., Peshawar, Pakistan.
- Jabbar, A., Ejaz-Ud-Din, Akhtar, S., Khan, F.M. and Alizai, M.N. *Comparative analysis of marketed genuine and fake honey*. Sarhad Journal of Agriculture (94) 10 (4) 391–398 [En, X]
 The chemical characteristics of 23 honey samples were investigated. The samples were procured from the local market, Peshawar, Pakistan. Total soluble solids, water content, total acidity, free acidity, lactone, pH, refractive index, ash, total sugars, reducing sugars, sucrose, diastase activity number and mineral constituents (potassium and sodium) were determined. Results obtained indicated that 20 samples were pure while the rest were impure. There were wide variations between the mean values of chemical constituents and minerals in both types of samples. These differences were statistically highly significant in the parameters studied in the following order: ash, total acidity, free acidity, total sugars, potassium-to-sodium ratio, pH, sodium, reducing sugars, sucrose and diastase number.
 Pakistan Council Sci. & Industrial Res., Jamrud Road, Peshawar 25120, NWFP, Pakistan.
- Jasra, A.W., Sabira Ashfaq and Kasi, M.A. *Apple pollination problems in Balochistan, Pakistan*. International Journal of Agriculture and Biology (2001) 3 (2) 210–213 [En, X]
 A survey of 76 growers showed that most of them know about pollination processes and some realise the value of honey bees, but half the growers spray 2–7 times per season with pesticides.
 National Aridland Development and Research Inst. (NADRI), Ministry of Food, Agriculture and Livestock (MINFAL), National Agricultural Research Centre (PARC), Park Rd, Islamabad, Pakistan.
- Kamal, S. and Akhtar, M. *Role of insects in pollination of raya (Brassica juncea H.F. & T.) flowers*. Pakistan Journal of Agricultural Sciences (1976) 13 (1) 65–72 [En]
 Plants were treated (A) by covering with plastic bags, (B) by spraying each week with phosphamidon, or (C) left untreated. Number of seeds/inflorescence, number of pods/plant, and number of seeds/g were all highest in (C), lowest in (A). Seed yields per plot were 569 g, 1431 g, 1647 g, respectively, in (A), (B), (C). D.G. Lowe
 Dept. Entomology, Agric. Univ., Lyallpur, Pakistan.
- Kan, B.M., Shahid, M. and Chaudhry, M.I. *Effect of honey bee pollination on the fruit setting and yield of loquat*. Pakistan Journal of Forestry (1986) 36 (2) 73–77 [En, Bb]
 In experiments carried out in Peshawar, Pakistan, fruit production was compared for panicles of *Eriobotrya japonica* (A) pollinated by honeybees, (B) pollinated by other bees in an orchard without honeybees, and (C) self-pollinated (bagged to exclude insects). Fruit set was 83%, 46% and 4% in A, B and C, respectively; the numbers of ripe fruits were 59, 28 and 2, and the weights of fruit/panicle 708, 252 and 21 g, respectively. It is recommended that honeybee colonies should be introduced to loquat orchards for pollination. P. Walker
 Agric. Res. Inst., Tarnab, Peshawar, Pakistan.
- Khan, B.H. *Beekeeping in the Hazara Division of the NWFP*. Indian Bee Journal (1981) 43 (2) 54–55 [En, B]
 North-West Frontier Province of Pakistan; A Beekeepers' Association is contemplated there (p. 45).
- Khan, B.M. *Honeybee resources in North West Frontier Province of Pakistan. Honeybees in mountain agriculture [edited by Verma, L.R.]*. New Delhi, India; Oxford & IBH Publishing Co. (1992) 59–65 ISBN 81-204-0650-8 [En, Bdo]
 Beekeeping with *Apis cerana* and *A. mellifera*, and honey collecting from wild *A. dorsata* and *A. florea* nests, are described briefly. A honey extraction calendar gives details of nectar flows and average honey yields. D.G. Lowe
 Entomology Department, NWFP Agricultural University, Peshawar, Pakistan.
- Khan, B.M. and Chaudhry, M.I. *Comparative assessment of honey bees and other insects with self-pollination of sarson in Peshawar [Pakistan]*. Pakistan Journal of Forestry (1988) 38 (4) 231–238 [En]
 Self-pollinated sarson [*Brassica campestris* var. sarson] (covered with muslin netting) produced seed yields of 26.46–34.34 (mean 28.68) g/plant. Plants on which the flowers were pollinated by honey bees [*Apis* spp.] or by other insects yielded 67.20–90.02 (mean 74.37) and 41.72–56.35 (mean 48.42) g/plant, respectively. The seeds from insect-pollinated plants were larger, better shaped

and more viable than the seeds from self-pollinated plants. Department of Entomology, NWFP Agricultural University, Peshawar, Pakistan.

Khan, B.M., Chaudhry, M.I. and Khawaja, P. *Acarine disease of honey bees and its control in Pakistan.* Pakistan Journal of Forestry (1987) 37 (2) 109-114 [En, Bb]

In 1982-83, *Acarapis woodi* infestations in the Peshawar region of Pakistan caused 85% losses of honeybee colonies, particularly those of *Apis cerana*. Experimental studies showed that dequeening colonies could form the basis of an effective control method. Queens were removed from colonies (dequeened), together with any frames of sealed brood, and put into new hives, each containing three frames of drawn comb (queenright colonies). Dequeened and queenright colonies were both fed syrup for 15 days and half of each were treated with Folbex (chlorobenzilate). A 50% reduction in honeybee mortality was recorded 10 and 15 days after the division in Folbex-treated and untreated dequeened colonies respectively. The same reduction in mortality was recorded after three and five days in treated and untreated queenright colonies respectively. Figures for complete recovery were 18 and 25 days, and 12 and 15 days, respectively, for dequeened and queenright colonies. The addition of package bees to the queenright colonies helped colony build-up. The dequeened colonies successfully raised new queens. D.G. Lowe Entomology Dept., NWFP Agric. Univ., Peshawar, Pakistan.

Koeniger, N. and Muzaffar, N. *Lifespan of the parasitic honeybee mite, Tropilaelaps clareae, on Apis cerana, dorsata and mellifera.* Journal of Apicultural Research (1988) 27 (4) 207-212 [En, Bb]

T. clareae survived in cages with adult bees of *A. mellifera* for up to 25 hours and with *A. cerana* for up to 27 hours. On *A. dorsata*, the maximum lifespan was 57 hours. In an empty glass vial, the mites lived for 30 hours. In similar vials with a pupa of *A. mellifera* they survived for more than five days. Dead *T. clareae* collected from the *A. dorsata* experiments showed injuries which were apparently caused by the biting of *A. dorsata* bees. Author
Honeybee Res. Programme, PARC, NARC, P.O. NIC., Islamabad, Pakistan.

Makhdoomi, S.M.A. and Chohan, M.S. *Migration schedule for successful bee farming.* Journal of Agricultural Research, Pakistan. (1980) 18 (1) 37-39 [En, B]

A survey of bee forage in West Punjab and the North West Frontier Province of Pakistan was conducted over several years. Geographical distributions, flowering periods, and potential honey yields (where known), are given for the following major nectar sources: shain (*Plectranthus rugosa*) [*Rabdosia rugosa*]; loquat (*Eriobotrya japonica*); *Euclayptus* spp.; oilseed crops (*Brassica* spp.); deciduous fruit trees (apricot, apple, plum, etc.); forest and avenue trees (*Adhotoda vasica*, *Acacia modesta*, *Prosopis* spp., *Carissa opaca*, *Dalbergia sissoo*, *Cedrela toona* [*Toona ciliata*]); berseem (*Trifolium alexandrinum*); shaftal (*Trifolium resupinatum*); lucerne (*Medicago sativa*). Some of these species also yield pollen in significant amounts. A schedule is given for migratory beekeeping in this area. D.G. Lowe
Ayub Agric. Res. Inst., Faisalabad, Pakistan.

Manzoor-ul-Haq and Muhammad Fiaz. *Insect pollination of sunflower (Helianthus annuus) in Pakistan.* Journal of Apicultural Research (1980) 19 (1) 83-87 [En, B]

In 1975 and 1976 bee visitors on 'Armaveric' sunflower were *Andrena fulvicrus*, *Apis dorsata*, *A. florea*, *Ceratina viridis-sima* and *Xylocopa dissimilis* especially during early and middle parts of the day. Studies on bagged and open seed heads, and on those sprayed with phosphamidon, showed the need for insect pollination for a high yield of good quality seed. Author

Dept. Entomology, Univ. Agric., Faisalabad, Pakistan.

Manzoor-ul-Haq, Rafie-ul-Din, M. and Chaffar, A. *Effect of insect pollination on fruit bearing in Kinnow mandarin (Citrus reticulata), and physical and chemical properties of the fruit.* Journal of Apicultural Research (1978) 17 (1) 47-49 [En, B]

Studies were made at Lyallpur, Pakistan, to determine the effect of insect pollinators, mostly *Apis dorsata* and *A. florea*, on the fruit set and matured, and on the physical and chemical properties of Kinnow mandarin (*Citrus reticulata*). Significantly more fruit set and matured on branches accessible to insect pollinators than where insects were repelled or excluded. Effects of fruit size, juice content and the number of seeds were also significant, but not acidity, or sugar and total soluble solids. Author
Dept. Entomology, Univ. Agric., Lyallpur, Pakistan.

McGinley, R.J. and Rozen, J.G. Jr. *Nesting biology, immature stages, and phylogenetic placement of the Palearctic bee Pararhophites (Hymenoptera; Apoidea).* American Museum Novitates (1987) (No. 2903) 1-21 [En, Bb]
Observations were made at a nesting site of *P. orobinus* in Baluchistan, Pakistan, in 1984. The following aspects are described: nest architecture, egg deposition, development, larval behaviour, cocoon construction, floral relationships, and nest provisions. A cladistic analysis of the phylogenetic relationships of Pararhophites with other taxa of long-tongued bees, using characters of nesting biology and of larval and adult anatomy, is presented. Pararhophites probably belongs to the megachilid lineage rather than to the anthophorid/apid line where it has been assigned in the past, and its taxonomy is discussed. D.G. Lowe

Dept. Entomology, Natn. Museum Natural History, Smithsonian Inst., Washington, DC 2

Michel, P. *Development of beekeeping in Pakistan. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7-12 September 1992.* Cardiff, UK; International Bee Research Association. (1994) 156-158 ISBN 0-86098-215-7 [En, Bdo]

Pak-German Apiculture Promotion Project, c/o National Agricultural Research Centre, PO NARC, Islamabad, Pakistan.

Muzaffar, N. *Honeybee - an efficient pollinator.* Progressive Farming (1982) 2 (1) 5-7 [En, B]

Crop pollination by *Apis* species in Pakistan.

Muzaffar, N. *Beekeeping – an income generating cottage industry for rural women in Pakistan. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 313–316 ISBN 0-86098-196-7 [En, Bdo]

Muzaffar, N. *A note on foraging of the occidental bee *Apis mellifera* L. on 'shain' *Plectranthus rugosus* in Pakistan*. *Pakistan Journal of Agricultural Sciences* (1991) 28 (1) 107–108 [En, Bc]

The shrub *Plectranthus rugosus* flowered from August to October 1990 in the Swat area of the Western Himalayas. Honey bee colonies which foraged on *P. rugosus* in the higher hills developed well and produced surplus honey. Yields averaged 7.4–12.9 kg/colony in colonies of various sizes (5–10 frames) in three localities (total, 315 colonies). J. M. Gedye

National Agricultural Research Centre, Islamabad, Pakistan.

Muzaffar, N. *Beekeeping – an income-generating cottage industry for rural women in Pakistan. Honeybees in mountain agriculture [edited by Verma, L. R.]*. New Delhi, India; Oxford & IBH Publishing Co. (1992) 113–117 ISBN 81-204-0650-8 [En, Bdo]

Pakistan Agricultural Research Council, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. *Studies on hornets attacking honeybees in Pakistan*. *Pakistan Journal of Agricultural Research* (1986) 7 (1) 59–63 [En, Bc]

In Pakistan, several vespid species preying on honeybees were captured and identified as *Vespa basalis*, *V. velutina pruthii*, *V. orientalis*, *V. tropica haematodes* and *Vespula germanica*. The first two species caused heavy losses during the forage dearth from July to October, taking adults, brood and honey. *Apis mellifera* was more susceptible to hornet attack than *A. cerana*. Among control methods tested, a trap (2-cm depth of sugar solution in a plastic jar, 12 cm high and with a 5-cm diameter opening) was cheap and effective. *V. velutina* was especially attracted to these traps. Larvae and pupae of this species are attacked by the mite *Pyemotes ventricosus*, but its incidence is very low. P. Walker

Natn. Agric. Res. Centre, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. *Studies on low cost honey bee hives in Pakistan. Bee keeping in the year 2000. Proceedings of the Second Australian and International Beekeeping Congress, Surfers Paradise, Gold Coast, Queensland, Australia, July 21–26, 1988 [edited by Rhodes, J.W.]*. Australia; International Colour Productions Pty. Ltd. for the Federal Council of Australian Apiarists' Associations. (1988) 229–231 ISBN 0-86774-011-6 [En, Bdo]

Brood chambers, shallow supers and outer covers were constructed from various mixtures of clay, wheat straw, mud stone, cement, sand, newspapers, wheat flour, dry agave leaves, rice husks and rice husk ash, mixed with water to form a stiff paste which then hardened. The dimensions of the hive parts approximated to those of

Langstroth hives, and the hives were used successfully for both *Apis cerana* and *A. mellifera*. Five types of frames were made, ranging from simple top-bars from which a triangular piece of wax foundation was suspended, to standard full-depth Langstroth frames with normal sheets of foundation; some of the frames had plastic or cloth sheets coated with wax. Cavities in walls without frames were also tried. The various types of hive boxes and frames are illustrated. Honey production using frames was more successful than using wall cavities. D. G. Lowe
Agric. Res. Council, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. *Distribution and competition of *Apis* spp. in Pakistan. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 449–452 ISBN 0-86098-196-7 [En, Bdo]

A survey of *Apis* species was made in Pakistan and a map showing their distribution is presented. Different species are dominant in different areas and the factors involved are discussed. These include competition for forage and nesting sites, and the ecology and topography of an area. Drones of *A. cerana* are attracted to queens of *A. mellifera* and vice versa, and this causes interference with mating in these species. D. G. Lowe

Pakistan Agric. Res. Council, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. *Insect and plant sources of honeydew honey in Pakistan. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 127–133 ISBN 0-86098-196-7 [En, Bdo]

A survey was made of honeydew-producing insects found on various host plants in different ecological areas of Pakistan. *Apis cerana* was found to collect honeydew produced by 117 species of hemipterous insects on 165 species of plants, and these are listed, with locations where found, in a table. Honeydew honey is thought to form a very small proportion of the honey harvested by beekeepers in Pakistan. D. G. Lowe

Pakistan Agric. Res. Council, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. *Comparative performance of the oriental bee *Apis cerana* F. and the European bee *A. mellifera* L.* *Pakistan Journal of Zoology* (1990) 22 (2) 203–206 [En, Bb]

The performances of 12 colonies of the Margalla strain and 12 of the Swat strain of *A. cerana* and of 12 Italian *A. mellifera* colonies in three areas of Pakistan were compared. A table gives results for 11 behavioural characteristics, which include maximum foraging range (1100, 1250 and 1600 m, respectively, for Marghalla, Swat and Italian bees), swarming and absconding (none in *A. mellifera*), and robbing (much less in *A. mellifera*). Major pests of *A. cerana* were wax moths, and the mites *Acarapis woodi* and *Tropilaelaps clareae*, whereas hornets (*Vespa* spp.) were serious pests of *A. mellifera*. Average honey yields (total of three nectar flows) were 7.6, 9.2 and 29.5 kg/colony, respectively, for Marghalla, Swat and Italian bees. It is concluded that there is scope for expansion of beekeeping with *A.*

mellifera, but that the use of *A. cerana* is more appropriate in areas with large hornet populations. *P. Walker*
Pakistan Agricultural Research Council, NARC, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. Integrated management of the oriental honeybee *Apis cerana* F. in Pakistan. Pakistan Journal of Zoology (1991) 23 (2) 167–168 [En, Bc]
Most beekeepers in Pakistan are still using traditional beekeeping methods and honey yields are lower than their potential levels. In this study three *A. cerana* colonies were kept in Langstroth hives which were moved to different areas with good forage at different times of the year. The colonies were fed as necessary in the period from February to August, each colony receiving a total of 21 litres of sugar syrup (two parts sugar to one part water). Other management methods used included queen replacement, swarming control, and control of pests and diseases. None of the colonies swarmed and average honey yields were 11.3 kg/colony in April and 9.6 kg/colony in October. *P. Walker*
National Agricultural Research Centre, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. Investigations on the seasonal incidence and control of the acarine mite *Acarapis woodi* (Rennie) in *Apis cerana* F. colonies in Pakistan. Pakistan Journal of Zoology (1991) 23 (2) 139–143 [En, Bc]
Of 41 colonies of *Apis cerana* sampled in different areas during September 1985, 44% were infested with *Acarapis woodi* and perished by the end of the following April. Incidence of the mite was higher among colonies kept in hives than in feral colonies. Infestations were low in the spring but high in late summer and autumn. European honey bees (*Apis mellifera*) appeared to have some resistance to the mite. Control trials showed that bromopropylate (Folbex VA) gave good control but re-infestation was a problem. The most effective treatment was to make four applications at 5-day intervals, but this was expensive. *J. M. Gedyé*
National Agricultural Research Centre, Islamabad, Pakistan.

Muzaffar, N. and Ahmad, R. Some honeybee flora for *Apis* spp. in Pakistan. Pakistan Journal of Zoology (1991) 23 (3) 201–218 [En, Bc]
Previous studies have revealed 565 plant species that are foraged by honey bees for pollen, or nectar, or both, in Pakistan. This study was to determine additional sources of nectar and pollen by recording species visited by honey bees in various parts of the country. The flowering periods of the 379 species noted, and their importance as sources of nectar and pollen, are tabulated. The major sources of honey are *Acacia modesta* and *Robinia pseudoacacia* in April, *Trifolium* spp. and *Prosopis* spp. from April to June, *Plectranthus rugosus* from September to October, and *Brassica* spp. from October to February. *J. M. Gedyé*
National Agricultural Research Centre, Islamabad, Pakistan.

Partap, U. and Partap, T. Warning signals from the apple valleys of the Hindu Kush-Himalayas. Productivity concerns and pollination problems. Kathmandu, Nepal; International Centre for Integrated Mountain Development (2002) 104 pp. ISBN 92 9115 605 1 [En, Bd]

This book contains the results of surveys carried out as part of the project to promote the sustainable management of *Apis cerana* and other indigenous bees by mountain communities in order to increase productivity and to conserve biodiversity. The surveys were carried out in apple-producing areas in India (Himachal Pradesh), China (Maonian valley), Pakistan, Bhutan and Nepal. Decreasing yields and quality are due to inadequate pollination, the reasons for which are discussed. Suggestions are made for the type of beekeeping that would improve apple yields in each area. *P. Walker*

Partap, U. Bee flora of the Hindu Kush-Himalayas: inventory and management. Kathmandu, Nepal; International Centre for Integrated Mountain Development (ICIMOD). (1997) xi + 297 pp. ISBN 92-9115-662-0 [En, Bd]
This book is intended to be a practical guide to the main bee forage resources of the Hindu Kush-Himalayan region, for the use of beekeepers, farmers, extension workers and scientists. The book has two sections. The first consists of four chapters, the first of which provides an introduction to the honey bee species and beekeeping of the region (which includes parts of Afghanistan, Bhutan, India, Nepal, Bangladesh, China, Myanmar and Pakistan). The second chapter gives an overview of Himalayan bee forage and assesses its potential as a beekeeping resource. Chapter 3 gives aids to the identification of bee flora, particularly their pollen grains. Chapter 4 focuses on methods of bee forage management; a flowering calendar for the Kathmandu Valley is provided. The second section of the book (pp. 61–226) describes 237 of the most promising honey plants in the Hindu Kush-Himalayas area, including species which provide surplus honey, those which are useful during colony build-up and those which support colonies during dearth periods. The plants are arranged in five groups: agricultural crops, horticultural crops, forage legumes, ornamental plants, wild plants and forest trees. Plants in each group are arranged according to their importance in honey production, and details are provided on distribution, morphology, flowering period, honey characteristics and pollen grain structure; over 120 colour plates illustrate the form and habit of the plants. Sources of honeydew honey and species which secrete nectar toxic to bees or man are also listed. The four annexes comprise a general inventory of 366 species of bee flora of the region, a glossary of technical terms, a key for the identification of 279 pollen types and a list of multipurpose plants which could be grown in plantations, on common land and on roadsides. There is also a bibliography of 160 references and a subject index. This will be a valuable reference work for all those interested in beekeeping in the region. *D. G. Lowe*

Rahoo, G. M., Lohar, M. K., Munshi, G. H. and Nizamani, S. M. The insect pollinators of sunflower, *Helianthus annuus* L., in Sind, Pakistan. Pakistan Journal of Agriculture, Agricultural Engineering, Veterinary Sciences (1985) 1 (2/4) 79–80 [En, Bc]
Insects were sampled on sunflower crops in October–March in Sind, Pakistan. Those carrying *H. annuus* pollen grains on their bodies were assessed as pollinators. All of the 525 insects identified were *Hymenoptera* (mainly bees), including 225 *Apis florea*. Of the other 13 species caught,

only *Xylocopa rufescens* and *X. fenestra* were common. Foraging activity by pollinators was at its peak at around midday. D. G. Lowe
Dept. Entomology, Sind Agric. Univ., Tandojam, Pakistan.

Rathore, M. S. and Verma, L. R. Economics of beekeeping in Hindu Kush-Himalayan (HK-H) region. Honeybees in mountain agriculture [edited by Verma, L. R.]. New Delhi, India; Oxford & IBH Publishing Co. (1992) 221–233 ISBN 81-204-0650-8 [En, Bdo]

The economics of beekeeping are discussed, using previously published figures for Bangladesh, Pakistan, Himachal Pradesh (India) and Nepal. D. G. Lowe
International Centre for Integrated Mountain Development, Kathmandu, Nepal.

Ruttner, F., Woyke, J. and Koeniger, N. Reproduction in *Apis cerana*. 2. Reproductive organs and natural insemination. *Journal of Apicultural Research* (1973) 12 (1) 21–34 [En, B]
The morphology of the genitalia, and the mating behaviour of *Apis cerana indica* from Peshawar, Pakistan, are described. The morphology of the vagina of the *A. cerana* queen, in particular the open valvifold, makes instrumental insemination easier than in *A. mellifera*. In the drone, both the quantity of semen and the concentration of spermatozoa in it are lower than in *A. mellifera*. In the seminal vesicles about 1.5 million spermatozoa were found per drone, and in the ejaculated fluid about 1.0 million per drone. One queen, dissected immediately after a second mating flight, had a quantity of semen in the oviducts corresponding to that from 14 drones, so on both flights together this queen may have mated with some 30 drones. A mating sign was observed on newly mated queens, but it lacked the chitinized plates found in *A. mellifera*. It is concluded that, to ensure full insemination, *A. cerana* queens must mate with more drones than is necessary for *A. mellifera* queens. Evolutionary trends in the genus *Apis* are discussed. Author
Inst. für Bienenkunde, 637 Oberursel (Taunus), Im Rosengärtchen, Germany.

Schmitt, M. Mohamed Ali and his bees: impressions of a Pakistan bee-farm. [Mohamed Ali und seine Bienen: Eindrücke von einer pakistanischen 'bee farm']. *Imkerfreund* (1974) 29 (9) 338–340 [De, B]

Schneider, P. and Kloft, W. Observations on group defensive behaviour in the eastern honeybee. [Beobachtungen zum Gruppenverteidigungsverhalten der Ostlichen Honigbiene *Apis cerana* Fabr.]. *Zeitschrift für Tierpsychologie* (1971) 29 (4) 337–342 [De, en, B]

Films were made of wild *Apis cerana* in Afghanistan and Pakistan, and of *A. cerana* in hives. When a flying hornet enemy appeared, the guard bees formed into groups of about 30 and moved on the ground in the same direction as the hornet. As the latter approached, each bee opened its wings, rocked its head forward, threw its abdomen upwards, and then rocked the whole body, each swing taking 0.17–0.28 seconds. Sounds (270–298 cycles/second, lasting 0.03–0.07 seconds) were recorded when dummy hornets were used. P. Walker

Inst. Angewandte Zoologie, 53 Bonn, An der Immenburg 1, Germany.

Shafi, M. Pest and disease records. Pakistan. A new mite pest of hive bees. *Quarterly Newsletter, Asia and Pacific Plant Protection Commission* (1986) 29 (3) 31 [En]
Neocyphophthalmus indica was found feeding on *Apis cerana* larvae and pollen.

Shah, F. H. and Muhmud, B. A. Quality evaluation of indigenous [Pakistan] honey. *Pakistan Journal of Scientific and Industrial Research* (1987) 30 (7) 551–552 [En]
Of 25 samples analysed, 13 failed to meet the standard specifications.

Shahid, M. Beekeeping in the North West Frontier Province of Pakistan. Honeybees in mountain agriculture [edited by Verma, L. R.]. New Delhi, India; Oxford & IBH Publishing Co. (1992) 193–209 ISBN 81-204-0650-8 [En, Bdo]

Includes a table of 109 bee forage plants.
Department of Entomology, NWFP Agricultural University, Peshawar, Pakistan.

Shahid, M. and Qayyum, A. Bee flora of the N.W.F.P. *Pakistan Journal of Forestry* (1977) 27 (1) 1–10 [En, B]
This list of plants that yield nectar and/or pollen consists of 13 major sources and 109 minor sources growing in the North-West Frontier Province of Pakistan. For each plant the following details are given: common and scientific names, family, distribution, whether nectar or pollen source, flowering period. Major nectar flows come from *Trifolium* spp., *Plectranthus rugosus*, *Eriobotrya japonica*, *Brassica campestris*, *Acacia modesta* and *Dalbergia sissoo*; migration of colonies can give higher honey yields. P. Walker
Dept. Entomology, Fac. Agric., Univ. Peshawar, Peshawar, Pakistan.

Siddiqi, M. R. and Wilson, T. K. Pollen of the genus *Knema* (Myristicaceae). *Pakistan Journal of Botany* (1975) 7 (2) 197–200 [En]

Soomro, A. H., Khuhro, R. D. and Ansari, H. U. Status of insects associated with mango blossom. Proceedings of the 5th Pakistan Congress of Zoology, University of Karachi, January 8–11, 1986. Karachi, Pakistan; Zoological Society of Pakistan. (1987) 123–125 [En]
Pollinating insects included several species of bees, flies and ants.

Syed, I. H. Morphological studies of the larva of *Apis dorsata*. *Pakistan Journal of Zoology* (1972) 4 69–71 [En, X]

Verhagen, R. Apicultural notes in Pakistan 1971. *South African Bee Journal* (1972) 44 (4) 13–18 [En, B]

Verma, L. R. Beekeeping in integrated mountain development. Edinburgh, UK; Aspect Publications with support from the International Centre for Integrated Mountain Development. (1991) xvi + 367 pp. ISBN 1-85529-088-X [En, Bd]

This book covers frame-hive beekeeping as a feature of rural development in the Hindu Kush and Himalayan region of Asia; the region includes mountainous parts of Burma, Pakistan, India, Nepal, Bangladesh, Bhutan and China. The first part of the book is intended to make plan-

ners and other experts aware of the importance of bee-keeping in the region, and the second part provides information on bees and beekeeping for specialists more directly concerned. Its main content is a study of the present situation, but there are also some recommendations for the future. It is science-oriented, with an extensive compilation of data on morphological and other characteristics of *Apis cerana*, many resulting from the author's own work. The book sets out the status and economics of mountain beekeeping with *A. cerana* and/or introduced *A. mellifera* in the countries concerned. It also refers in passing to other Asiatic *Apis* species, to traditional beekeeping and the use of top-bar hives, and to mountain regions in other continents. Species and genera of honey plants are listed under their botanical families, with information on flowering period, distribution, and value as a nectar/pollen source. The use of *A. cerana* and other insects in crop pollination is covered, with special attention to apple and some reference to the effects of altitude. The book contains a reference section of about 650 publications and general and scientific name indexes. It should be a useful source of information for those concerned with assessing and developing beekeeping in the Hindu Kush and Himalayan region. *E. Crane*
International Centre for Integrated Mountain Development, G.P.O. Box 3226, Kathmandu, Nepal.

Wali-ur-Rehman. *Beeflora at Peshawar*. *Pakistan Journal of Forestry* (97) 47 (1/4) 53–58 [En, 3 ref.]

In a survey of bee plants at the Pakistan Forest Institute and in neighbouring areas, 130 species were recorded: 39 species of forest trees, 12 of fruit trees, 28 of ornamentals, 13 of agricultural crops and vegetables, and 38 of annual herbs. A table gives flowering period for each species, and value as a nectar and/or pollen source. Major sources include *Acacia modesta*, three *Eucalyptus* species, *Olea cuspidata* [*O. europaea* subsp. *cuspidata*], *Prosopis chilensis*, *Swietenia mahagoni*, *Xylosma longifolium* and *Ziziphus mauritiana* (all forest trees), *Eriobotrya japonica* (a fruit tree), *Amorpha fruticosa*, *Citrus acida* [?] and *Spiraea cantoniensis* (ornamentals) and *Brassica campestris* (crop). Six tree species were the major sources of nectar and pollen with long flowering periods (2–4 months), and are recommended for mass planting for the development of beekeeping in Pakistan.

Pakistan Forest Inst., Peshawar, Pakistan.

Wali-ur-Rahman, M.I.C. *Bee-foraging plants at Peshawar, Pakistan*. *Pakistan Journal of Forestry* (1985) 35 (2) 71–76 [En]

Ninety bee forage plants from among the forest and fruit trees, ornamentals and agricultural crops serving as major and minor sources of nectar and pollen were recorded at the campus of the Pakistan Forest Institute, Peshawar. A foraging calendar was prepared showing both major and minor sources of nectar and pollen and their blooming periods. *Eucalyptus camaldulensis*, *E. ochrophylla*, *E. tereticornis*, *E. pilularis*, *E. fruticetorum*, *E. microtheca*, *E. rudis*, *Eriobotrya japonica*, *Acacia modesta*, *Dombeya acutangula* out of major sources and *Callistemon citrinus*, *Tecoma stans*, *Holmskioldia* sp. out of minor sources have long blossoming periods and are suitable for planting to increase bee forage. *Author*

Pakistan Forest Inst., Peshawar, Pakistan.

Wali-ur-Rehman and Chaudhry, M.I. *Efficacy of microbial insecticides against wax moth, Galleria mellonella* (L.). *Pakistan Journal of Zoology* (1980) 12 (1) 148–150 [En, B]

Bactospeine (B) and Dipel (D) are preparations containing 16,000 IU *Bacillus thuringiensis*/mg. *G. mellonella* larvae were reared on crushed beeswax containing 0.2 or 0.5 g B or D per 10g wax; with B, larval mortality was 78.3% and 100%, and with D, 40% and 53.3%, respectively. When the preparations were dissolved in water and applied as sprays to larvae on comb foundation, mortality levels with B were 95% and 100%, but with D only 20% and 30%, respectively. It is concluded that wax moth larvae might be controlled by putting in the hive (on the bottom board) a mixture of B and crushed wax. *P. Walker*

Pakistan Forest Inst., Peshawar, Pakistan.

White, K.J. *Dalbergia sissoo* (Roxb.): an annotated bibliography. Bangkok, Thailand; Winrock International Institute for Agricultural Development. (1990) xix + 120 pp. ISBN 974-7315-33-5 [En, Bd]

D. sissoo is widely used in forest plantations in Pakistan, India and Nepal, and is extensively grown by small-scale farmers for wood, fuel and fodder. This bibliography gives references, most with abstracts, to 382 publications. The 20-page index is based on the Oxford system of decimal classification. *D. sissoo* has some value as a source of honey and there are eight entries on this aspect. *D.G. Lowe*

Papua New Guinea

New Zealand Beekeeper. *Beekeeping in Papua New Guinea.* *New Zealand Beekeeper* (1985) (No. 188) 28 [En, B]

AQIS Bulletin. *Might be bee mites.* *AQIS Bulletin* (1995) 8 (1) 9 [En, Bj]

Varroa (*Varroa jacobsoni*) has been detected in feral colonies of the Asian honey bee *Apis cerana* on Dauan Island, in the far north of the Torres Strait adjacent to Papua New Guinea. This island and the neighbouring Saibai and Boigu Islands, all Australian territory, have been declared an infected zone. The remaining Australian islands in the Torres Strait (which is c. 150 km across) have been declared a surveillance zone, monitored by the Australian Quarantine and Inspection Service. The Australian mainland remains free of both *V. jacobsoni* and *A. cerana*. A. G. Matheson

Anderson, D. L. and Fuchs, S. *Two genetically distinct populations of Varroa jacobsoni with contrasting reproductive abilities on Apis mellifera.* *Journal of Apicultural Research* (98) 37 (2) 69–78 [En, Bj]

Australian-reared *A. mellifera* sister queens were transported to Germany and Papua New Guinea and established in colonies infested with *Varroa jacobsoni*. Female mites in Germany readily reproduced on their brood whereas in Papua New Guinea they did not. The observations indicated that the cause of the reported inability of female *V. jacobsoni* to reproduce on *A. mellifera* in Papua New Guinea does not rest with the resident *A. mellifera* population. DNA sequences of a 454 base-pair region of the cytochrome oxidase subunit 1 (CO1) gene obtained from reproducing *V. jacobsoni* collected from *A. mellifera* colonies in Germany differed by 6.8% from similar sequences obtained from non-reproducing *V. jacobsoni* from *A. mellifera* colonies in Papua New Guinea. The presence of a Xho I restriction endonuclease (RE) site in the German but not in Papua New Guinea sequences, and a Sac I RE site in the Papua New Guinea but not in the German sequences, allowed for the rapid identification of individual mites of the German (GER) and Papua New Guinea (PGN) genotypes. Further studies confirmed that non-reproducing female *V. jacobsoni* that were the only *V. jacobsoni* present in *A. mellifera* colonies in Java, Indonesia, prior to 1993 were of the PNG genotype. However, reproducing female *V. jacobsoni* that suddenly appeared in *A. mellifera* colonies in Java in 1993 were of the GER genotype. Following 1993, reproducing mites of the GER genotype and non-reproducing mites of the PNG genotype were detected in a single *A. mellifera* colony in Java and in another single colony in another region of Indonesia. The results demonstrate that differences in genotype can explain observed differences and changes in the virulence of *V. jacobsoni* towards *A. mellifera*.

CSIRO Division of Entomology, PO Box 1700, Canberra, ACT 2601, Australia.

Anderson, D. *The disease and pest situation in the Pacific region; the threat of exotic diseases and pests from Papua*

New Guinea; diseases and disorders of queen bees. *Australasian Beekeeper* (1990) 92 (6) 227–231 [En, Bj]

The situation in each of the following is summarised briefly: Fiji, Norfolk Island, Western Samoa and New Zealand. In Papua New Guinea (PNG), beekeeping in the Highland region has been developed with aid from New Zealand, and over 200 beekeepers now have 4000 *Apis mellifera* colonies in hives. However, this beekeeping is threatened by the continuing spread of *A. cerana* swarms (55–100 km/yr) which are infected with AFB and Kashmir bee virus. These pathogens have not previously been reported in PNG. The swarms are also infested with *Varroa jacobsoni* and possibly low numbers of *Tropilaelaps clareae*. The likely future directions of spread of *A. cerana* are suggested; if they reached Australia, the situation would be very serious. The last part of this article discusses research, just started, on diseases and disorders of *Apis mellifera* queens. P. Walker

Division of Entomology, CSIRO, Canberra, ACT 2601, Australia.

Anderson, D. L. *Mites and pathogens of the European honey bee Apis mellifera and the Eastern hive bee Apis cerana in Papua New Guinea.* Auckland, New Zealand; DSIR, Entomology Division. (1989) v + 76 pp. [En, Bdo]

This is a report of a survey which involved field observations, and also laboratory tests on samples of bees (larvae, pupae, adults) from 91 hived *A. mellifera* colonies and 10 feral *A. cerana* colonies. In *A. mellifera*, Nosema apis was found in 28% of colonies, the average infection being 6 x 10⁵ spores/bee. Bacillus larvae was found in one colony at one site (first report of AFB in Papua New Guinea), but Melissococcus pluton was not detected. No cases of chalk brood were found. Sacbrood virus was the commonest virus detected, followed by black queen cell virus. The other two viruses detected (chronic bee paralysis virus and Kashmir bee virus) were present in only a few colonies. *Varroa jacobsoni* was found in three colonies at one site, and in two at another. *Tropilaelaps clareae* was found in three colonies, but *Acarapis woodi* was not detected. In *A. cerana* colonies, *N. apis*, chalk brood, EFB, *A. woodi* and *T. clareae* were not detected, nor were any known viruses of *A. mellifera*, but all the colonies were heavily infested with *V. jacobsoni* and Kashmir bee virus was common. The study also revealed that *A. cerana* has spread from its original introduction site (Vanimo), and the threat to commercial beekeeping because of the spread of *V. jacobsoni* is discussed. A training programme for beekeepers and the introduction of control methods against *Varroa* are recommended. D. G. Lowe

Entomology Div., DSIR, Private Bag, Auckland, New Zealand.

Anderson, D. L. *Non-reproduction of Varroa jacobsoni in Apis mellifera colonies in Papua New Guinea and Indonesia.* *Apidologie* (1994) 25 (4) 412–421 [En, fr\de, Bj]

Mite incidence and reproduction were determined in colonies of *A. cerana* and *A. mellifera* in Papua New Guinea,

Irian Jaya and Java. At each locality and in colonies of each bee species, adult female mites were present in capped brood cells, with proportionally more drone than worker brood cells infested. In the *A. cerana* colonies, female mites reproduced only in capped drone brood cells. In *A. mellifera* colonies, there was no evidence of successful mite reproduction on either worker or drone brood. Although not reproducing in *A. mellifera* colonies, adult female mites were nevertheless feeding and surviving; they must have spread from nearby *A. cerana* colonies. There was no evidence that the mites' inability to reproduce in *A. mellifera* colonies resulted from extremely slow reproduction, interspecific competition between *V. jacobsoni* and *Tropilaelaps clareae*, resistant bee populations, or climatic conditions. These results have implications for finding and developing novel means of controlling *V. jacobsoni* in localities where the mite has become a serious pest of *A. mellifera*. Author CSIRO Division of Entomology, Black Mountain, PO Box 1700, Canberra, ACT 2601, Australia.

Anderson, D. L., Halliday, R. B. and Otis, G. W. The occurrence of *Varroa underwoodi* (Acarina: Varroidae) in Papua New Guinea and Indonesia. *Apidologie* (1997) 28 (3/4) 143–147 [En, fr\de, Bj]

Female *V. underwoodi* were collected from sealed drone cells in *Apis cerana* colonies in Papua New Guinea (PNG), and in the Indonesian provinces/islands of Java, Sulawesi, Irian Jaya, Biak and Yapen. Gravid female mites were also found in *A. nigrocincta* colonies in Sulawesi. Adult female *V. underwoodi*, showing no signs of reproduction, were collected from capped worker cells in *A. mellifera* colonies in PNG. On the basis of morphological structures, the adult female *V. underwoodi* from PNG were indistinguishable from those described from other localities.

CSIRO Division of Entomology, GPO Box 1700, Canberra, ACT 2601, Australia.

40 LIB Australian Quarantine and Inspection Service. The threat to Australia from exotic bee mites. *AQIS Bulletin* (1991) 4 (2, Supplement) 4 pp. [En, Bc]

Clinch, P. G. Nosema apis and mites in honeybee colonies in Papua New Guinea. *Journal of Apicultural Research* (1979) 18 (4) 298–301 [En, B]

Colonies of *Apis mellifera* in a beekeeping project in Papua New Guinea were surveyed in November 1977, to determine the prevalence of *Nosema apis* and mite infestation. Bees in samples from 47% of 403 colonies of *Apis mellifera* contained *Nosema apis* spores, but only four colonies showed more than 5×10^6 spores per bee. Approximately 30,000 bees from 424 colonies were screened for mites, and *Acarapis externus*, *A. dorsalis* and *Neocypholaelaps africana* were identified; none has previously been recorded in Papua New Guinea. No mite species believed to be of danger to honeybees was found. Author Wallaceville Animal Res. Centre, Res. Div., Min. Agric. and Fisheries, PB, Upper Hutt, New Zealand.

Dawson, C. Beekeeping conference at Banz, Papua New Guinea. *New Zealand Beekeeper* (1975) 37 (3) 56–58 [En, B]

Delfinado-Baker, M. and Aggarwal, K. Infestation of *Tropilaelaps clareae* and *Varroa jacobsoni* in *Apis mellifera ligustica* colonies in Papua New Guinea. *American Bee Journal* (1987) 127 (6) 443 [En, Bj]

Approximately 200–300 *Varroa jacobsoni* and 150 *Tropilaelaps clareae* were found in each of eight colonies examined in Vanimo, Papua New Guinea. Drone cells contained a maximum of two *V. jacobsoni*, whereas up to six *T. clareae* were found on a single worker pupa. *Apis cerana*, which was probably first introduced to the country in 1985, is now well established in Vanimo, but this species is less affected than *A. mellifera* by these two mites. It is now known that *T. clareae* infests all five species of *Apis* in south-east Asia: *mellifera*, *cerana*, *dorsata*, *laboriosa* and *floreana*. P. Walker Beneficial Insects Lab., USDA, Beltsville, MD 20705, USA.

Dunn, K. J. Exotic Asian bee detected in Torres Strait. *Bee Briefs* (1992/1993) 9 (2/3) 18–19 [En, Bj]

The eastern honey bee *Apis cerana*, present in Papua New Guinea since at least 1987, was in February 1993 found on two Australian islands in Torres Straits. No parasitic mites (*Varroa jacobsoni* or *Tropilaelaps clareae*) were found in a sample of 13 bees taken from one swarm, but the movement of *A. cerana* to this area is considered to pose a real risk of spreading parasitic mites. Australian quarantine measures in the area have been strengthened. A. G. Matheson

Erskine, W. Measurements of the cross-pollination of winged bean in Papua New Guinea. *SABRAO Journal* (1980) 12 (1) 11–13 [En, B]

Cross-pollination of *Psophocarpus tetragonolobus* in four environments was measured by growing alternate rows of green- and purple-stemmed plants, and growing on the seed from the green-stemmed genotypes. The highest rate of cross-pollination (7.6%) was found in plants grown in the wet season at a lowland site, and was due to the activity of carpenter bees, *Xylocopa aruana*. At the other sites, cross-pollination was less than 1%. It is suggested that cross-pollination might have been higher if the flowers of the two genotypes had been the same colour. J. M. Gedy Fac. Agric., Univ. Papua New Guinea, Papua New Guinea.

Hirashima, Y. Bees of the genus *Palaeorhiza* Perkins (Hymenoptera, Colletidae) of Papua New Guinea collected by the Kyushu University expedition, I. *Esakia* (1988) (No. 26) 5–19 [En, Bj]

Hirashima, Y. and Lieftinck, M. A. Systematic studies on the genus *Palaeorhiza* of New Guinea collected by the third Archbold Expedition (II) (Hymenoptera, Colletidae). *Esakia* (1983) (No. 20) 93–129 [En, B]

Hirashima, Y. and Roberts, H. Bees of the genus *Palaeorhiza* Perkins (Hymenoptera, Colletidae) in the National Forest Insect Collection of the Forest Research Station, Bulolo, Papua New Guinea (I). *Esakia* (1984) (No. 22) 115–128 [En, B]

Hirashima, Y. and Roberts, H. Discovery of the bee genus *Pharohylaeus* Michener from Papua New Guinea, with description of a new species (Hymenoptera, Colletidae). *Esakia* (1986) (No. 24) 63–66 [En, B]

- Hirashima, Y. and Tadauchi, O. *Two new species of Prosopisteroidea from Papua New Guinea (Hymenoptera, Colletidae, Hylaeus)*. *Esakia* (1984) (No. 21) 59–65 [En, B]
Two new species of the subgenus *Prosopisteroidea* of the genus *Hylaeus*, *margaretae* and *paradisicola*, are described.
- Howcroft, N.H.S. *Reproductive biology of Spathoglottis (Orchidaceae)*. *Science in New Guinea* (1996) 21 (3) 159–175 [En, Bb]
Studies of the reproductive behaviour of *Spathoglottis* species in Papua New Guinea showed that despite the occurrence of both cleistogamous and chasmogamous forms within a species complex, all flowers are basically developed for insect pollination. Although the full sequence of pollination of *Spathoglottis* species was not observed, the evidence collected suggested that *Amegilla cingulata*, a solitary bee, is the most likely pollinator and is attracted by deceit to the callus of the flower which resembles a pollen mass. The present evidence also suggests that, because this species of bee is not found above 1600 m, other pollinators may exist beyond this level to the altitudinal limit of *Spathoglottis* (3370 m).
Papua New Guinea Forest Research Institute, PO Box 314, Lae, Papua New Guinea.
- Kidd, L.J. *Introduction and spread of honeybees in mainland Papua New Guinea. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) 127–136 [En, B]
This paper follows earlier reports by Michener. The introduction and spread of *Apis mellifera* on the island is described. This species has shown its ability to adapt to a wide range of habitats, and wild colonies nest in trees, holes in the ground, and in roofs and walls of buildings. Honey is taken from wild colonies, and up to 18 kg can be extracted from one colony. Until recently, domestic colonies were kept mainly by expatriates, but in the early 1970s trials were set up to examine the feasibility of a commercial beekeeping programme. Recently the Papua New Guinea and New Zealand governments have established a bilateral programme of research into beekeeping potential. Trials are based at Goroka, which seemed particularly promising and where there were colonies already; there are now 500 colonies there and others at Port Moresby on the coast. If trials are successful, it might be possible to extend beekeeping to villages, and eventually to reduce the country's honey imports. P. Walker
Dept. Geography, Univ. Papua New Guinea, Papua New Guinea.
- Michener, C.D. *The large species of Homalictus and related Halictinae from the New Guinea area (Hymenoptera, Apoidea)*. *American Museum Novitates* (1980) (No. 2693) 1–21 [En, B]
- Mopafi, I. *Beekeeping development in Papua New Guinea. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 189–191 ISBN 0-86098-196-7 [En, Bdo]
- Pauly, A. *Bees of the subfamily Halictinae in New Guinea and in the Bismarck Archipelago. [Les abeilles de la sous-famille des Halictinae en Nouvelle-Guinée et dans l'Archipel Bismarck (Hymenoptera: Apoidea: Halictidae)]*. *Zoologische Verhandlungen* (1986) (No. 227) 58 pp. [Fr, Bb]
- Shield, J. Lee, and Buick, T. *Potential for migration of Asian honeybee, Apis cerana, from Lae, Papua New Guinea, to Australia – options for minimising the risk*. *Australasian Beekeeper* (2000) 102 (2) 51–53 [En, Bj]
The risk of *A. cerana* entering Australia on ships coming from the port of Lae are examined. The possibility of minimising the risk either in Lae or in ships at sea is examined. The former option is recommended, and in particular any cargo likely to attract bees should be treated with a chemical deterrent. P. Walker
Dept of Primary Industries, Cairns, Qld, Australia.
- Spencer, R. *Appropriate technology: a bush-material bee-hive*. *American Bee Journal* (1988) 128 (11) 743–744, 764 [En, Bj]
The author, working on a nutrition programme in a remote area of Papua New Guinea, made some top-bar hives using local materials: green bamboo and split bamboo for the framework; stalks of *Saccharum spontaneum* (flattened and woven, or just straight stalks), or bamboo, for the hive walls; split bamboo sections for the top-bars with small bamboo stalks inserted as comb supports. A covering of sheet plastic kept out rain. Top-bars up to 40 mm wide were quite satisfactory with the European races of bees used, which have now been in the hives for about a year. P. Walker
- Spencer, R.A. *An appropriate technology beehive of sheet plastic*. *American Bee Journal* (1991) 131 (2) 99–100 [En, Bj]
This simple top-bar hive is cheap and easy to make. The framework consists of two parallel horizontal rails, about 100 cm long and 47 cm apart, supported by four vertical stakes set in the ground. Both rails and stakes should be very sturdy; stakes should be greased if ants are troublesome. Thick sheet plastic (c. 100 x 193 cm) is draped loosely over the rails and allowed to hang down between them to form the body of the hive, which thus has a curved cross-section. Top-bars are placed across the top, primed with wax underneath and, if desired, with dowels hanging down to support the comb. End-walls can be omitted as the hive can be used only in warm tropical areas, but end-walls of bamboo slats are beneficial. The hive has been used successfully with European honeybees in Hawaii and in the highlands of Papua New Guinea. In hot areas, the lack of insulation may allow the colony to overheat; it is not known whether sheet plastic hives are suitable for African races of honeybees. P. Walker
P. O. Box 1330, Kapaa, HI 96746, USA.
- Stace, P. *Observations on the Asian bee, Apis cerana, in the Rego area of Papua New Guinea*. *Australasian Beekeeper* (99) 101 (4) 149 [En, Bj]
During a feasibility study on *A. mellifera* (M) honey production in an area south-east of Port Moresby, some observations were made on *A. cerana* (C). C foraged actively on the same flowers as M and, even near an M apiary, C bees out-

numbered *M*. The local people regarded *C* as a nuisance and did not harvest honey from their nests. Honey yields of 10–15 kg/yr have been obtained from *M* colonies, and it is concluded that the two species can survive in the same area. No varroa mites were detected when colonies of both species were examined. *P. Walker*

Stone, G.N., Amos, J.N., Stone, T.F., Knight, R.L., Gay, H. and Parrott, F. *Thermal effects on activity patterns and behavioural switching in a concourse of foragers on Stachytarpheta mutabilis (Verbenaceae) in Papua New Guinea.* *Oecologia* (1988) 77 56–63 [En, Bc]

The foraging activities of the solitary bee *Amegilla sapiens* and of two butterfly species were observed on this shrub. *A. sapiens* foraged in the morning and late afternoon when temperature was below the daily maximum. Choice of patch of plants was determined by ambient temperature, and also nectar supply. At high temperatures, even if nectar was plentiful, *A. sapiens* ceased foraging and showed territorial and courtship behaviour. *P. Walker*
Department of Zoology, Oxford University, South Parks Road, Oxford, UK.

Stone, G.N. and Willmer, P.G. *Pollination of cardamom in Papua New Guinea.* *Journal of Apicultural Research* (1989) 28 (4) 228–237 [En, Bb]

This study assessed the role of two local wild bee populations (*Apis mellifera* and *Amegilla sapiens*) in the pollination of cardamom (*Elettaria cardamomum*) at two sites in highland Papua New Guinea in September and October 1987. Study of the foraging behaviour of both species indicated that, although less abundant than *A. m. mellifera*, *A. sapiens* was far more important as a pollinator than its relatively low numbers would suggest. Measurement of flight activity of both species throughout the day indicated that application of pesticides to cardamom crops should be carried out as late as possible in the day to minimise damage to pollinator populations. *Author*
Dept. Zoology, Univ Oxford, South Parks Rd., Oxford OX1 3PS, UK.

Sutherland, J.A. and Bull, P.B. *Pollination and fruit set in two species of pumpkin in lowland Papua New Guinea.* *Papua New Guinea Journal of Agriculture, Forestry and Fisheries* (1985) 33 (3/4) 143–147 [En, Bb]

Honeybees (*Apis mellifera*) and halictid bees (*Lasioglossum* sp.) were observed visiting two species of pumpkin (*Cucurbita moschata* and *C. maxima*) in lowland Papua New

Guinea, and it is assumed that they acted as pollinators. The numbers of bees visiting open female flowers of *C. moschata* was significantly higher for flowers which later developed into fruits. Although planted in adjacent plots and available to the same populations of bees, very few *C. maxima* flowers developed into fruits; female flower bud loss was the cause of low yields in this species. Hand pollination caused an apparent slight increase in yield for *C. maxima*. It is concluded that the failure of *C. maxima* to fruit satisfactorily was due to physiological factors and not to a lack of insect pollinators. *D.G. Lowe*
Bubia Agric. Res. Centre, P.O.Box 73, Lae, Papua New Guinea.

Swincer, J.C. *Honey bees. Liklik Buk [a rural development handbook/catalogue for Papua New Guinea].* Lae, Papua New Guinea; Liklik Buk Information Centre. (1977) 89 [En]

Walton, G.M. *Beekeeping development programmes in the tropical and subtropical Pacific. Apiculture in tropical climates, editor E. Crane.* London, UK; International Bee Research Association. (1976) 159–164 [En, B]

The area dealt with is perhaps the least well known of all from the point of view of beekeeping development. The report covers New Zealand aid programmes in Papua New Guinea, Niue, Tonga, Gilbert Islands, Western Samoa; other aid projects in Rarotonga and Fiji; beekeeping activities in the Hawaiian Islands, American Samoa, French Polynesia, Micronesia, New Caledonia, Wake Island. *E.E. Crane*
Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

Willmer, P.G. and Stone, G.N. *Incidence of entomophilous pollination of lowland coffee (Coffea canephora); the role of leafcutter bees in Papua New Guinea.* *Entomologia Experimentalis et Applicata* (1989) 50 (2) 113–124 [En]

C. canephora has been reported in the literature as primarily wind-pollinated, but observations made in Papua New Guinea suggest that it is pollinated primarily by bees and flies. The most important and frequent visitor to *C. canephora* flowers was *Creightonella frontalis*, a solitary bee species that nests within coffee plantations. The activity patterns and nesting biology of this bee were closely connected with the success of the coffee bushes, and measures to improve pollination are suggested. *Author*
Dept. Biology, University of St. Andrews, Bute Building, St. Andrews, Fife KY16 9TS, UK.

St Kitts and Nevis

Inter-American Institute for Cooperation on Agriculture. Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992. Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]

The first section of the Proceedings gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados, Dominica,

Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agro-forestry and environmental protection in the Caribbean. *D.G. Lowe*

IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia.

Crane, E. *Early honey production in St. Kitts and Nevis. Nevis Historical and Conservation Society Newsletter* (1989) 15 (March) 4–7 [En, Bc]

Historical records concerning the introduction of honeybees to St. Kitts and Nevis are described and discussed. Early references to stingless bees are also mentioned. *D. G. Lowe*

Woodside House, Woodside Hill, Gerrards Cross, Bucks. SL9 9TE, UK.

Henderson, J. Q. *Beekeeping the Nevis way.* London, UK; Voluntary Service Overseas. (1992?) (Ed. 2) 38 pp. [En, Bdo]

Mulzac, H. C. *Beekeeping on St. Kitts and Nevis. American Bee Journal* (1989) 129 (5) 315–317 [En, Bj]

Includes a list of nectar plants.

St Lucia

Duggan, R. M. *Bees and their predators in far-away places.* Teddington, UK; Central Association of Bee-Keepers (2000) 11 pp. [En, Ba]

The natural hazards and predators present in four Caribbean islands and three islands in the Indian Ocean are described.

St Vincent and the Grenadines

Inter-American Institute for Cooperation on Agriculture. Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992. Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]

The first section of the Proceedings gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados, Dominica, Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia,

St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agroforestry and environmental protection in the Caribbean.

D. G. Lowe

IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia.

Samoa

Food and Agriculture Organization of the United Nations. Proceedings of the Expert Consultation on Beekeeping with *Apis mellifera* in Tropical and Sub-Tropical Asia, Bangkok/Chiang Mai, Thailand, 9–14 April 1984. Rome, Italy; Food and Agriculture Organization of the United Nations. (1984) v + 250 pp. [En, B]

The proceedings include nine technical papers on various aspects of beekeeping in Asia, including: constraints caused by parasitic mites; bee forage; pollination; honey production; beekeeping in rural economies. Of these papers, four are abstracted or listed individually in *Apicultural Abstracts*. There are also 'status reports' for the following: Afghanistan, Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Western Samoa. The proceedings also contain a list of participants, list of apiaries visited, and the resolutions of the meeting. *D. G. Lowe*

Anderson, D. *The disease and pest situation in the Pacific region; the threat of exotic diseases and pests from Papua New Guinea; diseases and disorders of queen bees.* *Australasian Beekeeper* (1990) 92 (6) 227–231 [En, Bj]

The situation in each of the following is summarised

briefly: Fiji, Norfolk Island, Western Samoa and New Zealand. In Papua New Guinea (PNG), beekeeping in the Highland region has been developed with aid from New Zealand, and over 200 beekeepers now have 4000 *Apis mellifera* colonies in hives. However, this beekeeping is threatened by the continuing spread of *A. cerana* swarms (55–100 km/yr) which are infected with AFB and Kashmir bee virus. These pathogens have not previously been reported in PNG. The swarms are also infested with *Varroa jacobsoni* and possibly low numbers of *Tropilaelaps clareae*. The likely future directions of spread of *A. cerana* are suggested; if they reached Australia, the situation would be very serious. The last part of this article discusses research, just started, on diseases and disorders of *Apis mellifera* queens. *P. Walker*

Division of Entomology, CSIRO, Canberra, ACT 2601, Australia.

Epila-Otara, J. S. *Foraging behavior of honeybees (Hymenoptera: Apidae) on *Jatropha integerima* (Euphorbiaceae) in Upolu, Western Samoa.* *Micronesica* (1993) 26 (1) 83–94 [En, Bb]

Apis mellifera foragers were observed on the flowers of this

plant, which are monoecious. Most bees (90%) foraged for nectar, and some collected pollen. From a distance, bees did not distinguish between staminate and pistillate flowers but, when closer, they rejected the latter. Although pistillate flowers contain abundant nectar, it is less accessible than in staminate flowers. Individual bees characteristically foraged along one level of *J. integerima* canopies. Foraging rhythms of honey bees were regulated by closure of petal platforms. Honey bees were not effective pollinators as the stigma lobes were approximately 3 mm above the backs of foraging bees. *Author*

School of Agriculture and IRETA, University of the South Pacific, Private Mail Bag, Apia Western Samoa.

Parham, B. E. V. New Zealand Department of Scientific and Industrial Research. *Plants of Samoa: a guide to their local and scientific names with authorities; with notes on their uses, domestic, traditional and economic.* Information Series, New Zealand Department of Scientific and Industrial Research (1972) (No.85) 162 pp. [En, B]

Walton, G.M. *Beekeeping development programmes in the tropical and subtropical Pacific. Apiculture in tropical climates*, editor *E. Crane*. London, UK; International Bee Research Association. (1976) 159–164 [En, B]

The area dealt with is perhaps the least well known of all from the point of view of beekeeping development. The report covers New Zealand aid programmes in Papua New Guinea, Niue, Tonga, Gilbert Islands, Western Samoa; other aid projects in Rarotonga and Fiji; beekeeping activities in the Hawaiian Islands, American Samoa, French Polynesia, Micronesia, New Caledonia, Wake Island. *E.E. Crane* Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

Zmarlicki, C. *Report on the activities of the Bee Department at Pulawy [Poland] in developing beekeeping in some developing countries. [Raport o oddziaływaniu Oddziału Pszczelnictwa ISK na pszczelarstwo krajów rozwijających się].* Pszczelnicze Zeszyty Naukowe (1985) 29 373–376 [Pl, en, B]

FAO development programmes in Afghanistan, Burma, Indonesia, Iran, Turkey, Western Samoa, Vietnam.

Seychelles

Association Francaise des Volontaires du Progres. Beekeeping. [Apiculture]. *Revue de l'Association Francaise des Volontaires du Progres* (1983) (No. 36) 48 pp. [Fr, B]

This special number is devoted to the apicultural work of members of the French voluntary service in developing countries. Apiculture projects are or have been in operation in Central African Republic, Gabon, Cameroon, Togo, Niger, Senegal, Rwanda, Haiti, Seychelles, and are planned also for Benin, Burundi, Guinea Bissau, Mali and Mauritius. Traditional methods of honey hunting and beekeeping in various countries are described and illustrated, together with various top-bar hives and other applications of appropriate technology. Production and use of honey, beeswax and pollen are dealt with on a similar level. *E.E. Crane*

Abeille de France et l'Apiculteur. Direct from – the Association francaise des volontaires du progres. [En direct avec ... l'Association francaise des volontaires du progres]. *Abeille de France et l'Apiculteur* (1983/1984) (No. 678; 679) 541–547; 30–33 [Fr, B]

The aims of this organisation are discussed. Volunteers have been provided to help with beekeeping development projects in several African countries and in Haiti and the Seychelles. The work in some of these countries is described. The role of apiculture in developing countries is assessed. *P. Walker*

Bradbeer, N. (ed.). *International Bee Research Association. Beekeeping & Development.* (1991) (No. 18) 16 pp. [En, B]

This issue has articles on using aluminium newsprint sheets in beekeeping, making a solar wax extractor, tropical island beekeeping (Inhaca and Seychelles), meliponiculture, and beekeeping in Sudan. *D.G. Lowe* International Bee Research Association, 18 North Road, Cardiff, CF10 3DT, UK.

Duggan, R.M. *Bees and their predators in far-away places.* Teddington, UK; Central Association of Bee-Keepers (2000) 11 pp. [En, Ba]

The natural hazards and predators present in four Caribbean islands and three islands in the Indian Ocean are described.

Duggan, R.M. and Vorwohl, G. *Preliminary field observations on honey sources in Mauritius and the Seychelles, and microscopical examination of the honeys. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 198–202 [En, B]

The Mauritius Ministry of Agriculture's list of honey plants includes seven species described as important and 45 less important species. Microscopical analysis of nine honeys from Mauritius confirmed the presence of pollen grains from several of these genera or species. A list of 36 species of honey plants and other plants visited by bees is also provided for the Seychelles, based on field observations. Pollen grains of several of these genera or species were identified in 10 Seychelles honeys. The lists give plants in alphabetical order of their botanical names, with local names alongside. *P. Walker*

Redstone Wood Cottage, Philanthropic Lane, Redhill, Surrey RH1 4DE, UK.

Isola, A. *Beekeeping in the Seychelles. [Sognando l'apicoltura fra i mari delle Seychelles].* *Apitalia* (1988) 15 (14) 10–11 [It, B]

Kawa, M. and Sivapatham, K. *Tropical island beekeeping. Beekeeping & Development* (1991) (No. 18) 6–7 [En, B]

Inhaca in the Indian Ocean, and the Seychelles Archipelago.

Ratia, G. *Commissioned report on beekeeping in the Seychelles. [Rapport de mission sur l'apiculture seychelloise]*. Mahe, Seychelles; Ministère du Développement National. (1984) 129 pp. [Fr, Bd]

This report starts with a summary of the present situation, and lists nectar/pollen sources. On the four islands where the numbers of hives have been estimated, totals are: traditional 520, top-bar 180, movable-frame 140. Annual honey yield from the first two types is 3–5 kg, and from frame hives 10–25 kg. A plan for a beekeeping development programme is presented, together with a provisional estimate of costs and returns and some basic recommendations for beekeepers. Thirteen annexes provide much background information. *P. Walker*

Ministère du Développement National, Independence House, Mahe, Seychelles.

Silberrad, R. *Bee-keeping in Zambia*. *British Bee Journal* (1973) 101 (4289; 4290) 42–43; 54–55 [En, B]

Silberrad, R.E.M. *Bee-keeping in Seychelles*. Republic of Seychelles; Department of Agriculture. (1970) ii + 21 pp. + 4 pl. [En, B]

Silberrad, R.E.M. *Bees of the Indian Ocean region [Seychelles islands]*. *Proceedings of the XXXth International Congress of Apiculture*, Nagoya, 1985. Nagoya, Japan; Apimondia. (1986) 413–414 [En, Bd]

The local *Apis mellifera* hybrids are known as 'creole bees'; there is no evidence of *A. cerana* ever being on the islands.

Tealdi, C. *The Seychelle islands, a paradise also for bees and beekeeping. [Le isole Seychelles, paradiso anche delle api e degli apicoltori]*. *Ape Nostra Amica* (1990) 12 (5) 40–42 [It, B]

Hybrids have been obtained by crossing *Apis mellifera* uni-color with *A. mellifera* from Australia.

Sierra Leone

Peterson, M. *African honeybees in East and West Africa, and Africanized honeybees in Venezuela: some observations on behaviour. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 109–111 [En, B]

The author worked with honeybees in Mali, Sierra Leone, Ghana, Uganda and Venezuela, and noted wide variations in absconding and swarming behaviour, stability on combs and 'aggressiveness'.

Singapore

Singapore. *Laws and Statutes. [Honey]*. *S.L. Supplement No. 30. June 28, 1974*. (1974) 375 [En, B]

Bloodworth, B.C., Harn, C.S., Hock, C.T. and Boon, Y.O. *Liquid chromatographic determination of trans-10-hydroxy-2-decenoic acid content of commercial products containing royal jelly*. *Journal of AOAC International* (1995) 78 (4) 1019–1023 [En, Bc]

Thirty-nine samples of commercial products containing royal jelly were analysed by liquid chromatography for their trans-10-hydroxy-2-decenoic acid (10-HDA) content. Most of the samples contained 10-HDA. Samples claiming to be pure royal jelly contained from 1.98% to 6.37% 10-HDA (wt/wt). The 10-HDA content of samples claiming to contain royal jelly as an ingredient ranged from non-detectable to 1.28% (wt/wt). *Author*
Institute of Science and Forensic Medicine, NBC Building, Outram Rd, Singapore 0316, Singapore.

Chuah, G., Law, E., Chan, W.K. and Ang, C.L. *Case reports and mini review of bee stings of the cornea*. *Singapore Medical Journal* (1996) 37 (4) 389–391 [En, 12 ref.]

The cases of a 26-year-old Indian man and a 47-year-old Chinese man both of whom were stung on the cornea by 'bees' in Singapore are reported. The clinical features, acute measures and long-term management of this condition are briefly reviewed.

Department of Ophthalmology, National University Hospital, 5 Lower Kent Ridge Road, Singapore 119074.

Galil, J. *Pollination in dioecious figs: Pollination of Ficus fistulosa by Ceratosolen hewitti*. *Gardens' Bulletin, Singapore* (1973) 26 (2) 303–311 [En]

Female *C. hewitti* possess closed thoracic pockets and coxal combs. The pockets are filled with pollen taken from detached anthers (previously cut by the male wasp) in almost ripe (male phase) fruit. Pollen is lifted to the underside of the thorax by the arolia of the forelegs and pushed into the pockets by the combs. Pollination in male figs occurs at the end of oviposition prior to withdrawal of the ovipositor, when pollen is taken from the pockets by the forelegs and carried downwards on to the stigmata. The behaviour of the female wasp in female syconia is similar except that the act of oviposition does not culminate in actual egg laying. The significance of pollination in short-styled gall-producing flowers, and of ovipositor insertion into the style of long-styled seed-producing flowers, is discussed. *D.G. Lowe*

Dept. Botany, Tel Aviv Univ., Tel Aviv, Israel.

Lim, P., Tan, I.K. and Feng, P.H. *Elevated serum enzymes in patients with wasp/bee sting and their clinical significance*. *Clinica Chimica Acta* (1976) 66 (3) 405–409 [En, B]

The sera of 17 patients who had been admitted to hospital after wasp or bee stings had high amounts of glutamic-oxaloacetic transaminase (nine patients), creatine phosphokinase (14 patients) and lactate dehydrogenase (eight patients), indicating damage to muscle fibres. Amounts higher than normal of glutamic-pyruvic transaminase and

isocitrate dehydrogenase in the sera of six and five (of 14) patients, respectively, suggested liver damage. The amounts of these enzymes in the sera soon returned to normal, except in the most severe case where the patient developed acute tubular necrosis. *J.M. Gedy*
Dept. Medicine, Univ. Singapore, Sepoy Lines, Singapore 3.

Liow LeeHsiang, Sodhi, N. S. and Elmqvist, T. *Bee diversity along a disturbance gradient in tropical lowland forests of south-east Asia*. *Journal of Applied Ecology* (2001) 38 (1) 180-192 [En, wf]

Bee communities of eight forested sites in Johor (Malaysia) and Singapore were surveyed at the below-canopy level; the sites ranged from relatively undisturbed primary lowland dipterocarp forests to late secondary forests and exotic forests, including an oil palm plantation. Bee abundance, in particular that of *Apis* spp., was significantly higher in larger primary forests than in other types of forest. However, bee species richness was higher in disturbed forests. The distribution of bees was apparently influenced by variables closely related to forest disturbance and resource abundance, such as the density of large trees, temperature, and flowering intensity of trees and shrubs. More stingless bees (*Trigona* spp.) were found where trees were larger and ambient conditions more constant but flowering intensities lower. The differences between the bee communities in forests of urban Singapore and primary forests in Johor indicate that ecological processes in the forests of Singapore, in particular pollination, could be changing. However, pollination may not be totally intact in the primary forests surveyed, as their bee communities seemed impoverished.

The Swedish Biodiversity Centre, CBM, Box 7007, 750 07 Uppsala, Sweden.

Sakagami, S. F. *Stingless bees (Excl. Tetragonula) from the continental southeast Asia in the collection of Bernice P. Bishop Museum, Honolulu (Hymenoptera, Apidae)*. *Journal of the Faculty of Science, Hokkaido University, VI (Zoology)* (1975) 20 (1) 49-76 [En, B]

Fifteen *Trigona* species were collected, in Laos, Thailand, Cambodia, Vietnam, Malaya and Singapore, and deposited

in the Bernice P. Bishop Museum. They are described, with notes on taxonomy. *D. G. Lowe*
Zoological Inst., Hokkaido Univ., Sapporo, Hokkaido 060, Japan.

Shilkin, K.B., Chen, B.T.M. and Khoo, O.T. *Rhabdomyolysis caused by hornet venom*. *British Medical Journal* (1972) 1 156-157 [En, B]

Acute necrosis of skeletal muscle fibres (rhabdomyolysis) and consequent renal failure was reported in two patients after 180 and 250 stings respectively by *Vespa affinis*. Previously the only venom reported to have caused rhabdomyolysis was that from certain snakes. It is possible that the venom may be directly nephrotoxic, but it is thought more likely that the muscle necrosis led in some way to the renal lesion. Both the muscle and renal lesions proved reversible with prompt treatment. *A. S. Attwood*
Dept. Pathology Univ. Singapore, Singapore.

Wiebes, J. T. *A short history of fig wasp research*. *Gardens' Bulletin, Singapore* (1976) 29 207-232 [En, B]
Review.

Wongsiri, S., Wongsathuaythong, S. and Suwanagul, M. *Comparison of skin tests for honey bee allergy using venom extracts of Apis mellifera, Apis cerana and Apis florea in normal persons, atopic population and beekeepers*. *Progress in venom and toxin research. Proceedings of the First Asia-Pacific Congress on Animal, Plant and Microbial Toxins, Singapore, June 24-27 1987* [edited by Gopalakrishnakone, P.; Tan, C.]. (1987) 603-615 [En, Ba]

The venoms of *Apis mellifera*, *A. cerana* and *A. florea* were skin-tested on 99 individuals. There was no difference in the levels of significant positive skin reactions between the group of individuals without previous history of allergy and those who had suffered from allergic rhinitis, bronchial asthma or allergic dermatitis. Beekeepers showed a lower level of reaction than the other groups. *J. M. Gedy*

Bee Biology Research Unit, Faculty of Science, Chulalongkorn University, Bangkok 10500, Thailand.

Solomon Islands

Beekeeping & Development. *Zooming in on [beekeeping in] the Solomon Islands*. *Beekeeping & Development* (1992) (No. 22) 11 [En, Bj]

Evans, B. *Beekeeping handbook: a guide on how to keep bees in the Solomon Islands*. Honiara, Solomon Islands; Agriculture Information Section, Ministry of Agriculture and Lands. (1991) vi + 50 pp. ISBN 982-151-007-8 [En, Bd]

Forster, S. and Galvin, J.D. *Notes on honey sources of Kolombangara for beekeeping*. *Forestry Note, Forest Division, Ministry of Natural Resources, Solomon Islands* (1988) (No. 29-6/88) 6 pp. [En, Bc]

Honeybees have been kept at two localities on this island (Solomon Islands). A total of 39 honey sources have been recorded at one locality and 25 at the other. For each plant

species, information is given on flowering period, probable value as a honey source, and value as a pollen source. Honey yields from one locality (20 hives) are given for 1983-87. *P. Walker*

Greathead, D.J. *The multi-million dollar weevil that pollinates oil palms*. *Antenna* (1983) 7 (3) 105-107 [En, B]

It has recently been discovered that insects are an important factor in the pollination of oil palms (*Elaeis guineensis*), and an account is given of the introduction of the weevil, *Elaeidoobius kamerunicus*, into Malaysia from Cameroun in 1981. Hand-pollination of oil palms has now been discontinued and yields have increased by about 20%, worth about \$115 million per year. Other successful introductions have been made in Papua New Guinea, the Solomon Islands, Sumatra and Thailand. *D. G. Lowe*

Commonwealth Inst. Biol. Control, Imperial Coll., Ascot, Berks. SL5 7PY, UK.

Hirashima, Y. **A synopsis of the bee genus *Palaeorhiza* Perkins (Hymenoptera, Colletidae) of New Guinea. Part I. Subgenus *Palaeorhiza* s.str.** *Esakia* (1978) (No.11) 89–119 [En, B]

A new definition is given to the subgenus *Palaeorhiza*, which is further divided into six species groups. It occurs in Australia, New Guinea, New Britain, Solomon Islands, Amboina, Kai and Timor, and is composed of 13 species. Five new taxa are *P. abdominalis*, *P. flavipennis*, *P. combinata* and *P. purpurea* from Solomon Islands and *P. montana* from New Guinea. The lectotype of *Prosopis violacea* Friese is designated. *Author*

Entomological Lab., Fac. Agric., Kyushu Univ., Fukuoka 812, Japan.

Pauly, A. ***Homalictus* of the Solomon Islands. [Les Homalictus Cockerell (Hymenoptera Apoidea Halictidae)]**

de l'Île Rennell (Îles Salomons)]. *Natural History of Rennell Island, British Solomon Islands* (1984) 8 169–170 [Fr, B]

Sakagami, S. F. ***Tetragonula* stingless bees of the continental Asia and Sri Lanka (Hymenoptera, Apidae).** *Journal of the Faculty of Science, Hokkaido University, VI (Zoology)* (1978) 21 (2) 165–247 + 1 pl. [En, B]

A revision is presented for bees of the genus *Trigona*, subgenus *Tetragonula* Moure (= *Trigona iridipennis* group), of Continental Asia and Sri Lanka. Thirteen species including six new species are recognised; the species of which both male and female are known are classified into four groups. The type species *T. iridipennis*, previously described as widespread from Sri Lanka and India to the Solomon Islands, is redefined as belonging only to Sri Lanka and India. *T. laeviceps* represents a group common in south-east Asia. *P. Walker*

Zoological Inst., Hokkaido Univ., Nishi 8, Kital 9, Sapporo, 060 Japan.

South Africa

South Africa, Citrus and Subtropical Fruit Research Institute. **GA3 [transfer] trials with honeybees. [GA3-proewe met heuningbye].** *Information Bulletin, Citrus and Subtropical Fruit Research Institute* (1978) (No.70) 11–13 [Af, en] GA [gibberellic acid?] applied directly to citrus flowers has been shown to enhance fruit set, but this effect has not been achieved by spraying whole trees. In a trial to test the effectiveness of honeybees in transferring GA to flowers, GA powder was placed in a footbath at the exit of a hive which was placed either in a cage over an Orlando tangelo tree or in an open orchard. With the caged tree, flower GA content was increased 90-fold, but in an orchard GA transfer to the flowers was negligible.

Citrus & Subtropical Fruit Res. Inst., Nelspruit, South Africa.

South Africa. Laws and Statutes. **No. R 2336. Regulations relating to the grading, packing and marking of honey and mixtures of honey intended for sale in the Republic of South Africa.** *Government Gazette, South Africa* (1979) (No. 6706) 14–20 [En, B]

South Africa. Department of Agriculture. **No. R 280 of 30 March 2001. Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983). Regulations: amendment.** *South African Bee Journal* (2001) 73 (2) 77–95 [En, Bj] The regulations, which are set out here, include the designation of many introduced plants as weeds or invaders that should be removed/controlled. A table lists nearly 200 such species, many of which are good honey bee forage plants.

South Africa, Department of Agricultural Technical Services. **Annual Report of the Secretary for Agricultural Technical Services for the period 1 July 1979 to 31 March 1980.** (1981) vi + 134 pp. ISBN 0-621-06946-9 [En, B] Bee research reported (pp. 112–113) includes monitoring

of *Apis mellifera capensis* and use of *Xylocopa caffra* to pollinate *Medicago sativa*.

South African Bee Journal. **Legislation.** *South African Bee Journal* (2001) 73 (1) 40–48 [En, Bj]

Department of Agriculture No. R. 835 of 25th August 2000, Agricultural Products Standards Act, 1990 (Act No. 119 of 1990): Regulations relating to the grading, packing and marking of honey and mixtures of bee products intended for sale in the Republic of South Africa.

South African Bee Journal. **Research being carried out by the Plant Protection Research Institute.** *South African Bee Journal* (1981) 53 (6) 4, 7–16 [En, B]

Brief summaries of the following studies are given: screening tests for chemicals effective against nosema, assessment of eucalypts as nectar and pollen plants and of indigenous and ornamental plants as pollen sources, the effect of wind in the pollination of apple trees. Work on *Apis mellifera capensis* included the improvement of selected lines, and queen rearing techniques. *P. Walker*

South African Bee Journal. **Removal of wild bee swarms from State forests.** *South African Bee Journal* (1984) 56 (3) 61 [En, B]

Honey hunting was responsible for 10–15% of forest fires in South Africa in 1980–82.

South African Bee Journal. **News release by Dr. D. P. (Dave) Keetch, Director: Plant and Quality Control, Department of Agriculture.** *South African Bee Journal* (1993) 65 (2) 26–32 [En, Bj]

The adverse effects of the introduction of *Apis mellifera capensis* into summer rainfall areas populated by *A. m. scutellata* have been previously reported. Action has now been taken by the South African Department of Agriculture to give beekeepers in the affected areas finan-

cial assistance to establish new colonies. A special scheme was announced in December 1992, and on 26 January 1993 legislation was set up under the Agricultural Pests Act 1983 (Act No. 36) to prevent movement of Cape bees into the area. The new legislation also requires the elimination of all Cape honey bee colonies already in the area. Parts of the legislation are quoted and a note by the editor (pp. 31–32) gives further explanation. *P. Walker*

South African Bee Journal. Sunflowers [field day, Rietondale Research Station, Pretoria, 19 April 1996]. [Sonneblomme]. *South African Bee Journal* (1996) 68 (5) 132–159 [Af, en, Bj]

This issue of the *South African Bee Journal* consists of papers presented at a 'sunflower field day' held in Pretoria, South Africa, on 19 April 1996. Most papers are in Afrikaans with an English summary. The following relate to honey bees: A. Schehele, pp. 137–140, 'The present status of the South African beekeeping industry'; L. Erasmus, pp. 143–146, 'Preparing colonies for [sunflower] pollination on the Highveld'; D. de Klerk, pp. 146–149, 'Migrating with bee-hives – old practices and new developments'; T. Engelbrecht, pp. 149–153, 'Some factors which influence bee activity, pollination and seed yield in sunflower'. An article by M. Johannsmeier (pp. 140–142), in English, describes 'Nectar and pollen production of sunflower breeding lines'.

Apis, South Africa. Treatment of timber for hive parts. *Apis, South Africa* (1982) (March) 5–6 [En, B]

Describes the use of a copper-chrome-arsenic preservative and a water repellent coating; the inside of the finished hive is painted with propolis solution.

South Africa. Laws and Statutes. Act No. 36. To provide measures by which agricultural pests may be prevented and combated; and for matters connected therewith. *Government Gazette, South Africa* (1983) 214 18 pp. [En, B]

Includes restrictions on imports of honey and used apiary equipment (not allowed) and of beeswax (by special licence).

South Africa. Laws and Statutes. No. R. 2336. Regulations relating to the grading, packing and marking of honey and mixtures of honey intended for sale in the Republic of South Africa. *South African Bee Journal* (1989) 61 (3) 53–67 [En, Bj]

Wilgespruit Apiaries. Beekeeping correspondence course. Roodepoort, South Africa; Wilgespruit Apiaries. (1977) 40 pp. [En, B]

Abeille de France et l'Apiculteur. Beekeeping in South Africa. [Apiculture en Afrique du Sud]. *Abeille de France et l'Apiculteur* (1984) (No. 688; 689) 461–463; 528–529 [Fr, B]

Beeline. The horse-radish tree. *Beeline* (1996) 33 (4) 19–26 [En, Bj]

Information collected here on *Moringa oleifera* includes distribution and economic uses. Its fragrant flowers can provide a good nectar flow and attract many bees and other insects. In Africa it grows throughout the tropics

and is very common in parts of East Africa and South Africa. A pilot planting scheme in an arid area (in Mashonaland Central Province) was successful, and a further 100 million trees will be planted. *P. Walker*

Allsopp, M. *Capensis remnans do abscond.* *South African Bee Journal* (98) 70 (1) 156–160 [En, Bj]

Apis mellifera scutellata colonies invaded by *A. m. capensis* (C) tend to dwindle down to a few C workers which may either rear a new queen and re-establish a colony, or apparently die out. However, another possibility is that these last few workers abscond and then start a new colony. When many trap boxes in Kwazulu-Natal were examined, some were found to contain very black bees. When bee samples from six boxes were examined, some ovariole development was found in 78–93% of them and full development in 28–53%. After 14 days laying worker brood was present in all boxes, and a queen in one box and queen cells in the other 5. The results suggest that these new C colonies have developed from C bees that have absconded from dwindled colonies. Therefore, beekeepers must not assume that a dwindled colony will naturally die out and they must eliminate the remaining bees. *P. Walker* Honeybee Section, Plant Protection Research Institute, Agricultural Research Council, Private Bag X5017, Stellenbosch 7599, South Africa.

Allsopp, M. Survey for *Varroa jacobsoni* in South Africa. *South African Bee Journal* (98) 70 (1) 145–154 [En, Bj]

In September–December 1997 samples from 1307 honey bee colonies in 201 apiaries were examined for varroa mites. In the western Cape over half the 260 colonies surveyed were infested, but elsewhere in the country the incidence was very low (2% of colonies), and the affected colonies had all been previously migrated to an infested area. The south-west coast appears to have been the point of origin of the mites which may have arrived on a ship-borne swarm. In this area 75% of feral colonies were infested. *P. Walker*

Honeybee Section, Plant Protection Research Institute, Agricultural Research Council, Private Bag X5017, Stellenbosch 7599, South Africa.

Allsopp, M. *Apis mellifera litorea*: compounding the capensis-scutellata conundrum? *South African Bee Journal* (99) 71 (2) 56–58 [En, Bj]

Numbers of ovarioles (NO) have been determined in samples of honey bees from all over Zimbabwe and from Mozambique; in 77% of colonies sampled, mean NO was 4–5, and in 72% max. NO was at least nine (often up to 20). These values show that the bees are not *A. m. scutellata* (mean NO 5 or less), and – like *A. m. capensis* – some have high NO. The bees appear to be *A. m. litorea*. The implications of these data for the 'Capensis Survey' in southern Africa, in which bees are classified by NO, are discussed; in particular, it is suggested that not all bees with intermediate NO values are necessarily capensis-scutellata hybrids, and that some may be *A. m. litorea* or *litorea-scutellata* hybrids. *P. Walker*

Honeybee Section, Plant Protection Research Inst., Agricultural Research Council, Private Bag X5017, Stellenbosch 7600, South Africa.

Allsopp, M. Might varroa cure the Capensis problem? *South African Bee Journal* (2000) 71 (3) 80–81 [En, Bj]

It is possible that infestation with *Varroa jacobsoni* could eliminate 70% of weaker honey bee colonies in an area. As colonies in South Africa with the capensis problem (both managed and feral) are likely to be more susceptible to the mite, it is postulated that most of these hybrid colonies would not survive, but 30% of pure *Apis mellifera scutellata* colonies might do so, and 30% of pure *A. m. capensis* colonies. *P Walker*

ARC-Plant Protection Research Inst., Private Bag X5017, Stellenbosch 7599, South Africa.

Allsopp, M. and Begg, K. Badgers & bees: a survey. *South African Bee Journal* (2000) 72 (2) 75–79 [En, Bj]

Concerns honey badgers (*Mellivora capensis*).

ARC-Plant Protection Research Inst., P/Bag X5017, Stellenbosch 7599, South Africa.

Allsopp, M., Swart, D., Heever R. van der and Kryger, P. The latest on varroa in South Africa. *South African Bee Journal* (99) 71 (1) 23–25 [En, Bj]

The spread of *Varroa jacobsoni* is reported.

Plant Protection Research Inst., Agricultural Research Council, Private Bag X5017, Stellenbosch 7600, South Africa.

Allsopp, M. Biocontrol of bloublommetjies. *South African Bee Journal* (1993) 65 (2) 32–36 [En, Bj]

This species (*Echium plantagineum*) is a valuable pollen source for bees in the south-west Cape area of South Africa, especially for building up colonies to be used for pollination. The plant can also be a useful nectar source. A feasibility study on the biocontrol of this plant is being considered. Detailed studies of *E. plantagineum* made in Australia, where it was eventually classified as a noxious weed, are summarised and discussed. Beekeepers in South Africa are recommended to collect data on the value of the plant there. *P Walker*

PPRI, Private Bag X5017, Stellenbosch 7600, South Africa.

Allsopp, M. Summarized overview of the capensis problem. *South African Bee Journal* (1993) 65 (6) 127–136 [En, Bj]

The dwindling and dying of 50,000–100,000 honey bee colonies has been reported since 1991 from the Transvaal, Natal, Orange Free State and Northern Cape regions of South Africa. Mutation in the local *Apis mellifera scutellata* populations and drought have been ruled out as factors, and the cause is thought to be invasion of colonies by *A. m. capensis*: commercial beekeepers had moved colonies into the affected region from areas where capensis is endemic. Sampling of worker bees in affected colonies has shown characteristics of capensis (ovariole development, chemical signals and parthenogenetic reproduction), and the effects on colonies are similar to those reported in cases of colony usurpation of other races by capensis. This article reviews steps taken to counter the problem, including industry discussion, extension programmes and voluntary restrictions on colony movements. In 1993 the country was divided into two zones, with all capensis colonies in the scutellata area being eradicated

and colony movements between the two areas prohibited. Priorities for research and future action are suggested. *A. G. Matheson*

Allsopp, M. and Crewe, R. Report [on the Cape bee problem]. *South African Bee Journal* (1995) 67 (2, supplement) 6–16 [En, Bj]

In 1992 beekeepers in South Africa observed invasion of *Apis mellifera scutellata* colonies by *A. m. capensis* workers and their usurpation of scutellata queens, a phenomenon which subsequently became worse and was dubbed the 'Cape bee problem'. This discussion paper for a workshop held in April 1995 outlines the legislative measures taken and the effects on the beekeeping industry. Further options for research and beekeeping practice are outlined. *A. G. Matheson*

Allsopp, M., Govan, V. and Davison, S. Bee health report: Varroa in South Africa. *Bee World* (1997) 78 (4) 171–174 [En, Bj]

V. jacobsoni was found for the first time in South Africa, in experimental honey bee colonies in Stellenbosch, on 22 August 1997. A subsequent survey of 263 commercial colonies in the area showed that 124 were infested. *D. G. Lowe*

Honeybee Section, Plant Protection Research Institute, Agricultural Research Council, Private Bag X5017, Stellenbosch 7599, South Africa.

Allsopp, M. H. Foundation cell-size, super-size and honey production. *South African Bee Journal* (1994) 66 (6) 130–135 [En, af, Bj]

Near Stellenbosch, South Africa, nine colonies of *Apis mellifera capensis* of equal strength and headed by sister queen bees were established at each of two sites during a strong nectar flow. Honey storage area was provided by: (A) one deep super containing nine frames fitted with worker foundation (1016–1042 cells/dm²); (B) two shallow supers each containing nine frames fitted with worker foundation; (C) two shallow supers each with nine frames fitted with drone foundation (482–500 cells/dm²). New supers of the same type were added once to each hive in each group. Average honey production per colony was 29.3, 18.6 and 15.7 kg – and honey:wax ratio (measured only on frames more than 90% filled with sealed honey) 122.8, 60.3 and 47.9 – both for A, B and C respectively. Honey production figures were highly variable and no statistics are provided, but it is suggested that deep supers with worker foundation (A) are most suited to increasing honey production. *A. G. Matheson*

Honeybee Research Division, Plant Protection Research Institute, Agricultural Research Council, Private Bag X5017, Stellenbosch 7599, South Africa.

Anderson, A. J. and Allsopp, M. H. A preliminary evaluation of the organic control of Varroa jacobsoni in Cape honey-bees. *South African Bee Journal* (99) 71 (1) 12–20 [En, Bj]

In preliminary trials in South Africa, groups of four varroa-infested *Apis mellifera capensis* colonies were treated with one of the following: (A) formic acid, (B) oxalic acid, (C) thymol, (D) oils of marjoram and citronella. After treatment, mite mortality increased significantly in A, B and C,

but not in D. Treatment A killed all mites, but caused bees to cluster outside the hive. *P. Walker*
Dept of Environmental & Geographical Science, Univ. of Cape Town, Rondebosch 7700, South Africa.

Anderson, R.H. *Pollination behaviour of honeybees in apple orchards. Proceedings of the 1st Congress of the Entomological Society of Southern Africa, Stellenbosch, September 30–October 3, 1974 (Durr, H.J.R., Giliomee, J.H. and Naser, S. (eds). Pretoria, South Africa; Entomological Society of Southern Africa. (1975) 191–194 ISBN 0-620-01919-0 [En]*

Anderson, R.H. *South African beekeeping census 1974/75. South African Bee Journal (1978) 50 (2) 7–9, 11, 13–20 [En, B]*

Of 1736 forms sent to beekeepers, 702 were returned; of these 664 were from part-time and 38 from full-time beekeepers. From hives used for honey production, average yield was 34 kg/colony; the ratio of wax to honey production was one to 136. Most beekeepers used a deep brood chamber and shallow super; few hives are hired out for pollination. The answers to questions on many other aspects of management are summarised. *P. Walker*
Plant Protection Res. Inst., Stellenbosch 7600, South Africa.

Anderson, R.H. *Honeybees and honey at the Cape of Good Hope. South African Bee Journal (1985) 57 3–7; 49–53; 75–79 [En, B]*

Historical references to honey, honey hunting, and honeybees and other bees.

Anderson, R.H. *Pollination of apples and pears. Elgin, South Africa; Elgin Co-operative Fruitgrowers. (1986?) iii + 44 pp. ISBN 0-620-08777-3 [En, B]*

This informative booklet will be useful to fruit growers, and to beekeepers, especially those who hire out colonies for pollination. After a brief discussion of pollination terminology, the author describes the environmental factors which affect plants, and those which affect honeybees, particularly their foraging behaviour. Problems for the grower and for the beekeeper are dealt with, including the use of pesticides. The desirability of an integrated programme for pollinator/pest control management is emphasised. There are short sections on bee lures, conditioning, the use of bouquets of polliniser branches in the orchard, and the use of hive pollen inserts or dispensers. The booklet concludes with a list of recommended pollinisers, a 15-point guide to managing honeybee colonies for pollination, and a few personal thoughts of the author. Pages 17–28 contain 18 colour photographs, most of them illustrating variations in honeybee foraging behaviour. *D.G. Lowe*

Plant Protection Res. Inst., Stellenbosch, South Africa.

Anderson, R.H., Buys, B. and Johannsmeier, M.F. *South Africa, Department of Agricultural Technical Services. Beekeeping in South Africa. Bulletin, Department of Agricultural Technical Services, South Africa (1973) (No.394) 191 pp. ISBN 0-621-01165-7 [En, B]*

This is an enlightened book which will serve both as a teaching manual for beekeepers in South Africa, and as a source of information for others about the conditions of beekeeping there. For the latter the long section on South African nectar and pollen flora, is likely to be the most valued, together with the information on diseases and pests, and legislation. The honeybees in South Africa are *Apis mellifera capensis* (which occurs nowhere else in the world) and *A. m. adansonii* (which is here used for large-scale beekeeping), so the sections on bee biology and bee management are also of wide interest. The many diagrams are excellent and the photographs adequate. There is no index and no bibliography; the *Bulletin* is an A4 paperback, sold at only a fraction of its cost. *E.E. Crane*

Department of Agricultural Technical Services, Pretoria, South Africa.

Anderson, R.H., Buys, B. and Johannsmeier, M.F. *South Africa, Department of Agricultural Technical Services. Beekeeping in South Africa. [Byeboerdery in Suid-Afrika]. Bulletin, Department of Agricultural Technical Services, South Africa (1978) (No. 394) iv + 183 pp. ISBN 0-621-03843-1 [Af, B]*

Anderson, R.H., Buys, B. and Johannsmeier, M.F. *Beekeeping in South Africa. Bulletin, Department of Agricultural Technical Services, South Africa (1983) (No. 394) iv + 207 pp. + 1 pl. ISBN 0-621-08249-X [En, B]*

Anderson, R.H. and Buys, B. (eds). *Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24-26 January, 1990. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) v + 160 pp. ISBN 0-620-15132-3 [En, Bd]*

This book contains the proceedings of the symposium, including the opening and closing addresses and the two Crisp Memorial lectures (on pollination of apple and pear, and the value and use of honey bees for pollination). The other 37 contributions are grouped into seven sections, as follows: pollination/pollinator behaviour/honey bee management for pollination; Africanised honey bees; pesticides; biology and management of Cape (*Apis mellifera capensis*) and African (*A. m. scutellata*) honey bees; honey bee products and marketing; bee botany; beekeeping activities. There is a list of sponsors and an author index. *D.G. Lowe*

Argyle, E. *The Argyle method of beekeeping. South African Bee Journal (1984) 56 (6) 128–134 [En, B]*

The author devised a simple hive, the 'South African' hive, based on his observations of colony behaviour, and he has used the hive successfully for 30 years. It is essentially a horizontal top-bar hive with movable combs; the sides of the hive slope inwards slightly. The width and depth of the hive match the dimensions of a natural brood nest, thus the bees are encouraged to build their combs transversely. The bees naturally keep honey and brood separate, so a queen excluder is not needed. *P. Walker*

Barr, B. *Beekeeping for beginners. Sunnyside, South Africa; Northern Transvaal Beekeepers Association ([1994]) 43 pp. [En, Bdo]*

Begg, C. and Begg, K. Honey badgers v. beekeepers in South Africa. *Beekeepers' Quarterly* (2003) (No. 73) 22–24 [En, Bj]

The product, which is based on *Bacillus thuringiensis*, is sprayed on to the combs.

Berg, J. van den and Lotz, J.W. Importation of honeybees and hive products into South Africa. [Die invoer van heuning, byewas, heuningbevattende preparate, stuifmeel en byetoerusting en die beheermaatreels wat daarop van toepassing is]. *South African Bee Journal* (1987) 59 (3) 65–67 [Af, en, Bj]

The regulations which are in force (in order to maintain South Africa's freedom from serious bee diseases) are described.

Bester, T.G. Trek swarm beekeeping in the Lowveld. *South African Bee Journal* (1983) 55 (1) 15–16 [En, B]

Beylerveld, G.P. Practical beekeeping in South Africa. [Praktiese byeboerdery in Suid-Afrika]. Johannesburg, S. Africa, Transvaler-Boekhandel & Voortrekkerpers. (1969) 186pp. [Af, B]

Botha, J.J.C. Beekeeping in arid regions of the Cape. *South African Bee Journal* (1982) 54 (1) 11–13 [En, B]

Bredenkamp, G.L. The honey producing eucalypts of the highveld. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia. (1977) 120–126 [En, B]
Gives flowering characteristics, distribution, nectar and pollen productivity, and honey quality, for nine species.

Buys, B. Nosema in brood. *South African Bee Journal* (1972) 44 (6) 2–4 [En, B] Plant Protection Inst., Pretoria, South Africa.

Dead pupae from some hives in a South African apiary were found to contain spores exactly similar in appearance to those of *Nosema apis*. Two brood combs in each of three hives were sprayed with an aqueous suspension of these spores and within three weeks mortality of pupae rose by 7%. It was suspected that many prepupae which had also died from the disease were eaten workers. Attempts to infect imagines with the spores failed, therefore the species is different from *N. apis*. Methods of control were not examined. *D.G. Lowe*

Buys, B. A survey of honeybee pests in South Africa. Proceedings, 1 Congress of the Entomological Society of South Africa. (1975) 185–189 [En, B]

Buys, B. Outline of the [South African] Plant Protection Research Institute bee breeding project. *South African Bee Journal* (1976) 48 (4) 5–7 [En, B]

Buys, B. Nosema incidence in honeybees on the Cape breeding station. African bees: taxonomy, biology and economic use (D.J.C. Fletcher and Anderson, R.H. (eds)). Some observations on the island bees. Pretoria, South Africa; Apimondia. (1977) 84–90 [En, B]
Monthly samples of 30 bees (*Apis mellifera adansonii*) were

taken from each of 25 hives on Robben Island [see previous abstract] and examined for nosema disease. The average incidence was lowest in September–January, when 10% or less of bees were infected; it was highest in April (38%) and August (34%). The average incidence over the year was 20%, but all colonies were infected at one time or another. The amount of brood was high in September–January, but from January onwards when nosema increased there was a corresponding decline in brood. It is thought that there may not be a direct causal relationship between nosema incidence and amount of brood (and also total population), but rather that both are affected by flow conditions. *D.G. Lowe*

Plant Protection Res. Inst., Private Bag X5017, Stellenbosch 7600, South Africa.

Buys, B. A survey on honeybee pests in South Africa. *South African Bee Journal* (1982) 54 (4) 86–90 [En, B]

An analysis of 185 answers to a survey of pests, diseases, etc. is presented in a table. The pests most frequently reported were greater wax moths (*Galleria mellonella* and unspecified), ants, and the banded bee pirate (*Palorus latifrons*), but many others also caused damage. Thirty-three beekeepers reported the presence of EFB; 22 had had colonies stolen, and 20 reported poisoning of their bees. *P. Walker*

Plant Protection Res. Inst., Stellenbosch 7600, South Africa.

Buys, B. Cape worker-bees dislike African virgin queens. *South African Bee Journal* (1984) 56 (3) 63 [En, B]

During work on instrumental insemination, ripe queen cells or newly emerged virgin queens (*Apis mellifera capensis*) were successfully introduced into cages containing 200 *A. m. capensis* workers. When *A. m. adansonii* queens were introduced into cages of *A. m. capensis* workers, eight of the 13 queens were killed before insemination, and one afterwards. *P. Walker*

Plant Protection Res. Inst., Private Bag X5017, Stellenbosch 7600, South Africa.

Buys, B. Effect of humidity on artificial insemination of queen honey bees. *American Bee Journal* (1992) 132 (12) 801–802 [En, Bj]

Before and after instrumental insemination of *Apis mellifera capensis* queens with 4 µl semen, each queen was kept with about 200 workers at 34°C and an RH (%) of 35, 45, 65 or 85. Two days after insemination, spermathecal content was determined. Migration of spermatozoa into the spermatheca was negatively correlated with RH. It is recommended that queens are kept at 40% RH before and after instrumental insemination. *P. Walker*

Plant Protection Institute, Private Bag X134, 0001 Pretoria, South Africa.

Buys, B. Garnet eye-colour mutation in the African honeybee. *South African Bee Journal* (1993) 65 (5) 105–107 [En, Bj]
Drone honey bees [*Apis mellifera scutellata*] with dark reddish-brown eyes have been found in an apiary at Boksburg, South Africa. Their eye colour is similar to that produced by the garnet mutation, reported by Laidlaw in the USA [*Heredity* (1964) 55: 207–210]. *D.G. Lowe*

Directorate Plant & Quality Control, Private Bag X5015, 7599 Stellenbosch, South Africa.

Buys, B. First record in South Africa of the tracheal mite *Acarapis woodi*. *South African Bee Journal* (1995) 67 (3) 75–78 [En, Bj]

Honey bees collected from an apiary in Stellenbosch, South Africa, were found to contain the tracheal mite *Acarapis woodi*. The mite was subsequently found in bees collected in Transvaal and Kwazulu/Natal. A. G. Matheson Directorate Plant and Quality Control, private Bag X5015, 7599 Stellenbosch, South Africa.

Clark, P.L. *Aloe davyana* and the beekeeper. *South African Bee Journal* (1992) 64 (1) 3–6 [En, Bj]

A. davyana produces a light clear nectar and an abundance of orange pollen.

24 Clarendon Avenue, Strubenvale, Springs, South Africa.

Cobey, S. The African bee, *Apis mellifera scutellata*, threatened in her South African homeland by the Cape bee, *Apis mellifera capensis*. *American Bee Journal* (99) 139 (6) 462–467 [En, Bj] 1054/99

A report on the situation when the author visited South Africa in November 1997.

Ohio State Univ., 1735 Neil Ave, Columbus, OH 43210, USA.

Cooke, M. *Amphitoky: a new perspective in the biology of the Cape bee*. *South African Bee Journal* (1985) 57 (2) 25–35 [En, B]

A beekeeper describes his observations of the presence of drone as well as worker brood above the queen excluder in hives of *Apis mellifera capensis*, during October and November in three consecutive years. In each colony the queen was a good layer, and there was plenty of brood in the brood box; the queen excluder was not damaged, and the author concludes that all the brood above the excluder was produced by laying workers. The percentage of drone brood varied considerably between frames and between colonies, but could be as high as about 25% [of the frame?]. Although recent literature does not report such observations, other beekeepers – when questioned – had noticed the phenomenon. It has been suggested that it could be the result of hybridisation between *A. m. capensis* and *A. m. adansonii*, but the author believes that the Cape honeybee is amphitokous [capable of parthenogenetic reproduction of both males and females]. P. Walker 34 Seaview Rd., Somerset West, South Africa.

Cooke, M. *Turnabout is fair play – Cape bee invades African bee territory*. *American Bee Journal* (1992) 132 (8) 519–521 [En, Bj]

Pseudoqueens (laying workers) are known to be present in most colonies of *Apis mellifera capensis*; in general, they do not harm the colony, but they are disruptive to queen breeding programmes. In early 1992 some Transvaal beekeepers (1,000 km from the Cape) noticed dwindling and other symptoms in their colonies of *A. m. scutellata* and found *A. m. capensis* pseudoqueens were present. The six leading beekeepers recently reported that 30–50% of their colonies have been invaded; they have gassed 15,000

affected colonies so far. Points discussed at a meeting of Transvaal beekeepers are summarised here. It was deduced that colonies of *A. m. scutellata* taken to Port Elizabeth for apple pollination were invaded by Cape pseudoqueens; when these colonies were subsequently taken to other flows in Natal and Transvaal (especially the aloe flow which is used for making colony 'splits') pseudoqueens spread to other *A. m. scutellata* colonies. The requeening of invaded colonies does not seem to be a practical solution, but beekeepers agreed that they must be more vigilant in checking their colonies. Proposed control of the migration of Cape bees may be difficult to supervise. P. Walker 28 Lincoln Street, Harfield Village, 7700 Cape Town, South Africa.

Cooke, M.J. *Cape beekeeping at the crossroads*. *South African Bee Journal* (1982) 54 (2) 28, 31–35 [En, B]

The supply of honeybees for pollination has deteriorated because of the felling of nectar-bearing trees.

Cooke, M.J. *Queen-rearing – Ilse's [Mrs. Ilse Hartmann] way*. *South African Bee Journal* (1986) 58 54–60, 78–84 [En, B]

In Part 1 of this article the setting-up of a starter colony of young nurse bees is described; there must be no open brood at all. The starter colony must be made on the day it is to receive the grafted cell cups; this is particularly important if working with *Apis mellifera capensis*, as pseudoqueens may develop during any delay. The preparation of the cell cups is described; these have an internal diameter of 9 mm. (Manipulations with another colony to obtain the royal jelly required may cause Cape bees to stop building queen cells, and another colony must then be used.) Mrs Hartmann's method for selecting and removing suitable larvae from the breeder colony is described. Until put into the starter colony the cell cups are covered with a damp towel to prevent dehydration of royal jelly and larvae. After a night in the starter colony most of the cells have been accepted and are transferred to the finisher colony. Cape bees seal cells after five days, when the larvae are one day old; the cells should be left for another four days before being caged individually. In Cape bees it is essential to remove the gauze separating the starter colony from its original brood chamber. The young bees can then return to the chamber, otherwise pseudo-queens will start to develop in the starter colony. Further details about the procedure are given in answers to a series of questions. P. Walker

34 Seaview Road, Somerset West 7130, South Africa.

Cooke, M.J. *Are we opening Pandora's box again?* *American Bee Journal* (1987) 127 (1) 15–17 [En, Bj]

It is known that *Apis mellifera capensis* has a shorter brood cycle than the European bee, and this is of interest to scientists working on *Varroa jacobsoni*. Scientists in other countries ask for Cape bees, eggs and semen for research purposes, and these requests are fulfilled if the government of that country gives an authorisation certificate. The author thinks this is very unwise because of the known ability of individual Cape workers to enter African colonies, become pseudoqueens, cause supersedure and thus turn the colonies into Cape colonies. This might hap-

pen with other races. It has also been found that the Cape bee can regulate its temperature well, and so it might be able to survive the long winter in the northern hemisphere. *P. Walker*
34 Seaview Rd., Somerset West 7130, South Africa.

Cooke, M.J. Observations on the reversed orientation of pupae of the Cape bee. *South African Bee Journal* (1987) 59 (6) 129–131 [En, B]

Brood being reared in drone cells by laying workers of *Apis mellifera capensis* consisted mainly of workers, but some drones were also present. It was also observed that some pupae were in a 'tail-out' position, i.e. head towards the bottom of the cell. This orientation was found in both workers and drones, but was more common in the latter; it was not found in brood reared in worker cells. All full-term pupae in this position were dead or inert, presumably because they were unable to emerge. A few of the 'sub-adult' workers were engorged with honey; it is assumed that, in attempting to bite their way out of the cells, they had found and eaten honey in adjacent cells. *P. Walker*
28 Lincoln St., Harfield Village, 7700 South Africa.

Cooke, M.J. The saga of the Cape bee invasion continues in South Africa. *American Bee Journal* (1992) 132 (11) 726 [En, B]

The invasion of African honey bee [*Apis mellifera scutellata*] colonies in Transvaal by laying worker Cape honey bees [*Apis mellifera capensis*] is reported to be increasing [see *American Bee Journal* (1992) 132 (8) 519–521]. Examples are given of beekeepers who have transported Cape bees into Transvaal and the Orange River area. *D.G. Lowe*
28 Lincoln Street, Harfield Village, Cape Town 7700, South Africa.

Crane, E. Satellite bibliography to Bibliography of tropical apiculture. No. S/27. Beekeeping and bee research in South Africa. London, UK; International Bee Research Association. (1978) 13 pp. ISBN 0-86098-064-2 [En, B]
Annotated list of 177 entries.

Crewe, R. and Allsopp, M. Sex and the single queen: recent experiments with capensis and scutellata queens. *South African Bee Journal* (1994) 66 (3) 58–62 [En, B]

The report explains why this research is necessary and why permission has been obtained to transport queens and bees between Stellenbosch and Johannesburg (in both directions); it also describes precautions taken to prevent the experimental *Apis mellifera capensis* bees from becoming established in the northern study area. Experiments to determine the sex of offspring of virgin *A. m. capensis* queens showed that they can produce female (as well as the usual male) brood, but probably lay only after being treated with CO₂. The dosage is being studied. Cross-breeding experiments with *A. m. capensis* and *A. m. scutellata* are now being carried out to determine whether the production of female brood by *A. m. capensis* laying workers is under normal genetic control. *P. Walker*
Department of Zoology, University of the Witwatersrand, Johannesburg, South Africa.

Crewe, R.M. Pheromones and the colonial defensive behaviour of *Apis mellifera adansonii* L. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia (1977) 77–83 [En, B]
Samples of guard bees taken from two queenright colonies, and from two colonies that had been queenless for 27 days, were processed as described by Crewe and Hastings. Content of 2-heptanone varied from about 6 to 10 µg per head; that of isopentyl acetate varied from 30 plus or minus 13 to 138 plus or minus 69 ng per sting. The removal of the queen had no effect. It is suggested that guard bees may be characterised by a particular 'blend' of the two pheromones, with which the temperament of the colony they originate from is correlated. *D.G. Lowe*
Dept. Zoology, Univ. Witwatersrand, 1 Jan Smuts Ave., Johannesburg 2001, South Africa.

Crewe, R.M. Compositional variability: the key to the social signals produced by honeybee mandibular glands. The biology of social insects [edited by Breed, M.D.; Michener, C.D.; Evans, H.E.]. Boulder, CO, USA; Westview Press. (1982) 318–322 [En, B]

The mandibular gland secretions of virgin and mated queen honeybees of *Apis mellifera mellifera*, *A. m. adansonii* and *A. m. capensis* (mated only), were analysed for 8-hydroxyoctanoic acid, 9-oxo-2-decenoic acid (9-ODA), 9-hydroxy-2-decenoic acid (9-HDA), 10-hydroxydecenoic acid, and 10-hydroxy-2-decenoic acid (10-HDA). 10-HDA was the main component in the secretions of young virgin *mellifera* and *adansonii* queens, but it became less important with age; in older virgins 9-ODA, or a mixture of 9-ODA and 9-HDA, predominated. In mated laying queens the mixture of components in the secretion was unique to each individual, but there were consistent differences between races. The relative amounts (as mean percentage composition) of 9-HDA, 10-HDA and 9-ODA respectively were: in *A. m. mellifera*, 32, 15, 37; in *A. m. adansonii*, 14, 8, 65; in *A. m. capensis*, 10, 1, 85. The significance of the results in relation to communication between queen and workers is discussed. *D.G. Lowe*
Dept. Zoology, Univ. Witwatersrand, Johannesburg, South Africa.

Crewe, R.M. Differences in behaviour and morphology between capensis and adansonii. *South African Bee Journal* (1984) 56 (1) 16–20 [En, B]

When the queen is removed from an *A. m. capensis* colony, laying workers develop rapidly; some of them are very aggressive. Their behaviour is described and compared with that of the (fewer) laying workers which develop in a dequeened *A. m. adansonii* colony. The behaviour is apparently associated with age and with ovary development. Analysis of mandibular gland secretions of laying workers showed that in *A. m. capensis* the secretion is similar to that of the queen. Mandibular gland secretions of queens were also compared; content of queen substance was highest (84.83% of total compounds) in *A. m. capensis* secretions, compared with 65.39% and 37.25% in those of *A. m. adansonii* and *A. m. mellifera*, respectively. *P. Walker*
Dept. Zoology, Univ. Witwatersrand, Johannesburg, South Africa.

Crewe, R.M. Natural resistance to *Varroa in capensis*? *South African Bee Journal* (1984) 56 (4) 86–87 [En, B]
Because of the shorter post-capping stage (9.6 days) than in European *A. mellifera* (12–12.5 days).

Crewe, R.M. Lability of the mandibular gland signal of three races of African honey bees. Chemistry and biology of social insects. [Eder, J. and Rembold, H. (eds).]. Munich, German Federal Republic; Verlag J. Peperny. (1987) 433–434 ISBN 3-925995-01-3 [En, Bd]

The races used in these studies were *Apis mellifera capensis*, *A. m. scutellata*, *A. m. mellifera* and *A. m. intermissa*. Laying workers of *capensis* were produced by placing 1-day-old bees in cages with 30 *scutellata* workers. Similarly, 2-day-old *intermissa* were placed in cages with 80 *capensis* workers. The queens that were used were maintained in nucleus colonies. Mandibular gland (MG) contents were extracted, then analysed by capillary GC. MG contents of *scutellata* workers were dominated by 10-hydroxy-2-decenoic acid (10-HDA), and laying workers occasionally produced 9-keto-2-decenoic acid (9-ODA) as a minor component. In *capensis* workers, 9-ODA started to predominate in the MG contents after two days, and 10-day-old workers produced a mixture characteristic of queens. In *intermissa* and *scutellata* queens the MG contents changed from a relatively worker-like composition to one in which 9-ODA predominated. In *capensis* queens, 9-ODA predominated even in virgins (80% of MG contents) and very little 10-HDA was present (3.8%). The results thus show that *capensis* workers produce queenlike signals and virgin queens do not show a change in signal composition with age. *D.G. Lowe*
Dept. Zoology, Univ. Witwatersrand, 1 Jan Smuts Ave., Johannesburg 2001, South Africa.

Crewe, R.M. Natural history of honey-bee mandibular gland secretions: development of analytical techniques and the emergence of complexity. Africanised honey bees and bee mites [Needham, G.R., Page, R.E., Jr., Delfinado-Baker, M. and Bowman, C.E. (eds)]. Chichester, UK; Ellis Horwood. (1988) 149–158 ISBN 0-7458-0319-9 [En, Bd]
Knowledge of the composition and function of mandibular gland (MG) secretions of honeybees is reviewed. The advances in analytical techniques and sampling methods used to characterise the secretions are detailed. The MG chemistry of workers and queens of *Apis mellifera mellifera*, *A. m. scutellata*, *A. m. capensis*, and *A. m. intermissa* are discussed and the differences between them highlighted. The possibility that the MG secretions consist of components with a range of volatilities that produce signals with short time constants and ones with long time constants, is explored. Results of the measurement of ambient signals from queens suggest that it is possible to partition the signal in this way. The development of the capability to measure ambient signals offers the prospect of being able to specify the composition of a chemical signal that is responsible for a particular behavioural response. *Author*
Dept. Zoology, Univ. Witwatersrand, 1 Jan Smuts Ave., Johannesburg 2001, South Africa.

Crewe, R.M. and Fletcher, D.J.C. Volatile secretions of two Old World stingless bees. *South African Journal of Science* (1976) 72 (4) 119–120 [En, B]

Head extracts of *Trigona danoii* contained neral (cis-citral) and geranial (trans-citral). Synthetic citral elicited no behavioural response from the bees. Head extracts of *T. gribodoi* contained four volatile substances which were not identified. *F.B. Wells*

Dept. Zoology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Crewe, R.M. and Hastings, H. Production of pheromones by workers of *Apis mellifera adansonii*. *Journal of Apicultural Research* (1976) 15 (3/4) 149–154 [En, B]

Pheromones secreted by the mandibular glands and the sting apparatus of *Apis mellifera adansonii* workers of known ages were analysed quantitatively. Production of both pheromones was found to vary with age. Isopentyl acetate in the sting apparatus reached a peak approximately 20 days after emergence. The amount of 2-heptanone produced by the mandibular glands was small for the first 14 days after emergence, but increased continuously after this age. *Author*

Dept. Zoology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Crewe, R.M., Hepburn, H.R. and Moritz, R.F.A. Morphometric analysis of two southern African races of honeybee. *Apidologie* (1994) 25 (1) 61–70 [En, fr\de, Bj]

A suite of 10 morphological characters was identified that discriminated between the two races, *Apis mellifera capensis* and *A. m. scutellata*. Collections of samples from 32 localities (spanning the sub-continent from the west coast to the east coast and from Cape Town in the south to north of Johannesburg) were used to define the current distribution of the two races and the hybrid zone between them. The data obtained from the morphometric analysis are in good agreement with data on laying worker reproduction. *Author*
Department of Zoology, University of the Witwatersrand, Johannesburg, South Africa.

Crewe, R.M. and Moritz, R.F.A. Variation in the components of head extracts of workers and queens of *Apis mellifera intermissa* Buttel-Reepen. *Zeitschrift für Naturforschung*, C (1989) 44 (7/8) 590–596 [En, Bc]

Head extracts of mated queen honey bees from Tunisia, and of their worker offspring, were analysed. The GC/MS patterns of the nine major components were distinct for each caste; in both castes, the patterns changed with age. The patterns for workers reared in a cage without a queen differed from those of workers in a queenright colony. Extracts from queenless workers were dominated by (E)-9-hydroxydec-2-enoic acid (HDA9) until they were 16 days old. Large quantities of 10-hydroxydecanoic acid (HDAA) and (E)-10-hydroxydec-2-enoic acid (HDA) were also present. (E)-9-ketodec-2-enoic acid (ODA) was the predominant compound in queens and was also present in relatively large quantities in queenless workers eight days old. In workers from queenright groups HDA was the major component and HDA9 and HDAA were also prominent. The genetic variance of the component composition of head extracts was higher in queens than in workers. The possible significance of this is discussed. *P. Walker*
Department of Zoology, University of the Witwatersrand, P.O. Wits 2050, South Africa.

Crewe, R.M. and Velthuis, H.H.W. *False queens: a consequence of mandibular gland signals in worker honeybees.* *Naturwissenschaften* (1980) 67 467–469 [En, B]

Published results of analyses of the components of mandibular gland secretions of queens and workers are discussed, and some new results are presented. Total fatty acid production was significantly higher in queens, even at one day old, than in workers. Surprisingly, 10-hydroxy-2-decenoic acid (10-HDA) was the predominant acid in the secretion of young queens (as it was in the secretion of workers). It is concluded that the pheromone effect of the honeybee mandibular gland secretion is produced by a blend of components, and that it is not a simple distinction between 9-HDA in queens and 10-HDA in workers. *P. Walker*

Dept. Zoology, Univ. Witwatersrand, Johannesburg, South Africa.

Crewe, R.M., Wossler, T. and Allsopp, M.H. *Workers in queens clothing: why capensis workers become pseudo-queens. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [Anderson, R.H. and Buys, B. (eds)].* Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 83–89 ISBN 0-620-15132-3 [En, Bd]

Analysis of head extracts from queenlike workers (pseudo-queens) of *A. m. capensis* showed that they were rich in compounds associated with queen mandibular gland secretions, particularly (E)-9-ketodecen-2-enoic acid (9-ODA). Comparison of pseudoqueen extracts with extracts from workers in queenright colonies showed that pseudo-queens had relatively greater amounts of various components, but that queenright workers produced a secretion that would be considered queenlike in other honey bee races. The secretions of workers contained relatively less 9-ODA and relatively more (E)-9-hydroxydecen-2-enoic acid (9-HDA); amounts of (E)-10-hydroxydecen-2-enoic acid (10-HDA) were low in relation to the secretions of workers of other races. The genetic control of mandibular gland secretions is discussed. *D. G. Lowe*

Department of Zoology, University of the Witwatersrand, P.O. Wits 2050, South Africa.

Dafni, A. *Note on side advertisement in flowers.* *Functional Ecology* (1994) 8 (1) 136–138 [En, Bc]

Previous work has shown that in some species the area of the profile planar projection (the view at right angles to the flower's long axis plane) is equal to or larger than that of the en-face planar projection (the view at right angles to the plane of the flower's mouth). A high ratio between the area of the side view and that of the en-face view has been termed 'side advertisement' (SA). Two studies were made: the first dealt with 16 different species from different genera in the Israeli flora, the second in 99 South African species of *Erica*. All measurements were carried out by placing a clear plexiglass plate as close as possible to the flower (from en-face and profile views) and drawing the planar projection outlines on a clear plastic transparency at life-size scale. The areas of the flower's images were determined with a digital manual planimeter. In the first study no association was found between SA and floral symmetry, position or size. However, SA was found in flowers

pollinated by large bees, hawkmoths [*Sphingidae*] and birds. Of the *Erica* species studied, those pollinated by short-tongued insects (solitary bees, short proboscis flies [*Diptera*] and beetles [*Coleoptera*]) have significantly lower SA values than bird-pollinated flowers. Those pollinated by long-tongued *Diptera* have intermediate SA values.

Institute of Evolution, Haifa University, Haifa 31999, Israel.

Dafni, A. and Kevan, P.G. *Floral symmetry and nectar guides: ontogenetic constraints from floral development, colour pattern rules and functional significance.* *Botanical Journal of the Linnean Society* (1996) 120 (4) 371–377 [En, Bc]

It was hypothesised that the external and internal visual contours of a flower should complement each other in shape and colour so that the scanning behaviour of an anthophile takes in both sets of contours sequentially on its approach to the flower obviating the need to change direction to land for obtaining nectar and pollen. This hypothesis was tested, with respect to shape, by comparing the symmetries of floral shape (external contours) with the nectar guide colour patterns (internal contours) in several distinct floras. These include the bulbous species of South Africa, species of the Canadian Arctic, alpine flora of the Rocky Mountains and the floras of Israel and the UK. The results showed that only 1% of the total flora examined has nectar guides which are discordant with flower shape (13 of 1320 species). It is suggested that the complementarity of these contours is constrained by floral development.

Institute of Evolution, Haifa University, Haifa 31905, Israel.

Dams, M. and Dams, L. *Spanish rock art depicting honey gathering during the Mesolithic.* *Nature*, UK (1977) 268 (5617) 228–230 [En, B]

Many of the rock paintings in the Barranco de la Valltorta, Castellon, have been known for years; a recently discovered scene depicts honey gathering from a wild bees' nest. There are five human figures on a ladder, which is of a more complex construction than seen in other Spanish rock paintings, and is similar to ladders depicted in Drakenensberg rock paintings, South Africa. *P. Walker*

171 Ave. Laterale, 1180 Brussels, Belgium.

Darling, D.C. *The life history and larval morphology of *Aperilampus* (Hymenoptera: Chalcidoidea: Philomidae), with a discussion of the phylogenetic affinities of the *Philomidae*.* *Systematic Entomology* (1992) 17 (4) 331–339 [En, Bc]

The host association and larval morphology of *Aperilampus* are documented for the first time based on specimens collected during the excavation of ground-nesting bee nests in South Africa. *A. varians* is a primary parasite of the pupa of *Halictus* (*Seladonia*) *africanus*. The first and final-instar larvae are described and illustrated, and notes are provided on the behaviour of the first-instar larva. *Author*

Department of Entomology, Royal Ontario Museum, 100 Queen's Park, Toronto, Ontario M5S 2C6, Canada.

Davison, S., Govan, V., Leat, N. and Allsopp, M. *Bee diseases in South Africa I: EFB, AFB, chalkbrood and bee viruses.* *South African Bee Journal* (2000) 71 (3) 84–87 [En, Bj]

Dept of Microbiology, Univ. of Western Cape, Bellville 7535, South Africa.

Davidson, B. C. and Hepburn, H. R. **Transformations of the acylglycerols in comb construction by honeybees.** *Naturwissenschaften* (1986) 73 (3) 159–160 [En, Bc]

Wax scales (S) were collected from *Apis mellifera adansonii* workers, and comb wax (C) from pollen-free laboratory colonies. S and C were similar in that the mono- and di-acylglycerol fraction made up about 91% of the total glycerol, but analyses showed that during conversion of S to C the di-acylglycerol content was approximately halved, and the mono-acylglycerol content doubled. The effect of this ought to increase fluidity (reducing comb stiffness), but this does not occur because the saturation of fatty acids is greater in C than in S. *P. Walker*

Dept. Medical Biochemistry & Physiology, Univ. Witwatersrand Medical School, Johannesburg 2001, South Africa.

Davis, A. J. and Tribe, G. D. **Room to spare? Is *Drosophila flavohirta* Malloch, exploiting *Eucalyptus gomphocephala* A. DC flowers, in an incomplete guild?** *African Entomology* (1996) 4 (2) 277–280 [En, Ba]

D. flavohirta lays eggs in the flowers of eucalypts, including *E. gomphocephala*. The larvae which develop feed on nectar and pollen, and the adults feed on pollen. Feeding by *D. flavohirta* reduces nectar availability for honey bees (*Apis mellifera*). This study in South Africa showed that *D. flavohirta* larvae are significantly aggregated in the flowers, within racemes, thus allowing the potential co-existence of other floricolous species on the flowers. *D. G. Lowe*

Department of Biology, University of Leeds, Leeds, LS2 9JT, UK.

Deschodt, C. C. **Some aspects of importance to beekeeping of South African indigenous trees and shrubs. African bees: taxonomy, biology and economic use (editor D. J. C. Fletcher).** Pretoria, South Africa; *Apimondia* (1977) 35–49 + 3 pl. [En, B]

Climatic and geographical factors that affect the distribution of trees and shrubs in South Africa are summarised, and relevant literature is reviewed. Important nectar and pollen producing genera and species are described, with notes relating to their apicultural value, where known. *D. G. Lowe*

P.O.Box 4488, Pretoria 0001, South Africa.

Desmond, A. ***Capensis* threat to Zimbabwean beekeeping.** *Beeline* (1995) 32 (2) 10–16 [En, Bj]

This article discusses the possibility of the Cape honey bee, *Apis mellifera capensis*, spreading to Zimbabwe and having a deleterious effect on that country's beekeeping as it has done in South Africa [e.g. see Allsopp, M. *South African Bee Journal* (1993) 65 (6) 127–136]. *D. G. Lowe*

Donaldson, J., Nänni, I., Zachariades, C. and Kemper, J. **Effects of habitat fragmentation on pollinator diversity and plant reproductive success in renosterveld shrublands of South Africa.** *Conservation Biology* (2002) 16 (5) 1267–1276 [En, es, X]

Overall, the species richness of bees and other flower-visiting insects did not vary significantly between fragments of different sizes, but the abundance of certain bee species was significantly affected by fragment size, together with

other factors such as vegetation cover and the ratio of grass to shrubs. Fragment size and distance to large remnants of vegetation had a significant influence on seed or fruit set in four of the seven plant species examined.

Conservation Biology, Kirstenbosch Research Centre, NBI, P/Bag X7, Claremont 7735, South Africa.

Donaldson, J. M. I. ***Oplostomus fuliginus* (Coleoptera: Scarabaeidae): life cycle and biology under laboratory conditions, and its occurrence in bee hives.** *Coleopterists Bulletin* (1989) 43 (2) 177–182 [En, Ba]

O. fuliginus has been known as a pest in beehives in southern Africa since the early 1900s. This is the first description of its life cycle and breeding habits. In laboratory studies eggs were laid in a mixture of soil and cattle dung and took 6–10 days (mean 7.9 days) to hatch. The larvae (description given) were fed on a mixture of soil, compost and cattle dung in the ratio of 1:2:3 by volume and took 30–38 days (mean 33 days) to become pupae. The pupae took 21–29 days (mean 25 days) to eclosion. Survival rate of eggs was 95%, larvae 61% and pupae 71%. Female and male adults could be distinguished by the shape of the abdominal sternites. They fed preferentially on open honeybee (*Apis mellifera*) brood containing larvae, also on newly capped brood and survived well on pollen and honey. In nature they seldom feed on flowers as do other Cetoniinae. *Author*

Vegetable & Ornamental Plant Res. Inst., Private Bag X293, Pretoria 0001, South Africa.

Doull, K. M. **The 'secret' of the aloes [*Aloe davyana*].** *South African Bee Journal* (1976) 48 (1) 18–21 [En, B]

In parts of northern Transvaal aloes provide almost the only bee forage in the dry winter weather of July–August, with sunny days and often frosty nights. From observations and discussions during visits in mid-July and mid-August 1975, the author offers an explanation of the 'aggressiveness' and high rate of swarming of bees (*A. m. adansonii*) in aloes, as follows. The plant is a good source of pollen but yields rather little nectar, which bees collect only from the (larger) flowers that open first, or in the early morning when nectar has absorbed moisture in the night and runs down to the tips of the flowers.

Waite Agricultural Inst., Univ. Adelaide, Adelaide, SA, Australia.

Drusedau, M. U. H. and Mills, M. G. **The health aspects of beekeeping. Part 1. A descriptive study.** *South African Bee Journal* (1988) 60 (4) 74–83 [En, Bj]

The information presented here was obtained from questionnaires filled in by 61 beekeepers in Southern, Eastern and Northern Transvaal; 13 of them were full-time beekeepers with an average of 777 hives, who had been keeping bees for an average period of 32 years. All used smoke when handling colonies, and some said the most effective fuels contained propolis, pine needles or decomposing leaves. All 61 beekeepers wore full protective clothing, although a few did not use gloves. Some recommended working at night. The number of stings received during a session ranged from 0 to over 100, but the maximum was commonly not more than 10. The beekeepers' reactions to stings are discussed. Fifteen of the beekeepers reported

some other injury during management operations, seven of them having suffered a back injury. *P. Walker*
Medical Fac., Univ. Witwatersrand, 1 Jan Smuts Ave.,
Johannesburg 2001, South Africa.

Eardley, C. and Schwarz, M. *The Afrotropical species of Nomada Scopoli (Hymenoptera: Anthophoridae)*. *Phytophylactica* (1991) 23 17–27 [En, af, Bc]
National Collection of Insects, Plant Protection Research
Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *A taxonomic revision of the genus Xylocopa Latreille (Hymenoptera: Anthophoridae) in southern Africa*. *Entomology Memoir, Department of Agriculture, Republic of South Africa* (1983) (No. 58) ii + 67 pp. [En, af, B]
Twenty-four species of *Xylocopa*, of which *X. watmoughi* is here described as new, are recognised from southern Africa. Of these, three species probably only intrude into the northern region of the subcontinent and a further two species are known only from a single distribution record. Forty-two species and nine subspecies and varieties have been recorded in synonymy, of which 29 species and the nine subspecies and varieties are here proposed as new synonyms. A key for the identification of the species is provided, and partial or complete species descriptions are given. An additional 11 species and two varieties that are either of uncertain identity or of which the record distribution in southern Africa is doubtful are discussed. These species and varieties are neither described nor included in the key. *Author*
Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *Catalogue of Apoidea (Hymenoptera) in Africa south of the Sahara. Part 1. The genus Xylocopa Latreille (Anthophoridae)*. *Entomology Memoir, Department of Agriculture and Water Supply, Republic of South Africa* (1987) (No. 70) iii + 20 pp. [En, af, Bc]
Lists 126 species and 33 subspecies, with notes on distribution, nests, parasites, food plants.

Eardley, C.D. *The Afrotropical species of Eucara Friese, Tetralonia Spinola and Tetraloniella Ashmead (Hymenoptera: Anthophoridae)*. *Entomology Memoir, Department of Agriculture and Water Supply, Republic of South Africa* (1989) (No. 75) iii + 62 pp. [En, af, Bdo]

Eardley, C.D. *The genus Epeolus Latreille from subsaharan Africa (Hymenoptera: Anthophoridae)*. *Journal of Natural History* (1991) 25 (3) 711–731 [En, Bb]
National Collection of Insects, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *The Melectini in Subsaharan Africa (Hymenoptera: Anthophoridae)*. Pretoria, South Africa; Department of Agriculture, Directorate of Agricultural Information. *Entomology Memoir, Republic of South Africa, Department of Agricultural Development* (1991) (No. 82) 49 pp. ISBN 0-621-13255-1 [En, af, Bdo]
The Afrotropical species of the Melectini are revised. The tribe comprises two small endemic genera, *Acanthomelecta* and *Afromelecta*, and a large old world genus, *Thyreus*.

Acanthomelecta is monotypic and *Afromelecta* contains two species, of which *A. liefuncki* is here described as new. Thirty species of *Thyreus* are recognised. *T. empeyi* and *T. forchhammeri* are described as new, and 46 specific and sub-specific names have been placed in synonymy; 11 species have been left in abeyance because their correct identity cannot be ascertained. Keys for the identification of the genera and the species in each genus are provided and complete descriptions are given for most species. *Author*
Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *The southern African Panurginae (Andrenidae: Hymenoptera)*. *Phytophylactica* (1991) 23 (2) 115–136 [En, af, Bc]
National Collection of Insects, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *The African species of Pachymelus Smith (Hymenoptera: Anthophoridae)*. *Phytophylactica* (1993) 25 (4) 217–229 [En, af, Bc]
Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *Complementary descriptions and new synonyms of some Afrotropical Anthophoridae (Hymenoptera)*. *African Entomology* (1993) 1 (2) 145–150 [En, Ba]
Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *The genus Amegilla Friese (Hymenoptera: Anthophoridae) in Southern Africa*. *Entomology Memoir, Republic of South Africa, Department of Agriculture* (1994) (No. 91) 68 pp. [En, Bdo]
The southern African species of *Amegilla* are revised. Seven new species are described and 18 new synonyms are given. A key for the identification of the 31 species in the genus is provided. *D.G. Lowe*
Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. *The genus Scapter Lepeletier & Serville (Hymenoptera: Colletidae)*. *African Entomology* (1996) 4 (1) 37–92 [En, Bb]
This genus of *colletid* bees is endemic to Southern Africa. It comprises 31 species and is represented in most biotypes. All species, including 11 new species, are described. *D.G. Lowe*
Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C.D. and Brooks, R.W. *The genus Anthophora Latreille in Southern Africa (Hymenoptera: Anthophoridae)*. *Entomology Memoir, Department of Agriculture and Water Supply, Republic of South Africa* (1989) (No. 76) iii + 55 pp. [En, af, Bdo]

Eardley, C.D. and Mansell, M.W. *Preliminary report on the natural occurrence of insect pollinators in a mango orchard*. *Yearbook – South African Mango Growers' Association* (1993) 13 127–128 [En, af]
Insects visiting mango flowers on a farm in the Letsitele

Valley were sampled at hourly intervals over a 3-day period. A total of 1323 insect visits were recorded. Honey bees were excluded from the survey, but they frequently visited flowers throughout the day. The most abundant bees were *Braunsapis bouyssoui* and *B. facialis* (17%). Blow flies were the most frequent visitors, with *Rhyncomya forcipata* Villeneuve (30%) the most common. House flies (*Musca domestica*) were also observed on flowers.

Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C. D. and Mansell, M. W. Preliminary report on the natural occurrence of insect pollinators in an avocado orchard. Yearbook – South African Avocado Growers' Association (1993) 16 127–128 [En]

A survey of insect pollinators was carried out in an avocado orchard on the Westfalia Estate during a 3-day period in September 1992. Observations began at 08.00 hours and continued until 16.00 hours. Many insects other than honeybees visited the avocado flowers, but most species were present in such low numbers that even if they pollinated the flowers, their influence could be assumed to be negligible. Most of the insects simply robbed the flowers of nectar and carried very little or no pollen. The only insects that appeared to pollinate the flowers were the honey bees (*Apis mellifera*), the small carpenter bee (*Allodape microsticta*) and a calliphorid fly (*Rhyncomya forcipata*). Of these, only the honeybees were present in sufficiently high numbers to influence pollination.

Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C. D. and Mansell, M. W. Preliminary report on the natural occurrence of insect pollinators in a litchi orchard. Yearbook – South African Litchi Growers' Association (1994) 6 13–14 [En, af]

A survey of two litchi orchards revealed that many insects other than honey bees visited flowers (data tabulated) but that most of these were present in such low numbers that their influence as pollinators could be assumed to be negligible. The aggressive behaviour of the honey bees also influenced visits by other insects.

Biosystematics Division, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C. D. and Mansell, M. W. Report on the natural occurrence of insect pollinators in a mango orchard. Yearbook – South African Mango Growers' Association (1994) 14 65–66 [En, af, Bc]

A total of 816 visits by species of Hymenoptera, Coleoptera, Diptera and Lepidoptera were recorded in a flowering mango orchard in Letsitele Valley, South Africa, in August 1993. The most abundant insects were small carpenter bees (*Braunsapis* spp., 188 visits), the blowflies *Stomorphina rugosa* (87) and *Rhyncomya forcipata* (76), and honey bees (*Apis mellifera*, 51). Most insects occurred in low numbers and robbed flowers of nectar. Because of their small size, the *Braunsapis* species are considered to be the most efficient pollinators of the tiny mango flowers. D. G. Lowe
Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eardley, C. D. and Mansell, M. W. Report on the natural occurrence of insect pollinators in an avocado orchard: second report. Yearbook – South African Avocado Growers' Association (1994) 17 117–118 [En, Bc]

In two avocado orchards in Pretoria, South Africa, insects visiting flowers were recorded and samples were collected for identification. Four species of wild bees and many species of flies (Diptera) were recorded, but the number from each species was very low. Many insect visitors were nectar robbers and carried little or no pollen. The main pollinator (over 80% of insect visits) was *Apis mellifera*, although its numbers varied from season to season. It may be possible to increase the population density of some other potential pollinators, e.g. *Allodape microsticta*. P. Walker

Biosystematics Division, Agricultural Research Council, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Eischen, F. A., Baxter, J. R., Elzen, P. J., Westervelt, D. and Wilson, W. T. Is the small hive beetle a serious pest of U.S. honey bees? American Bee Journal (98) 138 (12) 882–883 [En, Bj]

Aethina tumida, which is a pest of honey bees in South Africa, was first found in the USA (South Carolina) in November 1996. It is now present in 14 counties of this state and also in Georgia and Florida (although not all reports have been confirmed), and appears to be spreading. Colony damage seems most severe in Florida. Adult beetles eat eggs in the brood nest; beetle larvae open sealed honey bee brood cells and eat the contents, as well as pollen and some honey. The remaining honey often ferments and is unsaleable. Various control methods are being tested; meanwhile, beekeepers are cautioned against indiscriminate use of drenches for fire ant control, although such treatment may kill prepupal, pupal and emerging adult beetles in the soil near hives. P. Walker
Honey Bee Group, USDA-ARS-SARC, 2413 E. Hwy. 83, Weslaco, TX 78596, USA.

Ellis, J. Controlling small hive beetles (*Aethina tumida* Murray) in honey bee (*Apis mellifera*) colonies using a modified hive entrance. American Bee Journal (2002) 142 (4) 288–290 [En, Bj]

The modified entrance was a 3/4-inch (2-cm) PVC pipe located 3–4 inches (7.6–10.2 cm) above the bottom board. Hives fitted with these entrances had significantly fewer adult beetles (46.9/colony) than control colonies (107.7/colony). The amount of sealed brood in test colonies was slightly but not significantly less; also, the colony temperature increased as the amount of brood increased. Author

Dept of Zoology & Entomology, Rhodes Univ., Grahamstown, South Africa 6140.

Ellis, J. Life behind bars: why honey bees feed small hive beetles. American Bee Journal (2002) 142 (4) 267–269 [En, Bj]

The imprisoning of *Aethina tumida* in propolis cells in *Apis mellifera capensis* colonies, as recently reported, is discussed. In an experiment to establish whether the bees also feed the beetles, a colony in a 3-frame observation

hive was provided with dyed sugar water in the bottom frame; beetles were in the top frame with a mesh below so that they did not have access to the food. When the beetles were examined after one day, about one-third had red dye in their guts. Feeding was also observed; a beetle touches a bee's antennae in the same way as another bee solicits for food, and about 12–14% of these contacts are successful, i.e. the beetle is fed. *P. Walker*

Dept of Zoology & Entomology, Rhodes Univ., Grahamstown, South Africa 6140.

Ellis, J.D., Hepburn, R., Delaplane, K.S., Neumann, P. and Elzen, P. *The effects of adult small hive beetles, *Aethina tumida* (Coleoptera: Nitidulidae), on nests and flight activity of Cape and European honey bees (*Apis mellifera*)*. *Apidologie* (2003) 34 (4) 399–408 [En, de, fr, Bj]

Studies were made in South Africa (Cape honey bees, C) and USA (European honey bees, E) on colonies with < 5 hive beetles (controls) and colonies experimentally infested with 1400–1500 beetles. Abscending day did not differ significantly between treatment or bee race, but difference in absconding was greater between treated and control colonies in E than in C. C used significantly more propolis and had larger honey stores than in E, but treated C colonies had smaller pollen stores than controls (an effect not observed in E). Other results are reported, and overall it is concluded that the effects of treatment in E are symptomatic of absconding preparation. No. beetles in controls was significantly higher in E than in C; the percentage of beetles remaining in non-absconding treated colonies was higher in C than in E. The data indicate that adult *A. tumida* can cause significant harmful effects in E but not in C. *Author*

Rhodes Univ., Dept of Zoology and Entomology, Grahamstown 6140, South Africa.

Ellis, J.D. Jr, Hepburn, R., Delaplane, K.S. and Elzen, P.J. *A scientific note on small hive beetle (*Aethina tumida*) oviposition and behaviour during European (*Apis mellifera*) honey bee clustering and absconding events*. *Journal of Apicultural Research* (2003) 42 (47–48) [En, Bj]

Into each of six 3-frame nucleus colonies, 100 small hive beetle adults were introduced each day for 14 days. Two colonies absconded. The other four colonies were kept at 7° on day 17 which caused clustering, and then thawed and examined. They contained 253–905 beetles, mostly inside the bee cluster. Puncture marks were observed in about one-third of brood cell cappings; when these were removed, beetle eggs were found in the cells, usually >10 eggs/cell. In four infested *A. m. capensis* colonies in South Africa, no punctured cappings were found. *P. Walker*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Ellis, J.D. Jr, Holland, A.J., Hepburn, R., Neumann, P. and Elzen, P.J. *Cape (*Apis mellifera capensis*) and European (*Apis mellifera*) honey bee guard age and duration of guarding small hive beetles (*Aethina tumida*)*. *Journal of Apicultural Research* (2003) 42 (3) 32–34 [En, Bj]

The guard age and duration of honey bees guarding small hive beetles were determined by monitoring individually labelled honey bees of each subspecies. European honey

bees in the USA began guarding the beetles significantly earlier (at mean age 18.6 days), guarded beetles significantly longer (for 2.4 days), and stopped guarding beetles significantly sooner (at age 19.9 days) than Cape honey bees did in South Africa (20.6, 1.4 and 21.0 days, respectively). Although the timing of beetle guarding behaviour is significantly different, it does not explain the differential damage to colonies of the two subspecies caused by small hive beetles. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Ellis, J.D. Jr, Neumann, P., Hepburn, R. and Elzen, P.J. *Longevity and reproductive success of *Aethina tumida* (Coleoptera: Nitidulidae) fed different natural diets*. *Journal of Economic Entomology* (2002) 95 (5) 902–907 [En, X]

Newly emerged beetles were fed with different diets (unfed control; honey-pollen; honey; pollen; empty brood comb; bee brood; fresh or rotten apples). Longevity in honey-fed beetles (average max. 167 days) was significantly higher than on other diets. Offspring were produced on honey-pollen, pollen, bee brood, and apple diets, but not on honey alone, empty brood comb, or in controls. The highest reproductive success occurred in pollen-fed adults (1773.8 larvae/3 mating pairs of adults). Larvae fed with pollen, honey-pollen or brood had significantly higher pupation success rates of 0.64, 0.73, and 0.65, respectively, than on the other diets. Sex ratios of emerging adults fed with diets of pollen or brood as larvae were significantly skewed toward females. Because *A. tumida* longevity and overall reproductive success was highest on foods available in honey bee colonies, it can cause large-scale damage.

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Evans, A.V. and Nel, A. *Notes on *Macrocyphonistes kolbeanus* Ohaus and *Rhizoplatys auriculatus* (Burmeister), with comments on their melittophilous habits (Coleoptera: Melolonthidae: Dynastinae: Phileurini)*. *Journal of the Entomological Society of Southern Africa* (1989) 52 (1) 45–50 [En]

Macrocyphonistes kolbeanus and *Rhizoplatys auriculatus* are reported feeding on the brood of honey bees [*Apis mellifera*]. The morphology of these species is described with particular reference to the mouthparts. The mouthparts of both species are compared to those of *Oplostomus fuliginosus*. *M. kolbeanus* is recorded from Mozambique and South Africa for the first time.

Dept. Entomology, Univ. Pretoria, Pretoria 0002, South Africa.

Evans, J.D., Pettis, J.S. and Shimanuki, H. *Mitochondrial DNA relationships in an emergent pest of honey bees: *Aethina tumida* (Coleoptera: Nitidulidae) from the United States*. *Annals of the Entomological Society of America* (2000) 93 (3) 415–420 [En, Bc]

Specimens of *A. tumida* were collected throughout its current range in south-east USA and from several sites in South Africa. A 1018-bp section of the mitochondrial cytochrome-c oxidase I gene was amplified and sequenced in 26 beetles collected from four US states, and in 14 beetles

collected from seven sites in South Africa. Mitochondrial DNA variation between all samples was <0.8%, which was still considered within the range expected for a single species. The US samples showed two distinct haplotypes, differing by 6 bp (0.6%). Both were found across and within several geographic regions; this is consistent with a single introduction. However, a broad survey of 151 beetles from their new range revealed significant heterogeneity in haplotype frequencies, perhaps resulting from multiple introductions. The data do not allow a precise estimate of the point from which *A. tumida* was accidentally exported from Africa. USDA-ARS Bee Research Lab., Building 476 BARC-E, Beltsville, MD 20705, USA.

Fielding, K., Hepburn, H.R. and Chandler, H.D. On the development of flight competence in worker honeybees. *Comparative Biochemistry and Physiology, A* (1980) 65 129–133 [En, B]

The tensile mechanical properties of the large indirect wing depressor flight muscle of worker *Apis mellifera adansonii* were measured on an extensometer. Muscles, with their cuticular origin and insertion points intact, were dissected from bees at all developmental stages from the pharate adult to foragers about 15 days old. Stiffness and maximum stress increased with age, but the elastic limit was nearly constant (40–45% of maximum strain). The development of mechanical stiffness of the flight muscle was slower than that of the cuticle, but was simultaneous with the development of the energy-producing systems of the flight muscle as measured by hexokinase and glycerol-3-phosphate dehydrogenase activity. The results suggest that it is the muscular element of the skeleto-muscular system which imposes constraints on behavioural activities at any particular stage of development. *D.G. Lowe*
Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Fivaz, J. Pollination in the South African mango industry. *South African Bee Journal* (2000) 71 (3) 91–94 [En, B]
Bavaria Fruit Estate, PO Box 569, Hoedspruit 1380, South Africa.

Fletcher, D.J.C. Should European races of honey-bees be introduced into South Africa? *South African Bee Journal* (1973) 45 (1) 19–25 [En, B]

An entomologist sets out the arguments, and quotes results of previous inter-continental importations. He regards the *A. m. adansonii* gene pool as something valuable, not to be impoverished or destroyed by hybridisation. More knowledge of African honeybees is needed and, while this is being obtained, controlled importation of mated queens of other races for experimental purposes, under strict control. *E.E. Crane*
Dept. Entomology, Univ. Natal, South Africa.

Fletcher, D.J.C. Evaluation of introductions of European honey-bees into Southern and Eastern Africa. Proceedings of the VIIIth International Congress of IUSSI. Wageningen, Netherlands; Centre for Agricultural Publishing and Documentation. (1977) 146–147 [En, B]

Examples are given of importations of European *Apis mellifera* into Southern and Eastern Africa. They represent a

greater introduction of genetic material than that which occurred in Brazil when *A. m. adansonii* escaped there, but European bees have never become established in Africa. This is considered to be due to their later daily start to foraging, shorter periods of foraging, inability to store much surplus honey, greater susceptibility to natural enemies, and other factors. It is unlikely that the *adansonii* race has been at all modified due to the introduction of European genetic material into Africa. *D.G. Lowe*
Bee Res. Lab., Plant Protection, Private Bag X134, Pretoria 0001, South Africa.

Fletcher, D.J.C. *Varroa jacobsoni*, a potential problem for South African beekeepers. *South African Bee Journal* (1977) 49 (6) 15–16 [En, B]

Fletcher, D.J.C. Relevance of the biology and management of *Apis mellifera scutellata* in Africa to the Africanized bee problem. 1988 AAAS Annual Meeting, 154th National Meeting, Boston, 11–15 February. Washington, DC, USA; American Association for the Advancement of Science. (1988) 54 [En]

In Africa, *A. m. scutellata* occupies widely differing habitats and is a correspondingly very variable bee. In the geographic area (the Transvaal Province of South Africa) from which the genetic stock imported into Brazil was derived modern commercial beekeeping is widely practiced. Contrary to data reported for Africanised bees in South America, colonies can attain a very large size and can be highly productive. Defensive behaviour (stinging) is well developed, but is variable and amenable to selective breeding. Colonies have a high reproductive potential and have a strong tendency to abscond. They are able to tolerate lower temperatures than might be expected. These characteristics and other considerations suggest that current schemes to prevent Africanised bees from entering the USA, and for limiting their distribution artificially if they should cross the Mexican border, are unlikely to be effective. A realistic approach would involve allowing the bees to establish their own ecological limits and breeding selectively for desirable traits after restoration of the *scutellata* gene pool via selected genetic material from Africa. *Author*
Bucknell Univ., Lewisburg, PA 17838, USA.

Fletcher, D.J.C. and Crewe, R.M. Nest structure and thermoregulation in the stingless bee *Trigona (Plebeina) denoiti* Vachal (Hymenoptera: Apidae). *Journal of the Entomological Society of Southern Africa* (1981) 44 (2) 183–196 [En, B]

Nests of the ground-nesting *T. (P.) denoiti* were excavated in Natal, South Africa, and compared with descriptions of nests excavated in Tanzania around 1953. A number of differences were found, among them a greater variation in the structure of the brood nest. Although the brood combs were spirally arranged, as in the Tanzanian nests, double as well as single spirals occurred and both types rotated either clockwise or anti-clockwise. The unique features of the nest architecture are discussed. An investigation of thermoregulation in the nests indicated that the bees had a limited ability to raise the nest temperature above ambient, and that the various layers of the nest had different

insulating properties. When the temperature of the brood nest was raised from 31.7 to 35.7°C over a period of nine hours, the brood, queen and many of the bees were killed. Thermoregulation by arboreal and ground-nesting *Meliponinae* is briefly discussed. *Author*
Dept. Entomology, Univ. Natal, Pietermaritzburg 3200, South Africa.

Fletcher, D.J.C. and Crewe, R.M. New records of stingless bees (Hymenoptera: Meliponini) in Natal. *Journal of the Entomological Society of Southern Africa* (1981) 44 (2) 197–198 [En, B]

In 1972, nine colonies of *Trigona (Hypotrigona) gribodoi* were found north-west of Empangeni, South Africa, some 100–136 km further south than previously recorded. In 1972–1973, six colonies of *T. (Plebeina) denoiti* were found in the same site, about 450 km further south than previously recorded. *Author*
Dept. Entomology, Univ. Natal, Pietermaritzburg 3200, South Africa.

Fletcher, D.J.C. and Johannsmeier, M.F. The status of bee-keeping in South Africa. *South African Bee Journal* (1978) 50 (4) 5–20 [En, B]

This report seeks to identify reasons for the slower growth of a modern beekeeping industry in South Africa than in many other countries. Honey production, though it has increased recently, is rather low; beeswax production is also small. Domestic demand for honey is poor, but could be stimulated, and there are available export markets for wax. The variety and extent of nectar sources, which are probably not fully exploited, are discussed. After a summary of some of the problems in managing *Apis mellifera adansonii*, recommendations are made; now that a modern beekeeping industry has been established, the next phase should consist of regular requeening of colonies. Phase 3 would involve a selective breeding programme to produce strains in which high productivity is combined with docility and other desirable characteristics. A publication dealing adequately with the specific problems of managing *A. m. adansonii* is needed. *A. m. adansonii* is an important pollinator of many crops (particularly kidney bean, sunflower, citrus and lucerne), but beekeepers usually supply colonies free of charge. *P. Walker*
Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Fletcher, D.J.C. and Tribe, G.D. Natural emergency queen rearing by *Apis mellifera adansonii* and its relevance for successful queen production by beekeepers, II. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher): Fletcher, D.J.C. and Tribe, G.D. Natural emergency queen rearing by the African bee *A. m. adansonii* and its relevance for successful queen production by beekeepers, I. Pretoria, South Africa; *Apimondia* (1977) 161–168 [En, B]

The number of non-mating flights by six emergency queens, that had been naturally reared in observation hives, varied from three to 12. Queens that eventually flew on one mating flight first flew (non-mating flight) when they were four days old. The four queens that made two mating flights first flew when they were three days old.

Queens flew only once per day until they were sexually mature, but they usually flew two or three times before a mating flight. This may have enabled them to monitor weather conditions – mating flights were undertaken only when the wind speed was 4 m/s or less. Non-mating flights lasted on average for 62 seconds, mating flights for 13 minutes 17 seconds; all flights occurred in the afternoon. Oviposition started two days after the first mating flight. It appears from the observations that *A. m. adansonii* queens make mating flights 5–6 days after pupal eclosion if weather conditions allow, whether or not they have previously been imprisoned in their cells by the workers. The implications of these timings for queen rearing programmes are discussed. *D.G. Lowe*

Fletcher, D.J.C. and Tribe, G.D. Natural emergency queen rearing by the African bee *A. m. adansonii* and its relevance for successful queen production by beekeepers, I. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 132–140 [En, B]

Of 57 viable queens reared by 12 queenless colonies in observation hives, only eight were reared from larvae that had been in the larval stage at the time of dequeening; the others were reared from larvae that had been in the egg stage. It is suggested that the period of development during which *A. m. adansonii* worker larvae can develop into queens is shorter than in European races. This and other factors are discussed in relation to queen rearing methods. *D.G. Lowe*

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Fletcher, D.J.C. and Tribe, G.D. Swarming potential of the African bee, *Apis mellifera adansonii* L. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 25–34 [En, B]

It is probable that a higher rate of swarm production is necessary in *A. m. adansonii* than in European races in order to compensate for the greater natural loss of colonies brought about by the African bee's many natural enemies. Theoretically, such a trait would be favoured by natural selection. The author suggests that the following characteristics interact in order to produce more swarms than in European races: higher fecundity of queens; shorter developmental period of workers; foraging at lower temperatures and at lower light intensities; foraging in rain; (possibly) faster rate of foraging; smaller body size; migration to resource-rich areas; swarming with virgin queens after loss of a mated queen. Events leading to the emergence of a prime swarm with one or more virgin queens ('queen-loss swarming') are described in detail. *D.G. Lowe*

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Fletcher, D.J.C. (ed.). Apimondia, International Symposium on African Bees. African bees: taxonomy, biology and economic use. Pretoria, South Africa; *Apimondia* (1977) ix + 207 pp. + 11 pl. [En, B]

This book contains the full proceedings of a symposium held in Pretoria on 17–19 November 1976. Most of the 29

papers read concerned the biology of *Apis mellifera adansonii*, and beekeeping with it or with its hybrids with European *A. mellifera*. Besides the full texts of these papers, which are abstracted or listed separately in *Apicultural Abstracts*, the book also contains the opening and closing addresses, an introduction, and the names and addresses of contributors. D.G. Lowe

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Ford, D.M., Hepburn, H.R., Moseley, F.B. and Rigby, R.J. Displacement sensors in the honeybee pollen basket. *Journal of Insect Physiology* (1981) 27 (5) 339–346 [En, B]

Worker honeybees (180 in all) bearing pollen loads were captured on their return to a hive and anaesthetised by chilling. Each was then colour-marked, and the spindle seta, or anterior setae, or posterior setae, surgically removed from one hind tibia. Bees were returned to the hive and 25 were recaptured on subsequent pollen foraging trips. In all cases, the pollen pellets obtained from the surgically treated corbiculae were significantly smaller than those from control bees. The neurophysiological characteristics of corbicular setae were investigated using isolated hind-leg preparations. Displacement of the spindle seta in 16 preparations failed to elicit a response, but responses due to displacement of the anterior corbicular setae were obtained from 32 legs; some exhibited a phasic response related to displacement angle, whilst others were simply 'on-off' detectors. A third type of setal response, with phasic and tonic components, was also related to angle of outward displacement. The results suggest that at least some of the anterior corbicular setae are capable of measuring the size of a forming pollen load. D.G. Lowe

Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Ford, D.M., Hepburn, H.R. and Rigby, J. Do honeybees measure their pollen loads? *South African Journal of Science* (1979) 75 511–512 [En, B]

The neurophysiological characteristics of corbicular setae were examined by recording electrical impulses from the exposed nerve trunk in the femur while individual corbicular setae were mechanically displaced. In 14 of the 17 preparations, a marked increase in rate of impulses occurred only during movement of the seta; when movement stopped the number of impulses per s returned to normal even though displacement of the seta was maintained. In three of the preparations a similar increase occurred during movement of the seta, but when the seta was held stationary in the new position (as would happen if there were a pollen load) the impulse rate was maintained at a higher level than before displacement. It is suggested that at least some corbicular setae play a role in the bee's measurement of the size of a pollen load during its formation. P. Walker

Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Francis, B.R., Blanton, W.E. and Nunemaker, R.A. Extractable surface hydrocarbons of workers and drones of the genus *Apis*. *Journal of Apicultural Research* (1985) 24 (1) 13–26 [En, B]

Extractable surface hydrocarbons of adults of various ages chosen at random from species of honeybees (*Apis florea*, *A. dorsata*, *A. mellifera* and *A. cerana*), and newly-emerged adult workers of subspecies of *A. mellifera* were analysed by GC and combined GC/MS. There were significant quantitative and qualitative differences between the hydrocarbons of the four species of *Apis*. The quantity of hydrocarbon per bee was higher for *A. dorsata* and *A. cerana* than for *A. mellifera*, and even the quantity found in the much smaller *A. florea* approached that of *A. mellifera*. The major hydrocarbons of the surface waxes of *A. florea*, *A. mellifera*, and *A. cerana* were normal alkanes and alkenes. For *A. dorsata*, there was also a substantial proportion of branched alkanes. Small quantities of branched alkanes were found in the surface waxes of *A. mellifera* and *A. cerana*, but only traces were found in those of *A. florea*. Compared with workers, drones of *A. dorsata* and *A. cerana* had higher proportions of branched alkanes and short-chain alkenes and lower proportions of normal alkanes and long-chain alkenes. For random-age bees, the unsaturated hydrocarbons of *A. mellifera adansonii* covered a wider range of chain lengths than those of the other *A. mellifera* subspecies investigated. The quantities of hydrocarbons extracted per individual from samples of newly emerged worker bees of different subspecies of *A. mellifera* were consistent and the chromatograms showed only minor variations. Honeybees from South Africa (*A. m. adansonii* and *A. m. capensis*) and 'Africanised' bees from Brazil had a substantially higher proportion of C35 unsaturated hydrocarbons than bees of European origin (*A. m. mellifera*, *A. m. ligustica* and *A. m. carnica*). Author

Coll. Agric., Univ. Wyoming, Laramie, WY 82071, USA.

Franck, P., Garnery, L., Loiseau, A., Oldroyd, B.P., Hepburn, H.R., Solignac, M. and Cornuet, J.M. Genetic diversity of the honeybee in Africa: microsatellite and mitochondrial data. *Heredity* (2001) 86 (4) 420–430 [En, Bc]

A total of 738 colonies from 64 localities along the African continent have been analysed using the Dral RFLP of the COI-COII mitochondrial region. The mitochondrial DNA appears to be composed of three highly divergent lineages. The African lineage previously reported (named A) is present in almost all the localities except those from north-eastern Africa. In this area, two newly described lineages (called O and Y), putatively originating from the Near East, are observed in high proportion. This suggests an important differentiation of Ethiopian and Egyptian honey bees from those of other African areas. The A lineage is also present in high proportion in populations from the Iberian Peninsula and Sicily. Furthermore, eight populations from Morocco, Guinea, Malawi and South Africa were assayed with six microsatellite loci and compared with a set of eight additional populations from Europe and the Middle East. The African populations display higher genetic variability than European populations at all microsatellite loci studied thus far. This suggests that African populations have larger effective sizes than European ones. According to their microsatellite allele frequencies, the eight African populations cluster together, but are divided in two subgroups: the populations from Morocco and those from the other African countries. The populations from southern Europe show very low levels of

'Africanisation' at nuclear microsatellite loci. Because nuclear and mitochondrial DNA often display discordant patterns of differentiation in the honey bee, the use of both kinds of markers is preferable when assessing the phylogeography of *Apis mellifera* and to determine the taxonomic status of the subspecies.

Centre de Biologie et de Gestion des Populations, Campus International de Baillarguet, 34980 Monferrier-sur-Lez, France.

Franck, P., Koeniger, N., Lahner, G., Crewe, R.M. and Solignac, M. Evolution of extreme polyandry: an estimate of mating frequency in two African honeybee subspecies, *Apis mellifera monticola* and *A. m. scutellata*. *Insectes Sociaux* (2000) 47 (4) 364–370 [En, X]

Mating frequencies were compared in the two species using five microsatellite loci. Queens of eight colonies of *A. m. monticola*, collected in Malawi, mated 5–19 times producing an average relatedness among workers of 0.328. Six colonies of *A. m. scutellata* collected in South Africa displayed a significantly higher degree of polyandry. The difference in the degree of polyandry observed between the populations suggests that socially based selective pressures are not of primary importance in the evolution of extreme polyandry, but ecological selective pressures play a more significant role.

Laboratoire de Modélisation et de Biologie Evolutive, CBGP-INRA, 488 rue de la croix Lavit, F-34090 Montpellier, France.

Free, J.B. Value and use of honeybees for pollination. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B.J.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 10–15 ISBN 0-620-15132-3 [En, Bd]

Bee Research Unit, Zoology Department, University College, Cardiff, UK.

Froneman, I.J. Subtropical crops. Pollination by honeybees. [Subtropiese gewasse. Bestuiving deur bye]. Information Bulletin, Citrus and Subtropical Fruit Research Institute, South Africa (1988) (No. 196) 12 pp. [Af]

Graphs show the 9-year (1964–72) yields from a litchi plantation and the 7-year (1981–87) yields from a macadamia plantation in relation to the numbers of hives in each [size not specified]. Annual yields were closely related to hive numbers.

Citrus & Subtropical Res. Inst., Nelspruit, South Africa.

Gess, F.W. Further records of the utilization by aculeates of old paper wasp nests. *Sphecos* (1990) (No. 19) 19 [En, 1 ref.]

Five males of *Megachile* (*Eutricharaea*) *gratiosa* are reported to have emerged in March 1973 from several leaf-capped old Polistes nests removed from the facade of the Albany Museum, Grahamstown, South Africa, that January. Also, one wasp, a female *Pison transvaalense*, emerged from a mud-topped cell in January 1973, and a dead female and four dead males of the same species were extracted at a later date from cocoons within the mudtopped cells.

Albany Museum, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. A fourth contribution to the knowledge of the ethology of the genus *Ceramius* Latreille (Hymenoptera: Vespidae: Masaridae) in southern Africa. *Annals of the Cape Provincial Museums, Natural History* (1990) 18 (9) 183–202 [En, Bb]

Ethological accounts, including nest structure and flower visiting records, are given for six species of *Ceramius*. Notes are given on usurpation of nests of *C. braunsi* by *Megachile* (*Eutricharaea*) *aliceae* and the association with this bee of the parasitic bee *Coelioxys* (*Coelioxys*) *recusata*. Author

Albany Museum, Somerset Street, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. Solitary bees: the little known and unsung thousands. *Naturalist* (Port Elizabeth) (1990) 34 (1) 23–32 [En, Ba]

This is a popular account of nesting by solitary bees. As examples, notes are given on the nests of some southern African *Colletidae*, *Megachilidae* and *Anthophoridae*. D. G. Lowe

Albany Museum, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. A preliminary survey of the aculeate wasps and the bees of the lower reaches of the Nossob River Valley, Kalahari Gemsbok National Park, South Africa. *Koedoe* (1991) 34 (2) 77–88 [En, Ba]

Notes on flowers visited and nest type are given.

Department of Entomology and Arachnology, Albany Museum, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. Effects of increasing land utilization on species representation and diversity of aculeate wasps and bees in the semi-arid areas of southern Africa. *Hymenoptera and biodiversity* [LaSalle, J. and Gauld, I.D. (eds)]. Wallingford, UK; CAB International. (1993) 83–113 ISBN 0-85198-830-X [En, Ba]

Wasps and bees were sampled and identified at four sites in semi-arid areas of southern Africa (known collectively as karoo). Their nest sites and nesting behaviour were also studied. By comparing results for the different sites, the effects of land use on wasp and bee diversity were deduced. As a result of increasing crop growing, stock grazing, use of pesticides, bush cutting, etc., the areas suitable for typical aculeate wasp and bee communities are shrinking. These insects are habitat specialists and do not adapt to change. It is concluded that eventually the whole ecological system of the karoo will be upset. P. Walker

Department of Entomology, Albany Museum, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. Nesting and flower visiting of some southern African Anthophorini (Hymenoptera: Apoidea: Apidae: Apinae). *Annals of the Cape Provincial Museums, Natural History* (1996) 19 (7) 347–373 [En, Bb]

Several species were studied at two sites in Cape Province. The nests of two *Amegilla* and two *Anthophora* species are described. An appendix lists 502 flower visits previously recorded for males and females of 16 *Amegilla* and 10 *Anthophora* species to plant species belonging to 26 and 11

families, respectively. The data show that the genera prefer species of *Acanthaceae* and *Boraginaceae*, respectively. It appears that these *Anthophorini* do not as a rule practice indiscriminate broad polylecty. *P. Walker*
Albany Museum, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. *Love among the flowers. The small annual, *Monopsis debilis*, and its pollinator, the bee, *Haplomelitta ogilviei. *Veld and Flora* (1994) 80 (1) 18–19 [En, Bc]**

Monopsis debilis (*Campanulaceae*) grows in dense patches in moist areas of SW southern Africa. Its flowering biology is described. Males and females of *Haplomelitta ogilviei* (*Melittidae*) were observed visiting the flowers regularly to collect nectar and (females) pollen. This bee appears to be the only pollinator of the plant. *P. Walker*

Department of Entomology, Albany Museum, Grahamstown 6140, South Africa.

Gess, F.W. and Gess, S.K. *Potential pollinators of the Cape Group of *Crotalariaeae* (sensu Polhill) (Fabales: Papilionaceae), with implications for seed production in cultivated rooibos tea*. *African Entomology* (1994) 2 (2) 97–106 [En, Ba]

This study characterises the assemblages of *Hymenoptera* that visit flowers of the genera *Aspalathus*, *Lebeckia*, *Wiborgia* and *Rafnia*, and evaluates the potential of their members as pollinators. All the assemblages from the western and eastern Cape are characterised by the presence of *Megachilinae* (*Megachilidae*) and *Xylocopinae* and/or *Anthophorinae* (*Anthophoridae*), and those from the west (excluding *Rafnia*) by the presence of *Masarinae* (*Vespidae*). The *Megachilinae* and *Xylocopinae* are potential pollinators. Two species of *Masarina* (*Masarinae*) are apparently restricted to *Aspalathus*, *Lebeckia* and *Wiborgia*, and are potential pollinators of the smaller-flowered species of these genera. Two species of *Ceramius* (*Masarinae*) are apparently restricted to *Aspalathus* and are potential pollinators and, within their distribution ranges, the most dependable visitors of this genus. Honey bees (*Apis mellifera*) and *Eumeninae* (*Vespidae*) visit all four genera but are probably of little importance as pollinators. *A. mellifera* is certainly able to obtain nectar from the smaller-flowered species without tripping the flowers. The implications of these findings for seed production in the rooibos tea (*A. linearis*) industry are discussed. *Author*

Department of Entomology, Albany Museum, Grahamstown 6140, South Africa.

Govan, V.A., Allsopp, M.H. and Davison, S. *A PCR detection method for rapid identification of *Paenibacillus larvae. *Applied and Environmental Microbiology* (99) 65 (5) 2243–2245 [En, wf]**

A PCR detection method is described which can be used on *P. larvae* colonies growing on a semiselective medium of nalidixic and pipermedic acid. The PCR primers were designed on the basis of the 16S rRNA gene of *P. larvae* and selectively amplified a 973-bp amplicon. The PCR amplicon was confirmed as originating from *P. larvae* by sequencing in both directions. Detection was specific for *P. larvae*, and the primers did not hybridise with DNA from closely related bacterial species.

Dept of Microbiology, Univ. of the Western Cape, Private Bag X17, Bellville 7535, South Africa.

Govan, V.A., Brözel, V., Allsopp, M.H. and Davison, S. *A PCR detection method for rapid identification of *Melissococcus pluton* in honeybee larvae*. *Applied and Environmental Microbiology* (98) 64 (5) 1983–1985 [En, Bc]

PCR was used selectively to amplify specific rRNA gene sequences of *M. pluton* from pure culture, from crude cell lysates, and directly from infected honey bee larvae. The PCR primers were designed from *M. pluton* 16S rRNA sequence data. The PCR products were visualised by agarose gel electrophoresis and confirmed as originating from *M. pluton* by sequencing in both directions. Detection was highly specific, and the probes did not hybridise with DNA from other bacterial species tested. This method enabled the rapid and specific detection and identification of *M. pluton* from pure cultures and infected honey bee larvae. *Author*

Dept of Microbiology, Univ. of the Western Cape, Bellville 7535, South Africa.

Govan, V.A., Leat, N., Allsopp, M. and Davison, S. *Analysis of the complete genome sequence of acute bee paralysis virus shows that it belongs to the novel group of insect-infecting RNA viruses*. *Virology* (New York) (2000) 277 (2) 457–463 [En, Bc]

The complete nucleotide sequence of the acute bee paralysis virus genome is reported. Analysis of the sequence data showed that this virus is similar to *Drosophila C* virus, *Plautia stali* intestine virus, *Rhopalosiphum padi* virus and *Himetobi P* virus. It is suggested that acute bee paralysis virus is a member of the cricket paralysis-like viruses.

Dept of Microbiology, Univ. of the Western Cape, Bellville 7535, Cape Town, South Africa.

Greeff, J.M. *Effects of thelytokous worker reproduction on kin-selection and conflict in the Cape honey bee, *Apis mellifera capensis. *Philosophical Transactions of the Royal Society of London, B* (96) 351 617–625 [En, Bc]**

In *A. m. capensis* the kin-structure of colonies is altered by the presence of thelytokous worker offspring, which are female. This results in changes in the kin structure of the colony and therefore changes in kin-value asymmetries and kin-selection. Consequently, many of the predictions regarding conflict in thelytokous species differ quantitatively or even qualitatively from those for arrhenotokous species. In *A. m. capensis* inclusive fitness arguments predict more conflict between workers over reproductive dominance, especially when the colony is queenless. Some of the unique traits of the bee workers on queen-loss can be explained as responses to such selection: (1) extreme aggression amongst workers; (2) very rapid development of ovaries; and (3) queen-like pheromones in workers upon queen-loss. It is predicted that workers will remove (police) less of their fellow workers' eggs than in other races. *Author*

Dept of Zoology and Entomology, Univ. of Pretoria, Pretoria 0002, South Africa.

Greeff, J.M. *Thelytokous versus arrhenotokous worker reproduction in the Cape honeybee and other eusocial*

Hymenoptera. *Hereditas* (Landskrona) (1996) 124 (1) 99–103 [En, Bc]

By extending the model of R.F.A. Moritz (1986) [*Entomologia Generalis*, 11: 159–164] the author suggests that thelytoky is the preferred reproductive mode of *Apis mellifera capensis*. This bias is not due to its life history and not because of a high risk of queen loss. The queen's mating frequency and the question whether worker reproduction is limited by colony resources or the sheer number of eggs are of importance in determining which reproductive strategy would be stable.

Department of Zoology & Entomology, University of Pretoria, Pretoria 0002, South Africa.

Greeff, J.M. and Villet, M.H. *Deducing the coefficient of relationship by the amount of recombination produced during automictic parthenogenesis.* *Hereditas* (1993) 70 (5) 499–502 [En, Bc]

In *Apis mellifera capensis*, workers can be produced from worker-laid eggs by the process of automictic parthenogenesis with central fusion (the pronucleus and one of the second division products of the first polar nucleus fuse). Estimates of heritabilities of traits using parent-offspring regressions have been based on the assumption that the coefficient of relationship (r) between workers and their parthenogenetically produced worker offspring is equal to 1. The limitations of this assumption are examined in this paper, and the logic of the argument is used in reverse to estimate r from measures of heritabilities. D.G. Lowe

Department of Zoology and Entomology, Rhodes University, PO Box 94, Grahamstown 6140, South Africa.

Grobler, S.R. and Basson, N.J. *The effect of honey on human tooth enamel and oral bacteria. Bee products: properties, applications, and apitherapy* [Mizrahi, A. and Lensky, Y. (eds)]. New York, USA; Plenum Publishing Corporation. (1997) 65–71 ISBN 0-306-45502-1 [En, Bd]

Human incisor crowns were polished to give a smooth surface and then exposed for different times to pure or diluted Eucalyptus honey. SEM showed no erosion of enamel after 30-minute exposures to undiluted honey, and Knoop microhardness tests showed no deterioration of enamel structure. Results were similar after exposure to 50% and 25% solutions of honey in water. However, a high degree of enamel erosion was observed after 30-minute exposure to 25% artificial honey (a mixture of sugars) in water. MIC was determined for the antibacterial effect of natural honey against seven oral *Streptococcus* species and strains of *Candida albicans* and *Staphylococcus aureus*. Honey did not inhibit growth of most of them until the concentration was 25%, but MIC was 17% and 12% for *Streptococcus anginosus* and *S. aureus* strains, respectively. P. Walker

Oral and Dental Research Institute, Faculty of Dentistry, University of Stellenbosch, Private Bag X1, 7505 Tygerberg, South Africa.

Grobler, S.R., Toit, I.J. du and Basson, N.J. *The effect of honey on human tooth enamel in vitro observed by electron microscopy and microhardness measurements.* *Archives of Oral Biology* (1994) 39 (2) 147–153 [En, 28 ref.]

Various fruit juices with relatively low pH are known to have erosive effects on human tooth enamel in a reasonably short time. Honey, also with a relatively low pH, could do the same, but scanning electron microscopy of crowns of 25 human maxillary incisors showed no erosion of enamel by honey over a period of 30 min, neither did Knoop microhardness tests show any deterioration of enamel structure. The absence of any effect could be only partly attributed to the calcium, phosphorus and fluoride values in honey.

Oral and Dental Research Institute, Faculty of Dentistry, University of Stellenbosch, Private Bag XI, 7505 Tygerberg, South Africa.

Guy, R. *Eucalyptus grandis Hill ex Maiden, as a honey plant in South Africa.* *South African Bee Journal* (1974) 46 (1) 6–7, 9 [En, B]

Guy, R.D. *A simple new hive and a beekeeping system for keeping the African bee.* *South African Bee Journal* (1975) 47 (5) 8–11 [En, B]

The 'Gorongosa' movable-comb trough hive can be simply and cheaply made to approximately the same dimensions as the Langstroth hive body. Fourteen bars are accurately spaced by frame spacers so that the combs are correctly spaced for the African bee (32 mm centre to centre). These hives, with covers, can be distributed in the miombo bush in groups of five, either on stands, or suspended by wires from a horizontal pole for easy working from a lorry. Three types of honey super are suggested. P. Walker

P.O. Box 151, Empangeni, 3880 South Africa.

Guy, R.D. *The Gorongosa bee tree.* *African Wildlife* (1972) 26 (4) 160–161 [En, B]

A specimen of baobab tree *Adansonia digitata* containing three nests of *Apis mellifera adansonii* is described. Numerous pegs and peg sockets in the trunk of the tree showed that it had been visited regularly by honey-hunters for centuries. Many old peg sockets were occupied by nests of stingless bees, probably *Trigona gribodoi*; other sockets had become filled with rain water and bees drank from these. Forktailed drongos, greater honeyguides and flocks of bee-eaters were often found around the tree. A. S. Attwood

Buccleuch Apiaries, P.O. Box 151, Empangeni, Zululand, South Africa.

Guy, R.D. *The honey hunters of Southern Africa.* *Bee World* (1972) 53 (4) 159–166 [En, B]

Methods and equipment used are described, together with practices associated with ownership of wild colonies and honey hunting. The history of beekeeping in the area is given with reference to cave and rock paintings, and the bee forage available. A. S. Attwood

Box 151, Empangeni, Zululand, Republic of South Africa.

Guy, R.D. *Commercial beekeeping with Apis mellifera adansonii in intermediate and movable-frame hives. Apiculture in tropical climates, editor E. Crane.* London, UK; International Bee Research Association. (1976) 31–37 [En, B]

In Zululand, South Africa.

Guy, R.D. Whence the Cape bee? *South African Bee Journal* (1976) 48 (2; 3) 7–8; 9–11 [En, B]

Discusses the origin of *Apis mellifera capensis* and its inter-relationships with *A. m. adansonii*.

Guy, R.D. The pros and cons of bar hive beekeeping in Africa. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia (1977) 202–204 + 2 pl. [En, B]

Guy, R.D., Johannsmeier, M.F. and Myburgh, A.J. South African bee plants. *South African Bee Journal* (1971/1972/1973) 43; 44; 45 (4, 5, 6; 1, 2, 3, 4, 6; 2) 3, 7, 2–4; 5–6, 12–13, 11, 6–8, 5–6; 2–3 [En, B]

Guy, R.D. Australian beemen – thank you. *South African Bee Journal* (1973) 45 (1) 3–14 [En, B]

This illustrated account of a study tour of Australian bee-keeping by a group from South Africa gives much information on practices and equipment used in commercial bee-keeping. *E.E. Crane*

P.O. Box 151, Empangeni, Zululand, South Africa.

Haffejee, I.E. and Moosa, A. Honey in the treatment of infantile gastroenteritis. *British Medical Journal* (1985) 290 1866–1867 [En, B]

Infants and children with gastroenteritis were treated with an oral rehydration solution containing 50 ml honey per litre, plus electrolytes. The standard recommended oral rehydration solution used for a control group contained 20 g glucose/litre instead of honey. In the test group, bacterial diarrhoea did not last as long and non-bacterial diarrhoea was not prolonged. It was concluded that honey could be used as a substitute for glucose in oral rehydration solutions, as long as the correct concentration is used, and the solution contains electrolytes. *P. Walker*

Dept. Paediatrics and Child Health, Fac. Medicine, Univ. Natal, Durban, South Africa.

Hall, H.G. Parental analysis of introgressive hybridization between African and European honeybees using nuclear DNA RFLPs. *Genetics* (1990) 125 (3) 611–621 [En, Bc]

Nuclear DNA restriction fragment length polymorphisms (RFLPs) can distinguish between African (A) and European (E) *Apis mellifera* (e.g. see Hall (1986), *Proceedings of the National Academy of Sciences of the United States of America* 83, 4874–4877). Three RFLPs, detected with random nuclear DNA probes, are now described. In tests using multiple samples of Old and New World honey bee populations, these three polymorphisms were found only in bees of E descent and are possibly specific to certain races; they were present at high frequencies in samples from managed colonies in several states of the USA, but were absent from A honey bees from South Africa. The results reported show that there is a paternal gene flow between managed E colonies and feral A populations in South and Central America, but there may be asymmetries in levels of introgressive hybridisation. Most of the managed colonies in southern Mexico (derived from E maternal lines) that were studied showed low levels of the European marker RFLPs, but the E markers were present at very low frequencies in only some feral swarms (A maternal lines). They were

almost absent from Venezuelan colonies (A maternal lines). The results indicate limited paternal introgression from E to A. These findings do not agree with other views of Africanisation. *P. Walker*

Dept. Entomology & Nematology, Univ. Florida, Gainesville, FL 32611, USA.

Hansen, H., Brødsgard, C.J., Kryger P. and Nicolaisen, M. A scientific note on the presence of *Paenibacillus* larvae larvae spores in sub-Saharan African honey. *Apidologie* (2003) 34 (5) 471–472 [En, B]

Spores were found in two of 10 South African and in a sample from Guinea Bissau, but not in any of the three Gambian honeys examined. The three positive samples had only light contamination. All honey imported to South Africa is irradiated before marketing, so viable spores should not be present. *P. Walker*

Danish Inst. of Agricultural Sciences, Dept of Crop Protection, Research Centre Flakkeberg, DK-4200 Slagelse, Denmark.

Hartmann, W.H. Commercial pollination in the western Cape. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 (Anderson, R.H. and Buys, B. (edss). Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 21–25 ISBN 0-620-15132-3 [En, Bd]

Commercial aspects of using honey bees (*Apis mellifera capensis*) for pollination in western Cape Province, South Africa, are discussed. Colony management and the requisites of colonies used to provide a paid pollination service are also described. It is estimated that 52,394 hives are needed for adequate pollination of apple, pear and plum orchards in the Cape, whereas only just over 12,000 are being deployed at present. *D.G. Lowe*

Hartmann's Apiculture, 17 Kenmore Road, Tamboerskloof, Cape Town 8001, South Africa.

Hattingh, V. and Giliomee, J.H. Pollination of certain *Leucadendron* species (Proteaceae). *South African Journal of Botany* (1989) 55 (4) 387–393 [En, af, Bc]

The genus *Leucadendron* in South Africa was found to be mainly beetle-pollinated, with *Pria cinerascens* the principal pollinator of *L. salignum* and *L. laeureolum*, and *Rhizophagus* sp. the principle pollinator of *L. tinctorum*. *L. daphnoides* was pollinated by honey bees, *Apis mellifera*, in addition to a number of small *Coleoptera* and *Diptera*. Honey bees were also abundant on male flowers of *L. sessile* but were not attracted to female flowers. *L. coniferum* was shown by exclusion experiments to be wind-pollinated and *L. salicifolium* also showed indications of wind pollination. *J.M. Gedy*

Dept. Entomology & Nematology, Univ. Stellenbosch, Stellenbosch 7600, South Africa.

Heever, C.H. van den. The influence of feeding on *Apis mellifera scutellata* queen rearing and brood production. MSc thesis, Bloemfontein, South Africa; University of the Free State (2002) 131 pp. [En, Bt]

In a study of queen rearing in a commercial programme, the presence of *A. m. capensis* laying workers reduced the

overall success rate to 20%. Other factors affecting queen rearing were investigated; results were better with 9-mm cell cups (vs 7, 8 and 11.5 mm), and when larvae were grafted with a drop of water rather than dry. Acceptance of queens was higher after a queenless period of 24 hours (vs 8.5 hours). In feeding trials with *A. m. scutellata* colonies, soya + pollen gave the highest brood production (at the lowest price); however, when pollen was freely available from plants, bees ignored pollen substitutes. In one year, a colony collects approx. 35 kg pollen. Seasonal variations in colony size, and in areas of brood, pollen and honey stores, are also reported. *P. Walker*

Hepburn, H.R., Radloff, S.E. and Oghiakhe, S. Mountain honeybees of Africa. *Apidologie* (2000) 31 (2) 205–221 [En, de, fr, Bj]

Honey bee samples from seven transects through different mountain regions of Africa (five in the east – from South Africa to Ethiopia – and one each in Namibia and Cameroon) were studied by analyses of morphometric characters, flight dimensional measurements and mitochondrial DNA restriction length fragments derived from the non-coding region of COI-COI by DraI restriction. Morphocluster definition was consistent with mtDNA cluster membership but not with flight dimensional data. When all three character suites are combined, six different kinds of unrelated mountain bees are obtained, the only common factor among the mountain bees is that they are larger than bees at lower altitudes. Because of fundamental differences in the restriction length fragments and other clusters obtained, it is concluded that mountain bees should probably be regarded as ecotypically differentiated populations of the subspecies surrounding each particular mountain. *Author*

Dept of Zoology and Entomology Rhodes Univ., Grahamstown, South Africa.

Hepburn, H.R., Radloff, S.E., Steele, G.R. and Brown, R.E. Dimensional aspects of flight in the honey bees of Africa. *Journal of Apicultural Research* (98) 37 (3) 147–154 [En, Bj]

Dimensional aspects of honey bee flight were evaluated in terms of subspecific categories, geographical distribution and population structure. The subspecies of *Apis mellifera* of Africa can be discriminated from those of Europe, but not among themselves. The African subspecies form two non-taxonomic groups with respect to flight. Significantly high values of variance occur within and between subspecies and populations. The spatial distribution of flight variance is not correlated with morphometric or pheromonal variance. *Author*

Dept. of Zoology & Entomology, Rhodes University, Grahamstown, 6140 South Africa.

Hepburn, H.R., Radloff, S.E., Verma, S. and Verma, L.R. Morphometric analysis of *Apis cerana* populations in the southern Himalayan region. *Apidologie* (2001) 32 (5) 435–447 [En, de, fr, Bj]

Morphometric characteristics were measured in 3704 individual workers from 279 colonies in 64 localities, with an average sampling distance of 50 km along a 2200-km transect between Pakistan in the west and Myanmar in the east. Analyses revealed four major morphoclusters, two of

which are further subdivisible into three biometric subgroups each. These morphoclusters can be only partially integrated into any current subspecific nomenclature available for *A. cerana*. Morphocluster separation is related to physiographic differences which create a partial temporal reproductive isolation associated with altitude. High variance domains occur at the edges of the morphocluster and biometric groupings. The bees decrease in size from west to east, but increase in size with increasing altitude.

Author

Dept Zoology and Entomology, Rhodes Univ., Grahamstown, 6140 South Africa.

Hepburn, H.R., Reece, S.L., Neumann, P., Moritz, R.F.A. and Radloff, S.E. Absconding in honeybees (*Apis mellifera*) in relation to queen status and mode of worker reproduction. *Insectes Sociaux* (99) 46 (4) 323–326 [En, 29 ref.]

Absconding frequency and latency in queenright and queenless honeybee colonies in thelytokous *A. m. capensis* (T), arrhenotokous *A. m. scutellata* (A) and their natural thelytokous hybrids was studied in South Africa. There was no significant difference in frequency of absconding among any of the queenright colonies. Absconding was significantly greater in T queenless colonies than in the queenless A colonies. Latency to absconding did not differ among the three groups of queenright colonies or between the queenright and queenless colonies of T and A. There were significant differences in latency between queenright and queenless hybrids and significant differences in latency among the three groups of queenless colonies. Among queenless colonies, T absconded twice as readily as did A, and the hybrids were intermediate. After absconding had occurred, one group of orphaned nestmates of T amalgamated with another queenright colony. In the case of A, either drones were produced or the residual queenless colony was joined by a queenless T group, which subsequently reared a queen and then absconded. Differences in the rate and degree of ovarian development indicated that queenless T workers have the physiological capacity for reproduction, a trait that contributes to colony fitness.

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Hepburn, H.R., Yothed, C., Illgner, P., Radloff, S.E. and Brown, R.E. Production of aerodynamic power in mountain honeybees (*Apis mellifera*). *Naturwissenschaften* (98) 85 (8) 389–390 [En, 5 wf]

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown, South Africa.

Hepburn, H.R. and Radloff, S.E. *Apis mellifera capensis*: an essay on the subspecific classification of honeybees. *Apidologie* (2002) 33 (2) 105–127 [En, de, fr, Bj]

The history of the classification of this subspecies is traced. Thelytoky in workers extends over 240–103 km², and the ratio of female/male progeny in laying worker offspring is clinal. Ovariole numbers are also clinal, but spermatheca size is not. Allozymically, southern African honey bees are homogeneous, but they differ in mtDNA haplotypes and nuclear DNA diversity. Morphometric analyses

yield three distinct clusters. Conventional morphometric classification is incongruous with the mode of parthenogenesis and distribution of mtDNA and nuclear DNA diversity in southern African honey bees. The terms '*A. m. capensis*' and '*A. m. scutellata*' are only meaningful if the precise geographical origins of the bees are specified. This review has about 80 references. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Hepburn, H.R. Reciprocal interactions between honeybees and combs in the integration of some colony functions in *Apis mellifera* L. *Apidologie* (98) 29 (1/2) 47–66 [En, fr, de, Bj]

Recent studies on this subject are reviewed (86 references), under the headings: comb building; material properties of combs; regulation of comb building; distribution of comb contents; combs and communication. The comb and its contents can provide information on crowding and storage space, which affect brood rearing, energy consumption and comb building. Significant chemical and physical changes occur in wax during comb building and its subsequent use. Combs mediate pheromonal cues and colony odour, and transmit vibrations during dance communication.

Dept. Zoology & Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Hepburn, H.R. The enigmatic Cape honey bee, *Apis mellifera capensis*. *Bee World* (2001) 82 (4) 181–191 [En, Bj]

Apiculture Section, Dept of Zoology & Entomology, Rhodes Univ., Grahamstown, South Africa 6140.

Hepburn, H.R., Radloff, S.E. and Fuchs, S. Population structure and the interface between *Apis mellifera capensis* and *Apis mellifera scutellata*. *Apidologie* (98) 29 (4) 333–346 [En, de, fr, Bj]

Honey bees of southern Africa below latitude 28 S (8743 worker bees from 442 colonies in 104 localities) were analysed morphometrically. Based on a combined data set from the morphometric data banks in Oberursel, Germany, and in Rhodes University, the distribution of morphoclusters of *A. m. capensis* and *A. m. scutellata*, as well as the extent of the hybrid zone, were re-established. The distribution was matched against particular traits such as thelytokous parthenogenesis, mitochondrial and nuclear DNA profiles, and sting alarm pheromone variability known from previous investigations. The striking incongruences in the geographical distribution of these traits demonstrate a dynamic and independent pattern of gene flow. They also create considerable disagreement between morphometric group definitions and those derived from other biological characteristics. *Author*

Dept Zoology and Entomology, Rhodes Univ., Grahamstown, 6140 South Africa.

Hepburn, H.R., Radloff, S.E. and Fuchs, S. Flight machinery dimensions of honeybees, *Apis mellifera*. *Journal of Comparative Physiology, B* (99) 169 107–112 [En, Bc]

The dimensions of flight machinery (FM) of nine African and nine European *Apis mellifera* subspecies were determined: wing surface area, whole body mass, wing loading

and thorax/body mass ratio. The values are tabulated, together with the calculated excess power index for each subspecies and published values of Mdh frequency distributions. Dimensions for the two groups differed significantly, and there were also some differences within the groups. Overall, the bees of the European group were 33% heavier and had 15% more wing surface area than those of the African group; however, the former have a thorax/body mass ratio of 0.45 and a wing loading value of 0.48 compared with 0.53 and 0.35, respectively for the African group. The latter group has a greater power per unit mass. Differences in metabolic capacity associated with Mdh allozymes finally result in an excess power index that is 38% greater in the African than in the European subspecies. *P. Walker*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown, South Africa.

Hepburn, E.J. A taste of honey. *South African Bee Journal* (1982) 54 (1) 3–5 [En, B]

Members of a food and wine society tested honeys from 13 South African plants. The preference ratings and descriptions given to each sample varied considerably among the 30 tasters; five of them preferred light honeys, three dark honeys, and the rest liked samples from each range. Every sample was given a rating of above average by at least three tasters; most popular were honeys from *Cladocalyx* and *Litchi*, followed by *Citrus*, *Sideroxylon* and *Protea* (Cape). *P. Walker*

38 Juno St., Kensington 2094, South Africa.

Hepburn, H.R. Some honeybee research activities at the University of the Witwatersrand. *South African Bee Journal* (1978) 50 (5) 11–14 [En, B]

Hepburn, H.R. Comb honey production and the new foundation. *South African Bee Journal* (1982) 54 (3) 56–62 [En, B]

Profitability of comb honey production would increase if the amount of honey consumed by bees to make wax and build combs were reduced. Calculations are presented to show that bees would use less wax if they drew comb on foundation with a larger cell size than normal. Commercially available foundation for African bees has 1050 cells/dm²; using foundation with 500 cells/dm² [about drone cell size], not only is much less wax drawn into comb, but differences in the amount of wax per super are negligible between supers with 8, 9 or 10 frames. *Apis mellifera adansonii* colonies in the Transvaal were given frames of foundation of various cell sizes, with between 170 and 522 cells/dm² comb was satisfactorily drawn on foundation with 493 cells/dm² giving a 35% reduction in the amount of wax drawn when compared with standard worker foundation. Using specially made rollers, foundation has now been produced with 490 cells/dm². Beekeepers are invited to test this foundation, using the procedure which is laid down here. *P. Walker*

Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Hepburn, H.R. Comb construction by the African honeybee, *Apis mellifera adansonii*. *Journal of the Entomological Society of Southern Africa* (1983) 46 (1) 87–101 [En, B]

Cell size discrimination by *A. m. adansonii* was investigated using beeswax foundation having a range of cell sizes; the number of cells/dm² varied from 170 to 1022. Different construction solutions and working tolerances were measured from combs built in queenright colonies. The major variable in comb building was that of wall thickness, with the walls of combs built on foundation only half as variable as those of naturally built comb. The largest cell size that the bees would consistently draw was on foundation with about 493 cells/dm². The ratio of honey to wax for combs established on 493 cells/dm² was 27:1 compared with 34:1 for combs obtained from the traditional 1022 cells/dm². These cell types thus differ significantly in the amount of wax required to contain the same amount of honey. *Author*
Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Hepburn, H.R. *Honeybees and wax*. Berlin, German Federal Republic; Springer Verlag. (1986) xii + 205 pp. ISBN 3-540-16918-0 [En, Bd]

This is a detailed account of about 370 published observations and experiments on the production and use of wax by honeybees; these include several by the author and his colleagues. The three parts of the book cover the nature and production of beeswax (Chapter 5 is on its composition and synthesis), the manipulation of wax by honeybees, and the stimuli responsible for the production and manipulation of wax. The text is illustrated with photographs and line drawings. There is an author index to the references cited, which range from early publications of historical interest to those on the most recent research (up to 1985). There is also a subject index. *P. Walker*
Dept. Physiology, Univ. Witwatersrand, 2193 Johannesburg, South Africa.

Hepburn, H.R. *Abscending in the African honeybee: the queen, engorgement and wax secretion*. *Journal of Apicultural Research* (1988) 27 (2) 95–102 [En, Bb]

An experiment was performed in December, 1985, in Transvaal, South Africa, to assess the relationships between repletion of the honey sac, wax secretion and queen status in relation to absconding in *A. m. scutellata*. Absconding was associated with engorgement of the honey sac and increased secretion of wax scales, but not with the numbers of wax-bearing bees. Wax secretion was correlated with engorgement of the honey sac, but not with tactile access to the queen. Colonies headed by *A. m. capensis* pseudoqueens swarmed more readily than those headed by conspecific *A. m. scutellata* queens. It is inferred that the *A. m. capensis* pseudoqueen lacks pheromonal parity with *A. m. scutellata* in terms of colony cohesion but is an adequate mimic of the *A. m. scutellata* queen for purposes of wax secretion. *Author*

Dept. Zoology & Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Hepburn, H.R. *Capensis in the Eastern Cape*. *South African Bee Journal* (1989) 61 (4) 87–89 [En, Bj]

One trait recognised as characteristic of *Apis mellifera capensis* is that the workers can lay diploid eggs. Using this trait, the distribution of *A. m. capensis* was surveyed, especially in areas where *A. m. scutellata* is present. *P. Walker*

Dept. Zoology & Entomology, Rhodes Univ., Grahamstown, South Africa.

Hepburn, H.R. *The first report on the biology of the Cape honeybee*. *South African Bee Journal* (1990) 62 (6) 128–132 [En, Bj]

A paper on Cape honeybees (*Apis mellifera capensis*) was published by Lord de Villiers, Chief Justice of the Union of South Africa, in *Nature*, on 3 May 1883. The paper, which is reproduced in full, and other historical references, are discussed. *D.G. Lowe*

Department of Zoology & Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. *Incidence of the tachinid bee fly, Rondaniooestrus apivorus, in southern Africa*. *South African Bee Journal* (1991) 63 (4) 86–87 [En, Bj]

A survey in which 8186 bees from 110 colonies were examined, showed that the incidence of parasitism of worker honey bees by maggots of this fly was only 1% (41 maggots found). It is considered unlikely that *R. apivorus* will become of economic importance. *D.G. Lowe*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. *What and where is the Cape bee – an interim report. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H.; Buys, B.]*. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 74–83 ISBN 0-620-15132-3 [En, Bd]

Research on *Apis mellifera capensis* by the author and others is reviewed, with 51 references. Aspects covered are: Mdh allozymes; reproductive organs, including spermatheca, ovary and ovariole number; morphology, including size and colour; mandibular glands; behaviour; distribution. Research on these and other aspects of *A. m. capensis* biology is continuing.

Department of Zoology and Entomology, Rhodes University, P.O. Box 94, Grahamstown 6140, South Africa.

D.G. Lowe

Hepburn, H.R. *The biology of queen production in the Cape honeybee*. *South African Bee Journal* (1992) 64 (6) 132–138 [En, Bj]

This review, with 43 references, first describes early observations and research on the biology of *Apis mellifera capensis*; these eventually led to Anderson's (1965) studies [*South African Journal of Agricultural Science* 8, 1163–1164] on which he based a method for queen rearing. Further research was undertaken on the effects of queen loss in Cape honey bee colonies and on the mechanism of the suppression of queen cell construction. It is concluded that the perception of the queen by workers depends on their having physical access to her, and she must have intact mandibular glands (and abdominal tergite glands, although these are less important). This is similar to the mechanism in European *Apis mellifera*, but in *A. m. capensis* the threshold of the inhibition response to the mandibular gland secretion is higher. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Box 94, 140 Grahamstown, South Africa.

Hepburn, H. R. 'Follow-flow' brood rearing in capensis and scutellata. *South African Bee Journal* (1992) 64 (5) 104–109 [En, B]

This review, with 40 references, compares the brood rearing patterns of honey bee species in southern Africa with those of European honey bees. In the latter, brood rearing patterns are clearly related to climate and patterns of flowering in plants. In southern Africa, where rains and floral cycles vary widely, brood rearing cycles in *Apis mellifera scutellata* and *A. m. capensis* are much more variable and complex; they can even differ considerably between two adjacent areas. In some areas, brood rearing follows flows rather than anticipates them. Brood rearing is also affected by the migrations of absconding 'trek swarms'. Southern African and European species also differ in development periods of immature stages and in the tendency (in *A. m. capensis*) for laying workers to develop. Attempts to introduce *A. m. ligustica* during the past 60 years have always failed. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Box 94, 6140 Grahamstown, South Africa.

Hepburn, H. R. Pheromonal and ovarian development covary in Cape worker honeybees, *Apis mellifera capensis*. *Naturwissenschaften* (1992) 79 (11) 523–524 [En, Bc]

Workers from 17 colonies (queenright or queenless) were examined. The content of a major component of a queen-like mandibular gland pheromone ((E)-9-oxo-2-decenoic acid, 9-ODA) significantly increases with ovarian development in workers; the amount of 9-ODA relative to other components also increases. Another component found in the mandibular gland pheromone of workers of most *A. mellifera* races (10-hydroxy-2-decenoic acid) was virtually absent in Cape bees. These and other results suggest that workers in a queenless colony develop through four stages: pheromonally worker-like, some of which lay eggs and others do not, and pheromonally queen-like, some of which lay eggs and others do not. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa.

Hepburn, H. R. Swarming, absconding and migration in southern African bees. *South African Bee Journal* (1993) 65 (3) 61–66 [En, B]

This paper concisely reviews factors influencing reproductive and absconding swarming behaviour in honey bees (*Apis mellifera*), with 53 references. Some data are given for both types of swarming by Cape honey bees (*A. m. capensis*) in South Africa: absconding/migrating occurs over a 2–3 month period during February–July, depending on location, and reproductive swarming over a 2–3 month period during August–January, also depending on location. *A. G. Matheson*

Department of Zoology and Entomology, Rhodes University, Box 94, 6140 Grahamstown, South Africa.

Hepburn, H. R. Reproductive cycling and hierarchical competition in Cape honeybees, *Apis mellifera capensis* Esch. *Apidologie* (1994) 25 (1) 38–48 [En, fr, de, B]

On queen loss, Cape honey bees may requeen from the brood of a queen or from the brood of an egg-laying worker, or it may remain as a laying worker colony. These three possibilities are reached through eight different social developmental pathways. The fate of any individual queenless colony varies with brood status and the rates and kinds of worker differentiation that occur on queen loss. Worker differentiation is widespread and includes ovarian and pheromonal development; but only few individuals actually reach 'surrogate queen' status. The complex pathways that occur in queenless Cape colonies seem to be determined both by social context and hierarchical competition among workers. *Author*

Department of Zoology and Entomology, Rhodes University, P. O. Box 94, 6140 Grahamstown, South Africa.

Hepburn, H. R. Flight and foraging in capensis and scutellata. *South African Bee Journal* (1995) 67 (2) 38–42 [En, B]

This literature review discusses the few comparative studies of the foraging behaviour of *Apis mellifera capensis* and *A. m. scutellata*. Relevant studies on one or other of these races are also included. (A list of references is available from the author.) *P. Walker*

Department of Zoology and Entomology, Rhodes University, P. O. Box 94, 6140 Grahamstown, South Africa.

Hepburn, H. R. and Allsopp, M. H. Reproductive conflict between honeybees: usurpation of *Apis mellifera scutellata* colonies by *Apis mellifera capensis*. *South African Journal of Science* (1994) 90 (4) 247–249 [En, Bc]

Workers from six queenless *A. m. scutellata* colonies were examined over two weeks. At dequeening, workers showed no ovarian development (OD), and at a week later, 42% still showed none and 47% had slight OD. In the second week, 15% had no OD and 84% partial OD; less than 1% had eggs. In a second experiment, 400 marked *A. m. capensis* workers were introduced into each of two *A. m. scutellata* colonies which were dequeened five days later. On this day, 48% of marked bees (then 12 days old) had no OD, but six days later (bees 18 days old) 26% had no OD, 53% were partially developed and 21% had eggs. Thus, the OD of these *A. m. capensis* workers was similar to that of workers in *A. m. capensis* colonies, although only 12% of workers in such colonies have eggs at this stage. Changes in the composition of mandibular gland secretion in *A. m. scutellata* workers after dequeening were also studied. The secretions of the two subspecies rapidly develop quantitative differences in the relative proportions of individual components. Overall, the results explain how it is possible for *A. m. capensis* workers to usurp *A. m. scutellata* colonies which they invade. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H. R., Armstrong, E. and Kurstjens, S. The ductility of native beeswax is optimally related to honeybee colony temperature. *South African Journal of Science* (1983) 79 416–417 [En, B]

Sheets of wax were excised from the walls of naturally drawn drone comb of *Apis mellifera adansonii*, warmed to the required temperature in a water-bath and tested on an

extensometer at an extension rate of 53.2×10^{-6} m/s. The results showed that the energy required to deform equal volumes of beeswax (relative workability) decreased more than tenfold with an increase in temperature from 20° to 35°C. The effort required in bringing the material to failure as in biting and chewing pieces of wax (absolute workability) showed a sixfold decrease between 20° and 35°. Increasing the temperature from 35° to 40° halved both relative and absolute workability but this temperature would cause bees to die. In addition, the weight of honey in combs would be more than sufficient to exceed the yield stress of the wax. The results are discussed in relation to comb building and the seasonal cycle in honeybee colonies. *J. M. Gedy*
Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Hepburn, H.R., Bernard, R.T.F., Davidson, B.C., Muller, W.J., Lloyd, P., Kurstjens, S.P and Vincent, S.L. *Synthesis and secretion of beeswax in honeybees*. *Apidologie* (1991) 22 (1) 21–36 [En, fr\ de, Bj]

The ultrastructure of the cells of the wax gland complex in *Apis mellifera capensis* workers was studied in relation to the synthesis and secretion of beeswax. The hydrocarbon and fatty acid profiles of epidermal cells and oenocytes were determined in relation to the ages of the bees. Smooth endoplasmic reticulum (SER) was absent from both epidermis and adipocytes from adult emergence until the end of wax secretion. The oenocytes were rich in SER. The hydrocarbon and fatty acid content of the oenocytes closely matched that of newly secreted wax. That the oenocytes are the probable source of the hydrocarbon fraction of beeswax is consistent with histochemical and autoradiographic data for honeybees and with biosynthetic data from other insects. The cyclical changes of organelles and chemical composition of the wax gland complex closely coincided with measured, age-related rates of wax secretion in worker honeybees. *Author*
Department of Zoology & Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R., Cantrill, R.C., Thompson, P.R. and Kennedy, E. *Metabolism of carbohydrate, lipid and protein during development of sealed worker brood of the African honeybee*. *Journal of Apicultural Research* (1979) 18 (1) 30–35 [En, B]

The relative amounts of carbohydrate, lipid and protein were determined in whole bees over the course of their development in the sealed cell. Oxygen uptake, respiratory quotients, and changes in wet and dry weight were determined. Metabolism of sealed larvae, pupae and young pharate adults is based on the utilisation of lipid stores, but in older pharate adults it also involves the consumption of some protein. Carbohydrate might be used primarily in the deposition of the adult cuticle prior to emergence. *Author*
Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Hepburn, H.R., Chandler, H.D. and Davidoff, M.R. *Extensometric properties of insect fibroins: the green lacewing cross-beta, honeybee alpha-helical and greater*

***waxmoth parallel-beta conformations*. *Insect Biochemistry* (1979) 9 69–77 [En, B]**

The extensometric properties of insect silks, of three different crystallographic conformations, were studied in terms of their true stress-strain characteristics on tensile deformation in different aqueous media. These mechanical data are interpreted in terms of the phase transformations associated with conformational change and with microfibrillar structure. Silks from honeybee larval cocoons and lacewing egg-stalks had lower strain yield points in water at 20°C than wax moth silk. Stress-strain curves are presented for honeybee silk in various media. [Chem.Abstr. 90: 163589w (1979).] *F.B. Wells*
Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Hepburn, H.R. and Crewe, R.M. *Defining the Cape honeybee: reproductive traits of queenless workers*. *South African Journal of Science* (1990) 86 524–527 [En, Bc]

Diploid egg laying by workers (DELW) in queenless *Apis mellifera capensis* colonies has been previously reported at 14 localities in southern Africa; it has now been recorded at a further 12 localities, mostly farther north, thus greatly extending the area in which DELW is encountered. As expected, the ratio of males to females reared in a laying worker colony was found to be low in the Cape Town area; the ratio increased as the limit of distribution of DELW was reached. The number of ovarioles per ovary in a laying worker was 17.4 at Cape Town and 7.1 at East London, on the same transect. On the next transect to the north, the average was significantly different (approximately nine); north of latitude 32°S the value was only about three, and this continued well into northern Transvaal where *A. m. scutellata* is found. The diameter of the spermatheca in laying workers in southern Africa was found to vary greatly and is not considered useful in characterising Cape honey bees. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. and Crewe, R.M. *Portrait of the Cape honeybee, Apis mellifera capensis*. *Apidologie* (1991) 22 (6) 567–580 [En, fr\ de, Bj]

The honey bees of southern Africa were assessed for the following traits: diploid eggs laid by workers, worker ovariole number, spermatheca size, worker size and allozymes of malate dehydrogenase. *A. m. capensis* is readily defined in terms of the first two of these traits and may further be separated from *A. m. scutellata* by a suite of biological characteristics associated with laying worker development and behaviour, queenless cell building, foraging, thermoregulation and docility. *A. m. capensis* occurs in the fynbos biome along the southwest and south coasts of South Africa extending into the interior as far as the mountains bordering on the Klein Karoo. From here it hybridises with *A. m. scutellata* to the next mountain ranges near latitude 32° where hybrids fall away. This border is a barrier where there are fundamental differences in topography, climate and vegetation which place the two races ecologically totally out of phase, thus ensuring the relative stability of *A. m. capensis* and *A. m. scutellata* as separate races. *Author*

Department of Zoology and Entomology, Rhodes University, Grahamstown, South Africa.

Hepburn, H.R. and Guillarmod, A.J. *The Cape honeybee and the fynbos biome*. *South African Journal of Science* (1991) 87 70–73 [En, Bc]

In this review, with 61 references, available data for the following behaviours of *Apis mellifera capensis* are summarised: swarming, absconding, migration, brood rearing cycles, thermoregulation, foraging. A hypothesis is then proposed that the biology of this honey bee race is attuned remarkably well to the characteristics of the 'fynbos biome' of the Cape region: richness of the flora, variations in flowering cycles, the warm berg winds of winter, and the high incidence of fire. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Grahamstown, 6140 South Africa.

Hepburn, H.R. and Guye, S.G. *An annotated bibliography of the Cape honeybee, Apis mellifera capensis Escholtz (Hymenoptera: Apidae)*. *African Entomology* (1993) 1 (2) 235–252 [En, 313 ref.]

An annotated bibliography of all known publications on the biology of the Cape honeybee (*A. mellifera capensis*) is presented. The record covers the period 1778 to 1993 and include 313 entries. One half of these publications have appeared during the last decade.

Department of Zoology and Entomology, Rhodes University, PO Box 94, Grahamstown 6140, South Africa.

Hepburn, H.R., Hugo, J.J., Mitchell, D., Nijland, M.J.M. and Scrimgeour, A.G. *On the energetic costs of wax production by the African honeybee, Apis mellifera adansonii*. *South African Journal of Science* (1984) 80 363–368 [En, af, B]

Measurements of cluster temperatures, metabolic activity, wax gland development, food consumption and comb building were made on small groups of (about 500) workers, caged either with or without a queen and fed on sucrose solution. All four pairs of wax glands developed at almost the same rate, starting in workers six days old, reaching a peak at 12 days and then gradually declining. Gland development and comb building were highly correlated. Queenright workers developed glands and built comb, whereas bees that were queenless, but were near to queenright colonies, developed wax glands but did not build comb; workers which were not near a queen did not develop glands. Thermoregulation of the cluster began in bees five days old and then oscillated in a diel rhythm between 30° and 32°C. Metabolic rate increased with age and oscillated as did temperature. The sucrose to wax ratio varied with the age of the colony. Metabolic rate and sucrose consumption, and wax production and metabolic rate were highly correlated. The metabolic cost of wax production was about 6 ± 1 mW/g body mass of bee per mg of beeswax, with an efficiency of about 8% i.e. 70 µg beeswax is produced per 420 µW of bee labour. *Author*
Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Hepburn, H.R., Jones, G.E. and Kirby, R. *Introgression between Apis mellifera capensis Escholtz and Apis mellifera scutellata Lepeletier: the sting pheromones*. *Apidologie* (1994) 25 (6) 557–565 [En, fr\de, Bj]

The eight principal components of the alarm pheromone from the stings of guard bees from natural populations of *A. m. capensis* and *A. m. scutellata* and from bees in areas of hybridisation were analysed by gas chromatography. *A. m. scutellata* produces significantly more secretion than *A. m. capensis*. Autocorrelation analyses of intercolonial variance indicates regions of significant variation in these traits. This introgression coincides with hybridisation zones previously defined by other variables. Introgression intensity is related to relative honey bee population density and reveals a probable cyclical bottleneck in one area generated by climatic oscillations. *Author*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. and Kurstjens, S.P. *On the strength of propolis (bee glue)*. *Naturwissenschaften* (1984) 71 (11) 591 [En, B]

The tensile properties of samples of propolis collected by honeybees in an apiary at Pretoria, South Africa, were measured over the range 25–45°C. The tensile strength decreased 8-fold over this temperature range and the yield strain by nearly 3-fold. The results indicate that propolis is a plastic material which at its greatest strength is comparable to beeswax at its lowest strength over the temperature range used. The botanical origins of the propolis were unknown, although *Populus deltoides* and *Acacia karroo*, both propolis sources, were known to grow nearby. *D.G. Lowe*

Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Hepburn, H.R. and Kurstjens, S.P. *The combs of honeybees as composite materials*. *Apidologie* (1988) 19 (1) 25–36 [En, fr\de, Bj]

Mechanical changes in the combs of the African honeybee, *Apis mellifera scutellata*, in relation to maturation and temperature, were measured. Combs ranged in colour from white to brown and varied in silk content from 0 to 34%. New brood combs are composed of pure wax, but when a larva pupates it spins silk fibres (fibroin, a crystalline and hygroscopic protein) which are deposited randomly on the cell walls. Sheets of dewaxed silk were mechanically constant between 25 and 45°C, but both white silk-free comb (W) and brown comb containing 24% silk (B) decreased in strength, and very rapidly so near 40°; B was an order of magnitude stronger than W. On average, the breaking strain of B was double that of W. Both B and W showed decreasing stiffness with rising temperature, but when the stiffness of B was at its lowest (at 45°) it was still comparable to that of W at its greatest (at 30° and 35°). The energy required to fracture the combs showed a similar trend. The results are discussed in relation to the structural properties of the honeybee nest. *D.G. Lowe*

Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Hepburn, H.R., Magnuson, P., Herbert, L. and Whiffler, L.A. **The development of laying workers in field colonies of the Cape honey bee.** *Journal of Apicultural Research* (1991) 30 (2) 107–112 [En, Bb]

Colonies of Cape honey bees (*Apis mellifera capensis*) were assessed for the effects of various queen states (queenless, with a virgin queen, with a mated queen, with access to the head and thorax of a queen, with access to the abdomen of a queen) on the development of laying workers. The effect of queenlessness on workers of different ages was also studied. The highest frequency of laying workers in the worker population (5%) occurred in queenless colonies, followed by virgin-queenright (2.5%) and mated-queenright (less than 1%) colonies. The frequency of laying workers did not increase with longer periods of queenlessness; however, the younger the bees were on dequeening, the greater the ovarian development. Both the head and thorax or the abdomen of a queen partially inhibited ovarian development. Thus, with respect to queen suppression of worker ovarian development, the Cape honey bee differs from other races of *A. mellifera* only in degree, not in kind.

Author

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. and Magnuson, P.C. **Nectar storage in relation to wax secretion by honeybees.** *Journal of Apicultural Research* (1988) 27 (2) 90–94 [En, Bb]

This study was carried out in October–December, 1985, at Roodeport, South Africa, during a good Eucalyptus nectar flow. Experiments were performed to assess nectar collected and the availability of empty combs as well as free building space within the nest cavity in relation to wax secretion. There was a positive correlation between engorgement of the honey sac and wax secretion. While empty combs and free building space were positively associated with wax secretion, their intensity as stimuli was relative to context. *Author*

Dept. Zoology & Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Hepburn, H.R. and Muller, W.J. **Wax secretion in honeybees: thermal integrity of the festoon.** *Naturwissenschaften* (1988) 75 628–629 [En, Bc]

The thoracic temperatures of honeybees (*Apis mellifera capensis*) taken from festoons of wax-secreting workers were found not to differ significantly from those of brood comb bees. Both varied throughout the day but were well above ambient temperatures and significantly higher than the bees' abdominal temperatures. Abdominal temperatures of festoon bees were higher than those of brood comb bees and varied less during the day, suggesting a special physiological coupling of thorax and abdomen during wax secretion. Measurements of wax secretion showed that bees secreted an average of 3.7 g/hours. The rate appeared to be constant throughout the day and night. *J.M. Gedy*

Dept. Zoology & Entomology, Rhodes Univ., Grahamstown, 6140 South Africa.

Hepburn, H.R. and Radloff, S.E. **First approximation to a phenology of the honeybees (*Apis mellifera*) and flora of Africa.** *Oecologia* (1995) 101 (2) 265–273 [En, Bc]

The total angiosperm flora of Africa comprises an estimated 50 000 species; as a representative sample, flowering data for 5,645 species (11%) were taken from publications for different regions. Peak flowering by the total flora of Africa coincides with, or immediately follows, peak rainfall. Flowering intensity of the total flora decreases with distance from the equator, but that of the honey bee plant resource base ($\pm 2\%$ of total flora) does not. Flowering in the latter is highly synchronous (months 1–5 north of and 9–11 south of the equator). Both total and honey bee flora are completely incongruent with either the biomes or phytocoria of Africa. There is no significant correspondence between honey bee phenology and the total flora but significant correspondence occurs between honey bees and flowering in honey bee plant genera. A logistic regression model reveals that honey bee plant flowering predicts major honey bee colony events with a probability of 0.81 south of the equator and 0.71 for the whole continent. It is postulated that promiscuity in the bee plant genera and honey bees of Africa have contributed to their continental ubiquity. *Author*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. and Radloff, S.E. **Beeswax exports and rainfall in the savanna woodlands of east central Africa.** *Apidologie* (1996) 27 (6) 473–478 [En, fr\de, Bj]

Records of beeswax exports from Tanzania, Zambia and Kenya in 1936–1961, and the corresponding rainfall records, were subjected to time-series and regression analyses. Data were plotted in 'bee-years' (July–June) as this is the seasonality of the annual cycle of honey bee colonies in savanna woodland areas below the equator. Figures for honey production and beeswax exports for Tanzania in 1906–1985 were also analysed. The results show that beeswax exports and rainfall are most significantly and highly correlated when phase-lagged by one bee-year. Rainfall and honey production are also highly significantly correlated when lagged by one bee-year. However, honey and wax production are highly correlated on a same bee-year basis. Thus, the beeswax harvest of any one year depends on the rainfall of the previous bee-year. This is consistent with general effects of climate on vegetation and specifically with the fact that the trees of the miombo on which honey bees depend tend to flower in the dry season. *D.G. Lowe*

Department of Zoology and Entomology, Rhodes University, PO Box 94, 6140 Grahamstown, South Africa.

Hepburn, H.R. and Radloff, S.E. **Morphometric and pheromonal analyses of *Apis mellifera* L along a transect from the Sahara to the Pyrenees.** *Apidologie* (1996) 27 (1) 35–45 [En, fr\de, Ba]

Pheromones (mandibular gland and sting) and morphological characteristics of worker honey bees from Morocco and Spain were analysed with multivariate statistical methods. Principal component and stepwise discriminant analyses yielded three morphological clusters, corresponding to sahariensis and intermissa (including the ecotype

major) in Morocco and to iberica (with three biometric populations) in Spain, but no pheromone clusters. Inter-colonial variances for all characteristics formed significant asymmetries within the areas of classically defined subspecies. These were complemented by trends in intra-colonial variance. The combined morphometric and pheromonal variance spectra indicate regions of natural hybridisation along a Sahara-Pyrenees transect. *Author*
Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. and Radloff, S.E. Biogeographical correlates of population variance in the honeybees (*Apis mellifera* L.) of Africa. *Apidologie* (1997) 28 (5) 243–258 [En, fr\de, Bj]

Multivariate analyses of morphometric characteristics of worker honey bees from five transects through north-western, northeastern, west central, southwestern and southeastern Africa yielded sequences of statistically defined morphoclusters (= subspecies) alternating with heterogeneous zones of introgression. All transects contain areas of significantly high variance. High intra-colonial variance indicates localised genetic variation and outcross matings. Regions of high inter-colonial variance occur at and between sub-specific boundaries. These are typical of transitions between, and rainfall-temperature discontinuities within, different ecological-climatological zones. They constitute areas of ecological instability amidst otherwise contiguous populations. *Author*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Hepburn, H.R. and Rigby, J.R. Strength of beeswax foundation in relation to cell orientation. *Journal of Apicultural Research* (1981) 20 (4) 234–238 [En, B]

Rolled beeswax foundation of varying mass and number of cells per dm² was cut in three cell orientations, and tested mechanically in tensile and bending modes. The relative strength of the foundation was positively correlated with mass/dm². The relative tensile strength, tensile stiffness, bending strength, and bending stiffness, were significantly greater in foundation oriented with cell walls horizontal instead of vertical. Comb-in-frame strength could therefore be enhanced considerably simply by changing the orientation of beeswax foundation sheets in conventional frames from the customary vertical orientation to a horizontal one. *Author*

Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Hepburn, H.R., Villet, M.H., Jones, G.E., Carter, A.R., Simon, V.I. and Coetzer, W. Winter absconding as a dispersal mechanism of the Cape honey bee. *South African Journal of Science* (1993) 89 294–297 [En, Bc]

Energy consumption and colony survival characteristics were studied in *Apis mellifera capensis* in relation to winter absconding, in a (South African) climate with cycles of warm days interspersed with cold days. The data obtained were compared with calculated values for *A. m. scutellata*. In the hybrid zone between the two races, all queenless-broodless colonies examined produced worker comb, which is characteristic of *A. m. capensis*. In this state, this

race can construct emergency queen cells and rear queens, whereas *A. m. scutellata* cannot. All the hybrids studied produced some queen cells containing larvae or pupae after being queenless and broodless. It is concluded that *A. m. capensis* has climatic, vegetational, metabolic and reproductive advantages over *A. m. scutellata* throughout the hybrid zone. Risk assessment of absconding in winter shows that *A. m. capensis* has the capacity to disperse within the hybrid zone at a time of year when *A. m. scutellata* cannot. *P. Walker*

Department of Zoology and Entomology, Rhodes University, P.O. Box 94, Grahamstown 6140, South Africa.

Hepburn, H.R. and Whiffler, L.A. Construction defects define pattern and method in comb building by honeybees. *Apidologie* (1991) 22 (4) 381–388 [En, fr\de, Bj]

Observations were made on combs built by 24 colonies of *Apis mellifera capensis* and nine colonies of *A. m. scutellata* using frames without beeswax foundation. The colonies (average 8000 bees) were kept in nucleus boxes with three frames of brood and stores and two empty frames. Frames were examined weekly and 105 samples of the early stages of comb building were obtained. The results show that several festoons of bees may begin building at independent sites. Bees make combs parallel by manipulating the length of the cells, but incorporate dislocated combs into the total nest structure. They achieve parallelism through passive application of the bee space. Cell size and orientation vary independently and are unique to each festoon and comb. Combs are joined laterally near their mid-sections and are usually out of register. Cells are approximately hexagonal within a comb, but poor fit requires the insertion of pentagons, heptagons, and the use of fill and vacancies for the fusion of small combs into a single large comb. Poor fit of adjacent combs occurred in about 96% of all cases examined in *A. m. capensis* colonies. *D.G. Lowe*
Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Herrmann, J.M. Fruit flies and the eucalypt nectar flow. *South African Bee Journal* (1983) 55 (2) 25, 27–33 [En, B]

In 1976–1977, almost 80% of eucalypts grown in South Africa were *Eucalyptus grandis*. In the early 1970s this was a main honey source, and average yields of 50 and 28.5 kg/hive were recorded in Zululand and the Politsi area respectively. However, since 1974 honey production from this source has been rather low and variable (average 9.5 kg at Politsi). It has been observed recently that in some flowers all the nectar is consumed by larvae of the fly, *Drosophila flavohirta*; honeybees do not visit these flowers, but they do forage on uninfested flowers which produce abundant nectar. Some methods for dealing with this problem are discussed briefly. *P. Walker*
Plant Protection Res. Inst., Private Bag X134, Pretoria, South Africa.

Herrmann, J.M. The *Drosophila* fly in *Eucalyptus* flowers – who holds the answers to this riddle? *South African Bee Journal* (1984) 56 (1) 5–8 [En, B]

Honey yields from *E. grandis* in South Africa are variable. One reason may be that if flowers are infested with *Drosophila flavohirta* there may be little or no nectar avail-

able for honeybees. The flies lay their eggs in the newly-opened flower cup before it starts secreting nectar; the larvae, which hatch within 24 hours, feed on nectar. Egg-laying by the flies seems to depend on temperature and moisture; few larvae were found in an area where the minimum temperature was 6°C. Beekeepers are asked to report observations of infestations, and to record their honey crops from *E. grandis*. P. Walker

Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Herrmann, J.M. *Drosophila flavohirta* in Transvaal. [Die bloekom-nektarvlieg *Drosophila flavohirta* in Oos-Transvaal]. *South African Bee Journal* (1985) 57 (1) 8–14 [Af, B] Eucalyptus flowers were examined at 24 localities in Transvaal, South Africa, during February–May 1983 and 12–17 April 1984, for infestations with nectar-feeding *D. flavohirta* larvae. Infestations varied considerably between the localities and between the two years. At some localities, infestations were low in both years, but the mean percentage of *E. grandis* flowers infested was as high as 43% in one area and 32% in another. P. Walker

Plant Protection Res. Inst., Private Bag X134, Pretoria, South Africa.

Herrmann, J.M. *Insect pollination of some Erica species in the south-western Cape*. *Veld & Flora* (1985) (June) 57–60 [En, B]

A study of 13 *Erica* species in South Africa showed that honeybees (*Apis mellifera capensis*) constituted 42% of flower visitors, collecting pollen from most of the species, and nectar from all of them, and they are considered to be the most important pollinators. Anthophorids and other small bees, mainly allopapines and halictids, were responsible for 29% of visits to *Erica* flowers. Carpenter bees (2% of visits) preferred flowers of the *Leguminosae*, *Labiatae* and *Laminaceae* families. Moths, butterflies, flies and beetles accounted for 11% of visits to *Erica* spp. Sunbird visits comprised 16% of the total but their effectiveness as pollinators is unknown. J.M. Gedy

Plant Protection Res. Inst., Private Bag 134, 0001 Pretoria, South Africa.

Hersch, M.I., Crewe, R.M., Hepburn, H.R., Thompson, P.R. and Savage, N. *Sequential development of glycolytic competence in the muscles of worker honeybees*. *Comparative Biochemistry and Physiology*, B (1978) 61B (3) 427–431 [En, B]

Hexokinase and cytoplasmic glycerol-3-phosphate dehydrogenase activities rose dramatically in the mandibular muscle of worker honeybees just prior to emergence from the sealed cells, but only developed in the thoracic muscle after emergence. Lactate dehydrogenase remained low in both muscles. Thus, glycolytic metabolism occurs in the mandibular muscles before those of the thorax. F.B. Wells

Dept. Zoology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

**Hill, M.P. and Hulley, P.E. *Aspects of the phenology and ecology of the South American weed, Solanum sisymbri-
ifolium, in the Eastern Cape Province of South Africa*.** *African Plant Protection* (2000) 6 (2) 53–59 [En, X]

The flowers are pollinated by several species of native carpenter bees.

ARC-Plant Protection Research Inst., Private Bag X134, Pretoria 0001, South Africa.

Hoffman, M.T. *The pollination ecology of Aloe ferox* Mill. *South African Journal of Botany* (1988) 54 (4) 345–350 [En, af, Bc]

The flower morphology of this species suggests that it is pollinated by birds, but at two sites in South Africa a number of bee species (*Apis mellifera*, *Allodapula variegata*, two *Lasioglossum* spp.), a formicine ant, a chalcid wasp and a syrphid fly were also seen to visit the flowers, as well as five species of birds. Honey bees, which were the most frequent visitors, appeared to effect pollination whilst foraging for pollen, but nectar foragers probed the base of the flower away from the anthers and were probably ineffective pollinators. Birds are probably more effective than honey bees in effecting cross-pollination. D.G. Lowe

Botany Dept., Univ. Port Elizabeth, P.O. Box 1600, Port Elizabeth 6000, South Africa.

Holcroft, D.M. and Allan, P. *Artificial pollination of kiwifruit (Actinidia deliciosa) pollen storage and pollen application*. [Abstract]. *Journal of the Southern African Society for Horticultural Science* (1991) 1 (Supplement) 17 [En, Bc]

The pollen quality of different staminate cultivars was assessed by in vitro pollen germination tests, but the results were variable and no distinctly superior sources were found. It was found that pollen can be stored for short periods (a few weeks) in the freezer with or without a drying agent. For longer periods pollen viability was reduced least by low humidities (0–20% RH) and temperatures of –18°C (freezer) in the presence of carbon dioxide. Humidity was controlled by different concentrations of sulphuric acid. Pollen is usually applied to flowers by dusting methods using dry pollen. These conventional methods of application were compared to an aqueous spray pollination developed in New Zealand using a specially prepared solution. In an experiment using unbagged flowers (to prevent blossom rot) there were no significant differences between the treatments. Each method has advantages and disadvantages. Author

Department of Horticultural Science, University of Natal, Natal, South Africa.

Hung, A.C.F. *Preliminary evidence for a protein specific to an African honey bee race (Apis mellifera scutellata)*. *American Bee Journal* (1990) 130 (1) 49–50 [En, B]

A protein with an isoelectric point of c. 5.7 was found in *A. m. scutellata* workers collected from two colonies in hives and one wild colony in South Africa. The protein was present in 58 of the 61 bees (three may have been badly preserved). It was found in only two of 11 *A. m. scutellata* workers from Kenya, but was absent from all but one (a possible experimental error) of 100 workers from apiaries in Maryland, USA [presumably European bees]. The protein was present in 10 of 16 workers from Costa Rica, in 18 of 34 from Mexico and in 7 of 11 from Venezuela. P. Walker

Beneficial Insects Lab., ARS, USDA, Beltsville, MD 20705, USA.

Hung, A.C.F., Rubink, W.L. and Crewe, R.M. Association of enzyme/protein loci in individual honey bees (*Apis mellifera* L.) (Hymenoptera: Apidae). *Bee Science* (1991) 1 (4) 225–229 [En, Bj]

Isoelectric focusing was used to determine the distributions of alleles of hexokinase-1 (HK-1) and malate dehydrogenase-1 (MDH-1), and two specific Africanised honey bee (AHB) proteins, in individual honey bees sampled in Maryland, Florida and Texas, USA, in Johannesburg, South Africa, and in Mexico. The data from a total of 1207 bees were analysed as a binomial probability distribution. The result showed that the probability for a bee to be positive for the AHB-specific proteins is: $P = 0.55$ if it carries the *Mdh-11* allele; $P = 0.97$ if it carries the *Hk-1B* allele; and $P = 0.98$ if it carries both *Mdh-11* and *Hk-1B* alleles. *Author* Bee Research Laboratory, BARC-East, B-476 Beltsville, MD 20705, USA.

Illgner, P.M., Nel, E.L. and Robertson, M.P. Beekeeping and local self-reliance in rural southern Africa. *The Geographical Review* (98) 88 (3) 349–362 [En, Ba]

The advantages and disadvantages of beekeeping as an activity to increase the income of small-scale farmers are discussed. Some constraints to traditional beekeeping are described, and a few of the programmes to improve beekeeping potential are mentioned; the activities of the Bondolfi Beekeeper's Association in Zimbabwe are given as an example. *P. Walker*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown, South Africa.

Jackson, C. The Jackson horizontal hive. (97) 21 pp. [En, B(unpublished reports)]

PO Box 71085, Bryanston, 2021 South Africa.

Jeddar, A. and 5 others. The antibacterial action of honey: an in vitro study. *South African Medical Journal* (1985) 67 (7) 257–258 [En, B]

Fifteen Gram-positive and Gram-negative pathogenic bacteria were cultured in various media in the presence of 10, 20, 30, 40 or 50% honey. All the bacteria grew in the absence of honey, but none grew in the presence of 50% honey, and most were inhibited at 40%. The growth of *Vibrio cholerae*, *Streptococcus pyogenes* and *Haemophilus influenzae* was inhibited by honey at 20%. The mechanism of bacterial inhibition by honey is not known. A clinical trial is in progress to determine the value of orally administered honey in the treatment of infantile gastroenteritis. *D.G. Lowe*

Depts. Microbiology & Paediatrics & Child Health, Univ. Natal & King Edward VIII Hospital, Durban, South Africa.

Johannsmeier, M.F. The marula *Sclerocarya birrea*: well known bushveld tree but little known beeplant. *South African Bee Journal* (2000) 71 (3) 95–96 [En, Bj]

ARC-Plant Protection Research Inst., Private Bag X 134, Pretoria 0001, South Africa.

Johannsmeier, M.F. Pollen sources of honeybees in three different south-western Cape environments. *South African Bee Journal* (2000) 72 (1) 34–39 [En, Bj]

The contents of pollen traps attached to hives in three

apiaries were emptied every two or four weeks for one year, and analysed. The main pollen sources at each location in each month are tabulated, together with average weight of pollen trapped/two weeks and the amount of brood present. Several peaks in brood production can be linked to pollen flows from certain plants. Crude protein contents of 18 bee-collected pollens ranged from 8.7% to 31.0%; the highest values were for pollens from *Echium plantagineum*, *Malus* spp. and the *Mesembryanthaceae* family. *P. Walker* ARC-Plant Protection Research Inst., Private Bag X 134, Pretoria 0001, South Africa.

Johannsmeier, M.F. (ed.) Beekeeping in South Africa. (3rd) Pretoria, South Africa; ARC-Plant Protection Research Institute (Plant Protection Handbook No. 14) (2001) 288 pp. ISBN 1-86849-201-X [En, Bdo]

This is a revised edition of the book first published in 1973 (see *Apicultural Abstracts* 91/74), and again in 1983. The scope has been widened to include the 'capensis problem', and new chapters on beekeeping in top-bar hives and on hive products other than honey and beeswax, as well as new sections on allergy and on the history of beekeeping in this country. The book contains a bibliography at the end of each chapter, a glossary and a detailed index. *P. Walker*

Johannsmeier, M.F. Honey sources of the south-western Cape as inferred from pollen analyses of honey samples. *South African Bee Journal* (2001) 73 (1) 31–35 [En, Bj]

Pollen analyses were carried out on 62 honey samples from eight vegetation areas (mountain fynbos, Western Sandveld, south coast fynbos, crop plants, eucalypts, fruit farms, suburbs, unusual), and the main honey sources are reported. Pollens of *Eucalyptus cladocalyx*, an important nectar and pollen plant in south-west Cape, and other eucalypts were present in many of the honeys. Pollen from *Ericaceae* were dominant in the fynbos samples, but these also contained representatives from four other plant families. *P. Walker*

ARC-Plant Protection Research Inst., Private Bag X 134, Pretoria 0001, South Africa.

Johannsmeier, M.F. KwaZulu Natal's wonder bee plant. *South African Bee Journal* (2001) 73 (3) 170–171 [En, Bj]

Isoglossa deliculata (common names: hlalwane, kieselblaar, sewejaarbossie).

PO Box 36512, Menlo Park, Pretoria 0102, South Africa.

Johannsmeier, M. and Allsopp, M. Beeplants for South African suburban gardens. *South African Bee Journal* (1995) 67 (3) 70–74 [En, Bj]

Honeybee Research Division, Plant Protection Research Institute, Pretoria & Stellenbosch, South Africa.

Johannsmeier, M.F. Commercial beekeeping in the Transvaal in relation to honeyplants. *Proceedings, 1 Congress of the Entomological Society of South Africa.* (1975) 181–184 [En, B]

Johannsmeier, M.F. Aloe marlothii in South Africa. *South African Bee Journal* (1976) 48 (2) 10–14 [En, B]

Although this is one of the most common plants in parts of Natal and Transvaal, little has been reported about its

value as a bee plant. *A. marlothii* honey is described as 'fairly dark'.

Plant Protection Res. Inst., Private Bag X134, Pretoria, South Africa.

Johannsmeier, M.F. Can nectar flows from saligna gum be predicted? *South African Bee Journal* (1977) 49 (4) 9, 11–15 [En, B]

Johannsmeier, M.F. Factors affecting the nectar flow in *Eucalyptus grandis* (Hill) Maiden. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia. (1977) 184–194 [En, B]

After three seasons in which the *E. grandis* (saligna gum) honey flow was poor, honey crop figures submitted by beekeepers were compared with meteorological data. No correlation was found between nectar flow and rainfall, temperature and sunshine, except in one area where there was a positive correlation ($r = 0.71$) between yield and August–January sunshine. Long-term records showed that yields occur in 4- or 5-year cycles. Other variable factors, such as bee predator activity and colony management, were not investigated. D.G. Lowe

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Johannsmeier, M.F. What future for 'Kort Rus' sunflowers? *South African Bee Journal* (1977) 49 (3) 3–5 [En, B]

Discusses problems with this short variety of the giant Russian sunflower.

Johannsmeier, M.F. Beetles that eat bee brood [in South Africa]. *South African Bee Journal* (1980) 52 (5) 3–5 [En, B] *Hoplostoma fuliginosus* (Scarabaeidae).

Johannsmeier, M.F. Corbicular loads of the African honey-bee. *South African Bee Journal* (1981) 53 (5) 3–6 [En, B]

In a 3-year study, the contents of pollen traps on hives in 14 localities were analysed; in 187 samples, each consisting of about 500 pellets, the percentage of mixed pellets was 0–10.2% (average 0.7%). During two weeks of intensive brood rearing, the pollen collections of three colonies in one apiary were compared; in the first week the main pollen sources used by each colony were different, except that two colonies collected *Jasminum* pollen. In the second week two of the colonies switched to quite different pollen sources. Pollen samples contained some propolis in the first week – 34% in one colony and 3% in the others – but none the next week. At another apiary, less marked differences were found in the pollens collected. Other substances found in pollen traps were probably collected as pollen (or propolis) substitutes; also found was 'manna', sugar pellets collected from wounds in *Eucalyptus viminalis*. P. Walker

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Johannsmeier, M.F. Further notes on large hive beetles [in South Africa]. *South African Bee Journal* (1981) 53 (2) 4–5 [En, B]

Pachynoda sinuata.

Johannsmeier, M.F. Experiences with the Cape bee in the Transvaal. *South African Bee Journal* (1983) 55 (6) 130–138 [En, B]

This is an account of experiences with *Apis mellifera capensis* at the Government Apiary, Pretoria, in an area where the native bee is *A. m. adansonii*. Although *A. m. capensis* colonies may not survive for very long, laying workers from them may invade *adansonii* colonies, causing problems such as queenlessness, dwindling, and absconding. When *adansonii* colonies are introduced into an area with *capensis* bees, some hybridisation occurs, or colonies are invaded by *capensis* laying workers. Within 1–2 yrs, *adansonii* colonies are no longer pure. It is concluded that it is not advisable to take Cape bees out of their native area, and that the introduction of other bees into the Cape should continue to be discouraged. P. Walker

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Johannsmeier, M.F. A 'new' honey plant of the potato family: *Lycium*. *South African Bee Journal* (1984) 56 (5) 108–112 [En, B]

Johannsmeier, M.F. Beekeeping potential of native flora of South Africa. *South African Bee Journal* (1988) 60 (5) 98–108 [En, B]

The main vegetation zones of South Africa are described briefly and some important nectar sources in each zone are named. During the 1930s and 1940s scale-hive records were kept at several locations in various zones, and graphs plotted from the records for six sites are how published for the first time; they are discussed in relation to the local nectar flows (and rainfall). The average maximum daily gain during peak nectar flows was about 5 lb [2.3 kg], but a maximum of 18 lb [8.2 kg] was recorded in one colony. The value to honeybees of certain types of plants is discussed, and species recommended for planting are listed.

P. Walker

Apicultural Unit, Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Johannsmeier, M.F. Variety in commercial honey in South Africa. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 135–138 ISBN 0-620-15132-3 [En, Bd]

Variety in honey producing regions and plants; variety in characteristics; public response to variety; varietal advertising.

Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Johannsmeier, M.F. Beekeeping and forestry in South Africa. Southern African forestry handbook 1994 [edited by Sijde, H. A. van der]. Pretoria, South Africa; Southern African Institute of Forestry. (1994) 841–846 [En, Ba]

In several areas, Eucalyptus trees are important nectar sources, and they are more reliable than other major nectar sources. The total annual honey production of South Africa is 3200 t, of which approx. 1650 t come from

Eucalyptus, especially *E. grandis* (1000 t); a further 1000 t come from crop plants and the rest from weeds, indigenous flora and certain exotic plants, including many multi-purpose trees and shrubs. The wood of pine trees, *Pinus patula*, grown in South Africa is used in the manufacture of beehives (10,000 are incorporated into beekeeping annually). *P. Walker*

Plant Protection Research Institute, South Africa.

Johannsmeier, M. F. *Bee plants of the south-western Cape: nectar and pollen sources of honeybees*. Pretoria, South Africa; Department of Agriculture. (1995) iii + 59pp. ISBN 0-621-16097-0 [En, Bdo]

The environment of the south-western Cape of South Africa, the centre of the so-called 'fynbos biome', is described and nine tables of bee plants (classified into groups e.g. creepers and semi-climbers, annuals and biennials, crop plants, trees etc.) are presented. The tables give information about botanical names, common names, values as bee plants (nectar and/or pollen source, ranked from 0 to 4) and flowering times. Remarks on aspects such as pollen colour, honey characteristics and country of origin are made where possible. A short literature list is given and an index of common names is included. *D. G. Lowe*
Plant Protection Research Institute, Agriculture Research Council, Pretoria 0001, South Africa.

Johnson, S. D., Linder, H. P. and Steiner, K. E. *Phylogeny and radiation of pollination systems in Disa (Orchidaceae)*. *American Journal of Botany* (98) 85 (3) 402–411 [En, Bc]

A cladogram for 27 species was constructed using 44 morphological characters, and pollination systems were then mapped onto the phylogeny in order to analyse pathways of floral evolution. Shifts from one pollination system to another have been a major feature of the evolutionary diversification of *Disa*. Nineteen different specialised pollination systems were found in the species studied; it was also found that repeated evolution of broadly similar pollination systems has occurred in unrelated clades. One group is pollinated by carpenter bees. *Author*

Dept of Botany, Univ. of Natal, Private Bag X01, Scottsville, Pietermaritzburg 3209, South Africa.

Johnson, S. D. and Steiner, K. E. *Generalization versus specialization in plant pollination systems*. *Trends in Ecology & Evolution* (2000) 15 (4) 140–143 [En, wf]

The idea that most angiosperm flowers are specialised for pollination by particular animal types, such as birds or bees, has been challenged recently on the basis of apparent widespread generalisation in pollination systems. At the same time, biologists working mainly in the tropics and the species-rich temperate floras of the Southern hemisphere are documenting pollination systems that are remarkably specialised, often involving a single pollinator species. Current studies are aimed at understanding: (1) the ecological forces that have favoured either generalisation or specialisation in particular lineages and regions; (2) the implications for selection on floral traits and divergence of populations; and (3) the risk of collapse in plant-pollinator mutualisms of varying specificity.

School of Botany and Zoology, Univ. of Natal, Private Bag X01, Scottsville Pietermaritzburg 3209, South Africa.

Johnson, S. D. and Dafni, A. *Response of bee-flies to the shape and pattern of model flowers: implications for floral evolution in a Mediterranean herb*. *Functional Ecology* (98) 12 289–297 [En, Bc]

Reports research on the vision of *Usia bicolor* (Bombyliidae) which is almost the only pollinator of *Linum pubescens* in the Mediterranean region.

Dept of Botany, Univ. of Natal, Private Bag X01, Scottsville, Pietermaritzburg 3209, South Africa.

Johnson, S. D. *Pollination of Disa filicornis (Orchidaceae) through deception of mason-bees*. *South African Journal of Botany* (1992) 58 (6) 541–542 [En, af, 6 ref., 3 pl.]

D. filicornis, a Cape orchid, was found to be pollinated by *Chalicodoma* spp. The reasons for the bees visiting the flowers despite their lack of nectar are discussed.

Department of Botany, University of Cape Town, Private Bag, Rondebosch 7700, South Africa.

Johnson, S. D. *Carpenter bee pollination of Herschelianthe graminifolia (Orchidaceae) on the Cape peninsula*. *Flora (Jena)* (1993) 188 (1) 383–386 [En, Bc]

Field observations at two sites on the Cape peninsula, South Africa, showed that carpenter bees (*Xylocopa*) pollinate the orchid *H. graminifolia*. The orchid does not produce nectar and appears to function as a food-source mimic. Opportunistic male and female bees in search of nectar are attracted to the bright blue flowers. While attempting to enter the flower, the bee pushes against the column and the large pollinaria are attached to the ventral surface of the thorax. Pollinaria removal rates from flowers exceeded pollen deposition rates, indicating that many pollinaria do not reach the stigmas of other flowers. Pollinaria wastage was ascribed to the large distances between plants. This is the first report of pollination in the genus *Herschelianthe*. *Author*

Department of Botany, University of Cape Town, Private Bag, Rondebosch 7700, South Africa.

Johnson, S. D. *The pollination of Disa versicolor (Orchidaceae) by anthophorid bees in South Africa*. *Limleyana* (1994) 9 (4) 209–212 [En, 15 ref., 3 pl., 1 map]

Amegilla natalensis [*Anthophora natalensis*], a large anthophorid bee, was the sole observed pollinator of the orchid *Disa versicolor* at several sites in South Africa and Lesotho. The orchid has a sharply decurved nectar-containing spur which neatly accommodates the long curved tongue of *A. natalensis*. Pollinaria are ventrally attached to the mouthparts of the bee. Flowers of *D. versicolor* undergo a colour change from pink to brown during anthesis. This change in flower colour appears to function as an orientation cue for bees to locate newly opened flowers on the tall, densely packed inflorescence.

Department of Botany, University of Cape Town, Rondebosch 7700, South Africa.

Johnson, S. D. *Insect pollination and floral mechanisms in South African species of Satyrium (Orchidaceae)*. *Plant Systematics and Evolution* (1997) 204 (3/4) 195–206 [En, Bc]

The morphologically diverse flowers in the genus *Satyrium* reflect adaptations to a wide range of pollinators. Several recently discovered pollination systems in *Satyrium* are

described and illustrated here; these include pollination by solitary bees, carrion flies, butterflies and moths. Two basic types of floral mechanism are recognised in *Satyrium*: (1) species pollinated by lepidoptera and birds have long floral spurs and plate-like viscidia seated in lateral rostellum notches; these viscidia become attached to the proboscis or bill of the pollinator. (2) Species pollinated by flies and bees have relatively short floral spurs and globose viscidia seated in terminal rostellum notches; these viscidia become attached to the face, thorax or eyes of the pollinator.

Department of Botany, University of Cape Town, Rondebosch 7700, South Africa.

Johnson, S.D. and Steiner, K.E. Pollination by megachilid bees and determinants of fruit-set in the Cape orchid *Disa tenuifolia*. *Nordic Journal of Botany* (1994) 14 (5) 481–485 [En] Wild fires near Cape Town stimulated mass-flowering in several populations of *D. tenuifolia* early in 1992. The bright yellow flowers of the orchid are pollinated by various carder and leafcutter bees (*Megachilidae*) and occasionally monkey beetles. The highly elongate pollinaria become attached to the underside of the pollinator's thorax. The bees showed strong fidelity towards the orchid, despite the lack of nectar in its flowers. The orchid does not appear to mimic other rewarding species. It was concluded that the pollination system of *D. tenuifolia* depends on exploitation of instinctive foraging and territorial behaviour of male megachilid bees. The fruiting success of *D. tenuifolia* at the study site was pollinator-limited as supplementary hand-pollinations resulted in a twofold increase in the percentage of flowers which set fruits. Department of Botany, University of Cape Town, Private Bag, Rondebosch 7700, South Africa.

Jones, G.E. The mandibular gland secretions of the Cape honeybee (*Apis mellifera capensis* Esch.): factors affecting the production of the chemical signal and implications for further development of beekeeping in South Africa. Thesis, (2000) 93 pp. [En, Bt]

In GC-MS analysis of mandibular gland (M) extracts from virgin queens, 37 compounds were identified, including the components of queen pheromone (9-ODA, 9-HDA, HVA and HOB) and other aliphatic acids and phenols. The total volume and volume of most of the components increased with age of virgin queens, with 9-ODA reaching a maximum (87% of major components) about 3 days after emergence. Survival rate was highest in queens kept with or without workers in small mating nuclei. The presence of workers had a significant effect on the composition of M secretions, and the introduction to colonies of queens that had been kept with workers elicited significantly less hostile reactions than for queens kept alone. Composition of M secretions and 9-ODA:10-ODA ratios were determined in mated queens from five localities in the Eastern Cape, but no significant differences were found. *P. Walker*

Keetch, D.P. The danger of varroa disease for S.A. [South African] beekeeping. *South African Bee Journal* (1984) 56 (3) 52–55 [En, B]

Kepaletswe, K.M. Beekeeping in Botswana. Bees and beekeeping in southern Africa. Proceedings of the Inter-

national Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H.; Buys, B.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 152–154 ISBN 0-620-15132-3 [En, Bd]

Beekeeping Unit, Department Field Services, Ministry of Agriculture, Private Bag 003, Gaborone, Botswana.

Kirchner, W. and Friebe, R. Nestmate discrimination in the African stingless bee *Hypotrigona gribodoi* Magretti (Hymenoptera: Apidae). *Apidologie* (99) 30 (4) 293–298 [En, de, fr, Bj]

Using colonies collected in South Africa, interactions between single individuals were observed in arena experiments; the bees could discriminate nestmates from non-nestmates. In another experiment, colony A was replaced by colony B while A foragers were away from the nest. On their return they entered the tube of nest B, but came out immediately. However, individually marked A individuals introduced directly into nest B survived; they were not attacked or driven out of the nest. *P. Walker*

Univ. Konstanz, Fakultät für Biologie, 78457 Konstanz, Germany.

King, L. F. Ramnas – has it any value? *South African Bee Journal* (1974) 46 (1) 4–5 [En, B]

Raphanus raphanistrum is not highly regarded as a honey plant.

Koeniger, N. Headlines on the Cape bee: Is South African scutellata in danger? [Schlagzeilen über die Kapbiene: Sudafricanische scutellata in Gefahr?]. *Biene* (1992) 128 (10) 580–583 [De, Bj]

M. Cooke [*American Bee Journal* (1992) 132 (8) 519–521] has reported that many colonies of *Apis mellifera scutellata* in Transvaal, South Africa, have been invaded by laying workers of *A. m. capensis* which become 'pseudoqueens' in queenless colonies. Beekeepers contribute to the problem by moving colonies between Transvaal and the Cape. Hepburn & Crew [*Apidologie* (1991) 22 (6) 567–580] found that pure *A. m. capensis* populations are found in a narrow coastal belt and that there is a broad zone where scutellata x capensis hybrids are found. These findings are discussed and experiences with *A. m. capensis* in Oberursel, Germany (kept since 1973), are described. Initially, some *A. m. capensis* workers invaded nearby Carniolan (*A. m. carnica*) colonies, but these were requeened with Carniolans and Cape colonies have since been kept well apart from other colonies. Results have shown that tropical and subtropical races of *A. mellifera* can be kept in Germany only with great difficulty. They cannot be overwintered and must often be fed. They are susceptible to chalk brood, but not to varroa. *D. G. Lowe*

Institut für Bienenkunde, Karl-von-Frisch-Weg 2, 6370 Oberursel, Germany.

Koeppen, B.H. Determination of honey sugars by gas-liquid chromatography and analysis of a random selection of honeys available commercially in the Western Cape. *Food Industries of South Africa* (1980) 33 (6) 41, 43–45 [En, B]

The sugars in honey were silylated by a method based on that of Brobst and Lott, described by Doner (*Apicultural*

Abstracts 1397/80), and analysed by GLC. The procedure was reduced to 25% of the original scale, and triphenylethylene was used as an internal standard; dissolution and reaction of the sample were speeded up by agitation in an ultrasonic bath. Using the modified procedure, an analysis of mono- and di-saccharides was made within 15 minutes of sample injection, and of disaccharides alone within seven minutes. Of the 12 honey samples examined, four did not comply with South African Government Regulations (1979) which state that sucrose content should not be more than 5%, and that specific rotation should have a negative value of not less than -10° . Results are also given for water content, acidity, and colour and flavour. *P. Walker* Dept. Food Sci., Univ. Stellenbosch, Stellenbosch, South Africa.

Kok, C. V. de. *Beekeeping in the Letaba district. African bees: taxonomy, biology and economic use (D. J. C. Fletcher (ed.)).* Pretoria, South Africa; *Apimondia*. (1977) 91–95 [En, B] Beekeeping with *Apis mellifera adansonii* in NE Transvaal; the chief honey flows are from *Eucalyptus saligna* and Citrus.

Kolasinski, R. *Solving problems of bee pollination in kiwi plants in South Africa. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B. J.]* Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 28–30 ISBN 0-620-15132-3 [En, Bd] Aspects which are discussed include location of hives, feeding with sugar syrup, use of hail netting in the orchards, configuration of individual areas and duration of flowering season. P.O. Box 4, Comondale 2385, South Africa.

Korte, M. de, Weissenbacher, B.K.H. and Crewe, R.M. *Chemical signals in a stingless bee *Trigona (Meliponinae) denoiti* Vachal (Hymenoptera: Apidae: Meliponinae).* *Journal of the Entomological Society of Southern Africa* (1988) 51 (1) 9–16 [En, Bb] Gas chromatographic and mass spectrometric analyses of the chemical components of the mandibular glands of workers of *Trigona denoiti* revealed an increase in the absolute quantities and the diversity of chemical compounds with age. The two major components were identified as the two isomers of citral, neral (3,7-dimethyl-2-(Z),6-octadiene-1-al) and geranial (3,7-dimethyl-2-(E),6-octadiene-1-al). Mandibular gland secretions of males contained only citral. Bioassays indicated that these components had alarm pheromone activity in *Trigona denoiti*, but that they were not as effective as whole mandibular glands in eliciting a response. *Author* Dept. Zoology, Univ. Witwatersrand, Witwatersrand 2050, South Africa.

Kryger, P., Kryger, U. and Moritz, R.F.A. *Genotypical variability for the tasks of water collecting and scenting in a honey bee colony.* *Ethology* (2000) 106 (9) 769–779 [En, wf] The polyandrous mating behaviour of the honey bee queen increases genotypical variability amongst her worker offspring; microsatellite DNA analyses revealed a

total of 16 subfamilies in one colony of honey bees. The subfamilies were represented in significantly different proportions in two subgroups of bees (water-collecting bees and scenting bees), indicating a genetic component in task choice.

Dept of Zoology & Entomology, Univ. of Pretoria, Pretoria 0002, South Africa.

Kurstjens, S.P. *Physico-chemical characteristics of waxes produced by the African honeybee, *Apis mellifera scutellata*.* PhD Thesis, University of Witwatersrand, Johannesburg, South Africa. (1990) xx + 209 pp. [En, Bdo]

The physical and chemical alterations induced by mastication and manipulation of wax by the worker honeybee in comb construction, and the subsequent contribution afforded the structural integrity of the nest, are described. Virgin scale wax is highly structured, with the crystallites aligned approximately perpendicular to the planar surface, whereas comb wax has a random crystallographic arrangement. This reflects a disruption of the crystallite structure following mastication. Chemical analyses included investigation of both lipid and proteinaceous elements. Lipid composition was evaluated by enzymic as well as by thin-layer and gas-liquid chromatographic methods. The results indicated a reduction in scale diacylglycerols with a corresponding increase in saturated monoacylglycerols. Such modifications are highly suggestive of lipase activity within the salivary secretion added to the wax. The proteins of comb and scale wax were analysed electrophoretically, under reduced conditions. Each wax type possessed unique polypeptide fractions, in addition to sharing common protein species. It is speculated that those in common represent integral proteins, such as transport molecules, while the disparities noted may be due to salivary enzymic degradation, or even glycosylation. The effects of these textural and chemical alterations on the mechanical behaviour of the waxes was assessed. Tensile tests were performed on a variety of scale and comb wax preparations over the range of temperatures likely to impinge on the honeybee nest. These investigations revealed the specific structural contributions made by each of the physico-chemical alterations described. They showed that scales are ideal moulding materials due to their high distensibility and low stiffness, whereas the greater resistance to deformation and lower potential for extension of comb wax makes it a superior structural material. Tensile testing indicated that the inclusion of propolis and cocoon silk within the comb structure makes it structurally superior. *Author*

Fac. Sci., Univ. Witwatersrand, Johannesburg, South Africa.

Kurstjens, S.P., Hepburn, H.R., Schoening, F.R.L. and Davidson, B.C. *The conversion of wax scales into comb wax by African honeybees.* *Journal of Comparative Physiology*, B (1985) 156 95–102 [En, B]

The conversion of texturally anisotropic beeswax scales into planar isotropic comb was studied by crystallographic, mechanical and chemical methods. Comb wax contained more protein than wax scales, therefore protein is probably added to the wax whilst it is being chewed. Comb wax contained more monoglycerides than scales, whereas scales contained more diglycerides; lipase in the

honeybee's salivary secretion is probably responsible for the change. Mechanical tests showed that scale wax was twice as strong at 23°C as comb wax, but comb wax had twice the stiffness and was less distensible than scale wax. At about 35°C the energy needed to break comb wax was half that needed to break scale wax. It is suggested that the protein added to scale wax by the honeybee is responsible for the final stiffness of comb wax. *D. G. Lowe*

Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Kurstjens, S. P., McClain, E. and Hepburn, H. R. *The proteins of beeswax*. *Naturwissenschaften* (1990) 77 (1) 34–35 [En, Bc] Protein compositions of freshly constructed white beeswax combs (no pollen or foundation) were determined by polyacrylamide gel electrophoresis. Samples from *Apis mellifera scutellata* and *A. m. capensis* showed no differences. Electrophoretograms of wax scales taken directly from *A. m. capensis* workers showed 11 protein bands, compared with 13 for wax comb. Seven of the bands were common to waxes from both sources. Possible reasons for the different protein compositions of the waxes are discussed. *P. Walker*
Department of Physiology, University of Witwatersrand, Johannesburg, South Africa.

Lear, E. Dante Anderson (1913–1988) – nonconformist – experimentalist – pioneer. *South African Bee Journal* (1989) 61 (2) 26–35 [En, Bj]

Lear, E. N. *A pioneering holiday through south central Africa and some apicultural observations*. *South African Bee Journal* (1995) 67 (2) 44–51 [En, Bj]
This article includes some observations on queen rearing using the Jenter system with plastic queen cups.
P. O. Box 751017, Gardenview 2047, South Africa.

Lear, E. N. *South African mead notes*. *Bucharest, Romania: Apimondia Publishing House*. (1997) 187 pp. ISBN 973-605-022-X [En, Bd]

Part 1 of this book describes the fermentation process in general and gives examples of various food products in which fermentation is involved. Part 2 describes the equipment used in mead making, and the next three parts deal in turn with the main ingredients of mead – honey and water – and yeast. Part 6 examines the fermentation process in more detail, whilst Part 7 describes spoilage organisms, such as bacteria and the vinegar fly, and the need for sanitation in mead making. Parts 8–10 describe types of mead, exhibiting mead at shows, and recipes for different meads. The final four parts of the book deal with legislative aspects (South Africa), the South African Mead Masters Association (SAMMA), historical aspects, and possible medicinal qualities of mead. The book ends with a 37-page glossary of terms used in mead making; there is also a short reference list. *D. G. Lowe*

Leat, N., Ball, B., Govan, V. and Davison, S. *Analysis of the complete genome sequence of black queen-cell virus, a picorna-like virus of honey bees*. *Journal of General Virology* (2000) 81 (8) 2111–2119 [En, wf]

A virus with picorna-like biophysical properties was isolated from South African honey bees, and was identified

as an isolate of black queen-cell virus. Nucleotide sequence analysis was carried out. The new nucleotide sequence was deposited in the EMBL/GenBank/DBJ database under accession number AF183905.

Dept of Microbiology, Univ. of the Western Cape, Private Bag X17, Bellville 7535, Cape Town, South Africa.

Levin, M. D. *The Africanized bee in South America. African bees: taxonomy, biology and economic use (editor D. J. C. Fletcher)*. Pretoria, South Africa; Apimondia. (1977) 55–57 [En, B]

Lieberman, H. *Beekeeping with African bees in South Africa*. *American Bee Journal* (1987) 127 (3) 173–174 [En, Bj]

This article is based on an interview with a beekeeper in South Africa who manages about 1000 colonies, with much migratory beekeeping. The bees are very defensive, so manipulations and moving are done at night by beekeepers wearing full protective clothing and using miners' lamps. Apiaries are usually in isolated locations. Most hives (Langstroth) have only one brood box; queen excluders are not used. Full supers are taken off at night and the bees are removed by banging and shaking the supers on a special metal stand with springs; the bees fall down through a funnel and are collected below, then returned to the hive. The main nectar sources are eucalypts, various citrus trees, aloes and sunflower. *P. Walker*
Free State Bees, 2701 Oxford Circle, Upper Marlboro, MD 20772, USA.

Lomnitzer, R., Lanner, A., Rabson and A. R. *Low specific IgE, IgG and lymphocyte reactivity in a group of patients developing anaphylaxis following a honey-bee sting*. *Clinical Allergy* (1988) 18 (1) 39–44 [En, Ba]

Ten patients who developed severe generalised reactions following a honeybee sting were investigated for the presence of specific IgE and IgG antibodies, and for lymphocyte reactivity following in vitro honeybee venom (HBV) stimulation. Five of the patients (high responders) showed high HBV-specific IgE and IgG levels, whereas the other five patients (low responders) showed low HBV-specific IgE and IgG levels. Mononuclear cells from the high responder group incorporated significant amounts of ³H-thymidine when activated with pure bee venom, whereas insignificant lymphocyte proliferation was observed in the low-responder group. It is concluded that, amongst HBV-sensitive patients, a group of low responders exists in whom the mechanism of anaphylaxis cannot be explained.

Author

South African Inst. for Medical Res., P.O. Box 1038, Johannesburg 2000, South Africa.

Lomnitzer, R. and Rabson, A. R. *Lack of responsiveness of beekeeper mononuclear cells to in vitro stimulation with pure bee venom*. *Journal of Allergy and Clinical Immunology* (1986) 78 (1) 25–30 [En, Bb]

Lymphocyte proliferation activity after in vitro honeybee venom (HBV) stimulation was examined in a group of patients allergic to bee stings and in a group of beekeepers. Although the allergic patients responded strongly to increasing doses of HBV, the beekeepers demonstrated no proliferative activity and an inability to produce inter-

leukin-2 after HBV stimulation. Removal of adherent cells or various populations of suppressor cells did not affect the cellular unresponsiveness of cells of beekeepers. These, and other tests which are reported, suggest that the lack of proliferation of lymphocytes of beekeepers and the inability to produce interleukin-2 is not due to a suppressor mechanism or to the presence of anti-idiotypic antibodies coating the surface of lymphocytes. The mechanism behind the failure of lymphocytes of beekeepers to proliferate, representing a natural process of desensitisation, remains unclear. *Author*
SAIMR, P.O. Box 1038, Johannesburg 2000, South Africa.

Londt, J. G. H. *Afrotropical robber fly (Diptera: Asilidae) predation of honey bees, Apis mellifera Linnaeus (Hymenoptera: Apidae).* *African Entomology* (1993) 1 (2) 167–173 [En, 16 ref.]
Natal Museum, Private Bag 9070, Pietermaritzburg 3200, South Africa.

Information regarding predation of honeybees (*Apis mellifera*) by Afrotropical Asilidae is presented. Apidae are the fifth most common insect family preyed on by asilids. A total of 83 prey records from eight African countries is analysed. The importance of predator size in the selection of apid prey is examined. Asilids with a bulk index (length x depth) of less than 90 mm did not prey on honeybees. Fourteen genera in four subfamilies, Apocleinae, Dasypogoninae, Laphriinae and Stenoponinae, are recorded as apivorous. Possible reasons are given for the lack of recordings of the remaining six subfamilies. The survey indicates that asilids are more harmful to apiarists than previously suspected.

Loock, E. E. M. *Eucalypts suitable for honey production.* *South African Bee Journal* (1983) 55 (2) 42–46 [En, B]
Notes on 14 species, and their honeys.

Louw, G. N. and Nicolson S. W. *Thermal, energetic and nutritional considerations in the foraging and reproduction of the carpenter bee Xylocopa capitata.* *Journal of the Entomological Society of Southern Africa* (1983) 46 (2) 227–240 [En, B]

Carpenter bees, *X. capitata*, were studied on Virgilia trees at various sites on the east-facing slopes of Table Mountain, Cape Town, South Africa. They were inactive at low ambient temperatures (less than 23°C). Mean thoracic temperatures were 39.3° (foraging females), 38.1° (foraging males) and 41.1° (territorial males). During spring *X. capitata* forage on the flowers of the keurboom tree, *V. divaricata*, and during late summer on the closely related *V. oroboides*. Each flower of *V. divaricata* provides on average 1.23 mg of pollen and 0.7 µl of nectar with a sugar concentration of 66 g 100 ml⁻¹. Carpenter bees removed up to 93% of this nectar at a single visit. Data on nectar and honey sac contents were used to construct an energy budget for foraging females. Larval development is very efficient in energy terms, with an assimilation efficiency of 90% and a gross production efficiency of 54%. It is estimated that a female carpenter bee must spend 3.5 hours visiting 1678 Virgilia flowers to provide 43.0 kJ of energy for the production of a single adult bee. A large amount of time and energy is also invested in constructing elaborate nests. *Author*

Zoology Dept., Univ. Cape Town, Rondebosch 7700, South Africa.

MacGillivray, D. B. *A centrifuging method for the removal of insect pollen loads.* *Journal of the Entomological Society of Southern Africa* (1987) 50 (2) 521–523 [En, Bb]

A method was developed for producing a microscope slide containing the total pollen load from an individual insect. Melted glycerol gelatin is placed in a centrifuge tube and allowed to solidify. Xylene is pipetted onto the surface of the gelatin, an insect added to the tube and the tube centrifuged for 3 minutes. After removal of the insect, the tube is centrifuged for a further one minute at 15,000 rpm. The xylene is decanted from the tube and the pollen-impregnated glycerol gelatin placed on a heated microscope slide. A cover slip is added when the glycerol gelatin has melted sufficiently. The method as described is suitable for insects varying from about 3 mm to the size of a honeybee; larger insects would require larger tubes and more materials. *J. M. Gedy*
Dept. Entomology, Univ. Stellenbosch, Stellenbosch 7600, South Africa.

Magnuson, P. *Appropriate beekeeping information technology: we held a conference, and nobody came.* *South African Bee Journal* (1996) 68 (3) 68–73 [En, Bj]

A 'conference' on the Cape honey bee (*Apis mellifera capensis*) problem in South Africa was held recently, with 47 participants from 10 countries communicating via their computers and the Internet. The conference, which was organised from South Africa, is described briefly and advantages are listed. A computer-based information support system has been set up for beekeepers in South Africa. The BRIDGES beekeeping forum, which is a free service, is described. *P. Walker*
PPRI Private Bag X134, Pretoria 0001, South Africa.

Magnuson, P. C. *Honey stomach filling in Cape honeybee foragers. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B. J.]* Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 93–95 ISBN 0-620-15132-3 [En, Bd]

Worker honey bees (*Apis mellifera capensis*) were trained to forage from an artificial feeder in the centre of a ring of colonies, not more than 3 m away from the furthest. The feeder dispensed sugar solution varying in concentration from 100 to 700 g/litre. Foragers feeding on the sugar solution were timed, and then caught and dissected so that the contents of the honey sac could be measured. Multiple regression analysis showed that, irrespective of syrup concentration, foraging honey bees left the feeder with a consistent volume of sugar solution, indicating that it is the fullness of the honey sac which determines when a bee stops ingesting food. Under the conditions of this experiment, the average forager departed for the hive with a load of 38 micro l, which had been ingested in 35 seconds. This volume corresponded to a mass of 45 mg, equivalent to 75% of an 'empty' bee's mass, therefore the bees carried 0.6 micro l per mg of body mass. *D. G. Lowe*

Department of Zoology and Entomology, Rhodes University, P. O. Box 94, Grahamstown 6140, South Africa.

Manning, J.C. and Brothers, D.J. *Floral relations of four species of Rediviva in Natal (Hymenoptera: Apoidea: Melittidae)*. *Journal of the Entomological Society of Southern Africa* (1986) 49 (1) 107–114 [En, Ba]

Females of some species of *Rediviva* in southern Africa are known to collect oils from certain flowers which do not produce nectar (e.g. see Vogel and Michener, *Apicultural Abstracts* 477/86; Vogel, 760/86). Four *Rediviva* species have now been observed pollinating the flowers of some plants whose pollinators were previously unknown. *R. politissima* pollinates four species of *Diascia* (*Scrophulariaceae*) and visits other species belonging to other families; *Rediviva* sp. pollinates a different *Diascia* species; *R. rufocincta* pollinates *Bowkeria verticillata*; *R. colorata* pollinates *Disperis fannini*, and visits various other plants, but has not been observed collecting oil. *P. Walker*
Dept. Botany, Univ. Natal, PO Box 375, Pietermaritzburg, 3200 South Africa.

Mason, C.A. *Division of labor and adult interactions in eusocial colonies of two allodapine bee species (Hymenoptera: Anthophoridae)*. *Journal of the Kansas Entomological Society* (1988) 61 (4) 477–491 [En, Bj]

The behaviours of female nestmates of *Allodape exoloma* and *Braunsapis foveata* are described during the eusocial phase of their nesting cycles. Naturally associated nestmates were transferred to glass tubes and observed for periods of 2–5 weeks. Females consisted of foragers and non-foragers, but division of labour in other tasks was minimal. Trophallaxis occurred as a network, with all individuals donating and receiving. Pollen stored on nest walls and pollen and nectar provided for larvae were food sources used by all adult females. Oophagy by a worker as well as by queens, and ovipositions by workers are described. The behavioural repertoires of the two species are similar, but greater consistency in division of labour, reduced activity of queens, and less frequent agonism in *Braunsapis foveata* colonies suggest that this species has a more stable social organisation than does *Allodape exoloma*. *Author*
Dept. Zoology, Univ. Witwatersrand, P.O. Wits, 2050 South Africa.

Mazel, A.D. *Distribution of painting themes in the Natal Drakensberg*. *Annals of the Natal Museum* (1982) 25 (1) 67–82 [En, B]

Rock-painting themes discussed include bees and their combs, and also ladders such as are used for reaching bees' nests to take the honey. Both themes are illustrated. A map shows that all 13 paintings of bees in the Natal Drakensberg, South Africa, are in the northern part of the range, as well as eight out of nine paintings that depict ladders, and the ninth is not far south of the centre. On the other hand most, although not all, paintings of cattle, horses and historical scenes are in the southern half of the range. It is considered that in earlier times the northern part of the range is likely to have had climate and vegetation more suitable for honeybees than the southern part. The probable symbolic importance of bees and honey in the regions is also discussed. *E.E. Crane*

Natal Museum, Pietermaritzburg, South Africa.

McGregor, L. *Queen rearing with Apis mellifera scutellata. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B.]*. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 95–103 ISBN 0-620-15132-3 [En, Bd]

The author describes his methods for rearing queens and deals with the following topics: requirements for successful rearing of queens; preparation of a colony for starting queen cells; grafting; nuclei for the introduction and mating of queens; introduction of laying queens; dequeening; queen banks. *D. G. Lowe*

Canowie Farm, P.O. Box 142, Ixopo 4630, South Africa.

McMichael, M. and Hall, H.G. *DNA RFLPs at a highly polymorphic locus distinguish European and African subspecies of the honey bee Apis mellifera L. and suggest geographical origins of New World honey bees*. *Molecular Ecology* (1996) 5 (3) 403–416 [En, Bc]

A highly polymorphic locus in *A. mellifera* was detected with genomic probe pB178. Eighty-five alleles, consisting of MspI and DdeI restriction fragment length polymorphisms (RFLPs), were found among the samples of bees from Europe, South Africa, Honduras, Mexico and USA which were tested. Variants and alleles were discontinuously distributed in Old World European and African subspecies. Principal coordinate analysis of the genetic distances between the alleles resulted in the identification of three distinct groups corresponding to three groups of honey bee races with historically different geographical distributions: east European *A. m. ligustica* and *A. m. caucasica*; west European *A. m. mellifera*; and South African *A. m. scutellata*. The clustering of alleles into these groups is consistent with previous studies employing other nuclear and mitochondrial DNA markers, which in part support evolutionary hypotheses based on morphometric and allozyme data. The majority of alleles in bees from the USA grouped with those found in east European bees, while other alleles grouped with alleles found in *A. m. mellifera*. While the majority of the alleles in neotropical bees grouped with or were identical to African alleles, other alleles grouped with alleles found in *A. m. mellifera*, *A. m. ligustica*, and *A. m. caucasica*. Both west European and African alleles were found in individual neotropical colonies, which may indicate that honey bee subspecies which evolved allopatrically have hybridised in the human-assisted extension of their original geographical ranges. *Author*

Department of Entomology and Nematology, University of Florida, Gainesville, FL, USA.

McQueen, P. *Beekeeping in the Lowveld*. *South African Bee Journal* (1987) 59 (3) 53–57 [En, Bj]

Merwe, W.J. van der and Eloff, P.J. *Beekeeping in the Western Cape. [Byeboerdery in Wes-Kaapland]*. *South African Bee Journal* (1995) 67 (4) 105–114 [Af, en, Bj]

Certain socio-economic aspects of beekeeping in this area of South Africa are discussed and the main problems experienced by beekeepers are highlighted; a shortage of

pollination units in this important fruit-growing region was identified. *Author*

Meusel, M.S. and Moritz, R.F.A. Transfer of paternal mitochondrial DNA during fertilization of honeybee (*Apis mellifera* L.) eggs. *Current Genetics* (1993) 24 (6) 539–543 [En, Bc]

Strict maternal inheritance of mitochondrial (mt) DNA is believed to be the rule in most eukaryotic organisms because of exclusion of paternal mitochondria from the egg cytoplasm during fertilisation. In honey bees, polyspermic fertilisation occurs, and many spermatozoa, including their mitochondria-rich flagellum, can completely penetrate the egg, thus allowing for a possibly high paternal leakage. In order to identify paternal mtDNA in honey bee eggs, restriction fragment length polymorphisms (RFLP) of different subspecies were used. Total DNA extracts of different developmental stages of *Apis mellifera carnica* x *Apis mellifera capensis* hybrid brood were tested with a radioactively-labelled diagnostic mtDNA probe. Densitograms of autoradiographs indicated that the male contribution represented up to 27% of the total mitochondrial DNA in the fertilised eggs 12 hours after oviposition. In subsequent developmental stages the portion of paternal mtDNA slowly decreased until hatching of the larvae when only traces were found. The initially high paternal mitochondrial contribution is therefore not maintained in the adult bee. *Author*

Department of Zoology and Entomology, Molecular Biology Laboratory, University of Natal, PO Box 375, Pietermaritzburg 3200, South Africa.

Michener, C.D. The first South African dioxyine bee and a generic review of the tribe Dioxyini (Hymenoptera, Megachilidae). Washington, USA; Entomological Society of Washington. *Memoirs of the Entomological Society of Washington* (1996) (No. 17) 142–152 [En, Bb]

The first species of this tribe of parasitic bees to be found in South Africa, *Dioxoides alata* n. sp., is described. The genera of Dioxyini are reviewed and briefly described, and a key to the genera is provided. *D. G. Lowe*
Snow Entomological Museum, University of Kansas, Lawrence, KS 66045, USA.

Mogford, D.J. Colour discrimination in the pollination of *Portulaca grandiflora* Hook., by *Apis mellifera* L. *Journal of South African Botany* (1980) 46 (2) 121–125 [En, af, B]

Observations were made on a large bed of *P. grandiflora* in Grahamstown, South Africa, in February–March 1978. Most flowers were purple, with smaller numbers of red, yellow and orange. The number of flowers of each colour present, and the number of each colour visited by honeybees were recorded at each observation. Two statistical analyses both indicated that bees preferred the yellow and orange flowers, and actively discriminated against purple; red flowers were visited randomly. The results are discussed in relation to foraging behaviour and colour vision in honeybees. *D. G. Lowe*

Dept. Plant Sci., Rhodes Univ., Grahamstown, South Africa.

Moodie, G. Beekeeping in South Africa 70 years ago. *South African Bee Journal* (2000) 72 (1) 27–31 [En, Bj]

107/01 Honeywood Farm, PO Box 17, Heidelberg 6760, South Africa.

Moodie, G. Reasons for the survival of the Cape bee. *South African Bee Journal* (1983) 55 (2) 34–37 [En, B]

Its ability to survive cold wet winters, and to produce laying workers whose eggs develop parthenogenetically into females.

Moriarty, A. Wild flowers of Malawi. Cape Town, South Africa; Purnell. (1975) 166 pp. SBN 360-00174-2 [En, B]

With colour reproductions of 360 species; many are bee plants.

Moritz, R.F.A., Crewe, R.M. and Hepburn, H.R. Attraction and repellence of workers by the honeybee queen (*Apis mellifera* L.). *Ethology* (2001) 107 (6) 465–477 [En, wf]

The spatial distribution of worker honey bees in colonies of two African subspecies (*A. m. capensis*, C, and *A. m. scutellata*, S), as well as their natural hybrids, was determined in five observation colonies in South Africa, each containing one frame. When the queens were allowed to roam freely throughout the hive, they were observed on both sides of the frame in all colonies. The queen was then caged on one side of the frame in three colonies, the other two serving as controls; queen caging significantly affected the distribution of worker bees, with more S workers being attracted to the queen and more C workers being repelled by her. The hybrid workers were also repelled, but to a lesser extent. Thus, queens not only attract workers to form a retinue or during swarming, but also repel workers in the nest. Evasion of the reproductive suppression by the queen pheromones may be a typical behaviour for workers with a high reproductive potential.

442/03 Institut für Zoologie, Martin-Luther-Universität Halle-Wittenberg, Kröllwitzerstr. 44, D-06099 Halle/Saale, Germany.

Moritz, R.F.A. Natural and artificial selection in the Cape honeybee *Apis mellifera capensis*. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H.; Buys, B.J.] Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 63–73 ISBN 0-620-15132-3 [En, Bd]

Aspects of breeding honey bees, and the genetic characteristics of *Apis mellifera capensis*, especially its thelytokous parthenogenesis, are discussed.

Bayerische Landesanstalt für Bienenzucht, Burgbergstrasse 70, 8520 Erlangen, Germany.

Moritz, R.F.A., Cornuet, J.M., Kryger, P., Garnery, L. and Hepburn, H.R. Mitochondrial DNA variability in South African honeybees (*Apis mellifera* L.). *Apidologie* (1994) 25 (2) 169–178 [En, De, fr, Bj]

The mtDNA size variability in samples of honey bees from 102 colonies covering the area south of the 27th parallel of latitude in Africa was analysed using polymerase chain reaction (PCR). A region between the CO I and CO II genes revealed four different size variants, one being a novel mitotype for honey bees not fitting the previously pub-

lished repeat pattern in the region (a fragment P0 with 69 bp and varying number of fragment Q of 196 bp length). This region, which has been shown to be useful for the biogeographical classification of *A. mellifera* subspecies, only partially corresponded to the known distribution of African subspecies of honey bees based on morphometrical and physiological data. The P0QQ-type was the most common with an overall frequency of 0.76. The region which has been addressed as the hybrid zone between *A. m. capensis* and *A. m. scutellata* showed no mitotype variability and was monomorphic for the PQQ type. A considerable length polymorphism was found north and east of this region with a frequency of 0.57 for P0QQ type and 0.36 for the P0Q type. Less common were the P0QQQ type (0.02) and a type not fitting the known P and Q repeat system (0.02). Digestion of the region with the DraI restriction enzyme revealed previously undetected mtDNA variability in *A. mellifera* populations. *Author*
Institut für Biologie, Technische Universität Berlin, Franklinstr. 28/29, 10587 Berlin, Germany.

Moritz, R.F.A. and Hanel, H. Restricted development of the parasitic mite *Varroa jacobsoni* Oud. in the Cape honeybee *Apis mellifera capensis* Esch. *Zeitschrift für Angewandte Entomologie* (1984) 97 (1) 91–95 [En, de, B]

Laying queens of *A. m. carnica* and *A. m. capensis* were kept in small nuclei in a flight room. The brood combs were examined every six hours and the sealed cells marked on a transparent foil; after c. 100 cells had been marked the comb was kept in an incubator at 35°C. When the bees emerged each cell was marked again on the foil and the length of the post-capping stage determined. In a second experiment, a *V. jacobsoni* female was added to each of 25 cells through an opening in the capping, which was then re-closed. The mean length of the post-capping stage was 9.6 days in *A. m. capensis*, 12.0 days in *A. m. carnica*. The introduction of mites into the cells did not affect the duration of the post-capping stage. When the bees emerged none of the 25 *A. m. capensis* cells with an adult mite contained offspring capable of parasitising a bee, whereas seven of the 25 mite-containing *A. m. carnica* cells did so. In an examination of naturally infested *A. m. capensis* colonies, only 21% of all recorded mites produced (just one) offspring which could reach a stage at which they would parasitise a bee. In *A. m. carnica* colonies all female mites produced at least one offspring which could reach this stage. In *A. m. capensis* the mites reached this stage 0.7 days after the adult bee had emerged, in *A. m. carnica* they reached this stage 2.2 days before the bee emerged. *D.G. Lowe*

Inst. Bienenkunde, J.W. Goethe-Univ., 6000 Frankfurt am Main, Germany

Morse, R.A. The intercontinental movement of honeybees: history, advantages and dangers. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 58–62 [En, B]

Describes the history of honeybee imports into the USA.

Morse, R.A. Swarm orientation in honey bees. African bees: taxonomy, biology and economic use (editor D. J. C.

Fletcher). Pretoria, South Africa; *Apimondia* (1977) 195–201 [En, B]

Review of work on the pheromones involved in swarm orientation.

Mostert, D.P., Siegfried, W.R. and Louw, G.N. Protea nectar and satellite fauna in relation to the food requirements and pollinating role of the Cape sugarbird. *South African Journal of Science* (1980) 76 (9) 409–412 [En, B]

The nectar of *Protea repens*, a preferred food plant of the bird *Promerops cafer*, contains on average 11.7 g/100 ml of reducing sugars (glucose + fructose) but very low concentrations of protein and amino acids. Satellite insects, including honeybees, are also taken by the sugarbird, and the highest mean biomass of insects recorded in a single inflorescence was 86.0 mg (dry mass). These data, together with an estimate of the daily energy budget of the sugarbird, show that the birds must visit a very large number of blooms daily to satisfy their energy requirements. In doing so they fulfil an important requirement of an ideal pollinator. *Author*

Zoology Dept., Univ. Stellenbosch, Stellenbosch 7600, South Africa.

Mountain, P. Honey production in South Africa. *American Bee Journal* (1972) 112 (11) 408–410 [En, B]

Mountain, P.N. Keeping African bees on pallets. African bees: taxonomy, biology and economic use (editor D. J. C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 157–160 + 2 pl. [En, B]

Describes pallets that take four, five, six or 10 hives of *A. m. adansonii*; lifting is by hand, crane or fork lift truck.

Mountain, P.N. Some aspects of management of the African bee. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R.H.; Buys, B.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 104–109 ISBN 0-620-15132-3 [En, Bd]

The management of *Apis mellifera scutellata* is described briefly.

Mountain Honey Farm, P.O. Box 48, Irene 1675, South Africa.

Mountain, P.N., Schehle, J.A., Steinhobel, F. and Toit, A.P. du (eds). Pollination and honeybees. [Bestuiving en heuningbye]. Brooklyn, South Africa; *Pollination Services Association North* (1989) 21 pp. [En\ Af, Bd]

This small booklet on honeybee pollination gives guidelines for both beekeeper and crop producer, and describes the various factors that must be considered if an efficient pollination service is to be provided. The code of conduct of the Pollination Services Association North is outlined. *D.G. Lowe*

Pollination Services Association North, PO Box 11473, Brooklyn, Pretoria 0011, South Africa.

Muller, W.J. Wax secretion in the Cape honeybee (*Apis mellifera capensis* Esch.) in relation to juvenile hormone and age polyethism. PhD Thesis, Rhodes University,

Grahamstown, South Africa. (1992) x + 88 pp. [En, Bdo]
Field experiments with seven queenright colonies of *A. m. capensis* showed that wax secretion in worker honey bees was significantly related to the age of the worker and, while the secretion pattern remained the same, the absolute amount of wax secreted varied seasonally. Comb-building festoons, previously thought to be the site of wax secretion, contained only a fraction of the newly-secreted wax in a colony. Festooning behaviour was also found to be seasonal. The amount of wax secreted by workers was significantly affected by the colony. Laboratory experiments showed that although age-related changes in behaviour and physiology of worker honey bees appear to be modulated by juvenile hormone (JH), wax secretion is not dependent on JH. Manipulating JH-III levels by injecting the hormone and manipulating the only source of the hormone (the corpora allata: CA) did not affect wax secretion. Increasing blood JH level shortly after eclosion did not affect the amount of wax produced by workers aged 3–21 days, nor could a critical period be found during which elevated hormone levels would affect the rate of wax secretion. Removal of the CA from newly eclosed workers did not affect wax production. Removing the putative neural feedback inhibition on the CA by severing the neural connections with the brain did not result in a change in wax production. Implanting CA from older workers into younger workers had no significant effect. Methoprene, a widely-used JH analogue, caused reduced wax secretion in workers. It is suggested that methoprene poisons worker honey bees. The results suggest that JH has no effect on the regulation of wax secretion, and are consistent with an alternative model for wax secretion proposed by Butler [*The world of the honeybee* (1954) London, UK; Collins; pp. 93–94], who suggested that wax secretion and comb building are a result of the colony's requirements for empty comb in the face of an excess of incoming nectar. *Author*

Muller, W.J. and Hepburn, H.R. Temporal and spatial patterns of wax secretion and related behavior in the division of labour of the honeybee (*Apis mellifera capensis*). *Journal of Comparative Physiology. A, Sensory, Neural, and Behavioral Physiology* (1992) 171 (1) 111–115 [En, Bc]
Current hypotheses for honey bee behaviour suggest that in a colony there are age-related cohorts of workers having a high probability of performing a small set of related tasks in a restricted portion of the nest. Wax secretion and wax-working related activities were studied in this light. The results show that wax secretion is significantly affected by worker age and that bees between 3 and 21 days old form such a cohort. Comb building festoons, previously thought to be the site of wax secretion, produce only a small fraction of newly secreted wax in the nest. Wax secretion remains constant relative to age in the cohort but varies significantly with season as does bee participation in festooning behaviour. Wax secretion and wax working are both definable in terms of time and space in the nest, the relative probability of activity changing with season. Secretion itself is constrained by the cyclical activity of the underlying wax gland complex. *Author*
Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Muller, W.J. and Hepburn, H.R. Juvenile hormone III and wax secretion in honeybees (*Apis mellifera capensis*). *Journal of Insect Physiology* (1994) 40 (10) 873–881 [En, Bc]
Experiments were carried out on adult worker honey bees (*Apis mellifera capensis*) at Grahamstown, South Africa. Removal of the corpora allata of newly eclosed workers did not affect wax production. An experimentally increased JH III haemolymph concentration, as a result of either a single large injection dose or by implanting corpora allata from older workers into younger workers, did not affect either the onset of wax production or the mean amount of wax produced. No critical period could be established during which an elevated JH III concentration would affect the rate of wax secretion. Methoprene, on the other hand, significantly reduced wax secretion. This suggests that methoprene, applied pharmacologically as is done routinely in polyethism studies, is sublethal and poisonous to worker honey bees. *Author*
Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Munday, J. Pollen in the South African species of *Monechma* (Acanthaceae). *17th Annual Conference of the Electron Microscopy Society of Southern Africa, Pretoria, South Africa, December 1978.* Pretoria, South Africa; *Electron Microscopy Society of Southern Africa* (1978) 109–110 [En,

Muralidharan, K. and Hall, H.G. Prevalence of African DNA RFLP alleles in neotropical African honeybees. *Archives of insect Biochemistry and Physiology* (1990) 15 229–236 [En, Bb]
Three cloned DNA probes that reveal restriction fragment length polymorphisms (RFLPs) apparently specific to either African (A) or European (E) honey bees are reported. Of 14 alleles or haplotypes identified, five were present in bees collected in South Africa, Venezuela and Mexico, but absent from E-derived bees (USA); two were present in E but absent from A. The Venezuelan and Mexican samples showed a preponderance of African alleles, with low levels of European alleles. These and other results show negligible European maternal gene flow into feral Africanised populations in South and Central America. *P. Walker*
Dept. of Entomology and Nematology, University of Florida, Gainesville, FL 32611, USA.

Murless, P. Two and a half years of beekeeping in King William's Town, South Africa. *South African Bee Journal* (1994) 66 (5) 100–105 [En, Bj]
Beekeeping is recommended for urban areas because of high honey yields and a good financial return on investment. A floral calendar is given for this urban site in the Eastern Cape province of South Africa, where the main sources of surplus honey are *Jacaranda mimosaeifolia*, *Grevillea robusta*, *Eucalyptus camaldulensis* and *E. sideroxylon*. Average annual harvests (from a small number of hives) were 28.4 kg of honey and 0.78 kg of wax, per colony. *A.G. Matheson*
Fort Cox College, PO Box 2187, Kingwilliamstown 5600, South Africa.

Nel, E. *Global change and community self-reliance strategies in Southern Africa*. In Aldershot; Ashgate Publishing Ltd Sustainable development and geographical space: issues of population, environment, globalization and education in marginal regions. (2002) 159–172 [En, X]

Includes a case study of a beekeeping initiative in Zimbabwe.

Rhodes University, Grahamstown, 6140, South Africa.

Netshiungani, E.N. *Notes on the uses of indigenous trees in Venda*. *Journal of Dendrology* (1981) 1 (1/2) 12–17 [En]

Records the use of a piece of *Warburgia salutaris* bark in [fixed-comb?] hives to make bees aggressive and thus deter thieves (reported in *Apis*, South Africa (1982) July : 2).

Neumann, P., Hepburn, H.R. and Radloff, S.E. *Modes of worker reproduction, reproductive dominance and brood cell construction in queenless honeybee (*Apis mellifera* L.) colonies*. *Apidologie* (2000) 31 (4) 479–486 [En, de, fr, Bj]

Colonies of *A. m. capensis* (C), *A. m. scutellata* (S) and their natural hybrids (H) were dequeened and debrooded. The ratio of worker:drone cell construction and the sex of laying worker offspring were determined for 26 colonies. In laying workers, all C were thelytokous and all S were arrhenotokous; 42.1% of H produced only female offspring while none produced only male offspring. This shows a significant advantage for thelytokous laying workers to become reproductively dominant in H. C built only worker cells and S only drone cells. H produced either both cell types or only worker cells according to the mode of laying worker reproduction. In all colonies where laying workers produced male offspring, drone cell building was found. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Neumann, P., Pirk, C.W.W., Hepburn, R. and Radloff, S.E. *A scientific note on the natural merger of two honeybee colonies (*Apis mellifera capensis*)*. *Apidologie* (2001) 32 (1) 113–114 [En, Bj]

About 300 workers of known age from each of two unrelated colonies were marked before one colony was dequeened; it did not rear a new queen but entered the nest of the other colony. The behaviour of the marked bees in 48 different tasks was monitored after merging. No significant differences were observed between the two groups in total activity and in mean queen-worker distances of individual bees, but total activity decreased and queen-worker distances increased for each group after the merger. In general, patterns of behaviour demonstrated effective integration. The implications of the results are discussed. *P. Walker*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Neumann, P., Radloff, S.E. and Hepburn, H.R. *Parasitic Cape bees in the northern regions of South Africa: source of the founder population*. *South African Journal of Science* (2002) 98 (7/8) 404–406 [En, B CD1]

Multivariate discriminant analyses of nine standard morphometric characters of honey bee workers were used to track the origin of a social parasitic pseudo-clone of

thelytokous-laying *A. m. capensis* (C) workers that have invaded colonies of *A. m. scutellata* (S) in South Africa. Twenty social parasitic workers were sampled two infested at apiaries approx. 390 km apart and compared with data obtained from 80 colonies in four different geographical zones (zone I: thelytokous C morphocluster; zone II: natural thelytokous hybrids between C and S; zone III: thelytokous S morphocluster; zone IV: an arrhenotokous S morphocluster). Thelytokous-laying workers occur naturally in zones I–III. Highly significant morphometric differences were found among the bees in the four zones. The data support the conclusion that social parasitic workers belong to the thelytokous C morphocluster. It is most likely that the social parasitic workers originated from the heart of C's distribution range in the Western Cape region in zone I. Morphometric analysis makes it feasible to restrict the possible origin of the social parasitic workers from the natural distribution range of thelytoky (approx. 240,000 km²) down to approximately 12,000 km², which represents a resolution capacity of approximately 95%.

Institut für Zoologie/Molekulare Ökologie, Martin-Luther-Universität Halle-Wittenberg, Kröllwitzerstr. 44, 06099 Halle/Saale, Germany.

Neumann, P., Radloff, S.E., Moritz, R.F.A., Hepburn, H.R. and Reece, S.L. *Social parasitism by honeybee workers (*Apis mellifera capensis* Escholtz): host finding and resistance of hybrid host colonies*. *Behavioral Ecology* (2001) 12 (4) 419–428 [En, wf]

This study found that drifting and long-range drifting (dispersing) represent different behaviours, which were differently affected by taxon and queenstate of both mother and host colonies. Hybrid workers drifted more often than *A. m. capensis* (C) and *A. m. scutellata* (S) workers did. However, C workers dispersed more often than S and the hybrids combined, and S workers also dispersed more frequently than the hybrids. Dispersers from queenright C colonies were more often found in queenless host colonies and vice versa, indicating active host searching and/or a queenstate-discriminating guarding mechanism. The finding that C workers disperse significantly more often than other races suggests that dispersing represents a host-finding mechanism. The lack of dispersal in hybrids, as well as the different hosting mechanisms of foreign workers by hybrid colonies, may also be responsible for the stability of the natural hybrid zone between C and S.

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Nicolson, S.W. *Osmoregulation in a nectar-feeding insect, the carpenter bee *Xylocopa capitata*; water excess and ion conservation*. *Physiological Entomology* (1990) 15 (4) 433–440 [En, Bj]

The liquid diet and high metabolic water production during flight in *X. capitata* causes a water excess, and this is exacerbated by a low dietary intake of ions. In the Cape Town area, South Africa, the nectar and pollen of the preferred food plants, *Virgilia divaricata*, *Podalyria calyptata* and other *Fabaceae*, have low levels of sodium. Analyses of the bees and their body fluids showed that the bees have an exceptionally low Na content, and Na homeostasis seems to depend on recycling almost all Na which enters

the rectum. The copious dilute urine (137 mOsm) had Na and K concentrations of only 3.4 and 7.0 mM, respectively. Isolated preparations of *Xylocopa* Malpighian tubules secreted a fluid with a K concentration 10 times that of the blood. This means that recycling of K is as important as that of Na, and the bulk of K resorption probably occurs passively in the ileum. This study is the first to examine hymenopteran Malpighian tubules. Their stimulation by cAMP (cyclic adenosine monophosphate) is indicative of the presence of a diuretic hormone in *Xylocopa*. *Author* Dept. Zoology, Univ. Cape Town, Rondebosch 7700, South Africa.

Nicolson, S.W. *Eucalyptus* nectar: production, availability, composition and osmotic consequences for the larva of the eucalypt nectar fly, *Drosophila flavohirta*. *South African Journal of Science* (1994) 90 (2) 75–79 [En, 24 ref]

In spite of the value of *Eucalyptus* species as honey plants, little is known about their nectar. This study examines patterns of nectar secretion in *E. ficifolia*, the ornamental red-flowering gum, and *E. cladocalyx*, the sugar gum in South Africa. In both species evaporation was a major cause of diurnal variability in nectar volumes and concn. Flowers of *E. ficifolia* secreted nectar throughout the day, but the greatest volumes were available in the early morning, in 2- to 3-day-old flowers, and when relative humidity was high. Larvae of the eucalypt nectar fly, *Drosophila flavohirta*, which compete with honey bees for this nectar, were much more abundant in *Eucalyptus* flowers than previously reported from the western Cape. Measurements of nectar osmolality showed that *Eucalyptus* flower cups are an osmotically stressful habitat for these larvae.

Zoology Department, University of Cape Town, Rondebosch, 7700 South Africa.

Nicolson, S.W. and Louw, G.N. *Simultaneous measurement of evaporative water loss, oxygen consumption, and thoracic temperature during flight in a carpenter bee.*

Journal of Experimental Zoology (1982) 222 287–296 [En, B] Bees, *Xylocopa capitata*, were collected from the Cape of South Africa and studied in the laboratory. The use of suitable thermocouples and a sensitive capacitance-type humidity meter in an open flow-through system allowed instantaneous and simultaneous measurement of oxygen consumption, evaporative water loss, and thoracic temperature. All three variables fluctuated in close synchrony during pre-flight warm-up, flight, and subsequent cooling. Females with empty honey sacs had a high wing loading of 425 mg cm², and they exhibited a very high mass-specific oxygen consumption during flight (mean for free flight 52.3 ml O₂ gm⁻¹ hour⁻¹). Evaporative water loss was also high during flight (26.6 mg gm⁻¹ hour⁻¹) and was significantly correlated with rate of oxygen consumption as well as with temperature of the ambient air and the water vapour deficit. No indication of active evaporative cooling was evident and the bees are true endotherms capable of rapid pre-flight thermogenesis. Analysis of the osmotic and ionic concentrations of the body fluids showed that no water stress was experienced by the bees. *Author* Zoology Dept., Univ. Cape Town, Rondebosch 7700, South Africa.

Nicolson, S.W. and W.-Worswick, P.V. *Sodium and potassium concentrations in floral nectars in relation to foraging by honey bees.* *South African Journal of Zoology* (1990) 25 (2) 93–96 [En, af, Bc]

Sodium and potassium concentrations were measured in nectar from a variety of flowering plants visited by honey bees (*Apis mellifera capensis*). In 18 plant species the mean sodium concentration was 9.8 ± 1.4 mmol, and the mean potassium concentration was 18.7 ± 4.3 mmol. These results are compared with nectar ion concentrations in carpenter bee and hummingbird flowers. Analysis of honey bee body fluids showed that, although blood ion concentrations were closely regulated, the levels of sodium and potassium in the urine did not necessarily reflect those in the nectar being gathered. *Author*

Department of Zoology, University of Cape Town, Rondebosch, 7700 South Africa.

Nijland, M.J.M. and Hepburn, H.R. *Ontogeny of a circadian rhythm in the cluster temperature of honeybees.* *South African Journal of Science* (1985) 81 (2) 100–101 [En, B]

Colonies of 500 newly emerged *Apis mellifera adansonii* were given queens and placed in 3-litre plastic 'hives' in a darkened chamber at a controlled temperature of 29°C. The temperature of each cluster core was measured hourly for 21 days. During the first four days the temperature was erratic but it gradually increased to 29.5°. By day 6 it had begun to oscillate in a regular manner. The temperature began to rise at about 09.00 hours, reached a peak of 32–32.5° at about 18.00 hours and ended in a low of 30° at about 21.00 hours. The establishment of the regular circadian rhythm coincided with the development of the flight muscles. *J.M. Gedy*

Dept. Physiology, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Nunamaker, R.A. and Wilson, W.T. *Comparison of MDH allozyme patterns in the African honey bee (*Apis mellifera adansonii* L.) and the Africanised populations of Brazil.* *Journal of the Kansas Entomological Society* (1981) 54 (4) 704–710 [En, B]

Malate dehydrogenase (MDH) activity was measured in the blood of 552 Africanised bees from 12 colonies in two areas of Brazil. Over 90% of these bees had MDH allozymes identical to those in 460 *Apis mellifera adansonii* bees from 10 colonies in two areas of South Africa. The results indicate that the MDH gene pool of honeybees in Brazil has shifted strongly towards the African genotype. *Author* Honey Bee Pesticides/Diseases Res., USDA-SEA, Laramie, WY 82071, USA.

Nunamaker, R.A., Wilson, W.T. and Cox, R.L. *Isozymic uniformity in the presence of environmentally induced morphological variation in *Apis mellifera capensis*.* *Annals of the Entomological Society of America* (1986) 79 576–578 [En, Bc] Samples of workers collected from five feral *A. m. capensis* colonies in South Africa were compared with *A. m. capensis* workers from four colonies maintained at the Institut für Bienenkunde, German Federal Republic. They exhibited identical electrophoretic patterns for isozymes of malate dehydrogenase and non-specific esterases. The adults from Germany, which had been reared in cells constructed

on foundation with 0.5-cm diameter cell bases, were significantly larger than adults from South Africa (natural cell diameter 0.36 cm). Based on three body measurements – body length, head capsule width and forewing length – the larger (German) bees were comparable with samples of worker *Apis mellifera* from Wyoming, USA. P. Walker
Honey Bee Res., USDA, ARS, Weslaco, TX 78596, USA.

Nuru, A., Amssalu, B., Hepburn, H.R. and Radloff, S.E. Swarming and migration in the honey bees (*Apis mellifera*) of Ethiopia. *Journal of Apicultural Research* (2002) 40 (1–2) 35–41 [En, Bj]

Responses obtained in interviews with 240 beekeepers in 57 localities were analysed, giving information on the frequency of reproductive swarming and migration of about 3000 honey bee colonies, as well as the number of swarms per colony, and occupation rate of bait hives. Significantly high reproductive swarming proportions were found for *A. m. jemenetica* and *A. m. scutellata*, and low proportions for *A. m. bandasii*, *A. m. woyi-gambella* and *A. m. monticola*. Temporal distribution of swarming varies both within and between subspecies and is related to physiographic and climatic factors of the areas. The proportions of migrating colonies differed significantly between the five subspecies, but resource depletion was the most common causative factor for all. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown, 6140 South Africa.

Nuru, A., Hepburn, H.R. and Radloff, S.E. Induction of propolis production by *Apis mellifera bandasii* in traditional basket and Langstroth movable-frame hives in Ethiopia. *Journal of Apicultural Research* (2002) 41 (3–4) 101–106 [En, Bj]

Propolis production was assessed for 19 months in 16 colonies in traditional hives and 16 in Langstroth hives. Production was induced in some test colonies (T) in each group by making openings in the hives. Yields in Langstroth hives differed significantly between T (24.2 g/colony) and controls (9.5 g/colony), and also in traditional hives (12.7 and 4.8 g/colony). There were no significant effects on honey yield in T. Significant variations in propolis yield were also observed between colonies in the same group and between months. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown, 6140, South Africa.

Pager, H. Ndedema. Graz, Austria, Akademische Druck-u. Verlagsanstalt. (1971) 375 pp [En, B]

This magnificent book is subtitled 'A documentation of the rock paintings of the Ndedema Gorge'. The bee interest is centred on 'The honey hunters' (pp. 345–352), which gives a historical survey of reports (from 1947) of honey hunting by Bushmen and Hottentots. Honey-gathering techniques and equipment are then described in detail, and the ownership of bees' nests. Many rock paintings described, and 38 reproduced, from the Ndedema Gorge in the Drakensberg Mountains, Natal. They show vividly the wild honeybee swarms and nests, and honey hunters often surrounded by bees – working with the aid of ladders or climbing ropes of various types. R.D. Guy gives further details in *Bee World* 54(1) : 30(1973). E.E. Crane

70 20th Street, Parkhurst, Johannesburg, South Africa.

Pager, H. Rock paintings in Southern Africa showing bees and honey hunting. *Bee World* (1973) 54 (2) 61–68 [En, B]

70, 20th St., Parkhurst, Johannesburg, Republic of South Africa.
More than 4,000 rock art sites have been recorded in South Africa and Rhodesia; most of the work is thought to have been done in the last two millennia. A detailed study of 76 paintings was made, and these showed bees' combs and human activity in relation to honey gathering and in one case smoking of a bees' nest. Previously unidentified 'formlings' are also discussed and the author suggests that they represent bees' nests. A.S. Attwood

Pager, H. Honeycombs, ladders and bees in the rock art of Africa. Unpublished report prepared for the Bee Research Association. (1975) 79 pp. [En, B]

The author has collected together evidence he has uncovered in Algeria, Lesotho, Libya, Malawi, Morocco, Rhodesia, South Africa, South West Africa, Spanish Sahara, Tanzania, Tunisia, Uganda and Zambia. There are large numbers of published and unpublished drawings (see also *Apicultural Abstracts* 163/73, 191/74), together with documented extracts from books and other publications, and perceptive notes by the author. E.E. Crane

P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Pager, H. Stone Age myth and magic: as documented in the rock paintings of South Africa. **Pager, H. : The magico-religious importance of bees and honey for the rock painters and Bushmen of Southern Africa.** Graz, Austria; Akademische Druck- u. Verlagsanstalt. (1975) 119 pp. ISBN 3-201-00943-1 [En, B]

The author uses the extensive evidence of rock paintings in Southern Africa, together with the much more restricted evidence available in Europe and Australia, to piece together something of the life and magico-religious practices of Stone Age man. Swarms of bees and/or their nests are represented in six of the many reproductions of rock paintings in the book. Bees were usually painted as a dark body, with white wings spread out as in flight (or for peripheral bees in a flying swarm, sometimes omitted). The impression is realistic, as is that of human figures and mammals. Evidence of the great significance of bees to Stone Age man in South Africa is presented. E.E. Crane
P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Pasteels, J.J. A new species of *Pachyanthidium* (Hymenoptera: Megachilidae). *Journal of the Kansas Entomological Society* (1968) 41 (4) 481–483 [En]

The morphology of *Pachyanthidium micheneri* from Malawi, and Natal in South Africa, is described.

Pasteels, J.J. A new species of *Chalicodoma* from South Africa: *Chalicodoma (Pseudomegachile) trisecta*. [Une espece nouvelle de *Chalicodoma* Sud-Africaine: *Chalicodoma (Pseudomegachile) trisecta* (Hym., Megachilidae)]. *Bulletin et Annales de la Societe Royale Entomologique de Belgique* (1976) 112 (10–12) 278–280 [Fr, B]

Peters, D.S. *On the position of Aspidosmia Brauns 1926 with remarks on phylogenetic systematics of the Megachilidae. [Über die Stellung von Aspidosmia Brauns 1926 nebst allgemeinen Erörterungen der phylogenetischen Systematik der Megachilidae (Insecta, Hymenoptera, Apoidea)]*. *Apidologie* (1972) 3 (2) 167–186 [De, en\fr, B]

A detailed description of the genus *Aspidosmia* is given. Only two species from South Africa are known to belong to it, *A. arnoldi* (Brauns 1926) and *A. volkmanni* (Friese 1909); the original descriptions of these are completed and corrected. It appears that *Aspidosmia* belongs to the *Anthidiinae* rather than to *Osmia*, and it can be regarded as the most primitive group of the *Anthidiinae*. The *Fideliidae* are thought to be a sister group of the *Megachilidae*, and a possible ancestral type for the *Megachilidae* is described.

A.S. Attwood

Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany.

Pirk, C. W. W., Hepburn, R., Radloff, S. E. and Erlandsson, J. *Defense posture in the dwarf honeybee, Apis florea*. *Apidologie* (2002) 33 (3) 289–294 [En, de, fr, Bj]

Sequential analysis of colonies before and after smoking showed that the alarm stimulus caused significant changes in the posture, density and orientation of bees; they expose the abdomen and pack together more closely on the comb in a more vertical position. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Pirk, C. W. W. and Hepburn, R. *Egg laying and egg removal by workers are positively correlated in queenright Cape honeybee colonies (Apis mellifera capensis)*. *Apidologie* (2002) 33 (2) 203–211 [En, de, fr, Bj]

Some eggs are laid by workers in periods of low and of high egg removal. Worker egg laying (WL) and egg-removal rates for queen-laid eggs (QR) and worker-laid eggs (WR) were determined in three queenright colonies. WR was significantly higher than QR in all colonies, but WL differed significantly between colonies. WR and WL were positively correlated and co-dependent. Removal of worker eggs appears to be triggered by the number of worker eggs present. *Author*

Dept of Zoology and Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Plessis, T. A. du. *The use of gamma radiation to protect the local bee industry*. *South African Bee Journal* (1993) 65 (1) 3–8 [En, Bj]

In general, to prevent the spread of bee diseases and pests, the import of hive products to South Africa is forbidden by law. However, in recent years the Ministry of Agriculture has allowed the import of beeswax by the pharmaceutical and cosmetics industries. All beeswax must be treated in its sealed container (max. 25 kg) with gamma radiation, at a minimum absorbed dose of 25 kGy. A recent shortage of home-produced honey has also led to the development of procedures for gamma-irradiation of imported honey. As honey is a foodstuff it must not be exposed to radiation levels higher than 13 kGy; the minimum stipulated for quarantine purposes is 10 kGy. Treatment within these

limits can be achieved by irradiating honey in containers with a maximum diameter of 450 mm. *P. Walker*
Iso-Ster (Pty) Ltd, P.O. Box 3219, Kempton Park 1620, South Africa.

Plessis, T. A. du, Rensburg, H. J. van and Johannsmeier, M. F. *The gamma sterilisation of beeswax*. *South African Bee Journal* (1985) 57 (3) 54–57 [En, B]

Beeswax was melted and mixed with a suspension of *Bacillus subtilis* spores (used because *B. larvae* is not present in South Africa), so that the wax contained more than 200 spores/g. After cooling, each block (10 x 10 x 25 cm) was exposed to gamma radiation at a level between 0 and 30 kGy [10 kGy = 1.0 Mrad]. On subsequent examination of 30-g samples from each block, the control (0 kGy) contained 6000 *B. subtilis* spores, but spores were absent from all beeswax exposed to 12.0 kGy or more. The treatment did not affect acid value or melting point; saponification point was increased slightly. It is recommended that, to prevent the spread of honeybee diseases, imported beeswax should be exposed to a dose of 25 kGy. The wax should be in slabs not more than 10 cm thick, or in flakes or pellets (total 25 kg) in a hermetically-sealed polythene-lined bag. *P. Walker*

Iso-Ster (Pty), PO Box 3219, Kempton Park 1620, South Africa.

Pohl, H. and Kinzelbach, R. *A new species of Halictoxenos Pierce (Strepsiptera: Stylopodia: Stylopidae) from South Africa*. *African Entomology* (1995) 3 (1) 73–76 [En, 3 ref.]

A new species of Strepsiptera is described from South Africa. *Halictoxenos knerei* sp. nov. is parasitic on *Halictus (Seladonia) virescens* var. *africanus* and *H. (S.) jucundus* (Hymenoptera: Halictidae). The female and 1st-instar larvae of African *Halictoxenos* are recorded for the first time. A key is provided for the three *Halictoxenos* species recorded from the Afrotropical Region.

Institute of Zoology, Technical University of Darmstadt, Schnittspahnstrasse 3, D-64287 Darmstadt, Germany.

Potgieter, C. J., Edwards, T. J., Miller, R. M. and Staden, J. van. *Pollination of seven Plectranthus spp. (Lamiaceae) in southern Natal, South Africa*. *Plant Systematics and Evolution* (99) 218 (1/2) 99–112 [En, X]

Dept of Botany, Univ. of Natal Pietermaritzburg, P/Bag X01, Scottsville, 3209, South Africa.

Preez, H. L. H. du and Walters, M. C. *The influence of pollination by African honeybees (Apis mellifera adansonii) on large white kidney bean (Phaseolus multiflorus) production in the Transvaal Highveld*. *Phytophylactica* (1975) 7 (1) 53–58 [En, af\fr, B]

Development of and yields from plants (a) caged with honeybees were compared with yields (b) of open plots and (c) of plots caged so that all insects were kept out. Over four years, yields from (a) were significantly higher. Poor pollination in (c) resulted in an extension of the flowering period and a higher proportion of immature pods. On the open plots the number of honeybees was about 23 times as great as the number of solitary bees. *P. Walker*

Agric. Res. Inst. of the Highveld Region, Potchefstroom, South Africa.

Rabson, A.R. *The problem of bee sting allergy in South Africa*. *South African Bee Journal* (1979) 51 (6) 9, 11–12 [En, B]

Radloff, S. and Hepburn, R. *Population structure and morphometric variance of the *Apis mellifera scutellata* group of honeybees in South Africa*. *Genetics and Molecular Biology* (2000) 23 (2) 305–316 [En, es, Bc]

Almost 15,000 workers were collected from 825 honey bee colonies at 193 locations in east Africa, extending from South Africa to Ethiopia. Factor analysis established one primary cluster, designated as *A. m. scutellata*. Morphocluster formation and inclusivity (correct classification) were highly sensitive to sampling distance intervals. Within the *A. m. scutellata* region there were larger bees at with high altitudes, traditionally classified as *A. m. monticola* Smith, but it was evident in this study that these bees do not form a uniform group. Variance characteristics of the morphometric measurements showed domains of significantly different local populations. These mostly occurred at transitional edges of major climatic and vegetational zones, and sometimes with more localised discontinuities in temperature. It is also evident that the *A. m. scutellata* introduced nearly 50 years ago in the Neotropics were a particularly homogeneous sample which exhibited all the traits expected in a founder effect or bottleneck population. *Author*

Dept of Statistics, Rhodes Univ., Grahamstown 6140, South Africa.

Radloff, S.E. and Hepburn, H.R. *Honeybees, *Apis mellifera* Linnaeus (Hymenoptera: Apidae), of equatorial Africa*. *African Entomology* (99) 7 (2) 265–269 [En, Bb]

Morphometric and flight dimensional characters of worker honey bees from equatorial Gabon were analysed by multivariate methods to characterise the population. A single morphocluster and a single flight dimension cluster were obtained. When these bees were grouped together with those of other countries of the region, again a single morphocluster and flight cluster were obtained. All of the outlier samples were already designated as *A. m. adansonii* and completely surround the Gabon samples, thus establishing the same subspecies membership for the latter. The bees of Gabon are morphometrically more homogeneous than in any other area of Africa.

Dept of Statistics, Rhodes Univ., Grahamstown, 6140, South Africa.

Radloff, S.E. and Hepburn, H.R. *Honeybees, *Apis mellifera* Linnaeus (Hymenoptera: Apidae), of the Drakensberg mountains in relation to neighbouring populations*. *African Entomology* (99) 7 (1) 35–41 [En, Bb]

Multivariate morphometric analyses were performed on measurements of nine characteristics of 4011 worker bees from natural populations of the Drakensberg and surrounding areas in southern Africa. A discriminant function analysis yielded three morphoclusters: group 1 comprising an unnamed population at higher than 1500 m altitude in the mountains; group 2 consisting of bees considered to be *A. mellifera scutellata* x *A. m. capensis* hybrids, and group 3 consisting of *A. m. scutellata* surrounding the mountains at lower altitudes (less than 1500 m). The bees

of group 1 showed size similarities to disjunct populations of other large Afromontane bees, *A. m. monticola*. Group 2 bees occurred in an area of marked climatic variability, and they showed high variances in their morphometrics, pheromones and DNA characteristics. It is suggested that differences in swarming seasons among these populations effectively cause temporal reproductive isolation between the group 1 mountain bees and those *A. m. scutellata* below the escarpment.

Dept of Statistics, Rhodes Univ., Grahamstown, 6140, South Africa.

Radloff, S.E. and Hepburn, H.R. *Population structure of *Apis mellifera scutellata* (Hymenoptera: Apidae): filling the Uganda gap*. *African Entomology* (2001) 9 (2) 131–135 [En, Bb]

Morphometric measurements were made on samples of worker honey bees collected from 148 colonies in east Africa. The results showed that *A. m. scutellata* extends from South Africa to Ethiopia, but includes local populations of varying morphology. The honey bees of Uganda previously represented an important biogeographical gap in defining the population structure of this subspecies, but have now been resolved through the morphometric analyses of worker honey bees analysed with multivariate techniques. Honey bees from lower altitudes (<2000 m) formed one distinct morphocluster typical of *A. m. scutellata* throughout the continent, whereas those at higher altitudes (>2000 m) formed a separate distinct cluster of large, dark bees. The latter occur as an archipelago of mountain ecotypes of the subspecies.

Dept of Statistics, Rhodes Univ., Grahamstown 6140, South Africa.

Radloff, S.E. *Multivariate analysis of selected honeybee populations in Africa*. PhD Thesis, Rhodes University, South Africa. (1996) xv + 282 pp. [En, Bdo]

Eleven morphometric characters and GC analyses of sting pheromones of worker honey bees (*Apis mellifera*) were analysed by multivariate methods to characterise selected honey bee populations along five transects in Africa (north-western to south-east Spain, north-eastern, west-central, south-western, south-eastern). In some, but not all, areas pheromonal clusters were found to be coincident and concordant with the morphometric clusters, indicating that different honey bee traits have dispersed variably among populations. All transects were found to contain areas of significantly high variance. High intra-colonial variance was taken to indicate localised genetic variation coupled with out-cross matings. Centroids of high intercolonial variance occurred at and between cluster boundaries and were typical of transitions between, and rainfall-temperature discontinuities within, ecological-climatological zones, hence areas of ecological instability. Principal component and stepwise discriminant analysis yielded three morphometric clusters corresponding to *A. m. sahariensis* and *A. m. intermissa* in Morocco and to *A. m. iberica* (with three biometric populations) in Spain, but no pheromone clusters. The combined morphometric and pheromonal variance spectra indicated regions of natural hybridisation along a Sahara-Pyrenees transect. In the Horn of Africa, discrete and statistically homogeneous

populations were identified: *A. m. jemenitica*, *A. m. bandasii*, *A. m. sudanensis* in Ethiopia and an unclassified group in south-western Somalia. Areas of high intercolonial variance were interpreted as zones of hybridisation between the populations. Along a transect in west central Africa, three distinct homogeneous populations and two zones of hybridisation were found. These bees were designed as *A. m. adansonii*, whose area of distribution was intruded by an unnamed mountain group of bees and a third group, *A. m. jemenitica*. The delineation of the hybrid zones was supported by intercolonial variance spectra and these significant asymmetries were found to be coincident with transitions between the ecological-climatological zones. In south-west Africa, two discrete homogeneous populations and a zone of hybridisation between them were identified: *A. m. scutellata* in northern South Africa and southern Namibia and *A. m. adansonii* in northern Namibia. Along a transect in the southeastern woodland savanna of Africa, three discrete populations were classified: *A. m. litorea* in Mozambique, *A. m. scutellata* in Zimbabwe and *A. m. adansonii* in north-west Zambia. A zone of introgression between the last two subspecies occurred in south-central Zambia and in the Zambezi valley *Author*

Radloff, S.E., Hepburn, R., Neumann, P., Moritz, R.F.A. and Kryger, P. A method for estimating variation in the phenotypic expression of morphological characters by thelytokous parthenogenesis in *Apis mellifera capensis*. *Apidologie* (2002) 33 (2) 129–137 [En, de, fr, Bj]

Thelytokous parthenogenesis in *A. m. capensis* (C) was used to produce a series of clonal progeny that were reared in three different queenless arrhenotokous *A. m. scutellata* host colonies. Each individual C worker was genotyped at four DNA microsatellite loci and was measured for 36 morphological characters. The clonal workers, all of the same thelytokous matriline, were then analysed by multivariate analysis to determine the quantitative effects of environment on the characters; the natural variation in the phenotypic expression of the characters was then estimated. Coefficients of environmental variation were calculated and the relative stability of the character set was, in decreasing order: body size, forewings, wing venation, hairs, pigmentation. *Author*

Dept of Statistics, Rhodes Univ., Grahamstown 6140, South Africa.

Radloff, S.E., Hepburn, H.R., Robertson, M.P., Hille, R. van, Davidson, Z. and Villet, M.H. Discriminant analysis of the honeybee populations of southwestern Africa. *African Entomology* (1996) 4 (1) 1–6 [En, Ba]

Samples of worker honey bees were collected from seven locations between 29°S and 20°S; several morphological characteristics were measured and sting pheromones were analysed. Multivariate statistical analyses of the data established two distinct homogeneous populations: in northern South Africa and southern Namibia, *Apis mellifera scutellata*; in northern Namibia, *A. m. adansonii*. In between, there is a hybrid population. *P. Walker*

Department of Mathematical Statistics, Rhodes University, Grahamstown 6140, South Africa.

Radloff, S.E., Hepburn, H.R. and Villet, M.H. The honeybees, *Apis mellifera* Linnaeus (Hymenoptera: Apidae), of woodland savanna of southeastern Africa. *African Entomology* (1997) 5 (1) 19–27 [En, Bc]

The morphometric characters and sting pheromones of worker honeybees, *A. mellifera*, were analysed by multivariate methods to identify discrete populations in the southeastern woodland savanna of Africa. A discrete population in Mozambique is classified as *A. m. litorea*, a second in Zimbabwe as *A. m. scutellata* and a third group in south-western Zambia as *A. m. adansonii*. A zone of introgression between the last two subspecies occurs in south-central Zambia and in the Zambezi Valley.

Department of Statistics, Rhodes University, Grahamstown, 6140, South Africa.

Rebello, A.G. and Siegfried, W.R. Colour and size of flowers in relation to pollination of *Erica* species. *Oecologia* (1985) 65 (4) 584–590 [En, Bc]

Data on flower colour polymorphism were recorded for 341 of the 426 species of *Erica* in the south-western Cape, South Africa; of these species, 38% were colour polymorphic, the incidence being greater than expected for ornithophilous species and lower than expected for anemophilous species. Altitude and flowering season were correlated with the incidence of colour polymorphism; most polymorphs were found in species with large altitudinal ranges and extended flowering periods. The mean corolla length for pink, purple and white flowers was significantly shorter than that for red, orange, yellow and green flowers, suggesting that these two sets of colours corresponded with entomophily and ornithophily, respectively. There were no *Erica* species with blue flowers. It is suggested that the patterns of colour polymorphism, because of their relationships with the behaviour of pollinators, may reflect patterns of speciation. *Author*

Fitzpatrick Inst., Univ. Cape Town, Rondebosch 7700, South Africa.

Reece, S.L. The mandibular gland secretions and ovarian development of worker honeybees (*Apis mellifera*) in the Eastern Cape Province of South Africa. Thesis, Rhodes University, South Africa (2000) 73 pp. [En, Bt]

For this study, six honey bee colonies were collected from each of four localities where there are *A. m. capensis*, *A. m. scutellata* or their hybrid. In mandibular gland secretion of queenright workers from each group, 9-hydroxy-2-decanoic acid (9HDA) was the most abundant of the five fatty acids determined; small amounts of 9-oxo-2-decanoic acid was also present in samples from each group. The ratios 9ODA:10ODA and 9HDA:10HDAA (10-hydroxydecanoic acid) were relatively high, and were higher in bees from two of the groups. However, the percentage of bees with undeveloped ovaries was consistent with their queenright status. When the bees became queenless, the percentage of 9ODA increased in all samples. Workers from only one group did not become significantly more queenlike. In another group, after 14 days without a queen, the values of the two ratios were significantly higher than in the other groups, and some individual bees had ratios exceeding those found in *A. m. capensis* queens. This group also had the highest increase in the

number of bees with partially or fully developed ovaries.
Author

Reece, S.L. A scientific note on the ovarian and pheromonal development of drifted and non-drifted Cape honeybee workers (*Apis mellifera capensis*). *Apidologie* (2002) 33 (2) 213–214 [En, Bj]

Workers that had drifted from queenright *A. m. capensis* (C) colonies and *A. m. scutellata* colonies did not differ significantly from non-drifted bees in mandibular gland acids ratio (9-ODA:10-ODA) or in ovarian development. Drifters from queenless C colonies had more queenlike ratios and greater ovarian development than workers in the queen-right host C colonies. *P. Walker*

Dept of Zoology and Entomology, Univ. of Pretoria, 0002 Pretoria, South Africa.

Rinderer, T.E. Computer-assisted identification of hybrid strains of Western honey bees. *Florida Entomologist* (1988) 71 (3) 281–288 [En, es, Ba]

A standard, generally agreed upon principle of taxonomy is that species-specific characteristics can exist because members of different species do not freely produce fertile hybrids. The nomenclature of subspecies of *Apis mellifera* exemplifies three additional taxonomic principles. First, subspecies-specific characteristics have not been found in honeybees. Second, subspecies are distinguishable as groups by the multivariate techniques of principal component analysis or discriminant analysis. Third, subspecies identifications are statistically based and hence probabilistic. These characteristics of subspecies identification are ideally suited to computer applications. Computer systems can be used to collect data and then to apply complex statistical procedures to provide identifications. Such techniques have been used to analyse the honeybee populations of the Americas, which constitute populations resulting from subspecies hybridisation. Populations of Africanised bees from South America are morphometrically quite distinct from populations of *A. m. scutellata* in South Africa. In every respect, the Africanised bees clearly show the genetic influence of their European parents. Additionally, F₁ progeny of Africanised and European honeybees provide further evidence of the hybrid nature of Africanised bees. It is clear that Africanised bees in the Americas constitute a 'hybrid swarm', that is, they are 'a continuous series of morphometrically distinct hybrids resulting from hybridisation'.

Honey-Bee Breeding, Genetics & Physiology Lab., ARS, USDA, 1157 Ben Hur Rd., Baton Rouge, LA 70820, USA.

Robertson, M. and Johnston, G. The honeybees of the mountain kingdom of Lesotho. *South African Bee Journal* (1997) 69 (2) 20–23 [En, Bj]

There is no tradition of beekeeping in Lesotho, but under a recent project a number of people in the lowlands have started to keep honey bees in Langstroth hives. Samples of bees were collected from wild colonies in the area. In the mountains, it was more difficult to find and sample wild nests, but some samples were collected. The colonies were generally small and weak, probably due to the harsh climate and limited forage. However, one colony was found at an altitude of 2865 m, the highest so far reported, and

others were at 1828–2743 m. An analysis of morphological characteristics will be carried out to establish what race the bees belong to. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Rourke, J.P. A new species of *Mimetes* (Proteaceae) from the southern Cape. *South African Journal of Botany* (1988) 54 (6) 636–639 [En, af, Bc]

Mimetes chrysanthus, which is described and illustrated, is probably pollinated mainly by bees. Carpenter bees (*Xylocopa capensis*) were observed to be especially active on the bright yellow flowers and were probably foraging for pollen. *M. chrysanthus* secretes only minute quantities of nectar and access to the nectaries is impeded by the perianth segments. Sunbirds and sugarbirds were also seen on the flowers. *D.G. Lowe*

Compton Herbarium, National Botanic Gardens, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Ruttner, F. African races of honeybees. Proceedings of the XXVth International Apicultural Congress, Grenoble. Bucharest, Romania; Apimondia Publishing House. (1975) 325–344 [En, B]

In this review of published (and unpublished) biometrical and other observations on African *Apis mellifera*, the author distinguishes the following as races: north-west Africa: *intermissa*, v. *Buttel-Reepen* 1906 (Tellian bee); major, n. subsp.; *sahariensis* *Baldensperger* 1924. Egypt and Sudan: *lamarckii* *Cockerell* 1906 (Egyptian bee, formerly known as *A. m. fasciata*); *nubica* n. subsp. Central and South Africa: *scutellata* *Lepeletier* 1836 (East African bee); *littorea* *Smith* 1961 (West Africa); *monticola* *Smith* 1961; *adansonii* *Latreille* 1804; *capensis* *Escholtz* 1822 (Cape bee); *unicolor* *Latreille* 1804. Arabian Peninsula: *jemenitica* n. subsp. *E.E. Crane* Inst. Bienenkunde, Univ. Frankfurt, 6370 Oberursel (Taunus), Im Rothkopf 5, Germany.

Ruttner, F. The Cape bee – a biological curiosity? African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia (1977) 127–131 [En, B]

Ruttner, F. The present knowledge on the taxonomy of African races of bees. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia (1977) 50–54 [En, B]

See Ruttner, 1975 (*Apicultural Abstracts* 495/78).

Ruttner, F. Graded geographic variability in honeybees and environment. *Pszczelnicze Zeszyty Naukowe* (1985) 29 81–92 [En, pl\ ru\ de, Bj]

Samples of honeybees were selected along the North – South gradient of geographic latitude with the longest distance in the area of distribution of *Apis mellifera*. The morphological characters measured were analysed according to the method of Ruttner et al. (1978). A graded variation of a number of quantitative morphological characters was established, strongly correlated to latitude. This 'geocline' extends along the Atlantic coast from Scandinavia to South Africa, covering 94° of latitude. In the area of *Apis*

mellifera, however, the general trend for a decrease in size from high to low latitudes is reversed for the length of proboscis and hind leg (decreasing length with increasing latitude). In East Africa a cline was found from low to high altitudes. The relationships between morphometric variation and climatic factors, such as temperature, are discussed, and it is concluded that the number of exceptions to the general trend indicates that morphological variation in honeybees is not simply a response to the physical environment. *D. G. Lowe*

Inst. Bienenkunde, Univ. Frankfurt, Karl-von-Frisch Weg 2, 6370 Oberursel, Germany.

Ruttner, F. and Kauhausen, D. *Honeybees of tropical Africa: ecological diversification and isolation. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 45–51 [En, B]

In each of 180 samples of honeybees from 24 African countries (south of the Sahara), 40 characters were determined; analysis of the data showed that there was a high degree of variability. The distribution of honeybee races in tropical Africa shows a geographical distribution pattern, although no geographical barriers exist; ecological factors appear to be responsible for this diversification and isolation. Each of the following races has distinct morphological characteristics, as well as specific physiological and behavioural ones: *Apis mellifera litorea* in the east (from Somalia to Mozambique); *A. m. adansonii* along the entire west coast; *A. m. scutellata* in the savannah of East and South Africa; *A. m. monticola* on Mt. Kilimanjaro and other mountains of East Africa from Ethiopia to Burundi; *A. m. jemenitica* in arid zones of Chad, Sudan and Somalia. *P. Walker*

Inst. Bienenkunde, Univ. Frankfurt, 6370 Oberursel 1, Germany.

Schehle, J. A. *Beekeeping with plastic honey combs. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990* [edited by Anderson, R. H.; Buys, B.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 128–130 ISBN 0-620-15132-3 [En, Bd]

Aloe Bee Farm, P.O. Box 12394, Benoryn 1504, South Africa.

Schmidt, H.-W. *The reaction of bees to pyrethroids and other insecticides. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990* [edited by Anderson, R. H.; Buys, B.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 39–49 ISBN 0-620-15132-3 [En, Bd]

Methods for testing the toxicity of pesticide formulations to honey bees are discussed, and as a specific example the testing of the pyrethroid Baythroid [cyfluthrin] is described. Laboratory tests indicated that it was toxic, but mortality of bees in field trials was low, probably because of Baythroid's repellency. No effects on honey bee brood were detected when Baythroid was carried into the hive. *D. G. Lowe*

Bayer A.G., Pf-A/Biologische Entwicklung, Pflanzenschutzzentrum Monheim, 5090 Leverkusen, Bayerwerk, Germany.

Schmolke, M. and Schmolke, W. *Melanism, a little known honey bee disease.* *Beekeepers News* (2001) (No. 92) 8–10 [En, B]

In studies started in 1998, classic symptoms of melanosis were found in some samples of honey bee workers from Zimbabwe and Mozambique. In examination of samples from 175 colonies, melanosis was present in half of them; infection rate ranged from 0.25% to 95%. In some apiaries the disease was absent, and in others all colonies were infected. In 25 queens, various stages of melanosis were present in half of them. Newly-caught swarms, especially *Apis mellifera scutellata*, seem to have low or no infection, but infection rates increase with increasing period of commercial management. So far melanosis appears to be absent from South Africa. Symptoms and possible modes of transmission are discussed briefly. *P. Walker*

Zimbabwe Beekeepers Council Apicultural Technical Committee, PO Box BW 153, Borrowdale, Harare, Zimbabwe.

Schmolke, M. D. *Mating honey-bees in confinement. African bees: taxonomy, biology and economic use* (editor *D. J. C. Fletcher*). Pretoria, South Africa; *Apimondia* (1977) 169–175 [En, B]

Preliminary positive results of attempts to mate *Apis mellifera adansonii* inside a tower 14 m high.

Schoening, F. R. L. *The X-ray diffraction pattern and deformation texture of beeswax.* *South African Journal of Science* (1980) 76 (6) 262–265 [En, B]

The X-ray diffraction pattern of beeswax from *Apis mellifera adansonii* showed paraffin-like side spacings which were attributed to monoesters. Long spacings, which were seen in specimens of wax that had been melted and then solidified between glass slides, were attributed to diesters and hydrocarbons. Optical and X-ray observations of deformed (pulled) specimens indicated that the molecular axes tended to lie perpendicular to the direction of elongation. [Chem. Abstr. 93 : 116302z (1980).] *F. B. Wells*

Dept. Physics, Univ. Witwatersrand, Johannesburg 2001, South Africa.

Schonfeld, M. *Pollen production beekeeping in the Transvaal.* *South African Bee Journal* (1983) 55 (3) 51–55 [En, B]

Seeley, T. D. *What we do and do not know about the nest-site preferences of African honey bees. Africanized honey bees and bee mites* [Needham, G. R., Page, R. E., Jr., Delfinado-Baker, M. and Bowman, C. E.]. Chichester, UK; Ellis Horwood. (1988) 87–90 ISBN 0-7458-0319-9 [En, Bd]

This paper summarises present knowledge of the nest site preferences of *Apis mellifera scutellata*, gained from observations in Uganda, Kenya, Tanzania, South Africa, Zambia, French Guiana, Venezuela and Panama. The results indicate that a cavity of 40–80 litres is preferred to one of 10–20 litres, but experimental evidence about other variables is limited. *D. G. Lowe*

Section of Neurobiology & Behavior, Mudd Hall, Cornell Univ., Ithaca, NY 14853, USA.

Sellers, C.S., Mar, T., Bertsch, W. and Crewe, R.M. *Investigation of African honeybee races.* *Journal of High Resolution Chromatography & Chromatography Communications* (1987) 10 674–675 [En, Bc]

The cuticular hydrocarbon patterns of *Apis mellifera capensis* and *A. m. scutellata* from South Africa were examined by the conventional hexane wash method and by a dynamic head-space analysis. The latter was used for the various body parts: head, thorax, abdomen, legs, antennae. The same complex patterns were obtained by both methods. There were wide variations between the body regions of *A. m. capensis*, but all had the same basic pattern. The hydrocarbon compositions of *A. m. scutellata* and *A. m. capensis* show much greater similarities than do those of Africanised and European honeybees. *P. Walker*
Dept. Chemistry, Univ. Alabama, Tuscaloosa, AL 35486, USA.

Shackleton, C.M., Shackleton, S.E., Ntshudu, M. and Ntzebeza, J. *The role and value of savanna non-timber forest products to rural households in the Kat River Valley, South Africa.* *Journal of Tropical Forest Products* (2002) 8 (1) 45–65 [En in, X]

Includes honey beer.

Rhodes Univ., Grahamstown 6140, South Africa.

Skead, C.J. *Weaverbird pollination of Strelitzia reginae.* *Ostrich* (1975) 46 (2) 183–185 [En]

Spotted-backed weaverbirds, *Ploceus cucullatus*, were seen scooping up and eating pollen, some of which fell on, or was carried by beak or foot, to the stigma. These observations suggest that *P. cucullatus* may be an important pollinator of this plant. The nectary is too remote from the pollen for honeybees foraging for nectar to effect pollination. *C. J. Skead*

Kaffrarian Museum, King William's Town, CP, South Africa.

Smith, R.-K. *Europeanization of honey bees in South Africa.* *American Bee Journal* (1988) 128 (5) 329–330 [En, Bj]

The assay of certain hydrocarbons in honeybees is a sensitive and accurate method for the detection of Africanisation (*Apicultural Abstracts* 849/88). From a database covering tropical African (AFR), Africanised and European (EUR) honeybees, profiles or models – with standard deviations – of hydrocarbon characteristics were prepared for AFR and EUR, and then for 'Africanised' (AFZ1), which fell midway between AFR and EUR. AFR and AFZ1 groups were well separated in a cluster separation plot of the database. Hydrocarbon analyses were carried out on honeybee samples taken from managed colonies at five locations in South Africa. Some samples, especially those from Transvaal and Vrystaat, had hydrocarbon patterns indistinguishable from those of Africanised samples from South and Central America. Other evidence also points to a degree of Europeanisation in the Transvaal. It is concluded that when collecting data on 'pure' AFR bees, samples should be taken from farther north than South Africa. Also, it is suggested that beekeepers with Africanised colonies might find it useful to learn about the

management methods used in South Africa. *P. Walker*
Room 610, Lab. Division, Georgia Dept. Agric., Capitol Square, Atlanta, GA 30334, USA.

Sole, C.L., Kryger, P., Hefetz, A., Katzav Gozansky, T. and Crewe, R.M. *Mimicry of queen Dufour's gland secretions by workers of Apis mellifera scutellata and A. m. capensis.* *Naturwissenschaften* (2002) 89 (12) 561–564 [En, B CD1]

The development of the Dufour's gland was measured in *A. m. scutellata* (S) and *A. m. capensis* (C). In C it is longer and increased in length more rapidly than in A at comparable ages. Analysis of the Dufour's gland secretions of workers and queens of both races revealed that there were caste and racial differences. Secretions of queenright S workers were dominated by a series of long-chain hydrocarbons. In contrast, the secretions of the C workers both under queenright and queenless conditions were a mixture of hydrocarbons and wax-type esters, as were those of queens. Multivariate analysis of the secretion profiles indicated that laying workers of both races mimic queens. The secretions of the C laying workers mimicked queen secretions most closely, enabling them to act as successful social parasites.

Dept of Zoology and Entomology, Univ. of Pretoria, 0002 Pretoria, South Africa.

Sosath, S., Ott, H.H. and Hecker, E. *Irritant principles of the spurge family (Euphorbiaceae) XIII. Oligocyclic and macrocyclic diterpene esters from latices of some Euphorbia species utilized as source plants of honey.* *Journal of Natural Products* (1988) 51 (6) 1062–1074 [En, Bb]

In arid zones of South Africa several species of *Euphorbia* (e.g. *E. ledienii*, *E. coerulescens*, *E. triangularis*, *E. ingens*, *E. tetragona*, *E. cooperi*), known collectively as 'noors doring' or 'noors'. *D.G. Lowe*

German Cancer Res. Center, Inst. Biochemistry, Im Neuenheimer Feld 280, 69 Heidelberg, Germany.

Staden, D.F.A. von. *Kiwifruit pollination in South Africa.* *South African Bee Journal* (1987) 59 (3) 59–61 [En, Bj]

Steele, G.R., Villet, M.H., Radloff, S.E. and Hepburn, H.R. *Clinal morphometric variation in wild honey bees (Hymenoptera: Apidae) in South Africa.* *Diversity & Distributions* (98) 4 (1) 17–25 [En, 44 ref.]

It is important to delineate the region within South Africa where thelytokous worker honey bees (believed to be unique to *Apis mellifera capensis*) occur, i.e. morphological markers must be found that distinguish this race from the neighbouring *A. m. scutellata*. However, no evidence of the expected hybrid zone demarcating races has been found. Factor analysis revealed only one spherical cluster of samples. Trend surfaces of the local mean morphometric factor scores showed a cline that paralleled latitude, with distortions relating to montane and continental effects. Discriminant function analysis implicated certain mountain ranges in amplifying the effects of latitude. Trend surfaces of local intercolony factor variance showed morphometric homogeneity across most of the country. It is concluded that there is only a single population of honey bees in South Africa, and that it shows climate-correlated clinal variation. If the transportation of bees for commercial

apiculture is to be successfully regulated to solve the 'capensis calamity', further research should focus on the geographical distribution of thelytokous workers rather than on the capensis phenotype. Such workers have a wider distribution than *A. m. capensis*, occurring also at high frequencies around the type locality of *A. m. scutellata*. Dept of Zoology & Entomology, Rhodes Univ., Grahamstown 6140, South Africa.

Steiner, K. E. The pollination of *Disperis* (Orchidaceae) by oil-collecting bees in southern Africa. *Lindleyana* (1989) 4 (4) 164–183 [En, Bc]

Oil secretion in orchids outside of the New World was observed for the first time. Seventeen southern African species of *Disperis* were found to secrete floral oil primarily from an appendage of the lip concealed within the hood or galea. *Rediviva* (Melittidae) bees inserted their forelegs into the flowers and extracted the oil by using their absorptive tarsal setae. Pollinaria were deposited on the forelegs as they were withdrawn. Using analysis of pollen loads, it was found that three species of *Rediviva* pollinate at least seven *Disperis* species; at least four *Disperis* species are pollinated by more than one *Rediviva* species. Bees were not specific to *Disperis* and visits to their flowers were not as frequent as those to other oil-secreting taxa such as *Diascia* (Scrophulariaceae). J.M. Gedy

Compton Herbarium, National Botanic Gardens, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. A second species of the amphi-Atlantic genus *Alonsoa* (Scrophulariaceae) in South Africa. *Annals of the Missouri Botanical Garden* (1989) 76 (4) 1152–1159 [En, Bb]

Alonsoa unilabiata flowers are pollinated by various species of *Rediviva* (Melittidae), which forage for the oil secreted by trichomes in the shallow corolla sacs. D.G. Lowe

Compton Herbarium, National Botanic Gardens of South Africa, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. The *Diascia* (Scrophulariaceae) window: an orientation cue for oil-collecting bees. *Botanical Journal of the Linnean Society* (1990) 102 175–195 [En, Bb]

Flowers of *Diascia* (section *Racemosae*) are characterised by a translucent 'window' at the base of the upper corolla lip which is bright yellow with maroon flecks and varies in shape from a nearly flat to a deeply cone-shaped depression. The epidermal cells of this area are strongly UV-absorptive. In observations of natural populations, the behaviour of oil-collecting bees (*Rediviva* spp.) was almost identical despite the morphological variation of the window in the 22 species of *Diascia* studied. Bees landed upright on the flower, inserted their forelegs into the spurs and rested their outstretched mandibles against the window. Observations of the bees' foraging behaviour suggested that they use the window as an orientation cue after landing on the flower. J.M. Gedy

National Botanic Gardens of South Africa, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. Two new *Diascia* (Scrophulariaceae) species from the Nieuwoudtville area, western Cape. *South African Journal of Botany* (1992) 58 (3) 202–206 [En, af, Bc]

D. lewisiae sp. nov. and *D. insignis* sp. nov. secrete floral oil and are pollinated by oil-collecting bees in the genus *Rediviva*. D.G. Lowe

Compton Herbarium, National Botanical Institute, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. Two new *Diascia* species (Scrophulariaceae) from the Little Karoo. *South African Journal of Botany* (1992) 58 (1) 39–47 [En, af, Bc]

The self-incompatible *D. bicolor* and *D. decipiens* have large flowers with oil-secreting trichomes and are pollinated by oil-collecting bees (*Rediviva nitida*). D.G. Lowe

Compton Herbarium, National Botanical Institute, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. Has *Ixianthes* (Scrophulariaceae) lost its special bee? *Plant Systematics and Evolution* (1993) 185 (1/2) 7–16 [En, Bc]

Ixianthes retzioides is a rare, moderately sized shrub with large yellow flowers that are lined with glandular trichomes. Preliminary analysis indicates that the trichomes secrete a complex mixture of lipids. Floral morphology suggests that *Ixianthes* should be pollinated by a large oil-collecting bee, yet no oil-collecting bee has been observed visiting the flowers. This together with low fruit and seed set at the main study site suggests that *Ixianthes* has lost, at least locally, its specialised pollinator. Plants are self-compatible and set a limited amount of seed as a result of visits by pollen-collecting bees. Author

Compton Herbarium, National Botanical Institute, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. and Whitehead, V. B. The association between oil-producing flowers and oil-collecting bees in the Drakensberg of southern Africa. *Monographs in Systematic Botany – Missouri Botanical Gardens* (1988) 25 259–277 [En, fr, Bb]

Twelve *Diascia* species (Scrophulariaceae), each with flowers possessing a pair of spurs containing oil-secreting glands, have been found to be pollinated by oil-collecting bees in the genus *Rediviva* (Melittidae) in the Drakensberg area of South Africa. Variability in flower size and spur length among the *Diascia* species was quantified and shown to exceed the corresponding variability in foreleg length and overall size among the species of *Rediviva*. Species specificity among the pollinators was low. Only four *Rediviva* species were collected and only two of these (*R. neliana* and *R. sp. nov. 1*) are widespread and common. *R. neliana* pollinates nine *Diascia* species, while *R. sp. nov. 1* pollinates six species. Some *Diascia* spp. are pollinated by more than one *Rediviva* species even in the same locality. In areas of sympatry between two or more *Diascia* species, one bee may visit more than one *Diascia* species even on a single foraging trip. In such cases interspecific pollen flow is minimised by differences among the species in stamen and stigma placement within the flower. Depending on the species, pollen is deposited on the head, sternum, or dorsal abdominal tergites of the visiting bee. All of the

Drakensberg *Diascia* species are self-incompatible and therefore dependent on bees for pollination. *Author*
National Botanic Gardens of South Africa, Kirstenbosch,
Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. and Whitehead, V. B. Pollinator adaptation to oil-secreting flowers – *Rediviva* and *Diascia*. *Evolution* (1990) 44 (6) 1701–1707 [En, Bb]

Variation in foreleg and body size of the oil-collecting bee *Rediviva neliana*, the primary pollinator of 12 *Diascia* species in southern Africa, was investigated to see if it could be explained as a simple evolutionary response to variation in *Diascia* floral spur lengths. Average foreleg lengths in *R. neliana* females varied from 9.45 to 14.56 mm, and ratios of foreleg to body length varied from 0.88 to 1.19. Average *Diascia* spur lengths ranged from 5.31 to 13.88 mm and were correlated with *Rediviva* foreleg length ($r = 0.95$). The data support the hypothesis of co-evolution, but further information on the genetic basis of foreleg and floral spur variability is needed. *D. G. Lowe*
National Botanic Gardens, Kirstenbosch, Private Bag X7, Claremont, South Africa.

Steiner, K. E. and Whitehead, V. B. Oil flowers and oil bees: further evidence for pollinator adaptation. *Evolution* (1991) 45 (6) 1493–1501 [En, Bb]

Foreleg length and body size variation were examined in two species of *Rediviva* (*Melittidae*) in southern Africa. *R. 'pallidula'* populations varied significantly in mean foreleg length (from 11.34+/-0.42 mm to 12.67+/-0.36 mm), but not in body length (10.59+/-0.74 to 10.80+/-0.64), and foreleg length and body size were not significantly correlated. Foreleg variation appears to be a function of host plant spur length; 92% of the variance was explained by mean *Diascia* spur length. *R. rufocincta* populations varied significantly in mean foreleg length (10.12+/-0.70 mm to 12.34+/-0.68 mm) and in body length (9.03+/-0.26 mm to 10.56+/-0.24 mm). Foreleg length scales allometrically with body size in this species; 90.5% of the variance in foreleg length could be explained as a function of body length. Body size appears to be constrained by the morphology of the oil-secreting host plant. Both bees collect floral oil with specially modified setae on the tarsi of their forelegs. The length of the disti- + mediotarsus (referred to here as 'tarsus') in relation to the entire foreleg is shorter in *R. rufocincta* and does not increase as rapidly with increasing foreleg length as in *R. 'pallidula'*. These differences in variation can be attributed to differences in position of oil within the flowers. *R. 'pallidula'* collects oil from *Diascia* species that have the oil deeply situated in narrow floral spurs of varying length, while *R. rufocincta* collects oil from the broadly saccate flowers of *Bowkeria verticillata* and *B. citrina*. *Author*
Compton Herbarium, National Botanical Institute, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. and Whitehead, V. B. Resin collection and the pollination of *Dalechampia capensis* (*Euphorbiaceae*) by *Pachyanthidium cordatum* (*Hymenoptera: Megachilidae*) in South Africa. *Journal of the Entomological Society of Southern Africa* (1991) 54 (1) 67–72 [En, Ba]

In Natal, South Africa, foragers of *P. cordatum* were observed collecting resin and pollen from the inflores-

cences of *D. capensis*. Bees in this tribe of **Megachilidae**, while known to collect floral resin in the New World, have not previously been observed collecting it in the Old World. The size and behaviour of *P. cordatum* suggests that it is an effective pollinator of *D. capensis*, but the close proximity of staminate and pistillate flowers does not preclude self-pollination or pollination by generalist pollen collectors. *P. cordatum* males shelter in *Dalechampia* inflorescences in the afternoon and night during periods of inclement weather. At other times, they patrol inflorescences in search of females. *Author*
Compton Herbarium, National Botanical Gardens, Kirstenbosch, Private Bag X7, Claremont 7735, South Africa.

Steiner, K. E. and Whitehead, V. B. The consequences of specialization for pollination in a rare South African shrub, *Ixianthes retzioides* (*Scrophulariaceae*). *Plant Systematics and Evolution* (1996) 201 (1–4) 131–138 [En, Bc]

I. retzioides is a rare South African shrub with large yellow oil-secreting flowers. Populations studied previously revealed low levels of reproductive success and the absence of a specialised oil-collecting pollinator. A population in which the predicted specialist pollinator, *Rediviva gigas*, is present is now described. The presence of this oil-collecting bee resulted in a mean fruit set per plant of 97.2% and a mean seed set of 331.6. These figures were 7.4 and 7.8 times as high, respectively, as those for a population lacking its specialist pollinator. *D. G. Lowe*
Compton Herbarium, National Botanical Institute, Private Bag X7, Claremont 7735, South Africa.

Stirton, C. H. Broad-spectrum pollination of *Plectranthus neochilus*. *Bothalia* (1977) 12 (2) 229–230 [En, fr, B]

The commonest visitors to *P. neochilus* growing in botanical gardens were *Megachile* spp., *Xylocopa* spp., *Apis mellifera* and various other insects such as syrphids, bombylids and sphingids. The bees effectively pollinated the flowers, but the other insects inserted their probosci without touching the androecium or gynoecium. During two months of observations in the wild, only megachilid bees were observed visiting *P. neochilus*. The pollination ecology of this species is compared with that of *P. barbatus*, which appears to have a narrower spectrum of insect visitors. *D. G. Lowe*

Botanical Res. Inst., Dept. Agric. Technical Serv., Private Bag X101, Pretoria, South Africa.

Stirton, C. H. The pollination of *Canavalia virosa* by xylocopid and megachilid bees. *Bothalia* (1977) 12 (2) 225–227 [En, fr, B]

The floral morphology of *C. virosa* is discussed in relation to pollination. The large bee *Xylocopa flavorufa* seemed to be the only visitor capable of landing and maintaining its position whilst depressing the keel. *Megachile combusta* was able to depress the keel, but by a different method, which was not always successful. Smaller bees collected loose pollen and nectar from flowers damaged by nectar-feeding beetles, but they were unable to operate the pollination mechanism. The large inverted flowers of *C. virosa* therefore constitute a possible isolating mechanism. *D. G. Lowe*
Botanical Res. Inst., Dept. Agric. Technical Serv., Private Bag X101, Pretoria, South Africa.

Stort, A. C. and Bueno, O. C. Are *Apis mellifera* bees morphologically Africanized in Brazil? *Revista Brasileira de Biologia* (1985) 45 (3) 393–397 [En, pt, Bb]

A total of 111 external morphological traits were measured in typical honeybees from Pretoria, South Africa (*Apis mellifera adansonii*) [*A. m. scutellata*], and Italian (*Apis mellifera ligustica*) and German (*Apis mellifera*) bees. Only 25 of these traits were statistically different at the univariate level in the three subspecies. The 10 most variable traits, determined by discriminatory analysis, were: width of the area provided with sensory structures on segment 3 of the antenna, width of segment 3 of the antenna, width of the area devoid of sensory structures in segment 3 of the antenna, head length, length of segment 4 of the abdomen, lower interorbital width, clipeo-ocellar distance, upper interorbital width, length of the right eye, and width of segment 8 of the antenna. Multivariate comparison between the data obtained for the three subspecies and the data obtained for samples collected in six different regions of Brazil, using these 10 traits, showed that, in general, the hybrid bees of Brazil are much more similar to *A. m. adansonii* [*A. m. scutellata*] than to European honeybees. *Author*

Dept. Biologia, Inst. Biociencias, UNESP, 13.500 Rio Claro, SP, Brazil.

Struck, M. Pollination ecology in the arid winter rainfall region of southern Africa: a case study. *Mitteilungen aus dem Institut für Allgemeine Botanik Hamburg* (1992) 24 61–90 [En, de, Ba]

The composition of insect populations visiting flowers of 20 shrubby perennials growing on permanent plots in the northwestern Cape, South Africa, was studied over three flowering seasons. The flower types tended to be large and open with bright colours (yellow, pink, purple or white) with *Mesembryanthemaceae* and *Asteraceae* being the most common families. There were conspicuous variations in timing, duration and vigour of flowering, depending on the seasonal climatic conditions. Of the 300 species of insect visitors, 49% were solitary bees (mostly *Megachilidae* and *Anthophoridae*). Bees visited the largest range of host plants. Three guilds of plant taxa were distinguished which shared various pollinators. An analysis of bee pollen loads is presented. *J. M. Gedy*

Institut für Allgemeine Botanik und Botanischer Garten, Universität Hamburg, Ohnhorststrasse 18, D-2000 Hamburg 52, Germany.

Struck, M. Flowers and their insect visitors in the arid winter rainfall region of southern Africa: observations on permanent plots. Insect visitation behaviour. *Journal of Arid Environments* (1994) 28 (1) 51–74 [En, Ba]

Insect-plant relationships were studied for three years at Goegab, Cape Province, South Africa. The vast majority of plant species showed entomophilous pollination. Flower-visiting records are given for over 300 insect species, including 136 species of bees (Apoidea). Pollen loads from most of the bee species were analysed. The results indicate that the anthophilous insect fauna at this site is dominated by generalist foragers. *D. G. Lowe*
Institut für Allgemeine Botanik, Universität Hamburg, Ohnhorststrasse 18, D-22609 Hamburg, Germany.

Struck, M. Flowers and their insect visitors in the arid winter rainfall region of southern Africa: observations on permanent plots. Composition of the anthophilous insect fauna. *Journal of Arid Environments* (1994) 28 (1) 45–50 [En, Ba]
The composition of the anthophilous insect fauna of a plant community in Goegab, Cape Province, South Africa, was studied during a 3-year survey. More than 300 species belonging to 41 families were identified, including 136 species of solitary bees (Apoidea). *D. G. Lowe*
Institut für Allgemeine Botanik, Universität Hamburg, Ohnhorststrasse 18, D-2000 Hamburg 52, Germany.

Suryanarayana, M. C. Hlalwane – a plietesial bee plant from South Africa. *Indian Bee Journal* (1975) 37 (1–4) 35–36 [En, B]

Hlalwane is the Zulu word for *Isoglossa eckloniana*; plietesial (flowering once after several years) bee forage plants growing in India are also mentioned.

Swart, D. J. and Ueckermann, E. A. *Melittiphis alvearis* (Berlese) (Acari: Laelapidae) new to South Africa: friend or foe? *South African Bee Journal* (2001) 73 (1) 38–39 [En, Bj]

The first record of this mite in South Africa is for two specimens in an apiary near Greytown. The mite is described. ARC-Plant Protection Research Inst., Private Bag X 134, Pretoria 0001, South Africa.

Taber, S. Queen rearing with the Cape bee – it's much different. *American Bee Journal* (1983) 123 (6) 435–437 [En, B]

Teichman und Logischen, I. von, Robbertse, P. J. The anatomy and ultrastructure of the extrafloral nectaries of *Dioscorea sylvatica* and the composition of the nectar. [Die anatomie en ultrastruktuur van die ekstraflorale nektarkliere van *Dioscorea sylvatica* Eckl. en die samestelling van die nektar]. *Journal of South African Botany* (1979) 45 (1) 63–78 [Af, en, B]

Small droplets of nectar were noticed on *D. sylvatica* plants, especially when the humidity was high after rain. The active extrafloral nectaries on leaves, young stems, petioles and peduncles, are described in detail. TLC of the nectar showed the possible presence of arabinose, fructose, galactose, glucose, mannose, melibiose, raffinose, sorbose, sucrose and glucuronic acid, and eight amino acids (in low concentrations). Gas chromatography confirmed the presence of fructose, glucose and sucrose. The theory of Elias and Gelband, that extrafloral nectaries have a role as ant-attracting organs, seems inapplicable to *D. sylvatica*, for in natural conditions ants were never found on the plants. *Author*
Dept. Plantkunde, Univ. Pretoria, Pretoria, South Africa.

Theunissen, F., Grobler, S. and Gedalia, I. The antifungal action of three South African honeys on *Candida albicans*. *Apidologie* (2001) 32 (4) 371–379 [En, de, fr, Bj]

The three different honeys were from *Eucalyptus cladocalyx*, *Myrica cordifolia* and fynbos (mixture of heathers, mainly *Erica* spp.). Honey solutions of various concentrations (0–25%) in brain-heart infusion broth were incubated with *C. albicans*. At low concentrations – optimally 2.5% and 5% – the solutions (and a hypertonic sugar solution used as a control) stimulated growth of *C. albicans*, but

increasing honey concentration inhibited growth. The strongest antifungal activity was shown by the 25% solution of *M. cordifolia* honey (29.4% inhibition). *P. Walker*
Faculty of Dentistry, Univ. of Stellenbosch, Private Bag X1, Tygerberg 7505, South Africa.

Thompson, P.R. *The chemical and mechanical properties of cuticle from serially aged adult worker honeybees (*Apis mellifera adansonii* L.). African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher).* Pretoria, South Africa; *Apimondia* (1977) 7–14 [En, B]

A classification scheme based on cuticular colour and morphological changes was used to separate bees from sealed cells into 8 developmental stages. It was found that *A. m. adansonii* spent a mean time of 12 days 7 hours in the sealed cell and that the pharate adult stage began as soon as 4 days 16 hours after sealing. Thus, the pupal stage is much shorter, and the adult stage much longer, than has been suggested by other authors, for European *A. mellifera* e.g. Jay. Cuticle from the frons, scutum and abdomen of adults of known ages was stained with Mallory's Triple Connective Tissue Stain, and changes between stages were monitored. Cuticle from the frons and from the scutum were similar in thickness, differentiation and times of maximal epidermal cell secretory activity; that from the abdomen was thinner and showed two peaks of secretory activity. The development of the (amber-stained) exocuticle was associated with a decrease in total cuticle thickness. The development of black bands on the abdominal tergites was associated with a darkening of exocuticle. The staining properties of the cuticle reflected differences between endocuticle, mesocuticle and exocuticle in the amounts of hydrogen-bonded or rigidly-bound proteins. The connection between chemical changes and mechanical properties is discussed. *D.G. Lowe*

Physiology Dept., Univ. Witwatersrand, 1 Jan Smuts Ave., Johannesburg 2001, South Africa.

Thompson, P.R. *Histological development of cuticle in the worker honeybee, *Apis mellifera adansonii*.* *Journal of Apicultural Research* (1978) 17 (1) 32–40 [En, B]

The histological development of cuticle from adult worker honeybees from South Africa (*Apis mellifera adansonii*) was investigated. In order to obtain large numbers of individuals of known age from sealed cells, a grouping system was devised and the temporal limits of the groups determined. The terminology applied to the different stages in the life cycle was also examined, and the pupal stage was found to be shorter, and the adult stage much longer, than previously reported in the literature on *Apis mellifera*. Cuticle of the frons and scutum were similar in their patterns of differentiation and thickness, but showed certain differences from cuticle of the abdominal tergites. In general, however, the patterns of differentiation of cuticle from all three regions are similar to those found in many insects. *Author*
Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Thompson, P.R. *Cuticular sclerotization in the honeybee *Apis mellifera adansonii* L.* Ph.D. Thesis, University of Witwatersrand, Johannesburg, South Africa. (1979) xv + 151 pp. [En, B]

Sclerotisation in the worker honeybee was monitored by means of: histology, protein extractability, and tensile mechanical properties of the cuticle. For this work, brood was classified according to morphological criteria into Stages from 1 to 8, and three post-emergent Stages (9–11) were also used. Adult procuticle was first detected at Stage 4. Between Stages 6 and 9 (a period of c. 48 hours), the incorporation of cross-links into the cuticle was most rapid. The elastic modulus and breaking stress of the tergal abdominal cuticle increased with age until Stage 9, after which they decreased. The breaking strain showed an inverse trend. Much of the work in this thesis has been published. *P. Walker*

Fac. Sci., Univ. Witwatersrand, Johannesburg, South Africa.

Thompson, P.R. and Hepburn, H.R. *Changes in chemical and mechanical properties of honeybee (*Apis mellifera adansonii* L.) cuticle during development.* *Journal of Comparative Physiology*, B (1978) 126 (3) 257–262 [En, B]

The histology of the cuticle has been described previously; properties of the cuticle have now been studied in bees up to 91/2 days old. The following properties of abdominal cuticle generally increased with the age of the adult bee: weight of cuticle, the amount of protein not extracted by NaOH, elastic modulus and breaking stress (both decreased slightly from the age of eight days), relative stiffness. The breaking strain of the cuticle as a function of age gives a plot which is the obverse of that for elastic modulus and breaking stress. The mechanical properties varied in direct proportion to the amount of protein not extracted by NaOH. Endocuticle was readily extracted with NaOH, indicating that it is not stabilised with molecular cross-links. *P. Walker*

Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Toit, A.P. du. *Honeybees as pollinators of commercial sunflower.* *South African Bee Journal* (1987) 59 (6) 126–128 [En, B]

Seed companies in South Africa recommend a density of 2–3 hives/ha.

Toit, A.P. du. *Nectar flies, *Drosophila flavohirta* Malloch, (Diptera: Drosophilidae) breeding in *Eucalyptus* flowers.* *South African Forestry Journal* (1987) (No. 143) 53–54 [En, Bc]

Eucalyptus grandis is the most important honey plant in South Africa, but since 1976 honey crops from this species have been variable. Consumption of nectar by larvae of *D. flavohirta* has been suspected to be an important cause of low honey crops. In 1983–85, surveys in the northern and eastern Transvaal showed wide population variations between years and between seasons at the same locality. Heavy rainfall washed larvae out of the flowers and reduced populations considerably. A relatively low number of pupae was found. The percentages of flowers with larval infestations were highest in 1985, varying at seven locations from just under 20% to nearly 60%; at six of the same seven locations in 1984 infestations were below 20%. *D.G. Lowe*

Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du. *The pollination ecology of commercial sunflower (Helianthus annuus L.) in South Africa with special reference to the honeybee (Apis mellifera L.).* Magister in Scientiae Thesis, University of Pretoria, South Africa. (1988) ii + 143pp. [En, Bdo]

Problems with hollow-seededness of sunflower in the Springbok Flats area of South Africa resulted in preliminary investigations into the role of honeybees in the pollination of commercial sunflower crops. This was followed by a more comprehensive study of sunflower pollination ecology. The activity, abundance and diversity of all pollinating insects on sunflowers were recorded. The results revealed honeybees, supplied by migratory beekeepers, to be the most important pollinators of commercial sunflower in South Africa. Adequate honeybee numbers were obtained with a stocking density of one colony/ha. Daily and seasonal honeybee activity in sunflower fields is discussed in detail. Factors influencing activity included temperature, rain, pesticides and competitive vegetation. The pollination efficiencies of various insects in controlled cage studies were as follows: 72% seed set with honeybees, 76% with spotted maize beetle (*Astylus atomaculatus*), 38% with flies, 44% with American bollworm larvae (*Heliothis armigera*). The seed set on plants with no pollinating insects present was 44%. A seed set of 72% was achieved in open control plots. The nectar production of 17 sunflower cultivars, measured under glasshouse conditions, differed significantly. Nectar accessibility was determined by measuring corollary tube length. Nectar was generally accessible to honeybees various and long-tongued bees, while inaccessible to short-tongued *Halictidae*. Floral pigmentation was not a discriminating factor. Pollen trapping showed that hardly any of the vegetation surrounding sunflower fields could be regarded as competitive. Maize, grasses, *Xanthium* and *Clematis* were the most important pollen sources other than sunflower, which contributed between 70 and 99% of the collected pollen. Eucalyptus species were the most important nectar sources, apart from sunflower. *Author*

Fac. Science, Univ. Pretoria, Pretoria, South Africa.

Toit, A. P. du. *The importance of certain insects as pollinators of sunflower (Helianthus annuus L.).* *South African Journal of Plant and Soil* (1990) 7 (3) 159–162 [En, af, Bc]

Commercial sunflowers (*Helianthus annuus*) grown in cages to exclude insect pollinators had an average seed yield of 1221 kg/ha (45% seed set) compared with 1799 kg/ha (73% seed set) when grown in open fields. The introduction of honey bees (*Apis mellifera scutellata*) to cages increased average yield to 1859 kg/ha (72% seed set). Spotted maize beetles (*Astylus atomaculatus*) were efficient as pollinators (76% seed set) but American bollworm larvae (*Heliothis armigera*) and house flies (*Musca domestica*) were insignificant as pollinators, producing 44% and 38% seed set, respectively. *J. M. Gedy*

Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du. *Pollination of almonds in the Transvaal. [Abstract].* *Journal of the South African Society for Horticultural Science* (1990) 1 (Supplement) 18 [En, Bc]

A study on almond pollination was carried out during

August–September, 1989, in a high-density 3-ha orchard adjoined by a further 4 ha of almonds and 30 ha of pasture where *Aloe davyana* and *A. marlothii* were abundant. Sixteen honey bee colonies were introduced at the start of flowering. Honey bee foraging activity decreased from a daily average of eight visits/tree at 50–60% flowering to an average of five visits/tree at full flowering. Insignificant differences in fruit set were found in the eight wind directions, indicating good pollen movement by the bees. Pollen trapping showed that pollen loads contained 40–46% almond pollen and 49–51% *Aloe* pollen during almond flowering. The results show that, although alternative sources of forage can attract honey bees away from almonds, successful cross-pollination can still be achieved. *D. G. Lowe*
Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du. *Pollination research: a missing link in subtropical fruit production.* *Acta Horticulturae* (1990) 275 239–243 [En, Bc]

The results of a questionnaire survey on the status of subtropical crop pollination in South Africa are presented. Although the importance of honeybees as pollinators of some subtropical crops is acknowledged by the respondents, no recommendations for the practical use of honeybee colonies exist. Before 1986 less than 5% of Transvaal beekeepers were involved in the pollination of subtropical crops. Colonies were taken to litchi orchards, and to a lesser extent to macadamia and mango orchards, primarily to obtain honey. This resulted in the accidental pollination of these crops. Less than 2000 of the 60,000 hives used during 1987 in accidental and intentional pollination were placed in subtropical fruit orchards. Ways of providing better information on pollination to beekeepers and growers in South Africa are discussed. *Author*

Apicultural Unit, Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du. *Pollination of avocados, mangoes and litchis.* *Inligtingsbulletin – Instituut vir Tropiese en Subtropiese Gewasse* (1994) (No. 262) 7–8 [En, 1 pl.]

The first year's results from an ongoing study of insect pollination in avocado, mango and Litchi orchards near Tzaneen in the Eastern Transvaal Lowveld are discussed. All insect visitors were identified, honey bee foraging activity was investigated and the effect of pollinators on fruit set was determined by bagging 400 inflorescences while leaving another 400 to be open-pollinated. In avocados, in which 81% of visits were made by honey bees, insect pollinators were important for increased fruit set (a total of 33 fruits were obtained from the 400 open-pollinated inflorescences, compared with only two from the bagged ones). In mangoes, fruit set was poor in both open-pollinated and bagged inflorescences, probably a result of using the first inflorescences which growers normally remove. Honey bees were observed collecting extrafloral nectar from the bases of mango panicles. In litchis, honey bees were the most abundant visitors and fruit set averaged 6/inflorescence in open-pollinated panicles, compared with 2/inflorescence in bagged panicles.

Insect Ecology and Honeybee Research Division, Plant Protection Research Institute, Pretoria, South Africa.

Toit, A.P. du and Coetzer, L.A. **Difference in potential attractiveness to bees of seventeen South African sunflower (*Helianthus annuus*) cultivars. The Sixth International Symposium on Pollination, Tilburg, Netherlands, 27–31 August 1990 [Heemert, C. van and Ruijter, A. de (eds)].** Netherlands; Research Centre for Insect Pollination and Beekeeping and International Society for Horticultural Science. (1991) 288–293 ISBN 90-6605-384-4 [En, Bd]

The sugar value, determined by nectar volume and percentage sugar solids in the nectar, of 17 South African sunflower (*Helianthus annuus*) cultivars was significantly different. Significant differences in corolla length were also measured between cultivars; honeybees (*Apis mellifera scutellata*) were unable to reach all the nectar in certain cultivars. Nectar was inaccessible to short-tongued bees (*Halictidae*). Pigmentation of the corolla tube did not differ significantly. Although pigmentation of the stigma did differ significantly, it was considered a possible discriminating factor in one cultivar only. *Author*

Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Toit, A.P. du and Holm, E. **Diversity, abundance and behaviour of diurnal insects on flowering capitula of commercial sunflower in the Transvaal.** *South African Journal of Plant and Soil* (1992) 9 (1) 34–36 [En, af, Bc]

Studies of sunflower (*Helianthus annuus*) crops at three sites showed that mean numbers of visiting insects per 100 capitula ranged from 45 to 147. Honey bees (*Apis mellifera scutellata*) were the most common insect foragers at all sites (from 46% to 86%). Species of *Anthophoridae* and *Megachilidae* visited sunflowers for both nectar and pollen throughout the day, whereas *Halictidae* species visited only for pollen as their proboscides were not long enough to reach the nectar. However, these solitary bees were rare. Other well represented taxa included *Heliothis armigera* (American bollworm) larvae, *Astylus atromaculatus* (spotted maize beetle), and various *Diptera* and *Hemiptera*. *J.M. Gedy*

Apicultural Unit, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A.P. du and Holm, E. **Pollination activity and behaviour of honey bees (*Apis mellifera* L.) in commercial sunflower in the Transvaal.** *South African Journal of Plant and Soil* (1992) 9 (4) 168–172 [En, af, Bc]

Honey bee foraging activity in commercial sunflower fields was studied at Settlers, 100 km north of Pretoria, South Africa. Foraging activity, which was studied by means of the conventional strip count method, commenced after sunrise and reached a peak of 38 foragers per 100 capitula at 10.00 hours. A moderate decline followed between 11.00 and 15.00 hours (mean of 32 foragers per 100 capitula), whereafter another peak of 40 foragers per 100 capitula was reached two hours before sunset. Examination of returning foragers revealed that pollen foraging predominated until 09.00 hours and nectar foraging prevailed thereafter. Cross-pollination efficiency of honey bee foragers was good as more than 50% of foragers landed on the outer ring of florets and then moved to the inner ring where fresh pollen was available, before flying to the next

head. Movement between heads was indiscriminate, which enhanced pollen movement. *Author*

Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A.P. du and Swart, D. **Notes on foraging activity of honeybees in an avocado orchard.** *Yearbook – South African Avocado Growers' Association* (1993) 16 37–38 [En, 3 ref.]

Little is known about the pollination ecology of cultivated avocados in South Africa. The transfer of pollen requires an active agent as the flowers are protogynous. Successful pollination is further restricted as the stigmas are receptive to pollen for less than 12 hours. A survey of the honeybee foragers in a 50-ha flowering avocado orchard was conducted. Ten beehives were placed in the centre of the orchard while a second apiary with 20 hives was located at one end of the orchard. Honeybee activity was monitored by sampling returning foragers at hive entrances. Foraging loads (assessed in terms of pollen and propolis on the hind legs and nectar and water in the stomachs) were sized on a 0 (nothing) to 5 (very large) scale. The results did not reveal any distinct patterns of foraging activity during the day or the flowering season.

Apicultural Unit, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A.P. du and Swart, D. **Pollination of mango in the Letsitele Valley during the 1992 flowering season: first report.** *Yearbook – South African Mango Growers' Association* (1993) 13 129–130 [En, af, 6 ref.]

Returning foragers were examined for nectar, water, pollen and bee-glue in a 14 ha mango orchard (cultivars Kent and Keitt) in the Letsitele Valley. Low frequencies of pollen and nectar foragers indicated limited quantities of available pollen and nectar. Despite this, honey bees were observed visiting the inflorescences throughout the day and were even observed collecting extra-nectar from the bases of panicles, which has not been reported previously. It was concluded that extra-floral nectaries may help to ensure sufficient numbers of pollinators by helping to sustain honeybee colonies.

Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A.P. du and Swart, D. **Pollination of Bengal litchi during the 1992 flowering season at Politsi: first report.** *Yearbook – South African Litchi Growers' Association* (1994) 6 7–8 [En, af, Bc]

At the start of flowering of a 10-ha orchard of *Litchi chinensis* cv. 'Bengal', 22 honey bee (*Apis mellifera*) colonies were introduced. Foraging activity was monitored by sampling returning foragers at the hive entrance and identifying their loads: nectar, water, pollen or propolis. During the whole flowering period, nectar and pollen were collected from litchi flowers throughout the day, although activity decreased during the afternoon; water was collected on some days only, mainly in the afternoons. No propolis was collected. When 400 panicles on 20 trees were bagged to exclude insects, two fruits were obtained per panicle (mean weight 17 g) compared with an average of six (range 0–35) on 400 open-pollinated panicles (mean weight 18 g). *P. Walker*

Agricultural Unit, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du and Swart, D. *Pollination of 'Ryan' avocado during the 1993 flowering season at Politsi: second report.* Yearbook – South African Avocado Growers' Association (1994) 17 104–105 [En, 3 ref.]

Ten honey bee hives were placed in the centre of a 50-ha orchard and a permanent apiary with 20 hives was located at the eastern end of the orchard. Foraging activity and the composition of the foraging loads were investigated. The bees were shown to visit avocado flowers throughout the flowering period and both nectar and pollen were collected. Pollen from some other species in the orchard was also identified. Water foraging dominated during the entire period, reaching a maximum of 35% for the bees sampled, during the very high temperatures prevailing. Nectar foraging ranged from 20 to 32%. Graphs show the activity on different dates and at different times of day. Apicultural Unit, Agricultural Research Council, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du and Swart, D. J. *Pollination of mango in the Letsitele Valley during the 1993 flowering season: second report.* Yearbook – South African Mango Growers' Association (1994) 14 67–68 [En, af, Bc]

Twelve beehives were placed in a 14-ha mango (cv. Kent) orchard in the Letsitele Valley, South Africa, in 1993, and foraging honey bees (*Apis mellifera*) returning to the hives were examined for nectar, pollen and propolis. Pollen foraging rose from 23% (of foragers) in the morning to 50% at noon, declining in the afternoon to 40%. Nectar foraging peaked at 26% in the morning, declining to 13% at 16.00 hours. Foragers collecting both pollen and nectar increased from 21% at 08.00 hours to 35% at 10.00 hours and then declined to 18% at 16.00 hours. Up to 10% of bees collected water, but few gathered propolis, and up to 30% of workers (early morning) returned with no loads. It is concluded that the foraging behaviour of honey bees would enhance cross-pollination and the introduction of hives to mango orchards is recommended. D. G. Lowe Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du and Swart, D. J. *Pollination and fruit-set in Bengal litchi during the 1993 flowering season at Politsi: second report.* Yearbook – South African Litchi Growers' Association (1995) 7 31–32 [En, af, 2 ref.]

Honey bee foraging activity was monitored in an orchard of 21-year-old Litchi cv. Bengal trees, by investigating returning foragers at the hive entrance for nectar, water, pollen and propolis. At the start of flowering 24 hives were introduced into the 10-ha orchard. Foragers remained active on litchi flowers throughout the day and during the entire flowering period. Foraging for nectar was highest in the morning whereas pollen foraging reached its peak at noon. Bees also collected pollen from species of *Ageratum*, *Bidens*, *Taraxacum*, *Grevillea*, *Carya*, *Persea* and *Eucalyptus* in or around the orchard. Water was collected mainly in the afternoon. In a second experiment, fruit set was studied in 200 panicles marked and left open on 10

trees and in 300 panicles bagged with gauze (to exclude insects) on 15 trees. An average set of six fruits/open-pollinated panicle was recorded compared with less than 2/bagged panicle. The average weight of a fruit was 14 g for open-pollinated panicles. These results show that litchi has a limited ability for self-pollination, despite being self-fertile.

Apicultural Unit, Plant Protection Research Institute, Private Bag X134, Pretoria 0001, South Africa.

Toit, A. P. du. *Cost analysis of the profitability of beekeeping. [’n Winsgewendheids-ontleding van byeboerdery aan die hand van vyf voorbeelde].* South African Bee Journal (1990) 62 (2) 26–36 [Af, en, Bj]

For operations with 100 or 400 hives, migratory or non-migratory, in South Africa.

Toit, A. P. du. *The profitability of beekeeping. [Die winsgewendheid van byeboerdery].* South African Bee Journal (1987) 59 (5) 98–106 [Af, en, Bj]

Using sample figures, comparative cost analyses of profitability are made for five hypothetical beekeeping enterprises: (A) 100 colonies, (B) as A but colonies are migrated, (C) 400 colonies, (D) as C but migrated, (E) as D but using different marketing techniques. In all the enterprises, labour and transport make up the greatest part of the costs; constraints common to all are: the beekeepers' knowledge, the limited numbers of profitable apiary sites and marketing outlets. P. Walker Transvaalstreek, Privaatsaak X416, Pretoria, 0001 South Africa.

Toit, J. T. du. *Giraffe feeding on Acacia flowers: predation or pollination?* African Journal of Ecology (1990) 28 63–68 [En, fr, Ba]

Resource Ecology Group, Departments of Botany and Zoology, University of the Witwatersrand, P.O. Wits 2050, South Africa.

Tribe, G. D. *A migrating swarm of small hive beetles (Aethina tumida Murray).* South African Bee Journal (2000) 72 (3) 121–122 [En, Bj]

Plant Protection Research Inst., Private Bag X5017, Stellenbosch 7599, South Africa.

Tribe, G. *Drone congregation areas.* Bee Line (1979) 16 (6) 8–9 [En, B]

In 1977, nine *Apis mellifera* adansonii drone congregation areas (D) were discovered near a Pretoria apiary, usually at a distance between 1000 and 1500 m away. In 1978 drones from the apiary and from each D were regularly marked for three months. Drones from the apiary were found at all D sites; many were repeatedly recaptured at only one, but other drones visited several. About 2500 drones could be marked at a D in 2 hours after they had been attracted with a lure; this was estimated to be about a quarter of the drones present. Many were from feral colonies. Peak drone flight activity was usually at 15.00 hours but sometimes lasted from 14.45 to 16.00. At this time many swifts and swallows preyed on the drones. It was concluded that the 9 D really made up two large congregation areas, the larger covering 1 X 1.5 km. P. Walker

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Tribe, G.D. *The fate of the propolised nest.* *South African Bee Journal* (1979) 51 (6) 13–15 [En, B]

A nest inside a propolis sheath collapsed during a period of temperatures up to 30°C.

Tribe, G.D. *Bees of the Outeniqua in 1781.* *South African Bee Journal* (1982) 54 (4) 91 [En, B]

Historical account relating to feral colonies of *Apis mellifera capensis* in this area of the Southern Cape.

Tribe, G.D. *Drone mating assemblies.* *South African Bee Journal* (1982) 54 (5) 99–100, 103–112 [En, B]

The behaviour of *Apis mellifera adansonii* drones in the area around the Pretoria Bee Research Laboratory, South Africa, was studied by raising balloons fitted with a pheromone (queen substance) lure. Drone congregation areas were not static, but took on different forms according to season, weather or drone population density. It is proposed that the three main types be called 'sheltered' (the smallest), 'barrier' and 'convectional' (the largest). It is estimated that the largest congregation area studied was 1 X 1.5 km, and that the average distance of a congregation from the apiary was 1 km. 'Comets' of several hundred drones sometimes formed and up to 10,000 drones could be present in a congregation area. Drones usually took their first orientation flight seven days after emergence; mature drones made 3–5 flights/day (mean 3.7), each occupying 22 minutes on average. The flying speed of drones ranged from 30 to 65 km/hour, but as most drones spent an average 15 minutes per flight cruising within a congregation area, it is unlikely that most flew further than 1–1.5 km. The average queen mating flight took about 13 minutes, and queens are able to fly about 4.5 km in this period. *D. G. Lowe*

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Tribe, G.D. *What is the Cape bee?* *South African Bee Journal* (1983) 55 (4) 77–87 [En, B]

Of the characteristics which distinguish *Apis mellifera capensis* the most important is rapid development of laying workers (within 4–8 days of the removal of the queen) which lay eggs that develop into workers. The geography of the Cape and the effect of the climate on plants and bees are described. It is concluded that the Cape bee has diverged from *A. m. adansonii* in the course of evolution and has acquired certain characteristics as a result of environmental pressures, particularly wind. *A. m. capensis* is able to mate and forage in quite strong winds; colonies of *A. m. adansonii* introduced to the Cape did not survive long. *P. Walker*

Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Tribe, G.D. *Apis mellifera unicolor: the honeybee of Madagascar.* *South African Bee Journal* (1987) 59 (3) 50–52 [En, B]

From various types of evidence it is deduced that Madagascar broke away from the African continent several

million years before the evolution of the genus *Apis*. It seems likely that honeybees were taken to Madagascar from East Africa by Indonesian traders who settled on the island. It is known that beeswax and honey from Madagascar were being traded with Arabs in the 10th century. Published results of biometrical-statistical analyses of African races show that *A. m. unicolor* belongs to the African group and is close to *A. m. scutellata*. However, *A. m. unicolor* clearly differs from the other African races, and it is questionable whether a distinct race could have evolved in the few hundred years since honeybees could have been taken to the island by man. *P. Walker*

Plant Protection Res. Inst., Ryan Rd., Rosebank, Cape Town, South Africa.

Tribe, G.D. *A nesting site of the Cape bee in the West Coast Renosterveld.* *South African Bee Journal* (1988) 60 (5) 114–116 [En, B]

Four honeybee colonies with the appearance of *Apis mellifera capensis* were found nesting in the tangled roots or hollow stems of *Ficus cordata* fig trees near Bridgetown, South Africa. This locality (18°50' E and 33°06' S) is within the distribution range of the Cape bee, although outside the 'classical' *capensis* area. The bees foraged mainly on *Eucalyptus cladocalyx*; they also frequently visited the fruits of the fig trees, but whether they were foraging was not clear. Banded bee pirates, *Palarus latifrons*, were present at two of the honeybee nests. *P. Walker*

Plant Protection Res. Inst., Ryan Rd., Rosebank 8017, South Africa.

Tribe, G.D. *Drones caught in a spider's web within a drone congregation area.* *South African Bee Journal* (1989) 61 (5) 110–111 [En, B]

On hot afternoons drone honeybees (*Apis mellifera capensis*) can often be heard flying in a drone congregation area high above the canopy of *Pinus radiata* trees in a forest in Cape Province, South Africa. On one such occasion a spider's web was seen, strung between the tops of two trees about 10 m tall; 22 drones were trapped in it and were struggling to get free. Small 'comets' of flying drones (6–18), which formed and flew briefly below the web, were presumably attracted by the movements of the trapped drones. Eventually the web was shredded by comets of drones and congregating drones flew again at the original higher level. *P. Walker*

Plant Protection Res. Inst., Ryan Rd., Rosebank 7700, South Africa.

Tribe, G.D. *Drosophila flavohirta Malloch (Diptera: Drosophilidae) in Eucalyptus flowers: occurrence and parasites in eastern Australia and potential for biological control on Eucalyptus grandis in South Africa.* *Journal of the Australian Entomological Society* (1991) 30 (4) 257–262 [En, B]

Drosophila flavohirta, which causes substantial losses in honey production in South Africa, was reared from *Eucalyptus* flowers within Yuraygir National Park, NSW. Most infested flowers (88%) harboured a single fly pupa attached either to the style (77%) or stamen (21%). Nectar secretion by individual flowers ceased by the seventh day, forcing *D. flavohirta* larvae to migrate between flowers.

This, and predation by ants, makes localised mass flowering of hosts crucial to *D. flavohirta* survival. Two parasitoid species were recovered from *D. flavohirta* pupae. *Aprostocetus* sp. (*Eulophidae*) accounted for 97% of the parasitised pupae and a eucoilid for the remainder. The average parasitism was 15% (range 5–28%). *Author* Plant Protection Research Institute, Ryan Road, Rosebank, Cape Town 7700, South Africa.

Tribe, G.D. Heuningberg: past and present. *South African Bee Journal* (1996) 68 (2) 39–47 [En, Bj]

Heuningberg is the name of a mountain in the south-western Cape. Historical records of honey bees and plentiful supplies of honey in this area are discussed and the present fauna and flora are briefly described. There are now very few honey bee colonies in the area, as Heuningberg is surrounded by wheat fields; bee forage and nesting sites are scarce, and there is also no permanent water. Two apiaries (each of 15 hives) are known to exist on the flats near the Heuningberg, within copses of sugar gum (*Eucalyptus cladocalyx*), but banded bee-pirates (*Palarus latifrons*) are a pest. *D.G. Lowe*

Plant Protection Research Institute, Ryan Road, Rosebank 7700, South Africa.

Tribe, G.D. and Fletcher, D.J.C. A propolized nest in the open. *South African Bee Journal* (1977) 49 (4) 5–8 [En, B]

An *Apis mellifera adansonii* swarm, which settled on a tree near Pretoria, built combs which remained exposed through the winter. During the following summer the combs were enlarged and the nest was partly covered with propolis. After further enlargement in the second summer, the nest was completely covered in propolis. The nest was 80–90 cm long, 60 cm wide and 45 cm thick, and had several small entrances (up to 2 cm in diameter) in the lower half. A table gives the air temperatures to which the colony was exposed, minimum –2.6°C, maximum 33.7°C. *P. Walker* Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Tribe, G.D. and Fletcher, D.J.C. Rate of development of the workers of *Apis mellifera adansonii* L. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 115–119 [En, B]

Development was followed in three observation hives. The temperature ranged from a mean of 31.5°C at the centre of the brood nest to one as low as 26° at the edges. Mean durations of the various stages were: egg incubation period, 2 days 22 hours; from hatching of larva until sealing, 4 days 5 hours; sealing until emergence, 11 days 9 hours. The time for development from egg to adult (18 days, 13.5 hours) was therefore shorter than in European *A. mellifera* (usually about 21 days). The difference was mainly due to a 20–30% shorter larval period. *D.G. Lowe* Bee Res. Lab., Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Tribe, G.D. and Johannsmeier, M.F. Bees and quiver trees. *South African Bee Journal* (1996) 68 (4) 111–115 [En, Bj]

Information is given about four Aloe species which grown in South Africa. *A. bainesii* occurs in humid subtropical

summer rainfall areas; *A. dichotoma*, *A. pillansii* and *A. ramosissima* grow in rocky outcrops in arid desert to semi-desert in the north-west Cape and southern Namibia. *A. dichotoma* is the commonest species, and in several areas forms dense stands. Honey bees (*Apis mellifera scutellata*) are probably the main pollinators; the bees nest in rock crevices and cavities in the aloe trees. In years when *A. dichotoma* has a heavy nectar flow, it is probably an important nectar and pollen source for the bees. The nectar is very dilute, thus also providing a valuable source of water for bees. *P. Walker*

Plant Protection Research Institute, Ryan Road, Rosebank, Cape Town 7700, South Africa.

Tribe, G.D., Toit, A.P. du, Rensburg, N.J. van and Johannsmeier, M.F. Collection and release of *Aprostocetus* sp. (*Eulophidae*: *Tetrastichinae*) as a biological control agent for *Drosophila flavohirta* Malloch (*Drosophilidae*) in South Africa. *South African Bee Journal* (1989) 61 (4) 78–79 [En]

Larvae of *D. flavohirta*, the eucalypt nectar fly, compete directly with honeybees for *Eucalyptus grandis* nectar in parts of South Africa. In its native Australia the fly is reported to be rare but widely distributed. No parasites or predators were found on field-collected larvae, but two parasitic wasp species emerged from pupae in the laboratory. *Aprostocetus* sp. constituted 97% of the wasps. Laboratory-reared *Aprostocetus* females readily parasitised *D. flavohirta* pupae in the presence (but not in the absence) of eucalypt flowers. Two field releases of adult *Aprostocetus* were made in *E. grandis* stands in eastern Transvaal; a recovery survey, involving 68 *D. flavohirta* pupae, yielded no parasites. *P. Walker*

Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Tribe, G.D., Toit, A.P. du, Rensburg, N.J. van and Johannsmeier, M.F. The collection and release of *Tetrastichus* sp. (*Eulophidae*) as a biological control agent for *Drosophila flavohirta* Malloch (*Drosophilidae*) in South Africa. *Journal of the Entomological Society of Southern Africa* (1989) 52 (1) 181–182 [En, Ba]

The eucalypt nectar fly, *D. flavohirta*, completes its life cycle in eucalypt flowers; the larva competes with honeybees for nectar and may be responsible for reduced honey yields from *Eucalyptus grandis* in the eastern Transvaal. A parasitic wasp, *Tetrastichus* sp., that emerged from *D. flavohirta* pupae collected in Australia, was successfully reared in the laboratory on *D. melanogaster*. Adult wasps were released on two days in an area of flowering *E. grandis* during the build-up of *D. flavohirta* populations. Only 68 fly pupae have been examined so far, and no parasites were found on them, but further releases and surveys are planned. *P. Walker*

Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Van der Walt, J.P. and Van der Klift, W.C. *Pichia melissophila* sp.n., a new osmotolerant yeast from apiarian sources. *Antonie van Leeuwenhoek Journal of Microbiology and Serology* (1972) 38 (3) 361–364 [En\La, B]

A new ascogenous, osmotolerant species of yeast was iso-

lated from the intestinal tract of *Apis mellifera adansonii* workers. The asci contained 1–4 spores when grown on V-8 or malt agar. Cultures were able to grow on 60% glucose (wt/wt) in yeast extract agar. The yeast has not been recovered from foods with high sugar content, and is probably highly restricted in its distribution. T.A. Gochbauer
Microbiology Res. Group, South African Council Sci. and Indus. Res., Pretoria, South Africa.

Van Drunen, B. Pollination of fruit trees in the Western Cape. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; Apimondia. (1977) 4–6 [En, B]

The author describes the use and preparation of honeybee colonies for the pollination of plums, pears and apples, and emphasises the need for co-operation between farmer and beekeeper. D.G. Lowe
P.O.Box 77, Elgin, Cape 7180, South Africa.

Verma, S. and Ruttner, F. Cytological analysis of the thelytokous parthenogenesis in the Cape honeybee (*Apis mellifera capensis* Escholtz). *Apidologie* (1983) 14 (1) 41–57 [En, de\ fr, B]

Laying workers of *A. m. capensis* that produce impaternal offspring are normal diploids (with $2n = 32$ chromosomes). During the first maturation division (before oviposition) in the eggs of such workers, chromosome pairing, synapsis, chiasmata and diakinesis were observed. This indicated that a reduction division had occurred, resulting in a haploid set of 16 chromosomes. In eggs 3–4 hours after oviposition, during anaphase II, four haploid nuclei were observed, arranged in a line parallel to the egg surface. Later, the two central nuclei, i.e. the egg pronucleus and the central descendant of the first polar body (second division non-sister nuclei), fused to form the (diploid) zygote nucleus; the other two nuclei degenerated. The genetic consequences of the mechanism of automixis are discussed. D.G. Lowe

Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel/Ts., Germany.

Vicidomini, S. [Systematics and distribution of the Xylocopini (Insecta, Hymenoptera, Apidae, Xylocopinae): new and rare records for South Africa.] Sistematica e distribuzione degli Xylocopini (Hymenoptera, Apidae, Xylocopinae): nuove e rare segnalazioni per il Sud Africa. *Gli Uccelli d'Italia* (99) 24 102–106 [It, Ba]

Describes four Xylocopa and one Mesotrichia species.
Via Velardi 10, I-84014 Nocera Inferiore (Salerno), Italy.

Vogel, S. and Michener, C.D. Long bee legs and oil-producing floral spurs, and a new *Rediviva* (Hymenoptera, Melittidae; Scrophulariaceae). *Journal of the Kansas Entomological Society* (1985) 58 (2) 359–364 [En, B]

Species of the genus *Diascia* have flowers with a pair of lateral spurs into which oil is secreted. The spurs are of various lengths e.g. 12 mm in *D. nana*, 25 mm in *D. longicornis*. Species of the melittid bee genus *Rediviva* collect the oil and use it as a larval food. Females of species of *Rediviva* vary in form, particularly in the length of the forelegs, but all have short hairs on the tarsi that are presumed to take up oil and from which oil is probably transferred to the

hind scopal hairs for transport. A new species, *R. emdeorum*, which was found visiting the flowers of *D. longicornis* in South Africa, has forelegs 25 mm long and it is thought that it is probably able to reach the oil at the ends of the floral spurs. Pollen taken from the scopae of the type specimen was *Diascia* pollen. *R. longimanus* has been observed collecting oil from *D. longicornis* in Western Cape Province, and pollinating the flowers with both front legs inserted in the floral spurs. The female of *R. emdeorum* is described, and the possible co-evolution of *Diascia* and *Rediviva* is discussed. D.G. Lowe

Inst. Botanik, Johannes Gutenberg Univ., 6500 Mainz, German Federal Republic.

Voges, K. Worker cell size of *Apis mellifera transvaalensis* and its foundation requirements. *Apis*, South Africa (1982) (October) 4–8 [En, B]

The author describes his method for measuring and counting cells in brood comb. His results for comb drawn by honeybees (provisionally called *A. m. transvaalensis*) in central Transvaal show that foundation with 922 cells/dm² is best for these bees; the cell width is 5.05 mm and the rows are pitched at 4.29 mm. Foundation, manufactured by the author, with 925 cells/dm² has been given to colonies with good results. Commercially available foundation for African bees usually has between 1032 and 1066 cells/dm²; cell width is 0.17 mm too small for the Transvaal bees, and the rows are 0.33 mm too close together. P. Walker

38 Greenway, Greenside, Johannesburg 2193, South Africa.

Voges, K. Standard South African Langstroth beehive. *Apis* (1983) (January) 9–11 [En, B]

Voges, K. A standard South African Langstroth beehive? *South African Bee Journal* (1983) 55 (3) 63–66 [En, B]
Proposal for a standard hive, with sketches and dimensions.

Worswick, P.V. Comparative study of colony thermoregulation in the African honeybee, *Apis mellifera adansonii* Latreille and the Cape honeybee, *Apis mellifera capensis* Escholtz. *Comparative Biochemistry and Physiology, A* (1987) 86 (1) 95–102 [En, Bc]

Colonies of *A. m. adansonii* and *A. m. capensis* were maintained in 5-frame nucleus hives and fed with syrup before being used in laboratory studies in a temperature-controlled respiration chamber. Colony temperatures were measured by a grid arrangement of 48 thermocouples suspended between two brood combs. Each colony was kept at 20°C for a 24-hour acclimatisation period before the 6-day experimental period. The oxygen consumption was monitored continuously whilst the temperature was lowered at 18.00 hours every 24 hours. Data were collected for the following ambient temperatures: 20, 15, 10, 5, 0 and –10°. Both subspecies showed large diurnal changes in mass-specific metabolic rate. At 20°, minimal values of oxygen consumption occurred before sunrise: 1.07+/-0.15 ml O₂/g per hour for *adansonii*, 0.69+/-0.11 ml O₂/g per hour for *capensis*. The peak values, which occurred between 15.00 and 16.00 hours, were 1.69+/-0.25 ml O₂/g per hour for *adansonii*, 1.20 +/-0.24 ml O₂/g per hour for *capensis*. The diurnal cycle

disappeared completely at around 5°, with *capensis* showing a significant increase, and *adansonii* a decrease, in metabolic rate. Transient peaks in metabolic rate, with no temporal pattern, occurred in both subspecies. Colony mean core temperature at 20° was 34.30° in *adansonii* colonies, 34.75° in *capensis* colonies; at -10° the figures were 30.92° and 30.90°, respectively. Thermal profiles through the brood nest suggested that *A. m. adansonii* maintains a significantly larger area of the colony at core temperatures than *A. m. capensis*. The thermal regimes of the clusters are discussed in relation to the adaptation of the two subspecies to different environments. D.G. Lowe
Dept. Zoology, Univ. Cape Town, Rondebosch 7700, South Africa.

Worswick, P.V. Comparison of nectar foraging efficiency in the Cape honeybee, *Apis mellifera capensis* Escholtz, and the African honeybee, *Apis mellifera adansonii* Latreille, in the western Cape Province. *South African Journal of Zoology* (1988) 23 (2) 124–127 [En, af, Bc]

In studies carried out 20 km south of Cape Town, South Africa, colonies of *A. m. adansonii* had significantly more unsuccessful foragers than colonies of *A. m. capensis*, while *A. m. capensis* colonies had significantly more foragers returning with nectar. No significant difference was observed in the numbers of returning pollen gatherers or foragers carrying both pollen and nectar. Nectar foragers of *A. m. capensis* returned with significantly larger volumes of nectar than nectar foragers of *A. m. adansonii*. The nectar concentrations showed no significant difference. No significant difference was observed in the mass of pollen carried by returning pollen gatherers. The *A. m. capensis* foragers returning with both pollen and nectar had significantly larger volumes of nectar and larger loads of pollen. The nectar concentrations showed no significant difference. Colonies of *A. m. adansonii* showed a mean mass loss of 3.37 kg while colonies of *A. m. capensis* showed a mean mass gain of 1.88 kg over the experimental period of 78 days. The hypothesis has been advanced that these differences reflect adaptations in *A. m. capensis* to a more temperate environment. It is also suggested that the distribution of African honeybees in southern Africa and South America is limited by an inability to provision the nest with sufficient energy to withstand the temperate winter conditions prevailing in these latitudes. *Author*
Dept. Zoology, Univ. Cape Town, Rondebosch 7700, South Africa.

Warner, S.J., Cantrill, R.C. and Hepburn, H.R. Metabolism of [1-14C]palmitic acid in sealed brood of the African worker honeybee. *Comparative Biochemistry and Physiology*, B (1981) 68 (2) 355–356 [En, B]

The fate of [1-14C]palmitic acid injected into honeybee workers was monitored throughout metamorphosis. The palmitic acid was recovered from phospholipid, mono- and triglycerides, steroids, free fatty acids and cholesterol ester. The results show that triglycerides constitute the main source of fatty acids used for catabolic and anabolic reactions during worker development.

Dept. Physiology, Univ. Witwatersrand, Johannesburg, South Africa.

Watmough, R.H. The potential of *Megachile gratiosa* Cameron, *Xylocopa caffra* (Linnaeus) (Hymenoptera: Megachilidae and Anthophoridae) and other solitary bees as pollinators of alfalfa, *Medicago sativa* L. (Fabaceae), in the Oudtshoorn district, South Africa. *African Entomology* (99) 7 (2) 312–315 [En, X]

The number of flowers pollinated per minute by *X. caffra* was higher than in the other species; *M. gratiosa* pollinated 43% of the number, *X. scioensis* 39%, *Apis mellifera* 0.3% and *Anthophora* sp. 0.04%. However, *X. scioensis* was the most efficient pollinator due to its greater density. *Author*
ARC, Plant Protection Research Inst., Private Bag X134, Pretoria, 0001 South Africa.

Watmough, R.H. Carpenter bees in southern Africa. *South African Bee Journal* (1975) 47 (2) 7–9 [En, B]

Watmough, R.H. Biology and behaviour of carpenter bees in southern Africa. *Journal of the Entomological Society of Southern Africa* (1974) 37 (2) 261–281 [En, B]

There are some 30 *Xylocopa* species in Southern Africa; important factors in the regulation and distribution of populations are the availability of suitable nesting substrates, and of food, and also the action of vertebrate predators such as woodpeckers, baboons and rats. Invertebrate parasites are of less importance. Carpenter bees are univoltine and multivoltine. Nests are usually extensively branched. The mandibles are used for excavating tunnels and scraping off frass to be moistened with saliva for the construction of larval cell partitions, completed in a spiral fashion using the tip of the abdomen and the hind legs. Several types of buzzing sound are associated with different stages of tunnel excavation and larval cell provisioning. Mating occurs in the air, the male carrying the female with his middle legs and hind legs, the fore legs being free. These bees are of great importance in the pollination of certain indigenous and crop plants with a large and/or specialised flower structure. R.H. Watmough
Plant Protection Res. Inst., PB X134, Beatrix St., Pretoria 0001, South Africa.

Watmough, R.H. Mortality in natural xylocopid populations. Proceedings of the 1st Congress of the Entomological Society of Southern Africa, Stellenbosch, September 30–October 3, 1974 (Durr, H.J.R., Giliomee, J.H. and Neser, S. (eds)). Pretoria, South Africa; Entomological Society of Southern Africa. (1975) 173–180 ISBN 0-620-01919-0 [En]

Includes effects of weather, and of predation by birds and mammals.

Watmough, R.H. Mortality, sex ratio and fecundity in natural populations of large carpenter bees (*Xylocopa* spp.). *Journal of Animal Ecology* (1983) 52 (1) 111–125 [En, B]

Analyses of the nests of 15 *Xylocopa* species in southern Africa showed that the sex ratio averaged 36 males to 64 females, and that average fecundity was 7.35 eggs per female. Mean mortality of immature stages was 44%. Parasitism was lower where only univoltine *Xylocopa* species were present, partly because of the absence of the parasites *Coelopencyrtus* (Hymenoptera) and *Paralipsa* (Lepidoptera), which were found with multivoltine species.

Destruction by man, and predation by woodpeckers, baboons, small mammals and invertebrates such as ants, were low on average but occasionally reached 50%. The relatively high survival of immature stages and of females which had started to lay eggs conflicted with the under-utilisation of available sites, suggesting that mortality of pre-reproductive adults might be high. This was difficult to measure in natural populations. *J. M. Gedy*
Plant Protection Res. Inst., Private Bag X134, Pretoria 0001, South Africa.

Watmough, R.H. A leaf-cutter bee (*Megachilidae*) and a carpenter bee (*Anthophoride*) as possible pollinators of lucerne (*Medicago sativa* L.) in the Oudtshoorn district. *South African Bee Journal* (1987) 59 (5) 114 [En, Bj]

Two species, *Megachile gratiosa* and *Xylocopa caffra*, readily nested in artificial stem nests provided in sheds at a lucerne field. Both species collected pollen from the flowers. Mean numbers of eggs per female were 9.50 and 8.51, respectively, and mean reproduction rates were 1.65 and 4.20 per generation, respectively. Parasites caused high pupal and larval mortality in *M. gratiosa*, and will have to be controlled if the bee is to be used commercially for pollination. Many *X. caffra* females moved away from the field to nest, especially if there was not a large excess of empty artificial nests available. *P. Walker*

Plant Protection Res. Inst., Pretoria, South Africa.

Watmough, R.H. The effect of temperature on the developmental rate of the immature stages of large carpenter bees, *Xylocopa* spp. (*Hymenoptera: Anthophoridae*). *Journal of the Entomological Society of Southern Africa* (1989) 52 (1) 119–128 [En, Ba]

The immature stages of *X. caffra*, *X. capitata* and *X. rufitarsis*, collected in the southern and southwestern Cape, South Africa, were kept at fluctuating temperatures and a range of constant temperatures. Developmental times at these temperatures were measured. Linear regressions showed that larvae of *X. caffra* and *X. capitata* developed at the same rate. The prepupae and pupae of *X. capitata*, however, developed more slowly than those of *X. caffra*. No difference in the developmental rate of pupae was evident between *X. caffra* and *X. rufitarsis*. The minimum lethal temperature for all stages of all three species was about 15°C. The percentage of *X. caffra* developmental time spent in each of the stages was: egg 13%, predefaecating larva 12%, defaecating larva 10%, prepupa 15% and pupa 50%. The limited time in spring and summer when mean temperatures are above 15°C and/or a possible shortage of flowers producing pollen and nectar in the dry later summer cause *X. caffra* to be univoltine in the southwestern Cape. Further north, where the summer is longer and there is summer rain, *X. caffra* has two or more generations per year. *Author*

Plant Protection Research Institute, Private Bag X134, Pretoria, South Africa.

Weaver, R. The threat of Africanized bees to North America. African bees: taxonomy, biology and economic use (editor D.J.C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 63–66 [En, B]

Werger, M.J.A. (ed.). Biogeography and ecology of Southern Africa. Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first six chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation e.g. the afro-montane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16–31 each cover a major taxonomic group of animals. Chapter 27, by A.J. Prins, covers the Hymenoptera. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853–857 briefly describe the Apoidea known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. *D.G. Lowe*

Western, T. Improved ant isolator. *South African Bee Journal* (1989) 61 (5) 105–107 [En,

The common method of standing each leg of a hive stand in a tin of oil to prevent the passage of ants has some disadvantages. In an improved method a tin with a hole in its base, and smeared on the inside with grease, is inverted and fitted halfway up the leg of the hive stand. The isolator described in this article consists of two tins of different diameters and heights; the narrower (taller) one is slightly overfilled with a wet cement mix and then the wider (shorter) tin is inverted and placed over it. The pair of tins is temporarily inverted and pressed together until the cement is dry and the two are thus joined. The inner surface of the outer tin and the outer surface of the inner tin are then smeared with grease or thick engine oil. Four such isolators are arranged so that each (standing on the base of the narrower tin and with the wider tin upside down) supports the corner of a hive or hive stand. *P. Walker*
18 Hinsbeeck Ave., Florida Park 1709, South Africa.

Whiffler, L.A. Venom protein production, alarm pheromones, and guarding behaviour. *South African Bee Journal* (1988) 60 (3) 54–57 [En, Bj]

Results are reported for African honeybee workers [race not stated]. The amount of venom protein released in a sting was negligible at three days old then it increased with age; at 15 days it was about 30 micro g/bee, and by 17 days it reached 60 micro g/bee or more and remained at this level. Only four of the nine compounds in the alarm pheromone showed an increase with age: isopentyl acetate, benzyl alcohol, n-hexyl acetate and isopentyl alcohol. Maximum values were attained at about 17 days. In laboratory tests, bees were exposed to (A) whole sting alarm pheromone, or (B) a pair of mandibular glands, or (C) A + B. More bees responded to A than to B; response to C was similar to the response to A. Older bees (15–20 days) responded more readily than younger bees did.

Older bees (25 days) were the most successful in eliciting and responding to the signals of bees aged 17–20 days. *P. Walker*

Dept. Zoology & Entomology, Rhodes Univ., P.O. Box 94, Grahamstown 6140, South Africa.

Whiffler, L.A. *The role of the queen in comb building in Apis mellifera capensis honeybee colonies. Bees and bee-keeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [by Anderson, R.H. and Buys, B. (eds)].* Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 90–93 ISBN 0-620-15132-3 [En, Bd]

Comb building by *A. m. capensis* was studied using queenright and queenless colonies, and queens that were either caged or free-running, and sometimes with their mandibular and/or tergite glands removed or occluded. The effect of dead queens was also studied. The presence of a queen in a colony did not influence either the relative number of bees secreting wax or the actual rate of wax secretion. However, comb construction was enhanced when workers had direct access to a live queen. The presence of a freely moving queen lacking either mandibular and/or tergite glands did not affect the surface area or weight of comb constructed. No correlations between the comb construction variables and the relative amount of queen substance secreted by the queens (whether caged, free moving or with/without their mandibular and/or tergite glands) was found. The results demonstrate that direct physical access to the head of a queen, regardless of the possession of mandibular glands, is necessary for enhancing comb construction, but it is considered unlikely that 9-oxo-2-decenoic acid (9-ODA) alone is responsible for the comb-building stimulus. *D.G. Lowe*

Department of Zoology and Entomology, Rhodes University, P.O. Box 94, Grahamstown 6140, South Africa.

Whiffler, L.A., Drusedau, M.U.H., Crewe, R.M. and Hepburn, H.R. *Defensive behaviour and the division of labour in the African honeybee (Apis mellifera scutellata).* *Journal of Comparative Physiology, A* (1988) 163 401–411 [En, Bc]

The studies described in this paper were all carried out on worker *A. m. scutellata* taken from queenright colonies in apiaries in South Africa. The concentration of venom protein released by young worker honeybees was low (10–20 micro g/bee), gradually increasing with age, reaching a plateau of 60 micro g/bee at 17 days and remaining at this value in older bees. Nine alarm pheromones from the sting were identified and analysed gas chromatographically. Of these, only isopentyl acetate, isopentyl alcohol, benzyl alcohol and n-hexyl acetate showed concentration profiles that clearly differed with age. The mandibular gland alarm pheromone 2-heptanone had a reasonably well-defined concentration profile related to age. Behavioural assays showed that (1) more bees of all ages responded to an isolated sting (sting alarm pheromones) than to (2) an isolated pair of mandibular glands (2-heptanone). A response equivalent to (1) occurred when both a sting and a pair of mandibular glands were presented together. Older bees (15–25 days old) responded more readily to the donor

stings, mandibular glands and stings and mandibular glands together of 15–25 day-old bees than did younger bees. The responses of older bees (25 days old) were more rapid and of longer duration than those of younger bees. The results on the production of venom protein, alarm signals and their efficacy in recruitment, and on the latency and duration of worker responses, could be correlated with age. The defensive capacity of African worker bees is one which develops in relation to age and is consistent with defence being associated with division of labour in honeybees. *Author*

Dept. Zoology, Univ. Witwatersrand, Johannesburg 2050, South Africa.

Whiffler, L.A. and Hepburn, H.R. *Inhibition of queen cell construction in the Cape honeybee, Apis mellifera capensis.* *Apidologie* (1991) 22 (3) 229–236 [En, fr\ de, Bj]

Queen cell construction in a Cape honey bee colony was analysed with respect to queen status (mated, virgin, dead queens, queenless) and source of pheromones (intact or impaired mandibular or abdominal tergal glands) under different test conditions (queens free-running or in division boards or in cages). The greatest inhibition of queen cell construction occurred in colonies with intact, mated and free-running queens while least inhibition occurred in queenless colonies or colonies with dead queens. The results indicate that emergency queen cell construction is inhibited by pheromones of the mandibular gland present on several different parts of the queen's body. *Author*
Department of Zoology and Entomology, Rhodes University, P.O. Box 94, Grahamstown 6140, South Africa.

Whiffler, L.A. and Hepburn, H.R. *The queen in relation to wax secretion and comb building in honeybees.* *Journal of Comparative Physiology. A, Sensory, Neural, and Behavioral Physiology.* (1991) 169 (2) 209–214 [En, Bc]

The percentage of workers bearing wax scales, wax scale weight and weight of constructed combs were determined in colonies of *Apis mellifera capensis* and *A. m. scutellata* with a free or confined mated, virgin or dead queen, or a queen whose mandibular or abdominal tergite glands had been removed, or without a queen. The amount of wax recovered from festoon bees, and the percentage of these bees bearing wax, were independent of queen status, the queen's pheromones and worker access to the queen. However, colonies with full access to a freely moving mated queen always constructed significantly more comb than colonies with a virgin or dead queen or with confined queens with or without the glands. Colonies headed by a virgin queen built as little comb as queenless colonies. It is concluded that queen pheromones do not control wax secretion but probably stimulate comb construction. *P. Walker*

Department of Zoology and Entomology, Rhodes University, Grahamstown 6140, South Africa.

Whitehead, V.B. *Distribution, biology and flower relationships of fideiid bees of southern Africa (Hymenoptera, Apoidea, Fideiidae).* *South African Journal of Zoology* (1984) 19 (2) 87–90 [En, af, B]

Fideiid bees are 1–2 cm long with a dark integument, which in most species is obscured by a dense cream to

brown pile, sometimes with a banded appearance. Eleven species of these solitary ground-nesting bees have been identified in southern Africa. They carry pollen on abdominal scopae; *Fidelia paradoxa*, *F. villosa* and *F. kobrowi* visit only flowers of the *Mesembryanthemaceae*. The plant species visited by the other species are listed. Seven fideiid species are found in the winter rainfall area; their development period is in early summer. The four species which develop in autumn are found in the summer rainfall area. The distribution of the species is discussed. P. Walker
Dept. Entomology, South African Museum, PO Box 61, Cape Town 8000, South Africa.

Whitehead, V.B. and Prins, A.J. *The European wasp, Vespula germanica (F.) in the Cape Peninsula [South Africa]*. *Journal of the Entomological Society of Southern Africa* (1975) 38 (1) 39–42 [En]

Whitehead, V.B., Schelpe, E.A.C.L.E. and Anthony, N.C. *The bee, Rediviva longimanus Michener (Apoidea: Melittidae), collecting pollen and oil from Diascia longicornis (Thunb.) Druce (Scrophulariaceae)*. *South African Journal of Science* (1984) 80 (6) 286 [En, B]

R. longimanus females visiting flowers of the twin-spurred *D. longicornis* inserted their long front legs into the spurs and probed the distal ends. At the same time, the grouped anthers of *D. longicornis* were pressed against the sternum of the bee in the region of the procoxae, thus depositing pollen. *R. longimanus* also visited *Heliophila* (*Brassicaceae*), *Homeria* and *Morea* (*Iridaceae*) for nectar. Oil from the *D. longicornis* flower spurs was collected at the ends of the front legs by a system of adapted setae. The oil was transferred to the inner distal part of the middle tibia and the outer hind tibia or basitarsus and mixed with pollen as it was packed. J.M. Gedy

Dept. Entomology, South African Museum, PO Box 61, Cape Town 8000, South Africa.

Whitehead, V.B. and Steiner, K. *Oil-collecting bees in South Africa*. *African Wildlife* (1984) 39 (4) 144, 146–147 [En, B]

Melittid bees of the genus *Rediviva* collect oils from the flowers of *Diascia* spp. (*Scrophulariaceae*).

Whitehead, V.B. and Steiner, K.E. *Two new species of oil-collecting bees of the genus Rediviva from the summer rainfall region of South Africa (Hymenoptera, Apoidea, Melittidae)*. *Annals of the South African Museum* (1992) 102 (4) 143–164 [En, Ba]

R. pallidula sp. nov. and *R. saetigera* sp. nov. are described. The former collects oil from six *Diascia* species (*Scrophulariaceae*) and two species of orchids; the latter collects oil from *Bowkeria cymosa* and *Anatrabe integerrima* (*Scrophulariaceae*). D.G. Lowe

Entomology Department, South African Museum, PO Box 61, Cape Town 8000, South Africa.

Whitehead, V.B. and Steiner, K.E. *A new Rediviva bee (Hymenoptera: Apoidea: Melittidae) that collects oil from orchids*. *African Entomology* (1993) 1 (2) 159–166 [En, Ba]
Entomology Department, South African Museum, P.O. Box 61, Cape Town 8000, South Africa.

R. gigas sp. nov. is described. The bees are active in November and December in western Cape Province, South Africa, and the females collect oil from three species of orchids. D.G. Lowe

Whitehead, V.B. and Steiner, K.E. *A new Rediviva bee (Hymenoptera, Melittidae) from the north-western Cape Province, South Africa*. *Annals of the South African Museum* (1994) 104 (1) 1–11 [En, Ba]

R. albifasciata sp. nov. is described. The females collect oil from *Hemimeris racemosa* and *Colpias mollis* (*Scrophulariaceae*).

Entomology Department, South African Museum, PO Box 61, Cape Town 8000, South Africa.

Whittington, A.E. *Of honey bees and eristaline flies*. *Antenna* (London) (1994) 18 (3) 120–123 [En, 14 ref.]

The confusion between honey bees and *Eristalis* spp. resulting from mimicry by the latter is discussed from a historical perspective, with reference to predation experiments with robins and toads, and from an evolutionary point of view.

Natal Museum, PO Box 9070, Pietermaritzburg, South Africa.

Wilkins, T. *Beekeeping in the Western Province*. *South African Bee Journal* (1983) 55 (1) 7–11 [En, B]

Williams, R.R. *Facets of pollination: from fruit-set experiments with apple and pear in the U.K. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990 [edited by Anderson, R. H.; Buys, B.J.]*. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 3–9 ISBN 0-620-15132-3 [En, Bd]

This review, with 25 references, describes research on the pollination of apple and pear carried out in the UK. It covers the following aspects: pollen supply and pollinisers (pollen donors); foraging behaviour of honey bees and bumble bees; flower behaviour and flower attractiveness to foraging bees; improving pollination and fruit set. D.G. Lowe

Long Ashton Research Station, University of Bristol, Long Ashton, Bristol BS18 9AF, UK.

Wirtz, P. *Two unusual pollinators. [Zwei ungewöhnliche Bestäuber.]*. *Imkerfreund* (1992) 47 (1) 15 [De, B]

Published observations are reported and discussed. In South Africa, giraffes eat white acacia flowers and much pollen can be seen on their heads and necks as they move from tree to tree [see J. T. du Toit, *African Journal of Ecology* (1990) 28, 63–68]. In Madeira the lizard *Lacerta (Podarcis) muralis* subsp. *dugesii* visits various flowers and has been seen sticking its tongue into them, presumably drinking nectar. The lizard's head becomes covered in pollen [see F. E. Beyhl, *Courier Forschungsinstitut Senckenberg* (1990) 129, 153–158]. Although no scientific pollination studies have been made, it is likely that both these animals pollinate the flowers. P. Walker
Albertstrasse 21a, 7800 Freiburg, Germany.

Wolmarans, E. *Safety of pyrethroids to honeybees. Bees and beekeeping in southern Africa. Proceedings of the International Beekeepers' Symposium held at Stellenbosch, South Africa, 24–26 January, 1990* [edited by Anderson, R. H.; Buys, B.]. Cape Town, South Africa; S. A. Federation of Beekeepers' Associations. (1991) 51–59 ISBN 0-620-15132-3 [En, Bd]

The testing of Fastac (alphamethrin) for toxicity to honey bees is described; it had high toxicity in laboratory oral and topical tests, but had no adverse immediate or long-term effects under field conditions. This is attributed to the very low application rates used in commercial situations and the strong, short-lived repellency of Fastac immediately after application. It is concluded that Fastac is not hazardous to honey bees under normal field conditions. *D. G. Lowe*

Chemical Division, Shell South Africa (Pty) Ltd., P.O. Box 494, Johannesburg 2000, South Africa.

Woodhouse, B. *Bees and honey in the prehistoric rock art of southern Africa. South African Bee Journal* (1987) 59 (2) 36–41 [En, Bj]

The development of interest in this subject is traced, and literature published since 1970 is surveyed. Some sites that have not previously been reported in the literature are described briefly, with some further information on the paintings at the Ebusingata site in the Drakensberg. *P. Walker* 1 Buckingham Avenue, Craighall Park, 2196, South Africa.

Wossler, T. and Crewe, R. *Honeybee queen tergal gland secretion affects ovarian development in caged workers. Apidologie* (99) 30 (4) 311–320 [En, de, fr, Bj]

In a laboratory bioassay with *Apis mellifera capensis* and *A. m. scutellata*, a glass pseudoqueen was treated daily with virgin queen tergal gland extract and exposed to a group of caged queenless workers. Analysis using loglinear models showed that there were no interactions between treatment, race and cage, with respect to the frequency of developing ovaries; the response was homogeneous among cages and among the two races. The results demonstrated that the extract from queens of each race inhibited ovarian development in their own workers. *Author* Albertstrasse 21a, 7800 Freiburg, Germany. Communication Biology Research Group, Dept. of Zoology, Univ. of Witwatersrand, PB 3, Wits 2050, Johannesburg, South Africa.

Wossler, T. C. *Pheromone mimicry by Apis mellifera capensis social parasites leads to reproductive anarchy in host Apis mellifera scutellata colonies. Apidologie* (2002) 33 (2) 139–163 [En, de, fr, Bj]

This is a review with about 160 references. *A. m. capensis* (C) queen pheromones suppress the development of queenlike characteristics in workers in their colonies; however, if C workers invades an *A. m. scutellata* colony, the queen produce insufficient pheromones to prevent them from developing into reproductives, laying acceptable eggs, and mimicking queen pheromones. *Author* Dept of Zoology and Entomology, Univ. of Pretoria, Pretoria 0002, South Africa.

Wossler, T. C. and Crewe, R. M. *Mass spectral identification of the tergal gland secretions of female castes of two African honey bee races (Apis mellifera). Journal of Apicultural Research* (99) 38 (3–4) 137–148 [En, Bj]

Analysis of the tergal gland secretions of *A. m. capensis* and *A. m. scutellata* queens and workers and *A. m. capensis* pseudoqueens showed that they are composed of long-chain fatty acids, long-chain esters and a linear series of unsaturated hydrocarbons. Cuticular extracts consisted of a linear series of hydrocarbons with 23–41 C atoms; extracts from workers of both subspecies were identical, and extracts from queens were identical. The major component in tergal gland secretion was (Z)-9-octadecenoic acid. Virgin queen secretions could be distinguished from those of mated queens. *A. m. capensis* worker secretions and pseudoqueen secretions differed significantly from those of mated queens. Significant differences between the races were found for tergal gland secretions of mated queens (but not of virgin queens) and of workers. The profiles of these secretions could therefore be useful in distinguishing between the races. *P. Walker*

Communication Biology Research Group, Dept of Zoology, Univ. of Witwatersrand, Private Bag 3, Wits 2050, Johannesburg, South Africa.

Wossler, T. C., Veale, R. B. and Crewe, R. M. *How queen-like are the tergal glands in workers of Apis mellifera capensis and Apis mellifera scutellata? Apidologie* (2000) 31 (1) 55–66 [En, de, fr, Bj]

The tergal glands of virgin queens and workers were examined. Two types of tergal glands (A and B) were found in workers, and their morphology and location are described. The type-B tergal glands are bicellular and are found mainly in *A. m. capensis* queens and workers and in *A. m. scutellata* queens. There were no differences in gland location or structure in queens of the two races, but *A. m. capensis* workers had more glands of both types and larger type-A glands than *A. m. scutellata* workers had. *Author* Communication Biology Research Group, Dept of Zoology, Univ. of Witwatersrand, Private Bag 3, Wits 2050, Johannesburg, South Africa.

Woyke, J. *Brood rearing and absconding of tropical honeybees. African bees: taxonomy, biology and economic use (editor D. J. C. Fletcher). Pretoria, South Africa; Apimondia.* (1977) 96–102 [En, B]

Absconding and its relationship to brood rearing were studied in *Apis mellifera adansonii* and *Apis cerana*. Colonies were divided by a vertical queen excluder, and a test comb with brood was placed in each, in the centre of the queenless part. The number of eggs and larvae surviving four days after the egg count, and the amount of brood sealed, were measured on the test comb. During the main nectar and pollen flow, 99% of larvae survived 1–3 days and 95% of them were sealed, but when the flow diminished, only 90% of larvae survived 1–3 days and 8–77% were sealed. No larvae were sealed in a dearth period. A second experiment showed that during a dearth 6–45% of larvae were eaten by the workers on the first day after hatching and almost all had been eaten after 3–4 days. Queens continued to lay during dearth, but larvae which hatched from these eggs were eaten. Absconding colonies usually left

behind a few hundred eggs but very little brood. D.G. Lowe
Bee Div., Agric. Univ., Warsaw, Ursynow, Poland.

Woyke, J. *The density of bristles covering the wings as discrimination value between African and other races of honey bee. African bees: taxonomy, biology and economic use* (editor D.J.C. Fletcher). Pretoria, South Africa; *Apimondia* (1977) 15–24 [En, B]

The following species and races were investigated: *Apis mellifera adansonii* from South Africa (SA), Brazil (B), Tanzania (T), Guinea (G); *A. m. ligustica* from (B), USA, Italy (It); *A. m. capensis*; *A. m. mellifera*; *A. m. caucasica*; *A. m. carnica*; *A. cerana*; *A. dorsata*; *A. florea*. The bristles covering an area of 0.4 mm² in the middle of the discoidal cell in the forewings of 30 workers from each colony were counted. Mean results for *A. m. adansonii* were (B) 93, (SA) 88, (T) 77, (G) 72; those for *A. m. ligustica* ranged from 54 (B) to 66 (It). The other European races gave mean results ranging from 68 (*A. m. carnica*) to 84 (*A. m. mellifera*). Remaining results were: *A. m. capensis*, 100; *A. cerana*, 47; *A. florea*, 67; *A. dorsata*, 165. Drones had only half as many bristles as workers, whereas queens had twice as many. The African bees had smaller forewings than the European bees, but the cubital index was similar in all *A. mellifera* races. It is concluded that density of bristles on the forewings is the best character for distinguishing between African and the other races. D.G. Lowe

Bee Div., Agric. Univ., Warsaw, Ursynow, Poland.

Wright, M.G. *Seed production by Protea laurifolia (Proteaceae) after insect versus insect and bird pollination: a quality difference?* *South African Journal of Science* (1994) 90 (4) 199 [En, 8 ref.]

Birds were excluded from 20 *P. laurifolia* inflorescences at Du Toits Kloof by enclosing them within 15-mm-diameter wire mesh. Twenty inflorescences to which both birds and insects had free access were used as controls. Seed heads were removed from plants seven months later. Insect-only pollination resulted in significantly lighter embryos, lower seed set and slower germination than in controls.

Department of Botany, Rand Afrikaans University, PO Box 524, Auckland Park, Johannesburg 2006, South Africa.

Wyk, B.-E. van. *Nectar sugar composition in southern African Papilionoideae (Fabaceae)*. *Biochemical Systematics and Ecology* (1993) 21 (2) 271–277 [En, Ba]

The nectar sugar composition of several genera of the subfamily Papilionoideae (Fabaceae) were analysed, including many southern African endemic genera of the tribes Crotalariaeae, Podalyrieae and Liparieae. Nectar sugars were found to be of limited taxonomic value. Most of the samples contained high concentrations of sucrose. Fructose and glucose were present in more or less equal amounts, and were the dominant sugars in the nectar of *Erythrina* and *Sutherlandia* (both bird-pollinated) but also in *Pearsonia* and some species of *Lotononis* (both bee-pollinated).
Author

Vegetable and Ornamental Plant Institute, Agricultural

Research Council, Private Bag X1, Elsenburg 7607, South Africa.

Ziegler, H., Maurizio, A. and Stichler, W. *The characterization of honey samples according to their content of pollen and of stable isotopes. [Die Charakterisierung von Honigen nach ihrem Gehalt an Pollen und an stabilen Isotopen]*. *Apidologie* (1979) 10 (4) 301–311 [De, en\fr, B]

Continuing the work reported in *Apicultural Abstracts* 1072/79, results of pollen analyses are presented for 24 European honeys and 19 honeys from other parts of the world. For each sample the following were also determined: delta 13C; the deuterium to hydrogen ratio (delta D); carbon, hydrogen and ash contents. For all except two samples delta 13C values were between –22.64 and –26.75‰, i.e. in the range of C3 photosynthetic plants. Delta D varied with the geographical origin of the honey – the more arid the area, the higher the deuterium content of the honey produced there. Of the two honeys with high delta 13C and delta D values, one was shown to be adulterated; the other, an aloe honey from South Africa, is the first natural honey found with such high values. It is pointed out that aloes are CAM-type plants, i.e. CO₂ fixation takes place at night. P. Walker

Inst. Botanik und Mikrobiologie, Univ. Munchen, 8 Munich 2, Germany.

Zietsman, P.C. *Reproductive biology of Grewia occidentalis L. (Tiliaceae)*. *South African Journal of Botany* (1991) 57 (6) 348–351 [En, af, Bc]

Flowers of *Grewia occidentalis*, manually self-pollinated or bagged to prevent cross-pollination, produced no seed. Open-pollinated flowers had a seed set of 12% compared with 15% in manually cross-pollinated flowers. Pollen from other flowers on the same tree was incompatible. Honey bees (*Apis mellifera*) and two *Xylocopa* species were the only insects observed carrying abundant pollen loads. Of the honey bee visitors, 18% collected pollen only, 64% collected nectar only and 18% both pollen and nectar. Each 30 cm of flower-bearing twig was visited by an average of 86 honey bees per hour during the observation period of 10 hours. J.M. Gedye
National Museum, P.O. Box 266, Bloemfontein 9300, South Africa.

Zietsman, P.C. *Pollination in Pelargonium dolomiticum Knuth (Geraniaceae)*. *South African Journal of Botany* (1993) 59 (2) 259–264 [En, af, Bc]

Observations of *P. dolomiticum* showed that the flowers were protandrous. The only insect visitors to collect pollen were honey bees (*Apis mellifera*). Seed set in open-pollinated flowers was 70%. Emasculated bagged flowers set no seed. Nectar was produced during both sexual phases and bees visited irrespective of sexual phase. Most honey bees visited only one flower per plant and stayed for only two seconds. J.M. Gedye
National Museum, PO Box 266, Bloemfontein 9300, South Africa.

Sri Lanka

Commonwealth Secretariat; International Bee Research Association (eds). *Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth.* London, UK; Commonwealth Secretariat. (1979) viii + 196pp. ISBN 0-85092-160-0 [En, B]

The papers selected for this book present widely differing examples of achievements and difficulties in various parts of the developing world. There are 11 original contributions, and these are abstracted or listed separately. The remainder are reprinted extracts from various sources, which have already been reported in *Apicultural Abstracts* [54L/65; 57L/66; 1168, 1169, 1250L, 1251L, 1359/77; 131L, 132, 139, 432/78]. Appendix I (pp. 190–194) lists the common nectar sources in Malta, Sri Lanka, the Guianas and Belize, which form part of articles on these countries. Appendix II (pp. 195–196) is a conversion table of non-metric into SI units. *P. Walker*

Marlborough House, London SW1Y 5HX, UK.

Sri Lanka, Bureau of Ceylon Standards. *Specification for bee's honey.* *Sri Lankan Standard* (1979) (No. SLS 464:1979) 25 pp. [En]

Requirements for sampling and tests for moisture, reducing sugars, sucrose, ash, acidity, HMF.

Food and Agriculture Organization of the United Nations. *Proceedings of the Expert Consultation on Beekeeping with Apis mellifera in Tropical and Sub-Tropical Asia, Bangkok/Chiang Mai, Thailand, 9–14 April 1984.* Rome, Italy; Food and Agriculture Organization of the United Nations. (1984) v + 250 pp. [En, B]

The proceedings include nine technical papers on various aspects of beekeeping in Asia, including: constraints caused by parasitic mites; bee forage; pollination; honey production; beekeeping in rural economies. Of these papers, four are abstracted or listed individually in *Apicultural Abstracts*. There are also 'status reports' for the following: Afghanistan, Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, Western Samoa. The proceedings also contain a list of participants, list of apiaries visited, and the resolutions of the meeting. *D. G. Lowe*
Thailand, Department of Agricultural Extension;

International Development Research Centre. *The consultation of beekeeping development on Apis cerana, 16–17 January 1986, Phuket, Thailand.* Bangkok, Thailand; Department of Agricultural Extension. (1986) xi + 105 pp. [En, lost in mail 1999]

The proceedings of this meeting (photocopied from typed manuscripts) include the texts of 13 papers that were presented (three are in Thai). Several papers deal with various aspects of *Apis cerana* beekeeping in Thailand, and three discuss the research programmes of Kasetsart University, Chulalongkorn University, and the Entomology and Zoology Division of the Department of Agriculture. Other contributions describe beekeeping in Malaysia, Sri Lanka

and China. There is also one paper on Africanised honeybees (*A. mellifera*). *D. G. Lowe*

Baptist, B. A. *Beekeeping development programmes in Sri Lanka. Apiculture in tropical climates, editor E. Crane.* London, UK; International Bee Research Association. (1976) 135–142 [En, B] Dept. Agric. Biology, Univ. Sri Lanka, Peradeniya, Sri Lanka.

Honey production from hunting (*Apis dorsata*) and beekeeping (*Apis cerana*) is described. Honey sources are discussed, and the bases for an action programme are set out. Establishment of suitable vegetation areas, bee breeding and bee management, and beekeeper training, are all necessary. An appendix summarises regional features of climate and flora. *E. E. Crane*

Baptist, B. A. and Punchihewa, R. K. W. *A preliminary analysis of the principal factors which will affect apiary honey production in Sri Lanka.* Proceedings of the Second International Conference on Apiculture in Tropical Climates, New Delhi, February 29–March 4, 1980. (1983) 87–99 [En, B]

The physiographical and climatic characteristics of Sri Lanka are described, with particular reference to their effects on vegetation. The 11 commonest bee forage plants are listed, with their flowering periods, but their relative values as nectar plants have not yet been assessed. Of cultivated species, *Hevea brasiliensis*, *Cocos nucifera*, *Eucalyptus robusta* and *Tectona grandis* are the most important sources of nectar. Most of the honey sold in Sri Lanka is obtained from *Apis dorsata* and *A. cerana* by honey hunting. Traditional beekeeping, using round clay pots, is practised in parts of Sri Lanka, but there are few beekeepers with modern hives. A preliminary trial in 1978–79 to evaluate management methods, honey flows and migratory beekeeping, gave disappointing results in terms of honey yields. Requirements for further research are discussed. *D. G. Lowe*

CIDA – Sri Lanka Apiculture Project, Dept. Agric., Sri Lanka.

Crane, E. *The origination of Apis cerana beekeeping and its determining factors. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.* London, UK; International Bee Research Association. (1989) 425–437 ISBN 0-86098-196-7 [En, Bdo]

The following six possible stages in beekeeping in Asia are discussed: (1) opportunistic collection of honey from wild bees' (*Apis* spp.) nests; (2) ownership of wild *A. cerana* nests; (3) keeping *A. cerana* in fixed-comb hives; (4) keeping *A. cerana* in movable-comb top-bar hives; (5) keeping *A. cerana* in modern movable-frame hives; (6) keeping introduced *A. mellifera* in modern hives. Stages 3, 5 and 6 are described in greater detail, and a table is presented showing the probable dates when these first occurred in various parts of Asia. Regions where beekeeping with *A. cerana* is likely to have started early are thought to include

Kashmir, northern India, Pakistan, Afghanistan, Japan, Korea, Russian Far East and China, whereas it probably started late in the rest of India, Sri Lanka, Nepal, Tibet and Bhutan, and the countries of south-east Asia. It is suggested that knowledge of the history of *A. cerana* beekeeping should be applied to answering questions concerning the promotion of present-day beekeeping and to the choice of hive type in a particular area. *D.G. Lowe*

Dyer, F.C. and Seeley, T.D. *Dance dialects and foraging range in three Asian honey bee species*. *Behavioral Ecology and Sociobiology* (1991) 28 (4) 227–233 [En, Bc]

'Distance dialects' were measured in the dances of *Apis florea*, *A. cerana* and *A. dorsata* in Thailand. The dialects were then used to examine the hypothesis that a colony's dialect is adaptively 'tuned' to enhance efficiency of communication over the distances that its foragers typically fly. No striking dialect differences were found (in contrast to results of previous interspecific comparisons in Sri Lanka). The adaptive tuning hypothesis predicts that the foraging ranges of these three species should also be similar, but comparisons of colonial foraging range using the 'forage mapping' technique actually revealed marked differences. This raises the possibility that the link between foraging ecology and distance code in the dance is more subtle than previously supposed, if a link exists at all. *Author*
Department of Zoology, Michigan State University, East Lansing, MI 48824, USA.

Fernando, E.F.W. *Studies on apiculture in Sri Lanka. 1. Characteristics of some honeys*. *Journal of Apicultural Research* (1978) 17 (1) 44–46 [En, B]

The physico-chemical characteristics of four types of Sri Lanka honey, including one from extrafloral rubber nectar, are reported. They conformed reasonably well with the Indian Standard Specification for honeys of *Apis cerana* and with the European regional standard for honey. *Author*

Dept. Zoology, Vidyalkara Campus, Univ. Sri Lanka, Kelaniya, Sri Lanka.

Fernando, E.F.W. *The ecology of honey production in Sri Lanka. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) 115–125 [En, B]

The typical vegetation of each of the four main regions is described. Appendix 1b (pp. 191–192) lists 26 important honeybee forage plants, with their flowering dates; this is a preliminary list (mainly for the dry zone) and there are many other plants to be evaluated. The rich forest flora, particularly in the dry zone, sustains many wild colonies of *Apis cerana*, *A. dorsata* and *A. florea*. During the main nectar flow (June to September) honey hunters collect honey from these colonies, especially from *A. cerana*. The foraging activity of an *A. cerana* colony was observed in an area growing coconut; only about 25% of foragers were collecting pollen, and this was done mostly before 10.00 hours. Nectar foraging activity was greatest in the early morning, with a small afternoon peak. The bees also visited male inflorescences which had been injured by tapping for the collection of an exudate to make 'toddy'; *A. cerana* consti-

tuted about 77% of the insect visitors to these exudates, which have a high sugar content. The resulting honey would not be of good quality, but it is suggested that more apiaries could be established in such coconut plantations, particularly in the lowland wet zone, where migration of the colonies to rubber plantations is economically feasible. *P. Walker*

Dept. Zoology, Vidyalkara Campus, Univ. Sri Lanka, Kelaniya, Sri Lanka.

Fernando, E.F.W. *Some biometrical features of Apis cerana F. from Sri Lanka*. *Indian Bee Journal* (1979) 41 (1/2) 5–8 [En, B]

Biometrical studies were carried out on the proboscis and the number of wing hooks of worker *Apis cerana* collected from wild colonies in four lowland and two montane districts. The mean proboscis length of bees from Anuradhapura (lowland) was significantly lower than that of bees from the montane and the other three lowland areas. The mean length in the montane districts was significantly greater than the mean for any of the lowland groups. No significant difference was observed in the number of wing hooks between bees from the localities studied. The results indicate the existence of at least three ecological strains. *Author*

Dept. Zoology, Univ. Kelaniya, Kelaniya, Sri Lanka.

Hirashima, Y. *Some Asian species of Austronomia, a sub-genus of Nomia, with descriptions of three new species from Sri Lanka (Hymenoptera, Halictidae)*. *Esakia* (1978) (No.12) 89–101 [En, B]

Howpage, D. *Beekeeping in Sri Lanka*. *Beekeeping & Development* (1991) (No. 19) 10–11 [En, B]

Apiculture development project at Bindunuwewa, Bandarawela, Sri Lanka.

Inoka, W.A., Karunaratne, P. and Edirisinghe, J.P. *Bee diversity and floral hosts in selected habitats of the Peradeniya University Park*. *Ceylon Journal of Science, Biological Sciences* (2002) 30 21–36 [En, X]

In this study in Sri Lanka, 48 species of bees in 21 genera and four families (Anthophoridae, Apidae, Halictidae and Megachilidae) were identified; 43.8% of the total belonged to the genus *Lipotriches* (*Nomia*). *Apis cerana*, *A. dorsata*, *A. florea* and *Trigona iridipennis* were all present. The floral hosts were 26 plant species in 12 families, especially *Asteraceae*. Bee diversity was apparently determined by the availability of suitable plants; rice fields, weedy areas and built-up areas had the highest species diversity.

Dept of Zoology, Faculty of Science, Univ. of Peradeniya, Peradeniya, Sri Lanka.

Koeniger, N. and Koeniger, G. *Observations and experiments on migration and dance communication of Apis dorsata in Sri Lanka*. *Journal of Apicultural Research* (1980) 19 (1) 21–34 [En, B]

Apis dorsata has a regular annual cycle of migration in Sri Lanka. In February the colonies are spread throughout the coastal plains and the North Central Region. In June and July they migrate to the Up Country, which they leave again in October–November. The swarms seem to migrate

in several stages, remaining for some days at a resting place between flights. These have different characteristics from the nest sites. Before the swarm flew off, migration dances indicated the direction of its departure. These dances occurred all over the cluster, unlike food dances which occurred only on the area where the light intensity was greatest. If the bees could not see the sun or sky, dance and flight activities were very low, but migration dances indicated a constant direction. With an indirect view of the sky through a mirror, activity was greater than with none, but the direction of migration dances was not changed. Swarms left in the direction indicated by migration dances. Queenless portions of swarms were able to become airborne suddenly, and to fly in a co-ordinated way. Cluster formation was induced by 1 mg 9-oxo-trans-2-decenoic acid. *Author*

Inst. Bienenkunde, Univ. Frankfurt, 6370 Oberursel/Ts., Im Rothkopf 5, Germany.

Koeniger, N. and Koeniger, G. Change of host by parasitic mites in Asia after a new honeybee species is introduced. *Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5-9 November 1984.* (1985) 160-162 [En, B]

Summary of work in Sri Lanka.

Koeniger, N., Koeniger, G. and Delfinado-Baker, M. Observations on mites of the Asian honeybee species (*Apis cerana*, *Apis dorsata*, *Apis florea*). *Apidologie* (1983) 14 (3) 197-204 [En, de, fr, B]

Capped worker brood cells taken from six *A. cerana* colonies (in modern hives) in Sri Lanka were examined; *Varroa jacobsoni* mites (no reproductive stages) were present in a few worker cells from two colonies. Worker and drone brood from five colonies in Java were also examined. The numbers of mites were highest in drone cells, and reproductive stages were present only in drone cells. Drone cells containing dead pupae had not been uncapped by the bees, so mites present in these cells had died. *Euvarrhoa sinhai* was found in low numbers in all *A. florea* colonies examined (first report for Sri Lanka); *Tropilaelaps koenigerum* was present in five of six *A. dorsata* colonies. *Neocypholaelaps indica* (a pollen feeder) was found in colonies of all three *Apis* species; it has not previously been recorded on *A. dorsata* and *A. florea*. *P. Walker*

Inst. Bienenkunde, Univ. Frankfurt, Karl-von-Frisch-Weg 2, 6370 Oberursel, Germany.

Koeniger, N., Koeniger, G. and Wijayagunasekara, N.H.P. Observations on the adaptation of *Varroa jacobsoni* to its natural host *Apis cerana* in Sri Lanka. [*Beobachtungen über die Anpassung von Varroa jacobsoni an ihren natürlichen Wirt Apis cerana in Sri Lanka*]. *Apidologie* (1981) 12 (1) 37-40 [De, en, fr, B]

Seven colonies were examined by opening capped brood cells; *V. jacobsoni* was found in all colonies. All of the 66 adult mites found on drone pupae had produced nymphs and young females, whereas no nymphs or eggs were found on worker pupae. If this is true in general for *A. cerana*, it may be one of the reasons why the mite is less harmful to *A. cerana* than to *A. mellifera*, where *Varroa* reproduces on worker as well as on drone brood. *P. Walker*

Dep. Environmental Biology, Univ. Guelph, Ont. N1G 2W1, Canada.

Koeniger, N. and Vorwohl, G. Competition for food among four sympatric species of *Apini* in Sri Lanka (*Apis dorsata*, *Apis cerana*, *Apis florea* and *Trigona iridipennis*). *Journal of Apicultural Research* (1979) 18 (2) 95-109 [En, B]

Competition experiments at an artificial feeding dish revealed interactions among the species according to body size: *Trigona* attacked mainly *A. florea* and *A. cerana*; *A. florea* reacted to *A. cerana*, and *A. cerana* attacked *A. dorsata*. In exclusion experiments, smaller species proved more successful than larger ones. Altogether 51 comb samples with honey and pollen stores were examined microscopically; 46 pollen types recorded are listed, and most of them identified. The average number of different pollens in individual samples, and the absolute number in all samples from one bee species, were highest for *T. iridipennis* and lowest for *A. dorsata*. There was a correlation between the aggressiveness of a bee species and the versatility of the pollens in food stores. For some of the most common bee plants, correlations were found between body size of the bee species and the frequency of occurrence of the pollen grains in its food stores. Competition for food is not a limiting factor for the co-existence of the four bees studied. The disadvantage of the limited flight range of a small species is compensated by a more aggressive behaviour, which allows it to defend food sources in its smaller territory, and then to prevent disastrous competition. *Author*
Inst. Bienenkunde, Univ. Frankfurt, Im Rothkopf 5, 6370 Oberursel, Germany.

Krell, R. The results of diminishing forest resources on management and productivity of honey bees, based on examples of three tropical countries. *Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7-12 September 1992.* Cardiff, UK; International Bee Research Association. (1994) 35-37 ISBN 0-86098-215-7 [En, Bdo]

Nectar sources provided by the forests of Guyana, Belize and Sri Lanka are discussed.

ICON Development, Viale Regina Margherita 239, 00198 Rome, Italy.

Krombein, K.V. and Norden, B.B. Notes on trap-nesting Sri Lankan wasps and bees (Hymenoptera: Vespidae, Pompilidae, Sphecidae, Colletidae, Megachilidae). *Proceedings of the Entomological Society of Washington* (2001) 103 (2) 274-281 [En, X]

Dept of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0188, USA.

Pasteels, J.J. Megachilidae (Hymenoptera, Apoidea) collected by Dr. K. V. Krombein and his team in Sri Lanka. *Bulletin et Annales de la Societe Royale Belge d'Entomologie* (1987) 123 (7/9) 225-236 [Fr, en]

Universite Libre de Bruxelles, Avenue Delleur 35, 1170 Brussels, Belgium.

Punchihewa, R.W.K. Mating behaviour of *Apis cerana* in Sri Lanka is advantageous for controlled natural breeding.

[[Summary]]. *Apidologie* (1992) 23 (4) 348–349 [En\ De\ Fr, Bj]

Drones set off on mating flights between 15.00 and 17.00 hours. On average, a drone performed four mating flights, each lasting 12 min, with 3 minutes in the hive between flights. Drone congregation areas (DCAs) were seen in the tree canopy within about 500 m of the apiary. Drones from any one colony flew to various DCAs, but no further than 300 m from the hive. The mating flights of nine queens were also observed; mean flight duration was 9 minutes. All queens returned with a mating sign after their first flight, and the oviducts of a queen contained, on average, 7×10^6 spermatozoa, indicating that she had been mated by about seven drones. After the start of egg laying, the spermatheca contained an average of 1×10^6 spermatozoa. It is concluded that, as distances of mating flights are short, isolated mating apiaries can be set up. *P. Walker*

Honeybee Research Facility, Horticulture Station, Kananwila, Horana, Sri Lanka.

Punchihewa, R.W.K. *Beekeeping for honey production in Sri Lanka: management of Asiatic hive honeybee *Apis cerana* in its natural tropical monsoonal environment.* Peradeniya, Sri Lanka; Sri Lanka Department of Agriculture and Canadian International Development Agency. (1994) xxii + 232 pp. ISBN 955-9282-01-8 [En]

Many previous books about beekeeping with *Apis cerana* have been founded on adaptations of techniques for temperate-zone apiculture using *Apis mellifera*, but this comprehensive manual is based soundly on research and practical beekeeping experience with *A. cerana*. The author first reviews honey bee biology, concentrating on *A. cerana* but considering the other two species found in Sri Lanka (*A. florea* and *A. dorsata*). The majority of the book is directly practical, with chapters on the principles of beekeeping, the relationship between animal husbandry and beekeeping, hive design for *A. cerana*, colony population increase and management, swarming management and making increase, supplementary feeding, preventing absconding, pest incidence, use of the smoker, extracting honey, the economics of beekeeping. There is also a glossary, a short reference section, an appendix of historical documents on beekeeping in Sri Lanka, and a subject index. The book is well illustrated by 116 colour photographs, 42 diagrams and a map of Sri Lanka's natural resource zones. Though this book is written for Sri Lankan conditions much of it will be directly applicable to *A. cerana* beekeeping in coconut- and rubber-growing zones elsewhere in Asia, and will be of use to anyone interested in the management of *A. cerana*. *A.G. Matheson*

Honeybee Research Facility, Horticulture Station, Kanawila, Horana, Sri Lanka.

Punchihewa, R.W.K., Koeniger, N., Kevan, P.G. and Gadawski, R.M. *Observations on the dance communication and natural foraging ranges of *Apis cerana*, *Apis dorsata* and *Apis florea* in Sri Lanka.* *Journal of Apicultural Research* (1985) 24 (3) 168–175 [En, B]

The dance communication of Asiatic honeybees is qualitatively similar to that of *Apis mellifera*. However, in *A. cerana* and *A. florea* foraging at artificial feeders the dance tempo was observed to decline (i.e. the time per dance increased)

more rapidly than has been reported for *A. mellifera* as distance to the food source increased. *Apis cerana* and *A. florea* forage over short distances; at three of the six sites in this trial *A. cerana* did not visit feeders beyond 500 m. In *A. dorsata* the change in dance tempo with increasing distance to forage was much slower and similar, in this respect, to that reported for *A. mellifera*. Both *A. dorsata* and *A. mellifera* are able to forage over long distances, although in this trial 72% of *A. dorsata* foragers did not fly beyond 400 m. *Apis cerana* and *A. florea* may be unable to communicate long distances to food sources, as these distances would be indicated by very slow dances. These potential intrinsic limits, and observed constraints on foraging distance in *A. cerana*, suggest that beekeepers should manage *A. cerana* in small, well separated apiaries. In this way floral resources over small areas would not become so depleted by high densities of bees that honey yields are reduced.

Author

Apiculture Dev. Centre, Dept. Agric., Bindunuwewa, Bandarawela, Sri Lanka.

Punchihewa, R.W.K., Koeniger, N. and Koeniger, G. *Congregation of *Apis cerana indica* Fabricius 1798 drones in the canopy of trees in Sri Lanka.* *Apidologie* (1990) 21 (3) 201–208 [En, fr\ de, Bj]

Drone congregations of *Apis cerana* in Sri Lanka were found in the canopy of trees. The space in which the drones were flying had distinct borders demarcated horizontally and vertically by the canopies of trees: the area was about 10 x 6 m and the height of flight was between 4 m and 8 m. Some drones (118) were caught and marked at the congregation area. Marked drones were found within a radius of 100 m of each drone colony. The rate of recovery was 92% after 24 hours. The flight range of the drones was therefore very limited. The differences between drone congregation areas in Sri Lanka and of *Apis mellifera* in Europe are discussed. *Author*

Agric. Res. Stn., Sri Lanka Dept. Agric., Makandura, Gonawila (NWP), Sri Lanka.

Robinson, W.S. *Beekeeping with *Apis cerana* in Sri Lanka.* *Bee World* (1988) 69 (3) 125–130 [En, Ba]

In 1985 there were about 40,000 hives in Sri Lanka, about 40% of which were movable-frame; traditional hives are usually clay pots or hollow logs. Honey is used widely in traditional medicines and for table consumption, and costs about 80 rupees/kg (US\$1.40/lb). Most of the honey produced is extracted by squeezing or straining and is not of a high standard. Yields are low, perhaps 1–3 kg/hive, and beekeeping is not carried out commercially. There is a great diversity of bee forage, but it is threatened by deforestation, land cultivation and settlement schemes. Management techniques are discussed briefly, and the role of the Canadian International Development Agency (CIDA) in development schemes is mentioned. Diseases and mite infestations do not appear to cause serious problems, but enemies such as hornets and ants can cause severe colony losses. It is concluded that research and extension services could help the full potential of beekeeping in Sri Lanka to be realised. *D.G. Lowe*
P.O. Box 4329, Casper, WY 82604, USA.

Ruttner, F., Pourasghar, D. and Kauhausen, D. *Honeybees of Iran. 1. Apis florea*. [Die Honigbienen des Iran I. *Apis florea* Fabricius.]. *Apidologie* (1985) 16 (2) 119–137 [De, en\ fr, B]

A. florea colonies were found all along the southern boundary of Iran, from Baluchistan, near Pakistan (latitude 28°), along the coasts of the Gulf of Oman and the Persian Gulf to Luristan in NW Iran (latitude 34°). Along this strip, it is very hot in summer and there is little or no frost in winter. Most *A. florea* nests were found in towns and villages, not only on tree branches but also outside or inside buildings. When attaching a nest to a wall or under a ceiling *A. florea* modifies the usual comb structure which surrounds a tree branch. The size of combs measured was relatively large for *A. florea*, and morphometric analysis of samples of Iranian *A. florea* showed that they are larger than *A. florea* in Oman, Pakistan and Sri Lanka. The Iranian population may have evolved independently. At swarming time (May–June) 1–20 queen cells are built; the bees may migrate from the plains to the hills. P. Walker
Inst. Bienenkunde, Univ. Frankfurt, Karl-von-Frisch Weg 2, 6370 Oberursel, Germany.

Sakagami, S. F. *Tetragonula stingless bees of the continental Asia and Sri Lanka (Hymenoptera, Apidae)*. *Journal of the Faculty of Science, Hokkaido University, VI (Zoology)* (1978) 21 (2) 165–247 + 1 pl. [En, B]

A revision is presented for bees of the genus *Trigona*, subgenus *Tetragonula* Moure (= *Trigona iridipennis* group), of Continental Asia and Sri Lanka. Thirteen species including six new species are recognised; the species of which both male and female are known are classified into four groups. The type species *T. iridipennis*, previously described as widespread from Sri Lanka and India to the Solomon Islands, is redefined as belonging only to Sri Lanka and India. *T. laeviceps* represents a group common in south-east Asia. P. Walker

Zoological Inst., Hokkaido Univ., Nishi 8, Kital 9, Sapporo, 060 Japan.

Sakagami, S. F., Ebmer, A. W. and Tadauchi, O. *The halictine bees of Sri Lanka and the vicinity. III. Sudila (Hymenoptera, Halictidae) Part 1*. *Esakia* (1996) (No. 36) 143–189 [En, Bb]

The genus *Sudila*, mainly characterised by male gigantism, is reinterpreted as a subgenus of *Lasioglossum*, with six species.

Ainosato, 1-6, 2-2-6 10 Kitaku, Sapporo 002, Japan.

Snelling, R. R. *New bees of the genus Hylaeus from Sri Lanka and India (Hymenoptera: Colletidae)*. *Natural History Museum of Los Angeles County Contributions in Science* (1980) (No. 328) 1–18 [En, B]

Szabo, T. I. *Sri Lanka: the bee paradise*. *American Bee Journal* (1988) 128 (6) 405–409 [En, Bj]

Describes beekeeping on the island; in 1985 the 23,500 *Apis cerana* colonies in hives produced 39,390 kg honey.

Szabo, T. I. *Morphometric characteristics of Apis cerana from Sri Lanka*. *Apidologie* (1990) 21 (6) 505–509 [En, fr\ de, Bj]

Samples of workers were collected from 11 *A. cerana* colonies in different parts of the island. The coefficients of variability of 19 morphological characteristics were calculated and a tergite colour classification was carried out. The greatest mean coefficient of variability was 24.41% for tergite colour, and 7.94% for proboscis length, while the least variable was 1% for forewing length. The possibility of using highly variable simple characteristics in tandem selection is suggested. Author

Agriculture Canada Research Station, Box 29, Beaverlodge, Alta. T0H 0C0, Canada.

Wickramaratne, M. R. T. and Vitarana, S. I. *Insect pollination of tea (Camellia sinensis L.) in Sri Lanka*. *Tropical Agriculture* (1985) 62 (3) 243–247 [En, Bc]

Insects visiting a tea seed crop were collected throughout the year (52 sampling dates) and identified to family. The most numerous insects were *Diptera*, constituting 60–90% of total insects caught. *Hymenoptera* comprised 2–16% of the total insects caught, most being found from January to June. Very few bees (*Apidae*) were present (only 0.15% of the *Hymenoptera*). Over 80% of the insects captured on the flowers had tea pollen on their bodies. Flies seemed to be the best cross-pollinators as they moved rapidly between flowers and between plants. Bees probably effected more self-pollination as they foraged systematically on the flowers of one plant before moving to the next. It is suggested that they could be used for cross-pollination in suitably planted areas. The percentage of flowers pollinated ranged from 25% in December to 54% in July, but ranged from only 1.4% in May and April to 6.1% in November. The number of fruits reaching maturity was only 2% of the total number of flowers, but this is not attributed to lack of pollinating insects. P. Walker

Tea Research Inst., Talawakele, Sri Lanka.

Wickramasinghe, R. H. *Bee keeping and its management on coconut, rubber, cashew, citrus, gingelly, fruit, timber and other plantations*. *Journal of the National Institute of Plantation Management* (1983) 2 (1) 94–104 [En, Bc]
Beekeeping in Sri Lanka.

Wickramasinghe, R. H. *Honey usage in Sri Lanka's pre-history*. *Loris* (1993) 20 (2) 39–42 [En, Bc]

Institute for Tropical Environmental Studies, 41 Flower Road, Colombo 7, Sri Lanka.

Wilson, G. D. *Marketing pure bees honey in Sri Lanka. The Asiatic hive bee: apiculture, biology, and role in sustainable development in tropical and subtropical Asia [edited by Kevan, P. G.]*. Cambridge, Canada; Enviroquest Ltd. (1995) 245–248 ISBN 0-9680123-0-2 [En, Bdo]

The elements involved in marketing are defined as product, place, promotion and price. These are discussed in relation to the selling of honey, particularly in Sri Lanka. The importance of quality, packaging and brand establishment in satisfying consumer need or desire is stressed, and the initial experiences of the Sri Lankan Honey Production Project are described. D. G. Lowe

Swaziland

Bechtel, P. *Construction of the 'Mpofu hive'*. Newsletter for Beekeepers in Tropical and Subtropical Countries (1988) (No.13) 6-7 [En, Bj]

Instructions and diagrams are given for constructing a top-bar hive made of mud bricks (or stones), mortared with mud, and plastered with a cement plaster. The lid is made of a sheet of metal or plastic fertiliser sacks. The hive is permanently fixed to the ground (10-20 cm foundations) and cannot be moved (nor stolen). It is very durable, cheap to make, and is cool for bees in hot climates. The walls and floor are ant-proof, and the hive can be sterilised by building a fire inside it. Hives of this construction have been used successfully in the Mpofu area of Swaziland.

D. G. Lowe

Bee School, Lutheran Farmers' Training Centre, Box 229, Piggs Peak, Swaziland.

Bechtel, P. and Gau, K. *Introduction to beekeeping*. Mbabane, Swaziland; Ministry of Agriculture and Cooperatives. (1988) ii + 92 pp. [En, Bdo]

This book, No. 92 in a series of *Field Support Guides*, has been produced in order to provide basic information for Swazi people wishing to start a beekeeping enterprise. It covers: reasons for, and economics of, starting beekeeping; trapping bees with a bait box; setting up an apiary; veils; smokers; hives; hive stands and ant control; working with bees; feeding bees; and beekeeping development in Swaziland. Three appendices give information on planting gum trees (*Eucalyptus* spp.), beekeeping resources in Swaziland, and a glossary of beekeeping terms in English and siSwati. The Guide is well illustrated with drawings and diagrams and the instructions are clearly and simply written. D. G. Lowe

Gau, K. *A review of the Swaziland beekeeping project*. Piggs Peak, Swaziland; Near East Foundation and Home Economics/Beekeeping. (1992) 95 pp. [En, Bdo]

The objectives, methods and achievements of this beekeeping development project are described for the period 1985-91, and recommendations for the future are made. D. G. Lowe

Liberman, H. M. *Beekeeping in Swaziland, southern Africa*. *Gleanings in Bee Culture* (1987) 115 (1) 39 [En, Bj]

Motsa, C., Gau, K. and Bechtel, P. *Training for self-reliance: development of the Swaziland beekeeping project*. *Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6-10 November 1988*. London, UK; International Bee Research Association. (1989) 192-194 ISBN 0-86098-196-7 [En, Bdo]

Nkhambule, M. D., Bechtel, P. and Gau, K. *Factors influencing the design of beekeeping equipment in Swaziland*. *Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6-10 November 1988*. London, UK; International Bee Research Association. (1989) 353-358 ISBN 0-86098-196-7 [En, Bdo]

Werger, M. J. A. (ed.). *Biogeography and ecology of Southern Africa*. Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first 6 chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7-14 cover the main biogeographical areas and their vegetation e.g. the afro-montane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16-31 each cover a major taxonomic group of animals. Chapter 27, by A. J. Prins, covers the Hymenoptera. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853-857 briefly describe the Apoidea known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. D. G. Lowe

Tonga

Manson, D. C. M. *A new genus and species of mesostigmatid mite (Acarina: Ameroseiidae) associated with honey bees from Tonga [published as: A new species, genus and subfamily of mesostigmatid mite (Acarina: Ascidae) associated with honey bees from Tonga]*. *Journal of the Royal Society of New Zealand* (1974) 4 (2) 115-122 [En, B]

Edbarellus tonganus n.gen. et sp. is described from specimens collected from honeybees in Tonga. A key is presented to all the known genera of the Ameroseiidae. Author Min. Agric. and Fisheries, Levin, New Zealand.

Walton, G. M. *Beekeeping development programmes in the tropical and subtropical Pacific*. *Apiculture in tropical climates*, editor E. Crane. London, UK; International Bee Research Association. (1976) 159-164 [En, B]

The area dealt with is perhaps the least well known from the point of view of beekeeping development. The report covers New Zealand aid programmes in Papua New Guinea, Niue, Tonga, Gilbert Islands, Western Samoa; other aid projects in Rarotonga and Fiji; beekeeping activities in the Hawaiian Islands, American Samoa, French Polynesia, Micronesia, New Caledonia, Wake Island. E. E. Crane
Min. Agric. and Fisheries, Private Bag, Palmerston North, New Zealand.

Trinidad and Tobago

Laws and Statutes. Laws of Trinidad and Tobago. Chapter 67:53. Beekeeping and Bee Products Act. (1980) 20 pp. [En, B]

Current authorised revision of 1935 Act (amended 1949).

Beekeeping & Development. Zooming in on ... Trinidad and Tobago. Beekeeping & Development (1991) (No. 20) 9 [En, Bj]

Beekeeping statistics are given for Trinidad and Tobago.

Inter-American Institute for Cooperation on Agriculture. Proceedings, First Regional Training Workshop for Beekeeping, Castries, St. Lucia, May 11–13 1992. Castries, St. Lucia; Inter-American Institute for Cooperation on Agriculture. (1992) v + 129 pp. + 6 pp. [En, Bdo]

The first section of the Proceedings gives details of the workshop agenda, opening ceremony, and conclusions and recommendations. The second section contains reports on beekeeping in Antigua and Barbuda, Barbados, Dominica, Florida (USA), Grenada, Guadeloupe, Martinique, Montserrat, Nevis, Puerto Rico, Saint Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago. Section 3 comprises 10 technical papers on various aspects of Caribbean beekeeping, including Africanised honey bees, legislation, bee forage, hive products and marketing opportunities, queen rearing, and beekeeping organisations in the Caribbean. The final section concerns agro-forestry and environmental protection in the Caribbean. D.G. Lowe

IICA Office in Saint Lucia, PO Box 1223, Castries, Saint Lucia.

International Conference on Apiculture in Tropical Climates, 5th. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 1992. Cardiff, UK; International Bee Research Association. (1994) 319 pp. ISBN 0-86098-215-7 [En, Bdo]

This book contains the texts of 49 contributions presented at the conference, the addresses made at the opening and closing sessions, the conference resolutions, names of conference officers and delegates, and an author index. The papers are grouped under seven subjects: biology and behaviour of tropical bees; honey bee management; honey bees and the environment; mite parasites, pests and diseases of honey bees; beekeeping and development; Africanised honey bees; stingless bees. There are also four country reports and brief accounts of three workshops, involving African delegates, Caribbean delegates, and a discussion on top-bar hive beekeeping. The mixture of research results, techniques, reports and experiences contained in the Proceedings will be of interest to beekeepers, bee scientists and those involved in development work in tropical countries. D.G. Lowe

Aymard, G. and Thimann, R. Bee forage of Mesa de Cavacas, Portuguesa State, Venezuela. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.

Cardiff, UK; International Bee Research Association. (1994) 55–66 ISBN 0-86098-215-7 [En, Bdo]

A table gives details for 150 plant species of beekeeping interest, including common and scientific names, flowering period and nectar and/or pollen source.

Programa Recursos Naturales Renovables, Universidad 'Ezequiel Zamora', Guanare Edo, Portuguesa, Venezuela.

Bootsma, M. C., Sommeijer, M. J. and Punt, W. Study of floral resources of *Melipona trinitatis* at four localities in Trinidad, West Indies. [Etude des ressources florales de *Melipona trinitatis* (Hym., Meliponinae) a quatre localites a Trinidad, Antilles.]. Actes des Colloques Insectes Sociaux, Vol. 4. Compte rendu Colloque annuel, Paimpont, 17–19 September 1987. Paris, France; Ecole Normale Supérieure. (1988) 295–299 ISBN 2-905272-02-4 [Fr, en, Bd]

Two hives containing *M. trinitatis* colonies were established at each of four locations in northern Trinidad. Samples of pollen loads from corbiculae of returning foragers were taken at weekly intervals from 5 May–6 June 1987. Pollen analyses showed a number of similarities in the pollen sources at the sites, but some pollen types varied between sites in their importance. *Psidium guajava* was the most important species at all sites, and other important sources were *Mimosa pudica*, *Lagerstroemia* sp., *Solanum* sp. and certain *Loranthaceae*. D.G. Lowe

Lab. Physiologie Comparee, Univ. Utrecht, Utrecht, Belgium.

Bruijn, L. L. M. de; Sommeijer, M. J. Colony foraging in different species of stingless bees (Apidae, Meliponinae) and the regulation of individual nectar foraging. *Insectes Sociaux* (1997) 44 (1) 35–47 [En, Ba]

Experiments were carried out in Costa Rica, Trinidad and Tobago, and a tropical greenhouse at Arnhem, Netherlands, in order to study differences in the foraging behaviour of *Melipona fasciata*, *M. beechei*, *M. favosa* and *Tetragonisca angustula*. The *Melipona* species had a longer daily foraging activity period than *T. angustula*. Pollen foraging patterns of the *Melipona* species were different from that of *T. angustula*: *Melipona* bees collect pollen earlier in the day. In an experimental habitat without competitors, *Melipona favosa* did not collect pollen very early in the day. Individually marked returning foragers demonstrated in the course of the day distinct differences in nature and frequency of interactions with nestmates. Individual foraging flight frequency was lower and the intranidal transfer of nectar was delayed when syrup of a lower concentration was offered. The regulation of daily foraging activity patterns and the nectar foraging behaviour of individual worker bees are discussed. Author

Department of Social Insects, Ethology and Socio-ecology, Laboratory of Comparative Physiology, Utrecht University, P.O. Box 80.086, NL-3508 TB Utrecht, Netherlands.

Bruijn, L. L. M. de, Sommeijer, M. J., Biesmeijer, J. C., Nieuwstadt, M. J. van and Kraaykamp, H. Honey produc-

tion in stingless bees: differences in flight activity and foraging between *Melipona* and *Tetragonisca*. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.

Cardiff, UK; International Bee Research Association. (1994) 221–226 ISBN 0-86098-215-7 [En, Bdo]

Observations were made of the flight activity of three species of *Melipona* and *Tetragonisca angustula* in their natural habitats in Trinidad and Costa Rica, and in Burgers' Bush, a large tropical greenhouse in the Netherlands. Two distinct patterns were found. The *Melipona* species usually collected pollen in a short period of the day, most frequently at early hours. Nectar was collected in a much longer period with a maximum around noon. In *T. angustula* both nectar and pollen foraging took place throughout the day. Flight activity in *T. angustula* appeared to be correlated with light intensity, relative air humidity and temperature. In *M. beecheii* no such correlations were found. In Burgers' Bush, *M. favosa* did not show the typical *Melipona* activity pattern of natural habitats. The possible causes for these differences are discussed. *Author*
Bee Research Department, Utrecht University, PO Box 80 086, 3508 TB Utrecht, Netherlands.

Caron, D.M. Beekeeping in Trinidad. *American Bee Journal* (1989) 129 (9) 589–590 [En, B]

Feinsinger, P., Swarm, L.A. and Wolfe, J.A. Nectar-feeding birds on Trinidad and Tobago: comparison of diverse and depauperate guilds. *Ecological Monographs* (1985) 55 (1) 1–28 [En, B]

Francke, P.J., Siers, M.G. and Sommeijer, M.J. Foraging behaviour of stingless bees and honey bees with respect to three selected plant species on Tobago. *Proceedings of the Section Experimental and Applied Entomology of the Netherlands Entomological Society* (1996) 7 45–50 [En, Ba]

Daily patterns of foraging behaviour were studied in *Apis mellifera*, *Melipona favosa*, *Trigona nigra*, *Plebeia mosquito* and *Trigonisca buyssoni* on the flowering plant species *Antigonon leptopus*, *Mimosa pudica* and *Veichia palm*. Numbers of *A. mellifera* on the flowers were very low, although there were colonies in the study areas. There appeared to be no competition between the stingless bee species. The small species (*P. mosquito* and *T. buyssoni*) did not visit *A. leptopus*, probably because they cannot reach the nectar in flowers, or *M. pudica* because they could not obtain pollen by buzzing (sonication). *P. Walker*
Laboratory of Comparative Physiology, Utrecht University, Padualaan 14, P.O. Box 80.086, 3508 TB Utrecht, Netherlands.

Hallim, M.K. and Sommeijer, M.J. Beekeeping with *Melipona trinitatis* and *M. favosa* in Trinidad. *Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.* Cardiff, UK; International Bee Research Association. (1994) 227–229 ISBN 0-86098-215-7 [En, Bdo]
Ministry of Agriculture, Land and Marine Resources, St. Clair Circle, Port of Spain, Trinidad and Tobago, West Indies. In 1992 there were 60 beekeepers managing about 140 colonies of *Melipona trinitatis* in areas around Rio Claro,

Talparo and Arima, Trinidad. Colonies are collected from the natural nesting sites in hollow trees and transferred to wooden boxes, which are then hung from the roof of a house or placed on wooden stands or tables. Minimal management is practised and the boxes are generally opened only for the harvesting of honey during April and May. Honey yields are generally between 0.75 and 5.0 litres/colony. Stingless bee honey is often used by the beekeepers themselves or sold at prices twice as high as that for honey bee honey; it is mainly used in various medicinal treatments and in religious ceremonies. The major pests are phorid flies, ants and birds, and 'robber bees' (*Lestrimelitta* sp.) have also been reported. *D.G. Lowe*

Hallim, M.K. The presence of the Africanised bee in Trinidad. *Journal of the Agricultural Society of Trinidad and Tobago* (1980) 80 (4) 333–349 [En, B]

Hallim, M.K. Extension program suggestions for solving problems caused by Africanized bees in Trinidad and Tobago. MS Thesis, University of Guelph, Ontario, Canada. (1984) xi + 268 pp. [En, B]

Since the arrival of Africanised honeybees (*Apis mellifera scutellata* and its hybrids) in Trinidad in 1979, over 450 stinging incidents caused by them have been reported, and Government officers have destroyed more than 3,800 swarms of Africanised bees. In 1981 there were 430 beekeepers on the islands managing 7,209 colonies of European honeybees; between July 1979 and November 1982, 25 people gave up beekeeping. Up to February 1984, the Ministry of Agriculture had sold over 1,000 European queens to beekeepers whose colonies had exhibited Africanised characteristics. Honey production, which was 240 t in 1979, was 123.5 t in 1982. To find out the affects of the Africanised bee, and the management methods adopted by beekeepers in other countries, a questionnaire (in English, Portuguese and Spanish) was sent to 111 beekeepers in South and Central America, and to 76 professional apiculturists, including research workers. Only 30% responded, but after studying the answers it was possible to draw up recommendations for Trinidad and Tobago. It is concluded that the keeping of European honeybees should be phased out and that proper management of Africanised honeybees should be encouraged. Recommendations are made for the location of apiaries, number and distribution of hives, protective clothing, measures to control swarming and absconding, and techniques for requeening and smoking of colonies, etc. Suggestions are also made for the long term development of apiculture in Trinidad and Tobago. *P. Walker*
School Agric. Economics and Extension Education, Univ. Guelph, Guelph, Ont. N1G 2W1, Canada.

Hallim, M.K. Farming aggressive honeybees: some practical tips. *Agricultural Extension Bulletin*, Ministry of Agriculture Lands and Food Production, Trinidad and Tobago (1985) (No. 5) 6 pp. [En, Ba]

Management of Africanised honeybees or any other types of aggressive honeybees in the Caribbean or elsewhere.

Hallim, M.K. 1988 honey industry in Trinidad and Tobago. *Proceedings of the Fourth International Con-*

ference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988. London, UK; International Bee Research Association. (1989) 509–510 ISBN 0-86098-196-7 [En,

Hallim, M.K. Apiculture in Trinidad with Africanized honey bees. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 267–270 ISBN 0-86098-215-7 [En, Bdo]
Ministry of Agriculture, Land and Marine Resources, St. Clair Circle, Trinidad, West Indies.

Laurence, G. and Mohammed, I. The bee louse in Trinidad and Tobago. *Journal of the Agricultural Society of Trinidad and Tobago* (1975) 74 (4) 378–379 [En, B]

Laurence, G. and Mohammed, I. Notes on a bird pest of honeybees in Trinidad. *Journal of the Agricultural Society of Trinidad and Tobago* (1975) 75 (3) 258 [En, B]
White-bellied swallow (*Progne chalybea*).

Laurence, G.A. Common bee weeds of Trinidad and Tobago. *Journal of the Agricultural Society of Trinidad and Tobago* (1976) 76 (June) 16 pp. [En, B]

Laurence, G. and Mohammed, I. Beekeeping in Trinidad and Tobago. *Journal of the Agricultural Society of Trinidad and Tobago* (1976) 76 (4) 342–354 [En, B]

On these two islands a rich variety of bee forage is provided by an estimated 2200 flowering plant species, including crops such as coconut and coffee. About 45% of the total land area is afforested and in some parts there is high rainfall; several tree species are major nectar sources, especially *Mora excelsa*, *Leguminosae* and locust (*Hymenaea coubaril*). Honeybees are essential for the pollination of avocado and *Coffea robusta*, and they are probably useful in pollinating cocoa and mango, and possibly citrus fruits. The flavours and colours of the honeys produced are very varied. The average yield per hive is 40 kg, and yields up to 110 kg have been reported. Some beekeepers have colonies of *Melipona favosa favosa* and *M. fasciata trinitatis* which produce 1–10 litres of honey per colony. Fewer colonies are kept in the sugar cane growing areas; there is little plant forage, and aerial insecticide spraying can cause heavy losses of bees. Wax moths are common pests, and ants and birds also cause damage, but for several years there have been no reports of bee diseases. P. Walker
Min. Agric. Lands & Fisheries, Trinidad.

**Mohammed, F. and Starr, C.K. Comparative foraging of the sympatric stingless bees *Trigona nigra* and *Partamona nigrior* (Apidae: Meliponini). In Sommeijer, M.J. and Meeuwse, F.J.A.J (eds). Proceedings of the section Experimental and Applied Entomology of the Netherlands Entomological Society (N.E.V.), Vol. 10. Amsterdam; Netherlands Entomological Society (99) 195–202 [En, Ba]
Dept of Life Sciences, Univ. of the West Indies, St Augustine, Trinidad & Tobago. 58/00
These two species of very similar size occur together in abundance in Trinidad. Their foraging behaviour is com-**

pared: (A) daily rhythm of flight activity, and (B) pollen plants visited. *Author*

Otis, G. The swarming behaviour of the Africanized honey-bee. *Journal of the Agricultural Society of Trinidad and Tobago* (1977) 77 (4) 313–326 [En, B]
Includes swarm management and prevention of absconding.

Papademetriou, M.K. Some aspects of the flower behaviour, pollination and fruit set of avocado (*Persea americana* Mill.) in Trinidad. *California Avocado Society Yearbook* (1976) 60 106–152 [En]
Flowering duration varied from 1–2 to 7–8 months (average 2–3 months). There were two groups of cvs, those in which flowers first opened in the morning and then again at midday the following day, and those in which flowers first opened in the afternoon and then in the morning of the following day. Insects were necessary for pollination and fruit production. Without pollination seven of the 12 cvs tested set fruit, but this soon dropped. The principal insect visitors were *Polistes canadensis*, *Metapolybia singulata* and other *Vespidae*. D.G. Lowe
Univ. of the West Indies, St. Augustine, Trinidad and Tobago.

Persano Oddo, L. and Krell, R. Pollen spectrum of honeys from the southeastern Caribbean. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 101–105 ISBN 0-86098-215-7 [En, Bdo]
A total of 86 taxa in 58 samples of honey are listed and nectar sources are discussed.
Sezione di Apicoltura, Istituto Sperimentale Zoologia Agraria, Rome, Italy.

Ratia, G. Self-management, coconut trees and varroa. [Autogestion cocotiers et varroas.]. *Abeilles et Fleurs* (1993) (No. 418) 15–17 [Fr, B]
This personal account of the 5th International Conference on Apiculture in Tropical Climates, held in Trinidad and Tobago in 1992, contains much useful information on beekeeping in the Caribbean islands.

Sommeijer, M.J. Behavioural aspects of stingless bee reproduction at individual and colony levels. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992. Cardiff, UK; International Bee Research Association. (1994) 241–248 ISBN 0-86098-215-7 [En, Bdo]
The literature on reproduction in the *Meliponinae* is reviewed, with 17 references. Aspects discussed include: reproduction of stingless bees compared with that of honey bees; reproduction at different levels; production of worker bees; production and behaviour of sexuals; laying workers; mating; colony reproduction (swarming). D.G. Lowe
Bee Research Department, Utrecht University, PO Box 80 086, 3508 TB Utrecht, Netherlands.

Sommeijer, M.J. and Bootsma, M.C. *Melipona trinitatis* as a producer of honey in Trinidad, West Indies. [*Melipona trinitatis* comme productrice de miel a Trinidad, Antilles.]. *Actes des Colloques Insectes Sociaux, Vol. 4. Compte rendu Colloque annuel, Paimpont, 17-19 September 1987*. Paris, France; Ecole Normale Supérieure. (1988) 291-294 ISBN 2-905272-02-4 [Fr, en, Bd]

A survey of 47 beekeepers who keep stingless bees showed that meliponiculture in Trinidad, although a primitive, traditional practice, still attracts wide interest. The species being domesticated are *Melipona trinitatis* and *M. favosa*. Colonies are kept in boxes of widely varying size and shape, and annual honey yields vary from 0.75 to 10 litres/colony. D.G. Lowe

Lab. Physiologie Comparée, Univ. Utrecht, Utrecht, Belgium.

Sommeijer, M.J. and Bruijn, L.L.M. de. *Drone congregations apart from the nest in Melipona favosa*. *Insectes Sociaux* (1995) 42 (2) 123-127 [En, Bb]

A large non-nest-associated drone congregation (DCA) of the stingless bee *Melipona favosa* on the island of Tobago is described. The 400 or so drones had originated from different nests, and interacted aggressively. Several gynes arrived at the DCA. Olfactory stimuli triggered specific behaviours by the males as well as by the gynes but matings were not observed at the DCA. Author

Department of Social Insects, Ethology and Socio-ecology, Laboratory of Comparative Physiology, Utrecht University, P.O. Box 80.086, 3508 TB Utrecht, Netherlands.

Sommeijer, M.J., Rooy, G.A. de, Punt, W. and Bruijn, L.L.M. de. *A comparative study of foraging behavior and pollen resources of various stingless bees (Hym., Meliponinae) and honeybees (Hym., Apinae) in Trinidad, West-Indies*. *Apidologie* (1983) 14 (3) 205-224 [En, de\ fr, B]

Pollen loads, taken from foraging bees returning to their colonies, were analysed. The following species were studied: *Melipona scutellaris trinitatis* (four colonies), *M. favosa* (3), *Trigona mellaria* (1), *T. nigra* var. *paupera* (1), *Apis mellifera* (1). The pollen spectra for these bees showed considerable overlap, but the peaks for different plant species varied between bee species. Colonies of the same *Melipona* species had similar pollen spectra. At the start of the rainy season, some bees changed to different pollen sources; some plants continued to be major sources, e.g. coconut for *A. mellifera*. Most of the stingless bees collected pollen in the morning but individual *M. favosa* showed no particular sequence. When pollen collectors of this species returned to the nest they solicited food before unloading their corbiculae; in contrast, bees bringing nectar to the nest offered it to other bees. The latter behaviour has not previously been observed in stingless bees. P. Walker
Lab. Comparative Physiology, State Univ. Utrecht, Jan van Galenstr. 40, 3572 LA Utrecht, Netherlands.

Winder, J.A. and Silva, P. *Current research on insect pollination of cacao in Bahia. IVth International Cocoa Research Conference, St. Augustine, Trinidad, 8-18 January, 1972*. West Indies; Government of Trinidad and Tobago. (1972) 553-565 [En, Review]

Winston, M. *The establishment and spread of the Africanized honeybee in the Western Hemisphere*. *Journal of the Agricultural Society of Trinidad and Tobago* (1977) 77 (4) 303-313 [En, B]

The characteristics and behaviour of the Africanised bee are described, with suggestions for changes in management to lessen problems if it should eventually arrive in Trinidad. P. Walker
Univ. Kansas, Lawrence, KS, USA.

Tuvalu

Thin, A. *Beekeeping on a coral atoll*. *Bee World* (1984) 65 (2) 57 [En, B]

Description of a grant-aided project to introduce *Apis mellifera* to Vaitupu, Tuvalu.

Uganda

Bologna, M.A. and Laurenzi, M. *Descriptions of the triungulins of Synhoria testacea (Fabricius) and another undetermined African species (Coleoptera: Meloidae), with data on Horiini larvae*. *African Entomology* (1994) 2 (2) 155-162 [En, 25 ref.]

The 1st-instar (triungulin) larva of *S. testacea* (from a *Xylocopa capitata* tunnel in South Africa) and another unidentified Ugandan species, probably also a 334, are described. The descriptions clearly demonstrate two pairs of ocelli in both species. Comparative morphological data and information on *Horiini* triungulins are also included. The *Horiini* are obligate parasitoids of *Xylocopa* bees.

Dipartimento di Scienze Ambientali, Università della Tuscia, 01100 Viterbo, Italy.

El-Sarrag, M.S.A., Saeed, A.A. and Hussein, M.A. *Morphometrical study on the Sudanese honeybees*. *Journal of King Saud University, Agricultural Sciences* (1992) 4 (1) 99-108 [En, ar, Ba]

Twelve characteristics were measured in samples of honey bees collected from wild colonies at 50 locations in central and southeastern Sudan. Statistical analysis of the results showed highly significant differences between samples and between the eight provinces represented. At least two subspecies seem to be present: *Apis mellifera nubica*, found near the borders with Ethiopia and Uganda, and a yellow-banded bee in the other areas sampled, for which the name *A. m. sudanensis* nov. subsp. is proposed. P. Walker
Plant Protection Department, College of Agriculture, King Saud University, Riyadh, Saudi Arabia.

Johnson, E. *Bee keeping with the modern African hive*. Entebbe, Uganda; Department of Agriculture. (1976) 26 pp. [En, B]

Nsbuga-Nvule, E.C.B. *The present development of bee-keeping in Uganda. Beekeeping in rural development: unexploited beekeeping potential in the tropics with particular reference to the Commonwealth*. London, UK; Commonwealth Secretariat. (1979) 75–77 [En, B]

Nsbuga-Nvule, E.C.B. *A guide to beekeeping for beginners: an introduction to beekeeping in Uganda*. Entebbe, Uganda; Ministry of Agriculture, Animal Industry & Fisheries. (1993) 46 pp. [En, Bd]
Apiary Development, Ministry of Agriculture, Animal Industry & Fisheries, PO Box 2814, Kampala, Uganda.

Nyeko, P., Edwards Jones, G. and Day, R.K. *Honeybee, Apis mellifera (Hymenoptera: Apidae), leaf damage on Alnus species in Uganda: a blessing or curse in agroforestry?* *Bulletin of Entomological Research* (2002) 92 (5) 405–412 [En, X]

Bees were observed foraging selectively on young leaves and buds in search of a sticky substance, apparently propolis; they made wounds that enlarged so that the growing leaves were damaged. Such damage occurred widely, particularly on *Alnus acuminata* in Uganda, and up to 90% of leaves emerging/month in the dry season were damaged.

Faculty of Forestry and Nature Conservation, Makerere Univ., PO Box 7062, Kampala, Uganda.

Pager, H. *Honeycombs, ladders and bees in the rock art of Africa*. Unpublished report prepared for the Bee Research Association. (1975) 79 pp. [En, B]

The author has collected together evidence he has uncovered in Algeria, Lesotho, Libya, Malawi, Morocco, Rhodesia, South Africa, South West Africa, Spanish Sahara, Tanzania, Tunisia, Uganda and Zambia. There are large numbers of published and unpublished drawings (see also *Apicultural Abstracts* 163/73, 191/74), together with documented extracts from books and other publications, and perceptive notes by the author. E.E. Crane

P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Peterson, M. *African honeybees in East and West Africa, and Africanized honeybees in Venezuela: some observations on behaviour. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 109–111 [En, B]

The author worked with honeybees in Mali, Sierra Leone, Ghana, Uganda and Venezuela, and noted wide variations in absconding and swarming behaviour, stability on combs and 'aggressiveness'.

Radloff, S.E. and Hepburn, H.R. *Population structure of Apis mellifera scutellata (Hymenoptera: Apidae): filling the Uganda gap*. *African Entomology* (2001) 9 (2) 131–135 [En, Bb]

Morphometric measurements were made on samples of worker honey bees collected from 148 colonies in east

Africa. The results showed that *A. m. scutellata* extends from South Africa to Ethiopia, but includes local populations of varying morphology. The honey bees of Uganda previously represented an important biogeographical gap in defining the population structure of this subspecies, but have now been resolved through the morphometric analyses of worker honey bees analysed with multivariate techniques. Honey bees from lower altitudes (<2000 m) formed one distinct morphocluster typical of *A. m. scutellata* throughout the continent, whereas those at higher altitudes (>2000 m) formed a separate distinct cluster of large, dark bees. The latter occur as an archipelago of mountain ecotypes of the subspecies.

Dept of Statistics, Rhodes Univ., Grahamstown 6140, South Africa.

Roberts, E. *A survey of beekeeping in Uganda*. *Bee World* (1971) 52 (2) 57–67 [En, B]

Honeybees (*Apis mellifera adansonii*) are found wild over most of Uganda. Beekeeping is restricted to Kigezi, West Nile and Teso areas; it is a traditional occupation subject to many taboos and superstitions. Most beekeepers have 3–20 hives. In Teso and West Nile, trees form the bulk of the bee forage, but in Kigezi honey is produced from crops, pasture, weeds and exotic trees. The honey is harvested at night, as the bees are less likely to sting then; little or no protective clothing is worn. Disease is not a problem to beekeeping, but pests and predators are. They include the wax moth (*Galleria mellonella*), hive-beetle (*Aethina tumida*), ants, lizards, snakes and spiders. A.S. Attwood

Dept. of Crop Science and Production, Makerere Univ. College, Kampala, Uganda.

Seeley, T.D. *What we do and do not know about the nest-site preferences of African honey bees. Africanized honey bees and bee mites [Needham, G.R., Page, R.E., Jr., Delfinado-Baker, M. and Bowman, C. E.]*. Chichester, UK; Ellis Horwood. (1988) 87–90 ISBN 0-7458-0319-9 [En, Bd]

This paper summarises present knowledge of the nest site preferences of *Apis mellifera scutellata*, gained from observations in Uganda, Kenya, Tanzania, South Africa, Zambia, French Guiana, Venezuela and Panama. The results indicate that a cavity of 40–80 litres is preferred to one of 10–20 litres, but experimental evidence about other variables is limited. D.G. Lowe

Section of Neurobiology & Behavior, Mudd Hall, Cornell Univ., Ithaca, NY 14853, USA.

Stanford, C.B., Gambaneza, C., Nkurunungi, J.B. and Goldsmith, M.L. *Chimpanzees in Bwindi-Impenetrable National Park, Uganda, use different tools to obtain different types of honey*. *Primates* (2000) 41 (3) 337–341 [En, X]

Tools of two types were found at sites of bee activity. Chimpanzees apparently use small stick tools to forage for the honey of a stingless bee (*Meliponula bocandei*) that nests in tree cavities and also in subterranean holes; they use significantly larger, thicker tools to get honey from *Apis mellifera* nests.

Univ. of Southern California, California, USA.

Vicidomini, S. [*Systematics and distribution of the Xylocopini (Insecta, Hymenoptera, Apidae, Xylocopinae): new and rare records for Africa. II.*] *Sistematica e distribuzione degli Xylocopini (Insecta, Hymenoptera, Apidae, Xylocopinae): nuove e rare segnalazioni per*

l'Africa. II. Atti Mus. civ. Stor. nat. Morbegno (98) 9 73–76 [It, en, Ba]

Five Xylocopa species were recorded for the first time in central East Africa, one in Malawi and four in Uganda. Via Velardi 10, 84014 Nocera Inferiore (SA), Italy.

United Kingdom

United Kingdom, National Honey Show. [*National Honey Show publications*]. London, UK; National Honey Show. (1970–1975) [En, B]

The following leaflets, reprinted from the NHS Schedule in the previous year, deal with preparation for exhibition: No. 1. Tonsley, C.C. (1970): Preparation of liquid honey, 4 pp. No. 2. Andrews, S.W. (1971): Mead and meadmaking, 4 pp. No. 3. Padmore, F. (1972): Wax for show, 3 pp. No. 4. Tonsley, C.C. (1973): Granulated or crystallized honey, 4 pp. No. 5. Robson, W.S. (1974): Production and exhibition of comb honey, 4 pp. No. 6. Vickery, G. (1975): Management, production and exhibiting of heather honey, 4 pp. E.E. Crane

National Honey Show, 57 Church Road, London SW 19, UK.

United Kingdom, Ministry of Agriculture for Northern Ireland. Bee diseases. Annual Report on research and technical work of the Ministry of Agriculture for Northern Ireland 1972. Belfast, UK; Ministry of Agriculture for Northern Ireland. (1973) 61 [En, B]

In 1972, of 131 samples of honeybees submitted to the Ministry of Agriculture for examination, acarine was present in 32, and nosema disease in 24. *Malpighamoeba mellificae* was recorded for the first time in Northern Ireland since 1966, being present in one apiary in County Fermanagh. Also identified were one case of EFB, one of sacbrood, and (on an imported nucleus) one of *Braula coeca*. D.G. Lowe

Ministry of Agriculture for Northern Ireland, Belfast, UK.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Nosema and amoeba. Advisory leaflet, Ministry of Agriculture, Fisheries and Food (1975) (No. 473) 8 pp. [En, B] 1969, reviewed 1975.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Proposals for honey regulations. European Communities: Council Directive 74/409/EEC of 22 July 1974 on the harmonization of the laws of the Member States relating to honey. London, UK; Ministry of Agriculture, Fisheries and Food. (1975) 16 pp. [En, B] To implement European Communities Council Directive.

United Kingdom. Laws and Statutes. The agricultural produce (grading and marking) (honey) (revocation) regulations 1976. London, UK; Her Majesty's Stationery Office. Statutory Instrument (1976) (No. 1833) 2 pp. ISBN 0-11-061833-5 [En, B] Apply to England and Wales (from 1 May 1977); revoke the honey grading and marking regulations of 1934.

United Kingdom, Ministry of Agriculture for Northern Ireland. Bee diseases. Annual report on research and technical work of the Ministry of Agriculture for Northern Ireland, 1975. Belfast, UK; H.M. Stationery Office. (1976) [En]

Amoeba disease was found in 6 samples from an apiary in Belfast and in one from Bangor.

United Kingdom. Laws and Statutes. The honey regulations 1976. London, UK; Her Majesty's Stationery Office. Statutory Instrument (1976) (No. 1832) 12 pp. ISBN 0-11-061832-7 [En]

Apply to England and Wales; came into force 1 May, 1977.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Migratory beekeeping. Advisory Leaflet, Ministry of Agriculture, Fisheries and Food (1976) (No. 344) 4 pp. [En, B].

Cuba. Laws and Statutes. Requirements for the importation of bees from the United Kingdom. Havana, Cuba; National Institute of Veterinary Medicine. (1976) [Es, E (2pp.)]

United Kingdom, Ministry of Agriculture for Northern Ireland. Bee diseases. Annual report on research and technical work of the Ministry of Agriculture for Northern Ireland, 1976. Belfast, UK; H.M. Stationery Office. (1977) [En] Amoeba disease was found in five apiaries (two in 1975).

United Kingdom, Ministry of Agriculture, Fisheries and Food. Feeding bees. Advisory Leaflet, Ministry of Agriculture, Fisheries and Food (1977) (No. 412) 7 pp. [En, B].

United Kingdom. Intervention Board for Agricultural Produce. Subsidy payments on the denaturing of white sugar for feeding to bees. Explanatory leaflet, Intervention Board for Agricultural Produce (1977) (No. MS/SUG/21) 10 pp. [En, Third revision, B] Implements EEC Regulations Nos. 2049/69 (amended by 2863/71, 1640/73), 100/72 (amended by 2351/72, 2847/72, 1320/77).

United Kingdom. Laws and Statutes. The importation of bees order 1978. Statutory Instrument (1978) (No. 683) 4 pp. ISBN 0-11-083683-9 [En, B] Bees imported into the UK must now (after 1 July 1978) be certified free of *Varroa jacobsoni*.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Advice to intending beekeepers. Advisory Leaflet, Ministry of Agriculture, Fisheries and Food (1979) (No. B 55) 6 pp. [En, B] Replaces AL 283 (last edition was AA 426L/74).

United Kingdom, Laws and Statutes. Bees Bill 1979. London, UK; HM Stationery Office. (1979) 8 pp. ISBN 0-10-304680-1 [En, B]

Strengthens existing controls on the importation of bees and bee products in order to prevent the introduction of pests and diseases.

United Kingdom, Department of Agriculture for Northern Ireland. Bee diseases. Annual General Report of the Department of Agriculture, year ended 31 March 1980. Belfast, UK; H.M. Stationery Office. (1980) [En]
Of 258 samples submitted by beekeepers, 71 had acarine disease, 54 nosema disease and seven amoeba disease.

United Kingdom. Laws and Statutes. The importation of bees order 1980. Statutory Instruments (1980) (No. 792) 2 pp. [En, B]
Prohibits the importation of bees except under licence.

British Standards Institution. Specification for glass honey jars. British Standard (1981) (No. 1777:1981) 3 pp. [En]

British Beekeepers Association News. Summary of the laws applying to the sale and supply of honey produced in the United Kingdom. British Beekeepers Association News (1981) (March) 5-8 [En, B]

United Kingdom, Edinburgh School of Agriculture. Annual report 1981. (1982) 214 pp. [En, B]
The section on beekeeping (pp.96-98) includes accounts of co-operative honey marketing, and poisoning of honeybees by fenitrothion on raspberries.

United Kingdom. Laws and Statutes. The Bee Diseases Control Order 1982. London, UK; Her Majesty's Stationery Office. Statutory Instruments (1982) (No. 107) 8 pp. [En, B]
Refers to AFB, EFB and varroa disease.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Foul brood. Advisory Leaflet, Ministry of Agriculture, Fisheries and Food (1982) (No. 306) 6 pp. [En, B]
Revised edition.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Nosema and amoeba - two diseases of adult bees. Leaflet, Ministry of Agriculture, Fisheries and Food (1982) (No. 473) 6 pp. [En, B] Revision of AA 246L/77.

Long Ashton Research Station. Report of Long Ashton Research Station, University of Bristol, 1980. Bristol, UK. (1982) xviii + 236 pp. [En, B]
Describes trials of 'Beeline' on apple blossom (p. 27); in dry weather honeybees and *Bombus* spp. were more active for two days after spraying.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Varroasis - a parasitic disease of honey bees. Leaflet, Ministry of Agriculture, Fisheries and Food (1982) (No. 834) 6 pp. [En, B]

United Kingdom, Ministry of Agriculture, Fisheries and Food. Advice to intending beekeepers. Leaflet, Ministry of

Agriculture, Fisheries and Food (1983) (No. 283) 6 pp. [En, B]
Revised edition of leaflet B 55, which replaced AL 283.

United Kingdom, Edinburgh School of Agriculture. Annual report 1982. (1983) iv + 232 pp. [En, B]
The section on beekeeping (pp. 106-109) includes accounts of co-operative honey marketing and bee health statistics for 1981.

British Beekeepers' Association. Protecting honey bees from pesticides. Stoneleigh, UK; British Beekeepers' Association. (1983) 8 pp. [En, B]
General safety advice, crop spraying regulations (UK), guide for starting legal proceedings.

Long Ashton Research Station. Report of Long Ashton Research Station, University of Bristol, 1981. Bristol, UK. (1983) xviii + 204 pp. [En, B]
Describes trials of 'Beeline' on runner beans (p. 28); bees were twice as numerous on sprayed plots 24 hours after treatment.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Varroasis of bees: tobacco smoke detection. Pamphlet, Ministry of Agriculture, Fisheries and Food (1985) (No. 936) 2 pp. [En, B]

International Trade Centre, UNCTAD/GATT. Report on the markets for selected hive products in the United Kingdom, France and Italy. Prospects and developments. [Note sur les marches pour les produits selectionnes de la ruche au Royaume-Uni, en France et en Italie. Perspectives et developpements.] Geneva, Switzerland; International Trade Centre, UNCTAD/GATT. (1986) iv + 35 pp. [Fr, Bdo]
This publication contains many facts and figures for royal jelly, pollen and propolis that have not previously been collected together. For each of the three products the following are dealt with: composition and properties; harvesting and storage; main producing countries; uses, distribution and imports; names and addresses for the three title countries. Annex VI lists some addresses for other European countries; Annex VII gives a typical analysis of royal jelly imported into France. P. Walker
Palais des Nations, 1211 Geneva 10, Switzerland.

United Kingdom, Ministry of Agriculture, Fisheries and Food. Foul brood of bees: recognition and control. Advisory Leaflet, Ministry of Agriculture, Fisheries and Food, UK (1989) (No. P306) 4 pp. [En, Bc]

International Trade Centre, UNCTAD/GATT. Note on markets in the United Kingdom, France and Italy for selected products of the bee-keeping industry. Prospects and developments. Geneva, Switzerland; International Trade Centre UNCTAD/GATT. (1992) vii + 38 pp. [En, Bdo] 54-56 rue de Montbrillant, CH-1202 Geneva, Switzerland.
The original version of this booklet, in French, was published in 1986.

Adam, Brother. Beekeeping at Buckfast Abbey. Hebden Bridge, UK; Northern Bee Books. (1987) (Ed.4) 122 pp. ISBN 0-907908-37-3 [En, Bd].

Bailey, L. *Acarapis woodi: a modern appraisal.* *Bee World* (1985) 66 (3) 99–104 [En, B]

The life cycle of *A. woodi*, and factors affecting the spread of infestations, are outlined. The mite was considered an important pest in the United Kingdom in the early 1920s, but its incidence has declined steadily since 1925, coincident with a fall in the total number of honeybee colonies. A similar association between colony numbers and cases of paralysis indicates that a relationship exists between colony density and contagiously transmitted pathogens. The author suggests that a critical factor in this relationship is the relative availability of forage, and that the number of colonies in the UK today is roughly in equilibrium with the available nectar, whereas in the past the number of colonies probably exceeded this equilibrium density. The distribution of *A. woodi* in the USA is described and it is suggested that the heaviest infestations will occur in regions where the number of colonies exceeds the optimum density for the locality. The treatment of infestations is also discussed. [Available as an IBRA Reprint] D. G. Lowe 20 W. Common Grove, Harpenden, Herts., AL5 2AT, UK.

Bailey, L. and Perry, J.N. *The diminished incidence of Acarapis woodi (Rennie) (Acari: Tarsonemidae) in honey bees, Apis mellifera L. (Hymenoptera: Apidae), in Britain.* *Bulletin of Entomological Research* (1982) 72 655–662 [En, B] Investigations showed that there is a highly significant linear relationship between percentage of honeybee colonies detectably infested with *Acarapis woodi* and the total number of colonies in England and Wales. A decline of infestation since 1947 corresponds to a decrease recorded in the known number of colonies. It is suggested that the decrease has allowed the foraging activity of the remaining colonies to increase, so lessening the contact between old infested bees and young susceptible individuals sufficiently to hinder the spread and multiplication of mites within colonies. *Author*
Rothamsted Exp. Stn., Harpenden, Herts. AL5 2JQ, UK.

BBKA News. *Summary of the laws applying to the sale and supply of honey produced in the United Kingdom.* BBKA News (1984) (No. 50) 3–4 [En, B]

Bill, L. *For the love of bees: the story of Brother Adam of Buckfast Abbey.* Newton Abbot, UK; David & Charles. (1989) 160 pp. ISBN 0-7153-9261-1 [En, Bd] This biography of Brother Adam tells of how he came from southern Germany as a boy in 1910 to join the order of Benedictine monks at Buckfast in Devon, UK; of how ill-health brought about his move from the rebuilding work at the Abbey to the Abbey's apiary; and of his subsequent lifetime's involvement with beekeeping that has brought him worldwide fame as a bee breeder. His travels in Europe, the Middle East and Africa, searching for races of honeybees to incorporate in his breeding programme, are described, as is his work in building the Abbey's Bee Department into a highly successful commercial enterprise. The methods that Brother Adam has followed over the years are described in the context of beekeeping developments during the 20th Century – e.g. Isle of Wight disease (caused by *Acarapis woodi*), standardisation and development of hives and equipment, instrumental insemina-

tion of queens, changes in agriculture affecting bee forage, and, latterly, the spread of *Varroa jacobsoni*. The final chapter tells of Brother Adam's latest journey, at the age of 89, to East Africa in search of *Apis mellifera monticola*. The book, which includes 24 black-and-white photographs, concludes with a short bibliography and a brief index. D. G. Lowe

Baker, D.B. *The Hymenoptera collections of William Edward Shuckard and the dispersal of his type material.* *Beitrage zur Entomologie* (98) 48 (1) 157–174 [En, de, 47 wf] The dispersal and survival of the collections of the British entomologist W.E. Shuckard (1803–68) are discussed. Among the *Hymenoptera* he described were species of *Chrysidae*, *Mutillidae*, *Pompilidae*, *Sphecidae* and *Vespidae*. Hope Entomological Collections, Univ. Museum of Natural History, Oxford OX1 3PW, UK.

Bowman, C.E. and Ferguson, C.A. *Forcellinia galleriella, a mite new to British beehives.* *Bee World* (1985) 66 (2) 51–53 [En, B]

The morphology of its mouthparts suggests that this mite is saprophagous, perhaps feeding on pollen.

Bridge, L.H.E. *Problems of international honey marketing for importing and exporting countries. Proceedings of the XXVth International Apicultural Congress, Adelaide.* Bucharest, Romania; Apimondia Publishing House. (1977) 502–505 [En, B]
Applies chiefly to the UK.

Brown, R. *Honey bees: a guide to management.* Marlborough, UK; Crowood Press. (1988) 128 pp. ISBN 1-85223-051-7 [En, Bd]
Basic guide to beekeeping, particularly in the UK.

Calder, A. *Oilseed rape and bees.* Hebden Bridge, UK; Northern Bee Books. (1986) vi + 48 pp. + 4 pl. ISBN 0-907908-35-7 [En, B]

The reasons for the remarkable increase since 1950 in the amount of oilseed rape (*Brassica napus*) grown in the UK are described in Section 1. 'For beekeepers to be able now to rely, for an indefinite number of years to come, upon the regular annual availability, in May and June, of a huge new nectar source, is for them an historic advance' concludes the author, but in Section II he poses the question 'Does rape need bees?' Pollination and fertilisation in rape are described, and experimental work – which so far indicates that rape benefits little from cross-pollination by honeybees – is discussed briefly. Nectar secretion and honeybee foraging behaviour are described in Section III, whilst Section IV deals with the crystallisation of rape honey. The penultimate section deals with rape from the apiarist's viewpoint and advice is given about apiary sites, reorganising management practices to take advantage of the early high-volume honey crop provided by rape, and dealing with rape honey. The final section outlines the pest control measures used on rape crops and their possible effects on bees. There are eight colour photographs and nine line drawings, and a bibliography of 53 items. D. G. Lowe

Cooper, B. A. *The honeybees of the British Isles*. Codnor, UK; British Isles Bee Breeders' Association. (1986) viii + 165 pp. + 48 pl. ISBN 0-905369-06-8 [En, B]

This book has been compiled from written and photographic material prepared by B. A. Cooper before his death in 1982. Over 90% of the text is in Cooper's own words, and the editor, P. Denwood, has linked the material together skilfully to produce this account of one man's philosophy of beekeeping. The Introduction is largely autobiographical and includes an historical account of how the Village Bee Breeders' Association – later to change its name to the British Isles Bee Breeders' Association – came into being. Some basic terms and ideas are presented in 'Ecological genetics', and Chapter 3, 'Native bees', discusses the honeybees of the British Isles – 'a closely-related group of strains of *Apis mellifera mellifera*, the dark bee of Western Europe'. The author describes 23 of their physical and behavioural characteristics. Chapter 4 discusses superseding (queen reproduction in which the colony makes no preparation for swarming, and there is no prime swarm), as this is a pronounced trait in British native bees. The following chapter, on mating behaviour, includes a list of drone assemblies, with site names, dates, map references, and notes on sites and weather conditions. Chapter 6 is on management of native British bees. The remaining four chapters of the book are devoted to bee breeding, and they cover topics such as evaluation, selection, culling, propagation and mating. The importance of systematic record keeping is stressed. There are four appendices, entitled 'The inaugural meeting of VBBA', 'A note on Terence Theaker', 'A note on queen balling' and (by R. Price) 'A first introduction to bees and beekeeping'. The book also contains notes on Chapters 1–10, a glossary, a bibliography of 56 items, and an index. The 48 plates contain many black-and-white photographs taken by the author. The book has been written especially for beekeepers, and it assumes a basic knowledge of honeybee biology and some familiarity with beekeeping techniques, but it really has a much wider appeal than this and it should certainly be of interest to those concerned with genetics, ecology and insect behaviour. *D. G. Lowe*

Couston, R. *The case for banning imports of bees to the United Kingdom and Eire*. *Scottish Beekeeper* (1980) 57 (10) 150–152 [En, B]

Couston, R. *The case for banning imports of bees to the United Kingdom and Ireland*. *Irish Beekeeper* (1980) 35 237–240; 243–244 [En, B]

To prevent the spread of *Varroa jacobsoni*.

Croft, L. R. *Profitable beekeeping*. Chorley, UK; Elmwood Books. (1986) 104 pp. ISBN 0-946019-02-9 [En, B]

The author sets out to show that beekeeping in the UK can be a profitable exercise even for the small-scale hobbyist beekeeper. In Chapter 2, he stresses the importance of starting beekeeping in the correct manner by acquiring some basic knowledge, and goes on to discuss apiary locations and equipment. 'Equipment on a budget' is discussed in more detail in Chapter 3. The biology of the honeybee is described in Chapter 4, including the varieties available in the UK and their characteristics. Chapters 5 and 6 are devoted to management techniques.

Chapter 7, on honey, includes: important floral sources; extraction, composition and variation in honey; honeydew honey; toxic honey; packaging, selling and legal considerations. Other hive products which are potentially profitable – beeswax, propolis, mead, pollen, venom – are discussed in Chapter 8. The final two chapters discuss bee diseases and other problems. The appendix contains useful addresses, a reading list, and a list of equipment suppliers. There is also a subject index. The book contains much sound advice and can be read with interest both by the beginner and the established beekeeper. *D. G. Lowe*

Davies, A. C. *Rare bee books*. *Book and Magazine Collector* (1984) (July) 36–41 [En, B]

Dews, J. E. *A rational approach to bee breeding in the British Isles*. *Bee Breeder* (1987) (No. 3) 3–6 [En, B]

Advocates the identification, preservation and improvement of the best strains of *Apis mellifera mellifera* that still exist in the UK.

Edwards, M. *Optimizing habitats for bees in the United Kingdom – a review of recent conservation action. The conservation of bees [edited by Matheson, A.; Buchmann, S. L.; O'Toole, C.; Westrich, P.; Williams, I. H.]*. London, UK; Academic Press for the Linnean Society of London and the International Bee Research Association. (1996) 35–45 ISBN 0-12-479740-7 [En, Bd]

The author presents a personal view of land management for the benefit of bees, based upon his experiences as a consultant to national and local conservation and planning organisations. It is based upon a series of case studies illustrating opportunities and techniques for maintaining and improving bee populations and diversity and is intended as a practical introduction to the conservation of bee faunas for land managers as well as a starting point for discussion. The case-study habitats described are grazing marsh and associated dry areas, deciduous woodland, low-land heath and sand workings. The presence of flowers in a 'natural environment' is often taken for granted; the provision of areas of nesting habitat for bees rarely is. Consequently management advice is frequently primarily concerned with the provision of a suitable nesting habitat. The management of food sources is most important where oligolectic bees are involved, although the wider issue of which plants are suitable forage plants for the best conservation of the bee fauna also needs to be considered. Questions addressed include: what general advice can be given to site managers; is there a need for survey before advice is offered; and is it possible to offer brief training to site managers which will help them recognise potentially important areas within their sites? The need for evaluation of the effectiveness of the suggested management is examined and a number of possible monitoring systems are discussed. *Author*

Lea-side, Carron Lane, Midhurst, Surrey GU29 9LB, UK.

Edwards, R. *Species profiles*. (editor) *BWARS Newsletter* (2000) (Spring) 29–48 [En, B]

This includes distribution maps showing past and present records of *Bombus subterraneus* and *Andrena* species and several other bees, in Britain and Ireland.

Fletcher, M.R., Hunter, K., Barnett, E.A. and Sharp, E.A. **Pesticide poisoning of animals 1998: investigations of suspected incidents in the United Kingdom. A Report of the Environmental Panel of the Advisory Committee on Pesticides.** London, UK; MAFF Publications, Admail 6000 (99) viii + 54 pp. [En, X]

Foster, A.M. **Bee boles and bee houses.** Aylesbury, UK; Shire Publications. (1988) 32 pp. ISBN 0-85263-903-1 [En, Bd]
This brief, but attractively presented and well illustrated booklet gives a guide to structures built in Britain to house and protect skeps and other hives. The structures described include skep supports, bee boles, bee alcoves, bee shelters and bee houses. There is a short list of other publications and a list of places to visit in England, Scotland and Wales. D.G. Lowe

Fussell, M. and Corbet, S.A. **Bumblebee (Hym., Apidae) forage plants in the United Kingdom.** *Entomologist's Monthly Magazine* (1993) 129 (1544–47) 1–14 [En, Bc]
Flower visits by bumble bees (*Bombus* spp.) were recorded in a survey in 1987 and 1988. Participants undertook walks, and named bumble bees in terms of colour groups, each containing one or two common and widespread species and several rarer ones. The survey yielded records of over 33,000 flower visits. An analysis of records for the plant taxa that received more than five visits overall is presented, listing for each the month of peak visitation and the relative numbers of visits to each taxon made by each colour group of bumble bees. The results may help in the management of vegetation to supplement forage for particular species of bumble bees. *Author*
Zoology Department, University of Cambridge, Downing Street, Cambridge CB2 3EJ, UK.

Gilbert, D. and Macrory, R. **Pesticide related law.** Farnham, Surrey, UK; British Crop Protection Council. (1989) vi + 68 pp. ISBN 0-948404-33-7 [En, Bd]
This book is subtitled 'A guide to pesticide related law in the United Kingdom, with an historical review of the development of pesticide safety policy'. It will be a useful reference book for all those concerned with pesticides and the regulations covering their safe use. The contents include an introduction to pesticide regulation and policy, UK Statute Law, civil liability and EC Directives. The regulations covering manufacture, distribution (transport and storage), use and disposal are described in detail. D.G. Lowe
Environmental Resources Ltd., UK.

Heath, L. (ed.). **A case of hives.** Burrowbridge, UK; Bee Books New and Old. (1985) viii + 73 pp. SBN 905652-10-X [En, B]
This book was compiled to help beekeeping beginners, particularly in the UK, to choose which type of hive to use. The first chapter – 'Choosing a hive' – briefly sets out the needs of both bees and beekeeper. The next seven chapters are by different authors, each of whom describes a single type of hive, giving their personal experiences with it and describing its good and bad points. The hives described are the WBC, Smith, British National, British Commercial, Langstroth, Langstroth Jumbo and Modified Dadant hives. A further chapter describes a variety of

hives, including straw skeps, long hives, the British Deep hive, the Buckfast Dadant, and the Catenary hive. There is also a chapter on the cost of hives, an 'Epilogue' giving final advice, and a useful appendix explaining, with the help of drawings, many of the terms used. A second Appendix gives sources of materials and information, including equipment suppliers and a list of books. Although intended primarily for beginners, experienced beekeepers should also be stimulated to thought and discussion by this book. D.G. Lowe

Hooper, T. **Guide to bees and honey.** Poole, UK; Blandford Press. (1983) 260 pp. ISBN 0-7137-1382-8 [En, B].

Hooper, T. and Taylor, M. **The beekeeper's garden.** London, UK; Adam & Charles Black. (1988) 152 pp. ISBN 0-7136-3023-X [En, Bd]

This book was written with the intention of assisting beekeepers in the United Kingdom to plant their gardens with species that provide sources of nectar and pollen at various times of the year, and encouraging established gardeners to become beekeepers, or to at least appreciate the needs of bees. The first two chapters give an introduction to beekeeping and honeybees, the third discusses the use of hedges and gives a table of suitable hedging plants, and the fourth gives instructions on how to plan a garden. Chapter 5 is the largest in the book (pp. 36–143), giving descriptions of over 140 genera of flowering plants that provide bee forage – some with a single useful species, others with many. For each plant, descriptions are given of the flowers, growth habit, cultural requirements, value as a nectar and/or pollen source, and (where applicable) characteristics of its honey. The book concludes with chapters on pruning and the use of pesticides. There is an index of subjects, common names and scientific names. The book contains much useful information, attractively presented, and is well illustrated with colour and black-and-white photographs. D.G. Lowe

Hopkinson, G. **100 years of beekeeping examinations.** *British Bee Journal* (1982) 110 237–238; 254 [En, B]

Ibbotson, K. **Continued importation of queen honeybees into the British Isles.** *Bee Breeder* (1987) (No.3) 7–11 [En, Bj]
Considers the dangers of introducing diseases and foreign genetic material.

Lack, A.J. **The ecology of flowers of chalk grassland and their insect pollinators.** *Journal of Ecology* (1982) 70 (1) 773–790 [En, B]

The most prominent flowering species on a site in Cambridgeshire, UK, were *Helianthemum nummularium*, *Hippocrepis comosa* and *Onobrychis viciifolia* during June and early July, and *Centaurea nigra*, *C. scabiosa*, *Knautia arvensis* and *Scabiosa columbaria* from late July to September. Bumble bees, particularly *Bombus lapidarius*, were the most abundant visitors to most of these species; *Apis mellifera*, and some *Lepidoptera* and *Syrphidae*, were of lesser importance. In the early flowering groups of plants there was some specialisation for different pollinators and divergences in flowering time, suggesting that competition for pollinators or avoidance of interspecific pollen

transfer had exerted selection pressure. In the late summer group all plant species overlapped considerably in flowering times and their insect visitors, suggesting no strong selective pressures. There was a saturation of insect visitors in late summer, with particularly large numbers of *B. lapidarius*. *Author*

Dept. Botany and Microbiology, Univ. Coll., Swansea SA2 8PP, UK.

Lewis, T. Rothamsted Experimental Station. Entomology Department. Report of Rothamsted Experimental Station for 1981, Part 1. Harpenden, UK; Rothamsted Experimental Station. (1982) 95–112 [En, B]

Includes a survey of work on honeybee pathology at Rothamsted over the past 30 years (pp. 106–108).

Limbrey, S. The honeybee and woodland resources. Archaeological aspects of woodland ecology [edited by Bell, M.; Limbrey, S.]. Oxford, UK; British Archaeological Reports. (1982) 279–286 ISBN 0-86054-176-2 [En, B]

This paper is an enquiry into the possibility and the implications of the presence of honeybees (*Apis mellifera*) in Britain in prehistoric times. The close relationship in northern continental Europe between lime trees (*Tilia*) and honeybees is stressed, and other types of evidence are considered. It is concluded that 'for northern Europe, and particularly for Britain, the presence of honeybees perhaps before the Iron Age and certainly before the Beaker period remains hypothetical', as it does too for earlier interglacials, but I still think it worthwhile to stress the probability that they were here in Britain, from the time of arrival of the lime trees in the Boreal period and possibly before that in the Pre-boreal. The prospect for proving their presence lies more with archaeology and palaeobotany than in hopes of finding their own remains. *E.E. Crane*

The Newalls, Stn. Rd., Wyre Forest, Rock, Kidderminster, Worcs., UK.

Martin, S., Hogarth, A., van Breda, J. and Perrett, J. A scientific note on *Varroa jacobsoni* Oudemans and the collapse of *Apis mellifera* L. colonies in the United Kingdom. *Apidologie* (98) 29 (4) 369–370 [En, de, fr, B]

Debris was collected from the hive floor of eight naturally infested colonies until they collapsed. One colony collapsed after the first summer, and the others survived for two or three summers. The number of mites in the debris (cumulated total, peak and monthly means) was found to be a poor indicator of colony survival in the following year. Examination of bee samples showed the presence of six types of virus in dead adult workers and one in live brood. Three of the viruses are linked with *Nosema apis* and did not appear to be responsible for colony collapse, but within one year of collapse, one or more of the following appeared: deformed wing virus, slow paralysis virus, cloudy wing virus. Results are tabulated. *P. Walker*

Central Science Lab., Sand Hutton, York, YO41 1LZ, UK.

Martin, S.J. and Hogarth, A.N. Varroa research carried out by the National Bee Unit in the United Kingdom. New perspectives on varroa [Matheson, A. (ed.)]. Cardiff, UK; International Bee Research Association. (1994) 38–40 ISBN 0-86098-218-1 [En, Bd]

Research is underway to develop a rapid, sensitive and reliable diagnostic test for *Varroa jacobsoni* that is easily used by beekeepers, and to develop a reliable and accurate method of assessing varroa populations in infested colonies throughout the British beekeeping season. Preliminary results show that natural mite-fall is higher than previously reported, and is related to the number of emerging bees. The relationship between natural mite-fall and total number of mites in the colony varies greatly; in one colony which was studied it varied from 1:140 to 1:450. *A.G. Matheson*

Central Science Laboratory, National Bee Unit, Luddington, Stratford-upon-Avon, Warwickshire CV37 9SJ, UK.

Mistry, R.P. Analytical studies on honey. PhD Thesis, Salford University, UK. (1985) viii + 455 pp. [En, Bdo]

A total of 192 UK honeys from individual beekeepers, and an additional 68 samples including some commercial honeys and some from other countries, were analysed. In a preliminary trial, five UK honeys and 11 others were analysed for proteins by polyacrylamide gel electrophoresis in the presence of sodium dodecyl sulphate. Results indicated that there was no correlation between protein content and geographical origin. Of the total 260 samples, 256 were analysed for free amino acids by ion-exchange chromatography; 39 ninhydrin-positive substances were detected by a combination of paper electrophoresis and chromatography, and 28 of these were identified. Quantitative measurements of the concentration of each amino acid were made on an automatic amino acid analyser. The major floral sources of each honey were confirmed by pollen analysis. In UK honeys the dominant pollens were *Brassica napus*, *Trifolium repens*, *Castanea sativa*, *Calluna vulgaris*, *Myosotis arvensis*, *Aesculus hippocastanum*, *Impatiens glandulifera*, *Vicia faba* and *Clematis vitalba*. Maps of the amino acids present, and their concentrations, were correlated with the floral sources of the samples examined, rather than with their geographical origins. Canonical variates analysis of the results was carried out using a software package for data analysis called Statistical Package for Social Sciences (SPSS). The potential use of this technique of pollen analysis combined with amino acid measurements is discussed, and it is suggested that SPSS predictions could have value in detecting honeys adulterated by sugar syrups, UK honeys blended with cheaper foreign honeys, and honeys affected by heating or other commercial processing methods. *D.G. Lowe*

Mobus, B. and Connor, L. The Varroa handbook: biology and control. Hebden Bridge, UK; Northern Bee Books. (1988) 52 pp. ISBN 0-907908-41-1 [En]

This book is written in two sections. In the first, B. Mobus describes the biology of *Varroa jacobsoni*, the damage caused to honeybees, population dynamics of *Varroa*, methods of detection, and biological, physical and chemical methods of control. The emphasis in this section is on informing and preparing beekeepers in the United Kingdom for the arrival of *Varroa*, and the author refers to what has happened in Europe and the research carried out there. In the second section of the book, L. Connor describes what has happened since *V. jacobsoni* was found in the USA in 1987. He deals with the entry of the mite into

the USA, its subsequent spread (to 12 states at the time of writing), and the detection and control methods used. The book also has a section of 11 abstracts of selected research papers, a list of chemicals, and a short list of references. The book is clearly written and provides beekeepers with a comprehensive source of information. The accent throughout is on management and the practicalities of living with the mite once it is present in a honeybee [*Apis mellifera*] population.

Morse, R.A. *The complete guide to beekeeping*. London, UK; Robert Hale. (1988) (Ed. 4) 187 pp. + 16 pl. ISBN 0-7090-3154-8 [En, Bd]
Revised, updated edition; adapted for the UK.

Prys-Jones, O.E. and Corbet, S.A. *Bumblebees*. Cambridge, UK; Cambridge University Press. (1987) v + 86 pp. + 4 pl. ISBN 0-521-27781-7 [En, Bd]

This book (No.6 in CUP's Naturalists' Handbooks series) is intended primarily for school and university students, and others with no formal training in biology, who wish to study the biology of British bumble bees. Its main aim is to give readers practical guidance in making identifications and carrying out investigative work. The main aspects covered are: distribution and recognition; the natural history of true bumble bees (*Bombus* spp.); nests and their establishment in captivity; cuckoo bumble bees (*Psithyrus* spp.), parasites and nest associates; foraging behaviour; identification; techniques and approaches to original work. The text is clear and well illustrated, and technical terms are defined in marginal notes as they occur. The chapter on identification comprises Charts A (distinguishing between *Bombus* and *Psithyrus*) and B (distinguishing between male and female bumble bees), a quick-check key to the commonest species, and the four main keys to male and female *Bombus* and male and female *Psithyrus*. The keys have been adapted from those of Alford (1975). There are four skillfully painted colour plates, a further reading list, and a subject index. Although only 86 pages long, this book contains a surprising amount of information and much valuable advice. *D. G. Lowe*

Dept. Applied Biology, Univ. Cambridge, Cambridge, UK.

Schmid, W. *Controlling parasitic mites on honeybees*. United Kingdom Patent Application (1984) (No. GB 2 139 147) 7 pp. [En]

The compound 2-(2,4-dimethylphenylimino)-3-methylthiazoline caused 97% mortality of *Varroa* mites after seven days of application (as a 15% wettable powder formulation). Different formulations (emulsion, water-soluble powder, dispersible powder, fumigant strip) are described.

Sims, D. *Changes in farming practice and their implications for beekeeping*. *Bee Craft* (1983) 65 (7) 189, 191, 193, 195–197 [En, B]

The situation in England and Wales is discussed; changes in the arable areas in the east have affected beekeepers more than elsewhere. Adverse effects have resulted from: the increased use of pesticidal and other sprays; the great reductions in the growing of white clover (which used to be a major nectar source) and in areas of orchard; the earlier cutting of cattle forage crops, often before flowering.

In eastern England much permanent grassland, which provided useful forage, has been turned into arable land. However, beekeepers now benefit from the increased area of oilseed rape (174,000 ha in 1982), and by more field beans and soft fruit. To make use of these crops, the beekeeper has to be prepared to move his hives. In Wales and western England, beekeepers rely mainly on flowering plants in permanent grassland. *P. Walker*
Maltings, The Green, Foxton, Cambridge CB2 6SP, UK.

Stephens-Potter, L.A. *The beekeeper's manual*. Newton Abbot, UK; David & Charles. (1984) 127 pp. ISBN 0-7153-8485-6 [En, B]

Clear, well illustrated guide for the beginner.

Vernon, F. *Beekeeping*. Sevenoaks, UK; Hodder and Stoughton [Teach Yourself Books]. (1986) (Ed. 2) ix + 194 pp. ISBN 0-340-39044-1 [En, B]

Revised edition of *Apicultural Abstracts* 1251/77.

Waine, A.C. *Background to beekeeping*. Burrowbridge, UK; Bee Books New & Old. (1987) (Ed.3) 118 pp. ISBN 0-905652-18-5 [En, Bd]

Third edition of a book that was originally published in 1955.

Williams, P.H. *The distribution and decline of British bumble bees (Bombus Latr.)*. *Journal of Apicultural Research* (1982) 21 (4) 236–245 [En, B] Dept.

The suggested recent decrease in the distributional ranges of certain species of bumble bees was investigated by applying a numerical classificatory approach to data collected by the Bumblebee Distribution Maps Scheme.

Applied Biology, Univ. Cambridge, Pembroke St., Cambridge CB2 3DX, UK.

Williams, P.H. *On the distribution of bumble bees (Hymenoptera, Apidae) with particular regard to patterns within the British Isles*. PhD Thesis, University of Cambridge, UK. (1985) x + 180 pp. + 76 pl. [En, B]

Williams, P.H. *Environmental change and the distributions of British bumble bees (Bombus Latr.)*. *Bee World* (1986) 67 (2) 50–61 [En, B]

Regional patterns of distribution of bumble bees in England, Wales and Scotland, revealed by the Bumblebee Distribution Maps Scheme (see *Apicultural Abstracts* 1142/80) and a more recent survey in Kent, are described. The results indicate a decline in most *Bombus* species and the implications for farming, especially crop pollination, are discussed. This paper is based on the author's PhD thesis, which was abstracted in *Apicultural Abstracts* 774/86. *D. G. Lowe*
Dept. Entomology, British Museum (Natural History), Cromwell Rd., London SW7 5BD, UK.

Wix, P. *Honey production in the U.K. and the present European legislative situation*. *Proceedings of the Institute of Food Science and Technology*, UK (1976) 9 (2) 70–74 [En, B]

Young, M. *Beekeeping in Ireland and the United Kingdom*. *Journal of the Western Apicultural Society of North America* (2003) (Fall) 13–14 [En, B]

Hillsborough, Northern Ireland.

United Republic of Tanzania

Tanzania Ministry of Natural Resources and Tourism. *Certificate syllabus [for] beekeeping option.* Olmotonyi, Tanzania, Forestry Institute. (1971) 20pp. [En, B]

Food and Agriculture Organization of the United Nations, Agricultural Industries Division. *Tropical and sub-tropical apiculture.* Rome, Italy; Food and Agriculture Organization of the United Nations. FAO Agricultural Services Bulletin (1986) (No. 68) xiii + 283 pp. ISBN 92-5-102444-8 [En, Bdo]

The aim of this book is to provide a general introduction to beekeeping, but confined to those aspects necessary for an understanding of the problems of apiculture which are specific to the developing countries of the tropics and sub-tropics. It will be especially valuable to beekeepers in tropical countries, both those just beginning and those with more experience, and to apicultural and agricultural planners involved in development programmes. The contribution of many world experts to this comprehensive, well-illustrated FAO Bulletin, and the involvement of the International Bee Research Association during its preparation, are acknowledged. The plan of the book, and the subjects it covers, are outlined in the introductory chapter. Chapter 2 describes the species, races and strains of honeybees, their biology in the tropics, and the plants they forage on. The value of bees in pollination is emphasised. Chapter 3 describes the enemies of bees – diseases, parasites, predators, and man himself through his effects on the environment. Chapter 4 deals with honey hunting and traditional methods of beekeeping, including the construction and use of various hives. Transitional hives (the Kenya top-bar hive and the modified African long hive) are described in this chapter. Chapter 5 gives details of modern techniques for beekeeping with *Apis mellifera* and *A. cerana*; the aspects which are discussed include types of movable-frame hive, comb foundation, disease and pest control, colony management, and protective clothing and equipment. Honey, beeswax, and other hive products are the subject of Chapter 6, whilst Chapter 7 is devoted to a study of beekeeping economics in developing countries. A 'Bangladesh case study' is used to illustrate the principles involved. Chapter 8 considers the case history of a long-term programme for national beekeeping development in Tanzania and discusses education, training, extension work, research, and their organisation. The final chapter describes technical assistance projects with examples of FAO schemes in Burma, El Salvador, and Tunisia. The four Appendices give information on world honey plants European Codex honey standards, beekeeping in the Kalahari (by B. Clauss), and pesticide toxicities. All the chapters include a guide to further reading, and there is a 12-page bibliography. D. G. Lowe

Njiro Wildlife Research Centre. *Workshop proceedings: low productivity in East African beekeeping.* Arusha, Tanzania; Njiro Wildlife Research Centre (97) 79 pp. [En, Bdo] This meeting was held in Arusha on 19–21 May 1997. Papers were presented on appropriate technology (five

papers), the environment and hive occupancy (two) and marketing (two); there were also nine papers on projects and activities in different areas. The conclusions are summarised and recommendations are listed. P. Walker

Tanzania, Njiro Wildlife Research Centre. *A teachers' manual for beekeeping in Tanzania.* Arusha, Tanzania; Njiro Wildlife Research Centre. (1993) 105 pp. [En, Bdo]

This is a typed, duplicated document intended as a basic text for beekeeping training in Tanzania. The authors plan to upgrade it, incorporating comments and suggestions made by users of this version, and to translate it into Kiswahili. It covers bee biology, historical aspects of beekeeping, equipment including log hives, bark hives and modified Dadant hives, frames and top-bars, rendering beeswax and extracting honey, starting beekeeping, bee forage, diseases and pests, and management techniques. More advanced topics are also discussed, such as bee genetics, bees and biodiversity, and bee research in Tanzania. A short glossary of terms and a reading list are included. D. G. Lowe

Njiro Wildlife Research Centre, PO Box 661, Arusha, Tanzania.

Tanzania, Njiro Wildlife Research Centre. *NWRC Annual report 1995.* Arusha, Tanzania; Njiro Wildlife Research Centre. (1996) 37 pp. [En, Bdo]

This summary of the Research Centre's activities includes interim results of a project on the design of a top-bar hive. Aspects dealt with include: shape of the hive, volume, design of the top-bars, materials, swarm attractants, smokers, apiary pests, extension techniques for the introduction of top-bar hives to rural communities.

Annecke, D.P. and Prinsloo, G.L. *A new species of Cheiloneurus Westwood, 1833 parasitic in Ceratina from Tanzania.* *Pan-Pacific Entomologist* (1977) 53 (3) 233–236 [En, B]

Over 50 of these encyrtid parasites were collected from 11 *Ceratina* larvae in a nest in Tanzania.

Anzenberger, G. *Ethological study of African carpenter bees of the genus Xylocopa (Hymenoptera, Anthophoridae).* *Zeitschrift für Tierpsychologie* (1977) 44 337–374 [En, de, B]

Over 200 bees (100 marked) of four African species (*X. imitator*, *X. flavorufa*, *X. torrida* and *X. nigrita*) were observed for three months on the island of Rubondo in Lake Victoria, Tanzania, and 40 burrows were examined. Burrow construction, provisioning, reproductive behaviour and methods of defence are described. Food plants, foraging, provisioning, ontogenesis and emergence are also reported. A few colonisation experiments were made with young bees, and a spectrogram of begging sounds was obtained. P. Walker

Psychologisches Inst., Univ. Zurich, Attenhoferstr. 9, 8044 Zurich, Switzerland.

Armbruster, W.S. and Mziray, W.R. Pollination and herbivore ecology of an African *Dalechampia* (Euphorbiaceae): comparisons with New World species. *Biotropica* (1987) 19 (1) 64–73 [En, Bc]

D. cf. parvifolia was studied at sites in northern Tanzania. The staminate flowers have a laminated gland-like structure which secretes a clear sticky resin. Two species of bees visited the inflorescences to collect the resin and/or pollen, the most common being female *Heriades aff. spiniscutis* (Megachilidae). On 35% of the visits bees collected only resin, on 24% they collected resin and pollen, and on 41% of visits they collected only pollen. The body size of these bees (6–7 mm) is about twice the distance between the gland and stigma and between the gland and anther; as a result they commonly contacted the stigmas and/or anthers when foraging. In 9 of 13 inflorescences examined, stigmas had more pollen after a visit by *Heriades* than before, indicating that this bee is an effective pollinator. The inflorescences were also visited infrequently by worker *Trigona* sp., but these bees were too small to contact the stigma or anthers regularly. Visits by *Heriades* began about noon, peaked at about 13.30–14.40 hours, and ceased by about 16.00–17.00 hours. Rates of visitation by *Heriades* varied greatly among sites. The data suggest that the number of flowers open at each site influenced the visitation rate. In the absence of pollinators, 59% of ovules produced seed by self-pollination. *D.G. Lowe*

Dept. Biology, Fisheries & Wildlife, Inst. Arctic Biology, Univ. Alaska, Fairbanks, AK 99775, USA.

Bradbeer, N. Beekeeping development and the protection of tropical forests. [Sviluppo dell'apicoltura e tutela delle foreste tropicali.] *Ape Nostra Amica* (1990) 12 (3) 22–25 [It, en, Bj]

The importance for beekeeping of miombo forests in Tanzania is discussed.

Brenzinger, M. East African beekeeping vocabularies: kiZigua. *Afrikanistische Arbeitspapiere* (1987) 9 113–123 [En, Bc]

Most Wazigua people live in the Tanga region (NE Tanzania); 'miombo' woodland covers the western part of the region, and beekeeping is popular. The vocabulary used by Zigua beekeepers is listed and explained, giving an insight into how much they understand about honeybees and how they manage the colonies. Hives, which may be from 90 to 250 cm long, are made from hollowed-out logs; the log is cut in half lengthwise and fixed together with long wooden pegs. Hives are taken to a tall tree selected for the apiary – near forage plants and water – and are pulled up and wedged in the tree, ready for swarms to settle in. There are two main honey flows, around March and October, especially from six important tree species. Honey is harvested from the smaller hives after the second flow; it is not taken from larger hives until they have been occupied for two years. The beekeeper smokes the bees using a 'torch' made from the msaraka tree (*Spirostachys africana*, Euphorbiaceae) before taking most of the combs; however, he leaves some brood combs. The yield from about 300 hives is 60–70 litres honey, i.e. an average of 5.5–6.5 kg/hive. *P. Walker*

Inst. Afrikanistik, Univ. Koln, D-5000 Koln 41, Germany.

Chandler, M.T. Reducing pesticide hazards to honey bees in tropical East Africa. *PANS* (1976) 22 (1) 35–42 [En, B]

A table of 44 insecticides commonly used in East Africa classifies them according to their toxicities to honeybees. Application times may be more limited with *Apis mellifera adansonii* than with European honeybees because the former tends to work crops for longer periods. In East Africa little effort is made, except by government researchers, to protect bees during and after pesticide application; research on low honeybee hazard pest control programmes would be useful, e.g. on cotton, and the toxicity of pesticides to other pollinators, such as wild bees, should also be studied. *P. Walker*

P.O.Box 661, Arusha, Tanzania.

Chandler, M. T. and Mdemu, E. Pollination research in East Africa: problems and promises. *Proceedings of the III International Symposium on Pollination*, 1974. (1975) 57–65 [En, de\fr, B]

Two years' observations indicate that *Apis mellifera adansonii* is an efficient pollinator of lucerne, tripping on average 53.6% of the non-tripped flowers visited. Even with low bee populations when competing plants were present, or when flowering occurred during the rainy season, there was no significant change in tripping rate (50.1%). Although *A. m. adansonii* can be managed in movable-frame hives, it is considered that a breeding programme to produce gentler strains would be beneficial. *Trigona togoensis* is being kept in modern hives under experimental conditions in the hope that management methods can be worked out. The Beekeeping Section in Tanzania is also investigating problems such as conservation of wild pollinators, pesticide losses, and pollination of pyrethrum, cashew, coffee and beans. *D.G. Lowe*

Forest Inst., Olmotonyi, P.O. Box 943, Arusha, Tanzania.

Corner, J. Bees as a development resource in sub-Saharan Africa. Advancing agricultural production in Africa. Proceedings of CAB's First Scientific Conference, Arusha, Tanzania, 12–18 February, 1984 [edited by Hawksworth, D.L.] Farnham Royal, UK; Commonwealth Agricultural Bureaux. (1984) 385–388 [En, B]

Drescher, W. Beekeeping in Tanzania. [Bienennutzung in Tansania.] *Allgemeine Deutsche Imkerzeitung* (1975) 9 (5) 117–122 [De, B]

Includes wing measurements on various races.

Drescher, W. Experience with German apicultural development programmes. Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 119–124 [En, B]

In Central America and Tanzania.

Drescher, W. The use of movable-frame hives in development programmes (Africa and Latin America). Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 23–30 [En, B]

Costa Rica, Guatemala, Panama, Nicaragua, Tanzania.

Edrich, W. Night-time sun-compass behaviour of honey bees at the equator. *Physiological Entomology* (1981) 6 (1) 7–13 [En, B] Serengeti Res. Inst., Seronera, Tanzania.

At the equator the apparent movement of the sun occurs along paths perpendicular to the surface of the earth. When projected into the horizontal, the movement appears to be much slower in the morning and evening than around noon. When the sun is in the southern hemisphere, clockwise azimuthal movements (the horizontal component of the sun's movement) occur during the day and counter-clockwise movements during the night. The reverse occurs when the sun is in the northern hemisphere. African honeybees observed in their night-time dances apparently allowed for the azimuth moving backwards at night relative to its day-time movement. In several cases, bees evidently inferred the actual azimuthal position of the sun, rather than the one that would result from extrapolating a uniform movement of the sun. *J.M. Gedyé*

Fisher, E. Forest livelihoods: beekeeping as men's work in Western Tanzania. In Creighton, C and Omari, C K ((editors)) Aldershot; Ashgate Publishing Ltd. *Gender, family and work in Tanzania* (2000) 138–176 [En, X]

Fisher, E. Beekeepers in the global 'fair trade' market: a case from Tabora region, Tanzania. *International Journal of Sociology of Agriculture and Food* (1997) 6 109–159, 166–167 [En, es, Bc]

This paper presents a case study examining the importance of the international 'fair trade' market in honey and beeswax from western Tanzania. Research was carried out with producer members of Tabora Beekeepers Cooperative Society Ltd; their decision-making is examined in relation to local, regional and international market options for their produce. Producers' and consumers' perceptions of 'fair trade' are discussed. The system seems to have enabled the Tanzanian producers to gain a favourable international market for their produce, but it is concluded that fair trade is not an alternative to development and modernisation per se. *P. Walker*

Gnagi, A. Beekeeping developments in Africa. [Entwicklungsprojekte mit Bienenhaltung in Afrika.] Bern, Switzerland; Universität Bern. (1988) vi + 90 pp. [De, Bdo]

The present state of beekeeping in Africa is summarised. Reasons for encouraging beekeeping in developing countries are discussed, and examples are given of successful projects in Kenya, Botswana, Upper Volta and Tanzania, and of some that failed. Views differ on the type of hive suitable for such projects; experiences with modern hives are discussed and a case is presented for the use of traditional hives. Recommendations are made for future projects. *P. Walker* Inst. Ethnologie, Univ. Bern, Schwanengasse 7, CH-3011 Bern Switzerland.

Hassan, L.A.M and Svensson, B. Current success in field trials of improved top bar hives in Tanzania. In Raina, S.K., Kioko, E.N. and Mwanycky, S.W. (eds) *Proceedings of the first international workshop on the conservation and utilisation of commercial insects, Kenya, 18–21 August 1997*. Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 87–93 [En, Bd]

Colonies in hives with straight sides attached 13.4% combs to the side, but those in hives with a 10° slope attached only 8%. In northern Tanzania a top-bar hive with 20 top bars is large enough for most nectar flows; hive dimensions are given. In trials with different entrance holes it was found that the most suitable arrangement was a series of 16–20 holes of 8-mm diameter made in a zig-zag pattern in the short wall of the hive at a distance of 2 cm above the floorboard. Simple methods for making the hives have been developed. *P. Walker*

Njiro Wildlife Research Centre, PO Box 661, Arusha, Tanzania.

Hepburn, H.R. and Radloff, S.E. Beeswax exports and rainfall in the savanna woodlands of east central Africa. *Apidologie* (1996) 27 (6) 473–478 [En, fr\de, Bj]

Records of beeswax exports from Tanzania, Zambia and Kenya in 1936–1961, and the corresponding rainfall records, were subjected to time-series and regression analyses. Data were plotted in 'bee-years' (July–June) as this is the seasonality of the annual cycle of honey bee colonies in savanna woodland areas below the equator. Figures for honey production and beeswax exports for Tanzania in 1906–1985 were also analysed. The results show that beeswax exports and rainfall are most significantly and highly correlated when phase-lagged by one bee-year. Rainfall and honey production are also highly significantly correlated when lagged by one bee-year. However, honey and wax production are highly correlated on a same bee-year basis. Thus, the beeswax harvest of any one year depends on the rainfall of the previous bee-year. This is consistent with general effects of climate on vegetation and specifically with the fact that the trees of the miombo on which honey bees depend tend to flower in the dry season. *D.G. Lowe*

Department of Zoology and Entomology, Rhodes University, PO Box 94, 6140 Grahamstown, South Africa.

Hertz, O. Beekeeping in the tropics. [Biavl i troperne.] *Tidsskrift for Biavl* (1996) 130 (11, supplement) 1–32 [Da, Bj] The different species of bees in the various tropical regions are discussed. Short articles are devoted to traditional beekeeping in West Africa, and in East Africa, and with stingless bees. Denmark's beekeeping development projects in the following countries are described: Gambia, Guinea Bissau, Tanzania, and Dominica. *P. Walker*

Kekeya, M. Subsistence ecology of the Tongwe, Tanzania. *Kyoto University African Studies* (1976) 10 143–212 [En, B]

Honey collection is dealt with on pages 184–185; the hives used are made of two hollowed out half-logs bound together with cord. One man owns about 20–100 hives, sometimes nearly 300. The Sitete people have moved from Mount Sisaga where they once lived, but they still use their old honey collecting places there; these are mapped, together with the leopard traps they attend to in time left over from honey collection and hive making. The yield per hive may amount to 4 gal (25 kg) honey and 2 kg beeswax. Larvae of honeybees (*lususi*) and of *Trigona* (*ihula*) are among the insects still eaten by the Tongwe. *E.E. Crane* Fac. Education, Fukui Univ., 9-3-1 Bunkyo, Fukui, Japan.

Kihwele, D.V.N. *Constraints responsible for the low quality of honey and beeswax in Tanzania: a case study of miombo woodlands. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984.* (1985) 182–188 [En, B]

Actual and potential figures for honey production are discussed. Some of Tanzania's major honey plants are listed. Most beekeepers keep bees in log or bark hives hung in trees; data collected by interviewing beekeepers in Chunya and Tabora Districts shows that there are several reasons for the low quality and quantities of honey and beeswax produced. These are: clearing of bee forage to provide land for tobacco growing (required by law in some areas); scarcity of young beekeepers; lack of protective clothing; difficulty in assessing the best time to harvest honey from traditional hives; swarming; shortage of wire for hanging hives out of reach of honey badgers; poisoning of bees by insecticides; destruction of bee forage by caterpillars; scarcity of appropriate honey extractors, beeswax processing equipment and appropriate honey containers; lack of transport and the poor marketing system for honey and beeswax. Recommendations are made for dealing with these problems. *P. Walker*

Serengeti Wildlife Res. Inst., PO Box 661, Arusha, Tanzania.

Kihwele, D.V.N. *The African honeybees and their potential for commercial beekeeping. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.* London, UK; International Bee Research Association. (1989) 388–391 ISBN 0-86098-196-7 [En, Bdo]

The behavioural characteristics of African honeybees, especially *Apis mellifera scutellata*, and how they affect beekeeping management, are discussed. Some personal experiences with this bee are described and suggestions for developing beekeeping in Africa are made. *D.G. Lowe*
Forestry & Beekeeping Div., Ministry of Lands, Natural Resources & Tourism, PO Box 426, Dar-es-Salaam, Tanzania.

Kihwele, D.V.N. *The current development of beekeeping and future plans in Tanzania. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992.* Cardiff, UK; International Bee Research Association. (1994) 142–144 ISBN 0-86098-215-7 [En, Bdo]

Forestry & Beekeeping Division, Ministry of Tourism, Natural Resources & Environment, PO Box 426, Dar-es-Salaam, Tanzania.

Kihwele, D.V.N. *Honey production, quality control and marketing in Tanzania. Perspectives for honey production in the tropics: proceedings of the NECTAR symposium held in Utrecht, 18 December 1995 [edited by Sommeijer, M. J.; Beetsma, J.; Boot, W.-J.; Robberts, E.-J.; Vries, R. de].* Bennekom, Netherlands; Netherlands Expertise Centre for Tropical Apicultural Resources. (1997) 67–88 ISBN 90-801204-3-X [En, Bd]

Honey production in Tanzania is dependent on small-holder beekeepers who mainly use barrel hives for *Apis mellifera scutellata*. Over 95% of beekeeping in Tanzania is

practised in savanna forests (miombo). The rest is carried out around homesteads, in banana plantations and coffee farms, for example, where shade trees are used for hanging hives. Beekeeping with stingless bees (meliponiculture) is also practised on a small scale in Kilimanjaro, Arusha, Iringa, Mtwara and Singida. The local price for honey from stingless bees is about five times as high as that for honey from honey bees because of its higher medicinal value. The average productivity per *A. m. scutellata* colony per year using traditional hives is 15 kg honey and 1 kg beeswax. Productivity for stingless bees varies with species or varieties, from a few grams up to 12 kg honey. Quality control methods for honey include: (1) harvesting honey from remote forests away from pesticides; (2) harvesting honey without using fire (by some beekeepers); (3) straining honey using gadgets made of stainless materials such as bamboo strainers combined with skimming off beeswax particles; (4) storing honey in stainless containers such as clay pots, leather bags, bark and wooden containers, etc; (5) keeping in cool rooms, thatched with grass to protect against the heat of the sun. Marketing of honey (and beeswax) is carried out by beekeepers' co-operatives, private companies and individuals in both local and export markets. The problems of obtaining figures for actual national annual honey production are discussed. *Author*

Latham, P. *Beekeeping and some honeybee plants in Umalila, Southern Tanzania.* (rev. ed.) *Author* (2001) 91 pp. [En, Bdo]

After a brief description of traditional hives and equipment, pages 13–85 contain information on bee plants (one per page). There are many colour photographs, and a plant index. *P. Walker*

Latham, P. *Bee plants of Bas-Congo and southern Tanzania.* Canterbury, UK; Mystole Publications (2003) CD-ROM. ISBN 0-9543012-5-0 [En, B misc CD]

Two of the four files on this CD provide an introduction to beekeeping and some of the bee plants in Bas-Congo, Congo (106 pp.) and Umalila, southern Tanzania (88 pp.). Information on bee plants includes Latin and other names, value to honey bees, other uses, and propagation, as well as a picture. The other two files contain tables of plants with an indication of the months in which bees collect pollen and/or nectar from them. *P. Walker*

Madaha, J.M. *The Tabora Beekeepers' Co-operative Society Limited [Tanzania]. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.* London, UK; International Bee Research Association. (1989) 187–188 ISBN 0-86098-196-7 [En, Bdo]

Meixner, M., Ruttner, F., Koeniger, N. and Koeniger, G. *The mountain bees of the Kilimanjaro region and their relation to neighbouring bee populations.* *Apidologie* (1989) 20 (2) 165–174 [En, fr\ de, Bj]

A total of 27 honeybee samples was collected in the area of Arusha, Tanzania, at altitudes from 800 m to 2800 m. Morphometric analysis showed that most characteristics measured were significantly positively correlated with altitude, especially the length of tergites 3 + 4 (taken as a

measurement of body length), length of forewing, and hair length. No such correlation was found for proboscis length or wing venation angle J16. Multivariate analysis resulted in the separation of samples into two groups, from above and below 2000 m; the groups corresponded to the races *Apis mellifera scutellata* and *A. m. monticola*. The *monticola* populations on Mt. Meru and Mt. Kilimanjaro could be separated by only two characteristics: the venation angle J16 and the length of tergite 4. The Kilimanjaro *A. m. monticola* were compared with samples collected in this area in 1965; the latter had the same characteristics but were slightly bigger. *P. Walker*
Inst. Bienenkunde (Polytech. Ges.), J.-W. Goethe-Univ., Frankfurt am Main, Karl-von-Frisch-Weg 2, D-6370 Oberursel, Germany.

Muheto, R.N. and Wix, P. Remote sensing for natural resources evaluation: its value to apiculture. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984. (1985) 224–228 [En, B]

The development of techniques for remote sensing is described briefly. The application of the method to the evaluation of natural resources can be useful when combined with ground surveys, using special techniques for interpreting results. Several types of vegetation were differentiated by aerial photography of an area in England. In Tanzania, space-borne imagery, combined with some knowledge of the area studied, allowed identification of certain vegetational characteristics, e.g. miombo woodlands and fire-burnt areas, thus helping in the evaluation of the area from a beekeeping viewpoint. Further development of the techniques is needed. *P. Walker*
Min. Lands, Natural Resources & Tourism, PO Box 9372, Dar-es-Salaam, Tanzania.

Murray, S.S., Schoeninger, M.J., Bunn, H.T., Pickering, T.R. and Marlett, J.A. Nutritional composition of some wild plant foods and honey used by Hadza foragers of Tanzania. *Journal of Food Composition and Analysis* (2001) 14 (1) 3–13 [En, 36 wf]

The aim of this study was to analyse macronutrients and energy provided by most of the fruits and honey that are major non-meat products for the Hadza.
Dept of Anthropology, 1180 Observatory Drive, Univ. of Wisconsin-Madison, Madison, WI 53706, USA.

Ng'atigwa, V. and Yule, I.J. Increasing honey production in Tanzania through mechanization. *AMA, Agricultural Mechanization in Asia, Africa and Latin America* (1996) 27 (2) 58–63, 66 [En, 13 ref.]

This paper examines the economic viability of a mechanised honey processing plant designed to suit the current beekeeping conditions of Tanzania based on a case study in Babati district. The viability test was based on 1992 prices for products, corresponding costs and exchange rates. The designed system was capable of processing 42 t per annum and was proved to be very profitable with a break-even point at only 12 t annual production.
Sokoine University of Agriculture, Morogoro, Tanzania.

Ntenga, G. Training in beekeeping – Tanzania. Tabora, Tanzania, Beekeeping Section. (1968?) 15pp. [En, B]

Ntenga, G. Hive development in Tanzania. *American Bee Journal* (1972) 112 (1) 20–21 [En, B]

Ntenga, G. Beekeeping development programmes in Tanzania. Apiculture in tropical climates, editor E. Crane. London, UK; International Bee Research Association. (1976) 147–154 [En, B]

This is a fairly detailed account of past, present and future activity: before independence in 1961; the development potential; the present programme; foreign involvement. Among subjects discussed are market development, centres of various types, state bee farms, stingless bees, Ujamaa (self-help) villages, and school beekeeping. *E.E. Crane*

Min. Natural Resources and Tourism, PO Box 426, Dar-es-Salaam, Tanzania.

Ntenga, G.M. and Mugongo, B.T. Honey hunters and beekeepers: a study of traditional beekeeping in Babati District, Tanzania. Working Paper, International Rural Development Centre, Swedish University of Agricultural Sciences (1991) (No. 161) ii + 77 pp. [En, Bdo]

In Babati district, like in other areas of Tanzania, honey hunting is still practised widely, particularly in reserves such as Tarangire and Manyara National Parks, where bee nests are commonly located in hollow trees. Traditional beekeeping, using the local honey bee *Apis mellifera scutellata*, is closely linked with other activities. The log hive used by the Gorowa and Iraqw of Babati resembles other traditional log hives: it is cylindrical and consists of two parts, joined together by rope or wire. An apparently unique feature, however, is an opening which is often located in the middle of one side of the hive. This opening is used as a harvesting gate – the beekeeper can see the hive contents clearly and can remove the honey without disturbing the hive and the bees. Beekeepers use a strongly scented plant, *Ocimeras suave*, to bait their hives. The scent which this plant emits quickly attracts bees. It is common practice to site the hives horizontally, either by placing them between forked branches in trees or by suspending them from tree branches. There are several hazards to beekeeping, including man, the honey badger, various insects and birds. The most traditional use of honey is in the preparation of honey beer, which is central to all traditional ceremonies. Honey is also used in medicine and as a food, often mixed with sorghum. The long history of beekeeping in Babati, the sound knowledge of beekeepers today, and the strength of traditional markets for honey suggest that beekeeping is capable of further development, and this paper recommends ways in which this could be done. The paper concludes with seven appendices which give details of the methods used in the study and beekeeping methods used in this district. *D.G. Lowe*

Pager, H. Honeycombs, ladders and bees in the rock art of Africa. Unpublished report prepared for the Bee Research Association. (1975) 79 pp. [En, B]

The author has collected together evidence he has uncovered in Algeria, Lesotho, Libya, Malawi, Morocco, Rhodesia, South Africa, South West Africa, Spanish Sahara, Tanzania, Tunisia, Uganda and Zambia. There are large numbers of published and unpublished drawings, together with documented extracts from books and other publications, and perceptive notes by the author. *E.E. Crane*
P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Quong, A. *The implications of traditional beekeeping in Tabora region, Tanzania, for miombo woodland conservation. A comparative study of Igombe Forest Reserve and Ugalla River Game Reserve.* Tanzania; School for International Training. (1993) 50 pp. [En, Bdo]

The background to traditional beekeeping in Tanzania, and the characteristics of the Tabora region, including its vegetation and the market for bee products, are described. The study was carried out by field research and a series of interviews with beekeepers in the two chosen areas (Igombe and Ugalla). The results were analysed in order to give information on the environmental impact of beekeeping activities, such as collecting tree trunks and bark for hive construction, and the relationship between beekeeping productivity and the state, quality and size of the woodland. Details are given for numbers of hives, type (log or bark), hive material tree species, and siting tree species. All stumps and debarked trees were noted. The results indicate that beekeepers prefer to use log hives, with mninga (*Pterocarpus angolensis*) being the log of choice. The average annual replacement rate for log hives is 20%, with 1–3 hives being obtained from one tree. Log and bark hives are hung in taller, flower-producing trees. Honey is harvested from June through to September/October. The beekeepers smoke the bees from the hives using bundles of sticks or grass lit from a fire on the ground; the use of fire is regarded as a sensitive issue. Annual honey production is estimated at 2–14.4 kg per hive. Constraints to beekeeping include water shortage, and destruction of the forest by logging operations and for tobacco growing. It is concluded that traditional beekeeping is one of the least destructive forms of resource use in the miombo woodland, and recommendations for further studies are made. *D. G. Lowe*

Rueppel, T. *Ethnological aspects of beekeeping in East Africa. [Ethnologische Aspekte der Bienenhaltung in Ostafrika.]* Hausarbeit zur Erlangung des Magistergrades, Georg-August-Universität, Göttingen, Germany. (1982) iii + 97 pp. [De, B]

This is a detailed comparative study of the Okiek (Dorobo) tribe in Kenya, the Chaga in north-east Tanzania and the Hamar in south Ethiopia. For each tribe an account is given of the environment, food, social and political organisation, hives where used and honey collection methods. The uses of honey in food, in beer making, in rituals, marriage ceremonies, etc., and in trade, are also described. Ownership rights of beekeepers are dealt with, and the extent of knowledge about bees. The report is well illustrated, mostly with photographs. *E.E. Crane*
Philosophisches Fakultät, Georg-August-Universität, Göttingen, Germany.

Shirima, S. *The Danish market for Tanzanian natural honey (Report No. 23/87). The Danish, Norwegian, Swedish and Finnish markets for Tanzanian natural honey (Report No. 26/88).* Helsinki, Finland; Programme for Development Cooperation, Helsinki School of Economics. (1988) 50 pp. ISBN 951-700-557-1 [En, Bd]

The first part of this market research report (No. 23/87) describes a study on honey production in Tanzania in 1987. Details are given for actual and potential production, government participation in honey production and trade, types of honey produced, distribution of hives, beekeeping capacity, local usage of honey, the role of the Tabora Beekeepers Cooperative Society (TBCS) and its problems, and export marketing and practices. A study made in Denmark on the demand for natural honey, quality and packaging requirements, pricing and import regulations, indicated that market accessibility in Denmark is very minimal; there is stiff competition from other exporters such as Russia, Mexico, Australia, Argentina and Germany. Report No. 26/88 gives information on quality and packaging requirements, pricing and competition, terms of payment and delivery, and prospects for Tanzanian honey in Denmark, Norway, Sweden and Finland. A list of contact addresses is given. *D. G. Lowe*

Programme for Development Cooperation, Helsinki School of Economics, Lapuankatu 4, 00100 Helsinki, Finland.

Smith, F. G. *Three cells of honeycomb.* Nedlands, Australia; F. G. Smith. (1994) xii + 248 pp. ISBN 0-9587538-5-7 [En, 12 plates, Bd]

In this autobiography by Dr Francis Smith, the three cells in the title represent his three periods of beekeeping work: in Britain, Tanganyika and Australia. He studied forestry and kept bees in Scotland from 1946, and was Beeswax Officer in Tanganyika from 1949 until independence in 1962. Thereafter he worked in Western Australia, as Senior Apiarist until 1975 and then as Director of National Parks. Beeswax and honey were important exports of Tanganyika and Western Australia, respectively, and Francis Smith initiated many improvements in the production and quality of both products. The book also includes details of some of his scientific work on bees and a list of his publications, of which *Beekeeping in the tropics* (1960) became a standard text book. An appendix sets out the methods of pollen analysis used by Francis Smith in his studies of bee botany in Tanganyika and Australia. There is also a detailed index. *E. Crane*

Takeda, J. *An ecological study of the honey-collecting activities of the Tongwe, western Tanzania, East Africa. Kakeya, M.: Subsistence ecology of the Tongwe, Tanzania.* Kyoto University African Studies (1976) 10 213–247 [En, B]

This is a detailed study (by a non-beekeeper) describing hives, how bees are kept in them, and how the honey is collected. [see also previous abstract.] The Tongwe live in Tanzania, in miombo country on the eastern shore of Lake Tanganyika. Lists are given of species of trees used for making hives, and of those in which hives are set up. Mubike hives consist of two hollowed out half-cylinders, usually about 150 x 30 cm. For the rarer siphonpoli hives, the inner bark of *Julbernardia* or *Brachystegia* is used, and

they are lighter and less robust; those seen were 80 cm long and 30–40 cm in diameter. Tongwe living on the lake-side use oil of the sheatfish (*Dinopterus cunningtoni*) as a kind of magic to induce bees to occupy hives, which are sited 150–850 cm above the ground in trees. Honey collection is described; the beekeeper does not use a ladder but climbs the tree. In good conditions the honey yield may be 15 kg/hive, and the wax yield may be 10–15% as much. Plants over 1 m high, within 10 m of hives, are listed; many are *Leguminosae* and *Verbenaceae*. Major nectar-bearing plants are listed, and many of these are *Leguminosae*. Most honey is sold, but some is kept and eaten, as a sweetener. Wax is sold. Propolis is also collected; it is used as an adhesive – for instance to attach a horn ‘blood-sucker’ to the skin – and a lump is attached to the surface of a drum-skin to change the tone of the drum. *E.E. Crane*
Dept. Public Health, Univ. Ryukyus, Japan.

Vorwohl, G. *Honeys from tropical Africa: microscopical analysis and quality problems. Apiculture in tropical climates*, editor E. Crane. London, UK; International Bee Research Association. (1976) 93–101 [En, B]

Lists are given of pollen grains common in honeys from Tanzania and Kenya. A table lists characteristics (sediment, water, HMF, diastase and invertase contents) of 59 honey samples, from Kenya, Tanzania, Burundi, Madagascar, Ivory Coast and Upper Volta. The honeys are discussed, and their characteristics compared with German import requirements. *E.E. Crane*

Landesanstalt für Bienenkunde, Univ. Hohenheim, 7000 Stuttgart 70, Germany.

Vorwohl, G. *Pollen spectra of African honeys. Proceedings of the IVth International Palynological Conference, Lucknow, India, 1976–77*. (1981) 499–502 + 1 pl. [En, B]
Honeys from the following countries have been analysed and the results are discussed: Tanzania (33 samples), Kenya (1), Burundi (11), Upper Volta (1), Ivory Coast (1), Madagascar (12), Rhodesia, now Zimbabwe (1). Eucalyptus pollen was dominant in the samples from Burundi, Zimbabwe and Madagascar. Previously published analyses for honeys from northern Africa are also sum-

marised; these honeys have rather different pollen spectra. *P. Walker*
Dept. Apiculture, Univ. Hohenheim, 7000 Stuttgart 70, Germany.

Wainwright, D. *The bark hive beekeeping industry of central Africa: does it contribute to forest conservation or forest destruction? Bees and forest in the tropics. Proceedings of the Second NECTAR Seminar, Wageningen, Netherlands, 28 August 1992* [edited by *Beetsma, J.J.* Bennekom, Netherlands; Netherlands Expertise Centre for Tropical Apicultural Resources. (1995) 71–73 ISBN 90801204-2-1 [En, Bd]

Tanzania exported nearly 700 t beeswax in 1991 produced from, perhaps, 2 million traditional hives. In order to make bark hives, a beekeeper with 100 hives may destroy up to 25 trees/yr, but he also wants to conserve the forest which provides important resources. Beekeepers are reluctant to invest money in ‘improved’ hives. However, it may be possible to show beekeepers how to make better traditional hives and how to manage them better. *P. Walker*

Wix, P. *Honey production in Tanzania as an objective in rural development and its potential in the EEC market. Proceedings of the 6th International Congress of Food Science and Technology, 1*. (1983) 229–230 [En, B]

Wix, P. *Tanzania's beekeeping potential through rural development, in relation to the EEC market. Proceedings of the Third International Conference on Apiculture in Tropical Climates, Nairobi, Kenya, 5–9 November 1984*. (1985) 179–181 [En, B]

Discusses factors involved in developing beekeeping in Tanzania, and potential exports of honey and beeswax to the EEC.

Wix, P. and Lyatuu, P. *Development of beekeeping economy in Tanzania. Proceedings of the XXVIIIth International Congress of Apiculture, Acapulco, 1981*. Bucharest, Romania; Apimondia Publishing House. (1981) 215–220 [En, B]

Vanuatu

No entries

Zambia

Zambia, Forest Department. *An introduction to frame hive beekeeping in Zambia*. Ndola, Zambia; Forest Department. (1979 ?) 60 pp. [En, B]

After brief introductory chapters on the life cycle and behaviour of honeybees (*Apis mellifera adansonii*), the Dadant transitional hive, modified Dadant hive and 6-frame Dadant swarm box are described, with dimensioned drawings. The first is a horizontal hive with a central brood chamber and two vertical queen excluders. Instructions

are given for setting up the hives in an apiary, managing them, and harvesting and processing honey and wax. Transfer of a colony from a bark hive to a frame hive is described, the seasonal sequence of events and operations, and the important forage trees and their distribution in Zambia. In Zambia main pests are the honey badger, red ants, hive beetles, pirate wasps and black sugar ants; diseases are AFB, EFB and acarine disease. *E.E. Crane*
Forest Dept., P.O. Box 228, Ndola, Zambia.

Clauss, B. *Bees and beekeeping in the North Western Province of Zambia*. Report on a beekeeping survey. Kabompo, Zambia; Forest Departments IRDP. (1992) vi + 168 pp. [En, Bdo]

This report is based on a survey and research activities carried out between 1987 and 1991. After an introductory chapter which presents facts about the climate, vegetation, economy and beekeeping of North Western Province, Zambia, Chapter II gives details of the bee forage of the province, including honeydew and extrafloral nectar, and observations on honey bee foraging behaviour. The local honey bee (*Apis mellifera adansonii*) and its behavioural characteristics are described in Chapter III. Chapter IV gives details of traditional beekeeping, including honey hunting, bark hives, management, harvesting honey, and the place of women in village beekeeping. Trials were carried out in order to compare bark hives, Dadant frame hives and Tanzanian top-bar hives and the results are presented in Chapter V. It is concluded that bark hive beekeeping will remain the most appropriate method in the wooded parts of the province for the foreseeable future, although top-bar beekeeping may be accepted by younger beekeepers. Frame hives are considered too expensive and too risky for small-scale farmers in this area. The final five chapters deal with marketing, beekeeping problems, possible future development, local innovations in methods and equipment, and recommendations for research, training and extension activities. The eight appendices give details of cleptoparasitic drone flies (*Syrphidae*), flowering calendars, additional nectar and pollen sources, distribution maps of important bee trees, local plant names, vegetation types, marketing routes and figures, and a list of 71 references. D.G. Lowe

Clauss, B. *Cleptoparasitic drone flies. Proceedings of the Fifth International Conference on Apiculture in Tropical Climates, Trinidad and Tobago, 7–12 September 1992*. Cardiff, UK; International Bee Research Association. (1994) 113–115 ISBN 0-86098-215-7 [En, Bdo]

Two species of *Syrphidae*, *Eristalis plumipes* and *Simioides pachymera*, were observed hovering near hives in Zambia. Individual flies were seen to land and enter a hive without interference from the bees, then to reappear a few minutes later and fly off. Flies in observation hives were seen to feed from open honey and pollen storage cells. Worker honey bees which took notice of a feeding syrphid sometimes licked its thorax, wings or abdomen, and sometimes surrounded it like a queen, but never molested it. Other observations suggested that the flies may use pheromones and vibrations in order to deceive the bees. D.G. Lowe
Schesbuschweg 20, D-2050 Hamburg, Germany.

Clauss, B. and Clauss, R. *Zambian beekeeping handbook*. Kabompo, Zambia; Forest Department, Beekeeping Division. (1991) iv + 108 pp. [En, Bdo]

This book is intended for the use of beekeeping extension personnel in Zambia. It provides basic information about various simple and low cost methods of beekeeping, including various types of fixed-comb hives, but bark hive beekeeping is not encouraged ('leave the trees to the bees'). Movable-comb hives are also described, and there

are chapters on pests and problems, bee plants, village beekeeping, honey harvesting and storing, and wax processing. The manual is well illustrated and includes a short glossary. D.G. Lowe

Clauss, B. and Zimba, R. *Beekeeping development on the base of the existing traditional practices (Zambia – North-Western Province). Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 168–170 ISBN 0-86098-196-7 [En, Bdo]

Hepburn, H.R. and Radloff, S.E. *Beeswax exports and rainfall in the savanna woodlands of east central Africa*. *Apidologie* (1996) 27 (6) 473–478 [En, fr\de, Bj]

Records of beeswax exports from Tanzania, Zambia and Kenya in 1936–1961, and the corresponding rainfall records, were subjected to time-series and regression analyses. Data were plotted in 'bee-years' (July–June) as this is the seasonality of the annual cycle of honey bee colonies in savanna woodland areas below the equator. Figures for honey production and beeswax exports for Tanzania in 1906–1985 were also analysed. The results show that beeswax exports and rainfall are most significantly and highly correlated when phase-lagged by one bee-year. Rainfall and honey production are also highly significantly correlated when lagged by one bee-year. However, honey and wax production are highly correlated on a same bee-year basis. Thus, the beeswax harvest of any one year depends on the rainfall of the previous bee-year. This is consistent with general effects of climate on vegetation and specifically with the fact that the trees of the miombo on which honey bees depend tend to flower in the dry season. D.G. Lowe

Department of Zoology and Entomology, Rhodes University, PO Box 94, 6140 Grahamstown, South Africa.

Kaal, J., Velthuis, H.H.W., Jongeleen, F. and Beetsma, J. (eds). *Traditional bee management as a basis for beekeeping development in the tropics. Proceedings of the first NECTAR seminar, Royal Tropical Institute, Amsterdam, 7 May 1990*. Bennekom, Netherlands; Netherlands Expertise Centre for Tropical Apicultural Resources. (1992) 87 pp. ISBN 90-801204-1-3 [En, Bd]
The texts of the six papers presented at the seminar are given. They include: From forest to supermarket – traditional beekeeping in Zambia (pp. 25–38), by D. Wainwright.

Krell, R., Persano Oddo, L. and Ricciardelli d'Albore, G. *The influence of harvesting and processing methods on honey quality in Zambia and Malawi. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988*. London, UK; International Bee Research Association. (1989) 268–273 ISBN 0-86098-196-7 [En, Bdo]

Of 33 honey samples collected from Zambia and Malawi, four contained more than 21% moisture, 10 were too dirty to be acceptable under international standards, and four had an HMF content above 40 mg/kg. Five of the darker honeys had a mineral content of above 0.6% and some had

a bad odour. Many of the honeys were of excellent quality. The honeys investigated were harvested from traditional bark and log hives as well as from top-bar and frame hives by beekeepers of various training backgrounds. The honeys had also been processed by different methods, from boiling in tin cans, dripping through fine mesh screens, to pressing and various centrifugal extraction methods. The various methods and their influence on honey quality are discussed in detail. Pollen analysis indicated that the most important nectar sources were *Brachystegia*, *Julbernadia* and various *Compositae*, *Myrtaceae* and *Proteaceae*. D.G. Lowe
Dept. Entomology, Univ. Georgia, Athens, GA 30602, USA.

Lawton, R. M. *Natural resources of miombo woodland and recent changes in agricultural and land-use practices.* *Forest Ecology and Management* (1982) 4 (3) 287–297 [En, B]
Miombo woodland (deciduous woodland dominated by the legumes *Brachystegia* and *Julbernadia*) covers a large area of central Africa south of the Equator. The renewable resources of miombo, including beeswax and honey, are discussed and roughly evaluated. The trees and shrubs of miombo provide a nectar flow during most of the year; the main flow (from August to November) is from *Brachystegia* and *Cryptosepalum* species. In Zambia the annual yield from a frame-hive is thought to be about 20 kg honey and 2 kg beeswax. In the period from 1976 to 1980, Zambia exported about 17,000 kg beeswax. In tribes which have traditionally kept bees (e.g. Wanyamwezi, Lunda and Luvale), it is sometimes possible to introduce improved methods so that production of honey and beeswax can be increased. Some tribes which have in the past simply collected honey from wild colonies now plant to start bee-keeping. P. Walker
Land Resources Dev. Centre, Tolworth Tower, Surbiton, Surrey KT6 7DY, UK.

Munalula, B.P. *Forest conservation and beekeeping.* In Raina, S.K., Kioko, E.N. and Mwanjyky, S.W. (eds). *Proceedings of the first international workshop on the conservation and utilization of commercial insects, Kenya, 18–21 August 1997.* Nairobi, Kenya; International Centre of Insect Physiology and Ecology (99) 115–120 [En, Bd]

Pager, H. *Honeycombs, ladders and bees in the rock art of Africa.* Unpublished report prepared for the Bee Research Association. (1975) 79 pp. [En, B]
The author has collected together evidence he has uncovered in Algeria, Lesotho, Libya, Malawi, Morocco, Rhodesia, South Africa, South West Africa, Spanish Sahara, Tanzania, Tunisia, Uganda and Zambia. There are large numbers of published and unpublished drawings together with documented extracts from books and other publications, and perceptive notes by the author. E.E. Crane
P.O. Box 81211, Parkhurst, Johannesburg 2120, South Africa.

Persano Oddo, L., Krell, R. and Ricciardelli d'Albore, G. *Contribution to the identification of the geographical and botanical origin of honeys produced in Zambia and Malawi.* *Apicoltura* (1988) (No. 4) 113–138 [En, it, B]
The 70 pollen types identified in 28 honeys from Zambia and 10 from Malawi are listed. Honeys harvested in Zambia

after the April–May nectar flow were characterised by the presence of *Julbernadia* pollen associated with *Compositae* (*Vernonia* and *Bidens* in particular), *Myrtaceae*, and pollens from nectarless plants (*Gramineae* and *Cyperaceae*). These were probably unifloral *Julbernadia* honeys. Samples collected in Zambia in November and December showed an association of *Brachystegia*, *Rhamnus* type, *Myrtaceae* and *Combretaceae*, together with *Anacardiaceae*, *Oleaceae* type and *Sapindaceae*. The honeys from Malawi were more varied and they contained a greater variety of pollen types, of which *Vernonia*, *Synedrella*, *Eucalyptus*, *Macadamia* and *Faurea* were dominant. Certain samples contained honeydew elements. The main types of pollen grain are illustrated in 14 plates. Author

Sezione di Apicoltura, Istituto Sperimentale per la Zoologia Agraria, 00156 Rome, Italy.

Radloff, S.E., Hepburn, H.R. and Villet, M.H. *The honeybees, *Apis mellifera* Linnaeus (Hymenoptera: Apidae), of woodland savanna of southeastern Africa.* *African Entomology* (1997) 5 (1) 19–27 [En, Bc]

The morphometric characters and sting pheromones of worker honeybees, *A. mellifera*, were analysed by multivariate methods to identify discrete populations in the southeastern woodland savanna of Africa. A discrete population in Mozambique is classified as *A. m. litorea*, a second in Zimbabwe as *A. m. scutellata* and a third group in southwestern Zambia as *A. m. adansonii*. A zone of introgression between the last two subspecies occurs in south-central Zambia and in the Zambezi Valley.

Department of Statistics, Rhodes University, Grahamstown, 6140, South Africa.

Silberrad, R. *Bee-keeping in Zambia.* *British Bee Journal* (1973) 101 (4289; 4290) 42–43; 54–55 [En, B]

Silberrad, R. *African sweetness and fury: bee-keeping in Zambia.* *Country Life* (1976) 160 (4143) 1566, 1568 [En, B]

Silberrad, R.E.M. *Apiculture in the world: apicultural development in Zambia.* *Apiacta* (1974) 9 (2) 93–96 [En, B]

Silberrad, R.E.M. *Bee-keeping in Zambia.* Bucharest, Rumania; Apimondia. (1976) 76 pp. [En, B]

This book contains much practical information on the management of *Apis mellifera adansonii* in Zambia, in both fixed-comb bark hives and Dadant movable-frame hives (standard, or modified to have 28 frames in a single long chamber). The author's five-year records (1971–1974) for several thousand hives are set out in tables; they demonstrate how absconding, and the occupation of empty hives by absconding and migrating colonies and swarms, dominate beekeeping practice. Other differences between *A. m. adansonii* and European races are discussed, and differentiated from the many differences between tropical and temperate zones that themselves affect bee management. E.E. Crane

Storrs, A.E.G. *More about trees.* Ndola, Zambia; Forest Department. (1982) vi + 127 pp. + 28 pl. [En, B]
The section on beekeeping (pp. 66–71) includes a list of trees providing bee forage; honey recipes are also given.

Wainwright, D. *Beekeeping at the Integrated Rural Development Programme, Kabompo, Zambia. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.* London, UK; International Bee Research Association. (1989) 198–201 ISBN 0-86098-196-7 [En, Bdo]

Wainwright, D. *Socio-economic comparison of beekeeping technologies in Zambia. Proceedings of the Fourth International Conference on Apiculture in Tropical Climates, Cairo, Egypt, 6–10 November 1988.* London, UK; International Bee Research Association. (1989) 360–366 ISBN 0-86098-196-7 [En, Bdo]

Traditional beekeeping in Zambia, based on bark hives and log hives, produces large quantities of beeswax for export and honey for domestic consumption. Recently, attempts to introduce top-bar movable-comb hives have been made, and this paper compares economic aspects of the two forms of beekeeping under current conditions prevailing in Zambia. An analysis of costs and benefits at current Zambian prices indicates that a bark hive typically producing 7.5 kg honey/yr is more profitable than a top-bar hive producing 50 kg honey/yr except where top-bar hives are kept in highly organised production units in areas of good forage. Generalised socio-economic characteristics of bark hive and top-bar hive beekeeping are discussed. *D. G. Lowe*

Lympstone Cottage, Lympstone, Devon EX8 5JC, UK.

Wainwright, D. *Forest honey. Beekeeping & Development* (1991) (No. 20) 10–11 [En, Bj]

Forest beekeeping in the North-Western Province of Zambia is described. Honey and beeswax are produced by traditional methods and sold through a marketing company.

Wendorf, Horst (ed.). Berlin, Germany; Horst Wendorf Zambia: development in beekeeping (99) video (VHS). [En, Bav]

Small-scale farmers can overcome food shortages by sales of forest products, of which honey is the most important. Reports on the Smallholder Development Project, launched in 1993, to develop a sustainable beekeeping industry in Zambia, focussing on honey and beeswax marketing and the introduction of top-bar hives.

Werger, M.J.A. (ed.). *Biogeography and ecology of Southern Africa.* Hague, Netherlands; Dr. W. Junk bv Publishers. (1978) 2 vols, xvi + 1439 pp. ISBN 90-6193-083-9 [En, B]

The following areas are covered by this book: Angola, part of Shaba, Zambia, Malawi, Mozambique, Namibia, Botswana, Zimbabwe Rhodesia, South Africa, Swaziland and Lesotho. The first six chapters describe the environment, including its geology, meteorology, and vegetational history. Chapters 7–14 cover the main biogeographical areas and their vegetation, e.g. the afromontane region, the Cape region, the Indian Ocean coastal belt, etc. Chapters 16–31 each cover a major taxonomic group of animals. Chapter 27, by A. J. Prins, covers the Hymenoptera. In a book with such a wide scope as this one, little space can necessarily be allotted to bees; pages 853–857 briefly describe the Apoidea known to occur in southern Africa. The majority of the remaining chapters cover the ecology of special habitats, such as fresh water, mangrove swamps, termitaria and coastal marine. Man-land relationships are described, including conservation. This 2-volume set is very well produced; it provides a comprehensive study of the ecology of the region and should prove to be a valuable reference work. *D. G. Lowe*

Zulu, G. M. *Beekeeping in Zambia. Farming in Zambia* (1975) 9 (3; 4) 12–14; 15–16 [En]

Zulu, G. M. *Beekeeping in Zambia. Parts III and IV. Farming in Zambia* (1976) 10 (1; 2) 27–29; 8–9 [En, B].

In the last 25 years progress in information gathering and dissemination has surpassed that of any other period of history. Apiculture and apicultural research have been very much a part of this progression.

This book has a very simple format. It lists, in alphabetical order of first author, just about everything that has been written on bees, the practical application of bee science, beekeeping and hive products for all the countries of the Commonwealth.

Besides titles and authors, most of the entries have an abstract of the work or a note to amplify the title. Each entry is accompanied by various symbols and abbreviations, explained in a key, which indicate such things as original language, when published, where published and details of where a full version may be obtained.

Bees are recognised as very efficient pollinators: furthermore, they are consistent and diligent foragers. They will visit hundreds of flowers of the same kind in a single day. Because of this they have a vital role in increasing food production. It has been shown, but is often forgotten, that we depend for a huge percentage of our food production on the unmanaged pollination services of wild bees.

Pollination is essential for the reproduction of many flowering plants. It results in seeds which in turn mean crops which can be sold and eaten: for example, beans where the seed itself is eaten and fruits like apples and plums which develop around the seed. In short better bee husbandry means better crops, a better environment and, as a bonus, there are the cash crops to be found in hive products themselves.

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