



**THE BEEKEEPING DEVELOPMENT AND RESEARCH PROGRAMME OF
THE KHADI AND VILLAGE INDUSTRIES COMMISSION, INDIA**

by C.V. THAKAR
*(Director, Beekeeping Industry Khadi and Village Industries
Commission, Bombay, India)*

*(From "Apiculture in Tropical Climates", IBRA, London 1976
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Development Programme

Introduction

Beekeeping is not a traditional industry in India. However, collection of honey from wild bee colonies has been practised since time immemorial. Large quantities of honey collected by crude methods had a big market, as an article of food and as medicine. Efforts to introduce modern hives with *Apis mellifera* have been made since the 1880s. It was around 1910 that Rev. Father Newton for the first time designed a smaller hive, suitable for the indigenous *Apis cerana indica* in the extreme south. But as an industry beekeeping did not develop until the 1940s when Dr. Spencer Hatch in the southern-most coastal strip of India, Swami Shambhavananda in the district of Coorg in Karnataka, Shri S.K. Kallapur and Shri S.G. Shende in the Western Peninsula, and Shri R.N. Muttoo in the central Himalayan foothills, initiated efforts to popularize it among the rural population. Agricultural departments in some states also attempted to extend this industry to rural areas. Mahatma Gandhi, the Father of our Nation, included beekeeping in his rural development programme, and several persons with missionary zeal were trained in his Ashram for popularizing beekeeping in villages. All these attempts, however, had serious limitations. It was only after the formation of an All-India Khadi and Village Industries Board in 1953, which later was constituted as the Khadi and Village Industries Commission, that the beekeeping industry received serious attention for its development in a co-ordinated manner throughout the country. The establishment of the Khadi and Village Industries Commission is really the culmination of the rural re-construction programme envisaged by Mahatma Gandhi during the pre-independence era.

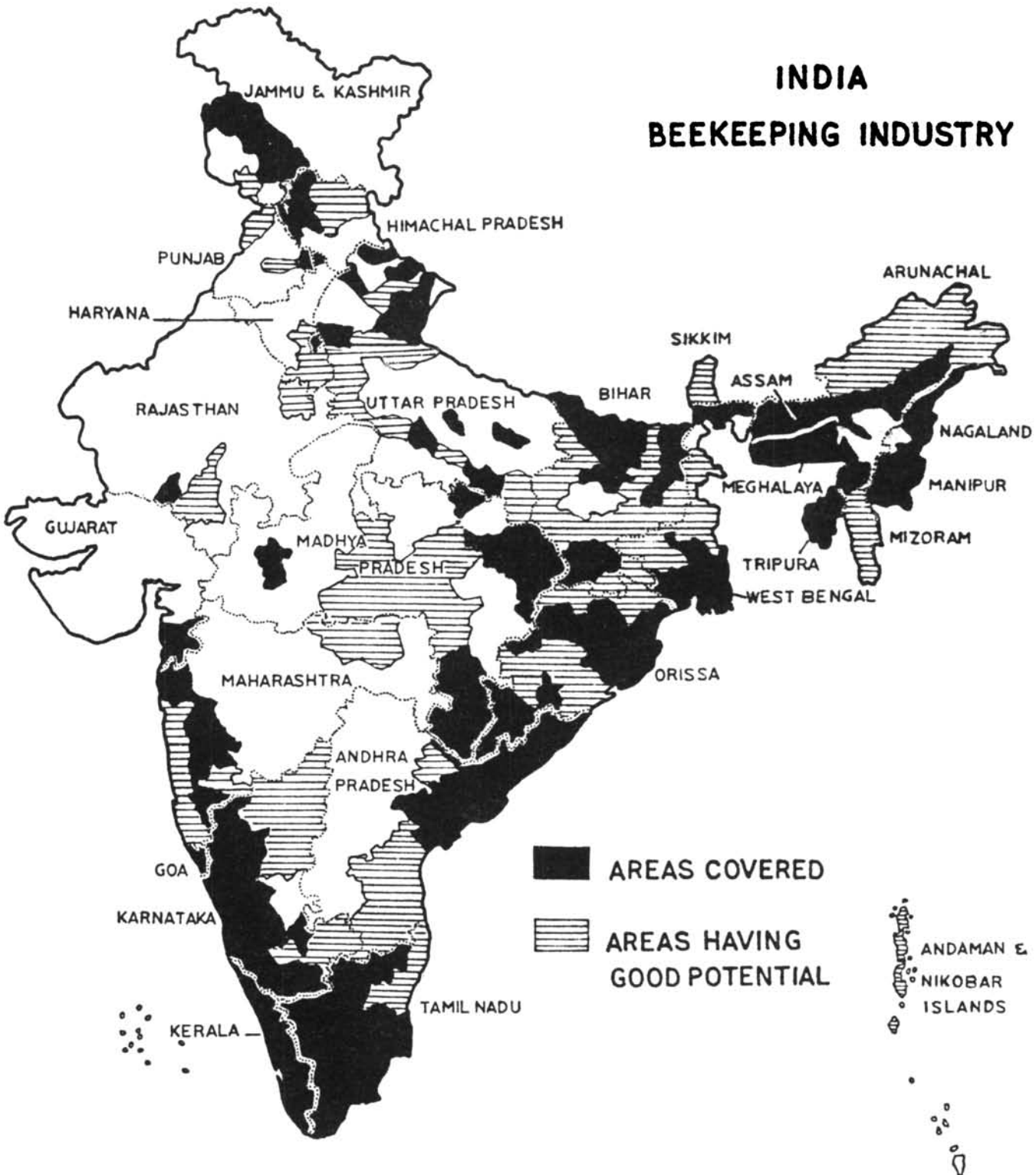
Organizational Structure

The Commission is an autonomous statutory body, established in an Act of Parliament by the Government of India; it is attached to the Ministry of Industries. It has its headquarters at Bombay and a network of technical, organizational and extension staff in all the states, reaching through district development blocks to villages. The artisans involved in the village industries activities have technical and other assistance close at hand.

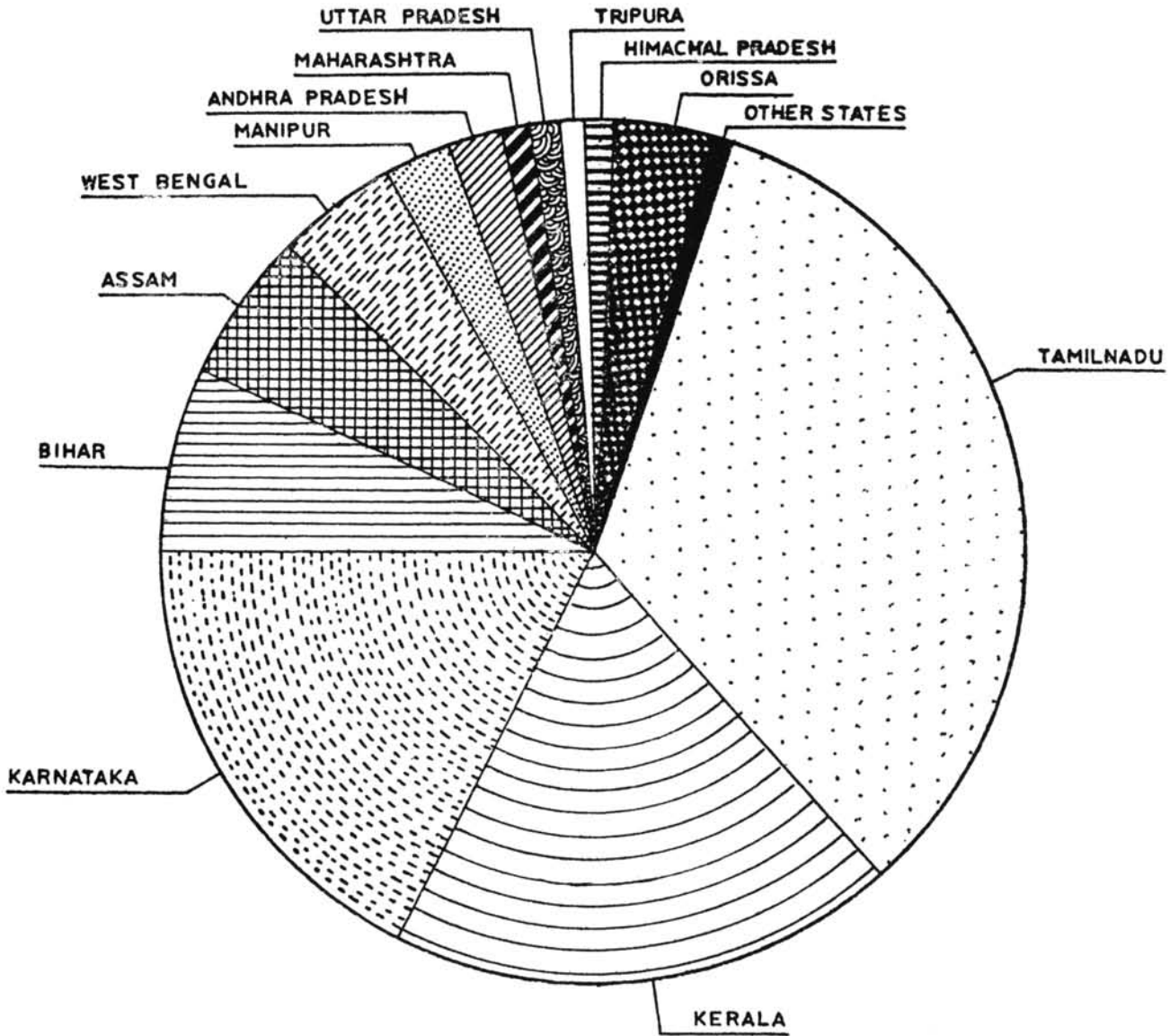
The functions of the Commission are to plan, organize and implement the programmes for the development of Khadi and village industries like spinning, weaving, pottery, leather-craft and beekeeping. Such programmes include stocking and supplying suitable raw material and supplying improved

INDIA

BEEKEEPING INDUSTRY



**INDIA
SHARE OF STATES
IN
APIARY HONEY PRODUCTION**



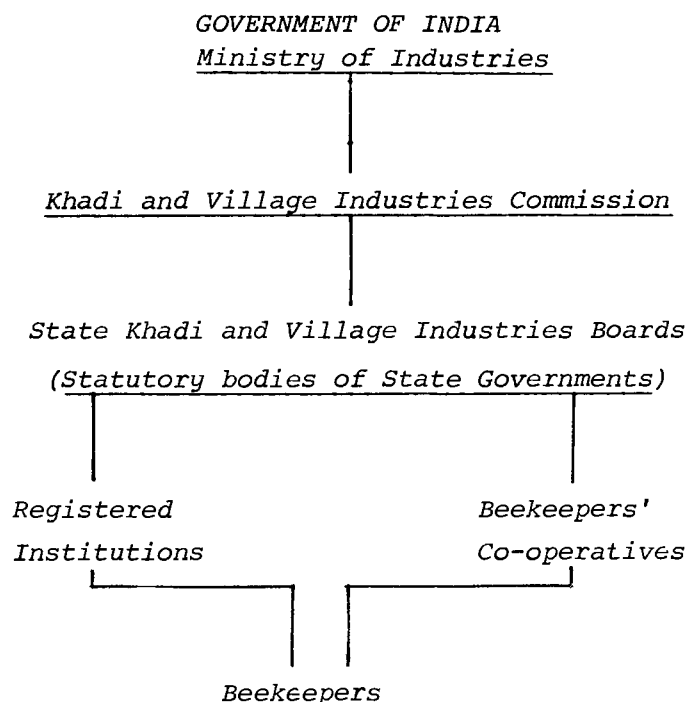
equipment, arranging the marketing of finished village industries products, promoting research in the improvement of tools and techniques, and providing training for artisans; also implementing people's education programmes through films, exhibitions, publications and other media. The Commission has so far produced four films on beekeeping.

The Commission executes the programmes through the State Khadi and Village Industries Boards and Registered Institutions and Co-operatives, to whom funds are released. The State Boards are local statutory bodies created by Acts of the State Governments, while the registered institutions are bodies registered in each state under the Public Trust Act and the co-operative societies under the Co-operative Act of the State. The local institutions and co-operatives, implementing village industries programmes in each State, function under the control of respective State Khadi and Village Industries Boards, through which they are accountable to the Commission.

Beekeeping
Development
Programme

The Beekeeping Directorate of the Commission has four functional wings: development, marketing, research and training. The development wing conducts surveys and prepares feasibility reports for the preparation of annual plans and perspective development. Financial budgets based on surveys are prepared in favour of State Boards and other agencies implementing programmes. The manufacture and supply of improved and standardized equipment are attended to. Technical help and supervision are also afforded by the extension wing of the Directorate, including assistance in the grading and marketing of honey produced by beekeepers. Beekeeping, as a part-time occupation, has now assumed national status as a subsidized programme for the benefit of under-employed people in villages.

Organizational structure for Khadi and Village Industries
Development Programme



The Beekeeping Directorate assists the organizations implementing programmes through set patterns of assistance approved by the Commission and the Government of India. The following are the main units of assistance.

1. Sub-station This is the basic unit for introducing beekeeping in new areas. The operative area has a radius of 5 - 8 km; it is selected through previous technical surveys. A trained fieldman is provided to educate the prospective beekeepers; he distributes hives and other equipment, and gives training in the management of colonies. This unit runs for a period of 5 years in the area, by which time it is expected that the beekeepers enrolled locally will have become self-reliant. Adjacent areas are covered similarly, and a viable beekeepers' co-operative society is established in due course, which then looks after the interests of the beekeepers in its jurisdiction; it may extend to a block level or a district level, depending upon the potential of the area.
2. Model Apiary -cum Nursery This unit comprises an apiary for demonstrating modern management practices suited to the locality; it also supplies colonies to beekeepers through a planned programme of colony multiplication.
3. Migration In order to induce beekeepers to migrate colonies during prolonged dearths, or for different flows or for pollination, a subsidy is provided to cover the expenditure of migration.
4. Assistance to Individuals This pattern is intended, by grants and loans, to encourage beekeepers to enlarge their apiaries, so that they become semi-commercial or full-time commercial beekeepers.
5. Honey House Grants and loans are provided in this pattern to beekeepers' co-operative societies or institutions, for the construction of honey houses, according to designs prepared by the Beekeeping Directorate. Such honey houses are designed for centralized collection, pooling, processing and packing of honey.
6. Comb Foundation Mill Similarly, grants and loans are provided to the organizations implementing programmes, for purchasing comb foundation mills of a size suited to their regions.
7. Training This pattern provides for graded training courses at all levels, from beekeepers to post-graduates.
8. Seminars and Exhibitions The Commission assists in organizing seminars and exhibitions, at district, State and All-India levels.

Subsidies to the extent of 50% of the cost of purchasing hives and other beekeeping equipment (e.g. honey extractors, smokers, colonies,) are given to beekeepers.

The beekeeping Directorate has an annual budget of Rs. 5 million (about £250,000 or \$ 700,000) for beekeeping development, research and training. Under the development programme Rs.2.2 millions are earmarked towards grants and Rs. 0.17 million towards loans. The Directorate has a research and technical staff of over 200, distributed throughout the country at various levels.



A beekeeper's apiary in the coastal belt of South India.



A beekeeper's apiary in his litchi orchard in Bihar State.

Progress

A small beginning was made, in a few villages only, in 1953. During subsequent five-year plan periods, more and more villages were covered, and by the end of 1974, 37,000 villages derived the benefit of modern beekeeping.

Initially, in 1953, only 232 persons were enrolled as beekeepers, but the number gradually increased year by year to 138,000 by the end of 1974. This is a clear indication of the benefits of beekeeping as a subsidiary occupation or semi-commercial enterprise, and more people are now coming forward to take up beekeeping.

Beekeeping in an organized sector made a very small start in 1953, with only 800 colonies producing 1280 kg honey. The average yield was only 1.5 kg per colony. During successive years, the number of colonies steadily increased, with a higher production per colony, and in March 1975 there were 545,000 colonies working under the Commission's programme, producing 2.3 million kg honey annually, with an average colony production of 4.7 kg.

During the last 20 years, the development of modern beekeeping has shown rapid growth, as a result of organizational efforts and of the adoption of more and more scientific methods of management (see table below)

<i>Year</i>	<i>No. beekeepers</i>	<i>No. colonies</i>	<i>Honey production (kg)</i>	<i>Average yield (kg)</i>
1953-54	232	800	1,280	1.5
1958-59	38,527	87,384	285,800	3.0
1963-64	57,198	164,597	713,745	3.8
1968-69	109,466	356,547	1,710,124	4.8
1974-75	136,000	545,000	2,321,000	4.7

Beekeeping in India is still largely a forest-based industry, but the Beekeeping Directorate is now planning to introduce it in agricultural areas, with emphasis on planned bee pollination of our agricultural and horticultural crops. This is encouraging beekeepers to migrate their colonies from forests to farms. Fortunately the flowering periods in forests and farms alternate, so migrations to agricultural areas from the forests, during heavy monsoon or snow, provide rich forage for colony multiplication and for additional honey yields. Though beekeeping remains a subsidiary occupation, a class of commercial beekeepers is slowly coming into being in southern India, where a few progressive beekeepers each keep 300 to 600 colonies producing 3000 to 6000 kg of honey valued at Rs. 30,000 to 60,000. As the technology reaches the villages, more people are likely to take to commercial beekeeping.

Future Deve-
lopment

On the basis of existing forest and agricultural areas in the country, at least 50 million colonies would be needed to exploit the natural resources of honey production and the needs of agricultural crops for cross-pollination. The national wealth contributed by beekeeping would run into several billions of Rupees. Future plans for beekeeping development in India are duly related to this long-range perspective.

Research
Programme

Introduction

Bee research in India, like the beekeeping industry, has a recent history. Its growth can be traced back a little over three decades. Even so, most of the earlier research was confined to the entomology departments of provincial agricultural directorates or colleges. The emphasis was naturally on crops pests; bees were treated in a minor way, restricted to academic aspects like comparative morphology, anatomy and bionomics. This research, though valuable, had little impact on the industry. The beekeeping industry, by its highly scientific and technical nature, needed strong research support in various applied aspects for its total growth. Mention must be made here of some commendable efforts made earlier in this direction by entomologists like Dr. Sardar Singh, Shri S. Ramachandran, Shri P.L. Sharma, Shri H. Vishwanathan and Dr.T. Milne. However, these efforts were in the nature of ad hoc schemes, and their results were inconclusive. Thus there was an utter need for a sustained broad-based, integrated, applied research programme, taking account of the climatic, phenological and floristic heterogeneities of the sub-continent. This need, however, had remained unfulfilled. It was in this situation that Dr. G. B. Deodikar conceived such a comprehensive programme of bee research. Since the resources in men, material and finance were extremely meagre, a modest beginning was made at Mahabaleshwar (western hill ranges of Maharashtra State) in 1951-52. I have been associated with this work since its inception.

Through the devotion and perseverance of a few persons the work developed, and the Apicultural Laboratory came into existence in 1954. Results obtained during the following 8 years were very encouraging. However, this work was confined to a limited area of Mahabaleshwar plateau and surrounding valleys in the western highlands. A need was then felt to expand the scope of this work to cover the entire country. All-India Khadi and Village Industries Commission considered a proposal for such a programme, and in November 1962 reorganized the above Apicultural Laboratory as the All-India Central Bee Research Institute at Poona. The basic objectives of this Institute can be summarized as:

1. Improving the efficiency of Indian honeybees through improvement in
 - (i) bee forage
 - (ii) bee management
 - (iii) bee breeding through genetic selection
2. Standardization of beekeeping equipment

3. Quality control of bee products
4. Assessment of the utility of bees in increasing crop yields through planned bee pollination.
5. Organization of graded training courses at all levels.

The Central Bee Research Institute in turn planned to establish Regional Bee Research Laboratories and Field Observation Stations in different representative areas. Three such Regional Research Laboratories have been established so far: in Mercara (Coorg District, Karnataka State); in Kodaikanal (Tamil Nadu) in the south; in Kangra (Himachal Pradesh) in the north. The Apicultural Institute at Mahabaleshwar continues to function as a Regional Research Laboratory. Field Observation Stations consisting of Experimental Apiaries (15 so far) are also being established in the areas covered by these Regional Research Laboratories. Basic data is collected from these Stations, compiled at the Regional Research Laboratories, and processed and analysed at the Central Bee Research Institute.

This programme requires simultaneous attention to such diverse scientific fields as ecology, floristics, bee botany, melissopalynology, bee management, bee genetics and bee breeding, bee pathology and the chemistry of bee products. The Institute accordingly has the following different sections:-

1. Bee Botany Botanical surveys of different regions; evaluation of plants for their utility to bees, their density and distribution; preparation of floral calendars and floral maps of the regions; these aspects are studied under this section. They reveal the build-up and flow periods and floral gaps of the area. It is observed in many areas that there is an abrupt break in pollen and/or nectar availability, resulting in abrupt cessation of brood rearing. Feeding of pollen supplements in combination with sugar syrup is being tried, to overcome such gaps. Another important activity is the introduction and propagation of new plant species, either indigenous or exotic, to tide over these short gaps and to enrich the vegetation. So far more than 3000 plant species are represented in the herbarium of the Institute, and are evaluated for their relative utility to bees, as major, minor or ancillary sources. Local plants toxic to bees or to human beings are included in this study.
2. Melissopalynology Confirmatory evaluation of the utility of these plants is made through palynological studies of seasonal pollen loads and nectar samples collected periodically from different regions under the purview of Regional Research Laboratories and Field Observation Stations. So far, nearly 3000 reference pollen slides of Indian bee plants in these areas are maintained in the Institute's national "Palynarium".
3. Bee Management As noted earlier, India is a vast sub-continent, and one standard management pattern of colonies would not suit all regions. Thus standardization of beekeeping equipment and of seasonal management practices, suited to a region under study, has been worked out. Hives, extractors comb foundation mills and other beekeeping equipment have been standardized through the Indian Standards Institution. Some areas in the southern

peninsular region, and some in the northern hill regions, have been worked on; studies in the remaining areas are being initiated. In areas already studied, methods of migration, comb renewal for wax-moth control, queen rearing and other seasonal management practices have been standardized, and this information is passed on to the beekeepers' co-operative societies and other agencies that implement the beekeeping extension programme.

There are vast areas of inaccessible forests inhabited by wild animals such as bears, and devoid of human habitation. This forest wealth, though rich in bee flora, is not utilized. In order to exploit these forest belts, this Institute has designed mobile and stationary bee houses to accommodate various numbers of colonies. These bee houses are being field-tested before their standardization.

4. Bee
Breeding

In India, we find different ecotypes of *Apis cerana indica* as we go from south to north, or from plains to hills. These ecotypes have evolved naturally in different "bee belts" in centuries past. Even within a given ecotype we find natural variation in characters like body size, tongue reach, resistance to disease, industriousness, and honey producing capacity. Out of the 1500 colonies maintained by the Institute in 15 apiaries at different places, colonies having a combination of desirable qualitative and quantitative characters are selected for breeding purposes. Queens are reared by a grafting method, and nuclei are used for mating in isolated apiaries previously populated with drones from superior stocks. Only the best colonies are allowed to rear drones. Thus a programme of mass selection, hybridization, progeny testing, culling inferior stock and selecting superior stock is continued, in order to increase the productivity of Indian honeybees. Inter-ecotypic crosses are effected in due course, for further improvement of the strain; this has given improved stocks with a significantly superior performance over successive years, compared with general averages.

5. Bee Pollination

India is mainly an agricultural country, with immense scope for bee pollination. But due to extreme heat during summer, colonies cannot be maintained on the plains of India throughout the year. The beekeeping industry in India is therefore mainly restricted to forest regions. However, with improved migration techniques evolved at the Central Bee Research Institute, it is now possible to migrate colonies between farms and forests to the advantage of both beekeepers and farmers. Experiments on the utility of bees as cross-pollinators of various agri-horticultural crops are being assessed. Considerable data in bee pollination of most of the oilseed crops have been collected, and experiments on some orchard crops, pulses, vegetables plantation crops and fibre crops have been initiated, with certain improvements in the design of experiments for crop pollination.

6. Bee
Chemistry

Quality control and marketing of bee products, particularly honey and beeswax, are aspects as important as beekeeping extension and research. In India honey is obtained from three different species of *Apis*. About 50% of the honey is produced from the "domesticated" *Apis cerana indica* bees in modern hives,



Using bees for the pollination of sunflower crops in a Farmer's field in Maharashtra State.



A commercial apiary in a migratory site in Jammu and Kashmir State.

and the remainder from the wild colonies of *A. dorsata*, *A. cerana indica* and *A. florea*. Analytical work on Indian honeys and beeswaxes at this research institute has made it possible to lay down purity specifications for these products through the Indian Standards Institution, the Agricultural Marketing Organization of the Government of India, and under the Prevention of Food Adulteration Act of the Government of India. Methods have been evolved to distinguish extracted honeys from squeezed honeys by quantitative estimation of the pollen per gram of honey and its transmittance.

The honey flow period in the plains of India is followed by summer when ambient temperatures reach a maximum of 47°C in many places. At these temperatures the hydroxymethylfurfural content of honey rises steeply and much beyond the limit of 40 ppm permissible in European standards. This Institute has worked on the problem, and has sent its findings to the Ministry of Health, Government of India, so that the existing qualitative Fiehe's test in their specifications can be modified.

7. Bee Path -ology

Prior to 1969, Indian beekeeping was not seriously confronted with any bees diseases. Acarine disease took a major toll of bee colonies in Himachal Pradesh and Jammu and Kashmir during 1960-65. In 1970-71, European foul brood was first detected in western hill ranges of Maharashtra State, and in 1975 Nosema disease was confirmed in Uttar Pradesh and Himachal Pradesh. Both these diseases were later confirmed by Dr. L. Bailey at Rothamsted Experimental Station, UK, and he also suspects a new viral disease among some samples sent by us. There is a general belief that the introduction of these bee diseases in to India is consequent upon the repeated introduction of colonies of *Apis mellifera* from Europe and America. A separate wing was therefore established in the Central Bee Research Institute, for the study of bee disease, pests and predators. The disease problem is dealt with simultaneously through

- (i) chemotherapy.
- (ii) better management
- (iii) breeding for disease resistance.

A wasp-trap has been fabricated, tested in the field, and standardized through the Indian Standards Institution.

8. Rock Bee Research

Apis dorsata, commonly known as the rock bee, is the largest and most "ferocious" honeybee of the world. The bees are very prolific honey producers, they withstand high temperatures, migrate over long distances, and are effective pollinators. They cannot however be handled easily, because of their temper, migratory habits, and construction of nests in inaccessible places. Observations on nesting behaviour were made on more than 2000 colonies in different parts of the country: on such aspects as nesting sites, comb building in relation to north-south direction, height of nest from ground level and comb structure. Preliminary experiments conducted at the Central Bee Research Institute showed that rock bee colonies can be hived in a specially designed bee box. Further experiments are in progress on supering these colonies, extracting their honey, and seasonally migrating them to suit their natural rhythm.

9. Training Training forms an integral part of the programme of the Central Bee Research Institute, and graded training courses in beekeeping are arranged. Field men and Apiarist courses (3 and 6 months, respectively) are a regular feature. Specialized training in queen rearing, processing and analysis of honey and beeswax and other aspects is arranged according to specific requirements. Refresher courses for field staff are arranged periodically, to acquaint them with developing techniques. Beekeeping staff from other developing countries are also trained at this Institute; a post-graduate diploma course will soon be started.

10. Library and Publications The staff of the institute have so far published over 120 research papers, and built up a comprehensive collection of books, journals and reprints of research on bees and beekeeping. The Institute houses the Branch Library of the International Bee Research Association to serve its Asian members. The IBRA supplies (gratis) surplus literature it receives from different countries of the world.

The Institute participates in editing the Indian Bee Journal. It regularly publishes Technical Bulletins on practical aspects of beekeeping in various local languages, to acquaint beekeepers and beekeepers' co-operative societies with new techniques in the industry.

The Indian Agricultural Research Institute (New Delhi) and the Punjab Agricultural University (Ludhiana) are engaged in research on physiological aspects, and on the introduction of *Apis mellifera*, respectively. Care is taken to avoid duplication of efforts in respective subject fields.

The Central Bee Research Institute is the only one of its type in India which is solely devoted to integrated research on various aspects of Indian bees and beekeeping industry. It will in future receive additional support from the Central Government, for the expansion of its research programme to other parts of India.

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Some Notes on Kashmir Bees

(by F. A. and T.A. Shah, Shah Beekeepers, Srinagar, Kashmir)

The honeybee native to the uplands of Kashmir is a variety of *Apis cerana indica*, which has not been subject to hybridization. In the environment of Kashmir it performs well, both in honey production and in general management characteristics, and it is not believed that *Apis mellifera* would do better.

The physical characteristics of the Kashmir bee can be summarized:

- (a) there are 61 worker cells per square inch.
- (b) the weight per bee is 100 mg.
- (c) the tongue length is 5.5 mm (preliminary measurements).
- (d) the life span is some 6 weeks in the working season, and over 6 months in the inactive season.
- (e) Breeding at the end of winter starts when maximum day temperatures are averaging around 5°C, and the laying capacity can reach 2000 per day.
- (f) Bees forage at temperatures of 10°C and above.

In their use of brood combs and storage combs Kashmir bees will expand the brood area according to the availability of food, and when a surplus becomes available they reduce brood rearing and give preference to storing as much surplus honey as they can. Comb building is proportionate to the expansion of brood area and availability of food to be stored. Honey cappings are convex and snow-white. No propolis is used.

Swarming can be minimized by careful management, which should include requeening. Otherwise a colony is likely to swarm twice in a season. Provided hives are kept clean, and inspected regularly, wax moth should not pose a problem, and the Kashmir bees themselves defend their hives well against ants, wasps and robber bees.

It is possible to obtain honey yields upwards of 35 kg per hive. Shallow supers are used, but queen excluders are not essential even for production of comb honey. Honeydew is collected only in the worst conditions of drought, otherwise the honey is from floral nectar.

Bees commence foraging almost immediately after they have been migrated to new hive sites. The Kashmir bee has also been found to forage under colder conditions than introduced *Apis mellifera*. In even short breaks of mild weather during the hardest part of winter, Kashmir bees have been observed foraging, sometimes several kilometres from the hive.

In general, the Kashmir bee winters very well and a small colony of 10,000 bees can subsist on 4 kg of honey. When food is scarce the bees restrict breeding and are less active, thus conserving their energy and the stores of food.

Diseases are not a problem in Kashmir, except for the recent outbreak of acarine disease in some areas.