

BEE MANAGEMENT AND PRODUCTIVITY OF INDIAN HONEYBEES

Daisy THOMAS*, N. PAL**, K. SUBBA RAO***

*Asstt. Director, **Director, ***Asstt. Dev. Officer
Central Bee Research and Training Institute, Khadi and Village Industries Commission
1153, Ganeshkhind Road, Pune 411016, INDIA
Tel.: 567 58 65, Tel./Fax: 91-020-565 53 51, E-mail: cbrti@pn3.vsnl.net.in; bkikvic@vsnl.com

In India beekeeping is practiced in mountains, foot hills, forest, agricultural lands, mangrove forests etc. The technique involved in beekeeping vary from region to region. The main harvest is from *Apis dorsata*, *Apis cerana* and *Apis mellifera*. Beekeeping with *Apis cerana* has been a growing industry in Central and Southern India. The Thai Sac brood disease wiped off *cerana* beekeeping in India. CBRTI has taken several steps to recover from the devastating disease. The critical surveys of natural bee populations and stock multiplication from disease resistance colonies, supply of disease resistance breed facilitated to revitalize *cerana* beekeeping especially in Suthern India.

Apis mellifera was successfully introduced in Northern and Eastern plains of India. The threat of Thai sac brood disease of *Apis cerana* forced the beekeepers to introduce *Apis mellifera* in south India also. Management technologies schedules have been evolved for specific locations in the country. Emphasis is given in the context of changing conditions of vegetation and climate. Beside the seasonal management for each agro climatic region, suitable management technologies have been adopted to improve colony productivity and for production of honey, bees wax, pollen, royal jelly etc.

Today, beekeeping is an important, sustainable, integral agricultural activity under the rural development programme in India, since it provides nutritional, economic, and ecological security and balance. The knowledge of agroclimatic conditions, the diversified flora, changing agri/horticultural pattern of the crop, the types of bees, the management practices etc. play a pivotal role in transforming the beekeeping industry in the country.

Geographical pattern and beekeeping potential

India is a vast country with varied climates and ecological conditions ranging from tropical to sub-tropical in its southern, central and eastern regions, from sub-temperate to temperate along its north and north west and semi arid to desert conditions towards the west. The major geographical regions facilitating beekeeping development are classified into: 1) Southern peninsular region; 2) North east region; 3) Indo-Gangetic plains; and 4) Northern hill region (THAKAR, 1976).

The geographical position of India and the related agro climatic condition favor the growth of a wide variety of flora natural and cultivated. The extensive area of forest and millions of acres of cultivated land sustains a large proportion of insects and honeybees. Realizing the viability of beekeeping, the Khadi and Village Industries Commission took up beekeeping as a village industry and extensively organized beekeeping programme throughout India and now there is more than a **million** bee colonies are reared by **lakhs** of beekeepers.

Attraction plank for settling migrating *dorsata* bees

Colonies can be attracted by using attraction plank which is a wooden piece smeared with beeswax on one side, to attract the swarm bees. The migratory sites and season of *Apis dorsata* colonies are identified and located initially. In such locations wooden planks are fixed onto the lower side of the tree branch with the wax smeared side of the plank facing downwards. The migratory swarms took shelter on the planks fixed on the tree branches on the smeared foundation marks mainly due to the aroma of beeswax. These colonies can later be transported to the apiary or pollination field, too. The pollen stored in the combs can be collected by simple hand method. Pollen is a highly nutritious food and can develop as protein food for the local population or for sale in the urban areas that can earn substantial income to the producer and also used to feed bee colonies in dearth period, as well as for royal jelly production and breeding purpose.

CBRTI organizes training for honey hunters in improved methods of handling bees, hygienic method of collection of honey and bees wax, pollen collection and its storage.

Apis cerana beekeeping

Apis cerana beekeeping is practiced in India since time immemorial. Traditionally, the farmers have been keeping this species in log-, wall-, and box hives. *Apis cerana* is a good pollinator, and have survival capacity due to the co-evolution of native floral sources, pests and predators accustomed to the same

climatic conditions. In South India, large number of beekeepers are earning their living from this indigenous bee. Intensive migratory beekeeping to rubber estates is practiced in this region.

Management for absconding, swarming, thai sac disease etc. are practiced through our field stations to the beekeepers apart from the routine management. The absconding menace is controlled by supply of excessive sugar feed during the entire lean period and encouraged to raise combs. The old combs are totally replaced by fresh combs. Colonies are encouraged to breed as coconut pollen is available throughout the year to maintain the strength so that it can resist the pests and enemies. On the set of monsoon, colonies develop swarming impulse, which is utilized for division and baby colonies.

The attack of thai sac brood disease to *Apis cerana* in 1991 was severe and the fast epidemic disease prevailed over the entire potential beekeeping areas of Kerala, Tamil Nadu, Karnataka. Almost 90% of the bee colonies perished affecting the honey production. The beekeepers that fully depended on beekeeping had major set back for their income resources. To revive the beekeeping activities, CBRTI have focused on simple hygienic management practices to check further spread of TSBV disease, stock development with resistant colonies, training to beekeepers and beekeeping staff on queen rearing etc.

The regular management practices are queen renewal, comb renewal, hygienic condition. C.F. sheet supply, continuous sugar feeding and strengthening, proper ventilation and sanitation of hives, sterilization of hives and bee equipments etc.

There is no chemical treatment for the viral disease, hence development of tolerant strains were undertaken to revive *cerana* beekeeping. Screening of colonies was done in the field centers of southern states. It was observed that colonies affected with disease for less than two months in a year showed normal growth and honey yield. The colonies that are completely free from disease throughout the year showed better and had more resistance to disease. Such colonies were isolated and further multiplication was undertaken by grafting method. Large number of queens was produced and colonies were requeened frequently. During this process resistance is passed on to generations within a short period. Such colonies were distributed to progressive beekeepers under the revival programme.

Apis dorsata, (the rock bee or giant bee) are found in foot hills of Himalayas and northern regions of the country. In central India in the forests and plains large number of *dorsata* colonies are present. The tribals collect large amount of honey and bees wax. The Sunderban forests in West Benegal are rich in *Apis dorsata*, the organic honey from these forests are of great demand today. The southern part of India is also having large number of *Apis dorsata* colonies and contribute large share of total honey production in India.

Apis florea (Little bee), is common in central part of India, occurs in arid and desert region of extreme climates, and also in plains and forests. Large quantity of *Apis florea* honey is collected from the Kutch area of Gujarat (SOMAN and CHAWDA, 1996); very less quantity is being collected in other parts, which are consumed by the hunters itself.

Trigona sp. (Dammar bee) is common in all parts of the country and remains long periods in the same abode. It is a very small bee and collects nectar from small flowers. Since the quantity of honey produced is small, these bees are not commercially used. It is a very important crop pollinator, and their honey has repute in folk medicine.

Apis mellifera has been imported initially to Punjab and has become popular among commercial beekeepers because of its higher honey yield. The *mellifera* gradually spread to Himachal, Bihar, Uttar Pradesh, West Bengal and recently in Kerala, Karnataka and Maharashtra. Since *Apis mellifera* beekeeping need sound financial support it is difficult for the poor farmers to afford.

Central Bee Research and Training Institute, with its network of field stations throughout the country developed a more effective and economic way of beekeeping.

Wild Bees and Improved Technology

It is estimated that around 2 million *Apis dorsata* colonies are available all over the terrain and the annual honey production is estimated to about 5000 tons along with 250 tons of bees wax. The local inhabitants are ruthlessly hunting these colonies by the traditional crude and destructive methods and earning their seasonal livelihood. The squeezing of combs makes honey turbid due to the crushing of larval juice and pollen grains, and fetch low market prize. Moreover due to the destructive method of honey hunting, every year 40 to 50% of the rock bee colonies are losing their life and in turn failed to complete their respective breeding cycles. Their decline in strength is a threat to the ecosystem. At the same time, beekeeping have to be encouraged for the economic upliftment of the tribal populations in the remote forest and hill areas. It helps in conservation of the resources, and also improves the health, nutritional and economic status of the people in these areas. Considering all these facts, appropriate and eco friendly management practices are developed and disseminated through extensive training programmes.

Honey collection and Bamboo clip

It is simple, cheap and locally available: a bamboo rod split into half having 2 to 2.5 meters length with arrow shaped edges is used as the clip to support the comb. The bamboo clip is placed just below the

honey portion of the comb. Both the ends of the clip are tied to the branch of the tree. The honey portion is removed by cutting using a sharp knife. The cut honeycombs are lowered down from the trees or cliffs in the containers using a rope. The bees rebuild the cut portion and again store honey. Thus repeated extraction can be obtained from the same colony. The honey storage combs are given lateral cuts on either side of the midrib. These are then placed on a wire mesh kept in a container or tray. The honey drains out easily from the combs without any contamination of pollen, wax or any other material. The honey can be stored in food grade material.

Potential areas for beekeeping in India

1. North eastern region and sub Himalayan forests and cultivated areas with oilseed crops and citrus orchards.
2. Sub Himalayan forests in the north and north west.
3. The irrigated agricultural and horticultural areas in Indogangetic plains with mustard, pulses, legumes and plantations of litchi and eucalyptus.
4. Jammu and Kashmir region where natural and cultivated plants providing bee forage (*Plectranthus*, saffron, false acacia).
5. Western *ghats* region where ever green, semi ever green and moist deciduous forest exist.
6. Extensive rubber plantations in associations with coconut groves in south.
7. The Deccan plateau region where irrigated agricultural and horticultural areas are developed.
8. The eastern *ghats* forest pockets along with the adjacent irrigated, agricultural, horticultural areas of cashewnuts, coconut grooves, coffee and rubber plantations.

India has number of unique plants, which are major unifloral sources of honeybees. Sandal wood in Kadappa forest, Sula in Himalayan region, Jamun in Mahabaleswar, Litchi in Bihar and U.P., Sunflower in Punjab, Mustard and Eucalyptus in U.P., Karanj in Bihar, Coriander in West Bengal, Coffee in Karnataka, Soapnut in coastal Karnataka and Andhra Pradesh, Mohul in Madhya Pradesh, Prosopis in Kutch, Rubber in Kerala, Citrus in Himachal Pradesh are among them. The plietesal species of Acanthaceae like *Carvia callosa* (Carvi), *Thelapeepale ixiocephala* (Whyati), *Strobilanthus scrobiculata*, (Strobilanthus), *Lepedagathis cuspidata* (Achra), in Mahabaleswar, *Achhmanthera* sp (Jayanthola) in the hills of Himalayas, *Nilagirianthus reticulates* (Kurunju) in Nilgiris are important honeybee forage sources. The flower gregariously at the intervals of 4, 8, 12 years and give profuse yields of unifloral honeys. In monsoon and post monsoon ground flora like *Amaranthus*, *Tridax*, *Balsam*, *Mimosa*, *Parthenium*, *Plectranthus*, *Phyla* etc. and maize and *jowar* cultivation has a major role for survival and development of the colony.

Bees in India

India is fortunate to have four native species of honeybees i.e. 1) *Apis cerana* 2) *Apis dorsata* 3) *Apis florea* and 4) *Trigona irridipennis* which shows its potentiality in beekeeping. The exotic species *Apis mellifera* has been introduced from western countries.

Apis cerana is available in all pockets of the country. The *Apis cerana* in India has several ecotypes with wide range of morphological characters like body size, cubital index, tongue reach etc. and genetical characters like absconding, swarming, higher honey yield, temper etc. varying from South to North. Hence the selective breeding of desired characters is possible with *Apis cerana* which can increase productivity. In the northern hills and in Himachal Pradesh, *Apis cerana* beekeeping is a small household activity providing some income and nutrition to the poor and tribals. They keep log hives in the house walls and revetments. In central India in Mahabaleswar, Kolhapur, Pune etc. *Apis cerana* beekeeping is common. Upper middle class and lower middle class people have taken up beekeeping in small scale and as hobby. In West Bengal, Sikkim, Arunachal Pradesh in hills and in Andhra Pradesh, Bihar, Orissa, mostly tribals are taken up *cerana* beekeeping. In Karnataka, Kerala and Tamil Nadu, lower class and middle class people are involved in *Apis cerana* beekeeping and is very popular and large quantity of honey is being produced from rubber estates.

Apis mellifera beekeeping

Apis mellifera was successfully introduced during 1960's in foothills of Himachal Pradesh and agricultural plains of Punjab. The basic stock of 10 to 15 colonies and few queens are multiplied in *laks* and *mellifera* beekeeping is popular in all northern states and recently in southern states. Lot of research have been carried out world wide with *Apis mellifera*, hence any problems faced by this species is easily sorted out with the scientists availing the facility of Internet or E-mail. The special traits of *Apis mellifera* to produce propolis, royal jelly, pollen etc. add great importance to this bee. The management practices are the base for the success of *mellifera* beekeeping.

In general, a cycle of management practices is done for *mellifera* beekeeping i.e. dearth management, winter management, comb management, queen management, honey flow management, pest and predator management etc. Due to climatic and floral conditions in northern states, beekeeping generally

starts with build-up period in September to November due to *rabi* crops like *lahi* and other oil seeds. Weak colonies build up and strong colonies store honey. Commercial beekeepers migrate colonies from the hills to the agricultural plains of Punjab, Haryana, Uttar Pradesh to avail *Brassica*, *Eucalyptus*, *Trifolium*, *Helianthus* etc. and also to litchi orchards up to April.

During dearth, sugar and pollen supplement feed to compensate the nectar and pollen dearth; during winter, the colonies dwindle due to the temperature fluctuations hence winter packing and sufficient food stores is a prerequisite. During the build-up period with the development of colonies C.F. sheet for drawn out combs, during honey flow, super combs to provide enough space to store nectar, queen excluder in quality honey production and higher honey yield are the other requisites. Several mites and pest infestations and microbial, bacterial and viral infections cause severe loss to the colonies (ABROL, RANA and GUPTA, 1988). Sulphur dusting, formic acid fumigation etc. is effective against mites.

Apart from these routine management CBRTI has developed several management techniques for higher productivity.

Drawn out combs

The *lahi* honey granulates faster and fetch low market prize. In view of utilizing the *lahi* honey flow beneficial to beekeeping, CBRTI has formulated special management for the production of drawn out combs during this period. C.F. sheets are provided to draw fresh combs. Fresh combs provides hygiene, aroma and colour of the honey. The cell size and depth of the cells of fresh combs facilitates higher honey production. The swarming tendency of the colony is also checked.

Millenium hive

In the northern states, during summer and winter temperature shows wide fluctuations. Bees have to spend lot of energy in maintaining the temperature of the brood during winter and in lowering the temperature by fanning and water evaporation during summer. During honey flow season in summer, as the nectar is processed to honey, excess moisture is produced inside the hive. Considering these facts CBRTI had designed a hive, "Millennium hive", with adequate insulation and ventilation. The millennium hive provides a direct flow of air current to remove the excess moisture. The insulated hive with thermocol maintains temperature for a long period and the bees need not expend much energy for maintaining the temperature. Experiment with extra ventilation shows higher honey yield during profuse rubber honey flow in *Apis mellifera* colonies in south India (RAO et al., 1998).

Royal jelly production

Royal jelly production has a great potential to increase the income of beekeepers, since the consumption is increasing, there is a big demand for fresh and good quality royal jelly and the prize is very attractive. CBRTI has initiated commercial production of royal jelly after the preliminary experiment in Hadwani. In order to extend the period of royal jelly collection, the colonies active period has to be extended. Each colonies strength is adroitly guided to prevent it from weakening, as the colony needs populous condition. In order to enhance royal jelly production, the colonies are fed with ample pollen. Trapped pollen is fed to the colonies during dearth period to achieve stable royal jelly production. Grafting proper age larvae, the size and shape of queen cell cup are the other prime requisites for royal jelly production. Managing the colonies for appropriate selection of larvae, raising strains of higher royal jelly yield are other management practices.

Queen rearing and stock improvement

Several methods have been adopted by CBRTI in mass scale rearing of queens. Under UNDP – Beekeeping project, special attention is given to the management of bees and to select high yielding stock from the existing colonies and breed the selected stock.

Summary and Discussion

The productive efficiency of the bees is the cumulative effect of bee management bee forage and bee breed. Bee management is successful only when the record of the colonies and planning is done properly. Due to diversity in flora, topography and activities of people, beekeeping and management is diverse. Beekeeping in India has been adapted to various ecosystems, socioeconomic profiles and habitat preferences. The *Apis dorsata* which is economically important as it is a producer of honey and bees wax, a good pollinator especially in forests, is a source of income to bee hunters and tribal. The management of colonies using clipping method, to protect the brood, and to extract honey hygienically has proved to be a success. The attraction plank to swarm the bees and to establish in new locations will be effective for

pollination and easier honey collection. The rock bee of Sunderban forest provides organic honey which has great market potential. The forests of Andhra Pradesh bestowed with a large variety of medicinal trees and shrubs provide ample honey and are widely used in Ayurvedic, Yunani medicines for treatment of different ailments. The *Apis florea*, which thrive in higher temperature yield lost of honey in Kutch; trials were undertaken for management of these colonies for honey production. The *Apis cerana* beekeeping in South is brought back to the normal stage by simple and hygienic management and resistant stock improvement. There is a renewed interest in *Apis cerana* beekeeping and beekeepers are re-establishing colonies in almost all areas. *Apis mellifera* is popular among commercial beekeepers due to its higher honey yield. CBRTI is able to contribute several management practices for *Apis mellifera* beekeeping. The routine management practices and special management for quality honey production with fresh drawn out combs, large-scale queen production with mass selection are among them. The millennium hive is an asset to *mellifera* beekeeping as it maintains populous colony in spite of temperature fluctuation, and enhances honey, queen and royal jelly production in all seasons. Time has come to generate more income to the beekeepers, and attention is to be persistently diverted to produce royal jelly, propolis, bee venom by exploiting *Apis mellifera* beekeeping. CBRTI's effort particularly in the field of revival of *Apis cerana*, handling and hygienic collection of honey from *Apis dorsata* are exciting, since the prospects are quite promising.

Acknowledgements

We are grateful to the Chairman, Chief Executive Officer, Deputy Chief Executive Officer of KVIC, UNDP officials, Programme Co-ordinator of UNDP for permission to present this paper in the APIMONDIA conference. We are thankful to all the officers and staff of Directorate of Beekeeping and CBRTI for encouragement and help.

REFERENCES

- Abrol D.P., Environmental factors influencing flight activities in honeybees, *Apis cerana* Fab. and *Apis mellifera* L. (Hymenoptera: Apidae): *Indian Bee J.* 60 (2) (1998), 71-75
- Misra R.C., Sharma S.K., Technology for management of *Apis mellifera* in India: Perspective in Indian Apiculture: *AgroBotanica*, 1997-1998, pp. 131-149
- Mohana Rao, Singh T.S.M.S., Subba Rao K., Top ventilation helps *A. mellifera* L. colonies to increase honey production during rubber nectar flow: *Indian Bee J.*, 60 (2) (1998), 108-110
- Soman A.G., Chawda S.S., A contribution to the biology and behaviour of dwarf bee, *A. florea* F. and its economic importance in Kutch, Gujarat, India: *Indian Bee J.*, 58 (2) (1996), 81-88
- Suryanarayana M.C., K. Subba Rao, *A. cerana* for Indian Apiculture and its management technology: Perspective in Indian apiculture: *AgroBotanica*, 1997-1998, pp. 66-118
- Thakar C.V., Practical aspects of bee management in India with *Apis cerana indica*: Apiculture in Tropical Climates, 1976, pp. 51-59