RESEARCH & PROPAGANDA WORK IN BEEKEEPING

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Insects are always regarded as man's enemies, since they devastate his crops, attack store grains, inflict injury on his live stock and above all annoy him personally. Likewise the Entomologist has been looked upon as a destroyer of these insects. But there is another side of the picture. Among insects are some which are man's friends. The predators and parasites which feed on crop pests, the weed killers like the prickly pear Cochineal, and silkworms, lac insects and honey bees from which valuable products are obtained, are all instances in point. Of these insects, the honey bees which form the subject of the present paper, besides giving us honey, also help in pollinating our plants.

In these days of economic depression there are immense possibilities for beekeeping as a side line to farming. The Madras Agricultural Department is trying to popularise beekeeping as a cottage industry. At the Apiary, started at the instance of the Director of Agriculture, research on various aspects of bee-keeping is being carried on. While in the western countries, the European bee—*Apis mellifica*—has been studied in detail, it has to be admitted that the data available on the Indian bee (*Apis indica*)—the only one of the indigenous bees which can be domesticated—is very meagre indeed. Hence the need for detailed studies of our Indian bees.

Items of Research. The main items of research carried on at the Apiary are (1) bee enemies, (2) trials of acclimatising the Hill variety of the Indian bee in the plains, (3) artificial feeding of bees, (4) queen rearing, (5) effects of shifting bee colonies, (6) bee pasturage, (7) range of flight, (8) the decrease and increase in the weight of colonies during different seasons, (9) the life history of the bees and egglaying capacity of the queen, and (10) beekeeping appliances.

1. *Enemies of Honey bees.* There are a number of enemies of the honey bee of which the *wax moth* is the most important. The ravages of this pest to honey combs are well known throughout the world. Its damage is conspicuous in Coimbatore from June to October. A few additional and interesting points in the life history and control of this insect were noted during the course of work here. The female prefers hidden and safe corners, narrow slits in the body of the hive, the cover of crushed cells in the comb etc. to lay eggs. Very often the egg-masses are found in slits which would hardly admit the slender ovipositor of the female moth. The moths need not enter the hives and

lay their eggs on the combs, since the active caterpillars, on hatching, are quite capable of finding their way to the combs. The maximum number of eggs laid by a single female in her life time was 868 and these were laid within the first three days after copulation. The egg period lasts for 8 days, the larval period for about a month and the pupal period for another 8 days.

Feeding habits of the caterpillars—The natural food of the worms appears to be only old combs with plenty of lining with "Propolis" and pollen collected and stored by bees. The caterpillars do not feed on wax, foundation combs or even newly constructed combs.

Longevity of the adults—In captivity, the male moths were found to live from 18 to 27 days with food and the females from 6 to 10 days.

Control measures—Apart from those already advocated such as frequent examination of hives and destruction of caterpillars from infested combs, keeping colonies strong, etc., a few other methods of control of this pest have been under investigation. A simple method to eliminate the worms from stored combs was found quite effective. The infested combs are exposed to the sun for a few minutes taking care to see that the temperature does not exceed 40°C. The worms being unable to bear the heat, wriggle out and collect themselves under the comb from where they could be easily picked and destroyed. The silken webbing woven by the caterpillars can be removed easily with a brush and the small holes in the combs are promptly repaired by the bees when the combs are given back to them. This simple method obviates the necessity for fumigating the infested combs with costly chemicals such as Carbon bisulphide, Sulphur, etc., as it is being done in the western countries.

From a study of the egglaying habits of the moth, a possible line of control is under investigation. It has already been mentioned that the eggmasses are usually laid in cracks and crevices in the hive body. Elimination of such defects by keeping the brood chamber super and roof in their proper positions will minimise the chances of infection. But, in spite of such precautions, eggmasses are often found laid in the narrow space between the brood chamber and the top or super. An Apiarist, having a trained eye, can easily detect the presence of these eggmasses and scrape them off but as the eggs are likely to be laid in the inaccessible and hidden crevices of the hive body the body may be changed as often as possible in cases wherever such infection is suspected.

Another bee enemy which has been studied is the bee hunter wasp (*Palarus orientalis*). This is a small wasp about 1¼ c. m. long, dark in color with transverse yellowish white stripes on the abdomen and thorax. It has recently been noted as a predator on bees at Tiruchengode, Coimbatore and Ponnani and is capable of doing considerable

damage. Since the pest has been noted for the first time in South India, attempts were made to study its life history and habits. The wasp is very active in its habits and makes underground tunnels with separate compartments to stock its prey which serves as food for its young ones. It waits near the entrance of bee colonies and being endowed with powers of quick flight it is able to snatch away bees and stock them in its underground home. Each wasp was found capable of collecting about 20 bees in a day, the time of hunting being limited to bright mornings and afternoons. Eggs are laid by the female wasp between the head and thorax of the prey; one egg being laid for each group of 4 or 5 bees in a compartment. The grub hatches out on the second day and begins to feed on the food provided by its parent. The grub is able to feed on all the bees in about 5 days by which time it attains its full growth. The pupation takes place inside an earthern cocoon made by the grub itself from which the adult emerges. Details regarding the actual pupal period and control measures against the predator are under investigation. The damage caused by these predators is sometimes serious since each wasp is capable of robbing about 20 bees in a day. Apart from the actual loss of the bees the disturbance caused by frequent visits of these robbers upset the routine work of the colony.

2. *Trials with the Hill variety of the Indian bee.* A dark variety of the Indian bee occurs in the Hills. The bees are bigger in size and darker in color than the Plains variety and are better honey gatherers. A colony of these got down from Coonoor was found to thrive well even under adverse conditions on the plains. Preliminary trials indicate that the hill bees are more prolific breeders and better workers. The colony under observation yielded double the quantity of honey obtained from a colony of plain bee kept under similar conditions. There was also an improvement in the temper of the Hill variety after coming over to the plains. A few more colonies have been brought from Coonoor for further trials to find out the possibilities of introducing these on the plains.

3. *Trials on the artificial feeding of honey bees.* Honey and pollen from flowers are the two important natural foods of the honey bee and the grubs. But during periods when flowers are not available, ways and means have to be found to substitute the natural foods by artificial material. Sugar and jaggery syrup, sugar candy and dilute honey are freely given as artificial food. As regards the substitute for pollen, the Italian bee in the western countries is said to utilise various articles such as spores of fungi, particles of saw dust, fine earth from swamps, rye, barley, linseed and pea meals, dry milk, white of eggs.

Based on the above facts, a few trials were made to find out the artificial substitutes of these bee foods for our Indian bee under South Indian conditions. Jaggery solution and sugar syrup were tried

separately and the bees fed on them eagerly and later converted and stored them as honey in their cells. Of the two, sugar syrup was consumed with greater avidity.

To study the qualities of the product from the two samples of food given, two hives were liberally fed with sugar syrup and jaggery solution respectively and honeys extracted separately and analysed. The figures obtained clearly indicate that there is very little difference between the synthetic honey and the natural product in the chemical composition but there is difference in the aroma and taste. The jaggery honey was dark in colour with a strong smell of molasses while the sugar honey was pale yellow in colour and poor in aroma and taste.

Incidentally, the concentrations of the liquids supplied as food and the honeys extracted from these hives were studied. The concentration of the jaggery solution supplied was 37·7% and that of the honey extracted was 71·4%. Similarly the strength of the sugar syrup fed was 53·4% whereas the honey showed a strength of 74·2%. This shows that the bees in the course of their manufacture of honey have eliminated respectively 33·7% and 20·8% of moisture in the jaggery and sugar solutions fed to them.

As for pollen substitutes various material such as Bengal gram flour, linseed and pea meals were tried separately as well as mixed with honey and the feed was given both inside the hive as well as kept outside near the hives. But none of these were favoured by the bees. Before concluding this aspect of research it may be mentioned here that artificial feeding with a honey substitute, whatever its advantages may be, has to be limited to the minimum, since it has its evil effects when taken beyond the limit. In nature, bees are accustomed to take in only minute quantities of nectar at a time and to converting them into honey prior to storing. And whenever any extraneous food such as sugar syrup or honey, is given to them they have a habit of gorging themselves which is as harmful to bees as is to human beings. The effects are much worse in cases where the substitute is sugar solution since the bees have to invert the sucrose contained in the sugar into dextrose and levulose in their stomach thereby causing undue strain on their delicate digestive system. Therefore bees should be fed artificially only when it is absolutely necessary. The food should be given in small quantities and stopped as soon as an adequate supply is found stored in the cells. A better alternative would be to leave a sufficient quantity of the honey stored by the bees in the combs so that they can draw on this reserve food during times of scarcity.

As regards pollen substitutes, since our Indian bees do not show any tendency to accept any artificial material the only alternative is to grow some quick growing pollen yielding crops such as maize, cumbu, niger or sunflower in times of scarcity of pollen.

4. *Queen rearing.* The necessity for spare queens is often felt, especially during the swarming season, when new queens get lost during their nuptial flight. The "Demarree" method of swarm prevention presents a very easy and convenient method of queen rearing. The procedure is briefly as follows:—A colony having a queen with desirable traits and with plenty of brood and eggs is selected. The colony is examined and the brood comb with the queen and bees is taken out and kept in a separate hive. The rest of the frames are given either with foundation or spare combs. A "queen excluder" is placed on the top of this box and over this the old hive with the other brood combs and bees is kept. The entrance of the upper hive is closed and both boxes are tied securely so as to prevent their toppling over. The queen excluder prevents the queen from having any access to the upper chamber as a result of which the workers there begin to rear queens out of the fertilised eggs. After the queen cells are sealed the frames along with the bees and the queen cells are taken out and distributed in a few hives. Thus, about half a dozen nucleus colonies are obtained from a single colony. The success of this method depends upon the prosperity of the season. Healthy queens are reared only during seasons when pasturage is available in plenty. Attempts made to send spare queens by post to different parts of this Presidency have been successful and this method enables us to send spare queens to parties requiring them.

5. *Effects of shifting bee colonies and memory of bees.* While managing an Apiary it may often be found necessary to shift bee hives from place to place for various reasons. Our experience shows that such shiftings should, as far as possible, be avoided since the colonies receive a set back from which they take over three weeks to recover. To study the effects of shifting, five colonies were first weighed and transported from our Apiary to a village about 2 miles off. The colonies were weighed on alternate days in the new locality. In spite of the fact that the latter place afforded much better pasturage facilities there was a steady decline in the weights of all the hives for the first ten days and it took another ten days to attain the original weight. The maximum loss of weight in one case was about 1 lb. 4 ozs. and the minimum was 6¼ ozs. The decrease is partly due to the rapid consumption of the reserve food material and partly due to a good number of the field bees straying away. Egglaying and brood rearing were not materially affected so long as pasturage conditions were satisfactory.

Incidentally, mention may be made of the strong memory of bees as it has to be taken into account while shifting bee colonies. When colonies are shifted from an apiary to a distant place and brought back within three weeks and kept anywhere near the original place, the returning foragers, by virtue of their memory of their old place,

have the habit of going back to that spot instead of returning to their hive. But this difficulty could be avoided if the colony is brought back to the original apiary after about six weeks, i. e., after the generation of the bees accustomed to the old place, have died out.

6. *Bee pasturage.* Before starting an apiary in a locality an accurate knowledge of the honey and pollen yielding flora of that locality is essential. The bee pasturage crops of Coimbatore as well as of the other districts of this Presidency were studied as opportunities occurred and we have now a list of most of the bee pasturage plants along with their months of flowering. The list is, by no means, complete and further work is necessary to make it more comprehensive. Attempts are also being made to introduce bee pasturage plants of economic value from elsewhere.

7. *Range of flight.* A knowledge of the range of flight of the bees is necessary for selecting the site for an apiary in relation to its proximity to the pasturage. The European bee is said to travel up to two miles for forage. But the range of flight of the Indian bee seems to be rather limited since bees from colonies shifted to a distance of about 4 or 5 furlongs from the original place did not come back to the previous place in spite of their pronounced homing instinct. The longest distance that our bees were noted to travel was about 3 furlongs.

8. *The decrease and increase in the weight of colonies during different seasons.* In our Apiary it is found that there is a phenomenal reduction in the strength of the bee colonies from June to October followed by a proportionate increase from November to May. In the absence of a better index of the prosperity or otherwise of a bee colony its condition was judged by its weight. Weights of a selected number of colonies were taken every fortnight for three years during adverse as well as prosperous seasons. The maximum decrease in weight during the lean season was 71% of the original weight, the increase during the subsequent prosperous season being 68%. The main reason for such striking variations is due to the availability or otherwise of bee pasturage. Colonies that have considerably dwindled in strength during the slack season are practically useless during the ensuing honey flow season as they take a pretty long time to rear up sufficient worker force for honey gathering; whereas the colonies that have not been affected by the adverse conditions begin to collect and store honey from the very start of honey season.

The main conclusion that can be drawn from the above investigation is that the secret of success in managing an apiary profitably, lies in the availability of sufficient pasturage throughout the year and the industry will not pay in localities where such conditions do not exist. Granting that the pasturage conditions are favourable the next important aspect of the industry is to build up the strength of the colonies

by certain special methods such as provision of additional breeding facilities, uniting colonies, artificial feeding, etc., just prior to the honey season so as to have the maximum number of workers, to collect and store honey from the very advent of the honey flow season. Incidentally, seasonal conditions also appear to play an important part in the economic aspect of beekeeping. Failure of rains as it has been the experience for the past three years, affects the nectar secretion in flowers and a continued rainy or windy weather prevents the bees from going out and thus curtails their activity.

9. *Life history of the bees and egglaying capacity of the queen.* Along with the above line of investigations, observations were made to find out whether the rapid increase in the population of the hives, during prosperous seasons, is brought about by the shortening of the life cycle or by a more prolific egglaying by the queen or by both. The average period of life cycle was found to be uniform throughout the year irrespective of the external conditions-the egg stage lasting for 3 days, the larval stage for 4 days and the pupal stage for 12 days ; the total life cycle not extending over 19 days. On the other hand, the increase in the population is brought about by the higher rate of egglaying, the daily average rate being about 300 eggs (which may even go upto 500 per day) whereas the rate is reduced to about 30 or 40 a day during the slack season.

10. *Beekeeping appliances.* Due attention was paid to this aspect of the work.

Honey extractor—An improved type honey extractor with a brass container and a special ball bearing device was evolved. The machine is priced at Rs. 9 only and there is a considerable demand for it.

Drone trap—Occasionally, the control of the drones becomes a regular problem and a simple drone trap, with the help of which the drones can be isolated and killed, was devised. The trap consists of a piece of wood about 2″ wide, the length being adjusted according to the width of the entrance. On the lower side of this block of wood there is a shallow cut of about ⅛″. Drones are generally found in numbers in the supers as well as on the top of the frames. In such cases, the super is removed and the top put on. The super frames are then taken out and the drones picked and crushed. To prevent the drones that might escape from entering the hive the drone trap is kept close to the entrance with the cut end below. The narrow space of ⅛″ is just enough to allow the workers inside and excludes the drones which have a thicker build. The latter can be easily disposed of since they collect themselves in large numbers, at the entrance. In the case of the hives which have no supers, the trap can be successfully used during the evenings when large numbers of the drones come out for their play flight.

Other items of research such as swarm prevention, artificial granulation etc. are in progress; the results of these investigations will be given in a later paper.

Propaganda. The popularity which beekeeping is gaining as a cottage industry is indicated by the steady demand for advice and appliances from all over the Presidency as well as from other provinces of India. Owing to the activities of the department as well as those organisations like the Rural Reconstruction Centre, Ramanathapuram, over 1000 hives distributed among 130 villages are being maintained in this Presidency. The figures given are those obtained last year. The department, in spite of inadequate equipment is doing its best to popularise this industry. A colony of bees along with some of the apicultural appliances has now become a regular feature in almost all the exhibitions and fairs. In addition to this, numerous demonstrations in hiving wild colonies and in the care and management of apiaries have been conducted in various parts of the Presidency. Apicultural requisites such as hives, extractors, smokers, are being made and supplied to the public almost at cost price. In order to popularise this industry further, short courses in beekeeping, for about a month during February are being held for the past two years. More than 50 young men have been trained in the subject and it is hoped that they carry their knowledge of the subject to the very door of the ryot.

A departmenal bulletin—Bulletin No. 37 - Beekeeping in South India—and a pamphlet on the subject were published and the popularity of these publications has been more than what was expected. A leaflet giving practical hints for amateur beekeepers is under preparation.

Before concluding this paper a word may be said about the economics of beekeeping. The appliances needed are not many nor are they costly. A teakwood hive with a colony of bees costs Rs. 5 only. On an average 6—10 lbs. of honey is got in a year from a hive fetching Rs. 7—8—0 to Rs. 12—8—0 at Rs. 1—4—0 per lb. Thus, if a ryot keeps at least 3 or 4 hives he can get about Rs. 30 per year. It will therefore be seen that the possibilities of beekeeping as a cottage industry are great.

Research Notes.

A Note on the interspecific cross in the Cucerbits.

Intergeneric and Interspecific crosses in the family Cucurbitaceae were attempted at the Agricultural Research Station, Pattambi. While the intergeneric crosses were failures, some of the interspecific crosses were successful. A brief description of a successful interspecific cross is given below:

One of the two species chosen for the cross, *Luffa acutangula*, is a cultivated variety the fruit of which is commonly used as a vegetable; the other species