Chapter 11

Ecobiology of the Little Honeybee (*Apis florea*) in Semi-arid Subtropical Climates of India

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The little honeybee (*Apis florea*) is a wild bee and a natural pollinator of several important plants in its area of distribution in Asia and parts of Africa. However, its biology is poorly understood. This paper presents results of some ecobiological observations made on this honeybee.

Materials and Methods

Observations were recorded on artificially managed and wild colonies of the little honeybee (*A. florea*) at CCS Haryana Agricultural University, Hisar, India. Total volume of crop contents was measured in 100 bees by capturing returning bees, pressing their abdomen gently and collecting reguritated liquid with a microcapillary. Results were compared with bees kept hungry for two hours and then fed 50% sugar solution for two hours. Plants visited by this honeybee were recorded and on the basis of foraging modes, its use as a pollinator was determined (Sihag, 1988). Temperature optimas were determined by recording initiation and cessation of foraging activity in different seasons. Life cycle and build-up patterns were studied by making periodic observations of comb size. Months of drone production, queen-rearing and swarming were identified. Time of mating/drone

Increased food supply for all larvae after dequeening

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It is generally known, that worker bees construct emergency queen cells after a colony is dequeened. However, other events happening after dequeening are little known. The amount of food supplied for larvae in queen-right and queenless colonies was compared. Three colonies were divided into two parts. One part remained queen-right, and the other was queenless. Food was collected from comb cells with larvae 1, 2, 3 and 4 days old. Larval food was collected from 6530 cells. In queen-right colonies, 10 larvae 1, 2, 3, and 4 days old received on average 32.1, 62.1, 98.4 and 126.3 mg of food respectively. In queenless colonies, 10 larvae 1, 2, 3, and 4 days old received on average 43.9, 78.9, 108.7 and 144.0 mg of food respectively. All larvae of the same age received significantly more food in queenless than in queen-right colonies. In percentage, larvae 1, 2, 3 and 4 days old received in queenless colonies 137, 127, 111 and 114% of food supplied for larvae in queen-right colonies. In successive days, the relative amount of food supplied for larvae in queenless colonies decreased from 175% the first day after dequeening to 105% seven days later. The increased amount of larval food in queenless colonies was not the result of different ratios of the number of worker bees to the number of larvae in queen-right and queenless colonies.

flight was observed. During the course of the year, diseases, pests, predators and enemies were identified and times of their incidence recorded. Duration of nest occupation and possible cause of nest desertion were recorded.

Results and Discussion

Apis florea consumes about 10 µl of nectar (ave. = 9.82 ± 3.8 µl, n=100; range 4.5–13.0 µl) although bees fed artificially had up to 15 µl solution in their crop (ave. =14.7 ± 0.92 µl, n=100; range 12–15 µl). This shows that this bee can carry small nectar loads and seems to have low energy requirements. This is evident from the fact that it is most reliable as a pollinator of plants having small flowers as shown in Table 1. Such flowers are not visited by larger bees either because of their small size or because of the low energy reward they offer (Abrol and Sihag, 1997).

This bee starts foraging when ambient temperature surpasses 18°C and continues foraging until ambient temperature approaches 43°C. Maximum foraging activity is shown at 30–40°C. These ranges are higher than those shown by *A. mellifera* and *A. dorsata*. In subtropical climates, this bee remains at subsistence level during dearth periods. Colonies with small combs (ave. diameter = 4.5 cm) and little brood were seen during July–August. These colonies show gradual increase in comb size with the commencement of foraging on ground flora and subsequently on *Zizyphus jujube* followed by many other plants as shown in Table 1.

Colonies start producing drones in February. Four to six queen cells are produced per colony (Table 2). Swarming takes place in late February to March. All newly established colonies start build-up activities in early summer when ample bee forage is available especially from ornamental plants, eucalyptus, berseem, jamun and neem. Each colony acquires a comb size of 10–15 cm diameter and 500–1000 g of honey. Maximum comb size achieved in old colonies

Table 1. Important plants visited by *Apis florea* at Hisar

Plant		Flowering time	Source
Common name	Scientific name		
Plants mainly dependent on *A. florea*			
Ber	*Zizyphus jujube*	August–September	NP
Ber	*Zizyphus mauritiana*	September–November	NP
Coriander	*Coriandrum sativum*	February–March	NP
Cumin	*Cuminum cyminum*	February–March	NP
Fennel	*Foeniculum vulgare*	February–March	NP
Carrot	*Daucus carota*	March–April	NP
Phalsa	*Grevia asiatica*	April–May	NP
Jamun	*Syzygium cumini*	May	NP
Neem	*Azadirachta indica*	May	NP
Khajoor	*Phoenix sylvestris*	March–April	P
Grape	*Vitis vinifera*	March–April	NP
Major flora visited by *A. florea*			
Pigeonpea	*Cajanus cajan*	September–October	N
Rape seed and mustard	*Brassica* spp.	October–February	NP
Gram	*Cicer arietinum*	February–March	P
Berseem	*Trifolium alexandrinum*	April–May	NP
Eucalypts	*Eucalyptus* spp.	February–March	NP
Curcubits	*Curcubita* spp., *Cucumis* spp., *Luffa* spp.	April–November	N

Note: Other plants visited by *A. florea* have been listed by Sihag (1990); N = nectar, P = pollen, NP = nectar and pollen.

Table 2. Some attributes of *Apis florea* at Hisar

Attributes	Value
Nectar loading capacity	15 ml
Temperature preference/tolerance	18-43°C
Humidity preferences	15-95 %
Months of drone production	Feb.-March
Months of queen-rearing/swarming	Feb.-March
No. of queen cells produced per colony	4-6
Mating/drone flight time	1130 to 1430 h
Maximum comb size	15 cm (diameter)
Maximum honey storage	500-1000 g

Table 3. Diseases, pests, predators and enemies of *Apis florea* at Hisar

Enemies	Months of occurrence
Viral diseases	Absent
Bacterial disease	Absent
Fungal disease	Not detected
Protozoan disease	Not detected
Endoparasitic mite	Not detected
Ectoparasitic mite (*Euvarroa sinhai*)	Feb.-March
Wax moth (*Galleria mellonella*)	April-May
Predatory wasps	Not observed
Robber ants	Absent
Robber bees	Absent
Predatory birds	Not observed

was about 15-20 cm in diameter. In mid-May, pollen sources dry up and the strength of colonies starts declining.

At Hisar, *A. florea* does not show any viral, bacterial, fungal or protozoan diseases (Table 3). Endoparasitic mite was also not detected. However, about 40 per cent of the colonies were infested with the ectoparasitic mite, *Euvarroa sinhai*. All colonies in mid-to late May were found to be infested with the wax moth, *Galleria mellonella*. However, there were no robber bees, robber ants, predatory wasps and birds near *A. florea* colonies.

Local migrations were found to be caused by the availability of bee forage and the pest status of colonies. As long as there were no pests and bee forage was available, colonies tended to stay. Average stay at a site was 2.3 ± 1.4 months (n=100). All colonies deserted their original nesting sites by late May.

Use of non-conventional timber for making bee boxes

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Kerala is the leading state in India in honey production primarily because of large quantities of nectar available from extra-floral nectaries of rubber trees (*Hevea brasilensis*). Rubber plantations are raised primarily for latex. When trees are felled after 30–35 years, they become a valuable source of cheap wood. In order to reduce the pressure on traditionally used forest trees, rubber wood was tested for making bee boxes. Rubber wood was protected from insects and fungal attack by treating it with preservatives. Bee boxes were field tested in forestry and agroforestry plantations and results were encouraging.

Comparative performance of *Apis mellifera* in modern and mud hives under substropical conditions of Himachal Pradesh

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Indigenously developed low-cost mud hives (prepared using wheat straw and mud) having frames of Langstroth size were used. Performance of *Apis mellifera* colonies kept in such hives was compared with those in modern Langstroth hives during summer (March–June). Brood area, honey and pollen stores were 22.22, 1.24 and 11.66% more respectively, in such hives. These lives were also superior in thermoregulation as the inside mean temperature was 1–2°C lower. These hives can be successful in stationary beekeeping with *A. mellifera*.

Apis florea in semi-arid subtropical climates makes an excellent natural pollinator of many plants especially those that larger bees, owing to

their high energetic demands, fail to visit. This bee survives the extreme summer as it has adapted to high temperatures and low humidity. It forages even at 43 °C when all other honeybee species either shun foraging or engage in water collection (Sihag, 1984, 1991). Like *A. dorsata* and *A. mellifera* in India (Sihag, 1991), *A. florea* is also free from honeybee diseases. Wax moth is the only common pest. The ectoparasitic mite, *Euvarroa sinhai*, is specific to this honeybee only and no other enemies of *A. mellifera* or *A. dorsata* were found (Sihag, 1991, 1998). Attack by wax moth is, however, so heavy that it causes absconding.

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