Chapter 12

Ecobiology of the Giant Honeybee (*Apis dorsata*) in Semi-arid Subtropical Climates of India

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The giant honeybee (*Apis dorsata*) is a wild bee and a natural pollinator of several plants in its area of distribution in Asia. 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 giant honeybee (*A. dorsata*) at CCS Haryana Agricultural University, Hisar, India. Total volume of crop contents was measured in 100 bees by capturing field bees, keeping them hungry for two hours and then feeding them on 50% sugar solution for two hours. Afterwards their abdomens were gently pressed and regurgitated liquid was collected with a microcapillary. 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 the 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 flight was observed. During the course of the year, diseases, pests, predators and enemies were

Amylase and esterase activity as markers in larvae of *Apis dorsata*

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Amylase and esterase activity were measured in the larval stage of *Apis dorsata* to ascertain the formation of ecoraces. *Apis dorsata* larvae were collected from migratory and permanent colonies in Assam. Amylase activity was measured with 3, 5-dinitrosalisylic acid (DNS) and esterase activity was determined using naphyl acetate as a substitute. Amylase activity was noted at pH 5.1–5.3. Three major isozymes were detected in PAGE in larvae of nomadic colonies. Zymograms of esterase also showed variations. Esterase activity of permanent colonies occurred at 0.091×10^{-3} mM against 0.086×10^{-3} mM for migratory colonies. The variations indicate the possibility of formation of an ecorace of *A. dorsata*.

identified and times of their incidence were recorded. Duration of nest occupation and possible causes of nest desertion were recorded.

Results and Discussion

Apis dorsata consumes about 35 µl of nectar (ave. = 35.5 ± 10.3 µl; range 24.0–52 µl). This bee, therefore, can carry large nectar loads and seems to have high energy requirements. This is evident from the fact that it is most reliable as a pollinator of plants with large flowers/inflorescences secreting plenty of nectar as shown in Table 1. Such flowers are handled effectively by this honeybee and are worth visiting because of the high energy reward they offer (Abrol and Sihag, 1997).

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

Plant	Flowering time	Source
Sunflower (*Helianthus annuus*)	Nov.–Dec., Feb.–March, May–June	PN
Rape seed and mustard (*Brassica* sp.)	Oct.–Feb.	PN
Curcubits (*Citrullus* sp., *Cucumis* sp., *Curcubita* sp., *Luffa* sp.)	April–Nov.	N
Maize (*Zea mays*)	May–Oct.	P
Onion (*Allium cepa*)	March–April	PN
Eucalypts (*Eucalyptus* sp.)	Feb.–March	PN
Siris (*Albizia lebbeck*)	April–May	N
Pigeon pea (*Cajanus cajan*)	Sept.–Oct.	PN
Gram (*Cicer arietinum*)	Feb.–March	P
Shisham (*Dalbergia sissoo*)	April–May	PN
Berseem (*Trifolium alexandrinum*)	March–May	PN
Citrus (*Citrus* sp.)	March	PN
Tomato (*Lycopersicon esculentum*)	March–April	P
Brinjal (*Solanum melongena*)	March–April	P

Note: Other plants visited by *A. dorsata* are the same as listed by Sihag (1990). N=Nectar, P=Pollen, PN=Pollen and nectar.

This bee starts foraging when ambient temperature surpasses 16°C and continues foraging to around 40°C. Maximum foraging activity is shown at 25–35°C. These ranges are lower than *A. florea* but higher than those shown by *A. mellifera*. In subtropical climates, this bee usually emigrates during the dearth period (after May); only a few colonies remain. Colonies migrate to this region in late October/ early November with commencement of foraging on pigeon pea/toria, and stay until mid-May when the dearth period starts.

New colonies established in October/ November grow to over 1–1.5 m in length and 0.5 m in height during their stay at Hisar. Growth is facilitated by regular flora availability in the region. Colonies start producing drones in February, six to nine queen cells are produced per colony (Table 2). Swarming takes place in late February to March. Drone flight takes place at sunset. All newly established swarm colonies start build-up in early summer when ample bee forage is available especially from ornamental plants, eucalyptus, alfalfa, berseem and sunflower. Each colony acquires a comb size of 1 m in length and 0.5 m in height and 3–5 kg of honey. In mid-May, pollen sources dry up and the strength of colonies starts declining. Ambient temperature crosses 43°C and relative humidity falls below 20%. At this time, over 99 per cent of colonies emigrate to the foothills.

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

Attributes	Value
Nectar loading	35 µl (24–52 µl)
Temperature preferences	16–40°C
Humidity preferences	30–95%
Months of drone production	Feb.–March
Months of queen-rearing/swarming	Feb.–March
No. of queen cells produced per colony	6–9
Mating/drone flight	Dusk
Maximum comb size	l=1.5 m, h=0.5 m
Maximum honey storage	3–5 kg

At Hisar, *A. dorsata* does not show any viral, bacterial, fungal or protozoan diseases (Table 3). Endoparasitic mites were not detected. However, about 15 per cent of colonies were infested with the ectoparasitic mite, *Tropilaelaps clareae*. All colonies in late March were found to be infested with the wax moth, *Galleria mellonella*. However,

Table 3. Diseases, pests, predators and enemies of *A. dorsata* at Hisar

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

there were no robber bees, robber ants, predatory wasps and birds near *A. dorsata* colonies.

Local migrations were not found in this honeybee. However, desertion of old combs was caused by the non-availability of bee forage and by the pest status of colonies as well as by adverse ambient temperature and relative humidity. As long as there were no pests in the colonies and bee forage was available, colonies tended to stay. Average stay at a site for an established colony was about eight months and for a new swarm colony about 2.5 months. All colonies deserted original nesting sites by late May.

Apis dorsata in semi-arid subtropical climates makes an excellent natural pollinator of many plants especially those with large size flowers/inflorescences that can meet the high energy demands of this bee (Abrol and Sihag, 1997). In thermal tolerance, this bee is between *A. mellifera* and *A. florea* (Sihag, 1984, 1991, 1998). *Tropilaelaps clareae* and *Galleria mellonella* are the only two pests and can be highly devastating to colonies causing desertion of combs (Sihag, 1982).

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