

POLLINATION POTENTIAL OF HONEY BEE *APIS FLOREA* LINN. IN RELATION TO BIOCHEMICAL PROFILES OF HOST PLANTS

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Introduction

Honey bees have an important place in agriculture and in preserving wild habitats. They often have highly specialized relationships with native floras, and play vital roles in maintaining natural forest vegetation. Honey bees are suitable for environmental monitoring purposes because of their diverse nesting strategies and specific host plant biochemical relationships. Moreover, plant diversity, abundance, structure and chemistry are prime determinants of herbivore community structure (Murugan, *et al.*, 1997).

There are four species of honey bees in India. They are giant rock bee *Apis dorsata* F., little bee *Apis florea* F., Indian bee *Apis indica* F. and mosquito bee *Melipona iridipennis* Dal. Among the honey bees, *Apis florea* is the potential pollinator of several forest trees. The pollinating activity of *A. florea* is most abundant during August, September and October.

The quality of plants as a resource for insects can vary over a much shorter time period too. Diurnal changes in flower availability are common; and continual changes in the nectar supply of some species are known to influence the behaviour and foraging strategy of pollinator species (Subbareddi & Reddi, 1984). This study has been undertaken to observe the pollination potential of *A. florea* on *Eucalyptus tereticornis* and *Ipomea staphylina* in relation to biochemical profiles of floral parts of *Eucalyptus* and *Ipomea*.

Materials and Methods

Ipomea staphylina L. and *Eucalyptus tereticornis* L. occur in forest areas in Maruthamalai and in Bharathiar University Campus, Coimbatore (Western Ghats 10°58' N, 82°18' E). Through systematic and regular visits to these two sites, the foraging activity of bees on these plants were recorded. Study year was from November 1994 to November 1995. *A. florea* visits on the flowers of *I. staphylina* and *E. tereticornis* were observed periodically in different seasons. The number of honey bees visited during morning, afternoon and evening hours were recorded on both the flowers. Bee visits per inflorescence were recorded for 30 minutes for 3 days. The relative abundance of *A. florea* at month-wise variation to flowering phenology were also recorded.

The biochemical profiles of floral parts of *I. staphylina* and *E. tereticornis* were analysed by standard methods. Protein was estimated by the method of Lowery *et al.* (1951). Carbohydrate by Dubios *et al.* (1958), total lipids by Folch *et al.* (1957) and Nitrogen (Vogel, 1963).

Results

Flowering in *Ipomea staphylina* and *Eucalyptus tereticornis* plants was highest during the months of November '94, September '95 and October '95 and in the month of March and April

'95 the flowering was completely absent. Percentage of *Apis florea* population was higher in the months of November, December '95, January and February '95. *Apis florea* visit was greater in morning time (6-10 hrs) of all days and then decreased rather gradually in the afternoon (12-14 hrs). Bees activity was moderate in the evening (16-18 hrs). It reached a moderate peak at 9 hrs and then onwards it began to decline rather gradually between 12 to 14 hrs and then rather suddenly dropped upto 18 hrs. The relative abundance of *A. florea* was more during the days after rain. The sunny days recorded a relatively lower population level of total visitors than on cloudy days. The *E. tereticornis* flowers attracted more number of honey bees than *I. staphylina*.

Protein and lipid content was maximum in pollen grains of *I. staphylina* carbohydrate content was higher on petals (132.48 mg/g) than the other flower parts. In *E. tereticornis* protein content was higher in stigma (140.21 mg/g) and optional level of protein and carbohydrate was found in pollen (120.60 mg/g). Pollen contained maximum amount of lipids 43.36 mg/g). Nitrogen and water content was higher in petals and stigma than on pollen (Table 2).

Relative abundance of *A. florea* was higher immediately after rain. Bee visits were normal in cloudy days than sunny days. Probably high temperature caused suppressive role for bee visits. Comparatively, *E. tereticornis* flowers attracted more number of honey bees.

Discussion

The flower of *I. staphylina* and *E. tereticornis* was small with easily accessible nectar and pollen. Such flowers are expected to be visited by a variety of bees (Heethus, 1979). Therefore its pollination success depends on the quality of visits which include the number of inter plants flights (Frankie, *et al.*, 1983). *A. florea* in the present study mostly confined their visits to the particular tree and plant (*E. tereticornis* and *I. staphylina*) they

Table 1. *A. florea* visits to *I. staphylina* and *E. tereticornis* during different time of the day

Time (IST)	Visits/30 min/ inflorescence	
	<i>I. staphylina</i>	<i>E. tereticornis</i>
6.30 - 7.00	5.0	8.0
7.00 - 7.30	5.0	8.4
7.30 - 8.00	6.0	8.9
8.30 - 9.00	6.2	9.0
9.00 - 9.30	6.0	7.5
12.30 - 13.00	-	1.3
13.00 - 13.30	-	1.0
16.00 - 16.30	1.4	3.0
16.30 - 17.00	1.0	2.0

IST- Indian Standard Time

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Table 2: Nutritional components from flower parts of *Ipomoea staphylina* and *Eucalyptus tereticornis*

Biochemical Parameters	Anther	Pollen	Stigma	Petals
Protein (mg/g)				
<i>I. Staphylina</i>	92.34+-6.85	121.08+-8.96	112.40+-7.31	89.93+-6.92
<i>E. tereticornis</i>	95.58+-7.31	120.60+-8.96	140.21+-10.38	93.68+-8.94
Carbohydrate (mg/g)				
<i>I. staphylina</i>	98.42+-8.53	111.02+-9.18	87.01+-7.48	132.48+-11.56
<i>E. tereticornis</i>	101.31+-8.87	115.65+-8.34	91.78+-7.34	143.56+-9.26
Lipid (mg/g)				
<i>I. staphylina</i>	25.05+-2.50	36.81+-2.89	33.18+-2.75	21.08+-1.83
<i>E. tereticornis</i>	31.69+-2.47	43.86+-3.63	39.15+-2.98	27.01+-2.10
Nitrogen (%)				
<i>I. staphylina</i>	1.29+-0.078	1.08+-0.013	1.34+-0.021	2.18+-0.065
<i>E. tereticornis</i>	1.38+-0.07	1.15+-0.07	1.49+-0.06	2.58+-0.08
Water content (%)				
<i>I. staphylina</i>	42.19+-2.81	38.03+-2.73	55.03+-3.92	75.02+-4.68
<i>E. tereticornis</i>	45.36+-2.94	36.91+-2.11	57.90+-3.95	69.01+-4.80

Mean +- SE of five observation

visited on a particular day and did not make any inter plant visits. Flower of *I. staphylina* and *E. tereticornis* were available either during the rainy season or during the summer season (an exception) they are visited by *A. florea*. Nectar secretion is minimal, and the bees are forced naturally to make repeated visits and/or to visit a large number of flowers to satisfy their nutritional demands (Gruden, 1976). Individual plants with higher average Nectar Production Rate (NPR) are visited frequently by bees like *A. florea* (Real & Caraco, 1986).

Most studies have showed that higher nectar rewards cause foragers to stay longer with in flower or inflorescences, in the present study also *A. florea* stayed for longer time with in the flower of *E. tereticornis* than *I. staphylina*. The activity of *A. florea* was influenced greatly by the amount of sunlight, temperature, rainfall and seasonal variation. Many environmental factors have been correlated with nectar standing crop including air, temperature, soil moisture (Corbet, 1990) and season (Zimmerman, 1983). *A. florea* preferred to visit *E. tereticornis* than *I. staphylina*, since *E. tereticornis* has higher flower density.

Insect requires appreciable amount of protein, carbohydrate, lipid and nitrogen for growth and development (Bertsch, 1983; Murugan & Ancy George, 1992). A direct correlation was found to exist between the honey bees visits and biochemical nature of flower parts. The increased rate of visit by *A. florea* to the flowers of *E. tereticornis* compared to *I. staphylina* was due to the higher amount of protein, carbohydrate and optimum level of lipid and nitrogen in *E. tereticornis*.

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