

Sesame (*Sesamum Indicum* L.) Crop Insect Pollinators with Special Reference to the Foraging Activity of Different Species of Honeybees

Sanganna M. Sajjanar¹ and Eswarappa G.²

¹Farm Superintendent, Agricultural Research Station, Siruguppa-583 121 UAS, Raichur.

²Assistant Professor, Department of Apiculture, College of Agriculture, UAS, GKVK, Bangalore.

Abstract: A study was carried out on insect pollinators of Sesame (*Sesamum indicum* L.) crop with special reference to the foraging activity of different species of honeybees during Rabi 2013-14 at Agriculture Research Station, Siruguppa, UAS, Raichur. Various insect pollinators visiting the sesame crop were observed during flowering period. A total of 14 insect species were found visited the sesame flower, out of 14 insect species, 10 spp belongs to Hymenoptera and 4 were belongs to Dipterans. Among Hymenopterans, the 4 spp of honeybees viz., *Apis dorsata*, *Apis cerana*, *Apis florea* and *Trigona iridipennis* were recorded during flowering period. The foraging activity of honeybees and other pollinators were recorded from 6 AM to 6 PM at an hourly interval during the flowering period. The number of pollinators visiting the sesame flowers were found maximum during 9 to 11 hours. The highest number of pollen foragers were recorded during mid morning hours.

Keywords: Sesame, Pollinators, Foraging activity

I. Introduction

Sesame (*Sesamum indicum* L.) which originated in Africa, is probably the most ancient oil seed plant cultivated in many parts of the world. Currently, China, India and Myanmar (Burma) are the world's largest producers of sesame, followed by Sudan, Nigeria, Pakistan, Bangladesh, Ethiopia, Thailand, Turkey and Mexico (Desai, 2004).

Sesamum is one of the important oil seed crop of Southern and Central India. Among the nine oil seed crops grown in India, Sesamum ranks third after Groundnut and Mustard. Sesamum believed to have originated in Indian sub continent and the crop is grown extensively in Uttar Pradesh, Rajasthan, Madhya Pradesh, Orissa, Tamil Nadu, Gujarat, Karnataka and West Bengal. Among these Uttar Pradesh, Madya Pradesh, Rajasthan and Orissa account for 65 per cent of the cultivated area and 55 per cent of the production respectively. The Sesamum occupies the fourth place in area and production next to Groundnut, Sunflower and Safflower in Karnataka and is being cultivated over an area of 113.30 thousand hectares with the production of 46.60 thousand tones (Anon., 2000).

Since most of the oil seed crops are cross pollinated still adequate pollination is vital for any significant increase in seed production by the utilization of honeybee as effective pollinators. The flower structure of Sesamum facilitates cross pollination although it is considered to be self pollinated. The extent of natural crossing ranges from 0.5 to 65 per cent. *Apis florea*, *Apis dorsata*, *Megachile umbripennis*, *Andrena ilereda*, *Ceratina sexmaculata* and *Trichometalle pollinosa* were reported to be common pollinators on Sesamum (Rashad *et al.*, 1980).

Besides honeybees, other pollinators such as flies, butterflies and wasps were also recorded on sesamum flowers in open pollination. However, their frequency of visit was very less compared to honeybees. The honeybees visited more numbers of sesamum flowers per minute compared to other pollinators. Thus the need of keeping sufficient number of bee colonies in the vicinity of the crops during flowering period was envisaged (Panda *et al.*, 1989).

Flowers of several plant species occur within the foraging range of 1 to 2 km from bee colony and bee exercise their instinct to compare and select a particular plant species which yield nectar with relatively higher sugar concentration or pollen with better nutritive value (Deodikar and Suryanarayan, 1977). Usually bees collect pollen and nectar which incidentally facilitates cross pollination. The present investigation was carried out to assess the insect fauna and their abundance on sesamum flowers with special reference to the foraging activity of honeybees.

II. Materials and methods

The sesamum crop was raised in plots of 10 X 9 m with all the recommended package of practices at the Agricultural Research Station, Siruguppa during crop season 2013-14. Which is located at an altitude of 380 m, latitude and longitude of 15° 38' N and 76° 54' E respectively. The observations on various insect

pollinators visiting sesamum flowers and their abundance with special reference to foraging activity of honeybees were recorded from initiation of flowering up to cessation of flowering.

The different species of insects visiting the flower of tagged one sesamum plant was observed and recorded from 0600 to 1800 hrs at an hourly interval for 5 minutes. Pollinators visiting the crop were collected and identified using taxonomic keys.

The relative abundance of different insect pollinators visiting sesame were recorded from 0600 to 1800 hrs for 5 min at hourly interval during flowering period per plant and are expressed as mean number of pollinators or bee visited per plant per 5 minutes.

The pollen and nectar foraging activity of different honeybee species were recorded by observing flower of tagged one sesamum plant canopy plant during flowering period for 5 min. The forager bees with pollen pellets in their corbicula (even small loads) were classified as pollen forager. Similarly, the forager bee without pollen loads in their corbicula were classified as nectar forager and were recorded throughout the study period from morning 0600 to 1800 hrs of the day at an hourly interval for one month and were expressed as number of pollen or nectar foragers per plant per 5 minutes. All the observations recorded in four replications and the data from field experiment was subjected to $\sqrt{x+1}$ transformation and analyzed statistically for comparing treatments using Fischer's Method of "Analysis of Variance" (ANOVA) technique as outlined by Panse and Sukhatme (1967) for completely randomized block design and results were interpreted at 5 per cent level of significance. Duncan's Multiple Range Test (DMRT) was used to know the difference between the treatments.

III. Results and Discussion

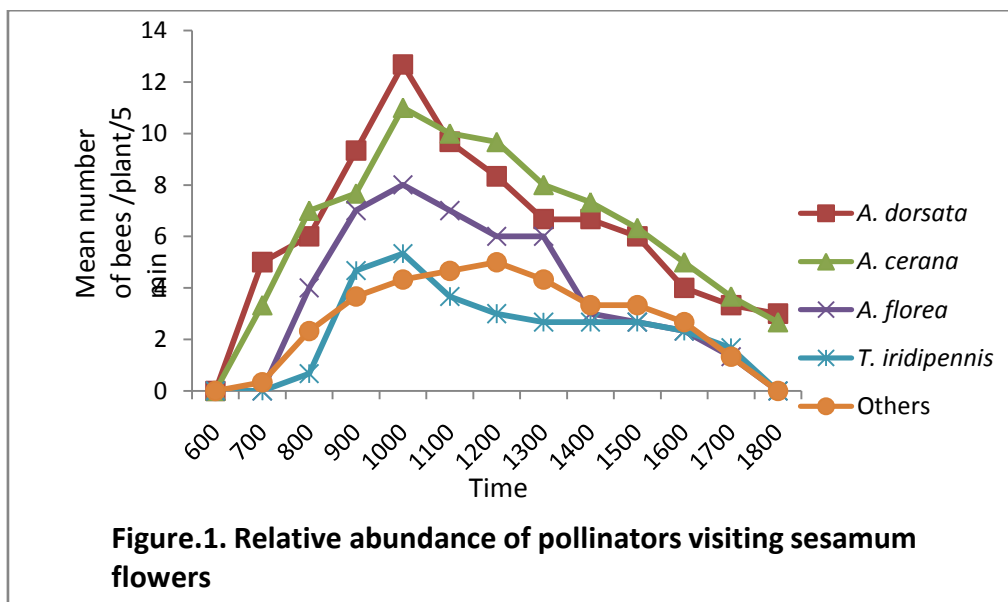
There are 14 number of different species of insects were found visited the sesamum during (Feb-March 2014) flowering period. Among different insect pollinators, ten species were belongs to Hymenopterans and four species belongs to Dipterans. Among Hymenopterans four species of honeybees belongs to Apidae and one species each belongs to Anthophoridae, Chrysididae, Formicidae, Megachilidae, Scolidae and Vespidae. Similar results on various species of insect pollinators belongs to Diptera, Lepidoptera and Hymenoptera particularly *Apis cerana* Fab, *Apis florea* Fab and *Trigona iridipennis* Smith were found collecting the nectar and pollen from sesamum flowers in Northern India (Ali and Alam, 1933; Sikka and Gupta, 1949; Mohana Rao *et al.*, 1984; Panda *et al.*, 1989).

The other insect pollinators under Diptera, one species each belongs to Calliphoridae, Muscidae, Syrphidae and Tephritidae (Table-1). Similar results on other insect pollinators such as *Pithitis* sp., *Stilbum cyanurum* Forst, *Camponotus sericus* Fab., *Megachile* sp., *Scolia* sp. and *Ropalidia marginata* Van der vecht were also recorded on sesamum flowers in smaller numbers from Northern India (Sikka and Gupta, 1949 and Panda *et al.*, 1989).

Table.1. Species of insects visiting sesamum flowers.

Order	Family	Species
Hymenoptera	Apidae	<i>Apis dorsata</i> Fab. <i>Apis cerana</i> Fab. <i>Apis florea</i> Fab. <i>Trigona iridipennis</i> Smith
	Anthophoridae	<i>Pithitis</i> sp.
	Chrysididae	<i>Stilbum cyanurum</i> Forst
	Formicidae	<i>Camponotus sericus</i> Fab.
	Megachilidae	<i>Megachile</i> sp.
	Scolidae	<i>Scolia</i> sp.
	Vespidae	<i>Ropalidia marginata</i> Van der vecht
Diptera	Calliphoridae	<i>Chrysomya bezziana</i> Villaneuve
	Muscidae	<i>Musca domestica</i> Linn.
	Syrphidae	<i>Eristalis</i> sp.
	Tephritidae	<i>Dacus cruciferae</i> Hendel

Observations on the relative abundance of different pollinators visiting sesamum flowers revealed maximum intensity of *A. cerana* (6.28 bees/plant/5min) followed by *A. dorsata* (6.21 bees/plant/5 min), *Apis florea* (3.64 bees/plant/5min) and stingless bee *Trigona iridipennis* (2.26 bees/plant/5min). In addition, the Dipterans were recorded 2.72 pollinators/plant/5min (Figure.1). These findings were in accordance with the findings of Mohan Rao *et al.* (1981) who observed a similar activity of *Apis cerana indica*, *Apis dorsata* and *Apis florea* on Sesamum cultivars and reported *Apis cerana indica* was the most frequent visitor of Sesamum followed by *Apis florea* and *Apis dorsata*.



The foraging activity different species of honeybees reveals that the *A. dorsata* and *A. cerana* was found forage from 0700 to 1800 hrs, whereas *A. florea* and *Trigona iridipennis* found to start forage one hour later than *Apis dorsata* and *A. cerana* and continued up to 1700 hrs.

The foraging activity all the species were found maximum during morning (1000hrs). Among the honeybees, *A. dorsata* were visiting the flowers in maximum numbers (12.67 bees/plant/5min) followed by *A. cerana* (11 bees/plant/5min), *A. florea* (8 bees/plant/5min) and lowest (5.33 bees/plant/5min) recorded with *Trigona iridipennis* (Figure.1).

The foraging activity of non *Apis* pollinators of Hymenoptera and Dipterans were also recorded and were found maximum (5/plant/5 min) at 1200 hrs (Figure.1)

Figure.2. Pollinators visiting sesame (*Sesamum indicum L.*) flowers



Apis dorsata –Nectar forager



Apis florea- Nectar forager



Apis cerana- Nectar forager



Apis dorsata- pollen forager



Apis florea- pollen forager



Pithitis sp.

The pollen foragers of *A. dorsata* (6.33bees/plant/5min), *A. florea* (3.67bees/plant/5min) and *Trigona iridipennis* (2.33bees/plant/5min) were found peak at 1000hrs. Whereas pollen foragers of *A. cerana* (5.67bees/plant/5min) were found peak at 1100hrs (Figure.3).

The significant variations were recorded in foraging activity of all species of honeybees at different hours of the day. This might be perhaps due to the complexity of various factors embracing the bee species and the floral rewards in terms of quality and quantity at different hours of the day.

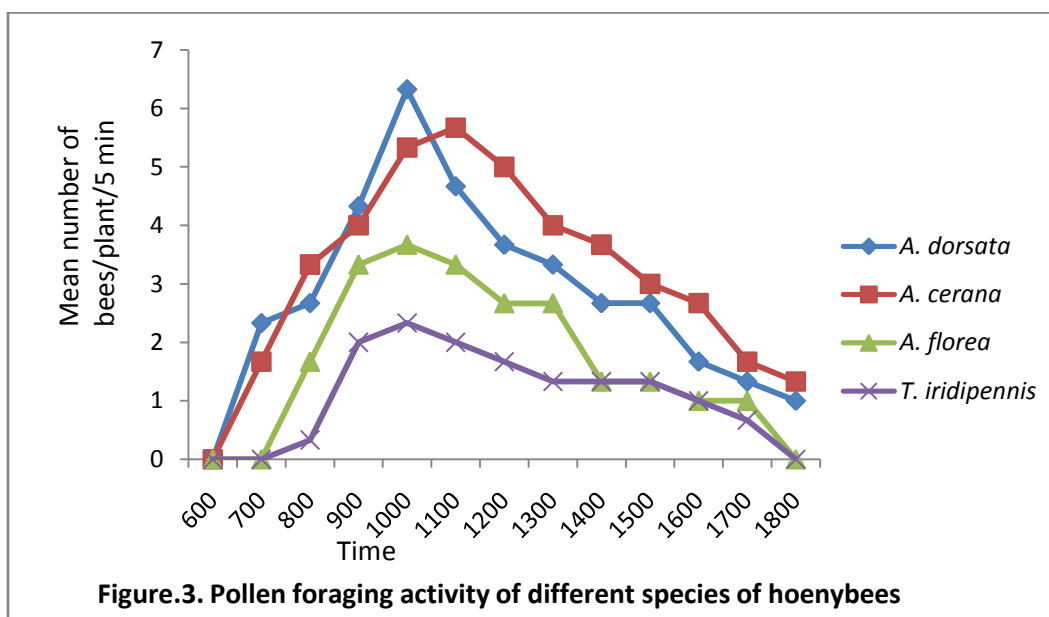
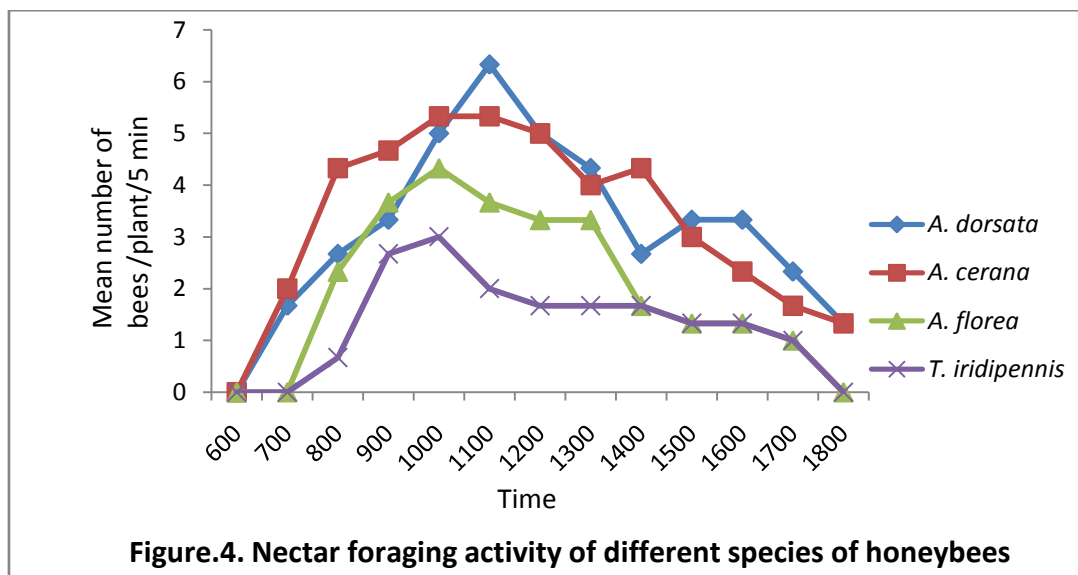
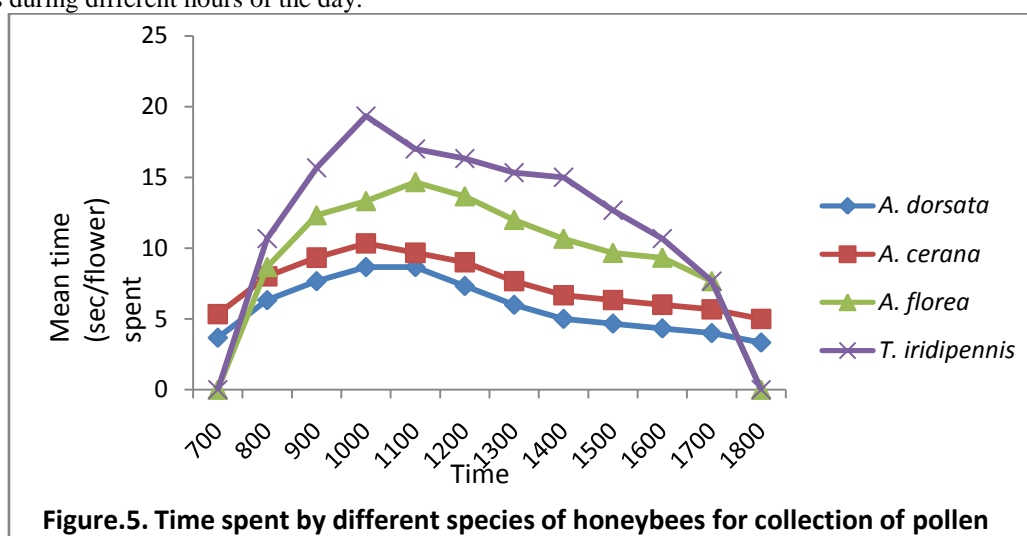


Figure.3. Pollen foraging activity of different species of honeybees

The nectar foragers of *A. cerana* (5.33bees/plant/5min), *A. florea* (4.33bees/plant/5min) and *Trigona iridipennis* (3.0 bees/plant/5min) were recorded at 1000hrs. Whereas the nectar foragers of *A. dorsata* (6.33bees/plant/5min) were found peak at 1100hrs (Figure.4). The mean numbers of nectar foragers of all the species of honeybees were found when compare to pollen foragers during morning hours indicates the presentations good quantity of nectar from the flowers. These findings are in conformity with the observations made by Verma (1983), who reported that the foragers were active throughout the year.



All the species of honeybee showed greater variation in time taken for collection of pollen from the flowers at different hours of the day (Figure.5). All the bees viz., *A. dorsata* (8.67 Sec /flower), *A. cerana* (10.33 Sec /flower), *A. florea* (14.67Sec /flower) and *Trigona iridipennis* (19.33 Sec /flower) were taken longer duration for collection of pollen from the flowers between 1000 and 1100 hrs of the day. Whereas lesser duration for the collection of pollen from flowers by *A. dorsata* (3.33 Sec /flower), *A. cerana* (5 Sec /flower) were recorded at 1800 hrs of the day, but the bees of *A. florea* and *Trigona iridipennis* were not noticed in collection of pollen from flowers at 1800 hrs of the day. The difference in duration taken for the collection of pollen by all the species of honeybees might be corroborated with quantity of pollen that will be presented by flowers during different hours of the day.



IV. Conclusion

Apis and non *Apis* species were found as a insect pollinators of sesame during the study period, however conservation of these pollinators by rational pest management tactics, i.e., pesticide application, if needed should be done in the late afternoon to protect the pollinators for high seed yield or spray at a time of the day when crop flowers are closed.

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