

Nature and Frequency of Visit of Pollinators in Sunflower

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ABSTRACT

An attempt made to study the pollinators of sunflower revealed that honey bees viz., *Melipona iridipennis* Sm., *Apis cerana indica* Fab., *Apis dorsata* Fab., and *Apis florea* Fab., were the frequent visitors to the crop. Their pollen and nectar gathering behaviour were described. In general, the frequency of visit of all pollinators in a flower head was observed to increase and was maximum between six to eleven days after the initiation of florets opening, their visits being reduced after all the florets opened. Visits by *Melipona iridipennis* Sm., and *Apis cerana indica* Fab., was continuous from 06.00 to 18.00 hr. The other pollinators viz., *Apis dorsata* Fab., *Apis florea* Fab., *Pithitis smaragdua* Fab., *Nomia elliotii* Sm., and *Crocisa ramosa* Lep., were not observed to make regular visits. Bee visits began at 06.00 hr. reached a peak between 08.00 and 12.00 hr and ceased by 18.00 hr.

INTRODUCTION

Sunflower is totally dependent upon insects for seed production. That sunflower head isolated from insects set little or no seed was reported by several workers (Furgala, 1954; Kushnir, 1958). Honey bees were the most important pollinators of sunflowers (Kushnir, 1960). In India, Atwal et al. (1970) reported that four species of honey bees were visiting the sunflowers for pollen collection. Pollen and nectar gathering behaviour of bees in sunflower was reported by Free (1964). Since no information is available in India on the pollinators of sunflower, observations were made on the species of insects involved, their nature and frequency of visit in relation to florets opening as well as at different times of the day and the results presented.

MATERIALS AND METHODS

The crop was raised in the farm of Tamil Nadu Agricultural University,

Coimbatore. From the field observations, it was noticed that the activity of pollinators was between 08.00 and 12.00 hr. To assess the visits of pollinators from the commencement to completion of florets opening in a flower head, four flower heads were marked and counts of important pollinators were recorded for one hour (08.00 to 09.00 hr). Observations were continued till all the florets opened in a flower head. Frequency of visit of pollinators was noticed at hourly intervals from 06.00 to 18.00 hr in three flower heads marked five days after the commencement of florets opening. In all cases, visits were recorded by recording the number of times the bees worked on the flower head, irrespective of repeated visits by the same individual. Detailed observations were made on the nature of visits of the pollinators in relation to nectar and pollen gathering. Statistical analysis was carried out after transforming the data into 'poisson values'.

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RESULTS AND DISCUSSION

The observations showed that the species visiting the heads in the largest numbers were those of *Apis cerana indica* Fab., *Apis florea* Fab., *Apis dorsata* Fab., *Melipona iridipennis* Sm., *Pithitis smaragdula* Fab. (*Ceratina binghami* Ckll), *Nomia elliotii* Sm., and *Crocisa ramosa* Lep. Those visiting in lesser numbers were of *Xylocopa fenestra* Fab., *X. leucothorax* Fab., *Polyommatus boeticus* Bing., *Papilio aristolachiae* Fab., *Megachile ceylonica* Bing., and *Tabanus striatus* Walk.

Nature of visit of pollinators:

Numerous bees of *M. iridipennis* were observed to cluster on the unopened florets at the time of florets opening and collected the resinous secretion. When the disc florets proceeded opening towards the centre, these bees congregated in the central unopened florets. Frequently they alighted over the anther tube of florets in the male stage and collected pollen. But they never thrust their head inside the corolla tube and collected the nectar. Their inability to collect nectar could be attributable to their smaller tongue. However studies have to be made to ascertain the role of *M. iridipennis* from the pollination point of view. They occasionally visited the extral floral nectaries located in the basal edge of the laminae of top leaves. More bees were seen with pollen loads early in the morning but they were not so active while foraging.

All the other species of insects were observed to collect pollen as well as nectar. While collecting nectar, they pushed their tongue and head inside the corolla tube and collected

the nectar from the base of corolla and in doing so, became dusted with pollen incidentally. Pollen was not deliberately gathered while collecting nectar. *A. cerana indica*, *A. dorsata* and *A. florea* circled round all the florets in the male stage, deliberately scrabbled the pollen from the anthers and pushed into their corbiculae while hovering up in the air. *P. smaragdula*, *N. elliotii* and *C. ramosa* gathered the pollen on the hairs of hind legs, sitting over the florets itself. All species of bees visited the florets both in the male and female stage while collecting nectar. Bees often changed readily from pollen to nectar collection and *vice versa*. These observations are in accordance with those of Free (1964) who reported similar behaviour of *Apis mellifera* L., on sunflower.

Frequency of visit in relation to florets opening: The data on the frequency of visit of pollinators in relation to florets opening are furnished in Table 1 and were found to be statistically significant. Continuous visits from the time the florets opened till it completed was made by two species viz., *A. cerana indica* and *M. iridipennis*. The other insects were not observed to make regular visits. The visits by *A. florea* and *P. smaragdula* were noted between the 3rd and the 17th day. Activity of *A. dorsata* was observed from 4th to 9th day. The number of other species viz., *C. ramosa*, *N. elliotii* and *M. ceylonica* was recorded on 7th to 10th day. The percentage of visits of various species was recorded to be 51.3, 32.7, 8.1, 4.7, 0.7, 0.6, 0.3 and 0.2 respectively for *A. cerana indica*, *M. iridipennis*, *A. florea*, *P. smaragdula*

TABLE 1. Frequency of visit of pollinators in relation to florets opening

Days after sowing	BEE SPECIES							
	A. Cerana indica	M. iridipennis	A. florea	P. smaragdula	A. dorsata	C. ramosa	N. elliotii	N. ceylonica
47 Commence- ment of flowering	1.00	5.00	—	—	—	—	—	—
48	7.50	10.00	—	—	—	—	—	—
49	11.50	21.00	1.00	—	—	—	—	—
50	25.00	16.00	6.00	2.00	0.50	—	—	—
51	29.50	14.50	5.50	4.50	0.50	—	—	—
52	31.00	15.00	7.50	7.00	1.50	—	—	—
53	40.50	10.50	9.00	2.00	0.50	0.50	0.50	0.50
54	29.00	18.00	12.00	1.00	1.00	0.50	0.50	0.50
55	36.00	11.00	4.00	4.50	0.50	2.00	1.00	0.50
56	22.00	30.00	3.50	2.50	—	1.00	—	—
57	39.50	20.00	—	3.50	—	—	—	—
58	15.00	18.50	1.50	2.50	—	—	—	—
59	16.00	20.00	1.50	0.50	—	—	—	—
60	26.50	11.00	4.00	1.00	—	1.00	—	—
61	15.00	8.00	2.50	1.00	—	—	—	—
62	14.00	4.50	1.00	1.50	—	—	—	—
63	10.00	4.50	0.50	1.00	—	—	—	—
64	4.50	1.00	—	—	—	—	—	—
65	1.00	0.50	—	—	—	—	—	—
Mean	19.70	12.57	3.13	1.81	0.23	0.26	0.10	0.07

Difference between species and between days after flowering are significant at 5% level of probability, C. D. being 1.03 and 1.55.

TABLE 2. Number of bees visiting at different times of the day

Time	Bee species					
	<i>M. iridipennis</i>	<i>A. cerana indica</i>	<i>A. dorsata</i>	<i>A. florea</i>	<i>N. elliotii</i>	<i>P. smargdula</i>
6.00 to 7.00	3.33	3.66	7.33	—	—	—
7.00 to 8.00	9.66	1.66	1.66	4.33	—	1.33
8.00 to 9.00	53.00	10.66	0.33	—	—	—
9.00 to 10.00	57.66	22.33	4.00	2.66	2.00	2.00
10.00 to 11.00	28.66	14.66	4.66	—	2.66	1.33
11.00 to 12.00	27.00	16.33	5.00	2.66	3.00	—
12.00 to 13.00	18.00	8.66	2.66	—	—	0.33
13.00 to 14.00	29.33	4.33	1.66	—	—	0.33
14.00 to 15.00	43.33	9.00	2.00	—	—	—
15.00 to 16.00	35.33	7.00	1.00	—	—	—
16.00 to 17.00	26.66	7.66	1.00	—	—	—
17.00 to 18.00	13.66	3.00	—	—	—	—
Mean	28.80	9.07	2.60	0.80	0.63	0.44

Differences between species and between hours are significant at 5% level of probability, C. D. being 1.95 and 2.16. The interaction is not significant.

The weather conditions on 18—1—1973 were as follows:

Maximum temperature = 30.8°C	Relative humidity = 96%
Minimum temperature = 17.8°C	Wind velocity = 2 kmph
Morning humidity = 94	Hours of bright sunshine = 10.2
Evening humidity = 55	

C. ramosa, *A. dorsata*, *N. elliotii*, and *M. ceylonica*. A maximum of 52.1 per cent of visits was made by all species from 6th to 11th days after the beginning of florets opening. The peak visits of all species may be attributable to the coincidence of maximum florets opening at that period with abundant nectar and pollen. Decrease in visits was noted after the 11th day but visits were continued upto the 19th day.

Activity of bees in relation to different times of the day: Significant differences in visits were noted at different times of the day in all the species of pollinators. The flower head was continuously visited from 06.00 to 18.00 hr by *M. iridipennis* and *A. indica*. The visits by other species were not regular. Activity of *A. florea* was noted from 08.00 to 12.00 hr. *N. elliotii* was recorded between 09.00 and 12.00 hr. The visits of *P. smaragdula* was observed between 07.00 and 14.00 hr. The activity of *A. florea*, *N. elliotii* and *P. smaragdula* was observed to cease in the afternoon. In general, bee visitation started at 06.00 hr and reached a peak in number between 08.00 and 12.00 hr and ceased by 18.00 hr. Such peak visits of bees between 08.00 to 12.00 hr might be due to the favourable weather conditions as well as the availability of

pollen and nectar during such a period. Bees with pollen loads were most numerous early in the morning probably in association with the anther dehiscence. Secondary peak of *A. indica* and *M. iridipennis* observed in the late afternoon might probably be due to the stigma pushing out the remaining pollen out of the anther tube as reported by Free (1964).

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