

Role of Mango Pollinator in Different Varieties of Mango Ecosystem

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Abstract

Mango tree are pollinated most predominantly insects, like numerous insects of the orders Hymenoptera, Diptera and Coleoptera. Pollen-grains have been observed adhering to the bodies of many species belonging to these orders. It is concluded that majority of pollinators belong to order Hymenoptera and Diptera. Among Hymenopterans insects, different species of honey bee are the most efficient flower-visiting insect. Insects belonging to the order Diptera are also the dominant pollinators. In Alphonso variety, total 461 insect pollinators were recorded in a season and it was revealed that, Hymenoptera (60.09 %) order had major contribution in pollination throughout the season. The total numbers of insect pollinators recorded in Kesar throughout the season were 435 and the order Diptera (64.37 %) had major contribution in pollination. Throughout the season a total number of 2295 insects of different species was recorded and the order Hymenoptera (78.00 %) had major contribution in pollination in Ratna variety of mango.

Keywords : Mango pollinators, mango ecosystem, alphonso, Ratna, Kesar.

Introduction

Mango (*Mangifera indica* L.) is the most important crop among the tropical and subtropical fruits grown in more than 111 countries of the world. Mango is the national fruit of India. India is the largest producer of mango in the world, and ranks first in area and production. The total production of mango in India is 18.431 metric tonnes (MT) from about 2.51 million ha area with the

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productivity of 7.32 MT ha⁻¹, which is 34.9 per cent of total area and 20.7 per cent of the total production under fruit crops in the country (Anonymous 2014). Konkan region on the west coast of Maharashtra is one of the largest mango growing belts which contribute nearly 10 per cent of total mango area in the country. It has been established that pollinating agents are essential for survival and reproduction of several wild plant species (Kearns *et al.* 1998). Naturally more than forty to sixty per cent flowers failed to receive any pollen (Mukherjee 1951). The single anther produces comparatively few pollen-grains (200 or 300) and the stigma is small to assist in catching pollen grains. Therefore, an attempt has been made to bring the light on the facts about the pollinators visiting mango flowers. Evidence concerning the pollinators in mango is still limited in Konkan region of Maharashtra.

Material and Methods

Field experiment was conducted at Nursery No. 10 and Centre of Excellence for Mango, Department of Horticulture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India to study the role of mango pollinator in different varieties of mango ecosystem. For this purpose three varieties of mango were selected *viz* Alphonso, Ratna and Kesar. From each variety, five plants were selected randomly and from each plant four panicles were selected and tagged at four different directions *i.e.* east, west, south, and north. Tagged panicles were monitored by observing them for visiting the pollinator species for Alphonso mango variety at weekly interval. A specific day was selected in a week like Monday for Alphonso, Wednesday for Kesar and Friday for Ratna. The observations of insect pollinator's complex on Alphonso, Ratna and Kesar

variety of mango were recorded in the month of January and February at flowering season. The observations were recorded at two hour interval i.e. 07.00-9.00, 09.00-11.00, 11.00- 13.00, 13.00-15.00 and 15.00-17.00 hours on the each tagged panicle for five minutes once in a week. The stop watch was used for recording the time. The visiting pollinators were collected by using insect collecting hand net. The collected pollinators were stored in the labeled glass vials containing 70 per cent ethyl alcohol and later identified in the laboratory. The data were averaged in time -wise and species- wise manner to draw the conclusion about the dominant group of pollinators visiting mango flowers and to access the most favorable period of the day where pollinators remained at peak.

Results and Discussion

Mean number of pollinators visited Alphonso variety in a season : It was observed that maximum numbers of pollinators were recorded from the order Hymenoptera and Diptera. In January and February, total number of insect pollinators recorded was 461 from different species mentioned (Table 1). Out of 461 insect pollinators from the order of Hymenoptera and Diptera visited the mango flowers, 277 (60%) were belonged to the order Hymenoptera and 184 (40%) to Diptera. Mean number of pollinators from the order Hymenoptera and Diptera were recorded 30.78 and 20.44, respectively. Whereas, mean number of insect pollinators recorded were 51.22 in a season. Principally, in case of Hymenoptera, families recorded were Apidae and Formicidae. The total numbers and percentage of Hymenopteran (277) insects belonging to Apidae were 223 (80.51%) and Formicidae 6 (19.49%). Hence, it was noticed that, Apidae had more contribution in pollination than Formicidae. Apidae (223) was again represented mainly by two species *Trigona spp.* (158:71%) and *A. florea* (65:29%). The order Diptera (184) was having represented by the familie viz., Syrphidae, Drosophillidae Calliphoridae, Muscidae and Tachinidae. Among them, Syrphidae had 112 (60.87 make round figures %) insect pollinators, followed by Drosophillidae 51 (27.72%) and other remaining Calliphoridae, Muscidae and Tachnidae had 08 (4.35%), 07 (3.80%) and 06 (2.26%) insect

pollinators, respectively. As mentioned earlier the observations recorded at two hours interval i.e. 07.00-9.00, 09.00-11.00, 11.00-13.00, 13.00-15.00 and 15.00-17.00 hours, the data indicated the diversity of insect pollinators at a particular time period and pollinator species. The study suggested that the maximum number of pollinators was 124 (26.90% out of 461) while, minimum recorded was 26 (5.64%) at 13.00-15.00 h and 07.00-09.00 h, respectively. Remaining number of pollinators recorded were 121 (26.25 %) at 11.00-13.00 h, 107 (23.21%) and 83 (18.00%) at 15.00-17.00 h and 09.00-11.00 h, respectively. Mean number of pollinators recorded were 24.80, 24.20, 21.40, 16.60 and 5.20 at 13.00-15.00 h, 11.00-13.00 h, 15.00-17.00 h, 09.00-11.00 h and 07.00-09.00 h, respectively from both the orders throughout the season. While, overall time wise mean number of pollinators in a season were 92.20. Time wise per cent distribution of pollinators was also recorded. The order Hymenoptera had 277 pollinators and recorded were 89 (32.13%) at 13.00-15.00h followed by 77 (27.80%) at 11.00-13.00 h, 63 (22.74%) at 15.00-17.00 h, 39 (14.08%) at 09.00-11.00 h and 9 (3.25%) at 07.00-09.00 h. While, from Diptera (184) number of pollinators recorded were 44 (23.91%) at 09.00-11.00 h, 11.00-13.00 h and 15.00-17.00 h followed by 35 (19.02%), 17 (9.24%) at 13.00-15.00 h and 07.00-09.00 h, respectively.

Mean number of pollinators visited Kesar variety in a season: It was observed that maximum numbers of pollinators were recorded from the order Diptera. In January and February, total number of insect pollinators recorded was 435 from different species (Table 2). Among them Diptera had 280 (64.37%), Hymenoptera 148 (34.02%) and Coleoptera 07 (1.61%). The mean number of pollinators from the order Diptera, Hymenoptera and Coleoptera recorded were 35.00, 18.50 and 0.88, respectively. Whereas, mean number of insect pollinators recorded were 54.38 in a season. Principally in case of the order Diptera (280), insect pollinator families viz., Drosophillidae, Syrphidae, Calliphoridae, Muscidae and Tachinidae recorded were 146 (52.14%), 85 (30.36%), 24 (8.57%), 21 (7.50%) and 4 (1.43%) insect pollinators, respectively. Hence,

Table 1 : Mean number of pollinators visited Alphonso variety of mango in a season (2016).

Visitors/pollinators	Time (h)					Total	Mean Week wise	Percentage
	7.00-9.00	9.00-11.00	11.00-13.00	13.00-15.00	15.00-17.00			
1) Hymenoptera	**09	39	77	89	63	277	*30.78	60.09
Hymenoptera (%)	3.25	14.08	27.80	32.13	22.74			
i) Apidae	02	34	63	74	50	223	24.78	80.51
a) Trigona	02	30	45	47	34	158	17.56	70.85
b) Honeybee	00	04	18	27	16	65	7.22	29.15
ii) Formicidae	07	05	14	15	13	54	6	19.49
2) Diptera	17	44	44	35	44	184	20.44	39.91
Diptera (%)	9.24	23.91	23.91	19.02	23.91			
i) Syrphidae	08	23	31	23	39	112	12.44	60.87
ii) Calliphoridae	00	01	00	01	06	08	0.89	4.35
iii) Muscidae	01	01	00	01	07	07	0.78	3.80
iv) Tachinidae	00	03	01	01	00	06	0.67	3.26
v) Dorsophillidae	08	16	12	09	30	51	5.67	27.72
Total	26	83	121	124	107	461	51.22	
Mean Time wise	5.2	16.6	24.2	24.8	21.4	92.2		
Percentage	5.64	18.00	26.25	26.90	23.21			

**The values taken are sum of all the insects visited during months of January and February in particular time period per panicle.

*Average number of insects in total nine weeks.

Table 2 : Mean number of pollinators visited Kesar variety of mango in a season (2016).

Visitors/pollinators	Time (h)					Total	Mean Week wise	Percentage
	7.00-9.00	9.00-11.00	11.00-13.00	13.00-15.00	15.00-17.00			
1) Hymenoptera	**39	27	48	20	14	148	*18.5	34.02
Hymenoptera (%)	26.35	18.24	32.43	13.51	19.46			
i) Apidae	39	27	48	20	14	148	18.5	100
a) Trigona	15	12	18	11	08	64	8	43.24
b) Honeybee	24	15	30	09	06	84	10.5	56.76
ii) Formicidae	00	00	00	00	00	00	00	00
2) Diptera	59	51	67	67	36	280	35	64.37
Diptera (%)	21.07	18.21	23.93	23.93	12.86			
i) Syrphidae	15	19	19	23	09	85	10.63	30.36
ii) Calliphoridae	01	05	06	05	07	24	3	8.57
iii) Muscidae	03	02	04	09	03	21	2.63	7.5
iv) Tachinidae	01	00	02	00	01	04	0.5	1.43
v) Dorsophillidae	39	25	36	30	16	146	18.25	52.14
3) Coleoptera	04	00	00	02	01	07	0.88	1.61
Coleoptera (%)	57.14	0.00	0.00	28.57	14.29			
Total	102	78	115	87	51	435	54.38	
Mean Time wise	51	39	57.5	43.5	25.5	87		
Percentage	23.45	17.93	26.44	20.00	11.72			

**The values taken are sum of all the insects visited during months of January and February in particular time period per panicle.

*Average number of insects in total nine weeks.

Table 3 : Mean number of pollinators visited Ratna variety of mango in a season (2016).

Visitors/pollinators	Time (h)					Total	Mean Week wise	Percentage
	7.00-9.00	9.00-11.00	11.00-13.00	13.00-15.00	15.00-17.00			
1) Hymenoptera	**206	489	517	378	200	1790	223.75	78.00
Hymenoptera (%)	11.51	27.32	28.88	21.12	11.17			
i) Apidae	203	468	505	378	193	1747	218.38	97.60
a) Trigona	68	106	172	106	91	543	67.88	31.08
b) Honeybee	135	362	333	272	102	1204	150.5	68.92
ii) Formicidae	03	21	12	00	07	43	5.38	2.40
2) Diptera	48	106	104	120	124	502	62.75	21.87
Diptera (%)	9.56	21.12	20.72	23.90	24.70			
i) Syrphidae	00	13	06	22	09	50	6.25	9.96
ii) Calliphoridae	05	18	21	36	22	102	12.75	20.32
iii) Muscidae	00	09	11	12	06	38	4.75	7.57
iv) Tachinidae	00	06	02	03	04	15	1.88	2.99
v) Dorsophilidae	43	60	64	47	83	297	37.13	59.16
3) Coleoptera	00	00	00	03	00	03	0.38	
Coleoptera (%)	0.00	0.00	0.00	100	0.00			
Total	254	595	621	501	324	2295	286.88	
Mean Time wise	50.8	119	124.2	100.2	64.8	459		
Percentage	11.07	25.93	27.06	21.83	14.2			

**The values taken are sum of all the insects visited during months of January and February in particular time period per panicle.

*Average number of insects in total nine weeks.

Drosophilidae had more number of insect pollinators among all the recorded Dipteran families. While, in the order Hymenoptera (148), all the insect pollinators 148 (100%) were from Apidae only. As mentioned earlier, observations recorded at two hours interval data indicated diversity of insect pollinators at particular time period and pollinator species. Thus, data mentioned in table 2 revealed that, maximum number of pollinators recorded were 115 (26.44% out of 435) and minimum number were 51 (11.72%) at 11.00-13.00 h. Remaining insect pollinators recorded were 102 (23.45%) at 07.00-09.00 h, 87 (20.00%) and 78 (17.93%) at 13.00-15.00 h and 09.00-11.00 h, respectively. Mean number of pollinators recorded were 57.50, 51.00, 43.50, 39.00 and 25.50 at 11.00-13.00 h, 07.00-09.00 h, 13.00-15.00 h, 09.00-11.00 h and 15.00-17.00 h, respectively from both the orders throughout the season. While, overall time wise mean number of pollinators in a season were 87.00.

Time wise per cent distribution of pollinators revealed that, the order Diptera had 280 pollinators. Among them 67 (23.93%) pollinators were recorded at 11.00-13.00 and 13.00-15.00 h followed by 59 (21.07%) at 07.00-09.00 h, 51 (18.21%) at 09.00-11.00 h and 36 (12.86%) at 15.00-17.00 h. And the order Hymenoptera had 148 pollinators. Among them, 48 (32.43%) were recorded at 11.00-13.00 h, 39 (26.35%) at 07.00-09.00 h, 27 (18.24%) at 09.00-11.00 h, 20 (13.51%) at 13.00-15.00 h and 14 (9.46%) at 15.00-17.00 h. Whereas, in the order Coleoptera (7) pollinators recorded were 4 (57.14%) at 07.00-09.00 h followed by 2 (28.57%) at 13.00-15.00 h and 1 (14.29%) at 15.00-17.00 h. Whereas during, 09.00-11.00 h and 11.00-13.00 h no Coleopteran pollinators was observed.

Mean numbers of pollinators visited Ratna variety in a season : It was observed that maximum numbers of pollinators were recorded from the order Hymenoptera.

In January and February, total number of insect pollinators recorded was 2295 from different species (Table 3). Among them 1790 (78.00%) were belonging to the order Hymenoptera, 502 (21.87%) to Diptera and 3 (0.13%) to Coleoptera. Mean number of pollinators from the order Hymenoptera, Diptera and Coleoptera recorded were 223.75, 62.75 and 0.38, respectively while, mean number of insect pollinators recorded were 286.88 in a season. Principally in case of Hymenoptera, families recorded were Apidae and Formicidae. The total numbers of Hymenopteran (1790) and per cent insects belonging to Apidae and Formicidae were 1747 (97.60%) and 43 (2.40%), respectively. Hence, it was indicated that, Apidae had more contribution in pollinators than Formicidae. Apidae was represented mainly by two species *A. florea* 1204 (68.92%) and *Trigona spp.* 543 (31.08%). In the order Diptera (502), the families were recorded viz., Drosophilidae, Calliphoridae, Syrphidae, Muscidae and Tachinidae. Among them Drosophilidae recorded were 297 (59.16%), followed by Calliphoridae 102 (20.32%), Syrphidae 50 (9.96%), Muscidae 38 (7.57%) and Tachinidae 15 (2.99%). The observations recorded at two hours interval i.e. 07.00-09.00, 9.00-11.00, 11.00-13.00, 13.00-15.00 and 15.00-17.00 hours, data indicated the diversity of insect pollinators at particular time period and pollinator species. Thus the study showed that, maximum number of pollinators recorded were 621 (27.06% out of 2295) while, minimum number 254 (11.07%) at 11.00-13.00h and 07.00-09.00 h, respectively. Remaining number of pollinators recorded were 595 (25.93%) at 09.00-11.00 h, 501 (21.83%) at 13.00-15.00 h and 324 (14.12%) at 15.00-17.00 h. Mean number of pollinators recorded were 124.2, 119.00, 100.2, 64.8 and 50.8 at 11.00-13.00 h, 09.00-11.00 h, 13.00-15.00 h, 15.00-17.00 h and 07.00-09.00 h, respectively from both the orders throughout the season. Overall time wise mean number of pollinators in a season was 459.00. Time wise per cent distribution of pollinators revealed that, the order Hymenoptera had 1790 pollinators of which 517 (28.88%) were recorded at 11.00-13.00 h followed by 489 (27.32%) at 09.00-11.00 h, 378 (21.12%) at 13.00-15.00 h, 206 (11.51%) at 07.00-09.00 h and 200 (11.17%) at 15.00-

17.00h. While, from Diptera (502), pollinators recorded were 124 (24.70%) at 15.00-17.00h, followed by 120 (23.90%) at 13.00-15.00 h, 106 (21.12%) at 09.00-11.00 h, 104 (20.72%) at 11.00-13.00 h and 48 (9.56%) at 07.00-09.00 h. The observations made in the present study partially agreement with those of according to Prakash (2002) also observed that cucumber crop was visited by insect species belonged to Hymenoptera, Diptera and Coleoptera. Whereas, Sajjanar *et al.* (2005) observed on spice basil insect visitors recorded were twenty of which eighteen belonged to the order Hymenoptera and two were belonged to Diptera. Sung *et al.* (2006) reported pollinators on mango flower and most of which belonged to order Hymenoptera and Diptera. Present results are in the conformity with those of Rakeshkumar and Chaudhary (1996) reported in litchi crop that Hymenoptera had major (87.7%) contribution in pollination. Phartiyal *et al.* (2012) reported that Hymenoptera had major group of insects visiting citrus flower at flowering stage. The results are more or less similar to Rana *et al.* (1997) who observed that the maximum activity of pollinators at 12.00 h compared to 09.00 h. Sihag *et al.* (1999) studied the pattern of honey bee visit reached to its peak between 11.00-13.00 h. Shivaramu and Cithiraichelvan (2002) recorded honey bee and *Trigona* on raddish flower with their peak activity between 13.00-16.00 h.

Conclusion

Mango tree are pollinated most predominantly insects like numerous insects of the orders Hymenoptera, Diptera and Coleoptera. Among Hymenopterans insects, different species of honey bee are the most efficient flower-visiting insect. In Alphonso variety, total 461 insect pollinators were recorded. Total number of 2295 insects of different species was recorded and the order Hymenoptera had major contribution in pollination in Ratna variety of mango.

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