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FORAGING BEHAVIOUR OF SOME SYRPHID FLIES ON MANGO

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ABSTRACT

This study in on the foraging behaviour of syrphid flies belonging to the tribes Eristalini (*Eristalinus arvorum, E. quinquestriatus* and *Mesembrius quadrivittatus*) and Syrphini (*Episyrphus balteatus*). The foraging activity, rate and speed, loose pollen grains and abundance were evaluated at Jorhat during 2018 and 2019 on mango flowers var. Amrapali. These revealed that the peak period of visit was 1000-1200 hr. The relative abundance of the syrphids was maximum (8.90± 0.22/ 5 min) at 1100-1200 hr and (7.07± 0.51/ 5min) at 1200-1300 hr; it was minimum (2.40± 0.17 and 2.49± 0.09/ 5min) at 0700-0800 hr, respectively. The loose pollen grains adhering to them ranged from 1294.80± 60.82 to 1415.80± 110.80/ forager. The maximum pollination index of 12.52 was obtained with the Eristalini, while it was 8.14 in Syrphini (2018); in 2019, it was 9.63 and 7.14, respectively. These syrphids visited flowers during midday with more activity, foraging rate and foraging speed.

Key words: Diptera, mango, pollination, Syrphidae, Eristalini, Syrphini, abundance, foraging behaviour, rate, speed, pollination index, pollen, diurnal activity

Mango *Mangifera indica* L. is an important tropical fruit crop, and nectar production in mango ensures its entomophilous pollination. Hover flies belonging to the family Syrphidae are frequent flower visitors and aid in pollination. However, relatively little research has been done on these (Larson et al., 2001). A survey in mango orchards revealed that flies of the Syrphidae and *Musca domestica*, and stingless bees *Trigona* spp., are the dominant flower visitors (Singh, 1960). It has been observed that the hover flies act as mango pollinators (Sung et al., 2006), and a study on pollination of mango concluded that dipterans and hymenopterans are the major pollinators (Singh, 1988). It is well established that syrphids are important for pollination of mango. No study is available in the North East India on these pollinators and this study aims at studying the foraging behaviour of the syrphid flies belonging to the tribes Eristalini and Syrphini on mango.

MATERIALS AND METHODS

The experiment was conducted in the Horticulture Orchard, Assam Agricultural University, Jorhat (26°47′N, 94°12′E, 86.6 masl) during 2017-2018 and 2018-2019. Observations on the flower visitors and foraging behaviour were made on mango variety Amrapali. The anthesis and dehiscence was observed for ten days at hourly interval from 0700 to 1600 hr during peak flowering. All insects visiting flowers were observed by: Visual counting by stop watch method; sweep net collection; and bowl trapping. Visual counting for 10 min at hourly intervals from February to March was made. The abundance of Eristalini (*Eristalinus arvorum, E. quinquestriatus Mesembrius quadrivittatus*) and Syrphini (*Episyrphus balteatus*) were computed.

Foraging speed was observed with the time spent on each flower using stop watch (Desh Raj and Rana, 1994). Foraging rate (no. of flowers visited/ min) was assessed following Free (1993). Relative abundance (syrphids/ m^2/ 5 min) was evaluated after Sihag (1986). The loose pollen grains sticking to the body of flies was counted by capturing it and shaking of its body and its hind legs as per Kumar (1990). Pollination index was assessed on the basis of their abundance and foraging behaviour such as foraging rate, foraging speed, and number of loose pollen grains sticking to their bodies. The rank assigned was on the basis of statistical analysis of mean value of foraging rate and speed, and number of loose pollen grains. The pollination index (rank assigned x relative abundance) was calculated following the method suggested by Kumar et al. (2012). The data obtained were analysed statistically using MS-Excel and SPSS 16.0.

RESULTS AND DISCUSSION

The foraging rate of Eristalini and Syrphini on mango peaked at 0800-0900 hr and 1300-1400 hr (3.68± 0.75 flowers/ min and 3.80± 0.10 flowers/ min),

respectively; the least values were at 0700-0800 hr and 1500-1600 hr (2.76± 0.50 and 2.14± 0.04, respectively in 2018; during 2019, the foraging rate was at peak at 1300-1400 and 1100-1200 hr (3.80± 0.10 and 6.47± 0.20, respectively, and at 1500-1600 hr and 0700-0800 hr (2.14± 0.04 and 2.92± 0.11, respectively) (Table 1). Fajardo et al. (2008) also observed that the relative abundance, foraging behaviour and efficiency of insect pollinators such as honey bees and flies in fruits crops including mango in Phillipines; the peak foraging time was 0800-0859 hr. Singh et al. (2018) reported that minimum foraging rate (6.37 flowers/ min) for *Episyrphus balteatus* was at 0900-1000 hr followed by at 1500-1600 hr on mustard bloom. Devi et al. (2017) observed a foraging rate of 17.42 flowers/ min for syrphid flies (*E. balteatus*) in mustard. The flies of Eristalini and Syrphini spent 26.98± 1.69 and 7.38± 0.27 sec/ flower (maximum foraging speed) during 0700-0800 hr and 20.58± 3.14 and 5.29± 0.08 sec/ flower during 1000-1100 hr and 1300-1400 hr (minimum foraging speed), respectively as observed in 2018; during 2019, the foraging speed was maximum at 0700-0800 hr (26.72± 0.97 flower/ min and 7.51± 0.12 flower/ min, respectively) and minimum during 0900-1000 hr and 1000-1100 hr (20.77± 0.20 flower/ min and 5.33± 0.17 flower/ min (Table 1). Bakshi (2015) reported foraging speed of *E. balteatus* over cherry bloom as 5.94 sec/ flower.

The relative abundance (number/ m^2/ 5min) of Eristalini and Syrphini was maximum at 1100-1200 and 0900-1000 hr (10.84± 0.30 and 8.76± 0.09, respectively) and the least at 0700-0800 hr (2.22± 0.08 and 2.24± 0.07, respectively) as observed in 2017; during 2018 it was maximum at 1100-1200 and 1200-1300 hr (8.90± 0.22 and 7.07± 0.51) while the least was at 0700-0800 hr (2.40± 0.17 and 2.49± 0.09), respectively (Table 1). Vishwakarma and Singh (2017) also observed with bees, flies and beetles that *Apis mellifera* was the most dominant after *Musca domestica* and *E. balteatus*; the foraging rate/ flower/ 5 min was maximum at 1200 hr. Singh and Mishra (1986) observed that *A. indica* was the most frequent followed by *Musa* spp. (3.40) and others including syrphids. Only 2.97 syrphids/ m^2/ 5min were observed on *Brassica oleracea* (Devi et al., 2016). More or less similar results were obtained by Singh

Table 1. Foraging rate, foraging speed and relative abundance of *Eristalinus* and Syrphini on mango

Time of observation (hrs)	Foraging rate (number of flowers visited/ minute)		Foraging speed (time spent, in sec/ flower)		Number of foragers/ m^2/ 5 min	
	Eristalinus	*Syrphini*	*Eristalinus*	*Syrphini*	*Eristalinus*	*Syrphini*
			2018			
0700-0800	2.76± 0.50	2.55± 0.18	26.98± 1.69	7.38± 0.27	2.22± 0.08	2.24± 0.07
0800-0900	3.68± 0.75	3.72± 0.27	24.90± 2.84	7.27± 0.07	5.37± 0.14	4.99± 0.19
0900-1000	2.64± 0.32	3.33± 0.20	20.90± 4.50	6.84± 0.15	9.85± 0.40	8.76± 0.09
1000-1100	3.36± 0.07	3.23± 0.41	20.58± 3.14	6.37± 0.12	10.35± 0.11	8.44± 0.09
1100-1200	3.38± 0.17	3.70± 0.07	21.90± 2.71	5.66± 0.10	10.84± 0.30	6.72± 0.11
1200-1300	3.03± 0.29	3.24± 0.45	22.22± 3.69	5.31± 0.05	9.66± 0.09	8.17± 0.05
1300-1400	3.56± 0.19	3.80± 0.10	20.86± 0.05	5.29± 0.08	9.03± 0.47	6.78± 0.13
1400-1500	3.41± 0.32	2.80± 0.07	20.89± 0.11	5.44± 0.09	6.54± 0.20	6.33± 0.07
1500-1600	2.93± 0.44	2.14± 0.04	21.03± 0.18	6.25± 0.13	3.63± 0.12	2.65± 0.10
Mean± SE	3.19± 0.34	3.17± 0.20	22.25± 2.10	6.20± 0.12	7.50± 0.18	6.12± 0.10
			2019			
0700-0800	2.55± 0.18	2.92± 0.11	26.72± 0.97	7.51± 0.12	2.40± 0.17	2.49± 0.09
0800-0900	3.72± 0.27	3.41± 0.13	24.08± 2.10	7.02± 0.07	4.07± 0.12	4.15± 0.07
0900-1000	3.33± 0.20	5.05± 0.13	20.77± 0.20	6.96± 0.14	5.99± 0.11	6.03± 0.11
1000-1100	3.23± 0.41	5.80± 0.17	20.95± 0.32	5.33± 0.17	7.26± 0.57	6.67± 0.12
1100-1200	3.70± 0.07	6.47± 0.20	21.99± 0.22	6.02± 0.12	8.90± 0.22	6.29±0.08
1200-1300	3.24± 0.45	4.89± 0.11	21.27± 0.21	5.74± 0.09	6.97± 0.52	7.07± 0.51
1300-1400	3.80± 0.10	4.30± 0.13	23.30± 0.15	5.76± 0.09	7.97± 0.16	6.23± 0.12
1400-1500	2.80± 0.07	2.78± 0.08	22.74± 0.11	6.28± 0.20	4.56± 0.10	5.67± 0.32
1500-1600	2.14± 0.04	3.55± 0.16	23.77± 0.09	6.35± 0.05	3.76± 0.09	3.71± 0.13
Mean± SE	3.17± 0.20	4.35± 0.14	22.73± 0.49	6.33± 0.11	5.76± 0.23	5.37± 0.17

Table 2. Pollination index of *Eristalinus* and Syrphini on mango (2018)

Pollinators	No. of loose grains/ forager (Mean± SE)	Rank assigned on the basis statistical analysis			Average	Relative abundance (number/ m^2/ 5 min)	Pollination index
		Foraging rate	Foraging speed	Loose pollen grains			
			Year 2018				
Eristalinus	1285.20± 92.86	1	2	2	1.67	7.50	12.52
Syrphini	1202.40± 78.86	2	1	1	1.33	6.12	8.14
			Year 2019				
Eristalinus	1415.80± 110.80	1	2	2	1.67	5.77	9.63
Syrphini	1294.80± 60.82	2	1	1	1.33	5.37	7.14

et al. (2018) that *E. balteatus* was the most abundant visitor in mustard.

The loose pollen grains on the body of Eristalini and Syrphini revealed that more pollen was on Eristalini (1285.20± 92.86) compared to Syrphini (1202.40± 78.86) in 2018; during 2019, these values were 1415.8± 110.80, and 1294.80± 60.82, respectively (Table 2). It was observed that 140 loose pollen grains were found adhering to the body of *E. balteatus* foraging on radish (Sharma et al., 2016). The pollination index showed that Eristalini (12.52) scored higher than Syrphini (8.14) during 2018; and in 2019, these values were 9.63 and 7.14. Singh et al., (2018) revealed that *E. balteatus* showed a higher rank than *E. frequens* on mustard.

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