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Relative Abundance of Syrphid Predators of *Brevicoryne brassicae* (L.) in Cauliflower Seed crop Ecosystem

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ABSTRACT

Nine species of aphidophagous Syrphids, *viz* , *Scaeva pyrastri* (Linn.), *Episyrphus balteatus* (Deg.), *Metasyrphus confrater* (Wied.), *M. corollae* (Fabr.), *Betasyrphus serarius* (Wied.), *Ishiodon scutellaris* (Fabr.), *Sphaerophoria indiana* (Bigot), *Melanostoma* sp. prob. *M. univittatum* (Wied.) and *Eupeodes (?) latilunulatus* (Collins) occurred as predators of *Brevicoryne brassicae* (Linn.) on cauliflower grown for seed production in the mid-hill regions of Himachal Pradesh during 1982-84.

Syrphid adult activity in the field was noticed as soon as aphids started forming colonies. *E. balteatus* and S. *indiana* were more abundant throughout the season. The larval counts, however, showed that *M. confrater* was the most abundant species accounting for 30.5 and 25.7 per cent of the total predatory larval population in the two years, respectively, followed closely by *E. balteatus*, *S. pyrastri*, and *E. latilunulatus*. The remaining species occurred in low numbers during March-April. Although one or the other species remained active in the field throughout crop season, syrphid larvae were relatively more abundant during March. The impact of predator populations on *B. brassicae* build-up is discussed on the basis of predator-prey ratio.

Key words : Cabbage aphid ***Brevicoryne brassicae***, Syrphids, relative abundance

The cabbage aphid, ***Bervicoryne brassicae*** (L.) is one of the key pests of cauliflower and other ***Brassica*** spp. in the mid-hill regions of Himachal Pradesh. Among the various predators of the pest, the syrphids have been found to be the most effective, owing to better synchronization of their phenology and high predation potential (Kotwal *et al.*, 1984). There is, however relatively little published information about the effectiveness, ecology and seasonal occurrence of aphidophagous Syrphidae. This paper deals with relative abundance of different syrphid species, and phenological observations made during 1982-84 in cauliflower seed crop ecosystem.

MATERIALS AND METHODS

The observations were recorded in 0.05 ha cauliflower (cv. Snowball 16) field during October-May of 1982-83 and 1983-84. The seedlings were transplanted with 50 x 40 cm spacing during the second week of October in both the years. All the recommended practices were followed except plant

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protection in order to raise the crop in a pesticide - free environment. The egg masses and larvae of the cabbage caterpillar, ***Pieris brassicae*** (Linn.) were removed mechanically to avoid excessive defoliation of the crop. Syrphid larvae observed feeding on aphids were picked and reared to adult stage.

Seasonal changes in populations of aphidophagous syrphids were monitored through larval counts and counting of adult visitors in the field. The egg stage was not sampled since it was not possible to separate them species-wise. Similarly, the pupal stage was also not sampled since most of the species pupated in soil or debris.

Counts were made at 5-day intervals starting from second week of December till harvest of the crop in second week of May. The predatory larvae were counted on 50 randomly selected plants. The larvae were identified on the basis of morphological characters suggested by Vockeroth (1969).

The population of syrphid adults was recorded over a randomly selected plot of 10 m^2 (4 x 2.5 m) accommodating about 50 plants. The counts were made throughout the season at 5-day intervals and each observation lasted for 10 min. On each sampling occasion, four observations were made from 10.00 a.m. to 4.00 p.m. at 2-hourly intervals and summed up for computing count/day.

The aphid population was sampled on 20 randomly selected plants on each sampling occasion by adopting the method followed by Tandon ***et al.*** (1977) whereby a 3-leaf sample (one each from lower, middle and upper whorl) was drawn from each plant. The number of aphids counted was multiplied by the total number of leaves to estimate aphids/plant.

RESULTS AND DISCUSSION

Nine species of Syrphidae were found preying upon the cabbage aphid, ***B. brassicae*** in the cauliflower seed crop ecosystem. They were ***Scaeva pyrastri*** (Linn.), ***Episyrphus balteatus*** (DeG.), ***Metasyrphus confrater*** (Wied.), ***M. corollae*** (Fabr.), ***Betasyrphus serarius*** (Wied.), ***Ishiodon scutellaris*** (Fabr.), ***Sphaerophoria indiana*** (Bigot), ***Melanostoma*** sp. prob. ***M. univittatum*** (Wied.), and ***Eupeodes*** (?) ***latilunulatus*** (Collins). All species, except the last two, have been reported earlier from India (Batra, 1960; Rao, 1969; Siddiqui and Krishnaswamy, 1972; Chorpade, 1981; Kotwal ***et al.***, 1984; Agarwala ***et al.***, 1984). Although genus ***Melanostoma*** has been reported from India, the species reported was ***M. orientale*** (Wied.) from Andhra Pradesh (Rao, 1969; Joshi ***et al.***, 1979). There is a need to establish the identity of these two species.

In the first year (1982-83), syrphid larvae were first observed on the crop by mid-December and the population increased slowly till the end of March; thereafter, it declined (Table 1). Only the larvae of ***S. pyrastri***, ***E. balteatus***, ***M. confrater*** and ***E. latilunulatus*** were recorded on the crop earlier than second week of March, all the other species being absent. During March there was a steady rise in population and a peak was observed on March 20, after which the population declined. By April 20, most species except

Table 1. Relative abundance of syrphid larvae in cauliflower seed crop ecosystem at Solan during 1982-83

Species	Mean number of larvae/plant during						Total count
	Dec	Jan	Feb	Mar	Apr	May	
S. pyrastri	0.02	0.01	—	1.07	0.70	—	1.80
E. balteatus	0.08	0.07	0.88	1.82	0.13	0.15	3.13
M. confrater	0.06	0.05	0.65	1.93	0.67	—	3.36
M. corollae	—	—	—	0.10	0.10	0.05	0.25
B. serarius	—	—	—	0.10	0.08	—	0.18
I. scutellaris	—	—	—	0.12	0.08	—	0.20
S. indiana	0.02	0.02	—	0.07	0.05	0.15	0.31
Melanostoma sp. prob. *M. univittatum*	0.02	0.03	—	0.02	0.08	—	0.15
E. latilunulatus	0.04	0.08	0.07	1 27	0.18	—	1.64
Total count	0.24	0.26	1.60	6.50	2.06	0.35	
Estimated population of *B. brassicae*/plant	16	141	338	720	350	95	
Predator : prey ratio	1 : 67	1 : 542	1 : 211	1 : 111	1 : 169	1 : 380	

E. balteatus and *M. corollae* had ceased their larval activity.

In the second year (1983-84), larval activity started between December 12 to 17, except in case of *I. scutellaris* and *M. corollae* both of which appeared late in the season on February 5 and March 1, respectively (Table 2). The population of *Melanostoma* sp. prob. *M. univittatum* remained almost negligible during mid-December and end of March. The peak larval counts were observed on March 26, which almost coincided with the previous season.

Among the species identified in the present study, *M. confrater* larvae were the most abundant followed by *E. balteatus, S. pyrastri* and *E. (?) latilunulatus*. The remaining species accounted for very low counts in the first year but had comparatively better counts in the second year.

The cabbage aphid population in general, remained low during 1982-83 compared to 1983-84 season. In the first year, the predator : prey ratios were narrower, presumaby due to the effect of adverse climatic conditions which affected both the predator and prey. In the second year, however, syrphid predators were able to keep the aphid population under check initially to some extent but failed to do so later in the season despite better larval counts. High activity of syrphid flies always coincided with peak aphid populations as reported by Azab *et al.* (1966) and Mahmoud *et al.*

Table 2. Relative abundance of syrphid larvae in cauliflower seed crop ecosystem at Solan during 1983-84

Species	Mean number of larvae/plant during						Total count
	Dec	Jan	Feb	Mar	Apr	May	
S. pyrastri	0.12	0.64	0.72	1.21	—	—	2.69
E. balteatus	0.08	0.84	0.90	1.20	0.10	0.10	3.22
M. confrater	0.08	0.06	1.90	2.41	—	—	4.45
M. corollae	—	—	—	0.84	0.05	—	0.89
B. serarius	0.08	0.04	—	0.39	—	—	0.51
I. scutellaris	—	—	0.98	0.76	0.05	—	1.79
S indiana	0.06	0.07	0.44	0.09	0.26	0.30	1.22
Melanostoma sp. prob *M. univittatum*	0.04	0.01	—	0.07	0.02	—	0.14
E. (?) latilunulatus	0.06	0.09	0.46	1.77	—	—	2.38
Total count	0.52	1.75	5.40	8 74	0.48	0.40	
Estimated population of *B. brassicae*/plant	53	520	1380	2223	153	52	
Predator : prey ratio	1 : 102	1 : 297	1 : 256	1 : 254	1 : 319	1.130	

(1981). In both the years, predator larvae generally failed to reach a ratio of 1: 100 which is considered ideal for syrphids (Straka, 1976; Wnuk, 1977).

The adults of most syrphid species started visiting cauliflower crop in December, except *M. corollae*, *B. serarius* and *I. scutellaris*, which seemed to require a longer overwintering diapause. Early in the season the adult population mainly comprised of gravid females which laid eggs on aphid-infested crop. By mid-January, the activity declined appreciably mainly due to adverse climatic conditions and to some extent scarcity of food, nectar and pollen for the adults. The activity was resumed as soon as the weather became favourable by mid-February. High adult activity coincided with flowering of cauliflower crop, more prominently in the former season than in the latter. In the first year, exceptionally high frequency of syrphids, especially *E. balteatus* was observed resulting in the maximum counts during early May.

During 1982-83, *E. balteatus* was the most frequent visitor of cauliflower crop, accounting for 20.4 % of the total count, followed by *S. indiana* (14.22 %), *I. scutellaris* (11.64 %), *Melanostoma* sp. prob. *M. univittatum* (11.05 %) and *M. corollae* (10.32 %), while the remaining species were infrequent visitors (Table 3). In the second year, however, *S. indiana* was the most frequent visitor (21.83 %), followed closely by *E. balteatus*

Table 3. Frequency of visits of adult aphidophagous syrphids in the cauliflower seed crop ecosystem at Solan during 1982-83

Species	Mean number of visits/10m²/10 min during						Total count	Percentage of total count
	Dec	Jan	Feb	Mar	Apr	May		
S. pyrastri	1.0	2.67	—	6.67	5.0	—	15.34	7.54
E. balteatus	3.0	0.5	1.0	5.67	4.83	26.5	41.50	20.4
M. confrater	3.0	—	2.17	12.33	—	—	17.50	8.6
M. corollae	—	—	—	4.0	6.0	11.0	21.00	10.33
B. serarius	—	—	—	2.83	3.5	10.0	16.33	8 03
I. scutellaris	—	—	—	4.67	6.0	13.0	23.67	11.64
S. indiana	3.6	—	—	3.33	5.0	17.0	28.93	14.22
Melanostoma sp prob. *M. univittatum*	2.8	0.17	—	1.67	4.83	13.0	22.47	11.05
E. (?) latilunulatus	3.0	0.83	—	6.33	6.0	0.5	16.66	8.2
Total count	16.4	4.17	3.17	47.5	41.1	91.0		

Table 4. Frequency of visits of adult aphidophagous syrphids in the cauliflower seed crop ecosystem at Solan during 1983-84

Species	Mean no. of visits/10m²/10min during						Total count	Percentage of total count
	Dec	Jan	Feb	Mar	Apr	May		
S. pyrastri	1.6	2.86	0.6	4.43	—	—	9.49	5.39
E. balteatus	4.8	5.57	—	10.0	12.67	3.5	36.54	20.76
M. confrater	3.0	—	3.6	13.71	4.0	—	24 31	13.81
M. corollae	—	—	—	8.71	2.17	1.0	11.88	6.75
B. serarius	2.4	—	—	6.0	—	3.0	11.40	6.48
I. scutellaris	—	—	4.4	11.57	4.33	2.0	22.30	12.67
S. indiana	6.4	2.71	3.0	5.14	17.17	4.0	38.42	21.83
Melanostoma sp. prob. *M. univittatum*	2.6	0.43	—	1.57	5.33	3.5	13.43	7.63
E. (?)latilunulatus	2.2	0.86	0.6	4.57	—	—	8.23	4.68
Total count	23.0	12.43	12.2	65.7	45.67	17.0		

(20.76%). *M. confrater* (13.81 %) and *I. scutellaris* (12.67 %) were the other two species that visited the crop more frequently during this season (Table 4).

These findings differ from those of Dusek and Laska (1974) who reported that in Czechoslovakia *Metasyrphus luniger* (Wied.) overwintered in the form of diapausing pupae and the adults appeared in late April and that *Syrphus rebesii* (Linn.) and *S. vitripennis* Meigen were the first to resume activity in May, followed by *Sphaerophoria scripta* (Linn.).

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