J. Biol. Control, 16(1): 27-30, 2002

Role of natural enemies in the management of *Lipaphis erysimi* (Kalt.) on *Brassica juncea* var. *rugosa* (Linn.)

L. CHITRA DEVI, T. K. SINGH and R. VARATHARAJAN
Department of Life Sciences, Manipur University
Canchipur, Imphal 795 003, India

ABSTRACT: The role of natural enemies on the population of *Lipaphis erysimi* (Kalt.) infesting *B. juncea* var. *rugosa* (Linn.) has been studied in three consecutive crop seasons (1993-96). The study revealed the occurrence of about a dozen natural enemies belonging to four groups *viz.*, syrphids, coccinellids, hemerobiid and aphidiid. Among these, syrphids were found to be dominant over the others in terms of density, species composition and prey consumption potential.

KEY WPRDS: Aphidiid, coccinellids, hemerobiid, *Lipaphis erysimi*, natural enemy, syrphids

In Manipur, *Brassica juncea* var. *rugosa* (Linn.) is widely cultivated and is used as an important vegetable during winter. It is attacked by a number of insect pests, amongst which mustard aphid; *Lipaphis erysimi* (Kalt.) is one of the most important pest. The population of the aphid is regulated to some extent by the natural enemies, which comprised of both predators and parasitoids. The aphidophagous predators include three different groups' *viz.*, syrphids, coccinellids and hemerobiids. While monitoring the populations of *Lipaphis erysimi* on *B. juncea* var. *rugosa*, the above mentioned predatory groups and parasitoids were encountered in the aphid colonies. Since natural enemies have been rated as efficient biocontrol agents of aphids (Dhiman & Kumar, 1986; Singh & Mishra, 1988; Radhakrishan & Muraleedharan, 1993; Shenhmar & Brar, 1995), an attempt has been made in this study to assess the biotic interaction between natural enemies and *L. erysimi* infesting *B. juncea* var. *rugosa*, in terms of prey feeding capacity, frequency of occurrence and seasonal incidence.

MATERIALS AND METHODS

Studies were conducted at the experimental field and the laboratory of the Department of Life Sciences, Manipur University. The incidence of *Lipaphis erysimi* and its associated natural enemies was monitored simultaneously for 3 successive cropping seasons (1993-1996) on *Brassica juncea* var. *rugosa*. At each sampling, 10 replicates of 3 leaves, one each from upper, middle and lower strata of the plant were randomly examined for determining the populations. While taking on the spot counts of aphid, density of the mummified aphids of the respective parasitoids, density of syrphid larvae, larvae and adults of coccinellids and hemerobiids were also separately noted. This sampling method was followed upto the end of vegetative phase. Observations of aphids, predators and parasitoids were taken for the apical 10cm length of the inflorescence till the fruit setting stage. The related abiotic parameters such as temperature, relative humidity and rainfall were also recorded during the observation period at weekly interval and they were correlated with the aphid population to understand their effect on population of aphids.

In addition to this, the feeding efficiency of some common predatory species was assessed by rearing them from their neonate stage separately in plastic Petri-dishes (9cm diam) with 5 replications each. In each culture, adequate number of aphids was provided. The mean duration of development and consumption rate was calculated. The data were analyzed statistically.

RESULTS AND DISCUSSION

Regular monitoring of the aphid density on *B. juncea* over a period of three crop seasons (1993-1996) revealed that the aphids appeared during the first week of November and continued till February. In Manipur, *B. juncea* is normally cultivated from September/October to January/February and used as an important winter vegetable. The crop has two distinct phases namely vegetative and reproductive, both being attacked by the aphid. Initially the population was very low and through a gradual increase, it attained a peak of about 380aphids/3 leaves/plant (pooled for 3 seasons) during December. With the onset of the reproductive phase, the aphid colony shifted from foliage to inflorescence of the same plant. Unlike its broad leaves (leaf area=625cm^2), the inflorescence could not harbour dense population of the aphid. A small peak of about 250 individuals/inflorescence (10cm) was observed during the last week of January, after which the population declined till the last week of February. The decrease in population of the aphid could be due to the completion of crop season.

Field assessment also indicated the presence of natural enemies comprising both predators and parasitoids. Predators were associated with *L. erysimi* after about one week of aphid infestation and continued till the harvesting stage of the crop, whereas parasitoids were observed during the later stage of the crop (February). Two species of parasitoids *viz.*, *Aphidius matricarae* (Haliday) and *Diaeretiella rapae* (Mc Intosh) were found and their parasitism was very low ($\leq$ 5%) in the vegetative stage and increased slightly in the fruiting stage of the crop. However, Dhiman & Kumar (1986) recorded that the parasitoid, *D. rapae* alone could bring about the reduction of *L. erysimi* population under field conditions. As compared to the parasitoids, syrphid, coccinellid and hemerobiid predators were found to be abundant in the aphid colonies. Altogether 11 species of predators were observed in the aphid colonies. Of these, 7 were syrphids [*Episyrphus balteatus* (Deg.), *Betasrphus serarius* Wied., *Ischiodon scutellaries* (Fabr.), *Metasyrphus confrater* Wied., *Paragus serratus* Fabr., *Sphaerophoria indiana* Big. and *Sphaerophoria* sp.] 3 were coccinellids [*Coccinella septempunctata* Linn., *C. transversalis* (Fabr.) and *Cheilomenes sexmaculata* (Fabr.)] and one was a species of hemerobiid, *Micromus timidus* Hagen. The study revealed that among the predators, syrphids were dominant over the other two groups in terms of species composition and seasonal occurrence. Agarwala *et al.* (1987) also observed the association of 9 syrphids and 4 coccinellids with *L. erysimi* on mustard crop in Tripura indicating the predominance of syrphids over the rest, which is evident in the present work. The predator populations followed a similar trend with that of aphid prey and the ratio between predator and prey ranged from 1:55 to 1:412 during different months of the crop. The correlation between them in terms of their abundance indicated a significant positive relation (r=0.65, P=0.05) whereas a negative correlation was obtained between temperature and rainfall with the aphid population (r = - 0.52 and - 0.26, respectively).

The mean consumption rates of the predators ranged from 67 to 774 aphids/larvae during their developmental period which ranged from 11 to 30 days (Table 1). The average feeding efficiency varied from species to species. For instance, the syrphid, *B. serarius* consumed as much as 774 individuals of *L. erysimi* and a minimum number of 67 aphids/ larvae was consumed by *M. timidus*. Similarly, the larval durations also varied from each other (Table 1). The minimum and maximum durations were observed in *E. balteatus* and *C. septempunctata*, respectively. Though the voracity varies with different predators, it depends on the

Table 1. Duration of development and consumption of some aphidophagous larvae

Predatory species	Duration of development (days)	Consumption (Mean ± SEM)
Syrphidae		
Episyrphus balteatus (Deg.)	10.9 ±0.2	397 ± 20.0
Ischiodon scutellaris (Fabr.)	13.3 ±0.5	364 ± 16.7
Metasyrphus confrater Wied.	16.1 ±0.8	641 ± 21.4
Betasyrphus serarius Wied.	13.3 ±0.2	774 ± 11.8
Paragus serratus Fabr.	16.1 ±0.3	163 ± 3.5
Coccinellidae		
Coccinella septempunctata Linn.	29.8 ±0.9	244 ± 16.4
Coccinella transversalis Fabr.	28.2 ±0.46	233 ± 9.7
Hemerobiidae		
Micromus timidus Hagen	17.7 ±0.99	67 ± 2.8

prey species too. For instance, *M. contrator* devoured as much as 300 individuals of *Cervaphis quercus* (Shantibala *et al.*, 1995) while Agarwala & Saha (1986) observed the consumption of *M. confrater* as 886 individuals of *A. gossypii.* The present study revealed that *M. confrater* consumed 641 individuals of *L. erysimi*. Variation in consumption rate could be due to different aphid species. In some cases the feeding rate is influenced by temperature and other rearing conditions (Veeravel & Bhaskaran, 1996).

Based on the seasonal abundance, feeding efficiency and synchronized occurrence of an array of predatory species along with the aphid, it becomes evident that predators play an important role in regulating the pest population. Amongst the different predators, *B. serarius* and *M. confrater* which have high feeding potential, can be used as biocontrol agents for effective management of *L. erysimi* on *B. juncea* var. *rugosa*. However, the effect of parasitoids and abiotic parameters on the aphid population cannot be ignored.

ACKNOWLEDGMENT

The authors are thankful to the Head, Department of Life Sciences, Manipur University for providing facilities to carry out the present work.

REFERENCES

Agarwala, B. K. and Saha, J. L. 1986. Larval voracity, development and relative abundance of predators of *Aphis gossypii* on cotton in India. 339-344 pp. In: Hodek, I. (Ed.). *Ecology of Aphidophaga.* Dr. W. Junk, Dordrecht, Academia Prague.

Agarwala, B. K., Das, S. and Bhaumik, A. K. 1987. Natural food range and feeding habits of aphidophagous insects in northeast India. *Journal of Aphidology*, **1**: 18-22.

Dhiman, S. C. and Kumar, V. 1986. Studies on the oviposition site of *Diaeretiella rapae*, a parasitoid of *Lipaphis erysimi* (Kalt.). *Entomon*, **11**: 247-250.

Radhakrishnan, B. and Muraleedharan, N. 1993. Bio-ecology of six species of syrphid predators of the tea aphid, *Toxoptera aurantii* (BDF) in southern India. *Entomon*, **18**: 175-180.

Shenhmar, M. and Brar, K. S. 1995. Biological control of mustard aphid, *Lipaphis erysimi* (Kalt.) in the Punjab. *Journal of Biological Control*, **9**: 9-12.

Shantibala, K., Varatharajan, R. and Singh, T. K. 1995. Population dynamics of *Cervaphis quecus* Takahashi (Homoptera: Aphididae) on *Quercus serrata* Thunberg (Fagaceae) in relation to the density dependent and independent factors. *Sericologia*, **35**: 737-742.

Singh, R. and Mishra, S. 1988. Development of a syrphid fly *Ischiodon scutellaris* (Fabr.) on *Rhopalosiphum maidis* (Fitch). Journal of Aphidology, **2**: 28-34.

Veeravel, R. and Bhaskaran, P. 1996. Temperature dependent development, adult longevity, fecundity and feeding of two coccinellid predators under laboratory condition. *Entomon*, **21**: 13-18.