

Population Dynamics of Various Predators Associated with Mustard Aphid, *Lipaphis erysimi* (Kalt.)

V.K. KALRA

Department of Entomology, Haryana Agricultural University, Hisar.

ABSTRACT

Studies on the population dynamics of various predators associated with mustard aphid, *Lipaphis erysimi* (Kalt.) revealed that three species of coccinellids (*Coccinella septempunctata* L., *Hippodamia variegata* (Coeze) and *Menochilus sexmaculata* Fab.), two species of green lace wing (*Chrysoperla carnea* (Stephens) and *Anisochrysa boninensis* Ckomota) and one species each of syrphid (*Episyrphus balteatus* Degeer) and chamaemyid (*Leucopis* (*Leucipis*) sp.) were found associated with the colonies of this pest. *C. septempunctata* population was dominant among coccinellids. *A. boninensis* and *E. balteatus* populations were almost negligible. Population of *Leucopis* sp. larvae was high at peak aphid incidence, thereby rendering it to be the most promising predator of *L. erysimi*.

KEY WORDS : *Lipaphis erysimi*, predators, population dynamics

The non-agile nature and colonial feeding behaviour of most aphid species (including *Lipaphis erysimi* (Kalt.) makes them vulnerable to a number of predators and parasitoids. While parasitoids, associated with this pest have been reported to be active only by the end of the rape-seed and mustard crop season i.e. March - April (Atwal *et al.*, 1971), the commonly reported predators have yet to prove their worth during the peak aphid incidence period i.e. mid February, when atmospheric temperature goes very low. Scattered reports of the studies on the efficacy of coccinellids (Sinha *et al.*, 1982; Anand, 1983) and syrphid flies (Alfiler and Calilung, 1978; Ghorpade, 1981; Agarwala *et al.*, 1983) on this aphid are available, but systematic studies on the population build up of the predators of this pest have not yet been reported. An experiment, therefore, was conducted to study the population dynamics of various predators associated with *L. erysimi* on Indian mustard.

MATERIALS AND METHODS

Indian mustard, *Brassica juncea* (L.) Czern & Coss, grown at the experimental farms of Haryana Agricultural University, Hisar, was kept under surveillance for the incidence of the mustard aphid, *L. erysimi* from germination of the crop till harvesting. Ten aphid colonies, each comprising of about 350 aphids, were collected every week from three locations, starting from the first week of December. These aphids were reared in the laboratory to identify and record the number of grubs / larva of various predators associated with them. The rearing of aphids was done in glass battery jars (9" x 6" diameter) covered with muslin cloth. Fresh mustard leaves were supplied daily for the aphids. The population of

coccinellid beetles was recorded by observing the number of beetles present on 100 colonies of aphids every week in the field. No insecticidal sprays were given to control the aphids. Side by side, the incidence of mustard aphid and various weather parameters were also recorded to study their influence on the population of predators under field conditions.

RESULTS AND DISCUSSION

Incidence of *L. erysimi* on mustard crop commenced during the end of November, therefore, the observation for the association of various predators with these aphids were started from the first week of December (Figs. 1 & 2). It was observed that three species of coccinellids i.e. *Coccinella septempunctata* L., *Hippodamia variegata* (Coeze) and *Menochilus sexmaculata* (Fab.), two species of common lace wing viz., *Chrysoperla carnea* (Stephens) and *Anisochrysa boninensis* (Ckomota) and one species each of the syrphid fly *Episyrphus balteatus* (DeGear) and chamaemyid (*Leucopis* (*Leucipis*) sp.) were found associated with the mustard aphid colonies.

Earlier, Ghosh *et al.*, (1981) had identified 20 predator species associated with this aphid. Among the seven predators recorded in the present studies, only *Leucopis* (*Leucipis*) sp., *C. septempunctata* and *E. balteatus* were recorded to be in significant numbers which had been recorded from elsewhere, too, in India (Sandhu and Kaushal, 1975; Roy and Basu, 1977; Singh and Malhotra, 1979). The population of other four species was almost negligible under field conditions.

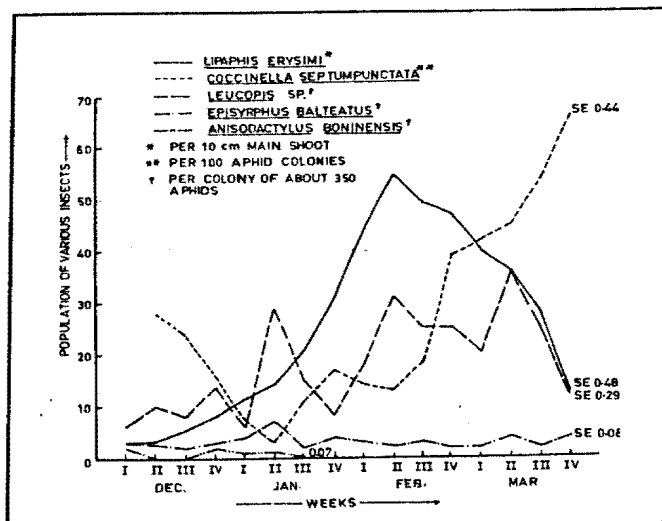


Fig. 1. POPULATION DYNAMICS OF VARIOUS PREDATORS ASSOCIATED WITH MUSTARD APHID, *Lipaphis erysimi* ON MUSTARD (1984 - 85)

C. septempunctata larvae and adults ranged from 24 to 33 (av. 30) per 100 aphid colonies upto the third week of December. However, it reduced to as low as three per 100 colonies by the second week of January following the decline in the atmospheric temperature (Min. 2°C). On the other hand, aphid population continued to rise reaching an average 21 aphids/10 cm long main shoot. The stable temperature during next one month period made this predator re-emerge and their population increased to 28 (av. 23) per 100 colonies of aphids during the third week of February. *C. septempunctata* population continued to show an upward trend reaching as high as 44 to 66 (av. 57) per 100 aphid colonies in the last two weeks of March (Max. temp. 32.6°C). Similar observations were recorded by Nath and Sen (1972). However, by this time *L. erysimi* population had started declining due to increase in temperature and maturity of the mustard crop, which had been reported earlier by Rai (1976) and Kalra (1979).

Leucopis (*Leucipis*) sp. population ranged from 4 to 15 (av. 11) per colony of about 350 aphids upto first week of January and it increased to an average of 29.5 during second week of January. A slight decline in its population was recorded in the end of January but the population increased to around 30 per colony of 350 aphids by the third week of March. Aphid population, too, remained high i.e. 29-41 aphids/10 cm long main shoot, during this period. However, *Leucopis* sp. population showed a decline as the temperature increased from second week of March which coincided with a decline in aphid population and

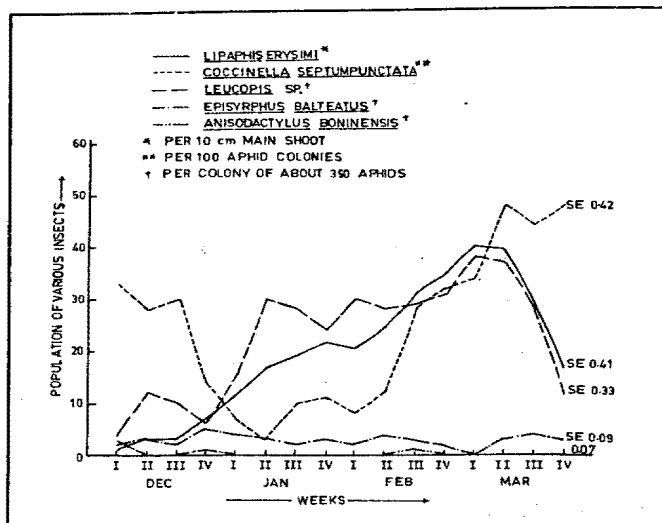


Fig. 2. POPULATION DYNAMICS OF VARIOUS PREDATORS ASSOCIATED WITH MUSTARD APHID, *Lipaphis erysimi* ON MUSTARD (1984 - 85)

maturity of the crop. *E. balteatus* population was observed to be 0-7 maggots per colony of 350 aphids almost throughout the season. Population of *A. boninensis*, *H. variegata*, *M. sexmaculata* and *Chrysoperla carnea* was almost negligible throughout the season.

Though *M. sexmaculata*, especially adult has been reported to prefer *L. erysimi* like *C. septempunctata* (Sharma, 1973; Anand, 1983; Verma *et al.*, 1983), yet due to their low population under field conditions, the chances of its becoming an important predator of this aphid seem to be remote.

The studies revealed that populations of *L. erysimi* and *Leucopis* sp. were directly related with each other (Table 1.). Similarly temperature influenced directly the populations of *C. septempunctata* and *E. balteatus* in the field. However, a negative correlation existed between relative humidity and *C. septempunctata* population. Similarly a negative relationship existed between population of *A. boninensis* with *Leucopis* sp. and the host *L. erysimi*.

The present studies revealed that *Leucopis* is emerging as one of the important predators of *L. erysimi* on mustard especially during the period when temperature goes down and mustard aphid multiplication increases. (Rai 1976; Kalra, 1979). Considering the fact that *C. septempunctata* and *E. balteatus* populations declined during the period when temperature went down (Nath and Sen, 1972), and the parasitoids of this aphid become active only when temperature started rising (Atwal *et al.*, 1971), the potential of *Leucopis* sp. a major natural enemy of *L. erysimi* need to be explored further.

TABLE 1. Correlation coefficients of biotic and abiotic factors affecting the population of various predators associated with *Lipaphis erysimi* (Kalt.) on mustard.

Aphid population	Max. temp.	Mini. temp.	Relative humidity	Rainfall	<i>Leucopis</i> sp.	<i>Episyrphus balteatus</i>	<i>Coccinella septempunctata</i>	<i>Anisochrysa boninensis</i>	
1	2	3	4	5	6	7	8	9	
1.	1.0000	0.1632	-0.0120	-0.0390	-0.0185	0.6824**	-0.3451	0.1411	-0.4488**
2.		1.0000	0.5965**	-0.6179**	-0.2631	0.0453	0.4340*	0.8093**	-0.0811
3.			1.0000	0.0593	0.2826	-0.0193	0.5017**	0.7041**	-0.1061
4.				1.0000	0.5650**	0.1656	-0.2449	-0.4706**	-0.0556
5.					1.0000	0.0242	-0.0781	-0.0151	0.1041
6.						1.0000	-0.3122**	0.0533	-0.4213*
7.							1.0000	0.5386**	0.1507
8.								1.0000	-0.1130
9.									1.0000

* Significant at 0.05 level.

** Significant at 0.01 level.

REFERENCES

- Agarwala, B.K. Dutta, S. and Raychaudhuri, D.N. 1983. An account of syrphid (Diptera : Syrphidae) predators of aphids available in Darjeeling District of West Bengal and Sikkim. *Pranikee*, 4, 238 - 244.
- Alfiler, A.R.R. and Calilong, V.J. 1978. The life history and voracity of syrphid predator, *Ischiodon oscutellaris* (F.) (Diptera : Syrphidae). *Philip. Entomol.*, 4, 105 - 117.
- Anand, R.K. 1983. Predation by *Coccinella septempunctata* Linn. and *Menochilus sexmaculata* Fab., on five species of aphids. *Pranikee*, 4, 234 - 237.
- Atwal, A.S., Chaudhary, J.P. and Ramzan, M. 1971. Mortality factors in the natural population of cabbage aphid, *Lipaphis erysimi* (Kalt.) (Aphididae : Homoptera), in relation to parasites, predators and weather conditions. *Indian J. agric. Sci.*, 41, 507 - 510.
- Ghorpade, K.D. 1981. Insect prey of Syrphidae (Diptera) from India and neighbouring countries : a review and bibliography. *Trop. Pest Mgmt.*, 27, 62 - 82.
- Kalra, V.K. 1979. *Integrated Control of the insect pest complex of mustard*, Ph.D. Thesis, Haryana Agril. University, Hisar. pp 103.
- Nath, D.K. and Sen, B. 1976. Some observations on aphidophagous Coccinellid beetles in mustard cultivation. *Sci & cult.*, 42, 288 - 290.
- Rai, B.K. 1976. *Pests of oilseed crops in India and their control*. Indian Council of Agricultural Research, New Delhi. pp.121.
- Roy, P. and Basu, S.K. 1977. Bionomics of aphidophagous syrphid flies. *Indian J. Entomol.*, 39, 165 - 177.
- Sandhu, G.S. and Kaushal, K.K. 1975. Biological studies and host range of *Leucopis* sp. (Chamaemyiidae : Diptera), a predatory fly on aphids in the Punjab. *Indian J. Entomol.*, 37, 185 - 187.
- Sharma, J.C. 1973. Predation of *Menochilus sexmaculata* Fab. on different species of aphids. *Indian J. Entomol.*, 35, 343 - 344.
- Singh, R. and Malhotra, R.K., 1979. Some studies on the biology of *Coccinella undecimpunctata* Muls a predator of mustard aphid. *Curr. Sci.*, 48, 904 - 905.
- Sinha, T.B., Pandey, R.K. Rajendra Singh, Tripathi, C.P.M. and Kumar, A. 1982. The functional response of *Coccinella septempunctata* Linn., a coccinellid predator of mustard aphid, *Lipaphis erysimi* (Kalt.). *Entomon*, 7, 7 - 10.
- Verma, S.N., Cargav, V.P. and Mittal, S. 1983. Host preference of six spotted lady bird beetle, *Menochilus sexmaculatus* (Fab.). *Indian J. Pl. Prot.*, 11, 66 - 69.