

Studies on the Coccinellid Predators of the Cabbage Aphid *Brevicoryne brassicae* in Himachal Pradesh*

P.K.SHARMA and A.K.VERMA

Department of Entomology

Dr.Y.S.Parmar University of Horticulture and Forestry

Solan, P.O.Nauni 173 230, Himachal Pradesh

ABSTRACT

Surveys conducted during 1985-91 on cauliflower, cabbage and knol- khol yielded thirteen species of coccinellid predators on nymphs and adults of the cabbage aphid, *Brevicoryne brassicae* (Linn.), a serious pest of cole crops in the mid-hill regions of Himachal Pradesh. Among the frequently occurring species, adults of *Adonia variegata* (Goeze) were the first to resume activity by first week of February followed by *Coccinella septempunctata* Linn. in the first week of March, while most other coccinellids were active during the last week of March or later. *C. septempunctata* was the most abundant species accounting for 47.3 per cent of the adult count, followed by *A. variegata* (26.2%). The hyperparasitoid, *Oomyzus scaposus* (Thompson) (= *Tetrastichus coccinellae* Kurdj.) (Hymenoptera, Eulophidae) was recorded on the coccinellid predators during May-June. *C.septempunctata* was more voracious than *A. variegata* and *Adalia tetraspilota* Hope. The average consumption by *C. septempunctata* grub was 323 and that of adults 3890 aphids.

KEY WORDS: *Brevicoryne brassicae*, natural enemies, *Adonia variegata*, *Adalia tetraspilota*, *Coccinella septempunctata*, hyperparasitoid *Oomyzus scaposus*

Natural enemies play a significant role in the regulation of the population of the cabbage aphid, *Brevicoryne brassicae* (Linn.) infesting cole crops grown mainly for seed production in Himachal Pradesh. Among the aphidophagous insects, coccinellids appeared predominantly during April-July (Kotwal *et al.*, 1984). Coccinellids are known for their capability to search and feed voraciously upon their prey in larval as well as adult stages, and to aestivate during summer and hibernate during winter to tide over the periods of unsuitable weather and low prey availability. Since *B. brassicae* resumes activity by early winter season on cole crops in the mid-hill region of the State (Tandon *et al.*, 1977), there are apprehensions about the role of coccinellids in aphid suppression owing to their requirement for higher thermal

threshold to resume activity (Butler, 1984). In the absence of experimental evidence, the predatory potential of these useful insects remained poorly elucidated. The present paper reports the incidence of coccinellid predators and their relative abundance, and feeding capacity of three frequently occurring coccinellids inhabiting cole crop ecosystems in Himachal Pradesh.

MATERIALS AND METHODS

Weekly samples of coccinellid predators were obtained from cabbage, knol-khol (head crops), and cauliflower (seed crop) fields between 1985-1991, as a part of the ongoing study on the population dynamics of *B. brassicae* in these crops. The grub stages were reared under laboratory conditions on their natural host for obtaining the adults.

* A part of M.Sc. thesis submitted by the senior author to Dr.Yashwant Singh Parmar University of Horticulture and Forestry, Solan

In order to study the seasonal incidence, seedlings of cabbage (cv. Pride of India), knol-khol (cv. White Vienna) and cauliflower (cv. Snowball K-1), were transplanted between first to third week of November, 1986 at 60x45 cm spacing. The crops were raised following the recommended agronomic practices except insecticidal application either on foliage or in soil. Sampling of coccinellids was carried out at weekly intervals immediately after transplanting and continued till mid-June, 1987 when all the three crops were finally harvested. The entire field under each crop was divided into 10 equal quadrats and the number of grubs and adults was recorded on 10 randomly - selected plants in each quadrat. The data pertaining to grubs were pooled, while separate counts of adults of common species were made but pooled for those occurring less frequently. The data from the three crops were then pooled and average population per plant was worked out. These

data are represented graphically (Fig.1). The extent of parasitization on coccinellid predators was also recorded.

The feeding capacity of *C. septempunctata*, *A. variegata* and *A. tetraspilota* was estimated in laboratory experiments. Individual grubs and adults were provided with known number of aphids daily on fresh cauliflower/cabbage leaves in plastic jars (6x6 cm) with their lids fitted with a small piece of cloth. There were atleast 17 replications per species. The number of aphids consumed by each instar and adult was recorded daily to determine the predatory potential under conditions of abundant supply of prey.

RESULTS AND DISCUSSION

In cole crop fields around Solan, representing the mid-hill region of the State, 13 species of aphidophagous coccinellids namely, *Coccinella septempunctata* Linn., *C.s.var*

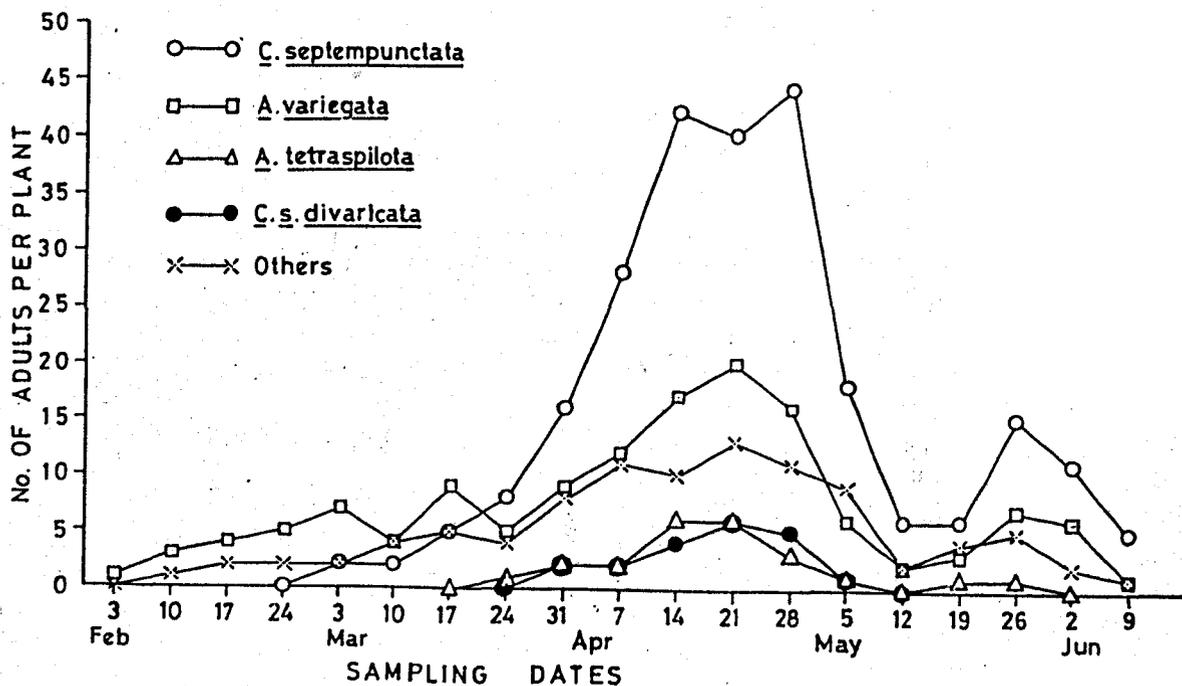


Fig.1. Seasonal fluctuations in the population of grubs, and adults of important coccinellid predators of *B. brassicae* at Solan during 1987

divaricata Oliver, *Adonia variegata* (Goeze), *A.v.orientalis* Ws., *Adalia tetraspilota* Hope, *A. bipunctata* (Linn.), *Menochilus sexmaculatus* (Fabr.), *Coelophora sexareata* Mulsant, *C. sauzeti* Mulsant, *Leis dimidiata* Fabr., *Oenopia kirbyi* Mulsant, *Hippodamia tredecimpunctata* (Linn.), and *Illeis* sp. were recorded on the cabbage aphid, *Brevicoryne brassicae* (Linn.). *A. bipunctata* and *Illeis* sp. were recorded for the first time while rest of the species have been reported earlier from Himachal Pradesh (Das and Raychaudhuri, 1983; Kotwal *et al.*, 1984).

The population counts on the three crops during 1987 when pooled, revealed that *C. septempunctata* was the most abundant species accounting for 47.3 per cent of the adult count, followed by *A. variegata* (26.2%)

resumed activity by last week of March or later.

Coccinellid population increased steadily initially, attained peak between 2-4th week of April and declined sharply thereafter (Fig.1). The peak period of activity coincided with the descending phase of aphid population on all the three crops as reported earlier from the state (Tandon *et al.*, 1977; Kotwal and Bhalla, 1983). The peak activity of *C. septempunctata* was reported to coincide with alfalfa aphid during June when it represented 53.7 per cent of the total predator complex (Khalil *et al.*, 1979) and on the peach leaf curl aphid, *Brachycaudus helichrysi* Kalt. in Iraq during May-June (Mahmood *et al.*, 1979). Variations in the time of appearance and activity may be attributed to varying environ-

Table 1. Consumption by three species of coccinellid predators of *B. brassicae* in grub and adult stages

	Number of aphids consumed					
	<i>C. septempunctata</i>		<i>A. variegata</i>		<i>A. tetraspilota</i>	
	\bar{x}	Range	\bar{x}	Range	\bar{x}	Range
GRUB						
First Instar	23.0	18-31	16.3	8-21	16.9	12-23
Second Instar	44.1	36-59	36.3	24-43	38.9	27-52
Third Instar	84.5	66-104	56.1	45-73	63.7	48-79
Fourth Instar	171.1	141-207	111.8	76-131	126.5	97-156
Total	332.7	287-380	219.3	171-245	246.1	209-284
ADULT						
Total Consumption						
Female	3890	2892-4813	1561	1280-1793	2190	1797-2451
Male	3052	2455-3757	1003	881-1268	1746	1264-2032
Av. Consumption						
Female	68.4	61.4-73.0	41.4	37.9-48.8	51.1	46.1-57.1
Male	59.4	53.4-66.4	31.8	27.5-36.0	45.3	39.5-52.8

while *A. tetraspilota* and *C.s. var divaricata* represented 4.4* and 3.8 per cent of the total count. The rest of the species were less frequently encountered in the cole crop ecosystems and jointly accounted for 18.3 per cent of the adult count. Adults of *A. variegata* were the first to resume activity by the second week of February followed by *C. septempunctata* in first week of March, while all other species

mental conditions in geographically distinct regions.

The coccinellids were parasitized by a gregarious endoparasitoid, *Oomyzus scaposus* (Thompson) (= *Tetrastichus coccinellae* Kurdj.) (Hymenoptera, Eulophidae). The parasitization was generally recorded between April to June, and the extent of

parasitization averaged 8.8, 12.8 and 6.4 per cent in *C. septempunctata*, *A. variegata* and *A. tetraspilota*, respectively. The parasite was reported from Assam, India (Saharia, 1981), Turkmenia (Myartseva, 1981) and Hungary (Radwan and Lovei, 1982).

The average consumption of aphids by grubs and adults, the range values observed, and the daily consumption rates of the three coccinellid species revealed that *C. septempunctata* was the most voracious both in grub as well as adult stages, followed by *A. tetraspilota* and *A. variegata* (Table 1). The present study supports the findings of Singh and Malhotra (1979) who reported average consumption of *C. septempunctata* at 284.6 individuals of *Lipaphis erysimi* (Kalt.), a major aphid species infesting cruciferous crops in the plains. Comparatively higher feeding rate on *Aphis craccivora* Koch was reported in the grubs of *C. septempunctata* by Talati and Bhutani (1979) which may be attributed to size as well as nutritive status of the prey species. Gumovskaya (1982) reported adults of *C. septempunctata* to consume 6700-9000 aphids (*A. fabae* Scop.) in their lifetime of 90 days whereas, Dirimanov and Dimitrov (1977) recorded consumption of 1200-1400 aphids (*M. persicae* (Sulzer)) by *C. septempunctata* during its lifetime.

Kapur (1942) reported the average consumption by the grubs of *A. variegata* at 130 aphids (*M. persicae*) and that of male and female adults at 1260 and 1530 aphids, respectively. The daily feeding rate of the adults of this species, according to Wang *et al.* (1984) was 30.9 aphids (*Schizaphis graminum* (Rondani)), which is comparable with the present findings (Table 1). In the case of *A. tetraspilota*, the average consumption of grubs was higher in the study when compared with 132 aphids of *L. erysimi* during the grub stage occupying 10.3 days (Nagarkatti and Ghani, 1972).

Keeping in view the proportion of *C. septempunctata* in the field and the feeding

capacity, it could be concluded that this species might have contributed to the maximum in suppression of *B. brassicae* populations in cole crop ecosystems in the State.

REFERENCES

- BUTLER, G.D. 1984. Development time of *Coccinella septempunctata* (Col.: Coccinellidae) in relation to constant temperatures. *Entomophaga*, 27, 349-352.
- DAS, S.K. and RAYCHAUDHURI, D.N. 1983. Parasites and predators of aphids (Homoptera: Aphididae) from India. VI. New records of seven arachnids, one dipteran and one neuropteran predator from Himachal Pradesh, India. *Entomon*, 8, 27-34.
- DIRIMANOV, M. and DIMITROV, A. 1977. Role of useful insects in the control of *Thrips tabaci* Linn. and *Myzus persicae* Sulz. on tobacco. *Proc. Internatl. Pl. Prot. Conf. Moscow*, pp. 225.
- GUMOVSKAYA, G.N. 1982. The role of ladybirds in the suppression of beet aphid. *Zash. Rast.*, 5, 29-30.
- KAPUR, A.P. 1942. Bionomics of Coccinellidae predaceous on aphids and coccids in North India. *Indian J. Ent.*, 4, 49-66.
- KHALIL, F.M., AWADALLAH, K.T. and MAHMOUD, T. 1979. Seasonal abundance of natural enemies associated with alfalfa plants in Hamam-Al-Alil. *Dtsch. Entomol. Zeit.*, 26, 181-186.
- KOTWAL, D.R. and BHALLA, O.P. 1983. Prediction of the cabbage aphid population peak on cauliflower seed crop. *Indian J. Pl. Prot.*, 11, 76-77.
- KOTWAL, D.R., BHALLA, O.P. and VERMA, A.K. 1984. Natural enemies of the cabbage aphid, *Brevicoryne brassicae* (Linn.) in the mid-hill regions of Himachal Pradesh. *Indian J. agric. Sci.*, 54, 1011-1012.
- MAHMOUD, T.T., KHALIL, F.M. and AWADALLAH, K.T. 1979. Population dynamics of aphids and its natural enemies on peach trees in Mousel region, Iraq. *Mesopotamia J. Agric.*, 15, 167-182.
- MYARTSEVA, S.N. 1981. Species of the genus *Homalotylus* Mayr. (Homoptera: Encyrtidae) parasites of coccinellids (Coleoptera: Coccinellidae) in Turkmenia. *Biologicheskikh Nauk.*, 6, 35-41.
- NAGARKATTI, S. and GHANI, M.A. 1972. Ecology of predators. *Coleoptera:*

- Coccinellidae. In 'Studies on predators of *Adelges spp. in Himalayas* (V.P.Rao and M.A.Ghani, eds). pp. 58-88, CIBC Trinidad, Publ. No.3, pp. 116.
- RAD VAN,Z. and LOVEI,G.L. 1982. Records of coccinellid parasites from apple orchards and corn fields. *Acta Phytopath. Acad. Sci. Hung.*, 17, 111-113.
- SAHARIA,D. 1981. Biology of *Coccinella repanda* Thunb., an important predator of mustard aphid *Lipaphis erysimi* (Kalt.) in Assam. *J. Res., Assam Agri. Univ.*, 2, 66-73.
- SINGH,R. and MALHOTRA,R.K. 1979. Bionomics of *Coccinella septempunctata* Linn. *Indian J. Ent.*, 41, 244-249.
- TALATI,G.M. and BHUTANI,P.G. 1979. Predatory capacity of *Coccinella septempunctata* on groundnut aphid. *Indian J. Pl. Prot.*, 7, 107.
- TANDON,P.L., BHALLA,O.P. and VERMA,A.K. 1977. Seasonal population fluctuations of cabbage aphid on seed cauliflower. *Veg. Sci.*, 4, 45-47.
- WANG,Y.H., LIU,B.S., FU,H.Z. and GUI,L.N. 1984. Studies on the habits and bionomics of *Adonia variegata* (Goeze). *Insect knowledge*, 21, 19-22.