Studies on the Coccinellid Predators of the Cabbage Aphid * 

Brevicoryne brassicae in Himachal Pradesh

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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 (Goze) 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 Kurd.) (Hymenoptera, Eulophidae) was recorded on the coccinellid predators during May-June. C. septempunctata was more voracious than A. variegata and Adalia tetrampilota 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 tetrampilota, 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.

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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...
divaricata Oliver, Adonia variegata (Goeze), A. 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%) while A. tetraspilota and C. 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 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 environmental 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

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

<table>
<thead>
<tr>
<th></th>
<th>Number of aphids consumed</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C. septempunctata</td>
<td>A. variegata</td>
<td>A. tetraspilota</td>
</tr>
<tr>
<td></td>
<td>x</td>
<td>Range</td>
<td>x</td>
</tr>
<tr>
<td>GRUB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Instar</td>
<td>23.0</td>
<td>18-31</td>
<td>16.3</td>
</tr>
<tr>
<td>Second Instar</td>
<td>44.1</td>
<td>36-59</td>
<td>36.3</td>
</tr>
<tr>
<td>Third Instar</td>
<td>84.5</td>
<td>66-104</td>
<td>56.1</td>
</tr>
<tr>
<td>Fourth Instar</td>
<td>171.1</td>
<td>141-207</td>
<td>111.8</td>
</tr>
<tr>
<td>Total</td>
<td>332.7</td>
<td>287-380</td>
<td>219.3</td>
</tr>
<tr>
<td>ADULT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>3890</td>
<td>2892-4813</td>
<td>1561</td>
</tr>
<tr>
<td>Male</td>
<td>3052</td>
<td>2455-3757</td>
<td>1003</td>
</tr>
<tr>
<td>Av. Consumption</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>68.4</td>
<td>61.4-73.0</td>
<td>41.4</td>
</tr>
<tr>
<td>Male</td>
<td>59.4</td>
<td>53.4-66.4</td>
<td>31.8</td>
</tr>
</tbody>
</table>
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* (Rondanii)), 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


Coccinellids on *B. brassicae*


