PREDATORY EFFICIENCY OF THE LARVAE OF COCCINELLA TRANSVERSALIS FABRICIUS ON THE BEAN APHID, APHIS CRACCIORA KOCH

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SUMMARY

Coccinella transversalis Fabricius (Coleoptera: Coccinellidae) is a common aphidophagous coccinellid in Manipur. Laboratory studies (temperature: 14°-21°C and relative humidity: 43-75%) were conducted during January-February 1988 to determine the predatory efficiency of the coccinellid larvae against the bean aphid, Aphis craccivora Koch. The consumption of aphids increased with the larval instar and was maximum by the last (fourth) instar larvae. The total number of aphid consumed by a single larva during its larval period varied from 401-736.

INTRODUCTION

Coccinella transversalis Fabricius is one of the common predators feeding on different aphid species in Manipur (Singh 1986). In India, this predator has been recorded as an important natural bio-control agent of some of the aphid pests (Rahman 1940; Behura 1965; Rao 1969; Nath and Sen 1976; Agarwala et al. 1981; Ghosh et al. 1981; Singh and Singh 1985; Ghosh and Chakrabarti 1986; Agarwala and Saha 1986; Devi and Singh 1986; Singh 1986; Singh et al. 1986). The present study was carried out during January-February 1988 to observe the predatory efficiency of the larva in terms of consumption of aphids.

MATERIALS AND METHODS

The predator was reared on Aphis craccivora Koch infested plant twigs of Dolichos lablab. The twig was inserted in small bottle (25×40 mm) having Knop's solution; each bottle was kept over a petridish (10×2 cm) covered with muslin cloth held by a rubber band. The plant twig was changed on alternate days. The eggs were removed and kept in petridishes for hatching. Ten newly hatched larvae were reared individually in paired petridishes and were provided daily with sufficient but known number of aphids on fresh plant parts.

Observations were made on the number of aphids eaten at 24 hours interval. The total consumption of aphids by each instar of the predatory larva was calculated. These laboratory studies were carried out at temperature and relative humidity ranging from 14°-21°C and 43-75%, respectively.
RESULTS AND DISCUSSION

The Fig. 1 reveals that the daily rate of aphid consumption increased progressively with the larval growth. The maximum number of aphid consumption was found on the penultimate day of the larval period and the rate of consumption of aphid decreased on the last day as the larva enters prepupation.

Fig. 1. Daily larval voracity of *Coccinella transversalis* Fabricius.

The average consumption of aphids by the first, second, third and fourth instar larvae was 35·5, 68·4, 131·6 and 288·5, respectively (Table 1). The total number of aphids consumed by the larvae during its development ranged from 401–736 aphids with an average of 516·3 aphids. Among the larval instars, the last instar larva was most voracious. The result is in conformity with the findings of Agarwala and Saha (1986).

**TABLE 1.** Instarwise larval consumption, rate of consumption and duration of development of *Coccinella transversalis* Fabricius.

<table>
<thead>
<tr>
<th>Larval instars</th>
<th>Consumption (No. of aphids)</th>
<th>Rate of consumption (No. of aphids/day)</th>
<th>Duration of development (in days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range Mean</td>
<td>Range Mean</td>
<td>Range Mean</td>
</tr>
<tr>
<td>1st instar</td>
<td>19–56 35·5</td>
<td>8·0</td>
<td>4·6 4·7</td>
</tr>
<tr>
<td>2nd instar</td>
<td>35–102 68·4</td>
<td>20·1</td>
<td>3·5 3·9</td>
</tr>
<tr>
<td>3rd instar</td>
<td>90–180 131·6</td>
<td>26·7</td>
<td>4·6 5·0</td>
</tr>
<tr>
<td>4th instar</td>
<td>215–436 288·5</td>
<td>40·9</td>
<td>5·9 7·7</td>
</tr>
<tr>
<td>Total Larval Period</td>
<td>401–736 516·3</td>
<td>24·6</td>
<td>19–23 21·3</td>
</tr>
</tbody>
</table>
ACKNOWLEDGEMENT

We are grateful to the Head, Life Sciences Department, Manipur University, Canchipur for the facilities.

REFERENCES


Biology of an Aphidophagous Coccinellid Predator, *Coccinella transversalis* Fab.

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**ABSTRACT**

*Coccinella transversalis* Fab. is a common predator of *Aphis craccivora* Koch (Hemiptera : Aphididae), on field beans in Manipur. The biology of the predator was studied in the laboratory (at 18.23±1.60°C and 55.54±2.38% R.H.). The life cycle from egg to adult was completed in 38.45 days. Incubation period took 8-10 days. The mean duration of I, II, III and IV larval instars, prepupa and pupa were 4.69, 3.92, 5.0, 7.69, 2.62 and 8.6 days respectively. The total larval period ranged from 19 to 23 days. The total consumption by a single larva was 526 aphids. Important morphological characters and size of developmental stages are given for easy identification in the field.

Key Words: *Coccinella transversalis*, *Aphis craccivora*, biology

The predator *Coccinella transversalis* Fab. has been reported to feed on 15 different aphid species in India and considered as an important natural bio-control agent of aphids (Rao, 1969; Tao and Chiu, 1971; Singh and Singh, 1985; Ghosh and Chakrabarti, 1986). Agarwala and Saha (1986) investigated the larval voracity and development of this predator feeding on *Aphis gossypii* infesting cotton. Debaraj and Singh (1989) reported the predatory efficiency of the larvae of this predator on *Aphis craccivora* Koch. However, information on its biology is not available, and so studies on the life cycle, feeding behaviour and the larval morphology were conducted in the laboratory.

**MATERIALS AND METHODS**

The grubs and the adult beetles along with the aphid infested host plants were collected from the field. They were reared on *A. craccivora* Koch infested twigs of *Dolichos lablab* L. in the laboratory. The mated females were allowed to oviposit on small twigs inserted in small bottles (25x40 mm) containing *Knop's* solution. This was enclosed by a glass chimney (10x14.5 cm) covered with muslin cloth. Sufficient number of aphids with the new plant twing was provided daily. The eggs were removed and kept in Petri dishes (10x2 cm) for hatching. The newly hatched larvae were reared individually inside the Petri dishes with sufficient but counted number of aphids. Observations were made on the number of aphids preyed daily and the remaining aphids were removed. Developmental period of each instar of the larvae and prepupal and pupal periods were recorded. Observations on copulation, oviposition and feeding behaviour were recorded. Various morphological changes of the larvae were studied throughout their development. Size of the developmental stages was measured. Calculations were based on 10 replications. The experiment was conducted in the laboratory at 18.23±1.60°C and 55.54±2.3% R.H.

**RESULTS AND DISCUSSION**

Adults attained sexual maturity after 7 days of emergence. During copulation, the male mounted upon the female's back and held firmly with the help of his fore and middle legs. Thereafter, the male bent his abdomen to receive the female genitalia. The male showed sideward movements of the abdomen at intervals until the mating was complete. Copulation period varied from 5 to 35 minutes, with an
average of 15 minutes. The mated female began to lay eggs after a preoviposition period of 3 to 6 days. The eggs were laid generally on the undersurface of the leaves and concealed places. Eggs were laid in batches consisting usually of 17 to 45 eggs in 3 to 4 rows. Usually 1 or 2 egg batches were laid in a day. Occasionally the eggs were laid singly.

The freshly laid eggs were yellowish-orange but became black before hatching. The unfertilized eggs were pale in colour. The eggs, 0.96-1.12 mm in length, were spindle shaped with both ends evenly rounded. Incubation period ranged from 8 to 10 days. However, shorter incubation period reported by Agarwala and Saha (1986) also existed. The difference may be attributed to low ambient temperature and relative humidity. The newly hatched grub commenced free movements from the egg shell after 2 to 3 hours. There were four larval instars. The size of the instars gradually increased up to 4th instar which was more voracious due to its large size (Table 1). Body of the 1st instar was fusiform, black and covered with delicate spines. Head small, eyes black, ocelli 3, antennae 3-jointed, mandible distinct, thorax with spines dorsolaterally, legs blackish with minute hairs, claw reddish brown in colour; abdomen with spines both dorsal and dorsolateral protuberances in each segments, caudal segment pale yellow with spines and ventral surface pale black. The second instar was little larger in size, more black and with an yellowish orange patch on the dorsolateral protuberances of the first abdominal segment. The third instar was distinctly black. Orange patches were more distinct in dorsolateral and lateral protuberances of the first abdominal segments. Six light yellow patches were seen in the dorsal, dorsolateral and lateral protuberances of the 4th abdominal segment. Fourth instar was completely black and colour patches were more distinct. Each colour patch in the 4th abdominal segment was united like a ring. Head and dorsal surface of the body were more sclerotized.

The total larval period range from 9 to 23 days. The fourth instar took more number of days than the earlier instars. Our results are in fair agreement with those of Tao and Chio (1971) who reared larvae on A. gossypii, Myzus persicae and Lipaphis erysimi but differed from that of Agarwala and Saha (1986) who reported a larval period of 8.8 days on A. gossypii. This may be due to difference in prey-species on which the coccinellid beetles were

<table>
<thead>
<tr>
<th>Developmental stages</th>
<th>Duration (days) Mean ± S.E.</th>
<th>Measurements (mm) Mean ± S.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg</td>
<td>9.14 ± 0.34</td>
<td>1.06 ± 0.02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.49 ± 0.00</td>
</tr>
<tr>
<td>Grub</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I Instar</td>
<td>4.69 ± 0.17</td>
<td>2.47 ± 0.17</td>
</tr>
<tr>
<td>II Instar</td>
<td>3.92 ± 0.13</td>
<td>3.45 ± 0.43</td>
</tr>
<tr>
<td>III Instar</td>
<td>5.00 ± 0.16</td>
<td>5.74 ± 0.64</td>
</tr>
<tr>
<td>IV Instar</td>
<td>7.69 ± 0.38</td>
<td>9.50 ± 0.57</td>
</tr>
<tr>
<td>Total</td>
<td>21.22 ± 0.52</td>
<td>-</td>
</tr>
<tr>
<td>Prepuberal period</td>
<td>2.62 ± 0.18</td>
<td>-</td>
</tr>
<tr>
<td>Pupal period</td>
<td>8.60 ± 0.22</td>
<td>5.36 ± 0.04</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.38 ± 0.00</td>
</tr>
<tr>
<td>Adult</td>
<td>-</td>
<td>5.91 ± 0.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.44 ± 0.06</td>
</tr>
</tbody>
</table>
Table 2. Feeding potential of C. transversalis on *Aphis craccivora*

<table>
<thead>
<tr>
<th>Larval instar</th>
<th>No. of aphids consumed (Mean ± S.E.)</th>
<th>Rate of consumption /day</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>35.50 ± 3.25</td>
<td>7.51 ± 0.63</td>
</tr>
<tr>
<td>II</td>
<td>68.40 ± 7.60</td>
<td>20.13 ± 1.36</td>
</tr>
<tr>
<td>III</td>
<td>131.60 ± 8.30</td>
<td>26.71 ± 1.73</td>
</tr>
<tr>
<td>IV</td>
<td>288.50 ± 23.10</td>
<td>40.98 ± 2.50</td>
</tr>
<tr>
<td>Total</td>
<td>516.30 ± 28.29</td>
<td>24.45 ± 1.21</td>
</tr>
</tbody>
</table>

reared. The mature 4th instar showed reduced mobility, stopped feeding and attached to a point to become a prepupa.

The prepupal period varied from 2 to 3 days. After casting off its skin, it transformed into pupa. Freshly formed pupa was yellowish orange in colour but it turned black with orange spots on the dorsal surface. Pupal period ranged from 8 to 9 days.

Freshly emerged adult was yellow in colour and its permanent erythral colouration appeared after 3 to 4 h. Body oval and convex with head black, posterior corners with 2 yellowish spots; eyes brownish; antennae clavate. 11-segmented; mouth parts black; elytra orange or red with 3 transverse black bands; leg black, slender, elongated and provided with short hairs. Ventral surface black with short hairs. Size of the adult varied from 5.43-6.80 mm in length. The life cycle from egg to adult was completed in 38 to 45 days (Table 1).

Feeding behaviour:

The mode of feeding of the larvae and the adults was similar. They attacked any part of the prey but very often in the soft part of the abdomen. The young larvae sucked the body fluid of the prey leaving the sclerotized body parts. The later instars showed in addition, a chewing action and the whole prey was consumed. During feeding, the predator held the prey up by raising their head, so that they cannot get any support from the substratum. The gradual increase in the feeding rate of older larvae was due to their increased requirement of food due to their increased size. A single larva consumed as many as 401 to 736 aphids during its development (Table 2). These results are more or less similar with the findings of Agarwala and Saha (1986) and Tao and Chio (1971). The larvae and adults exhibited cannibalism in the laboratory. Similar observation was reported by Kapur (1942).

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REFERENCES


Studies on Developmental Rate, Fecundity and Longevity of
Brevicoryne brassicae (L.) and Myzus persicae (Sulzer) on Mustard

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ABSTRACT

Developmental rate, fecundity and longevity of Brevicoryne brassicae and Myzus persicae were studied in the laboratory on mustard at 28.2±0.4°C and 24.9±0.3°C maximum and minimum temperatures, respectively and 51±0.5% R.H. The total nymphal duration and adult longevity of B. brassicae was 151.4±4.2 hrs and 11.4±0.7 days whereas M. persicae was 131.2±3.7 hrs and 14.6±1.1 days, respectively. Average fecundity per female of B. brassicae and M. persicae were 23±3.26 and 39.8±3.6, respectively. The result revealed that M. persicae showed a reduction in the duration of the larval instars and high rate of fecundity and adult longevity when compared to B. brassicae fed on mustard.

KEYWORDS: Brevicoryne brassicae, Myzus persicae, developmental rate, fecundity, longevity, mustard.

DISCIPLINE: Entomology.

Brevicoryne brassicae (L.) and Myzus persicae Sulzer, are the important aphid pests of mustard (Brassica juncea) in Manipur. The former is also a serious pest of cabbage but also attacks cauliflower, turnip, radish, etc. affecting their growth and reducing their market value considerably (Thakur et al., 1989). The latter, is one of the most destructive aphid species attacking plants of over 30 different families (David, 1954), and transmitting more than 200 viral diseases (Van Emden, 1969) and various aspects of its biology have been carried out on several crops in India and abroad (Weed, 1927; Lal, 1950; Ramaprasad et al., 1975).

In Manipur, Myzus persicae was observed infesting mustard in the vegetative stage and followed by Brevicoryne brassicae in the reproductive stage. But no information from India is available till now regarding the comparative biology of the two pests on the same host plant. Studies were, therefore, undertaken in order to assess developmental rate, fecundity and longevity of the two aphid species in the laboratory condition.

* Author for correspondence.
MATERIALS AND METHODS

Developmental rate, fecundity and longevity of *Brevicoryne brassicae* and *Myzus persicae* were studied in the laboratory on mustard during May to June, 1991 with minimum and maximum temperatures of 24.9±0.3 °C and 28.2±0.4 °C respectively and relative humidity of 51.05%. Potted plants were used for the purpose. Freshly emerged single first instar nymph of *B. brassicae* and *M. persicae* obtained from a laboratory culture maintained on mustard plant, was released on each potted plant. Detailed observations on duration of different instars, pre-reproductive, reproductive, fecundity and longevity were recorded daily during the course of study. Ten replications were maintained for each species.

RESULTS AND DISCUSSION

It was observed that both the apterous viviparous females of *B. brassicae* and *M. persicae* underwent four nymphal instars during this study. Duration of nymphal instars and total nymphal period of *B. brassicae* and *M. persicae* are presented in table 1. The data presented in table 1 showed that the total nymphal duration of *B. brassicae* was higher (151±4.17 hr) than that of *M. persicae* (131.2±3.7 hr). Even instarwise developmental period of *B. brassicae* was higher than that of *M. persicae*. Longer period of nymphal development of *M. persicae* on cabbage and cauliflower was reported by Raigopal and Abdul Kareem (1979).

Fecundity, longevity and daily rate of reproduction of both *B. brassicae* and *M. persicae* are presented in table 2. Adult longevity, fecundity rate and rate of reproduction of *M. persicae* were higher than that of *B. brassicae*. Similar rate of reproduction but longer longevity and higher fecundity of *M. persicae* on cabbage and cauliflower were reported by Raigopal and Abdul Kareem (1979).
Table 1. Duration of nympha1 instars and total nymphal period of *Brevicoryne brassicae* and *Myzus persicae* on mustard

<table>
<thead>
<tr>
<th>Aphid species</th>
<th>1st instar (hr)</th>
<th>2nd instar (hr)</th>
<th>3rd instar (hr)</th>
<th>4th instar (hr)</th>
<th>Total development (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Brevicoryne brassicae</em></td>
<td>40.0 ± 2.3</td>
<td>37.7 ± 4.6</td>
<td>37.4 ± 3.6</td>
<td>35.6 ± 2.8</td>
<td>151.4 ± 4.2</td>
</tr>
<tr>
<td><em>Myzus persicae</em></td>
<td>37.0 ± 3.5</td>
<td>28.0 ± 2.6</td>
<td>28.6 ± 2.6</td>
<td>37.6 ± 3.2</td>
<td>131.2 ± 3.7</td>
</tr>
</tbody>
</table>

Mean = Standard deviation.

Table 2. Fecundity and Adult Longevity of *B. brassicae* and *M. persicae* on mustard

<table>
<thead>
<tr>
<th>Aphid species</th>
<th>Pre-Reproductive period (day)</th>
<th>Reproductive period (day)</th>
<th>Post-Reproductive period (day)</th>
<th>Adult Longevity (day)</th>
<th>Total Fecundity</th>
<th>Daily rate of reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Brevicoryne brassicae</em></td>
<td>0.90 ± 0.03</td>
<td>9.0 ± 0.6</td>
<td>1.2 ± 0.2</td>
<td>11.4 ± 0.7</td>
<td>23.0 ± 3.2</td>
<td>2.50 ± 0.2</td>
</tr>
<tr>
<td><em>Myzus persicae</em></td>
<td>1.02 ± 0.08</td>
<td>11.4 ± 0.7</td>
<td>2.2 ± 0.5</td>
<td>14.6 ± 1.0</td>
<td>39.8 ± 3.6</td>
<td>3.49 ± 0.3</td>
</tr>
</tbody>
</table>

Mean = Standard error.
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REFERENCES


