

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 (Homoptera : Aphididae), on field beans in Manipur. The biology of the predator was studied in the laboratory (at $18.23 \pm 1.60^\circ\text{C}$ and $55.54 \pm 2.38\%$ 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 twig 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 $18.23 \pm 1.6^\circ\text{C}$ and $55.54 \pm 2.3\%$ 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

Table 1. Duration and measurements of life stages of *C. transversalis*

Developmental stages	Duration (days) Mean \pm S.E.	Measurements (mm) Mean \pm S.E.	
		Length	Width
Egg	9.14 \pm 0.34	1.06 \pm 0.02	0.49 \pm 0.00
Grub			
I Instar	4.69 \pm 0.17	2.47 \pm 0.17	0.76 \pm 0.03
II Instar	3.92 \pm 0.13	3.45 \pm 0.43	1.02 \pm 0.05
III Instar	5.00 \pm 0.16	5.74 \pm 0.64	1.43 \pm 0.10
IV Instar	7.69 \pm 0.38	9.50 \pm 0.57	2.45 \pm 0.14
Total	21.22 \pm 0.52	-	-
Prepupal period	2.62 \pm 0.18	-	-
Pupal period	8.60 \pm 0.22	5.36 \pm 0.04	3.38 \pm 0.00
Adult	-	5.91 \pm 0.23	4.44 \pm 0.06

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 upto 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 2. Feeding potential of *C. transversalis* on *Aphis craccivora*

Larval instars	No. of aphids consumed (Mean \pm S.E.)	Rate of consumption /day
I	35.50 \pm 3.25	7.51 \pm 0.63
II	68.40 \pm 7.60	20.13 \pm 1.36
III	131.60 \pm 8.39	26.71 \pm 1.73
IV	288.50 \pm 23.10	40.98 \pm 2.50
Total	21.22 \pm 28.29	24.45 \pm 1.21

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 elytral 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).

ACKNOWLEDGEMENTS

The authors are thankful to the Head, Life Sciences Department, Manipur University for providing facilities to conduct the study. Sincere thanks are also due to Dr. S.Chakrabarti, Kalyani University, West Bengal, for critical appraisal of the manuscript.

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