

Biology and feeding potential of *Coccinella septempunctata* Linnaeus (Coleoptera: Coccinellidae) on the chrysanthemum aphid, *Macrosiphoniella sanborni* (Gillette)

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ABSTRACT: The biology and feeding potential of *Coccinella septempunctata* Linnaeus were studied in the laboratory at $27\pm 2^{\circ}\text{C}$ and 70 ± 5 per cent relative humidity on *Macrosiphoniella sanborni* (Gillette), a common pest of chrysanthemum. The egg, larval, prepupal and pupal stages occupied 2.41 ± 0.19 , 9.35 ± 1.2 , 0.73 ± 0.1 and 3.53 ± 0.08 days, respectively. The adult female laid 330.8 ± 28.3 eggs in groups of 30 to 60. The sex ratio (female: male) was 1.5: 1. The adult longevity was 10-19 days in male and 26-35 days in female. The feeding potential of first, second, third and fourth instar grubs and adult was 9.17 ± 1.5 , 20.8 ± 3.3 , 34.1 ± 3.5 , 37.5 ± 4.7 and 55.3 ± 6.7 aphids/day/individual, respectively.

KEY WORDS: Biology, *Coccinella septempunctata*, feeding potential, *Macrosiphoniella sanborni*

Coccinella septempunctata Linnaeus feeds on a wide variety of aphid species, such as *Aphis fabae* Scopoli, *A. gossypii* Glover, *A. nerii* Boyer de Fonscolombe, *Brachycaudus helichrysi* (Kaltenbach), *Brevicoryne brassicae* (Linnaeus), *Cinara* sp., *Hyadaphis coriandri* (Das), *Hyalopterous pruni* (Geoffroy), *Lipaphis erysimi* (Kaltenbach), *Macrosiphum rosae* (Linnaeus), *M. rosaeiformis* Das,

Melanaphis sacchari (Zehntner), *Myzus persicae* (Sulzer) and *Toxoptera odinae* (van der Goot) (Bhagat, 1976; Agarwala *et al.*, 1987; Devi and Singh, 1987; Raj, 1989). During a study on the population dynamics of *Macrosiphoniella sanborni* (Gillette) on *Chrysanthemum* sp., the larvae and adults of *C. septempunctata* were commonly found to occur among the aphid colonies. The literature available on

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the biology and feeding potential of this predator on *M. sanborni* is meagre under Orissa conditions. Therefore, its biology and feeding potential was studied at the Post-graduate Department of Zoology, Gangadhar Meher College, Sambalpur.

MATERIALS AND METHODS

Five pairs of adult beetles (male and female) were collected from the field and reared on *M. sanborni* infested twigs of chrysanthemum in the laboratory at $27\pm 2^{\circ}\text{C}$ and 70 ± 5 per cent relative humidity. The mated females were allowed to oviposit in Petri-dishes containing twigs of chrysanthemum. Ten freshly laid eggs were kept individually in Petri-dishes (10x1.5 cm) for hatching and further rearing. The newly hatched grubs were provided with early instar nymphs of *M. sanborni*. Each grub was provided daily with at least three times the number of aphids it had consumed on the previous day. Observations on the number of aphids preyed daily were recorded and the remaining aphids were removed. Duration of development of each stage, its size and morphological characters, mating and oviposition behavior as well as fecundity were recorded. Mean daily consumption of the adult beetle on the first three days of emergence was also observed.

RESULTS AND DISCUSSION

Biology

Eggs: The freshly laid eggs were small, cigar shaped and shining deep yellow.

Average length and breadth of the eggs were 1.2 and 0.53 mm, respectively. The eggs turned light grey just before hatching. The average incubation period was 2.41 ± 0.19 (2-2.7) days (Table 1), whereas Agarwala and Saha (1986) reported the same as 4.2 days. The higher incubation period in the later case may be due to the low ambient temperature (21.7°C) at which the predator was reared.

Grub: The body measurements of first, second, third and fourth instar grubs were 1.67×0.56 , 3.41×0.89 , 5.8×2.42 and 10.86×3.36 mm, respectively. The average duration of these instars were 2.55 ± 0.13 (2.36-2.72), 1.9 ± 0.08 (1.78-2), 1.87 ± 0.1 (1.68-2) and 3.02 ± 0.13 (2.88-3.2) days, respectively. The total larval period was 9.35 ± 0.2 (8.96-9.86) days (Table 1). Agarwala and Saha (1986) reported the larval period as 12.6 days on *A. gossypii*.

Pupa: The full- grown grub stopped feeding and attached itself to the surface of the Petri-dish and/or to the leaves to become a pre-pupa. The average prepupal period was 0.37 ± 0.1 (0.58-0.9) days. It is in line with the observations of Agarwala and Saha (1986). The pupa was 6.76 mm long and 4.12 mm broad. The average pupal period was 3.53 ± 0.08 (3.4-3.64) days (Table 1). Agarwala and Saha (1986) reported the pupal duration as 6.4 days.

Adults: The average length and breadth of the male was 7.2×4.6 mm and that of female 8×5.2 mm. Among the laboratory reared specimens ($n=100$), the female to male ratio was 1.5: 1. The adults attained sexual maturity 4-8 days after emergence.

The mating period varied from 2.86 to 6 days with a mean of 4.35 ± 1.04 days. Copulation occurred both during day and night and lasted for an average 42 ± 12 (25-58) minutes. After mating, the female took 5.3 (3.5-7) days for oviposition. It laid eggs

hatch. Singh and Malhotra (1979) also observed the deposition of unfertilized egg by *C. septempunctata*. The post oviposition period varied from 2.5-3.12 days with a mean of 2.8 ± 0.2 days. The average longevity of the males was 14.6 ± 2.9 (10-

Table 1. Duration of development and feeding potential of *C. septempunctata* on *M. sanborni*

Stages of <i>C. septempunctata</i>	Developmental period in days	Total number of aphids consumed	No. of aphids consumed per day
Egg	2.41 ± 0.19	-	-
Grub			
I instar	2.55 ± 0.13	27.5 ± 2.22	9.17 ± 1.48
II instar	1.90 ± 0.08	1.6 ± 3.41	20.80 ± 3.34
III instar	1.87 ± 0.10	68.0 ± 4.61	34.05 ± 3.46
IV instar	3.02 ± 0.13	119.9 ± 5.25	37.47 ± 4.67
Total	9.35 ± 0.20	257.1 ± 10.49	25.37 ± 5.43
Prepupa	0.73 ± 0.10	-	-
Pupa	3.53 ± 0.08	-	-
Total	16.02 ± 0.56	-	-
Adult			
Male	14.62 ± 2.91	-	55.27 ± 6.70
Female	32.88 ± 2.64	-	55.27 ± 6.70

in batches of 30 to 60 and the time required to lay a single clutch of eggs varied from 25 to 55 minutes. These finding are in agreement with that of Singh and Malhotra (1979).

The adult female laid 238 to 386 eggs, with an average of 330.8 ± 28.32 eggs during an ovipositional period of 14.6 ± 2.5 (10-18) days. Singh and Malhotra (1979) reported the fecundity as 617.2 eggs. Some of the eggs laid were unfertilized and as such they gradually shrank and did not

19) days, whereas that of female was 32.9 ± 2.8 (26-35) days. The life cycle from egg to adult was completed in 16.02 days (Table 1). Agarwala and Saha (1986) recorded the total duration of life cycle as 24.2 days.

Feeding potential

The first instar grub of *C. septempunctata* consumed only first-second instar nymphs of *M. sanborni*. However, the later instar grubs and adults

consumed aphids irrespective of their developmental stages.

During the development, first, second, third and fourth instars grubs consumed 27.5 ± 2.2 , 41.6 ± 3.4 , 68 ± 4.6 and 120 ± 5.25 aphids (*M. sanbornii*), respectively. The mean consumption was 257.1 ± 10.5 aphids per grub (Table 1). The mean prey consumption of *C. septumpunctata* larva when fed on *L. erysimi* was 284.6 (Singh and Malhotra, 1979), on *A. gossypii* 761.2 (Agarwala and Saha, 1986) and on *B. brassicae* 332.7 (Sharma and Verma, 1993). The mean daily consumption at successive larval instars was 9.17 ± 1.48 , 20.8 ± 3.34 , 34.05 ± 3.46 and 37.47 ± 4.67 aphids of *M. sanbornii* (Table 1). According to Agarwala and Saha (1986), the mean daily consumption at successive instars was 17.06, 39.5, 62.71 and 113.6 aphids of *A. gossypii*. The mean daily consumption of adult was 55.27 ± 6.7 aphids. The female consumed more aphids than the males. Sharma and Verma (1993) recorded similar adult consumption.

Studies of natural enemies have shown that the high voracity of coccinellids observed in the laboratory may not be achieved in the field (Frazer, 1988). Therefore, further investigations are needed particularly in the field in order to measure the actual predatory potential of this predator.

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REFERENCES

- Agarwala, B. K. and Saha, J. L. 1986. Larval voracity, development and relative abundance of predators of *Aphis gossypii* on cotton in India, pp. 339-344. In: Hodek, I. (Ed.) *Ecology of Aphidophaga*. Academia, Prague and Dr. W. Junk, Dordrecht.
- Agarwala, B. K., Das, S. and Bhaumick, A. K. 1987. Natural food range and feeding habits of aphidophagous insects in north east India. *Journal of Aphidology*, 1(1 & 2): 18-22.
- Bhagat, K. C. 1976. Studies on the aphidophagous predators of Bhubaneswar. M. Sc. (Ag.) thesis, Orissa University of Agriculture and Technology, Bhubaneswar, India.
- Devi, S. S. and Singh, T. K. 1987. Aphids and their coccinellid predators of fruit trees in Manipur, northeast India. *Journal of Aphidology*, 1(1 & 2): 78-79.
- Frazer, B. D. 1988. Coccinellidae, pp. 231-247. In: *World Crop Pests*, 2B. *Aphids-Their Biology, Natural Enemies and Control*. Elsevier, Amsterdam.
- Raj, B. T. 1989. Seasonal abundance of natural enemies of aphids infesting potato crop. *Journal of Aphidology*, 3(1 & 2): 157-161.

- Sharma, P. K. and Verma, A. K. 1993. Studies on the coccinellid predators of the cabbage aphid, *Brevicoryne brassicae* in Himachal Pradesh. *Journal of Biological Control*, 7(2): 15-19.
- Singh, R. and Malhotra, R. K. 1979. Bionomics of *Coccinella septempunctata* Linn. *Indian Journal of Entomology*, 41: 244-249.