Indian Journal of Entomology 85(3): 773-775 (2023) DoI. No.: 10.55446/IJE.2021.385

FEEDING BEHAVIOUR OF *COCCINELLA SEPTEMPUNCTATA* AND *COCCINELLA TRANSVERSALIS*

Neelam Yadav[1]* and Neerja Agrawal[1]

[1]Department of Entomology, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur 208002, Uttar Pradesh, India
*Email: neelu.amogh@gmail.com (corresponding author)

ABSTRACT

The mass production of coccinellids at the Biocontrol Laboratory of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur included laboratory studies on the predatory behaviour of *Coccinella septempunctata* L. and *C. transversalis* (F.) (Coleoptera: Coccinellidae). The study was done with the natural food, *Lipaphis erysimi* and *Brevicoryne brassicae* (Hemiptera: Aphididae). The predatory efficiency of the larvae and adults was determined by quantitative method of aphids consumed. The results revealed that the feeding rate increased gradually from the first to fourth larval instar, irrespective of the aphid host, with the first instars being less voracious than later ones.

Key words: *Coccinella septempunctata*, *C. transversalis*, *Lipaphis erysimi*, *Brevicoryne brassicae*, life stages, feeding behaviour, predatory efficiency, larval instars, adults

Insect pests have always been a threat to agricultural productivity. Various chemicals (pesticides) are applied against insect pests to counter this (Pearson, 2004). The disadvantages of pesticides call for a safe and cheap methods of IPM which ensures environmental safety (Solangi, 2004). Ladybird beetles (Coccinellidae: Coleoptera) are important predators in natural and agricultural habitats and prey upon many economically important pests, including aphids, mealy bugs, scale insects, thrips, leafhoppers, mites, and other soft bodied insects (Dixon 2000; Khan et al. 2009, Takizawa et al*.,* 2000; Devi et al*.,* 2002). These are predators in both adult and larval phases (Gilkeson 2001; Oliveira et al., 2004; Cotrell 2005), and these feed on aphids or coccids, with a few feeding on both types of prey (Weber and Lundgren 2009). Such biological control performed by naturally occurring predators and parasitoids can have considerable impacts on aphids (Smith and Chaney, 2007; Bowie et al. 1999). Targeted release of such biocontrol agents against aphids in vegetable crops is widely used in greenhouse vegetable production (Rabasse and van Steenis, 1999; Zehnder et al*.*, 2007). This study explores the predatory feeding behaviour of two such coccinellids.

MATERIALS AND METHODS

Adults of *C. septumpunctata* and *C. transversalis* were collected from different crops and brought to the laboratory. Pairs of beetles were placed in duly covered rearing jars with sufficient number of aphids as food and substrate for egg laying. To rear the predator coccinellid, aphid colonies were maintained in cages in the laboratory on fresh leaves of mustard and cabbage. Mass cultures were initiated by collecting newly emerged adults and maintained in plastic jars (30x 15 cm), with an abundant supply of prey from the aphid colonies until oviposition. The rearing jars were provided with wrinkled paper to act as oviposition sites. The eggs laid were collected every 24 hr, transferred to petridishes, and allowed to hatch. The cultures were maintained at 25± 2°C and 65 ± 5% RH, from which emerged larvae were taken and fed with aphids, the emerginf adults from this stock were sexed, and the eggs were incubated. The 1st instar grubs were used for the studies. Newly emerged larvae were fed separately with 3rd or 4th instar nymphs of the aphids *Lipaphis erysimi, Brevicoryne brassicae*, which were kept fed on leaves of the respective host plants in petridishes. Each treatment was replicated 10 times with at least five individuals/ replication.

RESULTS AND DISCUSSION

Laboratory studies on the predatory behaviour of *C. septumpunctata* and *C. transversalis* on *L. erysimi* and *B. brassicae* revealed that the 4th instar larva consumed significantly more aphids. The behaviour estimated by the quantitative method of aphids consumed by each larval instars and adults revealed that the feeing rate increased gradually from the first to fourth instar, irrespective of the aphid host; the predation rate showed

Table 1. Feeding behaviour of coccinellid on aphids under laboratory conditions

S.No.	Insect stages (Predator)	*Coccinella septumpunctata*		*Coccinella transversalis*	
		Consumed *L. erysimi* (No.)	Consumed *B. brassicae* (No.)	Consumed *L. erysimi* (No.)	Consumed *B. brassicae* (No.)
1.	1st instar grub	16.33 (4.102)*	14.00 (3.807)	14.33 (3.850)	17.00 (4.183)
2.	2nd instar grub	23.33 (4.881)	17.66 (4.261)	21.0 (4.636)	19.00 (4.415)
3.	3rd instar grub	30.66 (5.580)	23.66 (4.915)	24.33 (4.982)	22.67 (4.813)
4.	4th instar grub	36.33 (6.068)	31.33 (5.641)	30.0 (5.522)	30.66 (5.582)
5.	Adult	40.33 (6.389)	36.66 (6.095)	34.33 (5.901)	32.00 (5.700)
	Total consumed/ one coccinellid	146.98 (12.144)	123.31 (11.126)	123.99 (11.157)	121.33 (121.33)
	CD (p=0.05)	0.139	0.293	0.210	0.257
	SE (m)	0.042	0.088	0.063	0.077

*Figures in parentheses square root transformed $\sqrt{X + 0.5}$

that *C. septumpunctata* consumed 146.98 aphids of *L. erysimi* and 123.31 aphids of *B. brassicae* (Table 1). The larvae and adult of *C. transversalis* consumed 123.99 of *L. erysimi* and 121.33 of *B. brassicae*. The aphids consumed/ day by the first instar larvae was less than the later ones, and the first and second instars preferred young nymphs compared to older nymphs and adults. Preference for young nymphs may be due to their smaller size and lower numbers of encounters (Dixon and Russel, 1972). The fourth instar larvae of *C. transversalis* consumed more aphids compared to adult female (65.67 and 62.17, respectively). Pandey and Khan (2002) observed that the fourth instar larvae of C. *septempunctata* consumed more aphids (*Myzus persicae*) than did the adults. Less consumption of *Aphis craccivora* was observed followed by *B. brassicae*; these findings of Jonathan (2005) and Maharajan (2018) support the present results. Wagle et al. (2006) observed that *C. transversalis* devoured 38.8 aphids of *B. brassicae/* day. Veeravel and Baskaran (1996) and Malik et al. (1998) showed that an adult of *C. transversalis* consumed 67.66 aphids/ day. The feeding potential of *C. septempunctata* and *Menochilus sexmaculatus* (F.) was studied on *L. erysimi* (Shenmar and Brar, 1995).

ACKNOWLEDGEMENTS

Authors acknowledge the University Grants Commission, New Delhi for the financial assistance in the form of post-doctoral fellowship.

AUTHOR CONTRIBUTION STATEMENT

All authors equally contributed.

CONFLICT OF INTEREST

No conflict of interest.

REFERENCES

Bowie M H, Gurr G M, Hossain Z, Baggen L R, Frampton C C. 1999. Effects of distance from field edge on aphidophagous insects in wheat crop and observations on trap design and placement. International Journal of Pest Management 45(1): 69-73.

Cotrell T E 2005. Predation and cannibalism of lady beetle eggs by adult lady beetles. Biological Control 34(2): 159-164.

Devi C, Singh L, Varatharajan R. 2002. Management of mustard aphid with natural enemy, plant product and chemical insecticide. Indian Journal of Entomology, 64: 373-376.

Dixon A F G, Russel R J 1972. The effectiveness of *Anthocoris nemorum* and *A. confusus* (Hemiptera: Anthocoridae) as predators of the sycamore aphid, *Drepanosiphum plantanoides*. II. Searching beahviour and the incidence of predation in the field. Entomologia Experimentalis Applicata, 15: 35-50.

Dixon A F G. 2000. Insect Predator-Prey Dynamics; Ladybird Beetles and Biological Control. Cambridge University Press.

Gilkeson L , Kelin M 2001. Natural enemies of crop insect pests. Cooperative Extention , Cornell University, Ithea, New York. 63 pp.

Jonathan G, Lundgren R N 2014. Wiedenmann Tritrophic Interactions among Bt (Cry3Bb1) corn, aphid prey, and the predator *Coleomegilla maculate* (Coleoptera: Coccinellidae). Environmental Entomology Article 34(6): 1621-1625.

Khan A A, Zaki F A, Khan Z H, Mir R A. 2009. Biodiversity of predacious ladybird beetles (Coleoptera: Coccinellidae) in Kashmir. Journal of Biological Control 23: 43-47.

Maharjan B, Thapa R B, Bajracharya A S R. 2018 Efficacy of two species of coccinellid predators against four different aphid pest species at Khumaltar, Nepal. Journal Inst. Agric. Anim. Sci. 35: 127-134.

Oliveira N C, Wilcken C F, Matos O C A 2004. Biological predator species the coccinellids (Coleoptera: Coccinellidae) .Journal of Entomological Research 48(4): 529-533.

Pandey K A, Khan M A 2002. Feeding potential of *Coccinella septempunctata* Linn. (Coccinellidae: Coleoptera) on mustard aphid, *Myzus persicae* Sulzer. Pestology, 6: 24-26.

Pearson S A 2004. Post embryonic development surival rate and predation potential of *Coccinella septumpunctata* Linn. in relation to the mustard aphid *Lipaphis erysimi* Kaltenbach. Journal of Entomological Research 18: 5-10.

Rabasse J M, Steenis M J V 1999. Biological control of aphids. In Albajes, R., M.L. Gullino, J.C. van Lenteren and Y. Elad (eds):

Integrated Pest and Disease Management in Greenhouse Crops. Kluwer Academic Publishers, Dordrecht, pp. 235-243.

Shenhmar M, Brar K S 1995. Biological control of mustard aphid, *Lipaphis erysimi* (Kalt.) in Punjab. Journal of Biological Control 9: 9-12.

Smith H A, Chaney W E. 2007. A survey of syrphid predators of *Nasonovia ribisnigri* in organic lettuce on the central coast of California. Journal of Economic Entomology 100(1): 39-48.

Solangi S 2007. Searching ability and feeding potential of larvae of 7-spotted beetle *Coccinella septempunctata* Linn. under laboratory and field conditions. Sarhad Journal of Agriculture 23(3): 705-711.

Takizawa T, Yasuda H, Agarwala B K 2000. Effect of three species of predatory ladybirds and oviposition of aphid parasitoids. Entomological Science 3(1): 465-469.

Veeravel R, Bhaskaran P. 1996. Temperature dependent development, adult longevity, fecundity and feeding potential of two coccinellid predators under laboratory condition. Entomon 21(2): 13-18.

Wagle B K S, Saravanan, L, Jacob P S, Anand P. 2006. Biology and predation potential of aphidophagous predators, *Coccinella septempunctata* and *Coccinella transversalis* on cabbage aphid *Brevicoryne brassicae* Linnaeus. The Allahabad Farmers 9(1): 70-74.

Weber D C, Ludgren J G. 2009 Assessing the trophic ecology of Coccinellidae: their role as predators and as prey. Biological Control 51(4): 199-214.

Zehnder G, Gurr G M, Kuhne S, Wade M R, Wratten S D, and Wyss E.. 2007. Arthropod pest management in organic crops. Annual Review of Entomology 52(5): 57-80.

(Manuscript Received: July, 2021; Revised: December, 2021;
Accepted: December, 2021; Online Published: April, 2022)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e21169