Journal of Biological Control, 34(2): 109-112, 2020, Doi: 10.18311/jbc/2020/24829

Research Article

Biology and feeding potential of *Eocanthecona furcellata* (Wolff) on its lesser known prey, *Spilosoma obliqua* (Walker)

JAYDEEP HALDER*, DEEPAK KUSHWAHA and A. B. RAI
ICAR-Indian Institute of Vegetable Research, Varanasi-221305, Uttar Pradesh, India
**Corresponding author E-mail*: jaydeep.halder@gmail.com

ABSTRACT: *Eocanthecona furcellata* (Wolff) (Hemiptera: Pentatomidae) is an important polyphagous predator of several agricultural, horticultural and forest insect pests. The biology and feeding potential of *E. furcellata* were investigated on Bihar hairy caterpillar, *Spilosoma obliqua* (Walker), a lesser known prey under laboratory conditions. Gravid female laid on an average 203.6±12.56 eggs during its life time. Nymphs passed through five instars in 22.25 to 27.25 days and developed into adults. First instar nymphs had the shortest duration (2.5 to 3.25 days) while fourth instar took maximum days (5.5 to 6.5) to complete, while second, third and fifth instars completed in 5.07 ± 0.26, 5.20 ± 0.71 and 5.24 ± 0.39 days, respectively. Female bugs were bigger in size and lived up to 28 days, while males survived up to 18 days when fed on second instar larvae of S. obliqua. Neonate nymphs devoured 1.6 larvae of *S. obliqua* while second, third, fourth and fifth instar nymphs consumed 7.73, 11.93, 12.13, 18.67 larvae of *S. obliqua*, respectively. Individual male and female in their adult stage consumed average 84.25 and 125.5 larvae, respectively, and total consumptions were 136.31 and 177.56 larvae during their life-cycle. From the study, it is evident that *S. obliqua* could be used as an alternative host to mass rear *E. furcellata* under laboratory conditions when the main host is scarce or not available.

KEY WORDS: Biology, *Eocanthecona furcellata,* feeding potential, predator, *Spilosoma obliqua*

(Article chronicle: Received: 09-03-2020; Revised: 11-05-2020; Accepted: 25-05-2020)

INTRODUCTION

Sustainable agriculture is gaining momentum. In this endeavour, more and more emphasis is being laid on integrated pest management which includes components like biological control of the pests of crops by natural enemies (Lenin and Rajan, 2016). Biological control of insect pests is now widely acclaimed due to their target specificity, self-perpetuity and obvious safety to the environment (Halder *et al*., 2010, 2013, 2017). Amongst the biocontrol agents , predators play a pivotal role in pest management. They are mainly free-living species and directly consume a large number of prey during their entire lifetime. Members of the order Coleoptera, Hemiptera and Neuroptera are considered as most potential insect predators in the biological control programme (Halder and Rai, 2016). Among these, heteropteran predators are important biological control agents against lepidopteran, coleopteran and hemipteran insects. *Eocanthecona furcellata* (Wolff) (Hemiptera: Pentatomidae) is a native generalist predator that can be easily reared in the laboratory and regarded as a potential larval predator. Its predation has also been reported from Southeast Asia, Japan, India and Taiwan (Ahmad *et al*., 1996; Chang, 2002). In India, *E. furcellata* has been considered as an important polyphagous predator on several important lepidopteran pests in agricultural, horticultural and forest plants. In vegetable ecosystem, it has been observed abundant on eggplant, okra, cowpea, bottle gourd during August to February months.

Bihar hairy caterpillar, *Spilosoma obliqua* (Walker) (Lepidoptera: Arctiidae), being a polyphagous pest, feeds on several vegetables like brinjal, cowpea, Indian bean, potato, sweet potato etc. apart from feeding on cereals, pulses, oil seeds and jute. Due to dense hairs on larval body, many parasitoids and predators generally do not prefer it. However, *E. furcellata* was observed to feed on *S. obliqua* larvae both under field and protected conditions. This polyphagous predator is amenable for mass production using laboratory lepidopteran hosts throughout the year and is easy to maintain and release. The insects can be released in the field at second or third nymphal stage so that they target the pests and manage them effectively (Shylesha and Sravika, 2018) and can suitably be exploited for pest management in organic vegetable production. This prompted to conduct detailed

studies on the biology and feeding potential of *E. furcellata* on *S. obliqua,* a lesser known prey of it.

MATERIALS AND METHODS

Laboratory studies on biology and feeding potential of *Eocanthecona furcellata* were conducted at Biological Control Laboratory, Crop Protection Division, ICAR-Indian Institute of Vegetable Research (IIVR), Varanasi (82°52' E longitude and 25°12' N latitude), Uttar Pradesh, India during 2015-16. Initial culture of the predator was collected from okra and brinjal experimental fields of ICAR-IIVR, Varanasi. The field collected predators were brought to the biocontrol laboratory for mass multiplication on *Corcyra cephalonica* larvae. Freshly laid eggs of *E. furcellata* were separated and allowed to hatch. After hatching, neonate nymphs were collected with a fine-tipped entomological brush and transferred individually in to a plastic jar (14 cm height and 11.5 cm dia) covered with muslin cloth and fastened by a rubber band. Late second instar (5±0.5 days old) of Bihar hairy caterpillar, *Spilosoma obliqua* (Walker) (Lepidoptera : Arctiidae)) larvae, reared on tender brinjal leaves, were provided as their food. Initially ten larvae were supplied which later increased to thirty larvae per day per nymph. As such forty such sets were maintained under laboratory conditions at 28±2ºC, 70-80% relative humidity and a photoperiod of 13:11 (L:D) hour. Nymphs after attaining adults were sexed and adult male and female (2:1 ratio) were placed in another plastic jar (19 cm height and 15 cm dia) with white filter paper at its base. The male and female adult bugs were paired 2-3 days after the emergence and provided with *S. obliqua* larvae, with brinjal shoots and leaves. Mated females were maintained individually in glass bottles having brinjal twigs to record the oviposition behaviour. Observations were made at regular intervals. The data on the duration of different nymphal periods, adult period, number of eggs laid, eggs viability and number of host's larvae consumed at each stage of predatory bug were recorded. The data obtained were subjected to statistical analysis as described by Gomez and Gomez (1984).

To study the feeding potential, different instars of *E. furcellata*, just after hatching, were collected and allowed to be fed by the late second instar (5±0.5days old) larvae of *S. obliqua*. The number of larvae provided ranged from 10-30 per day. Number of dead larvae, after feeding by the *E. furcellata*, were counted each day. Moribund larvae were also considered as dead. Number of larvae feeding by each instar of the *E. furcellata* were computed and expressed as number of larvae fed in each instar. Forty such replications were mainlined for the study.

RESULTS AND DISCUSSION

The predatory pentatomid bug, *Eocanthecona furcellata* was noticed on okra plants during September to November and on brinjal during December to February. Eggs were laid on the leaves and shoots and the nymphs after hatching congregated in a place under the leaf initially and later moved apart. A maximum of three adult bugs were noticed in a single okra plant and 4 in a single brinjal plant during the observation. These predatory bugs were noticed to predate upon a range of caterpillars including leaf folder and fruit borers. In laboratory, the bugs readily predated upon the late second instar larvae of Bihar hairy caterpillar and were active, which showed its suitability as prey.

Biological parameters of *E. furcellata* upon rearing on late second instar larvae of Bihar hairy caterpillar were recorded for two generations and presented in Table 1. Incubation period lasted for 5.5-8.25 days. The egg shell had a shiny chorion with projections at the top. Freshly laid eggs were whitish in colour which gradually turned into creamy to light brownish. They appeared reddish immediate before hatching. Freshly emerged nymphs were reddish in colour with black patches on dorsal surface and congregate near chorion. Nymphs passed through five instars in 22.25 to 27.25 days and developed into adults. First instar nymphs were the shortest in duration (2.5 to 3.25 days) while fourth instar took maximum days (5.5 to 6.5) to complete. Wing buds developed during last nymphal instar onwards while the nymphs turned in to yellowish orange colour before moulting into adults. Female bugs were bigger than its male counterpart and lived up to 28 days under laboratory conditions. Males were short living and survived up to 18 days. The adult bugs copulated only after passing three to four days after emergence. First batch of fertile eggs was laid by the gravid female bugs after 2 to 3.5 days of mating. Typical cylindrical eggs were laid in rows arranged in a cluster. Fecundity varied from 149 to 270 per gravid female.

All the instars and adults of the *E. furcellata* were observed thoroughly to be fed on the second instar larvae of *S. obliqua* under laboratory conditions. They puncture the host body by their specially adapted mouth parts and suck the body sap. Neonate nymphs consumed just 1.6 *S. obliqua* larvae while second, third, fourth and fifth instar nymphs devoured 7.73, 11.93, 12.13, 18.67 second instar larvae of *S. obliqua.* Cannibalism was not noticed during any nymphal stages as well as adult stages even though they were reared in groups. Male and female adults devoured on an average 84.25 and 125.5 larvae, respectively (Fig. 1) during their adulthood while their total consumption were 136.31 and 177.56 larvae,

respectively during their entire life span. Pronotal spines were seen only in adults.

Pillai and Agnihotri (2013) reported adult longevity of male and female of *E. furcellata* were 13.2 days and 22.6 days, respectively on *Maruca*. Kumar and Singh (2007) also reported longest life period of male (27.59 days) and female (45.20 days) of *E. furcellata* on *Spodoptera litura* . Maximum egg incubation period of 7 ± 1 days was recorded on *M. vitrata* and followed by *S. obliqua* with 6.33 ± 1.52 days. On *Corcyra cephalonica*, the incubation period was 5.33 ± 0.57 days (Tiwari *et al*., 2017). The third, fourth and fifth instars predator consumed 2.8, 5.8 and 7.3 preys of *Pericallia ricini* infesting castor and completed the stadial period in 3.9, 5.4, and 6.2 days respectively (Shophiya and Sahayaraj, 2014). In another study Rani and Havukkala, 1993 concluded that the predator could withstand up to 72 h starvation and temperature up to 40°C. Female bugs ingested more prey tissue than males. The efficient killing ability and polyphagy make *E. furcellata* a promising predator for biocontrol of Lepidopterous larvae in tropical and sub-tropical climates. As *S. obliqua* is easier to be reared than many other lepidoptearn pests in the laboratory, this may be taken advantage for mass-rearing of *E. furcellata* particularly when *Corcyra* larvae are scarce. Moreover, cost of production of *E. furcellata* reared on *S. obliqua* was lower than the *C. cephalonica* larvae and can be adopted by even marginal to resource poor farmers as this predator can be effectively used in managing the lepidopteran insect pests by augmentation. However, proper planning is required for year round availability of this prey.

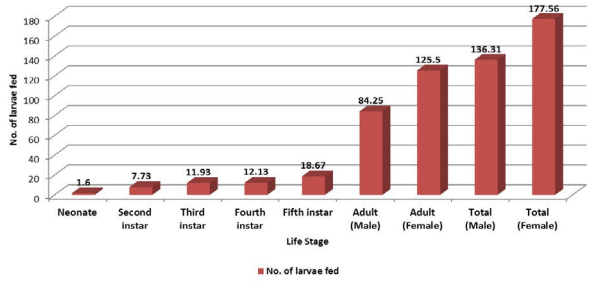

Fig. 1. Feeding potential of *Eocanthecona furcellata* on second instar larvae of *Spilosoma obliqua*

ACKNOWLEDGEMENTS

Authors are thankful to the Director, ICAR-IIVR, Varanasi, Uttar Pradesh for providing the necessary research facility for conducting the experiment.

REFERENCES

Ahmad M, Singh AP, Sharma S, Mishra RK, Ahmad MJ. 1996. Potential estimation of the predatory bug *Canthecona furcellata* Wolff (Hemiptera: Pentatomidae) against popular defoliator *Clostera cupreata* (Lepidoptera: Notodontidae). *Ann Forestry* **4**: 133-138.

Chang CP. 2002. Mass rearing and utilization of the predatory stink bug *Eocanthecona furcellata*. *Formosan Entomol.* **3**: 175-181.

Table. 1 Biological events in the life-cycle of *Eocanthecona furcellata* on *Spilosoma obliqua* under laboratory conditions

Biological parameter	Minimum	Maximum	Mean* ± SD
Fecundity (No.)	149	270	203.6 ± 12.56
Egg viability (%)	77	94	85.4 ± 5.13
Nymphal duration (days)			
First instar	2.5	3.25	2.75 ± 0.25
Second instar	4.5	6.25	5.07 ± 0.26
Third instar	4.75	5.5	5.20 ± 0.71
Fourth instar	5.5	6.5	5.97 ± 0.46
Fifth instar	5.0	5.75	5.24 ± 0.39
Total nymphal period	22.25	27.25	25.15 ± 2.37
Adult longevity (days)			
Pre-oviposition period	2	3.5	2.87 ± 0.21
Oviposition period	21	28	24.31 ± 2.16
Incubation period	5.5	8.25	7 ± 0.55
Male	15	18	17.18 ± 0.97
Female	21	28	24.31 ± 2.16

Gomez KA, Gomez AA. 1984. *Statistical procedures for agricultural research*. John Wiley and Sons, New York, 680 pp.

Halder J, Rai AB. 2016. Suitability of different prey aphids on the growth, development and reproduction of *Chrysoperla zastrowi sillemi* (Esben-Petersen) (Chrysopidae: Neuroptera). *Proc Zool Soc.* **69**(1): 89-95. https://doi.org/10.1007/s12595-014-0131-6

Halder J, Kushwaha D, Rai A B, Singh A, Singh B. 2017. Potential of entomopathogens and neem oil against two emerging insect pests of vegetables. *Ind J Agric Sci*. **87**(2): 220-224.

Halder J, Rai AB, Kodandaram MH. 2013. Compatibility of neem oil and different entomopathogens for the management of major vegetable sucking pests. *Natl Acad Sci Lett.* **36**(1): 19–25. https://doi.org/10.1007/s40009-012-0091-1

Halder J, Srivastava C, Dureja P. 2010. Effect of methanolic extracts of *Vinca rosea* and *Callistemon lanceolatus* alone and their mixtures against neonate larvae of gram pod borer, *Helicoverpa armigera* (Hüb.). *Ind J Agric Sci*. **80**(9): 820–823.

Kumar S, Singh SV. 2007. Longevity fecundity and sex ratio of *Canthecona furcellata* on Lepidopterous insect pests. *Annl Pl Prot Sci*. **15**(7): 235-281.

Lenin EA, Rajan SJ. 2016. Biology of predatory bug *Eocanthecona furcellata* Wolff (Hemiptera: Pentatomidae) on *Corcyra cephalonica* Stainton. *J Entomol Zool Stud.* **4**(3): 338-340.

Pillai AK, Agnihotri M. 2013. Biology and predator potential of *Eocanthecona furcellata* (Wolff.) on *Maruca vitrata* Geyer. *Madras Agric J*. **100**(1-3): 193-195.

Rani UP, Havukkala I. 1993. Predatory and mating behaviour of *Eocanthecona furcellata* (Wolff.) (Heteroptera: Pentatomidae) a promising natural enemy of Lepidopterous Larvae. *J Biol Control* **7**(1): 9-11.

Shylesha AN, Sravika A. 2018. Natural occurrence of predatory bugs, *Eocanthecona furcellata* (Wolff) and *Andrallus spinidens* (Fabr.) on *Spodoptera frugiperda* (Smith) (Hemiptera: Pentatomidae) in maize and their potential in management of fall army worm. *J Biol Control* **32**(3): 209-211. https://doi.org/10.18311/jbc/2018/22477

Shophiya NJ, Sahayaraj K. 2014. Biocontrol potential of entomophagous predator *Eocanthecona furcellata* Wolff against *Pericallia ricini* (Fab.) larvae. *Int J Curr Res.* **6**(10): 9052-9056.

Tiwari S, Maurya RP, Pandey AK. 2017. Effect of different insect hosts on biology and predation efficiency of *Eocanthecona furcellata* Wolff (Hemiptera: Pentatomidae). *Bioscan* **12**(1): 193-197.