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Biology and Predatory Potential of *Eocanthecona furcellata* (Wolff.) on *Maruca vitrata* Geyer

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***Eocanthecona furcellata* is an important heteropteran predator on several important insect pests. The life cycle of the bug passed through five nymphal instars with a total nymphal period of about 15-18 days (average 16.8 days). Male and female longevity were; 12.5 to 15.5 days and 21 to 24 days, respectively and total life cycle lasted for 38.8 and 30 days, respectively. The adults in comparison to nymphal instars were excellent predators. Maximum predation was observed on second instar larvae of *Maruca vitrata* (66.47%) by female and 58.33% by male followed by predation on third instar larvae by female 61.64% and 55.40% by male. Minimum predation was observed on fifth instar larvae by all predator stages.**

Key words: Biology, predatory potential, *Eocanthecona furcellata, Maruca vitrata*

Spotted pod borer, *Maruca vitrata* Geyer (*M. testulalis*) (Lepidoptera: Pyraustidae) is one of the key insect pests of tropical food legumes damaging tender leaf axils, flower buds, flowers and pods by webbing and boring clusters of flowers or pods during cooler parts of the year on about 39 hosts (Atachi and Djihou, 1994). Short duration, determinate pigeon peas and cowpeas with compact clusters are more susceptible. In cowpea the damage was about 20-60% (Singh and Allen, 1980) and in pigeonpea, it was 84 % (Dharmasena *et al.,* 1992) across the globe. Due to concealed larval habitat, insecticides showed varied levels of effectiveness (Saxena *et al.,* 1996). Among different measures to manage insect pests biological control is one of the best alternatives. Pest management with natural enemies has been advocated due to environmental, economical, social and ecological problems with insecticides. Among the entomophagous insects, heteropteran predators are important biological control agents. *Eocanthecona furcellata* (Wolff.) (Hemiptera: Pentatomidae), has received much attention in biological control due to its potential to control of lepidopteran, coleopteran and heteropteran insects (De Clercq, 2000). In India *E. furcellata* had been an important predator on several important lepidopteran insect pests, such as larvae of *Earias* sp. (Pant, 1960), *Spodoptera litura* (F.) on daincha (Cherian and Brahmachari, 1941), *Eutectona machaeralis* (Walker), *Hyblaea puerea* (Cramer), *Plecoptera reflexa* (G.), *Spodoptera litura* (F.) (Ahmad *et al.,* 1996), rice leaf folder, *Cnaphalocrocis medinalis* Guenee (Kumar and Singh, 2007), poplar defoliator, *Clostera fulgurita* (Walker) on poplar nurseries and plantations (Kumar and Singh, 2007; Ray, 2008; Kumar *et al.,* 2008; Ray and Khan, 2010; Ray and Khan, 2011), *Helicoverpa armigera* Hubner, *Spilosoma. obliqua* (W.) and *Trichoplusia ni* (Hubner) on sunflower (Basappa, 2011) and *Maruca vitrata* Geyer on pigeonpea (Nebapure and Agnihotri, 2011) and black gram (Pillai and Agnihotri, 2012). This predator can be an important biological control agent in bio-intensive insect pest management (BIPM) programme, if the mass rearing techniques can be developed. Keeping the above facts in view, detailed investigations were carried out on its biology and predation potential of different nymphal instars and the adults against the larval stages of *M. vitrata*.

Materials and Methods

The experiments were conducted in the pulse laboratory, Department of Entomology, in the year 2011and adult bugs of *E. furcellata* were collected from field in Norman E. Borlaug Crop Research Centre (NEB- CRC), G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India. The bugs were kept in plastic jars (1 lit. capacity) covered inside by blotting paper and provided with disease free larvae of *M. vitrata* as regular food along with flower buds and tender pods of pigeonpea. Jars were covered with muslin cloth for aeration. Eggs deposited by female bugs on the leaves and on blotting paper were kept separately in the plastic vials with sieve cap for hatching. Second instar nymphs were used for the stock culture.

Ten numbers of each nymphal instars and adults were provided with second and third instar larvae of *M. vitrata*. Nymphs from third instar stage onwards were kept individually in plastic vials (15x5 cm) with *M. vitrata* larvae to avoid cannibalism between

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nymphs. The number of prey larvae consumed was recorded daily and the dead larvae were replaced with live ones. After emergence of adults, they were kept in separate plastic vials with sieve cap along with larvae. The egg incubation period, nymphal period and adult longevity was recorded.

The stock culture of *M. vitrata* was maintained in the laboratory in the (five litres capacity) tall glass jars. First and second instar larvae were fed with flower buds and flowers and later instars with flowers and tender pods. One nymph of each predatory instar (i.e. 2nd, 3rd, 4th and 5th) was kept in different vials along with 10 *M. vitrata* larvae. The number of consumed larvae was recorded daily and fresh larvae were provided for further feeding. Predation of each nymphal instar was recorded. Similarly the adults of predatory bug were also kept in different vials along with hosts. Predation was recorded for total adult longevity period of the predatory bug. Each experiment was replicated five times.

Results and Discussion

Biology of Eocanthecona furcellata on larvae of M. vitrata

Observations on the biology of *Eocanthecona furcellata* on the larvae of *Maruca vitrata* revealed that the life cycle of, *E. furcellata* passed through five nymphal instars with a total nymphal period of about 15-18 days (average 16.8 days) (Table 1). The duration of the first instar nymph was observed to vary from 2-3 days with an average of 2.4 days. The duration of second, third, fourth and fifth instar nymphs lasted for 2.8, 3.2, 3.8 and 4.6 days, respectively (Table 1). Out of five nymphal instars, the maximum nymphal duration (five days) was recorded in fifth instar.

Male and female longevity were observed from 12.5 to 15.5 days and 21 to 24 days, respectively. Total life cycle of the female and male lasted for 38.8 and 30 days, respectively (Table 1).

Table 1. Biology of predatory stink bug *Eocanthecona furcellata* (Wolff.) on the larvae of *Maruca vitrata* Geyer

	Egg incubation period	Nymphal period (Days)					Total nymphal period	Adult longevity (Days)		Total life cycle of male	Total life cycle of female
	(Days)	First	Second	Third	Fourth	Fifth	(Days)	Male	Female	(Days)	(Days)
	6	2	3	3	4	5	17	12.5	24	29.5	41
	5	2	3	3	3	4	15	15.5	21	30.5	36
	5	3	3	3	4	5	18	12.5	24	30.5	41
	5	2	3	3	4	5	17	13.0	23	30.0	38
	4	3	2	4	4	4	17	12.5	21	29.5	38
Mean	5	2.4	2.8	3.2	3.8	4.6	16.8	13.2	22.6	30	38.8
SD±	0.70	0.54	0.44	0.44	0.44	0.54	1.09	1.30	1.51	0.50	2.16

The present study were in accordance with the studies carried out by Kumar and Singh (2007) who reported the average nymphal period of the bug as 16.78 days which is close to present observations (16.8 days). The male and female longevity observed by them were about 14.30 days and 23.24 days which are close to present observations (13.2 days and 22.60 days).

Tabasa (1991) also reported that the incubation period of *E. furcellata* ranged from 3-7 days. The average duration of first and fifth nymphal instar was 2.40 and 4.50 days, respectively. Ray and Khan (2001) reported the average longevity of adult *E. furcellata* as 38.25 days.

Predation of E. furcellata on larval instars of M. vitrata

The results revealed significant differences in predation of different instars of *E. furcellata* which attacked different instars of *M. vitrata*. Results in Table 2 indicate that the first instar larvae were more prone to adult's predation and maximum predation of 56.40 per cent by female was recorded. The trend of predation gradually increased from the 2nd instar to 5th instar nymphs. The per cent predation was 7.60, 17.20, 35.60, 43.60, 56.40 and 50.33 by 2nd, 3rd, 4th and 5th instar nymph, female and male adults, respectively.

Significantly maximum per cent predation was recorded by female adult (66.47 per cent) followed by 58.33, 41.80, 37.20, 20.00 and 13.80 per cent by male, 5th 4th, 3rd and 2nd instar nymph, respectively. Predation of the second and third instar was significantly less. It means that adults and late instar nymphs of predatory bug controlled more effectively the second instar larvae of *M. vitrata* than other instars.

Results revealed that the significantly maximum per cent predation was recorded by female adult (61.64 per cent) followed by male adult (55.40 per cent), fifth instar (25.60 per cent), fourth instar (20.40 per cent), third instar (15.20 per cent) and second instar (3.80 per cent) (Table 2).

Among the fourth instar larvae of *M. vitrata* host, significantly maximum per cent predation was recorded by female bug adult (53.19 per cent) followed by male adult (44.79 per cent), fifth instar

Table 2. Predatory potential of *Eocanthecona furcellata* (Wolff.) on larval stages of *Maruca vitrata* Geyer

Stage of predator	Larval stage of host (*M. vitrata*)* (No./Predator)				
	First instar	Second instar	Third instar	Fourth instar	Fifth instar
Nymph					
Second	7.60	13.80	3.80	5.80	4.00
	(15.99)	(21.79)	(11.13)	(13.92)	(11.50)
Third	17.20	20.00	15.20	13.80	7.92
	(24.49)	(26.55)	(22.93)	(21.79)	(16.34)
Fourth	35.60	37.20	20.40	17.80	11.76
	(36.63)	(37.58)	(26.84)	(24.94)	(20.03)
Fifth	43.60	41.80	25.60	11.60	11.60
	(41.32)	(40.27)	(30.38)	(19.87)	(19.90)3
Adult					
Female	56.40	66.47	61.64	53.19	36.79
	(48.67)	(54.61)	(51.73)	(46.82)	(37.33)
Male	50.33	58.33	55.40	44.79	41.45
	(45.19)	(49.79)	(48.10)	(42.00)	(40.07)
SEM	0.253	0.323	0.506	0.398	0.355
CD at 5%	0.740	0.945	1.47	1.16	1.03

(11.60 per cent), fourth instar (17.80 per cent), third instar (13.80 per cent) and second instar (5.80 per cent) were observed.

Maximum predation (41.45%) was recorded by male followed by female, fifth instar, fourth instar, third instar, and second instar nymphs of bug was recorded to be 36.79, 11.60, 11.76, 7.92 and 4.00, respectively. Older larvae of the host were less preferred by bug and it was very clearly indicated in the Table 2 that the predator preferred less per cent of fourth and fifth instar larvae of *M. vitrata*.

Adults of *E. furcellata* in comparison to its nymphal instar were excellent predators because the maximum predation was recorded only by adults on larvae of *M. vitrata*.

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