International Journal of Bioresource Science
Citation: IJBS: 2(2): 157-161 December 2015
DOI: 10.5958/2454-9541.2015.00011.0

Biology of mirid bug, *Creontiades biseratense* (Hemiptera: Miridae)

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Abstract

Bacillus thuringiensis is a naturally occurring soil bacterium that produces a protein which is toxic to insect pests. Mirid bugs apparently prefer to feed on the apical meristematic tissues, developing floral buds and developing seeds. Feeding damage can cause floral bud and young fruit destruction, resulting in severe reductions of seed set. Biology and morphometrics of cotton mirid bug (*Creontiades biseratense*), were studied at College of Agriculture, Raichur, UAS Dharwad under laboratory conditions. Bio-ecology of cotton mirid bug (*Creontiades biseratense*) indicated that eggs are transparent nacreous white, cigar shaped laid signally or in groups on squares, tender bolls and leaf tissues. The bug had five nymphal instars with a mean nymphal duration of 15.27 days. The total lifecycle of male and female was 34.92 and 42.72 days respectively and 35.52 and 44.22 with a mean fecundity of 135.40 and 140.90 eggs per female without honey and with honey respectively at room temperature.

Keywords: Bt cotton, mirid bug, biology

The main thrust of Indian cotton growers has so far been towards the repeated application of synthetic pesticides to combat pest problem. This excessive use of pesticides intensifies the pest problem and complicates pest control strategies besides causing massive ecological disruption and posing a threat to human health. The four R's Resurgence, Resistance, Residues and Replacement are the most potential problems associated with the indiscriminate use of pesticides in cotton agro-ecosystem and have made cotton cultivation non-profitable. Cultivation of Bt cotton would lead to reduction in the use of broad spectrum insecticides, conservation of natural enemies, non-target organisms, decrease in soil and water contamination and brings health benefits to the farm workers and others who come in contact with these insecticides (Bambawale *et al.* 2004). Cultivation of Bt cotton for the last three to four years is more specific to bollworms and no effect on sucking pests. Reduction of number of sprays, use of more specific insecticides led to secondary pests gaining more importance on Bt cotton *viz.* aphids and leaf hoppers (Anon, 2002), aphids and thrips (Sun Chang Gui *et al.* 2002), whiteflies (Anon, 2003), aphids and spiders mites (Deng Shudong *et al.* 2003), leafhoppers (Hedge, *et al.* 2004), mirid bugs (Patil *et al.* 2006) and mealy bugs (Anon., 2007). Lygus bugs apparently prefer to feed on the apical meristamatic tissues, developing floral buds and developing seeds. Feeding damage can cause floral bud and young fruit destruction, resulting in severe reductions of seed set and quality on various crops (Butler, 1923). Hence,

we studied biology and morphometrics of *Creontiades biseratense* under laboratory conditions which is useful to evolve appropriate control measures under field conditions.

Materials and methods

The biology of mirid bug on Bt cotton was studied in the laboratory conditions, Department of Entomology, College of Agriculture, Raichur, UAS, Dharwad during 2006-2007. Last instar nymphs from Bt cotton hybrid were maintained as culture in medium sized plastic containers till they become adults. From this culture, mating pairs were selected and multiplied on the potted cotton plants to obtain the pure culture. Fourty eggs were collected from potted cotton plants and kept in petri dishes of 7.5 cm diameter for hatching and observations were made on the changes that took place during incubation period. Two sets of ten pairs of freshly hatched nymphs were transferred to fresh Bt cotton squares in medium sized petri dishes individually and one set was provided additional food with honey and observation on nymphal development was taken at 12 hours interval. Two sets of ten pairs freshly emerged adults were paired based on size and genitalia and released in to petri dishes containing fresh cotton squares and one set provided additional food with honey and observed for mating. The oviposition period was recorded from two sets, each set containing ten pairs and one set provided additional food with honey and observations recorded from first egg laid by the female to last egg and total number of eggs laid by each female was recorded separately. The observation on post oviposition was also made with in this cage at 12 hours interval. Fecundity was recorded by totalling the number of eggs laid during the oviposition period for each female. Adult longevity was calculated by pooling the newly emerged adult, pre-mating, mating, pre-oviposition, oviposition and post oviposition period. Further, longevity of male was also recorded and both sexes were used for description. A separate culture was maintained to obtain all stages viz., eggs, nymphal instars and adults were measured with the ocular micrometer after calibrating with the stage micrometer.

Results and discussions

The mean incubation period of *C .biseratense* was 6.45 ± 0.68 days with a range of 5-7 days. Similar findings were also made by Ratnadass *et al.* (1994). They reported 5-7 days egg incubation period in case of *C. Pallidus.* The mean length of egg was 1.06 ± 0.05 mm and breadth was 0.25 ± 0.03 mm. The present findings were in close agreement with Kelton (1975) who reported eggs of *Lygus* bugs measuring 1.00 mm length. The mean duration of first instar varied from 2.50 ± 0.51 days, with a range of 2-3 days. The present results were similar to the findings of Foley and pyke (1985). They reported 2.97 days for *C. dilutus.* The mean duration of second instar nymphal period was 2.57 ± 0.43 days with a range of 2-3 days. Similar findings were also obtained by Foley and pyke (1985). They reported 2.20 days for *C. dilutus.* The second instar nymphs measured 2.10 ± 0.09 mm and 0.62 ± 0.01 mm length and breadth respectively. The mean duration of third instar nymphal period was 2.70 ± 0.30 days with a range of 2-3 days. The present findings are in agreement with the reports of Foley and pyke (1985) and Ratnadass *et al.* (1994) who reported 2.63 days for *C. dilutus* and 1-3 days for *C. pallidus* respectively. The mean length and breadth was 2.55 ± 0.04 mm and 1.09 ± 0.04 mm respectively. The mean duration of fourth instar nymphal period was 3.67 ± 0.30 days with a range of 3-4 days. The mean length and breadth was 3.26 ± 0.03 mm and 1.48 ± 0.04 mm respectively. The present findings are in agreement with the reports of Foley and pyke (1985) and Ratnadass *et al.* (1994) who reported 2.48 days for *C. dilutus* and 2-3 days for *C. pallidus* respectively. The mean length and breadth was 3.26 ± 0.03 and 1.48 ± 0.04 mm respectively. The mean duration of fifth instar nymphal period was 3.83 ± 0.58 days with a range of 3-5 days. The present findings are in close agreement with the reports of Foley and pyke (1985) and Ratnadass *et al.* (1994) who reported 4.33 days for *C. dilutus* and 2-4 days for *C. pallidus* respectively. The final instar nymph measured about 4.70 ± 0.60 mm in length and 2.27 ± 0.03 mm in breadth. The total nymphal period was 15.27 ± 2.12 days with a range of 12-18 days. The present findings corroborates partially with the findings of Ratnadass *et al.* (1994)

Table 1: Biological parameters of mirid bug, C, biseratense

Stage	Mean±SD	Range
Egg (Incubation period) (Days)*	6.45 ± 0.68	5-7
Nymphal duration (Days)*		
I instar	2.50 ± 0.51	2-3
II instar	2.57 ± 0.43	2-3
III instar	2.70 ± 0.30	2-3
IV instar	3.67 ± 0.30	3-4
V instar	3.83 ± 0.58	3-5
Total nymphal period (Days)*	15.27 ± 2.12	12-18
Premating period (Days)*	1.75 ± 0.42	1-2
Mating period (Days)*	3.60 ±.51	3-4
Pre oviposition period (Days)**	2.60 ± 1.33	2-3
Oviposition period (Days)**	10.30 ± 1.22	8-12
Post oviposition period (Days)**	6.20 ±1.22	4-8
Fecundity (Number of eggs)		
Only on cotton plants**	135.40 ± 31.12	72-170
Cotton plants with honey**	140.90 ± 32.24	75-185
Adult longevity (Days)		
Male**	13.20 ± 2.61	10-14
Female**	21.00 ± 3.50	15-25
Adult longevity with honey (Days)		
Male**	13.80 ± 2.61	10-17
Female**	22.50 ± 4.50	17-28
Total life cycle (Days)		
Without honey		
Male**	34.92 ± 5.07	27-39
Female**	42.72 ± 6.30	32-50
With honey		
Male**	35.52 ± 5.41	27-42
Female**	44.22 ± 7.30	34-53

Table 2: Morphometry of mired bug, C. biseratense

Stage	Length (mm)		Breadth (mm)	
	Mean ± SD	Range	Mean ± SD	Range
Egg	1.06 ± 0.05	1.00 - 1.10	0.25 ± 0.01	0.23 - 0.28
Nymphal stages				
I instar	1.17 ± 0.05	1.10 - 1.25	0.36 ± 0.03	0.30 - 0.40
II instar	2.10 ± 0.09	2.00 - 2.20	0.62 ± 0.01	0.60 - 0.64
III instar	2.55 ± 0.04	2.50 – 2.60	1.09 ± 0.04	1.00 - 1.10
IV instar	3.26 ± 0.03	3.20 – 3.30	1.48 ± 0.04	1.40 - 1.90
V instar	4.70 ± 0.06	4.60 – 4.80	2.27 ± 0.03	2.20 - 2.30
Adult				
Male	5.75 ± 0.07	5.70 - 5.80	2.64 ± 0.04	2.55 - 2.70
Female	6.00 ± 0.07	5.90 - 6.10	2.93 ± 0.09	2.90 - 3.00

where in the total nymphal period ranging from 8-14 days for *C. pallidus.* The adult female lived longer as compared to males. The average male longevity was 13.20 ± 2.61 days and 13.80 ± 2.61 days without honey and with honey respectively. While, female lived for 21.00 ± 3.50 and 22.50 ± 4.50 days without honey and with honey respectively. The mean body length of male was 5.75 ± 0.07 mm and breadth was 2.64 ± 0.04 mm with a range of 5.70 to 5.80 mm and 2.55 to 2.70 mm length and breadth respectively. While, female measured 6.00 ± 0.07 mm in length and 2.93 ± 0.09 mm breadth with a range 5.90 to 6.10 mm and 2.90 to 3.00 mm length and breadth respectively. The newly paired male and female mated after two to three days of emergence and mating losted up to 3-4 hours. The average pre-oviposition, oviposition and post ovipositional period was 2.60 ± 1.33, 10.30 ±1.22 and 6.20 ± 1.22 days respectivelywith a range of 2-3, 8-12 and 4-8 days respectively. The mean fecundity of *C. biseratense* was 135.40 ± 31.2 eggs and 140.90 ± 32.24 eggs without honey and with honey respectively and with a range of 72-170 eggs and 75-185 eggs per female without honey and with honey respectively. Total life cycle of male varied from 27-39 days with an average of 34.92 ± 5.07 days without honey and 27-42 days with an average of 35.52 ± 5.41 days with honey. Total life cycle of male varied from 32 to 50 days with an average of 42.72 ± 6.30 days and 34 to 53 days with an average of 44.22 ± 7.30 days without and with honey respectively. Information on the biology of *Creontiades biseratense* is lacking in the literature and these findings seems to be the first of its kind. However, the present findings are more or less similar to that of other mirid bugs with regard to total life cycle.

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