

RESEARCH ARTICLE

Biology of mirid bug, *Poppiocapsidea* (= *Creontiades*) *biseratense* (Hemiptera Miridae) on Bt cotton

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ABSTRACT

Detailed biology of the cotton mirid bug, *Poppiocapsidea* (= *Creontiades*) *biseratense* (Distant) (Hemiptera: Miridae) was studied at Raichur, India during 2011-12 season. Egg incubation period and nymphal development period ranged from 5-9 and 11-17 days, respectively. The duration of first, second, third, fourth and fifth nymphal instars were 2-5, 2-4, 2-3, 1-3 and 1-3 days, respectively. The male lived for 10-15 days while female lived for 16-22 days, fecundity varied from 80-165 eggs per female. Pre-oviposition, oviposition and post-oviposition period varied from 2-3, 9-14 and 4-8, days, respectively. All the developmental stages, nature of damage on Bt cotton and alternate hosts of mirid bug have been described. The adult female preferred to insert the eggs on petiole, followed by bracts, and flower petals. Both nymphs and adults were found to suck the sap by piercing their stylet into the plant tissues, squares and small tender bolls. The affected portion rapidly turns to dull in colour, then becomes blackens and ultimately dies. Affected parts gradually turned yellow, sunken and dropped down prematurely and symptoms like square staining, feeding punctures at the base of square, and on small bolls were found.

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INTRODUCTION

The plant bugs (Miridae) are the largest family of true bugs (Hemiptera: Heteroptera), comprising nearly 10,000 described species in approximately 1400 genera (Schuh, 1995). Within the Miridae family there is enormous variation in diet and feeding behaviour, including species that are major crop pests as well as important predators of crop pests (Gross and Cassis, 1991; Wheeler, 2001). Many phytophagous mirids are globally important pests of crops such as cotton, lucerne, soybean, mungbean, strawberry, sorghum, cocoa, apples and tea, and these species show enormous variation in diet, ranging from monophagy to polyphagy (Wheeler, 2001). Bt cotton has given solution to the bollworm complex to the larger extent but at the same time they were susceptible to most of the sucking pests. Due to large scale adoption of Bt cotton, there is considerable reduction of pesticide usage

which has led to emergence of a new pest, the mirid bug, *Creontiades biseratense* (Distant) which has assumed a major status in Karnataka (Patil *et al.*, 2006 and Udikeri *et al.*, 2009). However, the information on its biology is still fragmentary. Therefore, detailed studies were undertaken during 2006-07 season on the biology and morphology of the mirid bug on Bt cotton.

MATERIAL AND METHODS

The biology of the mirid bug was carried out at the Department of Agricultural Entomology, College of Agriculture and Main Agricultural Research Station, Raichur, Karnataka during 2011-12 *Kharif* season. The field collected final instar nymphs from Bt cotton hybrid were maintained as initial culture in plastic containers of size 15 cm (diameter) × 5.5 cm (height), till they became adults. From this culture, mating pairs were

Stage	Mean \pm SD	Range
Egg (incubation period) (days)*	6.71 \pm 1.34	5-9 days
Nymphal duration (days)*		
I Instar	3.47 \pm 0.92	2- 5 days
II Instar	2.81 \pm 0.49	2-4 days
III Instar	2.68 \pm 0.38	2-3 days
IV Instar	1.73 \pm 0.45	1-3 days
V instar	1.9 0 \pm 0.58	1-3 days
Total nymphal period (days)*	12.60 \pm 0.71	11-17 days
Premating period (days)**	1.60 \pm 0.51	1-2 days
Mating period (hours)**	3.72 \pm 0.64	3-5 hour
Preoviposition period (days)**	3.35 \pm 0.53	2-3 days
Oviposition period (days)**	9.00 \pm 0.81	9-14 days
Post oviposition period (days)**	6.70 \pm 0.71	4-8 days
Fecundity (number of eggs)**	126.10 \pm 10.65	80-165
Adult longevity (days)		
Male**	11.50 \pm 1.58	10-15 days
Female**	19.10 \pm 1.79	16-22 days
Total life cycle (days)		
Male**	32.70 \pm 3.23	28-36 days
Female**	40.40 \pm 2.27	30-42 days

* = Mean of 20 observations

** = Mean of 10 observations

Stage	Length (mm)*		Breadth (mm)*	
	Mean \pm S.D.	Range (mm)	Mean \pm S.D.	Range (mm)
Egg	0.93 \pm 0.04	0.89-0.99	0.28 \pm 0.04	0.21-0.33
Nymphal stages				
I Instar	1.52 \pm 0.04	1.48-1.60	0.44 \pm 0.04	0.40 -0.50
II Instar	2.51 \pm 0.05	2.44-2.58	0.61 \pm 0.03	0.59 -0.68
III Instar	2.88 \pm 0.08	2.79-3.00	1.21 \pm 0.20	0.98 -1.40
IV Instar	3.52 \pm 0.02	3.48-3.55	1.57 \pm 0.04	1.50 -1.62
V Instar	4.94 \pm 0.08	4.81-5.01	2.71 \pm 0.39	2.12 -3.01
Adult				
Male	5.52 \pm 0.50	4.80- 6.21	2.62 \pm 0.22	2.12 -2.89
Female	6.24 \pm 0.57	5.32-7.10	2.96 \pm 0.12	2.78 -3.22

* Mean of 10 observations

selected and multiplied on the potted cotton plants to obtain the pure culture. Forty eggs were collected from potted cotton plants and kept in Petri dishes of size 9 cm (diameter) \times 1.2 cm (height) for hatching. The Petri dishes were provided with blotting paper at the bottom to protect the eggs from desiccation and observations were made on the changes that took place during incubation period. Ten pairs of freshly hatched nymphs were transferred to fresh Bt cotton squares in 90 mm diameter sized Petri dishes individually. Cotton squares were collected daily in the morning and evening from unsprayed fields of Bt cotton maintained for the study and replaced with fresh ones. Observation on nymphal development was taken at 12 hours interval. The results have been furnished in Tables A and B.

RESULTS AND DISCUSSION

The female bug inserted the eggs singly or in groups on the petiole, bracts and flower petals. The freshly laid eggs were nacreous white in colour and cigar shaped. Two days before hatching, egg turned to pinkish colour, and developed a pair of shiny red spots at the anterior end representing compound eyes (Plate 1). Hook shaped egg cap was formed at the anterior end which aided in hatching. The incubation period of egg ranged from 5 to 9 days with a mean of 6.71 \pm 1.34 days. The mean length and breadth of egg was 0.93 \pm 0.04 and 0.28 \pm 0.04 mm, with a range of 0.89 mm to 0.99 mm and 0.21 mm to 0.33 mm, respectively.

P. biseratense has five nymphal instars. Nymphs were



a) : Mirid bug eggs inserted into the petiole



b) : Mirid bug eggs inserted into the flower petals



c) : Hook shaped egg cap of mirid bug egg

Plate 1: Eggs of mirid bug, *P. biserratense* on different parts of plant

green, or brown in colour and present inside the square, when disturbed, rapidly moved. Whereas, adults are swift fliers. The details of each nymphal stage are presented here under. The freshly hatched nymphs were transparent yellow in colour with the tip of antennae having reddish tinge and thorax with brownish or light reddish in colour and depending on feeding habit some turn to light green colour. The first instar nymphal period varied from 2 to 5 days with a mean of 3.47 ± 0.92 days. The average length and breadth of first instar was 1.52 ± 0.04 and 0.44 ± 0.04 mm, with a range of 1.48 - 1.60 mm and 0.40 - 0.50 mm, respectively. The present results are similar to the earlier findings of Foley and Pyke (1985) who recorded 2.97 days for *C. dilutus*. Similarly, Ratnadass *et al.* (1994) reported 1 to 3 days duration for first instar in *C. pallidus* with measurements of 1.52 ± 0.049 mm length and 0.448 ± 0.046 mm breadth.

The second instar nymph appeared light yellow or green in colour with brownish or reddish thorax. The period varied from 2 to 4 days with a mean of 2.81 ± 0.49 days. The average length and breadth of second instar was 2.51 ± 0.05 and 0.61 ± 0.03 mm with a range of 2.44 - 2.58 mm and 0.59 - 0.68 mm, respectively. The third instar nymphs were light yellow or green with brownish abdomen and brownish or reddish thorax and bigger than the second instar and wing pads were more prominent. The nymphal period varied from 2 to 3 days with a mean of 2.68 ± 0.38 days. The average length and breadth of third instar was 2.88 ± 0.08 and 1.21 ± 0.20 mm with a range of 2.79 - 3.0 mm and 0.98 - 1.40 mm, respectively.

The fourth instar nymphs were light yellow, green, brownish in colour and with brownish or reddish thorax and wing pads were more prominent than third instar. The nymphal period varied from 1 to 3 days with a mean of 1.73 ± 0.45 days. The average length and breadth of fourth instar was 3.52 ± 0.02 and 1.57 ± 0.04 mm with a range of 3.48 - 3.55 mm and 1.52 - 1.62 mm, respectively. The present findings are in close agreement with the reports of Foley and Pyke (1985) and Ratnadass *et al.* (1994) who reported 2.48 days for *C. dilutes* and 2 to 3 days for *C. pallidus*, respectively.

Fifth instar nymphs were light yellow or green with brownish thorax and very prominent wing pads. The fifth nymphal period varied from 1 to 3 days with a mean of 1.90 ± 0.58 days. The average length and breadth of fifth instar was 4.94 ± 0.08 and 2.71 ± 0.03 mm with a range of 4.81 - 5.01 mm and 2.12 - 3.01 mm, respectively (Plates 2 and 3). The present findings are in partial agreement with the reports made by Foely and Pyke (1985) and Ratnadass *et al.* (1994) who reported 4.33 days for *C. dilutus* and 2 to 4 days for *C. pallidus*, respectively. This variation may be due to change in species and climatic conditions.

The nymphs completed their entire period by sucking the sap from squares and small tender bolls. Moulting occurred in square by shedding exuvia which adhere to the inner side



Plate 2 : Different nymphal stages of mirid bug



Plate 3 : Colour morphs in different nymphal stages of mirid bug

of square at different instars. The total nymphal period ranged from 11 to 17 days with an average of 12.60 ± 0.71 days. The newly formed adults were light green in colour. After 10 to 14 hours, the body colour changed to reddish brown. Adults were brownish in colour with swift flying activity (Plate 4). Males were brownish in colour and smaller in size and it was 5.23 ± 0.50 mm and 2.62 ± 0.22 mm with a range of 4.80 – 6.21 mm and 2.12 – 2.89 mm, in length and breadth, respectively. The mean life span of male adult bug on cotton plants was 11.50 ± 1.58 days. The abdomen of female bug was slightly broader and elongate than male. The female bugs lived longer as compared to males with a mean adult longevity of 19.1 ± 1.79 days on cotton plant. Female measured was 6.24 ± 0.57 mm and 2.96 ± 0.124 mm with a range of 5.32 – 7.10 mm and 2.78 – 3.22 mm, in length and breadth, respectively.

Pre-mating period ranged from 1 to 2 days with an average of 1.6 ± 0.51 days. The duration of mating period ranged from 3-5 hours with a mean of 3.72 ± 0.64 hours. The pre-oviposition period ranged from 2 to 3 days with an average of 3.35 ± 0.53 days. The adult female preferred to lay the eggs on petiole, followed by bracts, flower, and on small squares. The oviposition period ranged from 9 to 14 days with a mean of



Plate 4 : Adult female and male of mirid bug

9.00 ± 0.81 days. Females lived longer than males. The post oviposition period ranged from 4 to 8 days with a mean of 6.7 ± 0.71 days. The fecundity per female ranged from 80 to 165 eggs per female with an average of 126.1 ± 10.65 eggs per female.

The longevity of males ranged from 10 to 15 days with an average of 11.50 ± 1.58 days. The longevity of females ranged from 16.0 to 22.0 days with average of 19.1 ± 1.79 days. The total life cycle of mirid bug, *P. biseratense* from egg to death of male adult under laboratory condition ranged from 28 to 36 days with a mean of 32.7 ± 3.23 . While, total life cycle from egg to death of adult female ranged from 30-42 days under laboratory condition with a mean of 40.4 ± 2.27 . The present results were similar to the findings of Udikeri *et al.* (2010) who reported that the most preferred site of oviposition was petiole where 85.4 per cent eggs were deposited particularly on its basal one fourth portions. Further, the present results were deviating to findings of Ravi and Patil (2008) who reported that eggs were deposited on the ventral side of the leaf, on square and petiole.

Nature of injury :

Both nymphs and adults were found to suck the sap by piercing their stylet into the plant tissues, squares and small tender bolls. The affected portion rapidly turns to dull in colour, then blackens and dies. Favoured plant parts for feeding are the squares of all sizes, young leaves and small bolls. Mirids also fed on the stalk (peduncle) of small squares since they are soft enough to penetrate with their stylet (Plate 5). Affected parts gradually turned yellow, sunken and dropped down prematurely and symptoms like square staining, feeding punctures at the base of square, and on small bolls were found. The present results were similar to the findings of Khan *et al.* (2004) who reported that, cotton mirid bug *C. dilutus*, pierced its stylet into the plant tissue and released the pectinase enzyme and other chemicals that destroy the cells in the feeding zone.



Plate 5 : Stylet of adult mirid bug

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