Annals of Plant and Soil Research 16(1): 29-31(2014)

BIOLOGICAL STUDY OF COTTON JASSID, *AMARASCA BIGUTTULA BIGUTTULA* (ISHIDA) ON *BT* COTTON UNDER *INVIVO* CONDITIONS

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Received: September, 2013; Revised accepted: February, 2014

ABSTRACT

Biology of leafhopper, Amrasca biguttula biguttula (Ishida) on Bt cotton, was studied under laboratory conditions. The mean developmental periods of egg, first, second, third, fourth and fifth nymphal instars were 6.63±0.62, 2.35±0.35, 3.20±0.62, 2.85±0.45, 2.62±0.41 and1.50±0.60 days, respectively. The total nymphal period was 14.30±2.52 days. The pre mating and mating, pre oviposition, oviposition and post oviposition periods were 1.52±0.45 and 4.50±0.38 minutes, 3.20±0.70, 6.50±0.85 and 2.50±54 days, respectively. The fecundity averaged to 16.50±3.00 eggs. The longevity of male was 13.35±1.16 and female was 14.50±1.82 days. The life cycle ranged from 24 to 41 days. The average lengths and breadths of the egg, first, second, third, fourth and fifth nymphal instars were 0.62±0.03 and 0.17±0.03, 0.65±0.04 and 0.21±0.03, 1.11±0.18 and 0.28±0.04, 0.28±0.04 and 0.45±0.03, 1.90±0.14 and 0.54±0.04, 2.34±0.16 and 0.54±0.04 mm, respectively. The average lengths and breadths of male was 2.42±0.05 and 0.71±0.02 mm while female was 2.71±0.03 and 0.71±0.03, respectively.

Key words: *Amrasca biguttula biguttula,* biological study, *Bt* cotton, leafhopper.

INTRODUCTION

Cotton (*Gossypium* spp) commonly known as "White Gold" is an important commercial crop and grown for its lint and seed which are valuable raw materials for textile and oil industries. It is grown under different agro climatic conditions throughout the world. In India, it is cultivated in about 111.61 lakh ha. with the production of 312 lakh bales and productivity of 475 kg/ha. Leaf hopper is one of the important sap feeders among the sucking pests of this crop. The desaping by leaf hoppers causes "Hopper burn" symptoms on leaves and become one of the limiting factors in higher productivity of cotton. The increasing trend of infestation of leafhopper on *Bt* cotton, compelled to give the emphasis on biological study.

MATERIALS AND METHODS

The biology of cotton leafhopper *A. biguttula biguttula* (Ishida) was studied from the start of August to the end of November, 2011, on *Bt* cotton hybrid Dr. Brant (BG-II) under the laboratory conditions at 25-30^{O}C and 70-80 per cent relative humidity at College of Agriculture, Indore. The pure culture was initiated with field collected final instar nymphs. These nymphs were released in potted cotton plants covered with muslin cages. The identification of nymphs was based upon the extent of wing pads developed up to fourth abdominal segment. These nymphs were maintained in rearing cages up to transformation into adult. The identification of male and female sexes was made through genetilia and abdominal characters. One pair of male and female was introduced into a microcage of size 7×5cm for oviposition and fecundity studies. Micro cage was fixed to the cotton leaf in such a way that leaf was inserted into it from one side and the other side of it was covered with the muslin cloth.

To observe the pre oviposion period a pair of newly emerged leafhoppers were released into a micro cage containing single cotton leaf. Micro cage was opened daily and leaves were processed using lacto phenol acid fuchsion chemical and observed the oviposion period from first to last egg was laid. Oviposition period was recorded from the first laid egg to the last laid egg. Total numbers of eggs laid by females were also recorded. The incubation period was recorded under room temperature in laboratory condition (Temperature 25-30^{O}C and relative humidity 70-80%). Observation on nymphal instars were taken by transferring freshly hatched nymphs into the glass containers containing cotton leaf with leaf stalked in a small vial containing water. On the basis of moulting or casted skin, the number of instars and required days for each instar were recorded. The length and width of each instar was also recorded with the help of microscope using software. The newly emerged adults were entered in micro cage, fixed to a single cotton leaf with food to observe the adult longevity, where as the adults were simply released in the glass containers without cotton leaf for recording the adult longevity without food. The measurements (mm) on length and breadths of these stages were taken by microscope using software.

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RESULT AND DISCUSSION

The egg lying by female leafhoppers was noticed in the leaf tissue singly on mid rib and other veins. Egg was observed translucent, slightly hooked towards the anterior end and the other end was pointed. The egg on an average measured 0.62±0.03mm in length and 0.17±0.03 mm in breadth. The incubation period was observed in the range of 6.50 to 8.50 days and averaged as 6.63±0.62 days (Table 1). Similar findings were reported by Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.*(2009) who observed the similar morphological characters of egg. The present investigations are in close agreement with the findings of Sharma and Sharma (1996), Sharma and Sharma (1997), Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.* (2009) who recorded the incubation period as 6.44, 6.27,4-5, 6-7 and 6.53 days, respectively.

The first instar nymph was noticed as transparent and yellowish in colour with conspicuous reddish brown and oval eyes. Its duration ranged from 2.50 to 3.50 days, and averaged as 2.35±0.35 days (Table 1). The average length and breadth was recorded as 0.65±0.04mm and 0.21±0.03mm, respectively. These findings are in close conformity with the findings of Bhalane and Paiel (1981), Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.* (2009). However, in the present findings the duration and morphological characters of the first instar nymph had partial variation with the findings of above scientists which might be due to change in laboratory temperature and genotype used for study.

Table 1: Biology and morphological characters of leafhopper, *Amarasca biguttula biguttula* on Bt cotton under laboratory conditions

Stage of development*	Range (Days)	Mean ± SD	Morphological characters of different stages of leafhopper			
			Length (mm)		Breadth (mm)	
			Range	Mean ± SD	Range	Mean ± SD
Egg	6.50-8.50	6.63±0.62	0.51-0.65	0.62±0.03	0.13±0.21	0.17±0.03
Nymphal period						
I instar	2.50-3.50	2.35±0.35	0.63-0.74	0.65±0.04	0.15-0.24	0.21±0.03
II instar	2.50-4.00	3.20±0.62	0.94-1.30	1.11±0.18	0.18-0.32	0.28±0.04
III instar	2.00-4.50	2.85±0.45	1.21-1.31	1.30±0.08	0.36-0.47	0.45±0.03
IV instar	2.00-3.50	2.62±0.41	1.72-2.12	1.90±0.14	0.49-0.59	0.54±0.04
V instar	1.50-3.00	1.50±0.60	2.04-2.57	2.34±0.16	0.51-0.62	0.54±0.04
Total nymphal period	10.50-18.50	14.30±2.52	-	-	-	-
Premating period	1.00-2.00	1.52±0.45	-	-	-	-
Mating period (min)	4.00-5.00	4.50±0.38	-	-	-	-
Pre ovipositional period	2.52-4.50	3.20±0.70	-	-	-	-
Ovipositional period	5.50-8.50	6.50±0.85	-	-	-	-
Fecundity (number)	15.00-18.00	16.50±3.00	-	-	-	-
Post ovipositional period	1.00-3.00	2.50±54	-	-	-	-
Adult longevity						
Male with food (days)	11.00- 16.00	13.35±1.16	2.37-2.52	2.42±0.05	0.67-0.75	0.71±0.02
Male without food (hours)	11.00- 13.00	12.30±0.51	-	-	-	-
Female with food (days)	13.00- 18.00	14.50±1.82	2.66-2.73	2.71±0.03	0.67-0.76	0.71±0.03
Female without food (hours)	15.50- 19.50	17.50±1.52	-	-	-	-
Total life cycle	24.00-41.00	32.00±1.96	-	-	-	-

**Mean of 10 observations*

In the second instar nymph externally marked white eyes were observed. On the posterior side meso and meta thorax and wing pad were observed slightly. The second instar nymphal period was ranged from 2.50 to 4.00 days, with an average of 3.20±0.62 days. The average length and breadth was measured as 1.11±0.18mm and 0.28±0.04mm, respectively (Table 1). These findings are almost in association with the findings of Bhalane and Paiel (1981), Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.* (2009). Morphologically the third and fourth instar nymphs appeared yellowish green with small wing pad and average period was noticed as 2.85±0.45 days and 2.62±0.41 days, respectively. The average length and breadth of third and fourth instars were 1.30±0.08 mm and 0.45±0.03 mm and 1.90±0.14 mm and 0.54±0.04 mm, respectively. The fifth instar nymph was greenish yellow in colour and its mean period was 1.50±0.60 days. The mean length and breadth was 2.34±0.16 mm and 0.54±0.04 mm, respectively. The total nymphal period was averaged as 10.50 to 18.50 days with an average of 14.30±2.52 days (Table 1). Observations recorded on all the parameters of nymphal stages showed the close

association with the findings of Bhalane and Paiel (1981), Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.*(2009). The slight variation in present findings might be due to the factors, stated earlier. The average premating period was observed as 1.52±0.45 days (Table 1) which was closely supported by Sharma and Sharma (1996), Sharma and Sharma (1997) and Hanumanthappa Madar (2003) who observed this period as 1.7, 2.55 and 1.45 days, respectively. Further, average mating period was noted as 4.50±0.38 minutes. Mating was noted from 7.30 am to 8.30 am and during late evening from 6.00pm to 7.30 pm. These findings are in close conformity with the findings of Thirumalaraju (1984) and Hanumanthappa Madar (2003) who noted mating period as 5.00 minutes of *Empoasca devastans*, 4.20 and 5-10 minutes of *A. biguttula biguttula*, respectively. The pre oviposition period was noticed as 3.20±0.70 days (Table 1) and it was supported with the findings of Sharma and Sharma (1996), Sharma and Sharma (1997), Hanumanthappa Madar (2003) and Shivanna *et al.* (2009) who reported this period as 3.1, 3.45, 3.75 and 3.30 days, respectively. The oviposition period was observed as 6.50±0.85 days which was closely supported with the findings of Singh (1978) and Hanumanthappa Madar (2003) who noticed 15.5 days of *Empoasca devastans* and 9.75 days of *A. biguttula biguttula*. Further the findings of Shivanna *et al.*(2009) and Sharma and Sharma (1996) are not in support of present study which might be due to change in experimental set up and also the laboratory condition, influenced the insect behaviour. Fecundity ranged from 15.00 to 18.00 eggs with a mean of 16.50±3.00 eggs (Table 1) which is in close conformity with the findings of Sharma and Sharma (1997), Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.*(2009) who recorded the fecundity as 17.5, 16-22, 14-24 and 17-24 eggs, respectively. The post oviposition period was recorded as 2.50±54 days (Table 1) which is in the support of Sharma and Sharma (1996), Sharma and Sharma (1997) and Shivanna *et al.*(2009) who observed this period as 3.1, 3.9 and 3.8 days, respectively.

Green coloured adults were observed with a pair of black dots on both the sides of vertex and sides of apical end of the tegmina. Genetalia of females was slightly bigger than males. Fed female's longevity was recorded as 13.00 to 18.00 days with an average of 14.50±1.82 days and of unfed female it ranged from 15.50 to 19.50 hours with an average of 17.50±1.52 hours. The average length and breadth of female leafhopper was 2.71±0.03 mm and 0.71±0.03 mm, respectively. Males contained blunt and round abdominal tip with prominent adeageus. Fed male´s longevity was noted as 11 to 16 days with its mean of 13.35±1.16 days and longevity of unfed male was as 11 to 13 hours with the average of 12.30±0.51hours. The average length and breadth of male leafhopper was 2.42±0.05 mm and 0.71±0.02 mm, respectively Table 1). The observations on morphological characters are in agreement with the findings of Thirumalaraju (1984), Hanumanthappa Madar (2003) and Shivanna *et al.* (2009). The results for adult longevity and total life cycle are in close conformity with the results of Shivanna *et al.* (2009) who reported that the life cycle was 19.00 to 35.00 days.

The results revealed that mean developmental periods of egg and the total nymphal period were noted in 6.63 ± 0.62 days and 14.30 ± 2.52 days, respectively. The life cycle ranged from 24 to 41 days. The lengths and breadths of male were averaged as 2.42 ± 0.05 and 0.71 ± 0.02 mm while in female it was 2.71± 0.03 and 0.71 ± 0.03mm

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