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Growth and development of *Amrasca biguttula biguttula* Ishida (Hemeptera, Cicadellidae) during different seasons on okra

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ABSTRACT: The influence of three seasons namely pre - kharif (Feb-May), kharif (May-Aug) and post-kharif (Aug-Nov) on the biology of jassid on okra under natural climatic conditions revealed that the developmental periods showed differences over seasons. The total nymphal period was longest in post-kharif (8.90±0.91days) followed pre-kharif (7.15±0.75 days) and the shortest during kharif (6.60±0.52 days). The longest total life span was observed in post-kharif (38.29±2.79) followed by pre-kharif (34.90±1.47 days) and shortest during kharif (33.75±1.89 days). Maximum eggs was laid in post-kharif (18.70±2.45 eggs/ female), followed by the pre-kharif (17.20±1.62 eggs/female) and least in kharif (16.20±1.55 eggs/ female). © 2022 Association for Advancement of Entomology

KEYWORDS: Biology, growth stages, pre-kharif, kharif, post-kharif, variation

Abelmoschus esculentus L. (Moench) is an important vegetable crop grown in tropical and sub-tropical parts of the world. Okra has occupied a prominent position among the export-oriented vegetables in India because of its high nutritive value, palatability and good post-harvest life. Among different insect pests infesting okra in terai region of West Bengal, fruit borer and jassid are key pests and considered as limiting factors in productivity of the crop okra. Jassid *Amrasca biguttula biguttula* Ishida (Homoptera, Cicadellidae), is a polyphagous pest and causes considerable damage to wide range of crops. The nymphs and adults suck the plant sap mainly from the lower surface of leaves and cause phytotoxic symptoms known as hopper burn which results in complete drying of leaves (Jayasimha *et al.,* 2012). In depth study of biology of this pest was attempted with sole motive to study the variation of growth stages in three different seasons.

The biology of *A. biguttula biguttula* was studied in instructional farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, India. The field collected final 30 instar nymphs of *A. biguttula biguttula* were released in potted Arka anemika variety of okra plants covered with net. The final instar nymphs were identified based upon the extent of wing pads developed and were maintained in rearing cages till they reach adult

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stage and lay eggs. After egg laying, the adults were removed. Observations were recorded for the incubation period and nymphal period. Ten pairs of newly emerged nymphs were collected and released on potted okra plant kept inside the cage size of 1 X 1m^2 wide with 1m height for eggs laying in five replications. The nymphs were observed at intervals of eight hours. The time of moulting was recorded when the exuviae were observed. The newly hatched nymph was considered the first instars and after moulting the nymphs were considered the second instars and so on. The number of instars and days required for each instar were recorded based on the moulted skin and size. The male and female sexes were identified based on the prominent adeagus in male and genetalia in female (Thirumalaraju, 1984). They were closely observed for matting and allowed egg laying. Cage was opened daily and the leaves were observed under magnifying glass for oviposition and this was continued till the last egg was laid. The duration of pre-oviposition, oviposition and post-oviposition were recorded.

Thirty newly emerged adults were transferred to fresh caged potted okra plant in 2:1 male-female sex ratio and allowed to mate. Each of the female was counted as a replication. Cage was opened daily and the leaves and fruits were observed under the magnifying lens to know the oviposition and this was continued till the last egg was laid. The sexed females laid translucent slightly oval shaped eggs scattered under the surface of the leaves of okra. In occasional case eggs were also laid on upper surface of leaves. The pre-oviposition, oviposition and post-oviposition duration were recorded. The total number of eggs laid by per female was recorded. Observations were recorded on incubation period, nymphal period and adult longevity. The time elapsed between the emergence of each individual and its death was recorded as longevity. The overall developmental duration from egg to adult were calculated for both male and female. The duration of each generation was estimated on the basis of the average length of the life cycle. SAS software (ver. 9.2) was used for data analysis. One way ANOVA was performed for each of the parameters and separation of the means was done using the Least Significant Difference test.

The overall developmental duration from egg to adult as well as the fecundity varied significantly over the seasons (Table 1).

Incubation period: The maximum duration of incubation period was found during post-kharif (9.10±0.88 days) followed by the pre-kharif (6.80±0.79 days) and kharif (6.60±0.70 days). The average incubation period of three seasons was 7.50±1.35 days.

Nymphal period: The jassid underwent through 5 nymphal instars before reaching the adult stage. The duration of each instar varied over the three different cropping seasons. The first instar nymph was longest in kharif (1.40±0.62) and pre-kharif (1.40±0.52) and shortest in post-kharif (1.50±0.53) with an average of 1.43±0.06. The development time of second instar nymph was longest in kharif (1.20±0.35) and pre-kharif (1.20±0.55) and shortest in post-kharif (1.55±0.44) with an average of 1.32±0.20. The third instar nymph took longest time in post-kharif (1.45±0.44a) and shortest during kharif (1.10±0.21) and pre-kharif (1.15±0.24) with an average of 1.23±0.19. The duration of fourth instar nymph was longest in post-kharif (2.00±0.47) followed by pre-kharif (1.60±0.39) and shortest in kharif (1.30±0.48). The longest development period of fifth instar nymph was recorded in post-kharif (2.40±0.52) followed by pre-kharif (1.85±0.24) and shortest in kharif (1.55±0.37) with an average 1.93±0.43 days. The total nymphal period was found longest in post-kharif (8.90±0.91days) followed pre-kharif (7.15±0.75 days) and the shortest during kharif (6.60±0.52 days). The total average nymphal period was 7.55±1.20 days.

Adult stage: In general, the females lived longer than the males. The females lived longer in the pre-kharif period (24.94±2.58), followed by the post-kharif period (24.55±1.19) and shorter in the kharif period (22.75±1.70). The longest male longevity was recorded in post-kharif period (22.65±1.29), followed by pre-kharif period (21.80±2.20) and shortest in kharif period (20.07±2.23). The mean

Table 1. Duration of developmental stages of *Amrasca biguttula biguttula* over seasons

	Pre-kharif	*Kharif*	*Post-kharif*	
Mean temperature (Min-max)	26.07°C (20.60-31.55 °C)	28.08 °C (23.65-32.50 °C)	27.37 °C (21.92-32.82 °C)	
Mean RH (Min-Max)	75.29% (71.97-78.61 %)	83.26% (78.69-87.83 %)	78.45% (74.73-82.16%)	
Developmental stages	Duration in days (Mean±SD)			
	Pre-kharif	Kharif	Post-kharif	Average
Incubation Period	6.80±0.79	6.60±0.70	9.10±0.88	7.50±1.35
Nymphal Period				
1st Instar	1.40±0.52a	1.40±0.62a	1.50±0.53a	1.43±0.06
2nd Instar	1.20±0.35a	1.20±0.55a	1.55±0.44a	1.32±0.20
3rd Instar	1.10±0.21b	1.15±0.24b	1.45±0.44a	1.23±0.19
4th Instar	1.60±0.39b	1.30±0.48b	2.00±0.47a	1.63±0.35
5th Instar	1.85±0.24b	1.55±0.37b	2.40±0.52a	1.93±0.43
Total	7.15±0.75b	6.60±0.52c	8.90±0.91a	7.55±1.20
Male longevity	21.80±2.20b	20.07±2.23c	22.65±1.29a	21.51±1.23
Female longevity	24.55±1.19a	22.75±1.70b	24.94±2.58a	24.08±1.56
Life cycle	34.90±1.47b	33.75±1.89b	38.29±2.79a	35.65±2.36
Fecundity	17.20±1.62b	16.20±1.55b	18.70±2.45a	17.37±2.23
Pre-oviposition	3.65±0.41a	3.45±0.44a	2.85±0.58b	3.32±0.42
Oviposition	17.30±1.34b	16.10±1.60c	18.44±2.28a	17.28±1.56
Post Oviposition	3.60±0.46a	3.20±0.42a	3.65±0.47a	3.48±0.19

Note: Within row means followed by the same letter(s) are not significantly different at 5% level

male and female adult life expectancy was found to be 21.51±1.23 and 24.08±1.56 respectively.

Life cycle: The number of eggs laid was higher in post-kharif (18.70±2.45 eggs/female), followed by pre-kharif (17.20±1.62 eggs/female) and the least number of eggs was laid in kharif (16.20±1.55 eggs/female). The average egg laying time of the three seasons was reported to be 17.37±2.23 days.

Fecundity: The number of eggs was higher in post-kharif (18.70±2.45 eggs/female) followed by the pre-kharif (17.20±1.62 eggs/female) and least number of eggs was laid in kharif (16.20±1.55 eggs/female). The average eggs of three seasons were recorded as 17.37±2.23 days.

Duration of oviposition: The period oviposition varied significantly. The longest pre oviposition was in pre-kharif (3.65±0.41days) followed by kharif (3.45±0.44) and shortest in post-kharif (2.85±0.58) with an average of 3.32±0.42. The longest oviposition period was recorded during post-kharif (18.44±2.28) followed pre-kharif (17.30±1.34) and shortest in kharif (16.10±1.60) with an average of 17.28±1.56. Post-oviposition period in post-kharif

was 3.65±0.47, followed by pre- kharif (3.60±0.46) and shortest during kharif (3.20±0.42) with an average of 3.48±0.19 (Table 1).

The incubation period of *A. biguttulla buguttulla* was recorded as 10 days during winter by Afzal and Ghani (1953) which confirms the post-kharif incubation. The incubation period of pre kharif and kharif recorded in the present study was supported by Rao (2003), Shivanna *et al.* (2009), Jayasimha *et al.* (2012), Jayarao *et al.* (2015), Kumar and Bhat (2012) and Shreevani *et al.* (2013). In the present observation, the average incubation period was obtained as 7.50±1.35. The results is consistent with Bhalani and Patel (1981) (7.00 days); Sharma and Sharma (1997) (7.30 days); 7.41±0.48 days (Jayasimha *et al.*, 2012) and Jayarao *et al.* (2015) (8.04±0.51 days). While shorter incubation of 4.50-5.30 days reported by Singh (1976) contradicts present incubation period. On other hand the longer duration were reported by, Shivanna *et al*. (2009) (11.68±3.74 days); Kumar and Bhat (2012) (16.9 to 17.6 days) and Shreevani *et al*. (2013) (12.30±2.42 days). Jayasimha *et al*. (2012) reported duration of different nymphal instar which is in accordance with the present study. The different nymphal period of post-kharif was in agreement with Jayarao *et al.* (2015). Shivanna *et al.* (2009) and Shreevani *et al.* (2013) reported longer duration of each nymphal period.

Jayasimha *et al.* (2012) reported the male and female longevity of 22.85±1.87 and 26.66 ±1.92 days respectively. This confirms the male and female longevity of post-kharif period. The 21 days of male longevity confirm the male longevity of pre-kharif but female longevity of 28 contradicts the female longevity of pre-kharif period (Kumar and Bhat, 2012). However Jayarao *et al*. (2015) reported shorter male and female longevity of 16 and 18 days. Jayasimha *et al.* (2012) observed that the pre-oviposition, oviposition and post-oviposition periods of 3.52±0.34, 16.54±0.37 and 3.85±0.24 days, which confirm the present pre-oviposition, oviposition and post-oviposition periods of pre-kharif and post-kharif. The pre- oviposition and post-oviposition period was also in line with the findings of Jayarao *et al.* (2015) and Shivanna *et al.* (2009); however shorter oviposition period of 6.65±0.26 and 3.90 days were recorded by the above workers respectively. The life cycle of pre-kharif, kharif and post-kharif was in close agreement to Jayasimha *et al.* (2012) and Sharma and Sharma (1997) as they observed life cycle of 30.31±2.07 days and 33.70 days respectively. However Shivanna et al. (2009) and Jayarao *et al.* (2015) reported shorter length of life cycle of 27.63 days and 29.50±1.96 days respectively.

The fecundity was found within the range of 16.20-18.70 in present study. The similar fecundity of 14.00 to 20.00 with an average of 16.60 ±1.98 eggs per female was also reported by the Jayasimha *et al*., (2012). Sharma and Sharma (1997) reported an average of 17.55 eggs per female with an average of 17.35. Jayarao *et al*. (2015) also obtained total fecundity of 17.53 ± 0.52 per female and Sharma and Sharma (1997) recorded the fecundity as 17.20 and 17.50 eggs. This confirms that the present fecundity of all the three seasons.

During the pre-kharif season the Jassid completed its life cycle with a shorter period of 34.90 days, suggesting a greater number of generations. Moreover, the fecundity of 17.20±1.62 in the pre-kharif season may lead to high population formation. On the other hand, in the kharif season, the shorter life cycle of 33.75 days indicates a higher number of generations, but the lower fecundity of 16.20 eggs/female and the heavy rains may prevent the jassid population from reaching a higher level. The highest fecundity was recorded in post-kharif (18.70±2.45). However, the longest life cycle of 38.29±2.79 may result in a lower number of jassid. The above information will be useful in the integrated pest management.

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