

Life history traits of *Cricula trifenestrata* (Lepidoptera: Saturniidae) feeding on *Mangifera indica*

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Abstract: The study was conducted to know the life history traits of *Cricula trifenestrata* feeding on the leaves of *Mangifera indica* in the laboratory condition. Results revealed that the fecundity of a female moth was 141.7 ± 11.79 , and observed hatching rate was $88.81 \pm 1.37\%$. The pre-oviposition, oviposition, larval and pupal period was found 2.3 ± 0.37 , 0.5 ± 0.03 , 28.5 ± 0.78 and 19.55 ± 0.59 days, respectively. The larvae passed through five instars and their consecutive durations were 5.3 ± 0.3 , 5.1 ± 0.31 , 6.1 ± 0.35 , 5.8 ± 0.33 and 6.2 ± 0.33 days. The longevity of male was found 2.9 ± 0.38 days and the female was 4.2 ± 0.28 days. The final instar larvae consumed the highest amount of leaf; while the 1st, 2nd, 3rd, 4th and 5th instar larvae consumed 0.50, 1.20, 2.80, 8.50 and 16.40g leaves, respectively. This information will help to develop effective control measure against this insect pest.

Key words: Life history, *Cricula trifenestrata*

Introduction

Mango (*Mangifera indica* L.) is one of the most popular fruit among millions of people in the orient and has a great economic importance in tropical and sub-tropical regions (Mondal *et al.*, 2004). Mango defoliator, *Cricula trifenestrata* Helfer is a destructive pest of mango. It is widely distributed in Asia, mainly tropical countries such as Bangladesh, India, Indonesia, Malaysia, Srilanka and Philippines. It is also distributed in Australia, Africa and South America (Mukherjee, 1953). Recently, mango defoliator has been found to cause serious damage to the mango plants in different parts of Bangladesh. It occurs occasionally in large number and all the varieties of mango are infested by this pest (Burhanuddin and Ahmed, 1989). The larvae are voracious eater and move from one side of the plant to another (Pal and Medda, 2006) and defoliate the whole plant leaving only the mid rib. The affected trees develop new shoots at odd times and no flowering and fruiting occur (Hossain, 1989). The adult moth is larger in size with the wing-span of 60-90 mm, and having reddish or yellowish-red body. This insect multiplies four times in a year and lives on mango and several other fruits as well as wild plants (Hossain, 1989). Management of this pest is now of great importance for mango growers. Before developing suitable control measures for any pest, sufficient information regarding life history is essential. So, the present study was undertaken to know the detail life history traits of mango defoliator.

Materials and Methods

Collection and rearing of insect

The life history traits of *C. trifenestrata* were studied in the laboratory of the Department of Entomology, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur during the period of April to July 2007. Male and female moths of *C. trifenestrata* were collected from the mango plant of BRAC centre, Dinajpur. For mating, five pairs of moths consisting of equal sex ratio were released in a small mango tree of HSTU campus. The tree was

covered with thin net to restrict the movement of the moths. The adult females were observed regularly at eight hours interval for their oviposition behaviour.

Biology

After mating the female moths laid eggs in rows at the edge of the mango leaves. The eggs were collected and they were kept in the laboratory at $25 \pm 2^\circ\text{C}$ and $75 \pm 5\%$ (RH) for hatching. After emergence, the first instar larvae were carefully collected with the help of a soft camel hair brush and were individually transferred in ten petridishes (one larva in each petridish). Medium aged fresh mango leaves (variety fazlee) were supplied every morning to each petridish as food and the leaves were renewed at 12 hours interval. Wet cotton was used to keep them fresh. Data were collected carefully to record the duration of developmental stages such as 1st, 2nd, 3rd, 4th and 5th instars larvae and the time of moulting on the basis of casting exuviae. The time elapsed between adult emergence and the first egg deposition was counted as the pre-oviposition period. The oviposition period was considered as the duration between the first and last egg laid by the female. Incubation period was considered the duration between the egg laying and egg hatching. The pre-pupation period was calculated by the time elapsed between the stopped of feeding and the pupation.

Measurement of leaf consumption

The amount of leaf consumed by each larval instar was measured daily by subtracting the weight of leaf before and after consumption. A mettler digital balance (model MR 220, No.971373) was used for this purpose. From laboratory stock culture, one newly hatched first instar larva was released into each petridish with ten replications. The medium mature leaves were supplied by making small pieces with the help of a sharp scissor. The initial weight of supplied leaf pieces in each petridish was taken separately. The amounts of leaf (g) consumed by a larvae within 24 hours were measured following the formula: $A = B - (C+D)$; where, A = weight of consumed leaves (g), B = initial weight of supplied leaves (g), C = weight of remnant leaves (g) and, D = weight of moisture loss from the control petridish (g).

Results and Discussion

Pre-oviposition, oviposition and incubation period

The females did not lay eggs just after attaining the adult stage. The pre-oviposition period varied from 1 to 4 days with an average of 2.3 ± 0.37 days (Fig. 1). The result of this study are in agreement with the result of Alam and Hazarika (1953) who reported that the pre-oviposition period ranged from 2 to 3.5 days with an average of 2.5 days. Huq *et al.* (1991) stated that the pre-oviposition period of *C. trifenestrata* was slightly over 2 days. A very short oviposition period was found and it was varied from 0.3 to 0.6 days, and the mean oviposition period was 0.5 ± 0.03 days (Fig. 1). Alam and Hazarika (1953) reported that the oviposition period of *C. trifenestrata* was 0.3 to 0.5 days which is supported by the present study. In this study, the incubation period varied from 7 to 11 days with an average of 8.7 ± 0.42 days (Fig. 1). Ali and Karim (1991) observed that the incubation period of mango defoliator was 9 to 10 days. Yadav and Kumar (2003) observed the incubation period of *C. trifenestrata* 10.40 ± 0.55 days feeding on large cardomon.

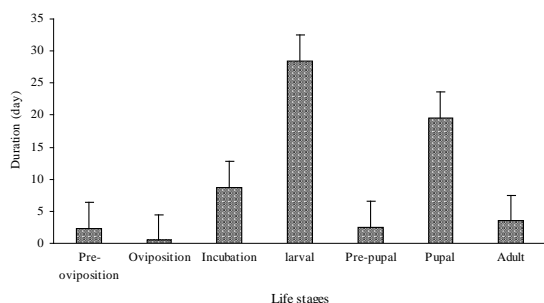


Fig. 1. Duration (mean ± se day) of different life stages of *C. trifenestrata* feeding on mango leaf

Larval, pre-pupal and pupal period

The total larval period was found 28.50 ± 0.78 days with the minimum of 25 days and the maximum of 32 days (Fig. 1). Huq *et al.* (1991) showed that the total larval period of *C. trifenestrata* ranged from 26 to 31 days with an average of 27.4 days. Ahmed and Alam (1994) observed that larval period of mango defoliator was 29.3 and 25.9 days for generation I and II, respectively. At the beginning of the pre-pupal period, the larva stopped feeding, became less active and did not move fast, and selected a hiding place such as surface of the leaves or stems or petridishes for pupation. The caterpillar made a golden silken cocoon with the help of secretion in which the larval transformation took place. The duration of the pre-pupa was 2 to 3 days with an average of 2.50 ± 0.17 days (Fig. 1). Ali and Karim (1991) found that the pre-pupal period of mango defoliator was 1 to 4 days with a mean of 2.8 days.

Adult period

The moths are nocturnal and they are yellowish or reddish in colour. The male possesses two dark spots on the fore wing. The females had 3 large irregularly

transparent spots on the forewings and a single one on the hind wing. The adult duration of moth was 3.55 ± 0.40 days (Fig. 1). It was supported by Hossain (1989) who found that the adult stage of mango defoliator as a moth lasted for 2 to 5 days only.

Fecundity and hatching rate

The female laid eggs in chain along the dorsal as well as ventral margin of the leaves. The fecundity of a female varied from 93 to 214 with an average of 141.70 ± 11.79 (Fig. 2). The hatching rate ranged from 82.67 to 95.67% with a mean of (88.81 ± 1.37) % (Fig. 2). Yadav and Kumar (2003) observed the range of the fecundity of *C. trifenestrata* from 157 to 252. Huq *et al.* (1991) showed that a female moth of mango defoliator laid 177.3 eggs of which 61 – 70 % hatched.

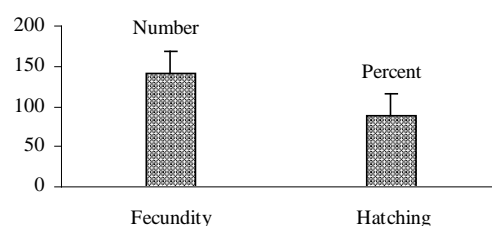


Fig. 2. Fecundity (mean ± se number) and hatching (mean ± se percent) of *C. trifenestrata* feeding on mango leaf

Duration of larval instars

It was observed that the larvae of *C. trifenestrata* passed through five instars with four moults. Just before moulting the larvae shrank and exhibited very slow movement and attached themselves to the surface of the petridish or leaves. After hatching, the soft bodied larva was light yellow to yellowish brown, which later turned to yellowish red with prominent dark brown head. The duration of the 1st larvae instar varied from 4 to 7 days with an average of 5.30 ± 0.30 days (Fig. 3). Ahmed and Alam (1994) observed the duration of the 1st instar larvae of *C. trifenestrata* 5.4 and 5.2 days for generation I and II, respectively. Huq *et al.* (1991) observed the duration of the 1st instar larvae 5.9, 5.6, 5.3 and 5.1 days for generation I, II, III, and IV, respectively. The 2nd instar larva came out by leaving the exuviae of the 1st instar. The body of the larva was clothed with tuft of long whitish and short blackish hairs arising from the tubercles. The general body colour of the larvae was combination of bands of red, yellow and black.. The results revealed that the duration of the 2nd instar larva was 4 to 7 with an average of 5.10 ± 0.31 days (Fig. 3). Ahmed and Alam (1994) stated that the duration of the 2nd instar larvae was 5.7 and 5.3, days for generation I and II, respectively.

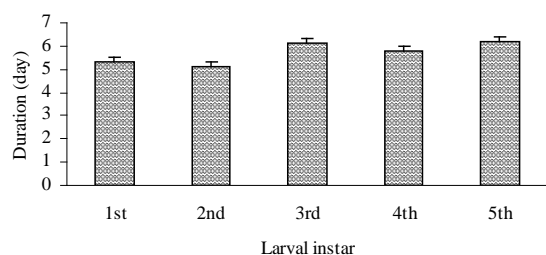


Fig. 3. Duration (mean ± se day) of different larval instars of *C. trifenestrata* feeding on mango leaf

The 3rd instar larvae were more active, fed more and increased in size. The color of the larva was reddish yellow with a blackish red head. There was a dense growth of softer whitish hairs, arising irregularly from the mid-dorsal area and the sides of each segment. Their prolegs were brick red in colour. The results indicated that the duration of the 3rd instar larvae lasted from 5 to 8 days with an average of 6.10 ± 0.35 days (Fig. 3). These results were in harmony with Ahmed and Alam (1994) who reported that the duration of the 3rd instar larva was 6.1 days. Whereas, Huq *et al.* (1991) found the duration of the 3rd instar larva was 6.4 days. The 4th instar larvae were similar to 3rd instar in color but they differ in size and shape. At this instar, the larvae seemed to be full grown as their size became remarkably large and fed more voraciously. Observation made on the duration of the 4th instar larvae varied from 4 to 7 days with an average of 5.80 ± 0.33 days (Fig. 3). These results were supported by Ahmed and Alam (1994) who found the duration of the 4th instar larvae were 6.0 and 5.1, days for I and II generation, respectively. Huq *et al.* (1991) observed that the 4th instar larvae lasted for 6.1 days. The full grown fifth instar larva was elongate, cylindrical and robust. The thorax and abdomen were brilliantly coloured by symmetrically arranged transverse alternating bands of black, yellow and red on the dorsal side of each segment. The average duration of final instar larvae lasted from 5 to 8 days with an average of 6.20 ± 0.33 days (Fig. 3). Huq *et al.* (1991) observed that the duration of 5th instar larvae was 6.1 days. Ahmed and Alam (1994) cited that the duration of the 5th instar larvae of *C. trifenestrata* was 6.1 for 1st generation and 5.0 days for 2nd generation.

Adult longevity

The female moths were larger than males in size, and the last abdominal segments of female were broader than that of the male. The results clarified that the longevity of male moth was 1 to 5 days with an average of 2.90 ± 0.38 days while the longevity of female moth was 3 to 7 days with an average of 4.20 ± 0.42 days. Yadav and Kumar (2003) observed the longevity of male and female moths was 4.08 ± 0.64 and 5.60 ± 0.87 days, respectively.

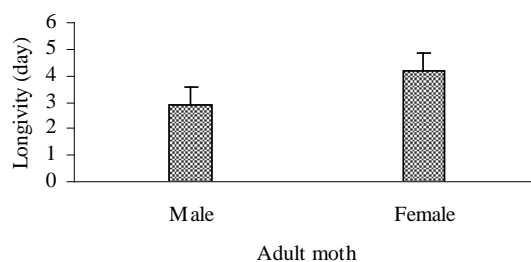


Fig. 4. Longevity (mean ± se day) of adult *C. trifenestrata* feeding on mango leaf

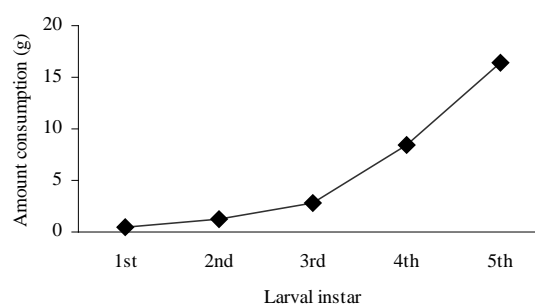


Fig. 5. Amount of leaf consumption by different larval instars of *C. trifenestrata* feeding on mango leaf

The data of the feeding behaviour revealed that 1st, 2nd, 3rd, 4th and 5th instar larvae consumed 0.50, 1.20, 2.80, 8.50 and 16.40 g leaves, respectively. The total leaf consumption by a larva was 27.2 g during the entire larval period of 28.50 days. It was observed that the final instar larva consumed the highest quantity of leaf among the instars. Ahmed and Alam (1993) cited that the mean leaf consumption of this insect was 35.75 g. They also observed that the leaf consumption by this insect from 1st to 5th instars larvae were 0.40, 0.59, 2.79, 13.27 and 18.67 g of leaves, respectively which is slightly different to the present finding. These variations might be due to the food materials used during the experiments. However, the information of the present study indicated an increased knowledge on the life history of *C. trifenestrata* that will be helpful for its management.

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