



BIOLOGY OF BRINJAL FRUIT AND SHOOT BORER, *LEUCINODES ORBONALIS*(GUENEE)

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ABSTRACT

Shoot and fruit borer, *Leucinodes orbonalis* is one of the most destructive pests of Brinjal in India. Laboratory experiments were carried out during 2017 in the Department of Entomology, CCS Haryana Agricultural University (HAU), Hisar to study its biology, which revealed that the eggs of this species were creamy white and laid singly. The average incubation period of eggs varied from 3.74 and 4.00 days during 1st and 2nd generations, respectively. There were five larval instars and the average larval duration varied from 11.50 to 12.85 days during 1st and 2nd generations, respectively. The pupa was dark brown in colour, oblong and the pupal period varied from 7.61 to 7.96 days during 1st and 2nd generations, respectively. The female abdomen was swollen; whereas, in the males, abdomen was cylindrical and thinner. Adult moths lived for 4.56 to 4.94 days during 1st and 2nd generations, respectively. The total life cycle of *L. orbonalis* ranged from 27.74 to 29.78 days during 1st and 2nd generations, respectively. The maximum eggs were laid during September *i.e.*, 80 eggs followed by 70.80 eggs during October 2017. The maximum oviposition period was reported during September 2017 (2.57 days) followed by October (1.99 days). There was a little dominance of female moth population. Male and female ratio ranged from 1:1.6 to 1:1.80 during September and October, respectively with an average ratio of 1:1.70.

Key words: Brinjal, fruit and shoot borer, *Leucinodes orbonalis*

INTRODUCTION

Brinjal or eggplant, *Solanum melongena* L. is an important vegetable crop grown in India and other parts of the world. It is cultivated round the year in almost all the states of India (Singh and Nath, 2010). The production of brinjal suffers immensely due to the attack insect pests. Brinjal is subjected to attack by a number of insect and non-insect pests from nursery stage to harvest. The most extensive pest of this vegetable is brinjal shoot and fruit borer, which reduces the yield and inflicts colossal loss in production (Bhushan *et al.*, 2011). The larvae bore inside an eggplant fruit and feed until they pupate. Fruit feeding is the major cause of damage. The larvae may also bore into tender shoots causing wilting and death of the branch terminals. This reduces the fruit-bearing capacity of plant. The pest incidence is likely to be influenced by the prevalence of maximum temperature. It is very active during the summer and rainy season and often causes more than 90% damage. The pest is likely to complete the life cycle comparatively at a shorter duration at elevated temperatures and increase their population, thereby the incidence. The per cent fruit borer incidence on brinjal had a positive association with maximum and minimum temperatures and also sunshine (Rao and Bhawani,

2010). At higher temperatures, due to climatic change (hot-humid), the borer incidence rise slightly. During the past two decades this crop has been increasingly wasted by eggplant fruit and shoot borer. So, the sufficient knowledge about the biology of an insect is necessary for adopting suitable control measure. Therefore, objective was to study biology of brinjal fruit and shoot borer *L. orbonalis*.

MATERIALS AND METHODS

Biology of shoot and fruit borer *L. orbonalis*

Rearing of the pest was undertaken to obtain mass culture which was used for studying the biology of the pest. The damaged fruits were collected from the brinjal field and were put in 10 x 10 cm glass jars. Muslin cloth was used to cover the glass jar and tightened with the rubber band. On every alternate day, the brinjal fruits were changed to maintain proper hygienic conditions in the glass jar. The fifth instar larvae that came out of the fruits pupated in spun cocoons at the periphery of muslin cloth. Separate glass jars were used to store the pupae. Single pair of male and female adult moths was transferred to individual glass jars covered with black paper containing black paper strips for oviposition. To

provide the natural environment, brinjal twigs were kept inside the jars with the bases of the twigs dipped in water solution. Adult moths were fed with honey solution dipped in cotton which was hanged along the wall of the jar and cotton swab thread held by the rubber band from the top of the jar. Mouth of each jar was closed by the muslin cloth held tightly with the aid of a rubber band. Along with the egg bearing paper strips, eggs obtained from these moths were shifted from jars to 10 x 10 cm glass petri dishes. Larvae were reared separately after hatching.

The biology of brinjal shoot and fruit borer was initiated with the eggs obtained from a few pair of moths and they were used for the further study. The neonate larvae of usually 0-8 hours old were fed on brinjal fruit slices in 10 × 10 cm glass petri dishes. Brinjal fruit pieces were changed regularly to prevent the fungal contamination and to maintain proper hygienic conditions.

Egg: Incubation period of egg was recorded and with the aid of fine camel hair brush, eggs oviposited over the inside wall of glass jars were removed carefully.

Larvae: After hatching of neonate larvae, following procedures were adopted for rearing of larvae. For first instar neonate larvae, tender leaves and tender buds of brinjal were provided. For 2nd and 3rd instar larvae of brinjal shoot and fruit borer, soft brinjal fruits were given. Until the beginning of pupation from hatching of neonate larvae was considered as larval period.

Pupa: When the full grown fifth instar larvae pupated around the muslin cloth inside the glass jar it was kept undisturbed for the completion of life cycle. After emergence of moths from the pupa they were distinguished into male and female. The time period between the pupation and the eclosion was considered as the pupal period.

Adult: The observations like adult longevity and sex ratio were recorded.

Adult longevity: Time period between eclosion of the

adult and death of the adult was considered as adult longevity. For study of adult longevity, the newly emerged male and female moths were released into the glass jars and honey solution was fed as food source.

Sex ratio: Male and female moths were distinguished based on the visual parameters like difference in abdominal length and width (female had bigger sized abdomen than that of male moth), eventually, the insects were separated sex wise to find out the sex ratio.

RESULTS AND DISCUSSION

Biology of shoot and fruit borer (*L. orbonalis*)

The biology of *brinjal shoot and fruit borer* was carried out for 2 generations (September to October) in the laboratory using brinjal fruits as food source. The minimum and maximum temperature during September to October ranged from 21.48 to 41.67°C and 19.84 to 40.52°C, respectively during 2017. The morning and evening relative humidity ranged from 85 to 56 per cent and 83 to 37 per cent during September and October 2017, respectively. The studies on biology were conducted with five sets of glass jar and each glass jar with ten eggs of brinjal shoot and fruit borer and continued for two generations during 2017.

Incubation period of the eggs: The creamy white eggs of brinjal shoot and fruit borer were gradually turned to orange and eventually to black colour just before they hatched. The eggs were laid singly on muslin cloth and black paper strips. Eggs were oval to elongate in shape (Figure 1). The incubation period of the eggs varied from 3.74 to 4.00 days (Table-2) during 1st and 2nd generations, respectively.

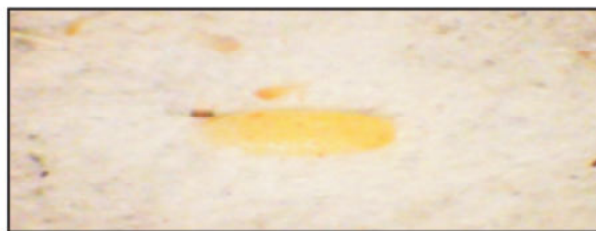


Fig. 1: Egg of brinjal shoot and fruit borer different

Table 1. Larval period of *L. orbonalis* during September & October (2017)

Month	Mean duration of different larval instars (days)					Larval period	Average larval period
	1 st	2 nd	3 rd	4 th	5 th		
September	3.285	2.214	2.285	2.142	1.571	11.50	12.17
October	3.714	2.214	2.285	2.214	2.428	12.85	

Larval period: The colour of newly hatched larva was dirty white which gradually turned to dark pink with growth. Totally five instars of larvae were reported during growing period of larva. (Figure 2) In this experiment, it was observed that the larval period varied from 11.50 to 12.85 days during two generations and average larval period reported was 12.17 days (Table 1).

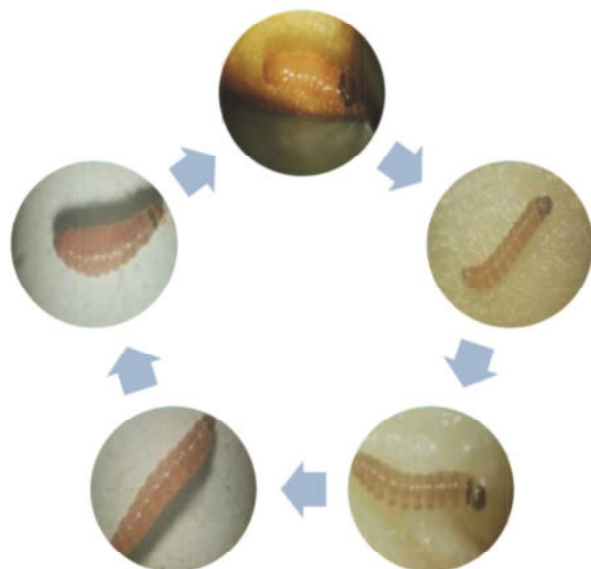


Fig. 2: Larval stage of brinjal shoot and fruit borer

Pupal period: Initially colour of pupa was pinkish which gradually turned to dark brown. The pupation occurred on the muslin cloth, plant leaves, glass jar and also inside of the fruits. The object type of pupa was seen with conical posterior end and blunt anteriorly, body was distinctly divided with a pair of spiracles on each segment of abdomen. (Figure 3). The studies on biology of brinjal shoot and fruit borer revealed that the pupal period varied from 7.61 to 7.96 days during first and second generations, respectively (Table 2).



Fig. 3: Pupa of brinjal shoot and fruit borer

Adult longevity: The adult moths were small sized with blackish brown head and thorax. The whitish wings of the adult moth were covered with brown and black areas which were larger on the forewings. Dirty white coloured hind wings were covered with black dots and angled margin. The female abdomen was swollen, ovate in structure and it was pointed towards the end whereas, in the males, abdomen was cylindrical and thinner as compared to females and it was blunt with some white hairy structures (Figure 4). The adult longevity varied from 4.56 to 4.94 days during first and second generations, respectively (Table-2).

Total life cycle: The total life cycle of *L. orbonalis* in the study conducted during 2017 ranged from 27.74 to 29.78 during first and second generations, respectively (Table-2).

Fecundity: The maximum eggs were laid during September *i.e.*, 80 eggs followed by 70.80 eggs during October 2017 showed in Table 2.



Adult male

Adult female

Fig. 4: Adult male and female moths of brinjal shoot and fruit borer

Table 2. Biology of shoot and fruit borer, *L. orbonalis*

Life stages	1st Generation (September)	2 nd Generation (October)
	Mean	Mean
Incubation period (Days)	3.74	4.00
Larval period (Days)	11.50	12.85
Pupal period (Days)	7.61	7.96
Adult Longevity (Days)	4.56	4.94
Total life cycle(Days)	27.74	29.78
Oviposition period(Days)	2.57	1.99
Fecundity (No.)	80	70.80
Sex ratio	1:1.6	1:1.80

Oviposition period: In this study conducted during September and October 2017 it was observed that oviposition period ranged from 2.57 to 1.99 days during first and second generations, respectively.

Sex ratio: Based on the characters of sexual dimorphism, the adult moths which emerged from pupae of *L. orbonalis* were collected and distinguished into male and female and were reared in laboratory. In this study it was observed that there was a little dominance of female moth population. Present study on biology of *L. orbonalis* revealed that male and female ratio ranged from 1:1.6 to 1:1.80 during September and October, respectively (Table-2).

Biology of shoot and fruit borer (*L. orbonalis*): The biology of *brinjal shoot and fruit borer* was carried out for two generations (September to October) in the laboratory using brinjal fruits as the food source.

Incubation period of the eggs: The creamy white eggs of *brinjal shoot and fruit borer* were gradually turned to orange and eventually to black colour just before they hatch (Figure 1). The incubation period of the eggs during the experimental period varied from 3.74-4.00 days. The present findings are in agreement with Jat *et al.* (2003), Wankhede *et al.* (2009), Kumar *et al.* (2011) and Bindu *et al.* (2013) who observed that under different laboratory conditions egg period ranges from 3 to 6 days.

Larval period: The colour of newly hatched larva was dirty white which gradually turned to dark pink as it grows (Figure 2). The larval period varied from 11.50 to 12.85 days during two generations and average larval period reported was 12.17 days. The present findings are in agreement with Allam *et al.* (1982), Sandanayake and Edirisinghe (1992), Pal *et al.* (2003) and Maravi *et al.* (2013) who have reported that under different laboratory conditions larval period varies from 9 to 18 days.

Pupal period: Initially colour of pupa was pinkish which gradually turned to dark brown colour. The obctect type of pupa was seen with the conical posterior end and blunt anteriorly, the body was distinctly divided with a pair of spiracles on each segment of the abdomen (Figure 3). The pupal period varied from 7.61 to 7.96 days during first and second generations, respectively. The findings of the present study are in agreement with Allam *et al.* (1982), Baang and Corey (1991), Suresh *et al.* (1996), Singh and Singh (2001), Jat *et al.* (2003), Pal *et al.* (2003), Wankhede *et al.* (2009), Radhakrishore *et al.* (2010), Maravi *et al.* (2013) and Onekutu *et al.* (2013). They observed that pupal period ranged from 7 to 12 days at different conditions of the laboratory.

Adult longevity: The adult longevity varied from 4.56 to 4.94 days during first and second generations, respectively. Various researchers have observed inconsistent results on the biology of *L. orbonalis* viz. Allam *et al.* (1982), Mehto *et al.* (1983), Baang and Corey (1991), Singh and Singh (2001), Jat *et al.* (2003), Harit *et al.* (2005), Wankhede *et al.* (2009), Kumar *et al.* (2011), Pramanik *et al.* (2012), Maravi *et al.* (2013) and Onekutu *et al.* (2013) who observed that adult longevity varied from 2 to 7 days at various laboratory conditions.

Total life cycle: The total life cycle of *L. orbonalis* in the study conducted during 2017 ranged from 27.74 to 29.78 during first and second generations, respectively. The present findings are in agreement with the observations of Allam *et al.* (1982), Suresh *et al.* (1996), Jat *et al.* (2003), Pal *et al.* (2003), Ghosh *et al.* (2005), Patial *et al.* (2007), Wankhede *et al.* (2009), Pramanik *et al.* (2012), Maravi *et al.* (2013) and Onekutu *et al.* (2013) who observed that total life cycle of *L. orbonalis* ranges from 19 to 44 days at various conditions of the laboratory.

Sex ratio: In this study, it was observed that there was a little dominance of female moth population. The male and

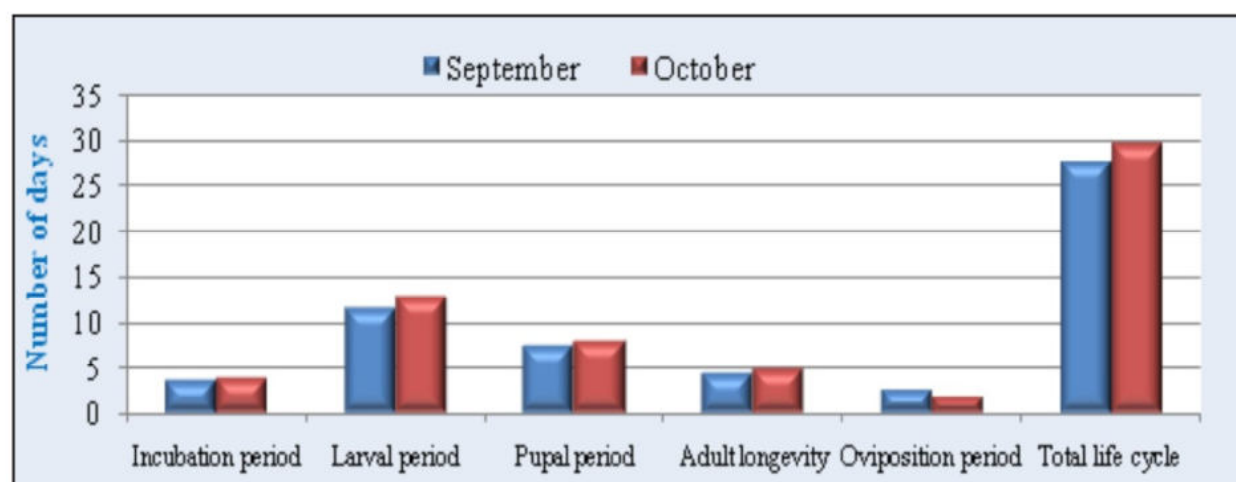


Fig. 5: Biology of brinjal shoot and fruit borer, *L. orbonalis*

female ratio ranged from 1:1.6 to 1:1.80 during September and October, respectively. Present experimental findings are in agreement with the studies of Pal *et al.* (2003), Maravi *et al.* (2013) and Onekutu *et al.* (2013) who have observed that male to female ratio varies from 1:1.07 to 1:2 under various conditions of the laboratory.

Oviposition period: In this study, during September and October 2017, it was observed that oviposition period ranged from 2.57 to 1.99 days during first and second generations, respectively. Present experimental findings are in agreement with the studies of Jat *et al.* (2003) who reported the oviposition period of 2.43 days.

Fecundity: The maximum eggs were laid during September *i.e.*, 80 eggs followed by 70.80 eggs during October 2017. In contrast to the observations of the present experiment, Singh and Singh (2001) observed average fecundity of 174.95 eggs per female.

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