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Biology of leaf webber and capsule borer, *Antigastra catalaunalis* (Duponchel) on sesame

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Abstract

The biology of leaf webber and capsule borer, *Antigastra catalaunalis* was studied on sesame variety HT-2 under laboratory conditions during *kharif*, 2016. Eggs laid singly, conical in shape and white in colour with length and width varied from 0.35 - 0.45 mm and 0.18 - 0.25 mm, respectively. Incubation period varied from 2.32 to 2.42 days and viability of eggs varied from 73.34 - 90.00 percent. There were five larval instars and total larval period varied from 9.88 to 13.08 days. The pupal period lasted from 5.25 to 7.25 days. The average length and breadth of pupa was 7.29 ± 0.32 and 1.26 ± 0.29 mm. Percent adult emergence ranged from 70.00 to 85.00 with an average of 76.00 ± 6.51 . Adults were stout and medium in size. The colour varied from light reddish brown to dark reddish brown. The females lived slightly longer than the males. The oviposition period ranged from 2.50 to 4.00 days and fecundity varied from 53.00 to 92.00. Average male to female ratio was 1.0 to 1.09.

Keywords: Biology, Sesame, *Antigastra catalaunalis*, Leaf webber and capsule borer

1. Introduction

Sesame, (*Sesamum indicum* L.) is one of the oldest cultivated oilseed crops. India ranks second in sesame production even though the area under sesame is highest ^[1]. In India, sesame is grown on an area of 19.47 lakh ha with production of 8.66 lakh tonnes and productivity of 445 kg/ha ^[2]. In Haryana, area under sesame is 3000 ha with production of 1000 tonnes and productivity of 500 kg ha⁻¹ ^[3]. Sesame seed contains up to 46 to 64 percent oil, 25 percent protein, high amount of minerals such as calcium, iron, and phosphorus ^[4]. Its oil is rich source of unsaturated fatty acids mainly linoleic acid (37 - 47%) and oleic acid (35 - 43%) ^[5]. It is also called as "Queen of oilseed" because of quality of oil. The yield potential of sesame has not been fully realized due to number of biotic and abiotic factors. Among the various biotic factors, the attack of insect pests is the major limiting factor in achieving higher productivity. The crop is attacked by 29 species of insect pests in different stages of its growth ^[6]. Among these, leaf webber and capsule borer, *Antigastra catalaunalis* is one of the major pest of sesame. It can cause up to 90 percent yield losses ^[7]. It attacks all parts of sesame plant except root. In early stage of crop, caterpillar feed on tender leaves by webbing top leaves. At flowering stage, larvae entered the bud and flower and feed inside the flowers. At capsule stage, it bore the capsule, entered inside, feed on developing seeds of capsules and destroyed the pod contents partly or wholly. If the infestation occurs at very early stage, the plant dies without producing any branch or shoot. Single caterpillar can destroy two to three plants in a week. If infestation occurs at a later stage, infested shoot remains without further growth. Although *A. catalaunalis* is serious pest of sesame in semi-arid conditions of Haryana but scanty information is available related to its biology. The present investigation was conducted on biology of leaf webber and capsule borer, *Antigastra catalaunalis* (Duponchel) on sesame.

2. Materials and Methods

Study on biology of sesame leaf webber and capsule borer, *A. catalaunalis* on sesame variety HT-2 was conducted during *kharif* 2016 in laboratory of the Department of Entomology, CCSHAU, Hisar. The advanced stage larvae were collected from the research farm and reared in laboratory in battery jars on sesame leaves and flowers of HT-2 variety. The mouth of the jars covered with muslin cloth. The larvae were allowed to pupate inside the jars. After adult emergence, these were collected from glass vials and transferred into another jars covered with black muslin cloth and fastened with rubber bands. These jars were also provided with cotton soaked in 10 percent honey solution. The eggs were laid on muslin cloth by female moth.

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Freshly laid eggs were counted and placed on fresh leaves with the help of moist soft camel hairbrush. Observations were recorded on their colour, size, shape and incubation period. Newly hatched larvae were released singly in glass vials for studying duration of each instar. Measurement of various stages was taken under the binocular with the help of ocular micrometer. However, advance larval stages and pupae were measured with the help of vernier calipers. The pre-oviposition, oviposition and post-oviposition periods, fecundity and longevity were studied by keeping the paired moths in glass jars.

3. Results and Discussion

3.1 Egg

Eggs were laid singly, minute, conical in shape and white in colour. The results are in conformity with Ahirwar *et al.* [8] who reported that the eggs of *A. catalaunalis* were minute and conical in shape. Incubation period varied from 2.32 to 2.42 days with mean 2.38 ± 0.04 days (Table 1). The present findings are in agreement with study of Singh [9] who reported that incubation period varied from 2.14 to 2.33 days on an average 2.27 days. Percent egg viability varied from 73.34 - 90.00 with an average of 83.33 ± 6.23 (Table 1). The findings are in agreement with study of Cheema and Singh [10] who reported that viability of eggs was 78.00 ± 11.40 percent during August and September. The length of egg varied from 0.35-0.45 mm with an average of 0.39 ± 0.04 mm, while the breadth varied from 0.18- 0.25 mm with an average of 0.21 ± 0.02 mm (Table 2). The results are in conformity with Ahirwar *et al.* [8] who reported length of eggs varied from 0.39 - 0.43 mm with an average of 0.41 mm, while the breadth varied from 0.21- 0.24 mm with an average of 0.22 mm.

3.2 Larva

The larva passed through five instars before pupation under laboratory conditions. Same number of larval instars was noticed by Cheema and Singh [10] and Kumar and Goel [11].

3.2.1 First instar larva

First instar caterpillar was tiny, cylindrical, cream coloured with black head. Larval period ranged from 96.00 to 132.00 h with a mean of 115.80 ± 13.28 h (Table 1). The findings are in agreement with study of Ahirwar *et al.* [8] who reported that first instar larval period was 96.00 to 132.00 h with mean of 110.16 ± 7.87 h. The average length and breadth of first instar larva was 4.78 ± 0.57 and 0.79 ± 0.14 mm with a range of 4.00 - 5.50 mm and 0.70 -1.00 mm, respectively (Table 2).

3.2.2 Second instar larva

Second instar larval period ranged from 30.00 to 48.00 h (mean 38.00 ± 6.68 h) (Table 1) and measured from 6.50 to 8.00 mm (mean 7.23 ± 0.64 mm) in length and 0.90 to 1.20 (mean 0.92 ± 0.16 mm) in width (Table 2). The present results were in contrast with the findings of Ahirwar *et al.* [8] who reported that period ranged of second instar larva was 24.00 to 48.00 h.

3.2.3 Third instar larva

The third instar larval period ranged from 36.00 to 48.00 h with the mean of 42.00 ± 5.33 h (Table 1). The average length and breadth was 9.78 ± 0.41 mm and 1.39 ± 0.05 mm with a ranged from 9.00 to 10.00 mm and 1.30 to 1.50 mm, respectively (Table 2). The results were in accordance with the observations of Ahirwar *et al.* [8] who reported that third instar larval duration was 12.00 to 24.00 h (mean 15.60 h).

3.2.4 Fourth instar larva

The duration of fourth instar larval period ranged from 20.00 - 24.00 h with mean of 22.80 ± 1.69 h (Table 1). Average length and breadth were 14.01 ± 0.57 and 1.68 ± 0.07 mm with range of 13.50 to 15.00 mm and 1.60 to 1.80 mm, respectively (Table 2). The findings are in agreement with study of Ahirwar *et al.* [8] who reported that this instar lasted for 20.00 to 22.00 h (21.05 h).

3.2.5 Fifth instar larva

The fifth instar larval period varied from 48.00 to 72.00 h with a mean of 63.60 ± 9.88 h (Table 1). The average length and breadth of fifth instar were 15.92 ± 0.84 and 1.96 ± 0.14 mm with a range of 15.00 to 17.00 mm and 1.80 to 2.20 mm, respectively (Table 2). The results collaborate the findings of Ahirwar *et al.* [8] who reported that this instar lasted for 48.00 - 72.00 (56.40 h).

3.2.6 Total larval period

Total larval period ranged from 9.88 to 13.08 days with an average of 11.76 ± 0.92 days (Table 1). The present results are in line with the findings of Suliman *et al.* [12] who found that total larval period of 10.20 days.

3.3 Pupa

Pupation took place in a transparent pale white silken cocoon. Freshly formed pupa was green in colour and latter turned into brown. Pupal period varied from 5.25 to 7.25 days (average 6.28 ± 0.70 days) (Table 1). The findings are in agreement with study of Naveen B [13] who reported that pupal period ranged from 6.50 to 7.80 days with a mean of 7.12 ± 0.67 days. The average length and breadth of pupa was 7.29 ± 0.32 and 1.26 ± 0.29 mm with a range of 7.00 to 8.00 mm and 1.00 to 1.80 mm, respectively (Table 2). The results collaborate the findings of Ahirwar *et al.* [8] who reported that mean length and width of pupa varied from 7.00 to 8.00 mm (mean 7.37 mm) and 1.00 to 1.80 (mean 1.42), respectively. Percent adult emergence varied from 70.00 to 85.00 with an average of 76.00 ± 6.51 (Table 1). The results were in accordance with the observations of Cheema and Singh [10] who reported that adult emergence varied from 76.03 to 93.34 percent during August-September.

3.4 Adult

Adults were stout and medium in size. The colour varied from light reddish brown to dark reddish brown. Males recorded lesser wing expanse and slender abdomen while the females were more in wing expanse and broader abdomen. Males were 8.00 to 8.50 mm (mean 8.18 ± 0.17 mm) in length and 22.00 to 24.00 mm (mean 22.70 ± 0.77 mm) in width with expanded wings. Females were longer as compared to male, varied in length from 11.00 to 12.00 mm (average 11.51 ± 0.43 mm) and in width from 25.50 to 28.00 (average 26.21 ± 1.12 mm) (Table 2). The present findings are in accordance with Ahirwar [8] who reported females are longer, 11.00 to 12.00 mm (mean 11.52 mm) in length and 25.50 to 28.00 mm (mean 26.77 mm) in width with expanded wings while males varied from 8.00 to 8.50 mm (mean 8.19 mm) in length and 22.00 to 24.00 mm (mean 23.00 mm) in width with expanded wings. Similar findings were also reported by Kumar and Goel [11].

3.4.1 Adult longevity

Longevity of males varied from 3.00 to 4.00 days (average 3.70 ± 0.40) and females varied from 5.13 to 6.88 days (average 6.02 ± 0.62) (Table 1). The findings are in

agreement with study of Choudhary ^[14] and reported that the longevity of the adult male varied from 3.00 to 5.00 days with an average of 4.10 days, whereas the females lived for 4.00 - 6.00 days with an average of 5.80 days.

3.4.2 Pre-oviposition, oviposition and post-oviposition periods

Pre-oviposition period of female adult ranged from 39.00 to 47.00 h (average 41.80 ± 2.62 h). The oviposition period varied from 2.50 to 4.00 days with an average of 3.20 ± 0.59 days. The post-oviposition ranged from 24.00 to 26.00 h with an average of 24.70 ± 0.95 h (Table 1). The results were almost similar to the observations of Cheema and Singh ^[10] who observed that pre-oviposition, oviposition and post-oviposition period was 1.43, 3.57 and 0.56 days, respectively from June to August.

3.4.3 Fecundity

Number of eggs laid by a single female during its life span varied from 53.00 to 92.00 with an average of 76.60 ± 12.04 (Table 1). The findings are in agreement with study of Cheema and Singh ^[10] who reported that single female laid on an average 84.91 ± 31.03 eggs from May to August.

3.4.4 Sex ratio

The male and female moth emerged from the pupae were segregated on the basis of size, wing expanse, wing characteristics and width of abdomen. Average male to female ratio was 1.0 to 1.09 (Table 1).

3.5 Total life cycle

Total life cycle ranged from 21.96 to 26.33 days (mean 24.00

± 1.28 days) in male, while in female ranged from 23.84 to 28.13 days (mean 26.32 ± 1.30 days) (Table 1). The results were in accordance with the observations of Singh ^[15] and Ahirwar *et al.* ^[8] who reported that total life cycle of *A. catalaunalis* varied from 22.00 - 33.00 days and 21.00 -39.00 days, respectively.

4. Conclusion and Future prospects

The present study on biology of *A. catalaunalis* revealed that incubation period of eggs varied from 2.32 to 2.42 days with an average of 2.38 days. Larva passed through five instars. Total larval and pupal period varied from 9.88 to 13.08 days (mean 11.76 days) and 5.25 to 7.25 days (mean 6.28 days), respectively. Longevity of adult male varied from 3.00 to 4.00 days with an average of 3.70 days, whereas females lived for 5.13 to 6.88 days with an average of 6.02 days. Total life cycle varied from 21.96 to 26.33 days (mean 24.00 days) in male and 23.84 to 28.13 days (mean 26.32 days) in female. Study on biology of this serious pest of sesame will help in formulating effective, socially acceptable and economically feasible management strategy. It will help in understanding future growth of generations and making forecasts. Future pest control strategy must incorporate the challenges of climate change so with this perspective effect of climate change on pest biology must be studied.

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Table 1: Duration of developmental stages of *Antigastra catalaunalis* (Duponchel) on sesame

Stages	Parameters	Range	Mean \pm SD
Egg	Incubation period (D)	2.32 - 2.42	2.38 ± 0.04
	Hatching (%)	73.34 - 90.00	83.33 ± 6.23
Larva	I st instar larval period (H)	96.00 - 132.00	115.80 ± 13.28
	II nd instar larval period (H)	30.00 - 48.00	38.00 ± 6.68
	III rd instar larval period (H)	36.00 - 48.00	42.00 ± 5.33
	IV th instar larval period (H)	20.00 - 24.00	22.80 ± 1.69
	V th instar larval period (H)	48.00 - 72.00	63.60 ± 9.88
	Total larval period (D)	9.88 - 13.08	11.76 ± 0.92
Pupa	Pupal period (D)	5.25 - 7.25	6.28 ± 0.70
Adult	Adult emergence (%)	70.00 - 85.00	76.00 ± 6.51
	Pre-oviposition (H)	39.00 - 47.00	41.80 ± 2.62
	Oviposition (D)	2.50 - 4.00	3.20 ± 0.59
	Post-oviposition (H)	24.00 - 26.00	24.70 ± 0.95
	Adult Longevity : Male (D)	3.00 - 4.00	3.70 ± 0.40
	Female (D)	5.13 - 6.88	6.02 ± 0.62
	Total life span : Male (D)	21.96 - 26.33	24.00 ± 1.28
	Female (D)	23.84 - 28.13	26.32 ± 1.30
	Fecundity per female	53.00 - 92.00	76.60 ± 12.04
Sex ratio	1:1 - 1:1.33	1.00:1.09	

H- Hours, D- Days

Table 2: Measurement of stages of *Antigastra catalaunalis* (Duponchel) on sesame

Stages	Length (mm)		Width (mm)	
	Range	Mean \pm SD	Range	Mean \pm SD
Egg	0.35 - 0.45	0.39 ± 0.04	0.18 - 0.25	0.21 ± 0.02
I st instar larva	4.00 - 5.50	4.78 ± 0.57	0.70 - 1.00	0.79 ± 0.14
II nd instar larva	6.50 - 8.00	7.23 ± 0.64	0.90 - 1.20	1.00 ± 0.09
III rd instar larva	9.00 - 10.00	9.78 ± 0.41	1.30 - 1.50	1.39 ± 0.05
IV th instar larva	13.50 - 15.00	14.01 ± 0.57	1.60 - 1.80	1.68 ± 0.07
V th instar larva	15.00 - 17.00	15.92 ± 0.84	1.80 - 2.20	1.96 ± 0.14
Pupa	7.00 - 8.00	7.29 ± 0.32	1.00 - 1.80	1.26 ± 0.29
Adult : Male	8.00 - 8.50	8.18 ± 0.17	22.00 - 24.00	22.70 ± 0.77
Female	11.00 - 12.00	11.51 ± 0.43	25.50 - 28.00	26.21 ± 1.12

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