



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(2): 55-61

© 2020 JEZS

Received: 07-01-2020

Accepted: 09-02-2020

Dwarka Prasad Athya

Department of Entomology

J. N. K. V. V Jabalpur,

Madhya Pradesh, India

Dr. Anand Kumar Panday

Department of Entomology

J. N. K. V. V Jabalpur,

Madhya Pradesh, India

Biology of leaf webber and capsule borer, *Antigastra catalaunalis* (Dup.) in sesame

Dwarka Prasad Athya and Dr. Anand Kumar Panday

Abstract

The biology of leaf webber and capsule borer, *Antigastra catalaunalis* was studied on sesame variety TKG-22. The results revealed that the female moths laid eggs singly on the lower surface of the leaves along the midrib and veins, in between the floral buds, inside the flowers and in stem and capsules. The average developmental period of first, second, third, fourth and fifth instar larvae were 103.75, 32.85, 23.90, 60.40 and 65.35 hours respectively. The total larval period ranged from 9.85 to 10.24 days and average 9.99 days. Pupa turned into brown before eclosion of the adult. The length and breadth of pupa varied from 6.87 to 7.39 mm with an average of 7.11 mm and 1.18 to 1.30 mm with an average of 1.23 mm, respectively. The pre-oviposition period of female moth varied from 9.85 to 10.30 hours with an average of 10.05 hours. The oviposition period of *A. catalaunalis* females ranged from 4.30 to 4.60 days with an average of 4.43 days. The total life cycle of *A. catalaunalis* varied from 18- 40 days.

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

1. Introduction

Sesame (*Sesamum indicum* Linnaeus) is an important oilseed crop grown since the beginning of arable cultivation. India ranks first in area, production and export of sesame in the world. Sesame is called the queen of oilseed crops by virtue of oil it produces. In India, at present sesame occupies an area of about 1544.9(000, ha) with an annual production of 715.7(000, tones) and an average productivity of 463 kg/ha. (Anonymous 2018) ^[3]. It feeds on the tender foliage by webbing the top leaves and also bores into the flowers and capsules and cause up to 90 per cent yield loss (Ahuja and Kalyan, 2002) ^[2]. 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

The biology of sesame leaf webber and capsule borer (*Antigastra catalaunalis*) was conducted in laboratory of PC Unit Sesame and Niger, College of Agriculture, JNKVV, Jabalpur (M.P.). The advanced stages larvae of *Antigastra* were collected from the research farm of AICRP Sesame and Niger and reared in plastic in jars. Fresh leaves and flowers of sesame variety Prachi was provided to feed the larvae. The mouth of the jars was 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 adult rearing cage. Inside the rearing cage sesame plants were kept for egg laying. The mouth of the rearing cages were covered with muslin cloth and fastened with rubber bands to prevent the escape of adults. These jars were also provided with cotton soaked in 10 per cent honey solution for the feeding of adults. Adults' moths were allowed to lay eggs on sesame plants inside the rearing cage. These eggs were used for the study of biology in the laboratory. Eggs were replicated ten times and in each replication ten eggs were kept to record the observations.

Corresponding Author:**Dwarka Prasad Athya**

Department of Entomology

J. N. K. V. V Jabalpur,

Madhya Pradesh, India

2.1 Observations were recorded

Observations were recorded on their colour, shape and incubation period. Newly hatched larvae released singly in glass vials to study the duration of each instar. The preoviposition, oviposition and post-oviposition periods, fecundity and longevity were also recorded by keeping the paired adult moths in glass jars. Observations on measurement of various stages were taken with the help of vernier calipers.

3. Results and Discussion

3.1 Site of egg laying: Female moths laid eggs singly on the lower surface of the leaves along the midrib and veins, in between the floral buds, inside the flowers and in stem and capsules. The finding corroborated with the findings of Kumar and Goel (1994) [5] and Ahirwar *et al.* (2010) [1] as similar egg laying pattern was observed by them.

3.1.1 Colour, shape and Size: Freshly laid eggs were creamy, whitish or dark whitish colored minute and conical in shape. Present findings are in conformity with the findings of Ahirwar *et al.* (2010) [1] they reported that the eggs of *A. catalaunalis* were minute and conical in shape.

3.1.2 Incubation period: Eggs were cream coloured when freshly laid and turned whitish prior to hatching. The incubation period of eggs varied from 2.10 to 2.20 days with an average of 2.15 days. The findings are in agreement with that of Ahirwar *et al.* (2010) [1] and Selvanarayanan and Baskaran (2000) [6]. The incubation period observed was 2 to 3.08 days by Ahirwar *et al.* (2010) [1], 2.45 days by Suliman *et al.* (2013) [8] and 2 to 7 days by Karuppaiah (2014) [4].

3.2 Larva: The larva passed through five instars before pupation under laboratory conditions. Same numbers of larval instars have been reported by the earlier workers Ahirwar *et al.* (2010) [1] and Karuppaiah (2014) [4] and Ahirwar *et al.* (2010) [1].

3.2.1 Damage symptoms and feeding behavior: Just after hatching from egg the larvae were started feeding by scraping the epidermis from undersurface of the leaves. Second instar larvae also fed on the leaf epidermis, tender and apical portion of the shoots and fastened the apical leaves with webs or together with silken threads and fed from inside. Third instar larvae, after initial feeding on the epidermis of leaves and tender parts of the plants, bored into flowers and capsules by scrapping. Fourth instar larvae fed on the leaf epidermis, tender parts of the branches and bored into flowers and capsules by scrapping. Fifth instar larvae fed mainly on flowers and capsules by scrapping and causing boring holes.

3.2.2 First instar: The newly hatched caterpillar (first instar) was a tiny, cylindrical, semi translucent, cream coloured caterpillar with reddish brown head capsule. Caterpillar had four pairs of prolegs and one pair of anal proleg besides three pairs of thoracic legs. These findings are supported by the findings of Kumar and Goel (1994) [5]. The length and breadth of first instar caterpillar varied from 4.54 to 4.77 mm with an average of 4.68 mm and 0.89 to 0.97 mm with an average of 0.92 mm, respectively. Developmental period of first instar caterpillar varied from 101.8 to 105.8 hours with an average of 103.75 hours. The duration of first instar larvae was reported to be 4 to 5.5 days by Ahirwar *et al.* (2010) [1] which

support the present finding.

3.2.3 Second instar: The second instar caterpillar was slightly larger than the first instar. Body colour slightly turned into whitish yellow, whereas colour of head capsule was brown. The length of the second instar ranged from 7.31 to 7.55 mm with an average of 7.45 mm, while breadth varied from 0.91 to 0.95 mm with an average of 0.93 mm. Developmental period of second instar varied from 30.2 to 35.2 hours with an average of 32.85 hours. Kumar and Goel (1994) [5] pointed out that the second instar larva of *A. catalaunalis* was whitish yellow with brownish head capsule and the developmental period was 1.82 ± 0.03 days. Developmental period, ranged from 1 - 2 days with an average of 1.45 ± 0.26 days as per the study of Ahirwar *et al.* (2010) [1].

3.2.4 Third instar: The third instar caterpillar slightly increased in size and the colour changed to pale green. Colour of the head capsule turned into black and brownish black hairs on black dots (setae and tubercles) were found on the abdomen of the caterpillar. Kumar and Goel (1994) [5] observed that the third instar larva of *A. catalaunalis* was pale green with black head capsule and black spots on the body. The length of the third instar caterpillar ranged from 9.79 to 10.19 mm with an average of 10.02 mm, while breadth varied from 1.19 to 1.27 mm with an average of 1.21 mm. Developmental period of third instar caterpillar varied from 23.5 to 24.2 hours with an average of 23.90 hours. Minute brown hairs and black dots (setae and tubercles) were found on the abdomen of the third instar larvae as reported by Ahirwar *et al.* (2010) [1].

3.2.5 Fourth instar: Fourth instar caterpillar (including all the prolegs) was pale green in the beginning and became green at the end with black head capsule. Setae and tubercles turned dark black and became prominent. Seta on each tubercle became clearly visible and there were three tubercles on each side of the mid dorsal line of each segment. Length of the fourth instar caterpillar varied from 13.01 to 13.05 mm with an average of 13.03 mm and breadth 1.55 to 1.61 mm with an average of 1.57 mm. Duration of the fourth instar caterpillar was 58.6 to 63.8 hours with an average of 60.40 hours. Kumar and Goel (1994) [5] observed that the fourth instar larva of *A. catalaunalis* was pale green with black head capsule and black spots on the body which corroborated with the present finding. All legs including prolegs and anal legs were green in colour (Ahirwar *et al.*, 2010) [1].

3.2.6 Fifth instar: Fifth instar caterpillar which fed on leaves and other vegetative parts was dark green, whereas caterpillar which fed on flowers and capsules was slightly pink in colour. Colour of prolegs was same as that of the body colour. Prominent mid dorsal line was noticed from thorax to the end of abdomen. Setae and tubercles were similar with that of fourth instar caterpillar. Length of the caterpillar varied from 15.03 to 16.91 mm with an average of 15.73 mm. Breadth ranged from 1.62 to 1.67 mm with an average of 1.65 mm. The duration of fifth instar caterpillar was 63.10 to 69.00 hours with an average of 65.35 hours. The total caterpillar period ranged from 9.85 to 10.24 days and average 9.99 days. Kumar and Goel (1994) [5] noticed that the fifth instar larvae of *A. catalaunalis* was greenish in colour with black head capsule and black spots on the body which measured $14.70 \pm$

0.26 mm in length and 1.029 ± 0.003 mm in breadth. One fine longitudinal line was observed dorsally from thorax to anal segment by Ahirwar *et al.* (2010) ^[1] which conformed the present finding.

3.3. Pre-pupa

When the caterpillar completed development, ceased feeding, became sluggish and the body turned darker and wrinkled. This moved towards the top of the rearing vial and some towards the leaf folds, flower and capsule debris. This stage was considered as pre-pupal stage.

The length of the pre-pupa ranged from 13.27 to 14.06 mm with an average of 13.58 mm. Breadth varied from 1.00 to 2.00 mm with an average of 1.62 mm. The pre-pupal period was 0.93 ± 0.02 days as reported by Kumar and Goel (1994) ^[5] and 2 to 8 days by Ahirwar *et al.* (2010) ^[1] which was partially in agreement with the present finding.

3.4. Pupa

3.4.1 Site of pupation: The caterpillar pupated at the top corner of the petri plates and sometimes between the leaf folds and other remains in the petri plates. In field conditions, pupation was observed to be occurred in between the leaf rolls and among the webbed mass of leaves, flowers and sometimes capsules. The pupation took place in a thin self-spun cocoon. Kumar and Goel ^[5] (1994) reported that the pupation of *A. catalaunalis* occurred in the leaf rolls, leaf webs, in between the pods as well as in fallen leaves, encapsulated in self-spun whitish cocoon. Selvanarayanan and Baskaran ^[6] (2000) noticed that the pupation of *A. catalaunalis* occurred inside the webbed leaves. The pupation occurred both inside the webbed leaves and in the soil as reported by Suliman *et al.* ^[8] (2013). Karuppaiah ^[4] (2014) reported that the pupation takes place within the webbing, under fallen leaves or in soil crevices in a thin transparent cocoon.

3.4.2 Colour, shape and size: Freshly formed pupa was soft, slender and green in colour. Prominent black eye spots were noticed after few hours of pupal formation. Pupa turned into brown before eclosion of the adult. The length and breadth of pupa varied from 6.87 to 7.39 mm with an average of 7.11 mm and 1.18 to 1.30 mm with an average of 1.23 mm, respectively.

3.4.3 Morphometric differences in male and female pupa: Males were slender and long, whereas females were comparatively broader and shorter.

3.5. Adult

3.5.1 Colour, size and appearance: Adult was small, delicate moth with brick red coloured forewings bearing veins and hind wings were pale yellow and slightly transparent with brownish red markings on them in both the sexes. Males were small with slender abdomen and females were comparatively larger with broad abdomen. These findings corroborated with the findings of Kumar and Goel ^[5] (1994).

3.5.2 Males: Male adults were small in size as compare to female. The abdomens of adults were small and slender. Length of the males varied from 7.38 to 7.42 mm with an average of 7.41 mm, while the breadth with wing expanded form varied from 21.03 to 21.37 mm with an average of 21.22 mm.

3.5.3 Female moths: Female moths were larger in size as compare to male. Abdomen was larger and broad in size as compare to male. Length of the female moths varied from 10.01 to 10.43 mm with an average of 10.22 mm and breadth with wing expanded form varied from 24.02 to 24.69 mm with an average of 24.38 mm. A slight variation in size of the adult *A. catalaunalis* was found with that observed by Kumar and Goel (1994) ^[5].

3.5.4 Pre-oviposition, oviposition, fecundity, post-oviposition and longevity: The pre-oviposition period of female moth varied from 9.85 to 10.30 hours with an average of 10.05 hours. The oviposition period of *A. catalaunalis* females ranged from 4.30 to 4.60 days with an average of 4.43 days. Ahirwar *et al.* (2010) ^[1] also found the oviposition period of 3 to 4 days which strongly supports the present finding. The egg laying capacity of female moths (fecundity) varied from 39 to 75 eggs with an average of 57 eggs. A fecundity of 30 to 90 eggs was noticed by Ahirwar *et al.* (2010) ^[1] which partially supports the present finding. The female moths lived for about 2 days after completion of egg laying. The longevity of the adult male varied from 3.75 to 3.85 days with an average of 3.79 days, whereas the females lived for 5.99 to 6.22 days with an average of 6.10 days. Kumar and Goel (1994) ^[5] reported that the longevity of mated males and females was 5.8 ± 0.25 and 7.2 ± 0.18 days, while of unmated ones was 6.6 ± 0.24 and 8.1 ± 0.28 days, respectively. Adult longevity of 5.90 ± 0.44 days was reported by Selvanarayanan and Baskaran (2000) ^[6], 4 to 12 days by Ahirwar *et al.* (2010) ^[1], 6.18 ± 0.20 days by Suliman *et al.* (2013) ^[8] and 6 to 8 days by Karuppaiah (2014) ^[4].

4. Sex ratio: The sex ratio of male: female was found to be 1:1 under laboratory conditions. Kumar and Goel (1994) ^[5] and Ahirwar *et al.* (2010) ^[1] mentioned that the sex ratio of adults (male: female) under laboratory conditions was 1:1.34 ± 0.07 and 1:1, respectively, the former partially and the latter fully in conformity with the present finding.

5. Total life cycle

The total life cycle of *A. catalaunalis* varied from 18- 40 days. The total life cycle of *A. catalaunalis* varied from 22-33 days and 21- 39 days (with an average of 27.93 ± 3.50 days) as registered by Singh (2003) ^[7] and Ahirwar *et al.* ^[1] (2010), respectively which is in close conformity with the present finding.

Different life stages of leaf webber and capsule borer



Plate 1: Eggs



Plate 2: 1st instar larvae



Plate 3: 2nd instar larvae



Plate 4: 3rd instar larvae



Plate 5: 4th instar larvae



Plate 6: 5th instar larvae



Plate 7: Sesame seedlings for rearing purpose



Plate 8: Vernier caliper



Plate 9: Pre pupae

**Plate 10:** Pupa**Plate 11:** Male (Adult)**Plate 12:** Female (Adult)

6. Conclusion And Future Prospects

The female moths of *Antigastra catalaunalis* laid 39 to 75 eggs singly along the midrib and veins of the leaves at lower surface, in between the floral buds and inside the flowers. The average developmental period of first instar caterpillar varied from 101.8 to 105.8 hours with an average of 103.75 hours. However for second, third, fourth and fifth instar the average larval developmental periods was 32.85, 23.90, 60.40 and 65.35 hours respectively. The total larval period ranged from 9.85 to 10.24 days and average 9.99 days. The length of the pre-pupa ranged from 13.27 to 14.06 mm with an average of 13.58 mm. Breadth varied from 1.00 to 2.00 mm with an average of 1.62 mm.

Pupa turned into brown before eclosion of the adult. The length and breadth of pupa varied from 6.87 to 7.39 mm with an average of 7.11 mm and 1.18 to 1.30 mm with an average of 1.23 mm, respectively. The average length and breadth of males and females were varying 7.41 and 21.22 mm and 10.22 and 24.38 mm respectively.

The pre-oviposition period of female moth varied from 9.85 to 10.30 hours with an average of 10.05 hours. The oviposition period of *A. catalaunalis* females ranged from 4.30 to 4.60 days with an average of 4.43 days.

The egg laying capacity of female moths (fecundity) varied from 39 to 75 eggs with an average of 57 eggs. The female moths lived for about 2 days after completion of egg laying. The longevity of the adult male varied from 3.75 to 3.85 days with an average of 3.79 days, whereas the females lived for 5.99 to 6.22 days with an average of 6.10 days. The sex ratio of male: female was found to be 1:1 under laboratory conditions. The total life cycle of *A. catalaunalis* varied from 18- 40 days.

Natural key mortality factors in the life history leaf webber and capsule borer should be studied. Effect of ecological aspects for the management of leaf webber and capsule borer should be studied. ETL and EIL for leaf webber and capsule borer for different stages of plant growths (vegetative, flowering and capsule) should be studied. Development of artificial diet for the rearing of larvae of *Antigastra* should be developed.

7. Acknowledgement

The authors are grateful to Dr. A. K. Panday, Scientist/Assistant Professor, PC Unit Sesame and Niger, College of Agriculture, JNKVV, Jabalpur (M.P.) for providing the necessary laboratory and field facilities.

Table 1: Duration of different life stages of *Antigastra catalaunalis* (Dup.) on sesame, variety Prachi.

S. No.	Life stages	Period		
		Minimum	Maximum	Mean \pm SD
01.	Egg (days)	2.10	2.20	2.15 \pm 0.06
02.	Larvae			
	1 st instar (Hrs.)	101.8	105.8	103.75 \pm 1.73
	2 nd instar (Hrs.)	30.2	35.2	32.85 \pm 2.13
	3 rd instar (Hrs.)	23.5	24.2	23.90 \pm 0.29
	4 th instar (Hrs.)	58.6	63.8	60.40 \pm 2.42
	5 th instar (Hrs.)	63.10	69.00	65.35 \pm 2.74
	Total larval period (Days)	9.85	10.24	9.99 \pm 0.17
03.	Pre-pupa (Hrs.)	19.5	22.9	20.52 \pm 1.59
04.	Pupa (Days)	4.7	5.8	5.30 \pm 0.45
05.	Adult			
	Pre-oviposition (Hrs.)	9.85	10.30	10.05 \pm 0.21
	Oviposition (Days)	4.30	4.60	4.43 \pm 0.13
	Post oviposition (Hrs.)	25.10	25.70	25.45 \pm 0.25
	Longevity			
	Male (Days)	3.75	3.85	3.79 \pm 0.04
	Female (Days)	5.99	6.22	6.10 \pm 0.10
06.	Total life span of female (Days)	34.70	35.80	35.08 \pm 0.50

Table 2: Biometrical parameters of different stages of *Antigastra catalaunalis* (Dup.) on sesame, variety Prachi.

S. No.	Stage	Particulars	Measurement (mm)		
			Minimum	Maximum	Mean \pm SD
01.	Larvae				
	1 st instar	Length	4.54	4.77	4.68 \pm 0.10
		Width	0.89	0.97	0.92 \pm 0.03
	2 nd instar	Length	7.31	7.55	7.45 \pm 0.10
		Width	0.91	0.95	0.93 \pm 0.015
	3 rd instar	Length	9.79	10.19	10.02 \pm 0.16
		Width	1.19	1.27	1.21 \pm 0.04
	4 th instar	Length	13.01	13.05	13.03 \pm 0.02
		Width	1.55	1.61	1.57 \pm 0.03
	5 th instar	Length	15.03	16.91	15.73 \pm 0.26
		Width	1.62	1.67	1.65 \pm 0.02
02.	Pre-pupa	Length	13.27	14.06	13.58 \pm 0.33
		Width	1.00	2.00	1.62 \pm 0.10
03.	Pupa	Length	6.87	7.39	7.11 \pm 0.24
		Width	1.18	1.30	1.23 \pm 0.05
04.	Adult				
	Male	Length	7.38	7.42	7.41 \pm 0.02
		Wing expanded	21.03	21.37	21.22 \pm 0.14
	Female	Length	10.01	10.43	10.22 \pm 0.19
		Wing expanded	24.02	24.69	24.38 \pm 0.33

8. References

1. Ahirwar RM, Gupta MP, Banerjee S. Bio-ecology of leaf roller/capsule borer *Antigastra catalaunalis* Duponchel. Advances in Biological Research. 2010; 1(2):90-104.
2. Ahuja DB, Kalyan RK. Losses in seed yield due to insect pests in different varieties of sesame, *Sesamum indicum* L. Annals. Plant Soil Res. 2002; 4(1):99-103.
3. Anonymous. 4th Advance Estimates, Agriculture Statistics Division, Directorate of Economics and Statistics, New Delhi, 2018.
4. Karuppaiah V. Eco-friendly Management of Leaf Webber and Capsule Borer (*Antigastra catalaunalis* Duponchel) Menace in Sesame. Popular Kheti. 2014; 2(2):2321.
5. Kumar S, Goel SC. Studies of the life history of a pyralid, *Antigastra catalaunalis* (Duponchel) in Western Uttar Pradesh. Bulletin of Entomology. 1994; 35(12):123-128.
6. Selvanarayanan V, Baskaran P. Biology and spinning behaviour of sesame shoot webber and capsule borer, *Antigastra catalaunalis* Duponchel (Lepidoptera: Pyraustidae). Sesame and Safflower Newsletter. 2000; 15:75-77.
7. Singh V. Biology of shoot webber and capsule borer, *Antigastra catalaunalis* (Lepidoptera: Pyraustidae) on sesame. Journal of Plant Protection. 2003; 30(1):88-89.
8. Suliman ENH, Bashir NHH, Tom Eamae, Asad YOH. Biology and Webbing behaviour of sesame webworm, *Antigastra catalaunalis* Duponchel (Lepidoptera: Pyraustidae). Global Journal of Medicinal Plant Research. 2013; 1(2):210-213.