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## Bionomics of leaf and capsule borer, *Antigastra catalaunalis* (dup.) Infesting sesame, *Sesamum indicum* (Linn.).

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### Abstract

Investigations on “bionomics and bio-intensive management of sesame leaf and capsule borer, *Antigastra catalaunalis* (Dup.)” were conducted at Agronomy farm and Department of Entomology, S.K.N. College of Agriculture, Jobner during *Kharif*, 2015 and 2016. *A. catalaunalis* were recorded as major insect pests of sesame during both the years of study. The different parameters of bionomics of *A. catalaunalis* have been presented as egg, larva, pupa and adult. The total life cycle of *A. catalaunalis* varied from 21 to 39 days with an average of 28.1 days. The incubation period varied from 47- 73 hours with an average of 60.6 hours. The larva passed through five instars on sesame leaves under laboratory conditions. Duration of larva was 8.21-12.16 days. Duration of the pre-pupa ranged between 21-121 hours with an average of 100.7 hours and that of pupa 3.10-12.0 days with average 7.18 days. Longevity of adult male varied from 3-5 days with an average of 4.1 days, whereas females lived for 4 - 6 days with an average of 5.8 days.

**Keywords:** Sesame, *Antigastra catalaunalis* (Dup.), Bionomics

### Introduction

Sesame, *Sesamum indicum* (Linn.) (family: Pedaliaceae) is the oldest oilseed crop of world cultivated throughout the India. East Africa and India are considered to be the native home of sesame (Bedigian, 1985 and Nayar and Mehra, 1970) [6] [10]. Its seeds contain 52- 57 per cent oil and 25 per cent protein (Smith *et al.*, 2000) [13]. The important sesame growing countries are India, china, sudan, Burma and Mexico. In India, the cultivation is mainly confined to Uttar Pradesh, Rajasthan, Madhya Pradesh, Andhra Pradesh, Odisha, Gujarat, Tamil Nadu and Karnataka. In India, production of sesame was estimated to be 8.11 lakh tonnes during 2014-15 (Anonymous, 2015a) [4,5]. The total area under cultivation of sesame in Rajasthan was about 3.30 lakh hectares with annual production to the tune of 9.49 thousand tonnes and average productivity of 288 kg (Anonymous, 2015b) [4, 5]. Its cultivation gained impetus because of high quality edible oil, rich source of carbohydrate, protein, calcium and phosphorus (Seegeler, 1983) and, therefore, considered to be the ‘queen of oil seeds’. The pests attack tolls a heavy loss (25- 90%) in seed yield (Ahuja and Kalyan, 2002) [3]. Among 67 insect pests damaging sesame crop, the leaf insect pests, *viz.*, leaf and capsule borer, *Antigastra catalaunalis* (Dup.); jassid, *Orosius albicinctus* Distant; whitefly, *Bemisia tabaci* (Genn.) and mirid bug, *Nesidiocoris tenuis* (Reuter) are considered to be key pests (Ahirwar *et al.*, 2009) [1]. The *A. catalaunalis* is an important pest because this attacks the crop in all the growth stages after about two weeks of emergence (Suliman *et al.*, 2004) [14]. The attack is more severe during dry seasons and after initiation of flowering. It feeds on tender foliage by webbing the top leaves, bores into the pods and shoots (Narayanan and Nadarajan, 2005) [9]. This insect pest causes 10-70 per cent infestation of leaves, 34-62 per cent of flower buds/ flowers and 10-44 per cent infestation of pods resulting in upto 72 per cent loss in yield (Ahirwar *et al.*, 2010a) [2]. The bionomics of insect pests lays the foundation for adoption of eco-friendly pest management approaches. As sesame leaf and pod caterpillar feed concealed within leaves and capsules, a correct management strategy using appropriate techniques is vital. As such, the study on bionomics of this serious pest of sesame is necessary for formulating effective and economical management strategy. A meagre amount of work has been carried out on bionomics and management of leaf and capsule borer, *A. catalaunalis* infesting sesame crop in Rajasthan.

### Materials and Method

Studies on bionomics of leaf and capsule borer were undertaken in laboratory at the ambient temperature. For laboratory experiment, the sesame variety, RT-125 was grown in pots. Full fed caterpillars were collected from the field of sesame crop and reared on the crop grown in

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pots (covered with muslin cloth) and on sesame leaves, fruiting bodies and other plant parts in the Petri dishes (7.5 cm diameter). The Petri dishes were provided with moist soil in their bottom. The leaves and flowers were changed daily upto the second instar larval stage. Thereafter, the buds, flowers, capsules and leaves were provided as food to the latter larval instars. The moths emerging from pupae were released in muslin cloth covered pots containing cotton swabs dipped in 20% glucose solution. The moths were kept under constant

watch for studying mating, oviposition behavior and egg laying. Freshly laid eggs were counted and placed on fresh sesame leaves with the help of moist soft camel hair brush.

### Result and Discussion

The different parameters of bionomics of *A. catalaunalis* have been presented in the subheads, egg, caterpillar, pupa and adult (Table-1 and 2).

**Table 1:** Morphometrics of different stages of *Antigastra catalaunalis* (Dup.) on sesame, *Sesamum indicum*

S. No.	Stage	Particulars	Measurement (mm)			
			Minimum	Maximum	Mean $\pm$ SD	
1	Egg	Length	0.38	0.43	0.39 $\pm$ 0.02	
		Width	0.21	0.25	0.23 $\pm$ 0.02	
2	Caterpillar	1 <sup>st</sup> instar	Length	4.90	5.60	4.95 $\pm$ 0.53
			Width	0.80	1.00	0.92 $\pm$ 0.07
	2 <sup>nd</sup> instar	Length	7.10	9.00	7.83 $\pm$ 0.64	
		Width	0.80	1.10	0.92 $\pm$ 0.08	
	3 <sup>rd</sup> instar	Length	11.10	12.10	11.69 $\pm$ 0.43	
		Width	1.10	1.50	1.31 $\pm$ 0.12	
	4 <sup>th</sup> instar	Length	13.50	13.90	13.72 $\pm$ 0.14	
		Width	1.20	1.90	1.57 $\pm$ 0.27	
	5 <sup>th</sup> instar	Length	14.50	16.00	15.25 $\pm$ 0.60	
		Width	1.50	2.00	1.70 $\pm$ 0.19	
3	Pre-pupa	Length	12.10	15.10	13.55 $\pm$ 1.05	
		Width	1.10	2.00	1.53 $\pm$ 0.38	
4	Pupa	Length	6.00	8.00	7.26 $\pm$ 0.76	
		Width	1.00	1.50	1.30 $\pm$ 0.16	
5	Adult	Male	Length	7.00	8.00	7.59 $\pm$ 0.39
			(Wing expanded)	22.00	23.00	22.55 $\pm$ 0.37
	Female	Length	10.00	12.00	10.96 $\pm$ 0.57	
		(Wing expanded)	25.10	27.00	26.14 $\pm$ 0.79	

Mean of 10 replications

**Table 2:** Duration of different stages of *Antigastra catalaunalis* (Dup.) on sesame, *Sesamum indicum* in laboratory

S. No.	Life stages	Period		
		Minimum	Maximum	Mean $\pm$ SD
1	Egg (Hrs.)	47.00	73.00	62.6 $\pm$ 9.72
	Hatching (%)	80.00	90.00	84.8 $\pm$ 3.91
2	Caterpillar			
	1 <sup>st</sup> instar (Hrs.)	96.00	131.00	108 $\pm$ 15.54
	2 <sup>nd</sup> instar (Hrs.)	23.00	47.00	32.1 $\pm$ 10.07
	3 <sup>rd</sup> instar (Hrs.)	12.00	22.00	16.7 $\pm$ 3.49
	4 <sup>th</sup> instar (Hrs.)	19.00	21.00	19.93 $\pm$ 0.75
	5 <sup>th</sup> instar (Hrs.)	47.00	71.00	58.7 $\pm$ 8.51
	Total caterpillar period (Days)	8.21	12.16	-
3	Pre-pupa (Hrs.)	21.00	121.00	100.7 $\pm$ 61.77
4	Pupa (Days)	3.10	12.00	7.18 $\pm$ 3.56
5	Adult			
	Pre-oviposition (Hrs.)	9.00	11.00	10.04 $\pm$ 0.73
	Oviposition (Days)	2.00	4.00	3.1 $\pm$ 0.80
	Post oviposition (Hrs.)	23.00	25.00	23.83 $\pm$ 0.96
	Longevity			
	Male (Days)	3.00	5.00	4.1 $\pm$ 1.71
	Female (Days)	4.00	6.00	5.8 $\pm$ 2.04
6	Total life span of female (Days)	19.00	39.00	28.1 $\pm$ 6.02
7	Fecundity (Number)	30.00	75.00	53.8 $\pm$ 13.98
8	Sex ratio (Female: Male)	-	-	1:1

Mean of 10 replications

### Egg

**Site of egg laying:** Female moths laid the eggs singly along the midrib and veins of the leaves at lower surface, in between

the floral buds, inside the flowers and in grooves of stem and capsules.

**Colour, shape and size:** Freshly laid eggs were minute and conical in shape. Eggs were cream coloured when freshly laid and turned whitish prior to hatching. The length of eggs varied from 0.38- 0.43 mm with an average of 0.41 mm, while the breadth varied from 0.21- 0.25 mm with an average of 0.23 mm.

**Incubation period:** The incubation period of eggs varied from 47- 73 hours with an average of 60.6 hours.

**Hatching of eggs:** The minimum and maximum hatching per cent were 80 and 90, respectively with an average of 85 per cent.

### Caterpillar

**Damage symptoms and feeding behavior:** First instar caterpillar when hatched out from the egg, fed by scraping the epidermis from undersurface of the leaves. Second instar caterpillar also fed on the leaf epidermis, soft parts of branches and fastened the leaves of growing point with webs or together with silken threads and fed from inside. Third instar caterpillar, after initial feeding on the epidermis of leaves and soft parts of the branches, bored into flowers and capsules by scrapping. Fourth instar caterpillar fed on the leaf epidermis, soft parts of the branches and bored into flowers and capsules by scrapping. Fifth instar fed mainly on flowers and capsules by scrapping and causing boring holes.

**Number of instars:** The caterpillars were found to pass through five instars on sesame leaves under laboratory conditions.

**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. The length and breadth of first instar caterpillar varied from 4.9 to 5.60 mm with an average of 4.95 mm and 0.80 to 1.00 mm with an average of 0.92 mm, respectively. Developmental period of first instar caterpillar varied from 96.00 to 131.00 hours with an average of 108 hours.

**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 7.10 to 9.00 mm with an average of 7.83 mm, while breadth varied from 0.80 to 1.10 mm with an average of 0.92 mm. Developmental period of second instar varied from 23.00 to 47.00 hours with an average of 32.1 hours.

**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. The length of the third instar caterpillar ranged from 11.10- 12.00 mm with an average of 11.69 mm, while breadth varied from 1.10- 1.50 mm with an average of 1.31 mm. Developmental period of third instar caterpillar varied from 12.00- 22.00 hours with an average of 16.7 hours.

**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 13.50- 13.90 mm with an average of 13.72 mm and breadth, 1.20- 1.90 mm with an average of 1.57 mm. Duration of the fourth instar caterpillar was 19.00- 21.00 hours with an average of 19.93 hours.

**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 14.50- 16.00 mm with an average of 15.25 mm. Breadth ranged from 1.50- 2.00 mm with an average of 1.70 mm. The duration of fifth instar caterpillar was 47.00- 71.00 hours with an average of 58.7 hours. The total caterpillar period ranged from 8.21- 12.16 days.

### 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 12.10- 15.10 mm with an average of 13.55 mm. Breadth varied from 1.10- 2.00 mm with an average of 1.53 mm. The longevity (duration) of pre-pupa was in the range of 21.00- 121.00 hours with an average of 100.70 hours.

### Pupa

**Site of pupation:** The caterpillar pupated at the top corner of the rearing vial and sometimes between the leaf folds and other remains in the rearing vial. 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.

**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 6.00- 8.00 mm with an average of 7.00 mm and 1.00- 1.50 mm with an average of 1.25 mm, respectively.

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

### Adult

**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. The males were smaller in size than the females. Length of the males varied from 7.00- 8.00 mm with an average of 7.59 mm, while the breadth with wing expanded form varied from 22.00- 23.00 mm with an average of 22.55 mm. Length of the female moths varied from 10.00- 12.00 mm with an average of 10.96 mm and breadth with wing expanded form varied from 25.10- 27.00 mm with an average of 26.14 mm.

**Pre-oviposition, oviposition, fecundity, post-oviposition and longevity:**

The pre-oviposition period of female moth varied from 9 to 11 hours with an average of 10.04 hours. The oviposition period of *A. catalaunalis* females ranged from 2-4 days with an average of 3.1 days. The egg laying capacity of female moths (fecundity) varied from 30-75 eggs with an average of 53.8 eggs. The female moths lived for about 2 days after completion of egg laying. The longevity of the adult male varied from 3- 5 days with an average of 4.1 days, whereas the females lived for 4- 6 days with an average of 5.8 days.

**Sex ratio:** The sex ratio of male: female was found to be 1: 1 under laboratory conditions.

**Total life cycle**

The total life cycle of *A. catalaunalis* varied from 19- 39 days.

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