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Biology and Morphometics of Plume Moth, *Exelastis atomosa* (Wals.) on Pigeonpea Variety- Saket under Laboratory Conditions in Gwalior, Madhya Pradesh Region, India

Bharat Lal*, N.S. Bhadauria and S.P.S. Tomar

Department of Agriculture Entomology, RVSKVV, Gwalior, Madhya Pradesh, India

**Corresponding author*

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A B S T R A C T

Biology and morphometrics of pigeonpea plume moth, *E. atomosa* (Wals.) on pigeonpea variety *viz*., Saket was studied during *Kharif*-2018 at the under laboratory condition RVSKVV, Gwalior (M.P.) at the room temperature 28±2^{o}C and relative humidity 72±2 per cent from October to November. Eggs were laid in singly on the pods sometimes on flower buds and occasionally on leaves of 5-50 eggs. The finding was including incubation period was ranged from 2-3 days with an average of 2.60±0.16 days. Eggs were measured 0.44±0.01, 0.34±0.01 mm in length and width. There were five larval instars with total larval duration ranged from 15-18 days with an average of 16.70±0.40 days to enter into pupal stage. The pupal period ranged from 6-9 days with an average of 7.30±2.01 days and measured ranged from 7.90-8.30 mm, 1.65-1.85 mm with an average of 8.12±0.04, 0.1.74±0.02 mm in length and width, respectively. Total life of *E. atomosa* was completed ranged in 31-36 days with an average of 34.10±0.66 days. The longevity of the adult was ranged from 5-7 days with an average of 6.40±0.22 days and length and width of adult ranged from 6.60-6.85 mm with an average of 6.67±0.08 mm and 11.45-1.75 mm, 1.63±0.03 mm, respectively.

Introduction

Pigeon pea (*Cajanus cajan*) is an important crop in semiarid and subtropical farming systems, providing high quality vegetable protein, animal feed and firewood. After Chickpea, Pigeonpea is second most important pulse crop grown in country. Pigeon pea ranks six in area and production in comparison to other legumes such as Beans, Peas and Chickpea. India has virtual monopoly in pigeon pea production accounting to 90% of world's total production and occupies an area of 3.88 M ha with a production of 3.29 MT (Anon., 2014). In India the area, production and productivity of pigeonpea 4.46 M ha, 4.18 MT and 937 kg ha^{-1}, respectively during 2017-18. Whereas, In Madhya Pradesh the area, production and productivity of pigeon pea 6.47 lakh ha, 8.39 lakh tones and 1296 kg ha^{-1}, respectively during 2017-18. (Anon., 2017-18). Pigeonpea is one the major pulse crops grown in India. As many as 250 insect sp. have been recorded

to attack pigeon pea (Upadhyay *et al.*, 1998). Insect pests feeding on flowers, pods, and seeds are the most important biotic constraint affecting tur yield. Gram pod borer (*H. armigera*), tur plume moth (*E. atomosa*), spotted pod borer (*Maruca vitrata*), tur pod fly (*Melanagromyza obtusa*), tur pod bug (*C. gibbosa*) and blister beetle (*Mylabris spp*.) are one of the most important constraints for low productivity of redgram in India.

The larvae bore into unopened flower buds for consuming the developing anther more damages is seen during flowering, pod maturing and pod filling stage. It is reported that on an average, the pod damage in pigeonpea to plume moth was 8.9 per cent and grain damage was 4.0 per cent unfortunately, the journalism available on its biology provides only the fragmentary information on average duration of the life stage of the insect. In gird region of Madhya Pradesh the life cycle of plume moth was not studied previously. In the present investigation, biological and morphometrics of *E. atomosa* was studied under laboratory conditions on redgram cultivar- saket at Gwalior, Madhya Pradesh.

Materials and Methods

The studied on the biology of plume moth were carried on pigeonpea variety-Saket under laboratory condition at the room temperature 28±2 ^{o}C and relative humidity 72±2 per cent at Department of Entomology, RVSKVV, Gwalior (M.P.) from October to November during *Kharif*- 2018. Full-grown larvae were collected from pigeonpea field and reared in petri-dishes till pupation. Fresh flower and pods were provided daily to larvae as a food. After pupation, the pupae were kept in glass jars covered with muslin cloth. After emergence, the adults were released in pairs into another glass jars individually. Honey solution (50%) soaked in small cotton swab as food source provided to them. After completion of mating, the male was separated and the female was kept inside the jar for recording fecundity.

Numbers of egg on the top and tied with rubber bands. Fresh twig with pods of pigeon pea cultivar saket were laid were counted daily with help of a hand magnifying lens till the death of the adult female. Eggs were removed from the twigs or plant part with a fine camel hairbrush and were placed over moist filter paper in petri-dish two eggs kept in each petri-dish (total-20) and hatching, one larva were transferred individually to petri-dish keeping single larva in each. Fresh flowers and pods provided daily as food for the larvae. The total no. of larval instars and duration of each instar was determined by examining the cast off larval head capsule. The pupal and adult longevity, different instars morphometrics in each instar of length, width of body and life cycle of adult (egg to Adult) were recorded. Measurements were done using granded scales (1-150 mm).

Results and Discussion

Biology of plume moth in pigeonpea

Comparative biology and morphometrics of plume moth was conducted under laboratory conditions. Data related to different developmental stages viz., egg, larva, pupa and adult were documented schematically. Incubation, larval, pupal periods and longevity of adult moths were also recorded.

Biology and morphometrics of plume moth, *E. atomosa* (Wals.)

The biology and morphometrics of plume moth was studied in laboratory, the duration of different developmental stage and data pertaining to morphometrics are presented in Table 1, respectively.

Egg

They were laid singly on the pods sometimes on flower buds and occasionally on leaves as well. Eggs were light green in colour and oval in shape. Oviposition usually took place at night. Incubation period ranged from 2-3 days with an average of 2.60±0.16 days. Similar to the present findings of Chaitanya (2012) reported that the incubation period varies with an average from 2.48±0.02 days. However, Vijayachander and Arivudainambi (2007) and Savde *et al.,* (2018) reported that the incubation period varies with an average from 2.22±0.03 days. The length and width of an egg ranged from 0.40-0.47 mm with an average of 0.44±0.01 mm and 0.30-0.40 mm with an average of 0.34±0.01 mm, respectively. Similar to the present findings of Savde *et al.,* (2018) reported that the average length and breadth of eggs were 0.40±0.02 and 0.30±0.01 mm. However, Chaitanya (2012) reported that the average length and breadth of eggs were 0.48±0.01 and 0.33±0.02 mm (Figure 1 and Plate 1).

Larval stages

During the period of larval development, five instars i.e., four larvae moults were observed. The five different larval instars appeared in various colours either green, reddish brown or greenish brown and were fringed with setae and spines all over the body. The details of the instars are as follows.

First instar larval

The newly hatched larva was green or brown or a mixture of both closely, resembling the colouring of the pod. The duration of the 1st instar larva ranged from 1-2 days with an average of 1.20±0.13 days. The present findings are in close agreement with Chaitanya (2012) reported that the duration of the first instar larva with an average of 1.30±0.45 days. The body length and width of larva ranged from 1.45-1.75 mm with an average of 1.62±0.04 mm and 0.41-0.48 mm with an average of 0.45±0.01 mm, respectively. Similar to the present findings of Savde *et al.,* (2018) reported that the body length and breadth of first instar larvae with in average of 1.50±0.02 and 0.45±0.03 mm.

Second instar larval

The larva was brownish or greenish in colour. The duration of the 2nd instar larva also ranged from 2-3 days with an average of 2.40±0.16 days. Similar to the present findings of Savde *et al.,* (2018) reported that the duration of the second instar larva with an average of 2.35±0.04 days. The body length and width of larva ranged from 2.30-2.60 mm with an average of 2.46±0.03 mm and 0.50-0.60 mm with an average of 0.54±0.01 mm, respectively. Similar to the present findings of Chaitanya (2012) reported that the body length and breadth of second instar larvae with an average of 2.48±0.02 and 0.56±0.01 mm. However, Savde *et al.,* (2018) reported that the body length and breadth of second instar larvae with an average of 2.30±0.04 and 0.55±0.01 mm.

Third instar larval

The third instar larva was distinguished from the second instar by the presence of prominent prolegs which were long and thin. The duration of the 3rd instar larva ranged from 3-5 days with an average of 3.60±0.22 days. The present findings are in close agreement with Chaitanya (2012) and Savde *et al.,* (2018) reported that the duration of the third instar larvae with an average of 3.81±0.01 days. The body length and width of larva ranged from 3.90-4.20 mm with an average of 4.04±0.03 mm and 1.12-1.22 mm with an average of 1.19±0.01 mm, respectively. Similar to the present findings of

Chaitanya (2012) reported that the body length and breadth of third instar larvae with an average of 4.05±0.36 and 1.19±0.01 mm. However, Savde *et al.,* (2018) reported that the body length and breadth of third instar larvae with an average of 3.98±0.01 and 1.20±0.01 mm.

Fourth instar larval

The duration of the 4th instar larva ranged from 3-6 days with an average of 4.40±0.34 days. Similar to the present findings of Chaitanya (2012) and Savde *et al.,* (2018) who reported that the duration of the fourth instar larvae with a mean of 4.41±0.04 days.

The body length and width of larvae ranged from 4.90-5.25 mm with an average of 5.14±0.04 mm and 1.54-1.65 mm with an average of 1.60±0.01 mm, respectively. Similar to the present findings of Chaitanya (2012) reported that the body length and breadth of fourth instar larvae with an average of 5.25±0.07 and 1.65±0.10 mm. However, Savde *et al.,* (2018) reported that the body length and breadth of fourth instar larvae with an average of 5.22±0.05 and 1.51±0.05 mm.

Fifth instar larval

The full grown caterpillar was long, cylindrical, greenish brown, with many setae. The duration of the 5th instars larvae ranged from 4-6 days with an average of 5.10±0.23 days. Similar to the present findings of Chaitanya (2012) reported that the duration of the fifth instar larvae with a mean of 5.12±0.12 days. The body length and width of larvae ranged from 6.80-7.50 mm with an average of 7.16±0.08 mm and 2.30-2.50 mm with an average of 2.41±0.02 mm, respectively. Whereas the total larval period ranged from 15-18 days with an average of 16.70±0.04 days. Similar to the present findings of Savde *et al.,* (2018) reported that the total larval period with an average 16.18±0.12 days to enter into pupal stage at Parbhani, MH. However, Subharani and Singh (2008) reported that the total larval period with an average of 23.12±0.93. Similar to the present findings of Chaitanya (2012) reported that the body length and breadth of fifth instar larvae with an average of 7.25±0.14 and 2.42±0.08 mm. However, Savde *et al.,* (2018) reported that the body length and breadth of fifth instar larvae with an average of 7.01±0.10 and 2.25±0.08 mm.

Pre-pupal stage

The full grown caterpillar by for pupation was found to pass through the pre-pupal stage. During this period, the last instar larvae stopped feeding and moved restlessly in search of suitable pupation sites. The duration of pre-pupa ranged from 1-2 days with an average of 1.10±0.39 days. These are in close findings of Chaitanya (2012) and Savde *et al.,* (2018) reported that the duration of pre-pupa was found with a mean of 1.09±1.73 days and 1.12±1.44 days. The dimension length and width of pre-pupa ranged from 7.85-8.20 mm with an average of 7.99±0.04 mm and 1.98-2.08 mm with an average of 2.03±0.01 mm, respectively. Similar to the present findings of Savde *et al.,* (2018) reported that the pre-pupa length and breadth with an average of 7.98±1.03 and 2.09±1.04 mm. However, Chaitanya (2012) reported that the pre-pupa length and breadth with an average of 8.02±0.10 and 2.06±0.05 mm.

Pupal stage

Pupation took place on the pod surface or in the entrance of look itself or even in the burn if the infested pod. The pupa was also fringed with short hairs and spines also soft, green or brown in colour with a close resemblance to the larva. The anterior half of the pupa could be raised when the insect was disturbed.

Table.1 Biology and morphometics dimension of plume moth, *Exelastis atomosa* (Wals.) on pigeonpea under laboratory condition

Developmental stages	Duration (Days)		Morphometrics dimension			
			Body length (mm)		Body Width (mm)	
	Range	Mean ± SD ± SEM	Range	Mean ± SD ± SEM	Range	Mean ± SD ± SEM
Incubation Period	2-3	2.60 ± 0.52 ± 0.16	0.40-0.47	0.44 ± 0.02 ± 0.01	0.30-0.40	0.34 ± 0.03 ± 0.01
Larval Period						
1st instar	1-2	1.20 ± 0.42 ± 0.13	1.45-1.75	1.62 ± 0.12 ± 0.04	0.41-0.48	0.45 ± 0.02 ± 0.01
2nd instar	2-3	2.40 ± 0.52 ± 0.16	2.30-2.60	2.46 ± 0.09 ± 0.03	0.50-0.60	0.54 ± 0.03 ± 0.01
3rd instar	3-5	3.60 ± 0.70 ± 0.22	3.90-4.20	4.04 ± 0.11 ± 0.03	1.12-1.20	1.19 ± 0.03 ± 0.01
4th instar	3-6	4.40 ± 1.07 ± 0.34	4.90-5.25	5.14 ± 0.14 ± 0.04	1.54-1.65	1.60 ± 0.04 ± 0.01
5th instar	4-6	5.10 ± 0.74 ± 0.23	6.80-7.50	7.16 ± 0.26 ± 0.08	2.30-2.50	2.41 ± 0.06 ± 0.02
Total Larval Period	15-18	16.70 ± 1.27 ± 0.40				
TLCD of larval	17-20	19.30 ± 1.27 ± 0.40				
Pre-pupal period	1-2	1.10 ± 0.30 ± 0.39	7.85-8.20	7.99 ± 0.11 ± 0.04	1.98-2.08	2.03 ± 0.03 ± 0.01
Pupal period	6-9	7.30 ± 0.90 ± 2.01	7.90-8.30	8.12 ± 0.13 ± 0.04	1.65-1.85	1.74 ± 0.07 ± 0.02
Longevity of Adult	5-7	6.40 ± 0.70 ± 0.22	6.60-6.85	6.67 ± 0.25 ± 0.08	1.45-1.75	1.63 ± 0.10 ± 0.03
Total Life Cycle(Egg-Adult)	31-36	34.10 ± 2.08 ± 0.66				

Fig.1 Life duration of each stage of plume moth, *Exelastis atomosa* (Wals.) on pigeonpea laboratory condition

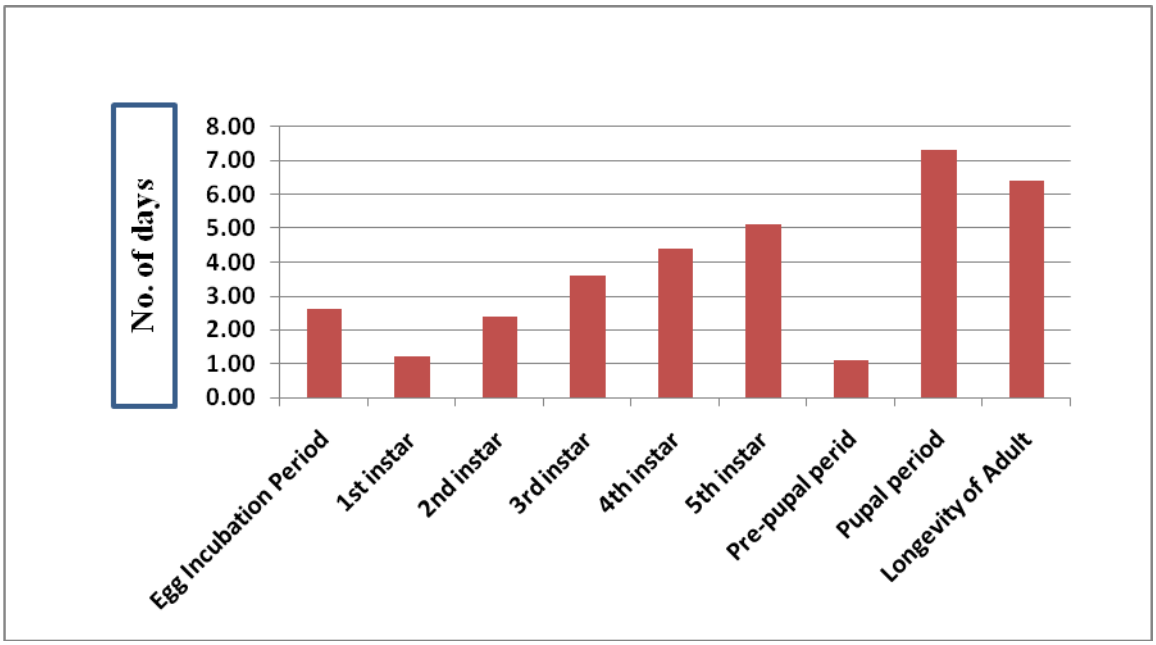
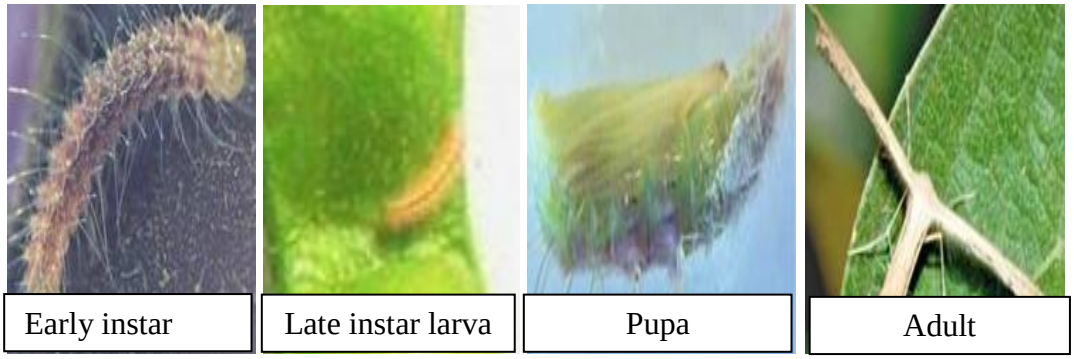


Plate.1 life cycle of plume moth



The duration of pupa ranged from 6-9 days with an average of 7.30±0.01 days. Similar to the present findings of Savde *et al.,* (2018) reported that the pupal period ranged from 7.25±0.23 days. The pupal length and width ranged from 7.90-8.30 mm with an average of 8.12±0.04 mm and 1.65-1.85 mm with an average of 1.74±0.02 mm, respectively. Similar to the present findings of Chaitanya (2012) reported that the pupal length and breadth with an average of 8.01±0.20 and 1.76±0.05 mm. However, Savde *et al.,* (2018) reported that the pupal length and breadth with an average of 8.25±0.20 and 1.80±0.08 mm.

Adult longevity

The adult mother was small, slender, light brown in colour. It is characterized by having the wings deeply fissured. The forewings were elongated and longitudinally deft into 2 to 4 divisions and hind wings into 3 divisions. The abdomen was dark brown in colour. The

longevity of the adult ranged from 5-7 days with an average of 6.40±0.22 days. Similar to the present findings of Savde *et al.*, (2018) reported that the mean longevity of the adult was 6.32±0.30 days when reared under laboratory condition on redgram during *kharif*-2017. However, Subharani and Singh (2008) reported that the mean longevity of the adult plume moth was 6.59±0.34 days when reared under laboratory conditions. The wing expanse of adult moth ranged from 6.60-6.85 mm with an average of 6.67±0.08 mm and 1.45-1.75 with an average of 1.63±0.03 mm in length and width, respectively. Similar to the present findings of Savde *et al.*, (2018) reported that the average length and breadth of adult 6.75±0.30, 1.40±0.06 mm in diameter. However, Chaitanya (2012) reported that the adult length and breadth with an average of 6.81±0.26, 1.74±0.05 mm in diameter.

Total life cycle

In the present investigations, the total life cycle of plume moth i.e. from egg to adult ranged from 31-36 days with an average of 34.10±0.66 days. Similar to the present findings of Savde *et al.*, (2018) reported that the total life cycle *E. atomosa* was complete in 33.09±0.35 days.

Similar to the present findings of Subharani and Singh (2008) and Chaitanya (2012) who reported that the total life cycle of *E. atomosa* was completed in 40-43 days with an average of 40.2 days.

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