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Studies on the biology and biometrics of okra shoot and fruit borer *Earias vittella* Fabricius at Raipur, Chhattisgarh

Jharna Chaturvedani and Jayalaxmi Ganguli

Abstract

Studies on the biology and biometrics of *Earias vittella* Fabr. were conducted in the Biocontrol laboratory, department of Entomology, IGKV, Raipur, Chhattisgarh, during September to November, 2022. Results depicted that the females of *E. vittella* laid spherical, bluish green coloured eggs usually singly and in small groups of 4 to 5. The mean incubation period and hatching percentage was 3.2 ± 0.46 days and $76.82 \pm 2.35\%$ respectively. The larvae passed through five instars. Boat shaped cocoons were formed for pupation and pupae were light brown to dark in colour and later turned to grey to greenish grey. Newly emerged adults were soft bodied, pale white with green longitudinal wedged shaped band in the middle of forewing whereas hind wings were pale white. Males were smaller in size than females. The last abdominal segment of male was roundish, while in female it was pointed with a tuft of hair. Duration of 1st, 2nd, 3rd, 4th and 5th instars were completed in (2.4 ± 0.22 , 2.4 ± 0.22 , 2.4 ± 0.22 , 2.4 ± 0.22 and 3.40 ± 0.22 days), respectively and the mean total larval period was 13 ± 1.02 days. The average duration of pre-pupal and pupal periods were of 3.2 ± 0.45 and 7.2 ± 0.53 days. The mean sex ratio (male: female), pre-oviposition period, oviposition period, post-oviposition period and fecundity recorded were $1:1.12 \pm 0.24$, 1.4 ± 0.22 days, 6.4 ± 0.51 days, 3.8 ± 0.77 days and 375.4 ± 33.79 eggs, respectively while average male and female longevity was 6.6 ± 0.46 and 8.2 ± 0.47 days, respectively. The average life span for male and female were completed in 32.6 ± 2.34 and 32.0 ± 3.06 days, respectively. Biometrics studies of *E. vittella* revealed that the mean width of eggs were 0.63 ± 0.22 mm. The mean length and width of 1st, 2nd, 3rd, 4th and 5th instar larvae were (1.65 ± 0.59 and 0.27 ± 0.1) mm, (2.30 ± 0.81 and 0.34 ± 0.14 mm), (6.13 ± 2.13 and 1.10 ± 0.37 mm), (12.36 ± 4.28 and 2.07 ± 0.72 mm) and (4.99 ± 5.26 and 3.11 ± 1.09 mm), respectively. The mean width of head capsule of 1st, 2nd, 3rd, 4th and 5th instar were 0.27 ± 0.06 , 0.49 ± 0.17 , 0.79 ± 0.26 , 1.25 ± 0.42 and 2.10 ± 0.70 mm, respectively. The mean length and width of pupa were 9.95 ± 3.53 and 2.98 ± 1.03 mm. The mean length and width of adult male were 9.17 ± 3.18 and 20.93 ± 7.36 mm and adult female were 11.47 ± 4.06 , and 17.92 ± 5.40 mm.

Keywords: Biology, biometrics, *Earias vittella*, head capsule, life cycle

Introduction

Among vegetables, okra [*Abelmoschus esculentus* (L.) Moench] is a popular and commercially cultivated vegetable crop commonly known as bhindi or ladies finger belongs to family Malvaceae and is an important crop grown throughout the year. In Chhattisgarh, it covers an area of 32.60 lakh hectares yielding 358.81 lakh tones in 2021-22, with a productivity of 11.01 MT per hectare (Anonymous, 2021) ^[1]. Vitamins, calcium, potassium and other nutrients that are frequently missing in the diets of developing countries are found in significant quantities in ladyfingers. Apart from the nutritional supplements, okra has multifarious use such as the cane juice from which gur or jaggery is made is cleaned using an extract of okra stems and roots. For making paper also, mature fruits and stems that contain crude fibre are utilised. Additionally, reports of its medical usefulness in treating ulcers, chronic dysentery, spermatorrhoea, genitourinary diseases and providing relief from haemorrhoids are also available. The immature fruits are collected and consumed as vegetables.

Infestation by a wide variety of insect species from seeding to harvesting is one of the bottlenecks in unprofitable okra cultivation. A widely distributed insect *Earias vittella* damages both shoot and fruit (Shrivastava *et al.*, 2017) ^[7]. In both the Kharif and summer seasons, it begins to attack 4-5 week old okra plants. Infested delicate top shoots wither, while growing flowers, buds and fruits fall off too early, making the fruit unfit for human consumption.

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According to estimates, the attack of this insect on okra resulted in a decrease in marketable output of almost 69% (Rawat and Sahu, 1973) ^[5]. The farmer-oriented approach, which includes cultural practices take advantage of the biological and behavioural weaknesses of insects and apply pressure on the pest population by modifying the environment, is one of the non-synthetic pesticide approaches that is essential. Considering of all these facts, the present investigation on okra shoot and fruit borer, *E. vittella* had been planned to undertake the study on biology and biometrics so that management can be done based on complete knowledge of insect.

Materials and Methods

To evaluate the biology and biometrics of *Earias vittella* the experiments were conducted during September to November, 2022 under controlled laboratory conditions (25 ± 2 °C, $70 \pm 10\%$ RH). The laboratory culture of okra shoot and fruit borer was initiated by collecting infested fruits of okra having large number of larvae and the collected larvae were reared individually in round clean plastic petri plates. The larvae were fed on fresh pieces of okra fruits daily in the morning till pupation. Pupae were shifted to another petri plate for adult emergence. The adults that emerged on the same day were placed in oviposition cage for the purpose of egg-laying. Adults were given cotton swabs that had been soaked in a 5 percent sugar solution as food. The oviposition substrate was provided as zigzag folded white paper strips. The cage was covered with muslin cloth. Thus, the paper strip with freshly laid eggs were taken out and kept in glass petri-plate. Eggs and neonates of *E. vittella* were further used for study.

Biology of *E. vittella* was conducted by using 5 numbers of larvae per petri-plate. A completely randomized block design with 5 replications was applied. Collection of eggs was done with the help of fine camel hair brush (size: 0) from the folded strips and used for the detailed study of biology, total duration of each stage.

For recording the data on biometric parameters of *E. vittella* from egg to adult stage, observations were recorded daily under laboratory conditions. Insect samples were stunned for estimating the instar wise average length and width from each individual stage of insects. Observations on size of egg, length and width of various larval instars, pupae and adults were recorded.

Results and Discussions

Biology of okra shoot and fruit borer, *Earias vittella* Fab. (Lepidoptera: Noctuidae)

Biology of *E. vittella* provided information about different stages and their behaviour, which is useful for better pest management at various life stages. The results obtained during the present study are discussed as under.

1. Egg

Under laboratory conditions, adult female of *E. vittella* deposited eggs singly and scattered in groups of 4 to 5 on white zig-zag paper kept in glass petri-plate and on tender shoots mostly on hairy parts of plant. The freshly laid eggs were small, spherical and bluish green which became darker after two days. The chorion of eggs were white and translucent, with parallel lines with a crown-like projection on it. Unfertilized eggs, on the other hand, had no change in colour and shrivelled the next day. The larvae emerged from

the eggs by making a hole through the egg shell, which later turned white. Similar description of egg laying, colour and shape by *E. vittella* on okra was also reported by Gaikwad (2013) ^[2].

2. Incubation period and Hatching percentage

The data given in (Table 1) indicated that the incubation period in laboratory condition varied from 3 to 5 days with an average of 3.2 ± 0.46 days. The hatching percentage of eggs of *E. vittella* ranged from 68.33% to 84.31% with a mean of $76.82 \pm 2.35\%$.

The present findings are in match with Rajveer *et al.*, (2016) ^[4] who also mentioned that incubation period of *E. vittella* ranged from 3 to 5 days. and Sahito *et al.*, (2019) ^[6] who reported hatching percent of *E. vittella* to be $85.14 \pm 7.60\%$ which is slightly higher than the present findings.

3. Larvae

The larvae of *E. vittella* were reared on okra fruits until they pupated in order to study the various larval instars. The information gathered about various larval instars is presented in Table 1.

Number of larval instar: During its larval period, the caterpillar moulted four times before pupation leading to five larval instars. Similar to the present studies, Rajveer *et al.*, (2016) ^[4] reported five larval instars of *E. vittella*.

- 1. Instar:** The first instar larva were small and creamy white in colour, had a dark brown head capsule and three pairs of true legs on the thoracic segments. The third to sixth abdominal segments each carried a pair of prolegs and the tenth segment had a pair of claspers. The body also had hairs, and the last abdominal segment had a significant number of densely packed setae. The current findings are in accordance with Vasuki (2017) ^[8] who also found similar characteristics of first instar larva. The first larval instar lasted for 2 to 3 days with an average of 2.4 ± 0.22 days.
- 2. Instar:** Freshly moulted second instar larvae were morphologically similar to first instar larvae except that they were larger. They were light brown in colour with reddish shade and white spots on the dorsal surface of their bodies, a prothoracic shield with several setae on each body segment, fleshy conical legs with hook-like structures at the tips, and a conspicuous head capsule. With an average of 2.4 ± 0.22 days, the second larval instar lasted from 2.00 to 3.00 days. Similar morphological features were also observed by Gaikwad (2013) ^[2].
- 3. Instar:** Compared to the second instar larva, the third instar larva was bigger in size. The dorsal side of body had more distinct white orange patches and a darker overall coloration. The legs were creamy white, while the head capsule was having a dark brown tone. The third larval instar extended from 2 to 3 days with an average of 2.4 ± 0.22 days. The present results are in match with Gaikwad (2013) ^[2] who gave similar description of third instar larvae and Vasuki (2017) ^[8] for larval duration.
- 4. Instar:** The larva in its fourth instar had a spindle-like shape, was stout and was dark purple in colour. The head was blackish in colour with fully developed mouth parts, while the second and third thoracic segments had orange and white spots on them. The first thoracic segment was

white with brown markings on it and orange colour spots on either side near the spiracles. From the second to eighth segments of the abdomen, there were continuous white marks. Due to the presence of different colour spot, the larva is known as “Spotted bollworm”. The duration of fourth instar larva of *E. vittella* varied from 2 to 3 days with an average of 2.4 ± 0.22 days. The present observations are in line with Vasuki (2017) [8] and Gaikwad (2013) [2].

- 5. Instar:** The bristles were dispersed throughout the body of the fifth larval instar, which was brown in colour with significant orange markings on both sides of the body and a median longitudinal stripe. The fifth larval instar lasted for 3.0 to 4.0 days with an average of 3.40 ± 0.22 days. The present results are in concurrence with Gaikwad (2013) [2] who gave similar description of fifth instar larvae and Vasuki (2017) [8] for larval duration.

Total developmental period: The total larval developmental period ranged from 11 to 16 days, with an average of 13 ± 1.02 days, as per the data in Table 1, which totally matches with Vasuki (2017) [8] who also reported that the total larval period ranged from 11.0 to 16.0 days with an average of 13.35 ± 1.73 days.

- 6. Pre-pupa and Pupa:** In general features, the pre-pupa resembled last larval instar, whose coloration gradually changed to reddish brown. Before pupating, fully fed larvae became lethargic, stopped eating and contracted antero-posteriorly. The pre-pupal duration lasted for 1.0 to 2.0 days with an average of 3.2 ± 0.45 days.

The larva spun a dirty white to light brown, silken, boat-shaped cocoon for pupation, and the pupae developed inside it attaching itself on the surface of the fruit, in contact with the okra seeds and on the bottom of the rearing glass petri-plate.

A brief pre-pupal period was followed by pupation. The newly formed pupa was object type, soft and varied in colour from light brown to dark brown, but gradually turned from grey to a greenish grey. It had a tapering back and a rounded front. The present findings are in close agreement with Vasuki (2017) [8] in case of pre-pupal and pupal characteristics. When the pupa was gently disturbed, its abdomen made a normal movement. The pupal period ranged from 06 to 09 days (mean 7.2 ± 0.53 days) as depicted in (Table 1).

Adult

Moths first appeared at night or in the early morning. Adult that had just emerged rested close to where it had come out after 4 to 5 minutes. The medium-sized adult moth of both the sexes had pale white forewings with a green stripe that was wider at the apex and pointed backwards, forming a wedge. Its hind wings were pale white with light brown markings. Filiform and yellowish grey antennae were present. The head was greyish white and the eyes were somewhat raised on the lateral aspect. The abdomen was cylindrical and lengthy with pale hairs and the head was smaller than the thorax. In general, female moths were larger than male. The female was distinguished from the male by the presence of tuft of hair on the last abdominal segment. Similar morphological features were also observed by Vasuki (2017) [8].

- 1. Pre-oviposition, oviposition, post-oviposition period, and fecundity:** (Table 1) summarizes the observations on pre-oviposition, oviposition, post-oviposition period, and

fecundity. The average pre-oviposition duration was 1.4 ± 0.22 days, although it ranged from 1 to 3 days. The average oviposition period was 6.4 ± 0.51 days with a range of 4 to 9 days. The post-oviposition phase lasted between 01 and 06 days, on average 3.8 ± 0.77 days. A total number of 5 pairs of adults were kept separately under observation and it revealed that a mean of 375.4 ± 33.79 eggs were deposited per female, ranging from 296 to 450. During the period of study, the relative humidity ranged from 68.0 to 80.0 percent and the temperature was between 25 and 30 °C. Earlier, Vasuki (2017) [8] also reported the pre-oviposition, oviposition, post-oviposition period, and fecundity of adult of *E. vittella* to be of 2.00 ± 0.46 days, 3.00 ± 0.97 days, 4.5 ± 0.50 days and 166 ± 25.43 eggs, respectively which partially support the current findings.

- 2. Longevity:** The longevity of male and female moths (Table 1) ranged from 5 to 8 and 7 to 10 with an average of 6.6 ± 0.46 and 8.2 ± 0.47 days respectively. More or less similar observations were also reported by Gaikwad (2013) [2].
- 3. Sex Ratio:** The observation on sex ratio of female and male were recorded and was found that females were more in proportion to males. Out of 30, laboratory reared insect population, female were 17 and male 13 and male to female ratio was 1:1.12.
- 4. Total Life Cycle:** (Table 1) summarises the observations for the total life cycle, from eggs to adult mortality. The data made it evident that the average life expectancy of males ranged from 25 to 38 days with an average of 32.6 ± 2.34 days and that of females ranged from 26 to 41 days, with an average of 32 ± 3.06 days. The overall life expectancy found in the current study more or less similar with Vasuki (2017) [8].

Biometrics of okra shoot and fruit borer, *Earias vittella*

During the research work biometric study of *Earias vittella*, okra shoot and fruit borer were noted at room temperature (25 ± 2 °C) in laboratory. The body size (including length and breadth of body) and head capsule width of each instar were also measured and recorded. The data regarding biometrics of *E. vittella* represented in (Table 2).

a. Biometrics of eggs [Diameter (in mm)]

Freshly laid eggs of *E. vittella* measured 0.57 to 0.72 mm in diameter with an average of 0.63 ± 0.22 mm. Vasuki (2017) [8] also mentioned in his research that the egg width of *E. vittella* ranged from 0.60 to 0.80 mm with an average of 0.66 ± 0.05 mm which matches with current result.

b. Biometrics of the larval neonate and instars [length and width (in mm)]

First instar: Newly hatched larva measured 1.25 to 2.1 mm in length with an average of 1.65 ± 0.59 and 0.23 to 0.32 mm in width with a mean of 0.27 ± 0.1 mm but before moulting the length and width of larva slightly increased.

Second instar: Just after moulting, the length of second instar larva measured 1.8 to 2.98 mm with an average of 2.30 ± 0.81 mm and the width of larva was measured 0.2 to 0.49 mm with an average of 0.34 ± 0.14 mm.

Third instar: The larva of third instar measured 5.21 to 7.32

mm with an average of 6.13 ± 2.13 in length and 1.01 to 1.29 mm with an average of 1.10 ± 0.37 mm in width.

Fourth instar: The length of fourth instar larva measured 10.56 to 14.67 mm with an average of 12.36 ± 4.28 mm and the width of larva was measured 1.89 to 2.12 mm with an average of 2.07 ± 0.72 mm.

Fifth instar: The last instar larvae measured 13.56 to 15.87 mm with an average of 14.99 ± 5.26 in length and 2.38 to 3.99 mm with an average of 3.11 ± 1.09 mm in width.

Present observations on measurements of different larval stages are more or less similar with Jondhale (2007) [3] who reported that average body length of *E. vittella* larvae were observed 1.69 ± 0.29 , 2.47 ± 0.42 and 6.47 ± 0.50 mm and average breadth 0.29 ± 0.04 , 0.38 ± 0.10 and 1.31 ± 0.058 mm, respectively.

c. Biometrics (width) of head capsule (in mm)

After each larval moult, the head capsule of particular instar was collected from the petri-plate and measurement on Trinocular digital Microscope and width was recorded. The data shown in (Table 2) revealed that the minimum width of head capsule of neonate larvae (first instar) was recorded 0.26 mm and maximum width was recorded 0.28 mm with an average of 0.27 ± 0.06 mm. The width of head capsule of second instar larvae measured 0.47 to 0.51 mm with an average of 0.49 ± 0.17 mm. The minimum width of head capsule of third instar was recorded 0.73 mm and maximum width was recorded 0.85 mm with an average of 0.79 ± 0.26 mm. The width of head capsule of fourth instar larvae measured 1.27 to 1.29 mm with an average of 1.25 ± 0.42 mm. The minimum width of head capsule of last (fifth) instar

was recorded 1.98 mm and maximum width was recorded 2.43 mm with an average of 2.10 ± 0.70 mm. The current findings are in confirmation with Jondhale (2007) [3] who also reported the measurement of first to fourth instar larvae head capsule width with mean of 0.27 ± 0.012 , 0.51 ± 0.018 , 0.85 ± 0.059 and 1.29 ± 0.021 mm, respectively.

d. Biometrics of pupae [length and width (in mm)]

The result in respect of biometrics of pupa depicted that the minimum length of pupa measured 8.70 mm and maximum length of pupa noted 10.50 mm with an average of 9.95 ± 3.53 . The minimum width of pupa was observed 2.78 mm and maximum width was noted 3.23 mm with an average of 2.98 ± 1.03 mm. Similarly, Vasuki (2017) [8] also depicted that pupa measured with an average of 8.18 ± 0.07 mm in length and 3.81 ± 0.14 mm in breadth which fully supports the current results.

e. Biometrics of adult male and female moths [length and wing-span (in mm)]

The male moth was smaller than female. The length of male moth ranged from 8.56 to 9.76 mm with an average of 9.17 ± 3.18 mm and breadth across the expanded wings of male moth ranged from 19.00 to 22.11 mm with an average of 20.93 ± 7.36 mm. In case of female, body length ranged from 9.59 to 12.88 mm with an average of 11.47 ± 4.06 mm, whereas, the body breadth across the expanded wings ranged from 20.31 to 23.80 mm with an average of 17.92 ± 5.40 mm. Similar observations were also reported by Vasuki (2017) [8] who mentioned that male moth was smaller than female moth with an average length of 9.02 ± 0.44 mm and average wing span of 21 ± 1.13 mm and that of female average length was 10.96 ± 1.04 mm and average wing span 22.02 ± 1.17 mm.

Table 1: Duration of different developmental stage of *E. vittella* under laboratory condition

S. No.	Stages of the insect	Minimum* (Days)	Maximum* (Days)	Mean \pm SD
1)	Incubation period	2	5	3.2 ± 0.46
2)	Hatching Percentage	68.33	84.31	76.82 ± 2.35
3)	Larval period			
a)	I Instar	2	3	2.4 ± 0.22
b)	II Instar	2	3	2.4 ± 0.22
c)	III Instar	2	3	2.4 ± 0.22
d)	IV Instar	2	3	2.4 ± 0.22
e)	V Instar	3	4	3.4 ± 0.22
	Total larval Period	11	16	13 ± 1.02
4)	Pre-pupal period	1	2	3.2 ± 0.456
5)	Pupal period	6	9	7.2 ± 0.53
6)	Pre-oviposition period	1	3	1.4 ± 0.22
7)	Oviposition period	4	9	6.4 ± 0.51
8)	Post-oviposition period	1	6	3.8 ± 0.77
9)	Adult Longevity			
a)	Male	5	8	6.6 ± 0.46
b)	Female	7	10	8.2 ± 0.47
10)	Total life cycle			
a)	Male	25	38	32.6 ± 2.34
b)	Female	26	41	32 ± 3.06
11)	Fecundity (No.)	296	450	375.4 ± 33.79

Table 2: Showing the biometrics of okra shoot and fruit borer, *Earias vittella*

S. No.	Stages of the insect	Minimum	Maximum	Mean ± SD
1)	Egg			
	a. Diameter (mm)	0.57	0.72	0.63 ± 0.22
2)	I Instar larva			
	a. Length (mm)	1.25	2.1	1.65 ± 0.59
	b. Width (mm)	0.23	0.32	0.27 ± 0.1
	c. Width of Head capsule (mm)	0.26	0.28	0.27 ± 0.06
3)	II Instar larva			
	a. Length (mm)	1.8	2.98	2.30 ± 0.81
	b. Width (mm)	0.2	0.49	0.34 ± 0.14
	c. Width of Head capsule	0.47	0.51	0.49 ± 0.17
4)	III Instar larva			
	a. Length (mm)	5.21	7.32	6.13 ± 2.13
	b. Width (mm)	1.01	1.29	1.10 ± 0.37
	c. Width of Head capsule (mm)	0.73	0.85	0.79 ± 0.26
5)	IV Instar larva			
	a. Length (mm)	10.56	14.67	12.36 ± 4.28
	b. Width (mm)	1.89	2.12	2.07 ± 0.72
	c. Width of Head capsule (mm)	1.27	1.29	1.25 ± 0.42
6)	V Instar larva			
	a. Length (mm)	13.56	15.87	14.99 ± 5.26
	b. Width (mm)	2.38	3.99	3.11 ± 1.09
	c. Width of Head capsule (mm)	1.98	2.43	2.10 ± 0.70
7)	Pupa			
	a. Length (mm)	8.70	10.50	9.95 ± 3.53
	b. Width (mm)	2.78	3.23	2.98 ± 1.03
8)	Adult Male			
	a. Length (mm)	8.56	9.76	9.17 ± 3.18
	b. Width (mm)	19.00	22.11	20.93 ± 7.36
9)	Adult Female			
	a. Length (mm)	9.59	12.88	11.47 ± 4.06
	b. Width (mm)	20.31	23.80	17.92 ± 5.40

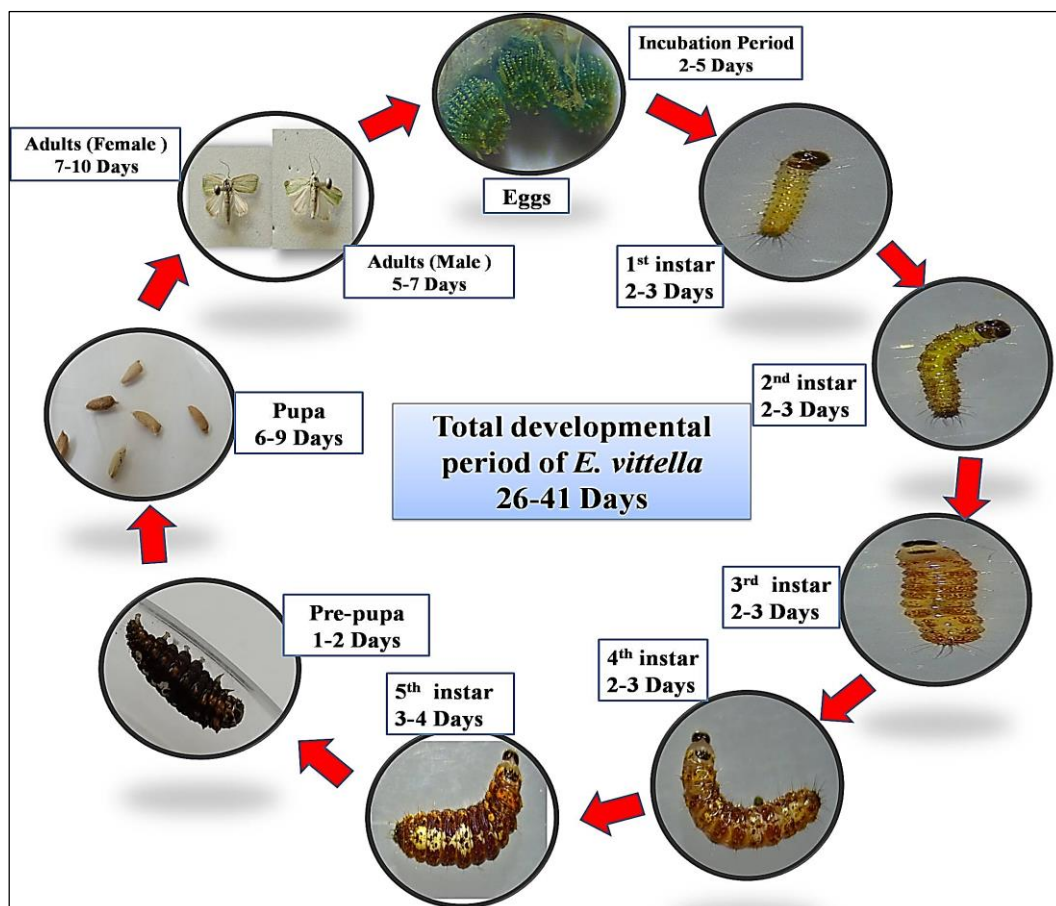
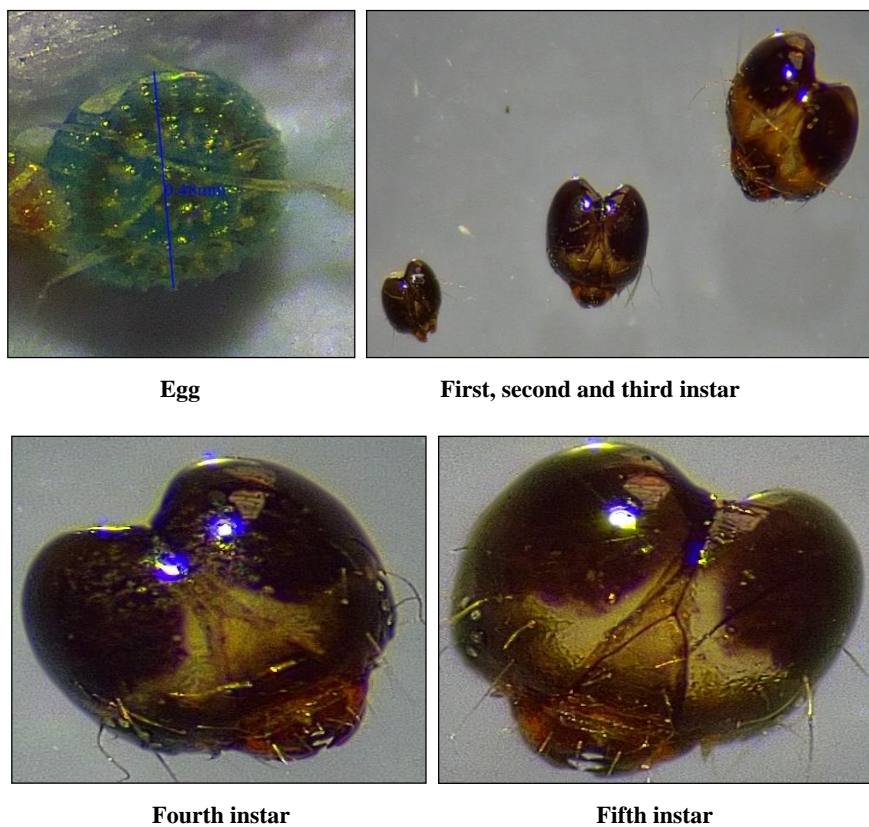


Plate 1: Life cycle of okra shoot and fruit borer, *Earias vittella*



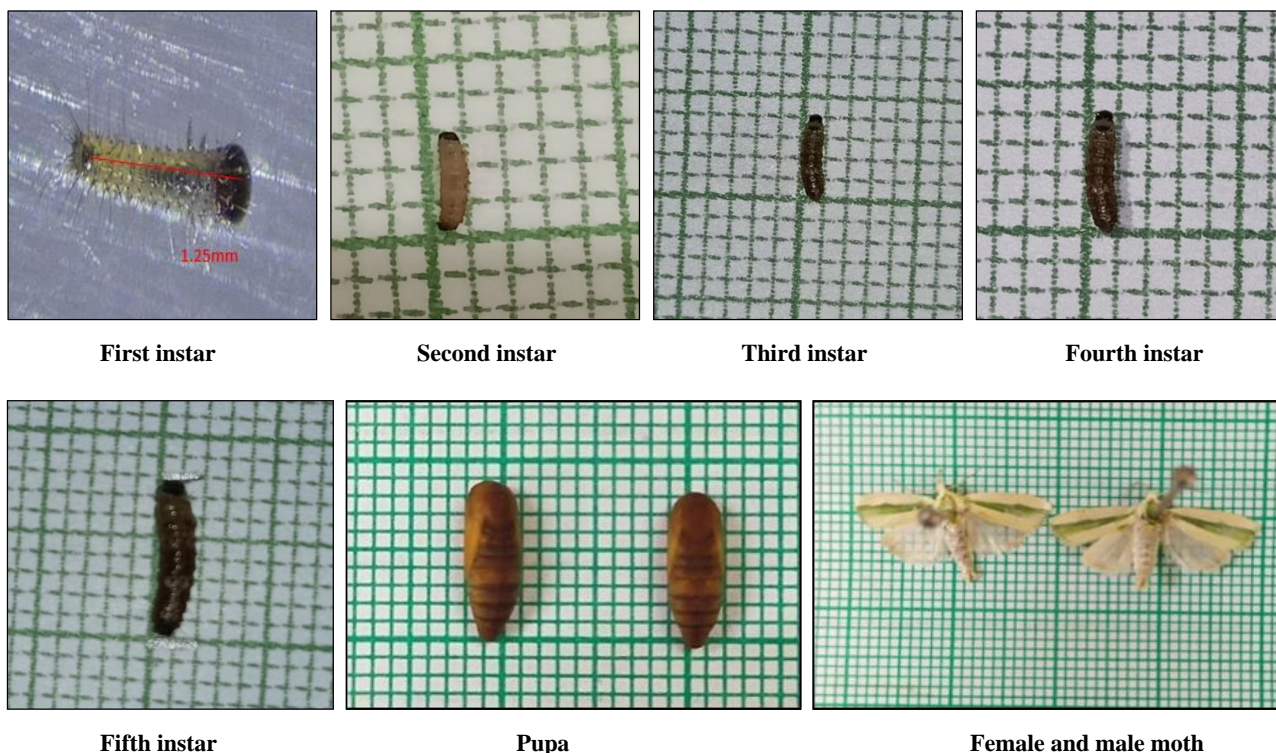
Egg

First, second and third instar

Fourth instar

Fifth instar

Plate 2: Biometrics of egg and head capsules of *E. vittella*



First instar

Second instar

Third instar

Fourth instar

Fifth instar

Pupa

Female and male moth

Plate 3: Biometrics of larval instars, pupa and adult (male and female)

Conclusion

Overall, it can be concluded that female of *E. vittella* laid spherical, bluish green coloured eggs usually singly and in small groups of 4 to 5 eggs. The mean incubation period and hatching percentage was 3.2 ± 0.46 days and $76.82 \pm 2.35\%$. The larvae passed through five instars, when *E. vittella* was reared on okra fruit. Durations of 1st, 2nd, 3rd, 4th and 5th instar

were completed in (2.4 ± 0.22 , 2.4 ± 0.22 , 2.4 ± 0.22 , 2.4 ± 0.22 and 3.40 ± 0.22 days), respectively and total larval period was of 13 ± 1.02 days. The average duration of pre-pupal period and pupal period was 3.2 ± 0.45 and 7.2 ± 0.53 days. The sex ratio (male: female), pre-oviposition period, oviposition period, post-oviposition period and fecundity were recorded on an average 1:1.12, 1.4 ± 0.22 days, $6.4 \pm$

0.51 days, 3.8 ± 0.77 days and 375.4 ± 33.79 eggs, respectively while average male and female longevity was 6.6 ± 0.46 and 8.2 ± 0.47 days, respectively. The average duration of total life-span for male and female were 32.6 ± 2.34 and 32 ± 3.06 days, respectively. Biometrics studies of *E. vittella* depicted that the mean width of eggs were 0.63 ± 0.22 mm. The mean length and width of 1st, 2nd, 3rd, 4th and 5th instar larvae were (1.65 ± 0.59 and 0.27 ± 0.1) mm, (2.30 ± 0.81 and 0.34 ± 0.14 mm), (6.13 ± 2.13 and 1.10 ± 0.37 mm), (12.36 ± 4.28 and 2.07 ± 0.72 mm) and (4.99 ± 5.26 and 3.11 ± 1.09 mm), respectively. The mean width of head capsule of 1st, 2nd, 3rd, 4th and 5th instar were 0.27 ± 0.06 , 0.49 ± 0.17 , 0.79 ± 0.26 , 1.25 ± 0.42 and 2.10 ± 0.70 mm, respectively. The mean length and width of pupa were 9.95 ± 3.53 and 2.98 ± 1.03 mm. The mean length and width of adult male were 9.17 ± 3.18 and 20.93 ± 7.36 mm and adult female were 11.47 ± 4.06 and 17.92 ± 5.40 mm.

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