



Bionomics and morphometric studies of tobacco caterpillar (*Spodoptera litura*) on rose plants

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Abstract

Bionomics and morphometrics of *Spodoptera litura* were studied by rearing it on rose flowers under laboratory conditions. Morphology of life stages i.e., egg, larva Pupa and adult along with developmental period were observed. Larvae were brought from the field of Rose crop and reared in glass jars by providing rose petals at the research laboratory during the period of year 2021-22. Total larval period completed in 25.65 - 36.73 days while it took 30.23 ± 0.38 average days respectively. The total development period was completed in 41.60 to 58.62 days with the Mean of 50.05 ± 0.79 days. The length of various larvae instars increased from 3.60 ± 0.05 to 31.62 ± 0.19 mm and breadth from 0.38 ± 0.09 to 3.59 ± 0.18 starting from first in a start to fifth instar respectively.

Keywords: *Spodoptera litura*, bionomics, morphometry, rose crops

Introduction

Spodoptera litura is also known as tobacco cutworm or cotton leaf worm /Tarro caterpillar. This is a nocturnal insect pest that belongs to the family Noctuidae. Insecta is the largest class of animal kingdom (Verma and Prakash, 2020) [24]. It is found all over the world and damages several field crops including cabbage, groundnut, cotton, tomato, soybean, cowpea, sweet potato, and ornamental plants, especially roses (Ahmad *et al.*, 2013) [2]. *Spodoptera litura* has grey to radish brown forewings which have a variegated pattern and paler lines along the veins. Larva of *Spodoptera litura* has variable colour i.e. young larvae are light green and in a later stage are dark green to brown. Sites of the body have longitudinal bands. At high population density, all plants are eaten by this pest (Abhishek and Patel, 2011) [1]. It causes losses to many economically important cultivated fields, crops, and ornamental plants. Due to tobacco caterpillar crop loss was found between 10 to 30% for major crops (Anonymous and Soybean, 2007[3]; Arya, 2018a [5]). Caterpillars prefer to feed on young tender leaves of plants and petals of rose flowers. Caterpillars also feed young shoot buds, balls, and fruits. The increasing infestation of the caterpillar of *Spodoptera litura* in the rose crop has raised a lot of questions regarding the factors responsible for its population build-up under natural conditions (Prمود *et al.*, 2015[15]; Ashwini *et al.*, 2016 [9]). The basic information on its life cycle is necessary for the rearing of the pest for its management. The present study was carried out keeping this in view in UP region (Corinto *et al.*, 2009[11]; Ashoka and Pavithran, 2022 [7]).

Materials and methods

The larvae of tobacco caterpillars were picked from an unspread field on rose during morning hours at Kanpur. The larvae were reared in a glass jar during 2021-2022. The mouth of the jar was covered with a muslin cloth tied with a rubber band. The mature larvae were fed with fresh rose petals without any infestation. In the prepupal stage, it is transferred to another jar containing soil for preparation. After the emergence of adults, males, and females, were identified and paired to transfer to the cage for mating. 10%

Honey solution shocked cotton was kept in the cage. Potted rose plants with flowers were also kept in a cage. Females lay eggs on different parts of plants. Females were identified by the tuft of hair on the tip of the abdomen.

Ten newly hatched larvae were transferred with the help of a soft camel hair brush to the petty dishes (5 cm × 1 cm) and were provided with fresh rose petals. The petals were changed every day with fresh petals and the faecal was removed and the development of the larva was observed daily. After the completion of larval development, pupation was started in the soil and data were recorded. (Taun *et al.*, 2015) [22]. The experiment was conducted at D.G. College Kanpur in CRD with three replications during the year 2021-22.

Observations on the number of days taken for each moulting, eggs, larvae, prepupa, pupa and adult were recorded. For the morphometric observation, the Length and width of larvae pupa and adult (5 of each stage) were measured with the help of ocular stage micrometre for first instar and with mm scale for the second to last instar. The breadth of different instars was recorded at their broadest part of the body. The mean of the different parameters was calculated and the standard deviation is done to quantify the number of variations (Shri and Jha, 2018) [19].

Results and discussion

The description of morphometrics of different life stages of *Spodoptera litura* and its development period feeding on rose flowers were recorded and given the table 1-2. It was found that females laid very small, round and yellowish white eggs on different parts of plants. Freshly laid egg measured from 3.59 ± 0.08 to 4.1 ± 0.8 mm in diameter. After hatching, *Spodoptera litura* larvae consist of five larval instars to become adults. It was also seen that some larvae passed through six instar lengths of 1st instar larvae varied from 3.10-3.90 mm. The first instar mean length was noted as 3.6 ± 0.05 mm. The mean value of breadth of 1st instar the larvae were found as 38 ± 0.09 mm. The length of the 2nd instar larvae ranged from 8.92 to 9.13 mm and its width ranged from 1.30 to 1.35 mm. The Mean value of length and breadth was found 9.2 ± 0.16 mm and 1.33 ± 0.04 mm,

respectively. The average length and width of third instar larvae were found 13.98 ± 0.06 and 2.93 ± 0.09 mm, respectively. Length of 4th instar larvae ranged from 25.28 to 26.15 mm in length mm and 2.60 to 2.78 mm in breadth similar results were found by Ashokaraj *et al.* (2011)^[8], Bae *et al.* (1997)^[10], and Ramaiah and Maheswari (2018)^[16] in their observations.

The length of the mean of the 5th instar larvae was found 31.62 ± 0.19 mm. In the prepupal stage length and breadth of larvae were noted as 30.85 to 33.82 mm and 4.80 to 4.99 mm respectively. So, the mean length of the larva from 1st instar to 5th instar revealed a great range of variation from 3.6 ± 0.05 mm to 33.25 ± 0.25 mm. Similarly, the breadth of pupa also exhibits a range of variations in Mean. 38 ± 0.09 mm to 4.95 ± 0.28 mm. Present findings have close conformity with the finding of Sasvihalli (2013)^[18], Singh *et al.* (2015)^[20] and Pragma *et al.* (2021)^[13].

Table 1: Morphometric of different life stages of *Spodoptera litura*.

Stage	Length (mm)		Breadth (mm)	
	Range	Mean	Range	Mean
Egg	2.35 – 3.60	3.59 ± 0.08	4.26 - 4.35	4.1 ± 0.8
Larval (Instar)				
i.	3.10 – 3.90	03.60 ± 0.05	0.25 – 0.38	0.38 ± 0.09
ii.	8.92 – 9.13	09.20 ± 0.16	1.30 – 1.35	1.33 ± 0.04
iii.	12.80 – 13.20	13.98 ± 0.06	1.98 – 2.95	2.93 ± 0.09
iv.	25.28 – 26.15	26.85 ± 0.15	2.60 – 2.78	2.74 ± 0.11
v.	30.00 – 31.50	31.62 ± 0.19	2.95 – 3.62	3.59 ± 0.18
Pre-Pupa	32.85 – 33.82	33.25 ± 0.25	4.80 – 4.99	4.95 ± 0.28
Pupa	16.55 – 17.75	17.84 ± 0.14	5.00 – 5.35	5.22 ± 0.08
Adult	14.58 – 15.85	15.90 ± 0.10	7.28 – 8.95	7.82 ± 0.25

*Mean of 10 observations

Table 2: Development Period (in days) of *Spodoptera litura* feeding on rose flowers.

Life Stage	Range (days)	Mean (days)
Egg	3.95 - 4.69	4.62 ± 0.42
Larva	i. Instar	$4.50 - 8.50$
	ii. Instar	$6.20 - 7.80$
	iii. Instar	$5.90 - 8.40$
	iv. Instar	$4.80 - 5.75$
	v. Instar	$4.25 - 6.28$
Total Larval Period	$25.65 - 36.73$	30.23 ± 0.38
Prepupal	$1.50 - 2.50$	1.75 ± 0.50
Pupal	$6.25 - 9.00$	8.70 ± 0.25
Adult	$4.25 - 5.70$	4.75 ± 0.50
Total	$41.60 - 58.62$	50.05 ± 0.79

*Mean of 10 observations

The pupal length varied from 16.55 mm to 17.75 mm and its breadth was observed from 5.00 mm to 5.35 mm. The mean value of larval length and breadth was estimated at 17.84 ± 0.14 mm and 5.22 ± 0.08 mm respectively. The size of adult males and females ranged from 14.58 to 15.85 mm in length and width expanded wings of 7.28 to 8.95 mm. The present findings on wing expand of adults (male and female) were in line with those of Armes *et al.* (1987)^[4], Zhu *et al.* (2000)^[25] and Tithi *et al.* (2010)^[21], who found the wing expansion breadth range as 7.35 mm to 8.99 mm. The incubation period ranged from 3.95-4.69 days with a 4.62 ± 0.42 mean value. The life cycle of *Spodoptera litura* was completed from 41.60 to 58.62 (mean 50.05 ± 0.79) days during 25 to 30 c temperatures (Sanjrani *et al.*, 1989^[17]; Vashisth and Chandel, 2013^[23]; Arya, 2018b^[6]).

1st, 2nd, 3rd, 4th, and 5th instar larvae take an average of 6.50 ± 0.35 , 7.35 ± 0.20 , 6.38 ± 0.70 , 5.25 ± 0.30 , 4.75 ± 0.35 days in the development. The prepupal stage of larvae varied from 1.50 to 2.50 days. However, the pupal period ranged from 6.25 to 9.00 days with 8.70 ± 0.25 average days. Similar observations were seen by Ashwini *et al.* (2016), Kandagal *et al.* (2013)^[12] and Pragma and Das (2022)^[14].

Conclusion

Spodoptera litura larvae reared at 25-30°C with RH 75 ± 5%. Total larval period was completed in 25.65 to 36.73 days while taking 30.23 ± 0.38 average days respectively. Total life cycle of this insect was completed in 41.60- 58.62, with average 50.05 ± 0.79 days respectively as the temperature increased. The number of days required for development is reduced. The length of different larval instars increased from 3.6 ± 0.05 mm to 31.62 ± 0.19 mm and breadth from 0.38 ± 0.09 to 3.59 ± 0.18 mm starting from the first instar to the fifth instar respectively.

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