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Bionomics of tobacco caterpillar *Spodoptera Litura* (Fab.) A leaf-eating caterpillar affecting soybean crop

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Abstract

In present study hatching of the eggs was observed in the early morning hours with the incubation period of 3.30 ± 0.00 days. The third, fourth and fifth instar larvae were voracious feeders eating the whole leaf blade leaving only the midrib intact and the total larval period lasted for about 12 to 17 days with an average of 14.5 ± 4.95 days on soybean. The pupal-period lasted for 7-9 days with an average of 7 ± 1.41 days. Adult male longevity was 6 to 8 days with an average of 7 ± 1.41 days and female ranged from 7 to 9 days with an average of 8.5 ± 0.71 days. Thus, entire life cycle of *S. litura* was completed in 28.7 to 38.5 days with an average of 33.4 ± 6.93 days under laboratory condition.

Keywords: Biology, *S. litura*, soybean and instars

Introduction

One of the major oilseed cash crops in India is the soybean [*Glycine max* (L.) Merrill.], which is a member of the Leguminosae family, subfamily Papilionaceae. It is referred to as the "Miracle bean, Golden bean, and Crop of the planet" since it is a special crop with high nutritional content. It offers 18-19% carbs, 6-7% total minerals, 5-6% crude fiber, 40% protein, 20% oil, and a high content of polyunsaturated fats, particularly Omega 6 and Omega 5 fatty acids. From a nutritional perspective, soybeans are a good source of lecithin and phosphorus, and they contain 20.00% edible oil and 43.2% protein. It also has good levels of vitamin E, potassium, and sulfur. The primary amino acids that the human body needs, such as leucine, methionine, and threonine, are found in soybean protein. It is referred to as "Poor Man's Meat" by vegetarians.

More than 112 plant species from 44 families have been documented to be harmed by *Spodoptera litura* (Fabricius), a polyphagous pest that is found in India and many other nations (Shivayogeshwara *et al.*, 1991) ^[13]. These, 40 species are known to exist in India (Chari and Patel, 1983) ^[2]. Numerous research workers have identified a variety of crops as its host plants, including maize, lentil, green gram, moth bean, castor, sesame, groundnut, tomato, cauliflower, cabbage, colocasia, agathi, indigo, slender pigweed, brinjal, chilli, banana, lucern, carpet weed, elephant yam, tobacco, grasses, etc. (Basu, 1944; Thobbi, 1961 and Patel *et al.*, 1987). A nocturnal moth belonging to the Noctuidae family, *Spodoptera litura* is often referred to as the cotton leafworm or tobacco cutworm. A significant polyphagous annoyance throughout Asia, Oceania, and the Indian subcontinent is *S. litura*. *S. litura* is a polyphagous pest that is economically significant in India and, after *Helicoverpa armigera* (Hubner), is regarded as one of the main threats to modern intensive agriculture and shifting cropping patterns globally. South East Asia, China, Korea, Japan, the Philippines, Indonesia, Australia, the Pacific Islands, Hawaii, Fiji, Bangladesh, Sri Lanka, India, and Pakistan are all home to the pest.

Materials and Methods

To study biology and morphometrics of *Spodoptera litura*, mass multiplication of *Spodoptera litura* was taken up. Before rearing egg masses were collected from untreated experimental field and transferred to a clean container by providing healthy soybean leaves with petioles.

The leaf was kept in the plastic container containing moist filter paper to keep it fresh. This served as immediate source of food for the first instar larvae. The leaves were changed every day till larvae entered into the pupal stage. Fifth instar larva were collected from containers and released in to another plastic container having soil for pupation. Pupae thus obtained were collected and kept in rearing boxes. During the process, male and female pupae were separated based on external genitalia. These pupae were kept in separate rearing chamber for adult emergence. As a source of food for newly emerged adults honey solution was provided.

Developmental stages

For describing different developmental stages of tobacco caterpillar, *Spodoptera litura* i.e., egg, larva, pupa, adult and changes in their body size and colour, each stage was observed and data were recorded regularly.

- **Egg:** Egg incubation period was recorded from the day of egg laying to emergence of first instar larva in days.
- **Larvae:** Immediately after hatching, first instar larvae were allowed to feed on fresh leaves in plastic rearing containers up to third instar because of their gregarious nature. However, during their successive development, the larval number was reduced in each rearing container. Fresh clean leaves were supplied everyday as food. The rearing plastic containers were replaced with clean sterilized ones on every alternate day. During fourth and fifth instar stages, single larva was transferred to plastic container and provided with sufficient leaves. As the size of the larvae was increasing, the number of containers also increased to provide more space.
- **Pupae:** After pupation the pupa collected and placed inside petri-dis for adult emergence. Pupal period i.e., from the day of pupation to the day of adult emergence was recorded by taking a sample of 10 pupae.
- **Adult longevity:** Longevity and reproductive capacity of adults freshly emerged, from one day old adults of *S. litura* were collected from the stock culture. Male and female adult were paired and kept in separate plastic jars. The sides of the jars were pasted with nappy liners as an oviposition medium. Petri-dishes were kept at the bottom of the jars in which cotton soaked in sucrose solution (10%). The diets were provided daily on need basis. The experiment was replicated thrice. The insects were observed daily for pre-oviposition, oviposition and post-oviposition period in each replication. During oviposition period, the eggs were collected from nappy liners pasted on the sides of the jars daily up to 6 days. The eggs were counted and kept in Petri-dishes for hatching under growth chamber. Upon hatching the larvae were fed the newly leaf for further generations and calculation of biological parameters. The data was recorded for further generations and calculation of biological parameters. The data was recorded on the pre-oviposition period, oviposition period, post-oviposition period, fecundity and adult longevity.

Results and Discussion

Egg

In present study, oviposition of *S. litura* was observed and occurred during night hour. Egg were covered with yellowish brown hairs and the hairs seen earlier as present

on the abdomen of the adult females were not seen after oviposition confirming that the female had dropped the abdominal hairs after oviposition to cover the laid egg mass. On removal of the hairy mass, it was seen that the eggs were laid one over the other in three layers. Eggs were spherical in shape and yellowish creamy in colour. In present study hatching of the eggs was observed in the early morning hours with the incubation period of 3.30 ± 0.00 days and few hours prior to hatching, colour of the egg mass changed from yellow to dark black.

Present finding are agreed with the finding of Kumar *et al.*, (1992) ^[6] who studies at constant temperatures of 20, 25, and 30 °C revealed that, at these three temperatures, the egg stage continued for 5, 4, and 3 days, respectively.

Kandagal and Khetagoudar (2012) ^[5] who recorded incubation period as 4 days, were almost similar with present finding that was 3 days.

Latha *et al.*, (2014) ^[7] who studied the biology of *Spodoptera litura* (Fabricius) on chewing tobacco and the reported that average incubation period of eggs was of 4.10 ± 0.32 days.

Larvae

First instar Larvae

The neonate larvae were pale green in colour with dark black head having distinctly visible black hairs on the body and tiny black spot on first abdominal segment and larvae were found to be feeding gregariously. First instar larval period lasted for about 2-3 days on soybean crop with an average of 2.5 ± 0.71 days.

Second instar

The second instar larvae were appeared pale green in colour and hairless. The first and second instar larvae were found scraping the chlorophyll of the leaves converting the lamina into a papery form. However, after moulting, the second instar larvae at late stage of development started dispersing to feed individually. The larval period lasted for about 2-3 days with an average of 2.5 ± 0.71 days.

Third instar

In present study, the third instar larvae changed their body colour from dark green with two dorsal black spots on the first abdominal segment and dark crescent shaped spots on the sides of the subsequent abdominal segment. Three yellowish colour bands were observed on each segment on the dorsal surface of the larvae from mouth to posterior end of the abdomen which were not clear. The larval period lasted for about 3-4 days with an average of 3.5 ± 0.71 days.

Fourth instar

The fourth instar larvae changed their colour from green to blackish brown. The three lines of dorsal bands changed the colour, with the central band become bright orange and the two Lateral bands become yellow. Black intermittent spots appeared dorsally along each lateral Yellow band and the larval period lasted for about 3-4 days with an average of 3.00 ± 1.41 days.

Fifth instar

After fourth moult, colour of the larvae changed to dark blackish brown with three lines or bands as mentioned above. The black intermittent spots clearly appeared dorsally along each lateral yellow band from anterior to

posterior part of the body. The instar larval period lasted for about 3-4 days with an average of 3.00 ± 1.41 days. Third, fourth and fifth instar larvae were voracious feeders

eating the whole leaf blade leaving only the midrib intact and the total larval period lasted for 13 to 18 days with an average of 14.5 ± 4.95 days on soybean.

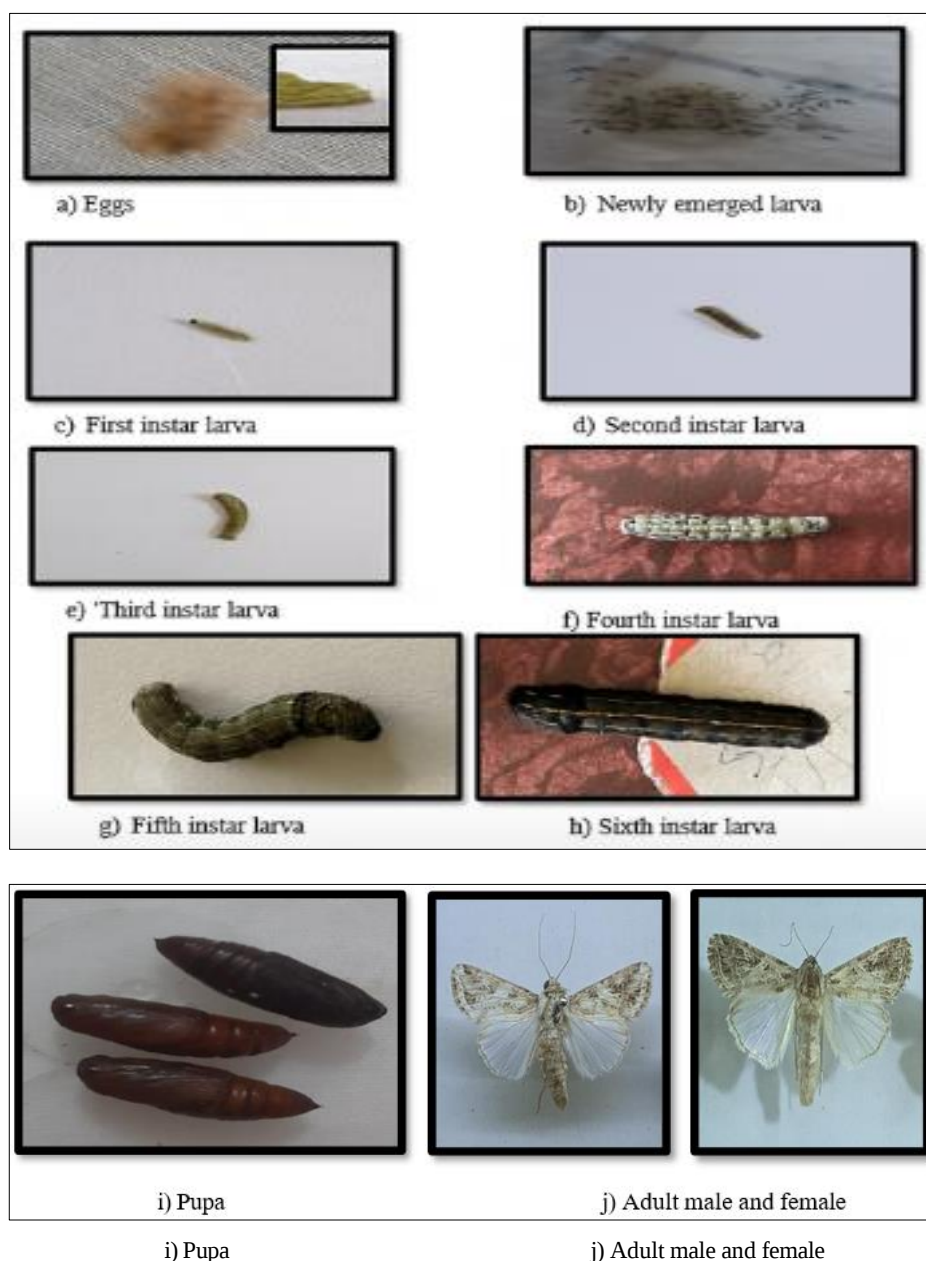


Fig. 1: Life cycle of *S. litura*

Table 1: Biology of tobacco caterpillar, *Spodoptera litura* (Fab.) on soybean

S. N.	Stage of insect	Minimum value (Days)	Maximum value (Days)	Mean (Days)	SD
1.	EGG Incubation Period	4	3	3.3	0.71
2.	LARVA				
a	1 st instar	2	3	2.5	0.71
b	2 nd instar	2	3	2.5	0.71
c	3 rd instar	3	4	3.5	0.71
d	4 th instar	3	4	3	1.41
e	5 th instar	3	4	3	1.41
	Total larval period	13	18	14.5	4.95
3.	PUPA				
a	Pre-pupal period	0.7	1	0.85	0.21
b	Pupal period	6	8	7	1.41
4.	ADULT				
a	Male	6	8	7	1.41
b	Female	8	9	8.5	0.71
c	Average	7	8.5	7.75	1.06
	Total life cycle	28.7	38.5	33.4	6.93

Pupa

Pupae appeared pale yellowish initially, later became dark reddish brown in colour. The male pupae showed genital aperture was observed on 9th abdominal segments. Likewise, the female pupae had genital aperture on 8th abdominal segments. The pupal-period lasted for 6-8 days with an average of 7 ± 1.41 days.

Adult

The adult moth was brown with a complex pattern of whitish creamy coloured criss-crossing markings on the forewings. The hind wings were silvery white in colour. The males had a prominent white band on forewings unlike female and male adults were somewhat bright coloured than female.

Adult male longevity was 6 to 8 days with an average of 7 ± 1.41 days and female ranged from 8 to 9 days with an average of 8.5 ± 0.71 days. Thus, entire life cycle of *S. litura* was completed in 28.7 to 38.5 days with an average of 33.4 ± 6.93 days under laboratory condition.

In the present study adult male longevity was 6 to 8 days with an average of 7 ± 1.41 days and female longevity ranged from 8 to 9 days with an average of 8.5 ± 0.71 days. Thus, entire life cycle of *S. litura* was completed in 28.7 to 38.5 days with an average of 33.4 ± 6.93 days.

Conclusions

In present study hatching of the eggs was observed in the early morning hours with the incubation period of 3.30 ± 0.00 days. The third, fourth and fifth instar larvae were voracious feeders eating the whole leaf blade leaving only the midrib intact and the total larval period lasted for about 12 to 17 days with an average of 14.5 ± 4.95 days on soyabean. The pupal-period lasted for 7-9 days with an average of 7 ± 1.41 days. Adult male longevity was 6 to 8 days with an average of 7 ± 1.41 days and female ranged from 7 to 9 days with an average of 8.5 ± 0.71 days. Thus, entire life cycle of *S. litura* was completed in 28.7 to 38.5 days with an average of 33.4 ± 6.93 days under laboratory condition.

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