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BIOLOGY AND MORPHOMETRICS OF *SPODOPTERA LITURA* (F.) ON CASTOR

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ABSTRACT

Biology and morphometrics of *Spodoptera litura* (F.) was studied by rearing it on castor under laboratory conditions. Morphology of life stages i.e., egg, larva, pupa and adult along with development period were observed. The width of head capsule was observed at each moult as 0.19, 0.25, 0.45, 0.71, 1.31 and 2.13 mm, respectively. The mean growth ratio of *S. litura* was observed as 1.64, which indicated that increase in head width in instars was only slightly varying from Dyar's law.

Key words: *Spodoptera litura*, castor, biology, morphometrics, life stages, instars, head capsule, growth ratio, Dyar`s law

The tobacco cut worm *Spodoptera litura* (F.) (Lepidoptera: Noctuidae) is a polyphagous pest infesting 112 species of plants belonging to 44 families, of which 40 species were reported from India (Chari and Patel, 1983). It attacks the economically important crops like tobacco, cole crops, castor, cotton, chilies, sunflower, groundnut, pulses and tomato (Yadav et al., 2012). Measurement of width of head capsule provides an information of morphometrics as in Lepidoptera, the head capsule width helps to determine the larval instars (Ashwini et al., 2016). Head capsule width of larval instars was used to determine the age of *S. litura* (Tithi et al., 2010). The number of larval instars and biology of *S. litura* helps in the development of crop pest models and pest management operations (Xue et al., 2010; Tuan et al., 2015; Etman and Hooper 1980). Dyar's law states that the head capsule width in caterpillar increases by a constant ratio at each moult that varies from species to species, usually about 1.2 to 1.4 which applies to almost all insect larvae (Dyar, 1890). This study evaluates the development period, growth and morphometrics of *S. litura* on castor.

MATERIALS AND METHODS

This laboratory experiment was carried out at the Department of Entomology, Faculty of Agriculture, Annamalai University, Chidambaram (11°23′48″ N, 79°42′58″ E) at 27± 2°C and 75± 10% RH in 2018. Larvae of *S. litura* were collected from the field and reared on castor leaves. For obtaining the uniform synchronized eggs, a potted castor plant (six weeks old) was placed in the ovipositional cage containing 50 pairs of newly emerged adults overnight (male 1: female 1). Then the egg-bearing leaves were collected and transferred to fresh castor leaf discs (3 cm dia) in petridishes (5.5 cm dia) sealed with paraflim. The immature stages were examined under the stereozoom microscope daily, and the developmental periods observed. To determine the larval instars, the individual larva was observed daily for the exuviae (n-25), with moulting confirmed by the casted off head capsule. After each moult, freshly moulted 15 larvae were killed in hot water (60°C). then excess moisture removed. The head capsule width, body length and body width of larva were measured using Leica image analyser software. The Dyar's law (1890) was tested for the number of larval instars and data obtained analysed in terms of ratio, and number of instars confirmed with computation of mean and standard deviation. Growth ratio was calculated by dividing value of succeeding instar with that of preceding one.

RESULTS AND DISCUSSION

The results obtained revealed that egg period was 3.0± 0.00 days as reported earlier by Balasubramanian et al. (1984). Mean development time was 3.6± 0.41, 2.7± 0.22, 2.2± 0.25, 2.4± 0.22, 2.3± 0.27 and 3.9± 0.26 days for larval instars I to VI, respectively. The pupal stage was 7.5± 0.31 days, and the adult longevity observed was 7.40± 1.06 and 8.36± 1.93 days for male and female, respectively. These results agree with those of Xue et al., (2010), Etman and Hooper (1980) and Tuan et al. (2015). The preoviposition, oviposition and postoviposition periods were 2.44, 3.84 and 2.08 days, respectively. Fecundity and % hatching were 1313.25 eggs/ female and 80.48 %. These agree with the

Table 1. Biology and morphometrics of *S. litura* (F.) on castor

Stages	Range (days)	Mean (days)± SE
Developmental period		
Egg	3.0 – 3.0	3.0± 0.00
I Instar	3.2 - 4.0	3.6± 0.41
II Instar	2.5 - 2.9	2.7± 0.22
III Instar	1.9 - 2.5	2.2± 0.25
IV Instar	2.1 - 2.7	2.4± 0.22
V Instar	2.1 - 2.5	2.3± 0.27
VI Instar	3.3 - 4.4	3.9± 0.26
Total larval period	15.8 - 18.4	17.1± 1.63
Pupa	6.9 - 8.1	7.5± 0.31
Male longevity	7.20 - 7.60	7.40± 1.06
Female longevity	8.23 - 8.49	8.36± 1.93
Mean adult longevity	7.28 - 8.48	7.88± 1.26
Total lifecycle	31.04 - 39.72	35.08± 6.68
Pre oviposition period	2.33 - 2.55	2.44± 2.1
Oviposition period	3.62 - 4.06	3.84± 1.41
Post oviposition period	1.99 - 2.17	2.08± 0.35
Fecundity (eggs/ female)	1291.08 - 1335.42	1313.25± 21.22
% Hatching	76.7 - 84.26	80.48± 8.63

Larval head capsule width

Larval instars	Estimated (mm)	Observed (mm) ± SE	Growth ratio
L1	0.19	0.19± 0.04	-
L2	0.19 x 1.64 = 0.31	0.25± 0.03	1.32
L3	0.31 x 1.64 = 0.51	0.45± 0.01	1.80
L4	0.51 x 1.64 = 0.84	0.71± 0.03	1.58
L5	0.84 x 1.64 = 1.39	1.31± 0.02	1.85
L6	1.39 x 1.64 = 2.28	2.13± 0.03	1.63
Mean growth rate =			1.64

Morphometrics

Stages	Length (mm)		Breadth (mm)	
	Range	Mean± SE	Range	Mean± SE
Egg mass (diameter)	-	-	3.9-4.2	4.03± 0.13
I Instar	0.61-0.20	0.91± 0.12	0.12-0.56	0.30± 0.01
II Instar	1.26-1.83	1.56± 0.24	0.98-1.71	1.36± 0.06
III Instar	3.13-3.91	3.52± 0.21	1.99-2.56	2.24± 0.08
IV Instar	6.26-6.96	6.61± 0.23	2.63-3.12	2.81± 0.11
V Instar	12.87-13.26	13.01±0.99	3.44-3.82	3.63± 0.07
VI Instar	24.2 - 24.99	24.61± 0.12	3.88-4.42	4.15± 0.02
Pupa	14.32 - 15.06	14.69± 0.24	5.06-5.63	5.18± 0.13
Adults	Body length (mm)		Wing span (mm)	
Male	15.86 - 16.03	15.95± 0.13	34.00 - 38.00	36.00± 0.00
Female	16.92 - 17.08	17.00± 0.07	34.00 - 38.00	36.00± 0.00

observation by Abhishek and Patel (2011) on groundnut. The results revealed six larval instars, with head capsule width of 1st, 2nd, 3rd, 4th, 5th and 6th larval instars being 0.19, 0.25, 0.45, 0.71, 1.31 and 2.13 mm, respectively. It was predicted that as linear measurements increase by a constant factor in instars, and growth does not follow Dyar's rule, with growth ratio being not commonly in the order of 1.4 (Dyar's, 1890). The width of head capsule revealed a ratio of 1.64, which was used for the calculation of head capsule width of each larval instar (Table 1). Contradictory results had been reported for *Helicoverpa armigera* by Khorasiya et al. (2014) and *Lymatria obfuscata* by Thakur (2016), where their growth ratio fits with Dyar's law. The morphometrics reveal that diameter of the egg mass as 4.03 mm, first instar larva was 0.91x 0.30 mm; second instar being 1.56x 1.36 mm; third was 3.52x 2.24 mm, fourth being 6.61x 2.81 mm; fifth measured 13.01x 3.63 mm; and the sixth was 24.61x 4.15 mm. Pupa measured 14.69± 0.24x 5.18 ± 0.13 mm, while adults measured 15.95 and 17.00 mm, respectively. Wing span of male and female moths measured 36.00 mm. The present results follow a similar trend observed by Tuan et al. (2015).

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