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Larval and post-larval development of *Spodoptera litura* (Fabricius) on some host plants

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Abstract. The tobacco caterpillar, *Spodoptera litura* (Fabricius) was reared on different host plants under laboratory conditions. This article reports the growth and development of *S. litura* on different host plants.

Keywords. *Spodoptera litura*; host plants; larval development; post-larval development.

1. Introduction

The tobacco caterpillar, *Spodoptera litura* is a serious and polyphagous pest of many economically important crops (Basu 1943; Thobbi 1961; Bhattacharya and Rathore 1977). It is a well-documented fact that food plants play a vital role in development, survival and reproductive potential of insects. In the present article we report the growth and development of *S. litura* on different host plants.

2. Material and methods

The eggs obtained from the moths reared as larvae on the leaves of castor, okra, groundnut and sunflower were kept in petridishes for hatching. The neonate larvae (100) were reared individually in plastic boxes (5 × 5 cm) on the respective host plants. Food was changed when required. Larvae pupated in the sieved moist soil provided in the plastic boxes. Observations on larval duration, per cent larvae pupated and larval weight on the 11th and 14th day after hatching were recorded. Sexing was made in the pupal stage. The pupal length, width and weight were recorded. The adults emerging from the respective host plants on the same day were paired and released for egg laying in plastic jars (12 × 15 cm) covered with muslin cloth held in position by rubberband. Cotton swabs soaked in 10% honey was provided daily for adult feeding. Paper strips (7·5 × 5 cm) folded in a zig-zag fashion was provided as oviposition sites. The egg clusters laid were separated from the muslin cloth and paper strips and thus the fecundity was worked out.

3. Results and discussion

The host plants exhibited differential response with respect to the percentage pupation, larval duration and growth index of *S. litura* (table 1). The percentage pupation ranged from 44·33–92·21% on groundnut and okra. The order of suitability of host plants for

Table 1. The mean per cent pupation, larval duration and larval weight of *S. litura* on different hosts.

Host	Mean per cent larvae pupated (*n*)	Mean larval duration (days)	Growth index (*n*/mean days)	Mean larval weight (mg)		Actual gain in larval weight (mg)
				11 days after hatching	14 days after hatching	
Castor	84·44 *a,b*	11·50 *d*	7·34	941·26 *a*	1302·74 *a,b*	361·48
Groundnut	44·33 *c*	19·52 *a*	2·29	31·01 *d*	215·31 *d*	184.30
Okra	92·21 *a*	15·42 *b*	5·98	308·76 *c*	1107·40 *b,c*	798·64
Sunflower	89·99 *a,b*	12·90 *c*	6·97	648·88 *b*	1395·94 *a*	747·06

Means in the same column followed by the same letter are not significantly different ($p = 0{\cdot}05$) by Duncan's multiple range test.
a, b, c, d—Significance of host plants with each other with Duncan's multiple range test.

pupation was okra > sunflower > castor > groundnut. The larval duration also varied significantly and ranged from 11·50 days on castor to 19·52 days on groundnut. The suitability of host plants for larvae was in the order: castor > sunflower > okra > groundnut. The mean larval weight on the 11th day of age was high (941·26 mg) on castor followed by sunflower, okra and groundnut.

A perusal of table 2 indicates that the host plants influenced the prepupal, pupal duration and mean per cent adult emergence. The mean prepupal and pupal period was longest on sunflower but pupal period on okra was similar to that of sunflower. The mean percentage adult emergence ranged from 41·11 on groundnut to 82·22 on okra. In general, females emerged earlier than males in all the host plants tested.

The results on the pupal measurements are dipicted in table 3. Significant differences were recorded in pupal length, width and weight of *S. litura* when the larvae were reared on different hosts. There was no relation between the pupal length, width or weight and the pupal duration.

The mean preoviposition and oviposition periods did not differ significantly except that on sunflower the preoviposition period was shorter (table 4). The highest fecundity was noted on sunflower (3649·4 eggs) while the lowest was on groundnut (3121·8 eggs). Reproductive index was calculated by dividing mean fecundity by average female pupal weight (Hough and Pimental 1977). On the basis of the reproductive index the host plants could be arranged in a descending order as: groundnut (10·68), okra (9·80), Sunflower (9·75) and castor (8·46). The life cycle from egg to adult emergence was shorter on castor (25·07 days) followed by sunflower (26·66 days), okra (30·03 days) and groundnut (32·80 days). In general females had a shorter life cycle than males. The females lived longer than males.

The mortality in the early instars of the larvae was 55·67 % on groundnut. Tiwari *et al* (1980) observed mortality in the early instars up to 12 days of the larval period due to less intake of leaf tissues of groundnut. The work of Thobbi (1961) and Singh and Byas (1975) also indicated heavy mortality on cotton. The mortality of larvae on okra, sunflower and castor was 7·79, 11·01 and 15·66 %, respectively. However, Singh and Hoi (1972) observed 22 % larval mortality when reared on castor. Bhattacharya and Rathore (1977) recorded 84·70, 80, 73·50 and 77·10 % pupation and growth index values of 5·39, 4·57, 2·93 and 3·97 on castor, cabbage, cotton and soybean, respectively. Bilapate and Thombre (1979) recorded 89·47 % pupation on sunflower at 26 ± 1°C temperature. A similar trend was observed in the present studies also. The differences in the larval period of *S. litura* feeding on many host plants have been reported by many researchers. Basu (1945) reported larval duration of 18–20 days on cauliflower, 14 days on castor and 14–16 days on okra (Thobbi 1961), 18 days on castor (Rattan Lal and Nayak 1963), 18·7 days on castor (Patel *et al* 1965), 15·4 days on castor (Singh and Hoi 1972), 14·18 days on castor (Aleemuddin 1979). The results obtained in the present investigations on larval period on okra and sunflower are in agreement with those of earlier workers (Thobbi 1961; Bilapate and Thombre 1979). Host plants which supported poor larval development gave smaller growth index values as in the case of groundnut. Thobbi and Srihari (1967) obtained high larval weight after 11 days on HC-6 irrigated castor variety. The differences in pupal durations of *S. litura* feeding on different host plants have been similarly demonstrated by different workers (Basu 1943; Singh and Byas 1975; Bhattacharya and Rathore 1977). Basu (1943) established a direct relationship between host plant and pupal duration. In the present investigation however, the larvae with higher growth index values do not necessarily yield pupae of

Table 2. The pre-pupal, pupal duration and per cent adult emergence of *S. litura* on different hosts.

Host	Mean pre-pupal duration (days)	Mean pupal duration (days)			Mean per cent adult emergence		
		Male	Female	Both	Male	Female	Both
Castor	1·14 b	9·55 *b*	7·37 *a*	9·24 *a*	27·77 *b,c*	23·33 *b*	51·11 *b,c*
Groundnut	1·24 *a,b*	9·68 *b*	6·66 *a*	8·98 *a*	23·33 *b*	17·77 *b*	41·11 *c*
Okra	1·05 *b*	10·33 *a*	8·77 *a*	9·50 *a,b*	38·88 *a,c*	43·33 a	82·22 *a*
Sunflower	1·42 *a*	9·86 *a,b*	8·84 *a*	9·50 *a*	46·66 *a*	26·66 *b*	73·33 *a,b*

Means in the same column followed by the same letter are not significantly different ($p = 0·05$) by Duncan's multiple range test.

Table 3. The mean pupal length, width and weight of *S. litura* on different hosts.

Host	Mean pupal length (mm)			Mean pupal width (mm)			Mean pupal weight (mg)		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Castor	19·20 *a*	18·70 *a*	18·97 *a*	5·75 *a*	6·02 *a*	5·97 *a*	368·46 *a*	374·22 *a*	373·98 *a*
Groundnut	18·64 *a*	15·44 *a*	18·50 *a*	5·69 *a*	4·93 *a*	5·76 *a*	330·64 *a*	292·19 *a*	334·57 *b*
Okra	18·37 *a*	18·86 *a*	18·64 *a*	5·51 *a*	5·83 *a*	5·67 *a*	294·74 *c*	348·71 *a*	321·68 *b*
Sunflower	18·82 *a*	18·71 *a*	18·77 *a*	5·82 *a*	5·95 *a*	5·86 *a*	350·44 *a,b*	374·22 *a*	357·41 *a*

Means in the same column followed by the same letter are not significantly different ($p = 0{\cdot}05$) by Duncan's multiple range test.

Table 4. The mean pre-oviposition, oviposition, fecundity and longevity of *S. litura* on different hosts.

Host	Mean pre-oviposition period (days)	Mean oviposition period (days)	Fecundity	Mean life cycle (days)			Mean adult longevity (days)		
				Male	Female	Both	Male	Female	Both
Castor	2·1 *a*	4·00 *a*	3166·8 *a*	25·48 *d*	20·17 *a*	25·07 *d*	6·00 *a,b*	6·70 *a*	6·35 *b*
Groundnut	2·0 *a*	3·80 *a*	3121·8 *a*	33·40 *a*	26·70 *a*	32·80 *a*	6·30 *b*	6·30 *a*	6·30 *a,b*
Okra	1·5 *a*	4·10 *a*	3420·5 *a*	30·65 *b*	29·46 *a*	30·03 *b*	8·70 *a*	7·20 *a*	7·95 *a*
Sunflower	1·2 *a*	4·00 *a*	3649·4 *a*	27·00 *c*	25·91 *a*	26·66 *c*	6·10 *a,b*	5·90 *a*	6·00 *a,b*

Means in the same column followed by the same letter are not significantly different ($p = 0·05$) by Duncan's multiples range test.

shorter duration and as such a definite relationship between the food plant and the pupal duration is difficult to establish. Similar observations were recorded by Pandey and Srivastava (1967). Basu (1945) demonstrated an inverse relationship between weight of pupae and pupal duration while Singh and Byas (1975) indicated positive relationship both for length and weight with pupal period. Pandey and Srivastava (1967) did not observe such a relationship for 24 wild host plants and presumed the role of some intrinsic physiological factors to be associated with it. Bilapate and Thombre (1979) reported 1721·23 and 1855·23 fecundity at 26 and 30°C temperature. Aleemuddin (1979) observed 2650·69 eggs per female on castor. In the present findings, the fecundity is at variance with those of previous workers. These variations may be due to the substrate used, rearing techniques or intensive care during rearing. Aleemuddin (1979) reported a 25·69 days life cycle on castor. In order to understand the suitability of host plants for *S. litura*, in all thirteen characters of biology were considered. The host plants were arranged for each character and scored by giving four points for the first position and reducing one point for each subsequent position. The total score for each host plant was considered by arranging them in order of suitability. The host plants were arranged in an ascending order of characters like: larval duration, pupal duration, life cycle, pre-oviposition period, per cent larvae pupated, larval weight, growth index, per cent adult emergence, pupal weight, oviposition period, fecundity, longevity of adults and reproductive index. Thus the order of suitability of host plants with the respective total points obtained was: castor (36); okra (36); sunflower (36) and groundnut (22).

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