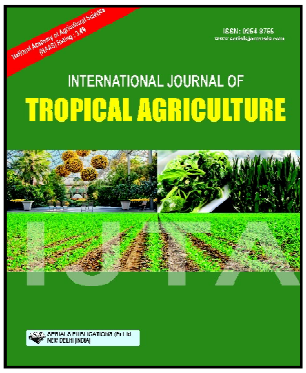

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Biology of the Bihar hairy caterpillar, *Spilarctia obliqua* (Walker) (Lepidoptera: Erebidae) on the vegetable crop and weed host

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Abstract: A comparative study on the breeding biology, duration of life cycle, number of larval instars, growth index, food consumption and utilization was carried out by rearing the insect larvae, *Spilarctia obliqua* on two different hosts viz., *Phaseolus vulgaris* Linn. and *Ipomoea carnea* Jac. The results of the study showed that the caterpillar undergoes 5 moults so as to develop into 6 instars and duration required for egg to adult development was found to be 44 and 48 days when reared on *P. vulgaris* and *I. carnea* respectively. Similarly the larva exhibited better growth index and food consumption on the crop than that of the weed host.

Keywords: Spilarctia obliqua, polyphagous, head capsule, growth index

INTRODUCTION

Spilarctia obliqua (Walker) is a polyphagous insect mostly confined to the oriental region and capable of infesting 126 plant species belonging to 24 plant families including a number of economically important plants such as cereals, grams, oilseeds and pulses (Rajen & Varatharajan, 1999; 2005). Of late, it has become a serious pest of mulberry plant (Geetha & Marimadaiah, 2006). Under the climatic conditions of Manipur, this pest emerges in large numbers during April and maintains density till October with the peak population in July/August. The larva undergoes 5 moults, passing through 6 instars and subsequently enters for pupation. After eclosion, the adults mate and lay eggs in cluster (Fig. 1). Since *S. obliqua* sustains its life cycle on crops and weeds, the present study is attempted to find out the breeding potential of *S. obliqua* on the crop and the weed host. Therefore, a comparative study on the duration of development of immature forms, determination of larval instars, food consumption

& utilization and growth index of the caterpillar was undertaken by rearing them on a crop and a weed viz. *Phaseolus vulgaris* and *Ipomoea carnea* respectively.

MATERIALS AND METHODS

Breeding biology and life cycle

To understand the duration of life cycle, longevity and fecundity of the insect, newly hatched larvae were separated from the stock culture of *S. obliqua* and 20 each were released in the individual rearing jar containing foliage of respective hosts. Six replications were maintained separately for *P. vulgaris* and *I. carnea* under laboratory conditions of 24±2°C, 65± 5% RH and Ca 12:12 hrs (L:D) photoperiod. Data pertaining to egg output, egg incubation period, larval duration, adult longevity on the two hosts were separately recorded during respective stages of development.

Determination of larval instars

The size variation of head capsule is an index of growth and development of the larvae. Therefore, head capsule measurement was considered here to determine the immature instars of the insect. Eggs obtained from the culture were allowed to hatch. From the emerging larvae, ten larvae were reared individually on each host mentioned above in separate jar. The head capsules were collected at every successive moult, right from initial stage and were stored separately in a small labeled plastic vial for the individual instars. At the end of the experiment, all the head capsules were separately measured across the greatest width (at the base of mandible) as well as the greatest length with the help of stereomicroscope having an ocular micrometer. The data thus obtained were computed and subjected to statistical analysis.

Growth index

Growth index was calculated following the method described by Deshmukh *et al.,* (1982)

$$Growth\ index\ (G.I) = \frac{\%\ pupation}{Larval\ period}$$

Food consumption and utilization

Since the first three early larval stages usually occur in a cluster of more than hundred individuals (Fig. 1), their food consumption index (CI) was not calculated due to their aggregation pattern, but rest of the stages were assessed for CI and other parameters. Required number of larvae were collected from stock culture and reared on the foliage of the respective hosts and carefully monitored for moulting and food consumption. The difference between initial weight of the leaf and unconsumed part of the leaf after 24 hours of interval was considered as food consumption. The insect's weight gain/ loss were calculated by subtracting its initial weight from its final weight. The quantum of ingested food was determined by subtracting the weight of left-out food from the weight of food provided earlier. The fecal matters of individual larva were separated from uneaten food and weighed. The following indices were calculated by computing the data using gravimetric analysis (Waldbauer, 1968; Singh & Sehgal, 1993).

RESULTS AND DISCUSSION

Female reproductive system

Studies were attempted on the female reproductive system of *S.obliqua* by dissecting the adult female at different age groups. The female reproductive system consisted of paired ovaries lying in the haemocoel, one on each side of alimentary canal. Each ovary showed the presence of 4 ovarioles and their proximal ends opened into the oviduct. The oocytes of various stages of development were arranged in each ovariole one behind the other in a single chain with immature oocytes at the apex and matured one at the bottom. Each ovariole is divided into an anterior germarium and posterior vitellarium, which will have germ cells

and oocytes respectively. The matured oocyte is released through the oviduct. The ovariole length was found to vary from 51 to 90 mm for the different age group of adult female (Fig- 2). According to the length of ovariole, number of oocytes/ovariole varied from 80 to 190. Mention may be made here that fecundity rate has been found to vary from 600 to 1200, of which the maximum egg-out was on crops and the minimum range on the weed host. However, they lay eggs in a cluster of 200-300eggs in 3-4 batches (Fig-1 & Table- 1). Studies on duration of life cycle, fecundity showed good performance of the insect on the crop *P.vulgaris* than the weed *I. carnea.*

Head capsule

Measurement on the length & width of the head capsule of the caterpillars of *S. obliqua* clearly revealed that the caterpillars pass through six larval stages. The larvae reared on *P.vulgaris* and *I. carnea* individually exhibited conspicuous difference in terms of length and width of the head capsule (Table 2).

Growth index and food consumption

The growth index of *S. obliqua* (GI) was calculated on the basis of available data on larval duration, percentage pupation and adult emergence. This index was found to be 3.12 on *P.vulgaris* and 2.05 on *I. carnea* (values significant at P <0.01) (Table 3). While comparing the GI between the two plants, a sharp difference could be seen between them, reflecting the insect's better performance on the crop than that of weed host. This index also confirms the superiority of the crop in terms of nutrition so as to promote insect's breeding ability.

Table 1
Duration of development of different stages of *S. obliqua*

Host plants	*Egg*	*Larva*	*Pupa*	*Adult longevity*	*Fecundity rate/ female*
Phaseolus vulgaris	5±0.8	28.5±1.4	10.5±0.9	8±0.8	1160±48
Ipomoea carnea	6±0.8	31±1.8	11±1.0	5±0.8	602±21

Table 2
Head capsule length and width when reared on a crop and a weed host

Larval stages	*Length (μ)**		*Calculatedt-value*	*Width (μ)**		
	P.vulgaris	*I. carnea*		*P.vulgaris*	*I. carnea*	*Calculatedt-value*
I	435± 22	235± 13	9.2	558± 19	353± 14	17.3
II	667± 27	607± 16	4.8	874± 46	772± 9	27.2
III	1035± 33	886± 16	5.6	1376± 42	1105± 45	8.8
IV	1490± 44	1262± 48	9.2	1972± 72	1654± 63	13.2
V	1749± 68	1654± 55	1.9	2462± 64	19 68± 26	16.9
VI	2148± 22	2007± 17	23.0	2948± 22	2309± 21	163.3

* Each value is mean of five replications

Table 3
Growth index of *S.obliqua*

Host plants	*Average larval period*	*% Pupation*	*% of adult emergence*	*Growth Index (G.I)*
Phaseolus vulgaris	28.5	89	81	3.12
Ipomoea carnea	31	63.6	67.4	2.05

*Each value is mean of five replications

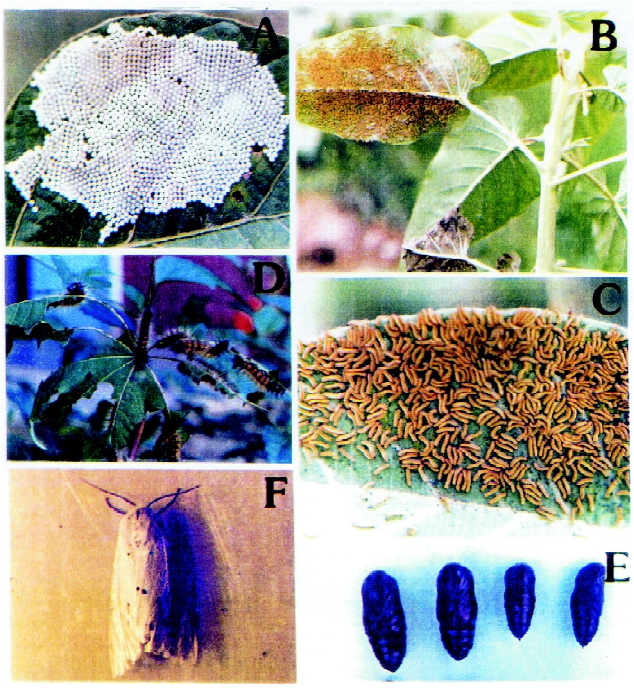

Figure 1: Life Stages of *Spilarctia obliqua*

A- Egg mass on bean leaf; B- Colony of I instar on *I. carnea* C- IV & V instar on castor leaf; D- II instar larvae on *I. carnea* leaf; E- Pupae; F- Adult female

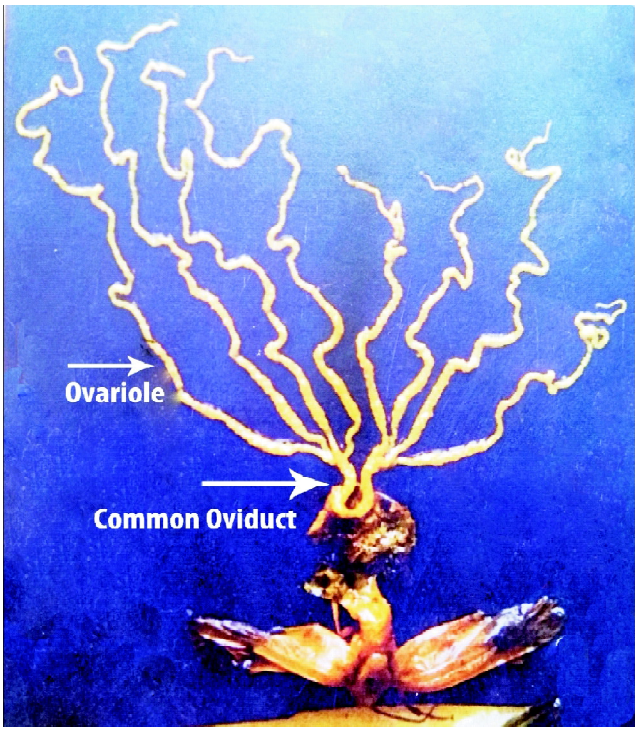

Figure-2: Ovary of *Spilarctia obliqua* showing the common oviduct, ovarioles and oocytes arrangement

Table 4
Food consumption, Growth rate and Food utilization by larvae of *S.obliqua*

Spilarctia obliqua *Instars*	*CI mg/ larva**	*GR mg/ larva**	*Utilization efficiency*		
			ECI (%)	*AD (%)*	*ECD (%)*
Food Plant: *Phaseolus vulgaris*					
IV	3.75	0.22	5.37	101.38	0.02
V	2.64	0.19	8.96	95.17	0.05
VI	0.89	0.12	16.01	94.17	0.06
Food Plant: *Ipomoea carnea*					
IV	4.99	0.39	5.21	93.46	0.02
V	2.82	0.13	8.13	85.75	0.06
VI	1.42	0.07	10.59	74.60	0.07

CI= Consumption index; GR= Growth rate; ECI= Efficiency of conversion of ingested food; AD= Approximate digestibility; ECD= Efficiency of conversion of digested food. (Source: Waldbauer, 1968; Singh & Sehgal, 1993). *Each value is mean of five replications

The food consumption index (CI) of IV instar was higher than V and VI instars, and CI of the larva was more on *I. carnea* than *P.vulgaris* but their utilization efficiency were better with *P. vulgaris* than *I.carnea* (Table-4). Based on the above observations it is inferred that *P.vulgaris* is an ideal host for *S. obliqua.* However, under the field condition, *I. carnea* is used by them as temporary reservoir especially during off season of the crop. Thus, *S.obliqua* is able to maintain its population continuously for seven months both on crops & weed host, under the climatic conditions of Manipur.

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