

## Studies on the Bionomics of *Notolophus posticus* W. a pest on castor in Madras State\*

by

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**Synopsis:** The bionomics of *Notolophus posticus* W. (Lymantriid; Lepidoptera) a pest on castor has been studied in detail under Coimbatore conditions and the observations are recorded in this paper.

**Introduction:** The Lymantriids commonly called tussock moths, are well known pests of some cultivated crops and forest trees. Among the oilseed crops, castor (*Ricinus communis* L.) is a well known host and the damage due to defoliation is often considerable. Observations made in 1962 at the Agricultural College and Research Institute, Coimbatore on the biology of *Notolophus posticus* W. are reported in this paper.

**Review of Literature:** *N. posticus* W. had been reported from Formosa, Ceylon, Burma, Bornea, Java, New guinea, Sikkim, Nagas, Nilgiris, Bellary and Coimbatore (Hampson 1892 and Fletcher 1914). Ayyar (1910) while recording the insect at Coimbatore, also studied the biology in a preliminary way, while De Alwis (1926) gave some details of its biology on Dadap in Ceylon. Sonan (1927), while listing 77 host plants belonging to 30 families, observed eight to nine generations, while Beeson (1961) stated that the pest has five to seven generations in a year. Thomson (1945 and 1946) recorded a number of Hymenopterous and Dipterous larval parasites on *N. posticus* while no egg or pupal parasite have been noted so far.

**Material and Methods:** During 1961, Caterpillars of *N. posticus* were collected from the field and mass rearing was done initially in glass troughs covered with muslin cloth. Pairs of male and female moths emerging from the troughs were caged separately until they mated and laid eggs. The caterpillars hatching out from these eggs were individually transferred to castor leaves (variety T. M. V. 1) contained in glass tubes. The feed in the rearing tubes was changed twice daily and the amount of leaf consumed each time was calculated in terms of leaf area with the aid of a graph paper.

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Detailed observations were made in 20 cases on the emergence of the imago, mating and egg laying habits, incubation period, hatching, details of the various instar including their measurements, feeding habits, pupation and sex ratio and the results are presented.

**Results: Longevity:** Moths emerge mostly during the night or in the early morning hours. Female moths which are generally sluggish cling to the cocoon and live for three to five days while active male moths live for two to four days only.

**Copulation and oviposition:** Mating takes place soon after the emergence of the moths and lasts for one to three minutes. The eggs are laid within a few hours on the surface of the cocoon itself in an irregular mass (Plate I). An interesting observation reported by Ayyar (1910) is that when apterous females of this pest were taken to the castor field at dusk, attract a large number of males, oviposition takes place even without mating, and the unfertilised eggs do not hatch.

At the time of actual laying, the egg is milk white in colour but turns cream within a few seconds. A few of the brownish hair from the posterior abdominal segments of the female moth adhere to the eggs. Fletcher (1914) has also observed that spherical and centrally depressed eggs are laid in clusters on castor and *Erythrina*.

**EGG AND HATCHING:** Egg is subspherical measuring 0.9 mm across with the slightly flattened top and a depression in the centre. The number of eggs laid by a female moth ranges from 109 to 656 with an average of 346 eggs for 20 females. Incubation period is seven days. Two days prior to hatching, the eggs attain a bluish tinge which intensify on the next day. The young caterpillars hatch out during the night or morning hours and the process of hatching is completed within one day.

**First instar caterpillar:** On an average, the first instar caterpillar measures four millimetre in length. Ground colour of the body is yellowish orange. Head is black and deeply notched posteriorly; the mouth parts, the thoracic and abdominal segments are pale brown in colour. Prothoracic shield is brown with two prominent orange coloured tubercles on either side bearing tufts of dark hair of different length which project forward. The two verrucae near the mid-dorsal line of the first four abdominal segments are more conspicuous which bear the characteristic tuft of hair in the later instar. The short tenth abdominal segment bears a few short setae and the anal proleg. Eversible glands are indistinct. Duration of the first instar is four days.

*Second instar caterpillar:* Ground colour of the body is yellow. The prothoracic segment is larger in size than other segments. The orange coloured anterolateral processes are black at the apex and bear a tuft of dark hairs of different lengths. The dorsal verrucae on the first four abdominal segments are dark and they apparently coalesce to form a transverse black band in each segment bearing short black shiny spherical eversible gland is visible mid-dorsally on the sixth and seventh abdominal segments. Second instar lasts for three days and measures about five to six millimetre.

*Third instar caterpillar:* The average length of third instar caterpillar is 8 mm. Head is reddish brown with distinct orange coloured prothorax. The anterolateral tubercles of the prothorax bear a dense tuft of long dark setae. First two abdominal segments possess dorsally, tuft of brownish yellow hairs. But the similar tufts on the third and fourth abdominal segments consist only short white setae. Eversible glands are brownish and the third instar lasts for three to four days.

*Fourth instar caterpillar:* Dorsal colour of the body is ochraceous with yellow dorsolateral line on the thorax and also on the fifth to the last segment. The head is brown and the hairs are more conspicuous and abundant. The anterolateral processes of prothorax have long tuft of dark clavate-plumose hairs of different lengths forming a long pencil of hairs which project forwards beyond the head and function as feelers. Conspicuous lateral tuft of Yellowish white setae are present in the first two abdominal segments. First four abdominal segments bear dorsally brush like prominent yellowish hairs and this structure is commonly called 'tussock' and hence the name 'tussock moth'. Tufts of long brown hairs of different lengths arise from the dorsal aspect of the eighth abdominal segment. The lateral verrucae are yellow with brownish setae. No special odour is associated with the reddish brown eversible glands which are moist and shiny in appearance. Duration of the fourth instar is four to five days and the average length is 17 to 19 mm.

*Fifth instar caterpillar:* The larva at this stage is similar to the fourth instar except in the increase in size of the body and intensity of the dorsal ochraceous and lateral orange yellow colours. The average length of this stage is 27mm. The dorsal tufts of hairs on the first four abdominal segments are more or less equal in length and deep yellowish in colour. The duration of this stage is six days.

*Pupation:* The prepupal period extends to nearly nineteen hours before the pupa is formed. Pupation generally takes place during night and frequently between one A.M. to six A.M. during pupation, the caterpillar sheds all the setae which are entangled with the silken threads to form a

PLATE I

*Egg and larval stages*

1. Ovipositing female moth.
2. Egg.
3. First instar caterpillar
4. Second instar caterpillar
5. Third instar caterpillar
6. Fifth instar caterpillar.

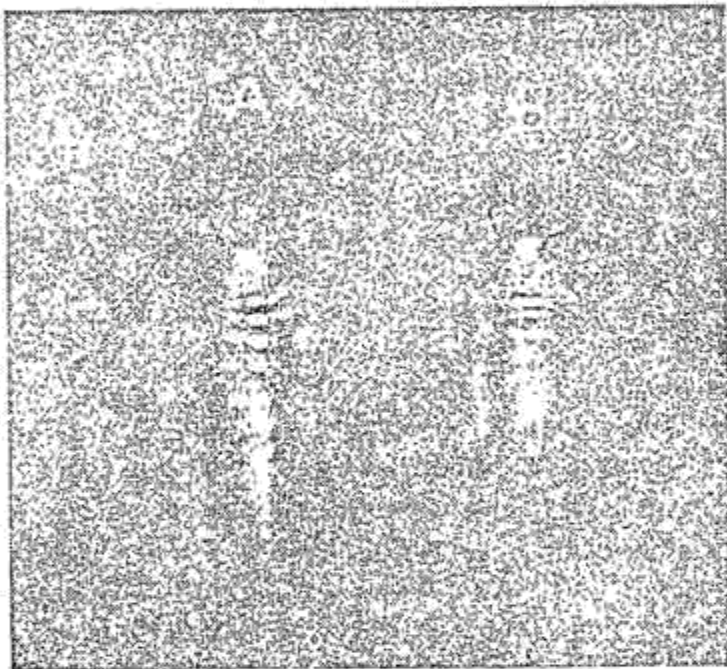


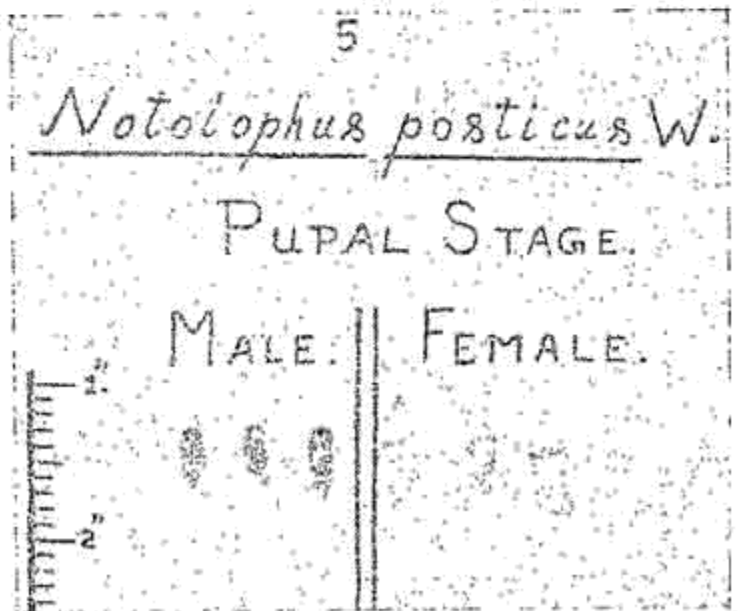
PLATE III

*Male and female pupae*

PLATE II

*Final instar caterpillars*

- A. Female caterpillar
- B. Male caterpillar.



translucent waterproof cocoon within which is formed the obtect pupa. In the field, the cocoons are constructed mostly inside the leaf folds in the lower leaves of the castor plant or occasionally on the twigs. Pupal period ranges from four to seven days under laboratory conditions.

**EMERGENCE OF THE IMAGO:** Two days prior to emergence of the imago, the eyes and wing regions of the male pupa turn dark while the dorsal side turns brownish. The wing region in the female pupa, however, does not show this colour change. Emergence occurs generally during night and in the early hours of the morning. The adult female with reduced wings emerges from the pupa and clings firmly to the cocoon without movements, whereas the male seeks a dry place away from the cocoon and the wings are stretched fully within an hour. The sex ratio of male and female moth is 1:1. The average longevity of the male and female moth is three and four days, respectively. Thus the total duration of the life cycle ranges from 27 to 33 days in which the incubation, larval and pupal periods are seven day, 16-19 days and four to seven days respectively. Fletcher (1914) has observed that the egg, larval and pupal periods last for eight, 25 and eight days respectively, while De Alwis (1926) reported from Ceylon that the three stages of the pest on Dadap last for seven to 11, 16-20 and seven to nine days respectively. The duration of developmental stages of the insect is detailed in Table I.

**SEX DIFFERENTIATION:** Certain differences between the caterpillars of the future male and female moths were observed. For easy understanding, the caterpillar which will give rise to female moth and that producing a male moth are separately designated as "female caterpillar" and "male caterpillar" respectively in the description below.

Male caterpillar moult four times in all, the fourth moult occurring before pupation inside the cocoon itself, whereas the female caterpillar moult five times, the fifth moult taking place inside the cocoon. The female caterpillars are more robust in appearance, measuring as much as 27 mm during the fifth instar as against 19 mm of a full grown fourth instar male (Table I and Plate II) and show a deeper shade of yellow in the general body colouration including the tussock on the first four abdominal segments. The larval stage lasts for 16 days in male and 19 days in females.

The female pupa measures 17 mm x 6 mm on an average while the male pupa is 10 mm x 4 mm. The female pupa has prominent antennae and wing regions (Plate III). The pupal period is seven days for males and four days for females.

Thus, sexes can be differentiated even in larval and pupal stages. This is besides the fact that there is extreme sexual dimorphism in the adult, the female moth possessing only vestigial wings.

**FEEDING HABITS:** Freshly hatched out caterpillars of *N. posticus* W. gregariously feed first on some portions of the egg shells. Later they move away from the cocoon and assemble on the upper surface of the leaf and feed on the parenchyma leaving only the veins and epidermis of the lower surface. After the first moult they get distributed and feed on the leaves making irregular holes between the veins. After the third moult the caterpillars feed voraciously and only the midribs are left out. Feeding is more active during the morning and evening hours when a much larger area of leaf is consumed than during mid-day and night.

The area of castor leaf consumed by the caterpillars of both the sexes was assessed. Among the different instars, the maximum area of leaf is consumed by the male caterpillar during the fourth instar and by the female caterpillar during the fifth instar *i. e.* during the final instars in both. The average total area of leaf consumed during the larval stage is 216 sq cm in the case of male and 270 sq cm in females (Table I). It is assessed that by feeding at this rate, each caterpillar would approximately consume more than one castor leaf (the average area of a castor leaf is 175 sq cm) during its life time. Though the quantity of leaf fed by the female caterpillar is less in the third and fourth instars compared to that of the males, the additional instar in the female caterpillar consumes the maximum area of leaf.

TABLE I

*Duration, measurements and feeding rate of developmental stages of Notolophus posticus* W.

S. No.	Particulars	Male	Female
1.	Incubation period (days)	7	7
2.	<i>First Instar:</i>		
	(a) Duration (days)	5	4
	(b) Maximum length (mm)	4	4
	(c) Leaf area consumed (sq cm)	1.1	1.1
3.	<i>Second Instar:</i>		
	(a) Duration (days)	2	3
	(b) Maximum length (mm)	5.6	3.8
	(c) Leaf area consumed (sq cm)	4.9	4.9
4.	<i>Third Instar:</i>		
	(a) Duration (days)	4	3
	(b) Maximum length (mm)	8.3	8.6
	(c) Leaf area consumed (sq cm)	56.2	27.7

S. No.	Particulars	Male	Female
5.	<i>Fourth Instar :</i>		
	(a) Duration (days)	...	5      4
	(b) Maximum length (mm)	...	19.4    17.5
	(c) Leaf area consumed (sq cm)	...	154.1   97.6
6.	<i>Fifth Instar :</i>		
	(a) Duration (days)	...	—      6
	(b) Maximum length	...	—      27.3
	(c) Leaf area consumed (sq cm)	...	—      139.2
7.	Total larval period (days)	...	16      19
8.	Total pupal period (days)	...	7      4
9.	Total leaf area consumed (sq cm)	...	216.2   270.2

**Summary:** The biology of the Lymantriid *Notolophus posticus*, a pest on castor, has been studied in detail under Coimbatore conditions and data on some aspects of the biology, life cycle and description of larval instars have been given. The sexes have been differentiated by taking into account the larval and pupal characters. The feeding behaviour and the average quantity of castor leaf consumed during the larval stage are also assessed.

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