

Research Article

Biology of leaf web worm, *Nausinoe geometralis* (Guenee) on jasmine under laboratory conditions

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ABSTRACT

Biology of leaf web worm, *Nausinoe geometralis* (Guenee) was studied under laboratory at 24.03 ± 1.75 °C and the average relative humidity was 53.9 ± 3.04 per cent during November-December 2006. Average larval period was 9.98 ± 0.84 days and pupal period was 7.84 ± 0.37 days. Adult period was 3.88 ± 0.83 days for male and 6.16 ± 0.37 days for female. The total life cycle was completed in 26.62 ± 2.57 days for male and 28.90 ± 2.11 days for female. The pre-oviposition, oviposition and post-oviposition periods were 1.60 ± 0.50 , 3.44 ± 0.051 and 1.12 ± 0.33 days, respectively. The female laid average 52.35 ± 25.33 eggs during its life span. The sex ratio (female: male) was recorded 1: 0.94 in laboratory.

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INTRODUCTION

Jasmine plant is attacked by a number of insect pests like leaf webworm, bud worm, gallery worm, tinged bug, thrips, green plant hopper, jasmine bug, leaf roller, blossom midge and non insect pest like red spider mite and cyclamen mite. Among them, Jasmine leaf web worm, *Nausinoe geometralis* (Guenee) (Lepidoptera : Pyralidae) is a serious pest of Arabian jasmine (*Jasminum sambac* Ait.) in India (David, 1958). The caterpillars web the leaves and nibble to make holes in the leaves which are quite often reduced to mere veins. The severely attacked bush present 'burnt appearance' because the damaged and dried leaves remain entrapped in the web. This results in reduced vitality of plant which tells upon the growth of the bush and consequently production of flower buds/flowers reduction in the subsequent year.

MATERIALS AND METHODS

The study on biology of leaf web worm, *Nausinoe geometralis* was carried out in the laboratory of the Department of Entomology, N.M. College of Agriculture, Navsari Agricultural University, Navsari at 24.03 ± 1.75 °C and average relative humidity 53.9 ± 3.04 per cent during November

December 2006.

Maintenance of culture:

The initial culture of jasmine leaf web worm was raised by collecting large number of larvae from the field of jasmine crop from Horticulture farm, ASPEE College of Horticulture and Forestry, N.A.U., Navsari. The larvae were kept in a plastic culture bottle having 20.00 cm height and 16.00 cm diameter containing jasmine leaves. Rearing bottle was cleaned everyday.

Rearing technique:

In the laboratory, larvae were reared separately on jasmine in transparent plastic tubes having 2.50 cm diameter and 7.50 cm length. The open end of plastic tubes was covered with the perforated lids to facilitate aeration. Jasmine leaves were provided as food daily till pre-pupal stage. At the time of pre-pupal stage, 1/3 part of each plastic tube was filled with leaves to facilitate pupation. The pupae formed were transferred to jars for emergence of the adults.

To rear the adults, newly emerged male and female moths were transferred in a glass jar (23 cm diameter x 10 cm height). Tender shoots of jasmine plant having leaves on them were

cut and cut end of the shoots were dipped in fresh water filled in conical flask (4.50 cm diameter at bottom and 8.0 cm height) to maintain turgidity of leaves. The shoots, thus prepared, were provided to the moths inside the rearing jars for resting and oviposition. The open end of glass jar was covered with fine musline cloth, secured in a position with the help of rubber band. Cotton swabs dipped in five per cent honey solution were placed in rearing jar for food to the moths. The shoots were substituted daily with fresh one. The eggs were collected from the leaves and used for further study.

Study on various stages of *N. geometralis*:

Eggs:

To study the incubation period and hatching percentage, freshly laid eggs were picked up with the help of fine moist camel hair brush and counted the number of eggs laid in Petridishes (10 cm diameter). The eggs were also examined under the microscope for their colour, shape and size. The observations on number of eggs hatched were recorded daily in the morning till unhatched eggs were shrunk. Incubation period was calculated from date of egg laying to the date of hatching. Hatching per cent was calculated from the number of eggs hatched out of the total number of eggs kept for hatching. Measurements of eggs were recorded under the microscope with the help of stage and ocular micrometer.

Larvae:

With a view to determine the number and duration of different larval instars and total larval periods, the newly hatched larvae (first instar) were placed individually with the help of fine camel hair brush in plastic culture tubes (3.50 cm diameter x 4.00 cm height) and leaves were provided to the larvae. The leaves in each tube were changed daily in the morning.

In order to determine the number of larval instars, the size of individual larvae was observed daily. Exuvium as well as casted off head capsule were also observed. The moulting was confirmed by the presence of casted off head capsule of the larvae of the subsequent instars. The larvae in each instar were studied for their colour and size. Observations on number of instars, durations of instars and total larval period were recorded. Measurement of eggs and immature stages were recorded under the microscope with the help of stage and ocular micrometer and mature stages of larva and adults measured with the help of standard scale.

Pre-pupae:

To record the pre-pupal period, the larvae were observed from the time when it stopped feeding and became sluggish to the time when it turned to pupae.

Pupae:

Freshly formed pupae were collected and placed

individually in plastic tubes (21.50 cm diameter x 7.50 cm height). Observations on pupal duration, colour and size were also recorded.

Adult:

A male and a female of the same age paired and reared separately in glass jar (23 cm diameter x 10 cm height). They were provided with five per cent honey solution as food and fresh leaves of jasmine were provided to them for resting and oviposition. The material provided for resting and egg laying was replaced daily with fresh one. The observations on adult period as well as colour and size of the adults were also recorded. The length and breadth with their expanded wings were measured directly with the help of standard scale.

Pre-oviposition, oviposition and post-oviposition period, fecundity and longevity:

In order to study the pre-oviposition period, oviposition period, post-oviposition period, fecundity and adult longevity, the newly emerged adults of *N. geometralis* were reared separately in rearing cage on jasmine plant.

Pre-oviposition period was calculated from the date of emergence of female adult to the date of starting of egg laying. Date of starting egg laying to ceasing of egg laying were noted as oviposition period. A period between the date of ceasing egg laying and the date of death of female was recorded as post-oviposition period.

Longevity of male and female adult was calculated from the date of emergence and date of death of adult, separately and average longevity was calculated.

To find out the fecundity, numbers of eggs laid by each female were recorded daily till the death of the female and average fecundity was calculated.

Total life cycle:

Total life cycle was considered as the period between date of egg laying and the date of adult death.

Sex ratio:

In order to determine sex ratio (male : female) under laboratory conditions, countered number of pupae were kept in different plastic tubes and observations on emergence of male and female moths were recorded to find out the sex ratio. The sexes were identified by observing the tip of the abdomen of the adults. In case of male, the slender abdomen was pointed, grayish and much more bent upward as compared to the tip of female abdomen with yellow slit like genital aperture identified by the presence of tuft of hairs on the tip of the abdomen of female while it was absent in male.

RESULTS AND DISCUSSION

The results of the investigation of leaf-web worm,

Nausinoe geometralis carried out in the laboratory are presented in Table 1 and 2 and discussed below :

Eggs:

Eggs of *N. geometralis* were small, flat, oblong and greenish in colour. Egg period on jasmine ranged from 3 to 4 days with an average of 3.88 ± 0.33 days (Table 1).

Length and width of eggs ranged from 0.87 to 1.10 mm with an average of 0.94 ± 0.04 mm and 0.63 to 0.76 mm with an average of 0.72 ± 0.02 mm (Table 2). Hatching percentage varied from 68.18 to 97.06 with an average of 92.95 ± 7.40 (Table 1).

Larvae:

The freshly emerged larvae were yellowish white with reddish yellow head which was broader than the body and tapered towards the anal end. There were four rows of grey spots on the body (two on the dorsal surface and each on the dorsolateral side of the body). Total larval period was 11 to 14 days with an average of 13.12 ± 0.73 days with five instars. Larval period (I, II, III, IV and V instars) of *N. geometralis* varied from 2 to 3 days (I instar), 3 to 4 days (II instar), 2 to 3

days (III instar), 2 to 3 days (IV instar) and 2 to 3 days (V instar) with an average of 2.76 ± 0.33 , 3.72 ± 0.46 days, 2.20 ± 0.41 , 2.20 ± 0.41 and 2.24 ± 0.44 days, respectively (Table 1).

First, second, third, fourth and fifth instar larvae measured in length and width as 3.50 to 5.00 mm and 0.30 to 0.40 mm (I instars), 7.00 to 8.00 mm and 0.60 to 0.80 mm (II instars), 10.50 to 11.00 mm and 1.20 to 1.40 mm (III instars), 14.90 to 15.30 mm and 1.60 to 1.70 mm (IV instar), 19.50 to 20.00 mm and 1.80 to 2.00 mm (V instars) with an average of 4.03 ± 0.32 and 0.39 ± 0.03 (I instars), 7.67 ± 0.30 and 0.72 ± 0.05 (II instars), 10.72 ± 0.18 and 1.31 ± 0.07 (III instars), 15.06 ± 0.12 and 1.66 ± 0.05 (IV instar), 19.88 ± 0.19 and 1.98 ± 0.05 (V instars), respectively (Table 2).

Pupa:

Pupation took place on the leaves with average pre-pupal period as 1.04 ± 0.20 days (Table 1). The newly formed pupae were light green in colour. Later, they turned to light brown before emergence of adult. They measured on an average of 13.28 ± 0.25 mm in length and 2.06 ± 0.10 mm in width (Table 2). The pupal period lasted for 7.84 ± 0.37 days.

Table 1 : Details of life cycle of *N. geometralis* on jasmine

Sr. No.	Particulars	Period (days)		
		Minimum	Maximum	Average \pm SD
1.	Egg period	3	4	3.88 ± 0.33
2.	Hatching percentage	68.18	97.96	92.95 ± 7.40
3.	Larval period			
	First instar	2	3	2.76 ± 0.33
	Second instar	3	4	3.72 ± 0.46
	Third instar	2	3	2.20 ± 0.41
	Fourth instar	2	3	2.20 ± 0.41
	Fifth instar	2	3	2.24 ± 0.44
	Total	8	12	9.98 ± 0.84
4.	Pre-pupal period	1	2	1.04 ± 0.20
5.	Pupal period	7	8	7.84 ± 0.37
6.	Adult period			
	Pre-oviposition	1	2	1.60 ± 0.50
	Oviposition	3	4	3.44 ± 0.51
	Post-oviposition	1	2	1.12 ± 0.33
	Longevity:			
	Female	6	7	6.16 ± 0.37
	Male	3	5	3.88 ± 0.83
7.	Total life cycle:			
	Female	25	33	28.90 ± 2.11
	Male	22	31	26.62 ± 2.57
8.	Egg laying capacity (number)			
		Male	Female	M:F
9.	Sex ratio	36	34	1:0.94

Table 2 : Measurement of various stages of *N. geometralis*

Stage		Number observed	Measurement in mm		
			Min.	Max.	Av. \pm S.D.
Egg	Length	25	0.87	1.10	0.94 \pm 0.04
	Width	25	0.63	0.76	0.72 \pm 0.02
Larva	Length	25	3.50	5.00	4.03 \pm 0.32
	1 st instar	25	0.30	0.40	0.39 \pm 0.03
2 nd instar	Length	25	7.0	8.0	7.67 \pm 0.30
	Width	25	0.60	0.80	0.72 \pm 0.05
3 rd instar	Length	25	10.50	11.00	10.72 \pm 0.18
	Width	25	1.20	1.40	1.31 \pm 0.07
4 th instar	Length	25	14.90	15.30	15.06 \pm 0.12
	Width	25	1.60	1.70	1.66 \pm 0.05
5 th instar	Length	25	19.50	20.00	19.88 \pm 0.19
	Width	25	1.80	2.00	1.98 \pm 0.05
Pre-pupa	Length	25	14.00	16.00	14.98 \pm 0.44
	Width	25	1.70	2.00	1.86 \pm 0.09
Pupa	Length	25	13.00	13.50	13.28 \pm 0.25
	Width	25	2.00	2.30	2.06 \pm 0.10
Adult (Female)	Length	25	10.00	10.70	10.19 \pm 0.25
	Width	25	21.00	22.50	21.96 \pm 0.29
Adult (Male)	Length	25	9.00	9.70	9.20 \pm 0.24
	Width	25	20.00	21.60	20.44 \pm 0.53

Adult:

Adult longevity of male and female of *N. geometralis* on jasmine varied from 3 to 5 days (male), 6 to 7 days (Female), with an average of 3.88 \pm 0.83 days (male), and 6.16 \pm 0.37 days (female) (Table 1).

The length and width of male and female ranged from 10.00 to 10.70 mm and 21.00 to 22.50 mm (female) and 9.00 to 9.70 mm and 20.00 to 21.60 mm (male) with an average of 10.19 \pm 0.25 and 21.96 \pm 0.29 mm (female) and 9.20 \pm 0.24 and 20.44 \pm 0.53 mm (male) (Table 2).

Total life cycle:

Total life cycle of male and female of *N. geometralis* on jasmine ranged from 22 to 31 days (male) and 25 to 33 days (female), with an average of 26.62 \pm 2.57 (male) and 28.90 \pm 2.11 days (female) Table 1.

Pre-oviposition, oviposition and post-oviposition:

Pre-oviposition, oviposition and post-oviposition period of *N. geometralis* on jasmine varied from 1 to 2 days (pre-oviposition), 3 to 4 days (oviposition) and 1 to 2 days (post-oviposition) with an average of 1.60 \pm 0.50, 3.44 \pm 0.51 and 1.12 \pm 0.33 days, respectively (Table 1).

Fecundity:

Fecundity of *N. geometralis* on jasmine ranged from 21

to 133 with an average of 52.35 \pm 25.53.

Hatching percentage:

Hatching percentage of *N. geometralis* eggs was varied from 68.18 to 97.96 (Table 1).

Sex ratio:

The sex ratio of male: female of *N. geometralis* recorded in laboratory was 1: 0.94 (Table 1).

The present findings of total life cycle of *N. geometralis* are almost in confirmation with the observations recorded by earlier workers *i.e.* David 1958, David and Venugopal (1962), Shukla and Sandhu (1988) and Deol (1974).

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