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Biology of *Cleora cornaria*, neem Looper (Lepidoptera: Geometridae) in Talwandi Sabo, Punjab

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Abstract

The present investigations were carried out on biology of neem semi-looper, *Cleora cornaria* (Geometridae, Lepidoptera.) under lab/field conditions. The pest was noticed first time feeding mainly on green leaves and tender branches of neem trees in Talwandi Sabo (Bathinda), Punjab. Different life stages of the pest, namely egg, larva, pupa and adult, were studied and the results are reported here in. The studies revealed that the life cycle of neem looper passed through four different stages i.e. egg, larva, pupa and adult. The egg duration ranged from 2 to 4 days. The larva passed through five instars and the average duration (days) of each instar was found to be 2.46 ± 0.51 , 2.66 ± 0.48 , 3.53 ± 0.51 , 4.26 ± 0.59 and 6.4 ± 0.50 days, respectively. The adult longevity of male and female moths of the looper was observed to be 5.1 ± 1.06 , 8.2 ± 0.94 days, respectively. The pupation took place underneath soil and plant debris near the bases of tree trunks of neem. The pupal stage was prolonged in winter and the pest stayed in hibernation from December to March. The next generation of adult moths started appearing in April as the day temperatures picked up. The adults were observed sitting on tree trunks in the early mornings, however, they were attracted to light traps during night hrs.

Keywords: *Cleora cornaria*, Pest, Neem, Biology, Longevity

Introduction

The neem (*Azadirachta indica*), also known as Indian lilac, is omnipotent, deciduous medicinal tree grown in tropical and sub-tropical climates of the world^[1]. It originated in the Indian subcontinent including Nepal, Pakistan, Bangladesh and Sri Lanka. The neem belongs to the family: Meliaceae, and subfamily: Meloideae. It is a fast-growing tree having deep green foliage and bearing honey scented flowers^[16].

Biologically, the neem contains many Alkaloids, Lavonoids, Liminoids, Triterpenoids, Phenols, Carotenoids, Steroids and Ketones. Amongst these, Azadirachtin (a mixture of seven isomeric compounds) is the most active^[23, 10]. It is worth adding that these natural substances are available in varying amounts in different plant parts, namely leaves, seeds and bark^[3].

The neem Leaves are used as Antiderm, Antifungal, Antiseptic, Antiviral, Fertilizers, Insecticides, Nematicides and Insect repellents^[19, 11]. It is also playing promising replacement in agriculture as they are less toxic to beneficial organism^[4]. Due its excellent medical properties it is called as "Wonder tree"^[7]. Neem oil is utilized in controlling a large number of pests in agriculture and public health. It is having promising effect against *Phenococcus solenopsis*^[8, 21], *Bemisia tabaci*^[12], *Helicoverpa armigera*^[2, 9], and it is act as good repellent against many species of mosquitoes species like *Anopheles culicifacies*^[5, 17, 15].

Despite its important properties this wonderful tree is attacked by a wide range of pest species, namely mites (Acarina), slugs (Gastropoda) and many Insects^[20]. During the present study many insects were recorded on neem, however, the population of *Cleora cornaria* attained the pest status and outnumbered the many in view of its damage by larval feeding on the neem leaf/ foliage. Review of literature revealed only a scanty information about this looper. Hence, the present studies were undertaken to explore its life cycle in view of its severity in Punjab.

Materials and Methods

Talwandi Sabo is located at latitude 29°59'0" N and longitude 75°5'0" East in Punjab, India. The state exhibits semi-arid climate accompanied with wide variations of summer and winter temperatures the agricultural land and the road infrastructure in Talwandi Sabo are surrounded

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by different types of trees such as citrus and guava plantations, Neem, Dharek, Shisham, Jamun, Mulberry and Kikkar etc. Wide range of plantations of *A. indica* are available alongside the roads, passages and canals and the studies were conducted during the year 2016-2017. The biology of neem looper was investigated on neem leaves and green/tender branches of neem at room temperature (20.3-21.2°C. & 48.9-71.7 R.H.) in laboratory. The neem leaves, harboring the looper larvae were collected from fields and brought to the laboratory for rearing test insects. The newly emerged male and female adults were used for further studies. Daily observations on various life stages were recorded using different parameters.

Adult longevity, Fecundity and Egg duration

The duration of adult life was recorded from the day of adult emergence till death. The adults were provided with five percent honey solution as food. 15 replications (both sexes) were observed for recording their adult longevity. The number of eggs laid by a female were counted daily and thus the total number of eggs/female in its life were taken as fecundity of the female. The Incubation period was counted as the duration in days after egg laying till hatching. The observations were taken on a number of days, the eggs took to hatching. The range and the average incubation period were calculated. The newly emerged larvae were transferred into glass jars for studying the larval duration of each instar.

Duration of larval instars and total larval period:

The larval duration was recorded as the duration in days from the hatching of eggs till the formation of pupae. The newly hatched larvae of *C. cornaria* (neem Looper) were individually placed in separate containers having fresh/tender/healthy neem leaves as a food source for the larvae. The food was replaced regularly with a view to keeping it fresh. To find out the duration of different larval instars, daily observations were made on casting of skins (molting) and head capsules. The range and average values of larval duration of different instars and total larval period were recorded, accordingly.

Pupal period, Percentage of adult emergence and Sex ratio (% Males)

The number of days (duration) taken from a pupal formation

till the emergence of adult moths was considered as pupal period. After completion of the last larval instar, the newly formed pupae were securely placed in glass containers (6 inches diam.) half filled with moist soil and covered with muslin cloth. Regular observations on adult emergence were taken. Newly emerged adults were removed from the containers. The range and average values of pupal duration were calculated.

For observing sex ratio, pupae were placed in fifteen different containers and each container was containing 10 pupae. The percentage of adult emergence were calculated after the emergence of total number of adults. The sex of adult was later conformed after the adult emergence from these pupae. The sex ratio (% males) were determined in each replica by dividing the number of male by total number of adults emerged during experiment^[22].

Results and discussion

Adult longevity, Egg duration and Fecundity

The results pertaining to adult longevity of *C. cornaria*, revealed that the male moths were short lived than the female moths. The adult longevity of the males ranged from 4 to 7 days with the average value of 5.1 ± 1.06 days, while the female longevity varied from 7 to 10 days with an average of 8.2 ± 0.94 days (Table 1). The findings are in line with many other members of Lepidoptera.

A single female of *C. cornaria* laid eggs ranging from 464 to 576 eggs, with an average of 504.06 ± 30.46 eggs per female during its life time. The freshly laid eggs were light green, smooth and round in shape. The eggs were laid on the underside of the leaves and on the muslin cloth as well under laboratory conditions. It was evident from the results that the incubation period (egg duration) ranged from 2 to 4 days with an average of 2.8 ± 0.77 days (Table 1). Earlier studies on *C. cornaria*, in Thailand, have revealed heavy losses by this pest to mangroves^[18]. In India its damage has been reported in teak plantations and tea gardens^[6, 14]. In 2009 at village Bhauli, Lucknow, *C. cornaria* were reported as major pest of neem and the female laid 527 ± 25.3 eggs. The longevity of *C. cornaria* males were 5.8 ± 0.2 days, whereas the females were survived for 8.60 ± 0.45 days^[13].

Table 1: Adult longevity, Egg duration and fecundity per female of *C. cornaria* on Neem

No. of observation	Adult longevity (days)		Egg duration (days)	Fecundity (No. of eggs)
	Male	Femlae		
1	4	9	2	490
2	6	7	2	510
3	5	8	3	480
4	7	9	3	576
5	5	10	2	533
6	6	8	3	468
7	4	9	2	528
8	7	7	3	467
9	4	8	4	486
10	5	9	4	512
11	5	7	3	520
12	6	9	2	498
13	4	8	4	464
14	5	7	2	500
15	4	8	3	529
Total Sum	77	123	42	7561
Mean±S.D	5.1 ± 1.06	8.2 ± 0.94	2.8 ± 0.77	504.06 ± 30.46
Range	4-7	7-10	2-4	464-576

Larval and Pupal Period

The studies revealed that larva of *C. cornaria* passed through

five instars, before entering into pupal stage. The first larval instar took 2 to 3 days to become second instar with an

average of 2.46 ± 0.51 days on neem leaves. The second instars larvae moulted to third instar in 2 to 3 days with an average of 2.66 ± 0.48 days. The duration of third instar was observed to be 3 to 4 days with an average of 3.53 ± 0.51 days. Fourth and fifth instar larvae took 3 to 5 and 6 to 7 days with an average of 4.26 ± 0.59 and 6.4 ± 0.50 days, respectively. The total larval period was ranged from 18-21 days with an average of 19.33 ± 0.97 days (Table 2). Similarly at Lucknow, *C.*

cornaria were showing five larval stages. In this First larva instar duration was 3.25 ± 0.12 days (range 2–4 days). Duration of second larvae stage was 2.85 ± 0.15 days (range 2–4 days). Third instars duration was of 3.00 ± 0.09 days (range 2–4 days). Fourth and Fifth instar were with a duration of 3.30 ± 0.12 days (range 3–4 days) and 4–5 days (4.50 ± 0.13 days) respectively [13].

Table 2: Duration of different larval instars, Total larval period and Pupal period of *C. cornaria*

No. of observation	Duration of larval instars of <i>C. cornaria</i> (days)					Total Larval period (days)	Pupal period (days)
	I	II	(Days)	IV	V		
1	3	3	4	4	6	20	10
2	2	3	4	5	6	20	10
3	3	2	3	4	6	18	9
4	2	2	3	4	7	18	11
5	3	3	3	3	7	19	11
6	3	3	3	5	6	20	12
7	2	3	3	4	6	18	10
8	3	3	4	4	6	20	10
9	2	2	4	5	7	20	10
10	2	3	3	4	7	19	11
11	2	3	4	5	6	20	9
12	3	3	4	4	7	21	9
13	2	2	3	5	6	18	10
14	2	3	4	4	7	20	12
15	3	2	4	4	6	19	10
Total sum	37	40	53	64	96	290	154
Mean± S.D	2.46 ± 0.51	2.66 ± 0.48	3.53 ± 0.51	4.26 ± 0.59	6.4 ± 0.50	19.33 ± 0.97	10.5 ± 0.96
Range	2-3	2-3	3-4	3-5	6-7	18-21	9-12

The mean pupal period of *C. cornaria* ranged between 9 to 12 days with an overall average of 10.5 ± 0.96 days (Table 2). Similarly in Lucknow, *C. cornaria* Pupal stage lasted for 13–15 days (13.90 ± 0.28 days) during 2009 [13]. The colour of pupa was dark brown. Adult emergence ranged from 70-100

percent with an average of 89.33 percent of adult emergence (Table 3). When sex ratio were considered, it was observed that females were emerging more than the males. On an average only 36.36% of males were emerged then the females (Table 3).

Table 3: Sex ratio (% males) and Percentage of adult Emergence

No. of Observation	Number of male obtained	Number of female obtained	Sex ratio (% males)	Percent adult emergence
1	3	4	42.85	70
2	4	5	44.44	90
3	3	5	37.5	80
4	4	5	44.44	90
5	5	5	50	100
6	3	4	42.85	70
7	1	9	10	100
8	2	7	22.22	90
9	4	5	44.44	90
10	4	4	50	80
11	2	7	22.22	90
12	2	8	20	100
13	4	6	40	100
14	3	7	30	100
15	4	5	44.44	90
Mean	3.2	5.7	36.36	89.33

This study on *C. cornaria* biology will further useful for development of proper control measure should be developed for controlling this major pest of *A. indica*.

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