# A biological status of neem semi-looper, *Cleora cornaria* in Jalgaon district, North Maharashtra, India


## ABSTRACT

The present investigation was conducted on the biological status of the neem semi-looper, *Cleora cornaria*, from September 2021 to November 2024. The pest was observed primarily on green leaves and tender branches of neem trees in the Jalgaon district, North Maharashtra. This study revealed that the life stages of semi-looper comprised four distinct phases: egg, larva, pupa, and adult. The egg incubation period ranged from two to four days. Five instars were identified during larval development, with an average duration of 15-22 days. Non-feeding pupal stages were observed in soil and plant debris. The pupal period varied from 11 to 15 days. Adult females exhibited larger body lengths and wing spans than males. The lifespan of males was observed to be 6.3±1.16 days (range 5-8 days), while female longevity was 10.3±1.16 days (range 9-12 days). This study aimed to provide a comprehensive understanding of the biology of the pest, including its developmental stages, to enhance pest management strategies for its impact on neem plant, *Azadirachta indica*.



**Keywords:** *Cleora cornaria,* neem semi-looper, Neem plant, life cycle, college campus


## 1. INTRODUCTION

Neem, *Azadirachta indica*, is a hardy, evergreen, and deciduous tree belonging to the family Meliaceae. It is a medium-sized tree with a straight trunk and a dense crown of pinnate leaves. It is widely cultivated in India, Africa, Bangladesh, Nepal, Pakistan, and Sri Lanka [1,2]. *Azadirachta indica*, derived from Persian, translates to 'the free tree of India' and holds a significant place in traditional medicine and ecological sustainability [3]. This species has gained prominence because of its diverse applications and adaptability to various environments. The Sanskrit name for the Neem tree is 'Arishtha,' which means 'reliever of sickness,' and it is therefore often referred to as 'Sarva Roga Nivarini,' meaning 'the universal healer' or 'one that cures all ailments and ills,' highlighting its long-standing use in traditional medicine for its wide-ranging therapeutic properties.

The Neem tree, renowned for its wide range of medicinal properties, has been traditionally utilized for centuries across the Indian subcontinent. Various parts of the tree, including the bark, leaves, roots, fruits, and seeds, are used in the treatment and prevention of numerous diseases because of their potent antibacterial, antioxidant, and antifungal properties [4,5]. Cultivated extensively across tropical and subtropical regions, Neem's adaptability to diverse environmental conditions has contributed to its significance in several fields, including pharmacology, agriculture, medicine, cosmetics, rubber, textile industries, and environmental sciences [6].

The neem plant contains over 140 bioactive compounds including alkaloids, flavonoids, carotenoids, steroids, azadirachtin, and ketones, all of which play crucial roles in disease management. Among these, azadirachtin is the most dominant biologically active component extracted from the seeds and leaves of neem plants [7,8]. Azadirachtin is widely used as a biopesticide, nematicide, and insect repellent in agroforestry, and has proven to be effective against various pests [9,10,11]. In addition to its medicinal and agricultural applications, neem is consumed as food by humans, animals, and birds [12].

The oil extracted from neem kernels is widely used in soap production and is also utilized as fuel for oil lamps in some rural areas in India. Neem oil is also widely used to control numerous agricultural pests [13,14] and serves as an effective repellent against various mosquito species, including *Anopheles culicifolia*, making it valuable for both agriculture and public health [5]. According to Csurhes (2016) [15], after oil is extracted from neem seeds, the remaining residue, known as "neem cake," is commonly used as an additive in cattle and poultry feed, making it an excellent fertilizer and soil conditioner [16,17]. Neem plays a crucial role in optimizing land use in eroded, marginal, saline, and alkaline soils, as well as in gullies and ravines across India. Neem plants are extensively used in India for reforestation, beautification, and as natural air purifiers along roadsides.

Despite its many beneficial properties, neem trees are vulnerable to a wide range of pests. Several studies have documented various insects that inflict damage to these plants as stem and fruit borer, defoliators, sap sucker and root borer [1,18,19,20,21,22]. More recently, Anand and James (2023) [23] identified 27 insect species belonging to 7 orders and 16 families responsible for causing significant harm to neem trees. In India, 38 insect pest species have been recorded on the neem, which belongs to eight orders and 32 families [24]. As is true for most trees, all parts of the neem, including the flowers, fruits, foliage, stems, bark, wood, and roots, are subject to injury. However, relatively few pest species cause serious damage. The pests affecting neem plants include various types such as seed and flower feeders, defoliators, root feeders, sap-sucking insects, and stem and shoot borers [19].

Among the various pests, including insects affecting neem plants, the neem semi-looper, *Cleora cornaria*, is the most prevalent defoliator, both in terms of infestation levels and population density. The larvae feed aggressively on young leaves, leading to significant damage and hindering plant growth and vitality [1,25,26].

Given the significance of neem trees and the limited research on pests affecting them, this study focused on the biology of the neem semi-looper *C. cornaria*, which infests neem trees. The primary objective was to investigate the life cycle of *C. cornaria* observed in the Jalgaon district, North Maharashtra, India. This study aims to provide a comprehensive understanding of the biology of the pest, including its developmental stages, to better manage its impact on *Azadirachta indica* (neem).

## 2. MATERIAL AND METHODS

A survey was conducted from September 2021 to November 2024 to document the life history of the neem semi-looper, *Cleora cornaria*, in *Azadirachta indica* plantations located along roads, open spaces, agricultural fields, and forest areas in the Jalgaon district, North Maharashtra, India. Caterpillars were collected from infested neem trees and reared under controlled conditions. Fresh neem foliage

was provided daily and waste material was removed regularly to maintain a clean environment for the caterpillars. The rearing boxes were monitored three times a day to observe larval development, feeding behavior, and other life cycle changes. Photographs documenting each stage of the life cycle of the neem semi-looper were taken directly from the rearing setup. Ten observations were documented in the study. The statistical analyses were done using Microsoft Excel 2010.

## 3. RESULT

### 3.1 Life Cycle

The neem semi-looper, *Cleora cornaria* is a holometabolous insect, undergoing complete metamorphosis with four distinct life stages: egg, larva, pupa, and adult (Fig. 1a-k). This nocturnal species avoids activity during daylight. The duration of the life cycle varies from weeks to months, depending on various biotic and abiotic factors. Shortly after emergence, males release sex pheromones to attract females, leading to mating. Once mated, females, laden with eggs, return to neem trees to deposit their eggs, initiating the next generation. The deposition of eggs begins a short time after the emergence and mating of females. The female moths lay eggs in clusters of 445-560 on the green growing shoots of neem trees.

#### 3.1.1 Egg

The fresh eggs were light greenish in color, smooth and rounded, and were observed underside of the neem leaves in a range of 389 to 512 eggs (Fig. 1a). The incubation period is ranging from to 3-4 days (Table 2).

#### 3.1.2 Larva

After hatching, the larvae migrating towards the edges of neem leaves, where they initiate feeding (Fig. 1b-f). These newly hatched larvae are typically about 1-3 mm in length, but with consistent and voracious feeding on neem foliage, they grow significantly, reaching a length of approximately 30-47 mm by the end of the larval stage (Table 1). Initially, the larvae display a light green coloration, which becomes progressively darker green with each successful molt. Larvae undergo 5 moulting stages before entering into pupal stage. This growth and molting process takes place over a period ranging from 15 to 22 days (Table 2), depending on environmental conditions such as temperature and humidity.

#### 3.1.3 Pupa

The pupal stage, characterized by immobility and the absence of feeding, occurs within a cocoon (Fig. 1g-h). The body length of each pupa was 16.4±2.07 mm (range 14-16 mm) in length and 6-9 mm in diameter (Table 1). They exhibit sexual dimorphism, with females typically being longer than males. Initially, green to dark green, the pupa's color transitions to brown and eventually to dark brown as development progresses. Notable features include a pair of prominent eyes and antennae. The pupal stage spans is 13.5±1.58 days (range 11-15 days), culminating in the emergence of an adult moth (Table 2).

#### 3.1.4 Adult

Sexual dimorphism is evident in adult moths, with females being larger than males. These insects possess a rudimentary forked proboscis, rendering them incapable of feeding. Filiform antennae and compound eyes were present in both the sexes. The thorax supports three pairs of legs and two pairs of wings, which are covered with scales. Adult moths exhibited wing patterns featuring various

grey tones and wavy lines (Fig. 1i-k). The body length and wing span of adult male is 17.6±2.01 mm and 26.2±1.4 mm respectively, while 21.3±2.79 mm and 27.8 ±1.62 mm are the body length and wing span of adult female respectively (Table 1). The adult mated for 1-2 min after 2-3 days of emergence, and females started egg-laying within 24 h of mating. Males survived for 6.3 ± 1.16 days (range 5-8 days), while the female longevity was 10.3 ± 1.16 days (range 9-12 days) (Table 2).

**Table 1: Body length of developmental stages of neem semi-looper, *C. cornaria***

| Number of observations | Length of life stages | | | | | | Adult Male | | Adult Female | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Instar I | Instar II | Instar III | Instar IV | Instar V | Pupa | Body length | Wing span | Body length | Wing span |
| **1** | 1.6 | 7.2 | 19 | 22 | 30 | 14 | 15 | 26 | 17 | 30 |
| **2** | 2.3 | 8.3 | 18 | 28 | 43 | 16 | 17 | 28 | 19 | 28 |
| **3** | 1.8 | 7.9 | 13 | 26 | 34 | 18 | 20 | 26 | 23 | 26 |
| **4** | 2.5 | 9.1 | 16 | 23 | 47 | 15 | 16 | 28 | 25 | 30 |
| **5** | 2.1 | 8.4 | 20 | 29 | 36 | 20 | 15 | 24 | 21 | 29 |
| **6** | 2.4 | 7.2 | 14 | 25 | 43 | 14 | 19 | 26 | 20 | 26 |
| **7** | 1.7 | 7.8 | 19 | 23 | 35 | 17 | 21 | 27 | 18 | 27 |
| **8** | 1.9 | 8.1 | 17 | 27 | 42 | 19 | 17 | 24 | 22 | 26 |
| **9** | 2.4 | 7.3 | 15 | 22 | 45 | 15 | 18 | 26 | 25 | 29 |
| **10** | 2.7 | 9.9 | 18 | 24 | 45 | 16 | 18 | 27 | 23 | 27 |
| **Total** | 21.4 | 81.2 | 169 | 249 | 400 | 164 | 176 | 262 | 213 | 278 |
| **Mean ±SD** | 2.14 ±0.37 | 8.12 ±0.87 | 16.9 ±2.33 | 24.9 ±2.51 | 40.0 ±5.75 | 16.4 ±2.07 | 17.6 ±2.01 | 26.2 ±1.4 | 21.3 ±2.79 | 27.8 ±1.62 |
| **Range** | 1.6-2.7 | 7.2-9.9 | 13-20 | 22-29 | 30-47 | 14-20 | 15-21 | 24-28 | 17-25 | 26-30 |

**SD- Standard Deviation*

**Table 2: Duration of developmental stages of neem semi-looper, *C. cornaria***

| Number of observations | Duration of life stages | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Eggs | Instar I | Instar II | Instar III | Instar IV | Instar V | Pupa | Adult Male | Adult Female |
| **1** | 3 | 2 | 4 | 4 | 3 | 6 | 14 | 5 | 9 |
| **2** | 4 | 4 | 3 | 4 | 3 | 5 | 12 | 6 | 10 |
| **3** | 3 | 4 | 3 | 3 | 4 | 6 | 14 | 6 | 9 |
| **4** | 3 | 4 | 2 | 3 | 3 | 5 | 15 | 8 | 11 |
| **5** | 3 | 3 | 4 | 3 | 4 | 5 | 11 | 7 | 10 |
| **6** | 2 | 3 | 2 | 4 | 4 | 5 | 14 | 5 | 10 |
| **7** | 3 | 4 | 3 | 3 | 3 | 5 | 15 | 7 | 12 |
| **8** | 4 | 3 | 4 | 4 | 4 | 6 | 14 | 6 | 9 |
| **9** | 4 | 2 | 4 | 4 | 3 | 6 | 15 | 8 | 12 |
| **10** | 2 | 3 | 4 | 4 | 3 | 5 | 11 | 5 | 11 |
| **Total** | 31 | 32 | 33 | 36 | 34 | 54 | 135 | 63 | 103 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 3.1 | 3.2 | 3.3 | 3.6 | 3.4 | 5.4 | 13.5 | 6.3 | 10.3 |
| **±SD** | ±0.74 | ±0.79 | ±0.82 | ±0.52 | ±0.52 | ±0.52 | ±1.58 | ±1.16 | ±1.16 |
| **Range** | 2-4 | 2-4 | 2-4 | 3-4 | 3-4 | 5-6 | 11-15 | 5-8 | 9-12 |

**SD- Standard Deviation*

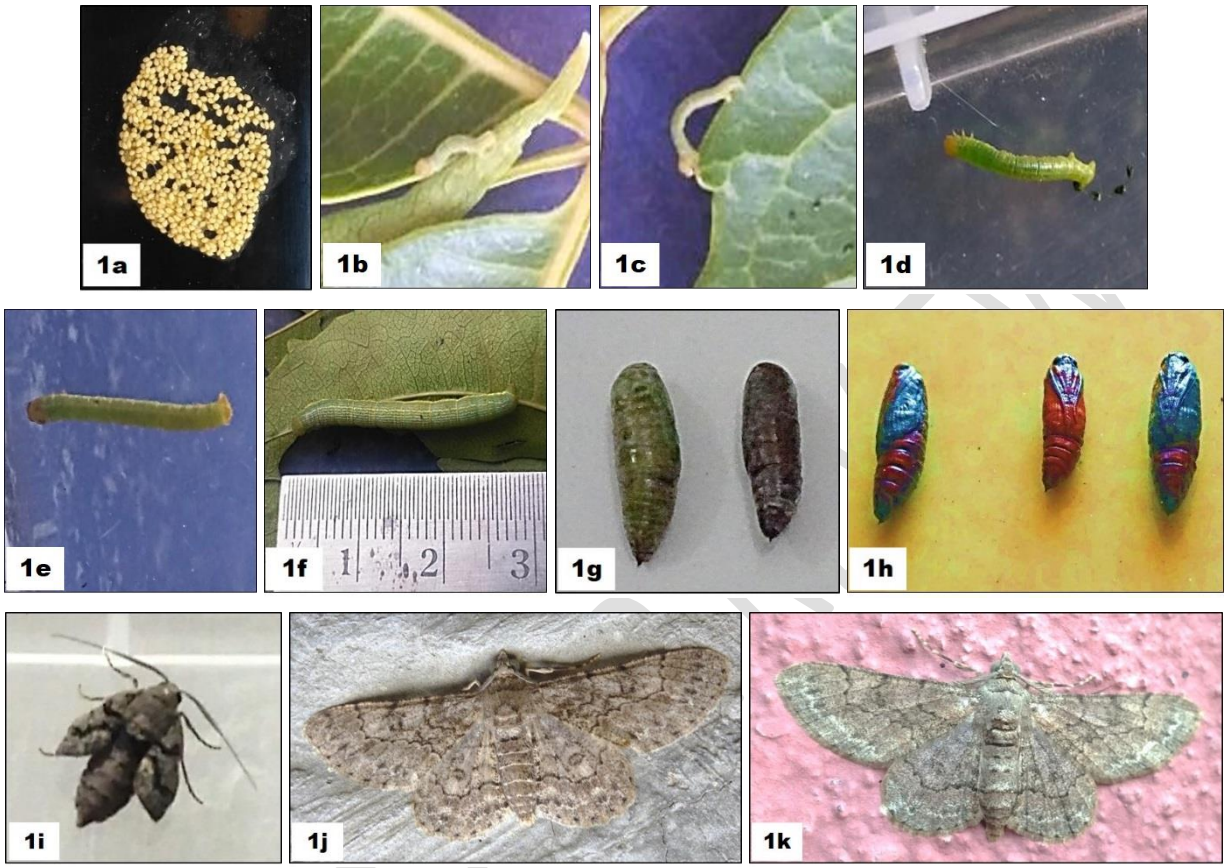


**Fig 1: Developmental stages of neem semi-looper, *Cleora cornaria***

*(**Note: Developmental stages:** 1a- eggs, 1b- I$^{st}$ instar, 1c- II$^{nd}$ instar, 1d- III$^{rd}$ instar, 1e- IV$^{th}$ instar, 1f- V$^{th}$ instar, 1g- early pupa, 1h- late pupa, 1i- newly emerged adult, 1j-k- Adult)*

## 4. DISCUSSION

The life cycle of the neem semi-looper, *Cleora cornaria*, is completed within four distinct developmental stages: egg, larva, pupa, and adult. Light-greenish eggs in the range of 389–512 were observed in a cluster underside the neem leaves. The incubation period of eggs was 3.1±0.74 days in, range from 2 to 4 days. According to Singh et al. [25], in laboratory conditions, the range of 464 to 576 eggs laid by a female and the incubation period were noticed with an average of 2.8±0.77 days with a range of 2 to 4 days. Similar results were also noted by Mishra and Omkar [27] from Lucknow where the average egg laying capacity of female was about 527± 25.3 eggs.

All larval stages vary in shape, size, and duration between larval instars. Total five larval instars were observed during the study which was also supported by Mishra and Omkar [27]. The newly hatched first instar was tiny, bright green in color, and showed semilooper movements. The first instars were usually found on the edges of small growing leaves feeding voraciously [25, 27]. The second, third, fourth, and fifth instar larvae fed voraciously to the neem leaves, resulting in an increase in body

length. The variation of larval duration and body length in each instar may depends of the environmental factors and availability of leaves [26, 27,].

The fifth larval instar then stops feeding and enters the moist soil for pupation. The prepupa was green in color remains for 1-2 days and later, the color pattern changed from brownish to blackish brown. The pupal duration varied owing to environmental factors in the range of 11-15 days. The findings were similarly reported by Mishra and Omkar [27] and Singh et al. [25]. Adult males were smaller than females in terms of body length and wing size. Both adults possessed filiform antennae, compound eyes, and a rudimentary proboscis. According to Mishra and Omkar [27], mating started–2-3 days after the emergence of adults, and after a day, females started laying eggs on the growing shoots of the neem.

Overall, the caterpillar of neem semi-looper moth, *C. cornaria* is a voracious feeder and is considered the major pest of many trees. In India, it infest severely tea garden [28], teak plantation [29], conifer forests, Saraj Valley of Himachal Pardesh [30] and on neem plant in Talwandi Sabo [25] and in Lucknow [27]. The larvae feed on green foliage and infest a large scale, which reduces the growth of the neem plant. According to Singh et al. [26], the highest level adult population of *C. cornaria* were observed in September and October, respectively. Later, infestation gradually decreased from December to March because of low temperatures.

**5. CONCLUSION**

The present study underscores the critical necessity of contemporary surveys to elucidate the biology and infestation patterns of the neem semi-looper (*Cleora cornaria*) in the Jalgaon district, North Maharashtra, India. These findings indicate that severe infestations caused by the larvae of this lepidopteran species significantly compromise the vigor of neem trees, potentially precipitating ecological imbalances and economic losses owing to diminished tree productivity. These results emphasize the importance of developing efficacious pest management strategies and conducting further research to mitigate the deleterious effects of this infestation on neem trees and local ecosystems.



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