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Biological Characteristics and Life Cycle of the Neem Looper, *Cleora cornaria* (Lepidoptera: Geometridae) in Jalgaon District, North Maharashtra, India

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

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ABSTRACT

The present investigation was conducted on the biological characteristics and life cycle of the neem looper, *Cleora cornaria* (Lepidoptera: Geometridae) from September 2021 to November 2024 in the Jalgaon district, North Maharashtra. This study revealed that the life stages of looper comprised four distinct phases viz., 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

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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.

Keywords: Cleora cornaria; neem looper; biological characteristics; life cycle; Jalgaon district.

1. INTRODUCTION

Neem, *Azadirachta indica* L, 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 (Biswas and Rahman, 2001; Paul et al., 2011). *A. indica*- derived from Persian, translates to 'the free tree of India' and holds a significant place in traditional medicine and ecological sustainability (Kumar and Navaratnam, 2013). This species has gained prominence because of its diverse applications and adaptability to various environments.

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 (Alzohairy, 2016; Chandramohan et al., 2016; Lokanadhan et al., 2012).

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 (Charmaine et al., 2005; Biswas et al., 2002). Azadirachtin is widely used as a biopesticide, nematicide, and insect repellent in agroforestry, and has proven to be effective against various pests (Joseph et al., 2010; Subapriya and Nagini, 2005; Schmutterer, 1990). In addition to its medicinal and agricultural applications, neem is consumed as food by humans, animals, and birds (Schmutterer, 1992).

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 (Biswas and Rahman, 2001; Boa, 1995; Ciesla, 1993; Kiyanthy, 2009; Schmutterer, 1998; Sharma, 2016). More recently, Anand and James (2023) (Anand and James, 2023) 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 8 orders and 32 families (Tewari, 1992). 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 (Ciesla, 1993).

Among the various pests, including insects affecting neem plants, the neem looper, *Cleora cornaria*, is the most prevalent defoliator, both in terms of infestation levels and population density. The larvae of the looper moth feed sporadically on the foliage of neem in nurseries and young plants, which disrupts plant growth and health (Biswas and Rahman, 2001). Mishra and Omkar (Mishra and Omkar, 2012) observed significant defoliation of mature neem trees caused by the neem looper in Bhauli village, Lucknow. A similar infestation was also reported on neem trees in the districts of Sultanpur, Pratapgarh, and Faizabad in Uttar Pradesh. The biology of *C. cornaria* on neem was researched by Singh et al. (Singh et al., 2017) in Talwandi Sabo, Punjab, and they also examined the seasonal distribution of the neem looper during the years 2016-2017 (Singh et al., 2017).

Given the significance of neem trees and the limited research on pests affecting them, this study focused on the biology of the neem 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 duration of developmental stages, to better manage its impact on *Azadirachta indica* (neem).

2. MATERIALS AND METHODS

A survey was conducted from September 2021 to November 2024 to document the life history of the neem looper, *Cleora cornaria*, in *Azadirachta indica* plantations located along roads, open spaces, agricultural fields, and forest areas in the Jalgaon district, North Maharashtra, India. For this study, 12 caterpillars (mainly 4th and 5th instars) were initially collected from infested neem leaves. In the laboratory, all caterpillars were transferred to rearing cages and provided with fresh neem leaves. The fifth instar larvae, on becoming sluggish, were transferred to separate rearing cages containing moist soil and dry plant leaves for pupation. All caterpillars were then moved for pupation under the soil, but adults emerged from only eight pupae, while the remaining four pupae went in diapause. Eight newly emerged adults were transferred to a cage covered with muslin cloth, and cotton-soaked honey was provided for feeding. Adult pairs were observed daily for oviposition and egg viability. After hatching, the first instars were separated, provided with fresh neem leaves in rearing cages, and further developmental stages were observed until adult emergence. The cages were maintained at room temperature (21- 22^{o}C) in the laboratory and monitored three times a day to observe larval development, feeding behavior, and other life cycle changes. Fresh neem foliage was provided daily and waste material was removed regularly to maintain a clean environment for the caterpillars. The duration of each stage, number surviving, and length of the larval, pupal, and adult stages were measured. Photographs documenting each stage of the life cycle of the neem looper were obtained directly from the rearing setup. Ten observations were made in this study. Two life cycles were studied for each year. Statistical analyses were performed using Microsoft Excel 2010.

3. RESULTS

3.1 Life Cycle

The neem looper 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). After emerging, the larvae gathered on the soft edges of neem leaves and began to consume the epidermal layer of the leaves between the veins. 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).

4. DISCUSSION

The life cycle of *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. (Singh et al., 2017), 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 (Mishra and Omkar, 2012) 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 (Mishra and Omkar, 2012). The newly hatched first instar was tiny, bright green in color, and showed looper movements. The first instars were usually found on the edges of small growing leaves feeding voraciously (Mishra and Omkar, 2012; Singh et al., 2017). 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 (Singh et al., 2017; Singh et al., 2017).

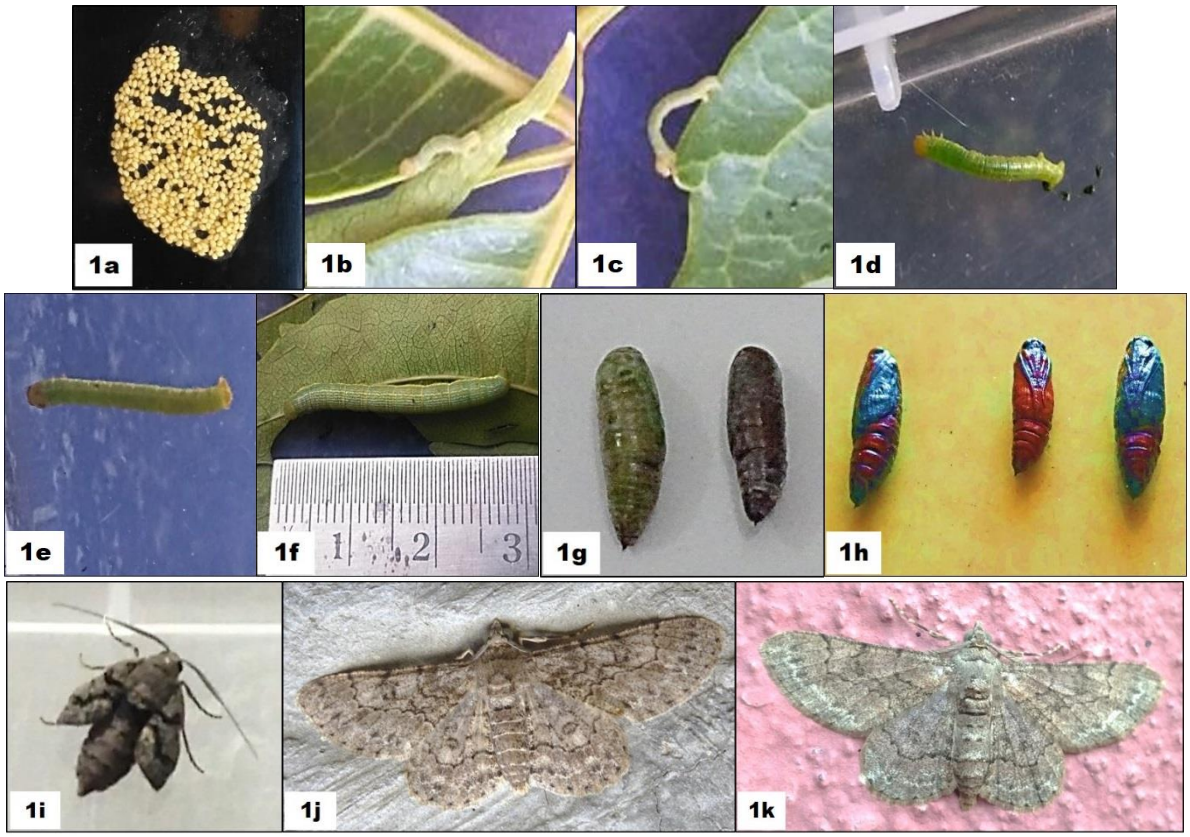

Fig. 1. Developmental stages of neem looper, *Cleora cornaria*
*(**Note: Developmental stages:** 1a- eggs, 1b- Ist instar, 1c- IInd instar, 1d- IIIrd instar, 1e- IVth instar, 1f- Vth instar, 1g- early pupa, 1h- late pupa, 1i- newly emerged adult, 1j-k- Adult)*

Table 1. Body length of developmental stages of neem 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	2.14	8.12	16.9	24.9	40.0	16.4	17.6	26.2	21.3	27.8
±SD	±0.37	±0.87	±2.33	±2.51	±5.75	±2.07	±2.01	±1.4	±2.79	±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 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*

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 (Mishra and Omkar, 2012) and Singh et al. (Singh et al., 2017). 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 (Mishra and Omkar, 2012), 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 looper moth, *C. cornaria* is a voracious feeder and is considered the major pest of many trees. In India, it infestseverely tea garden (Das et al., 2010), teak plantation (Nair, 2007), conifer forests, Saraj Valley of Himachal Pardesh (Thakur and Kumar, 2015) and on neem plant in Talwandi Sabo (Singh et al., 2017) and in Lucknow. The larvae feed on green foliage and infest a large scale, which reduces the growth of the neem plant. According to Singh et al. (Singh et al., 2017), the highest level adult population of *C. cornaria* was 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 looper (*Cleora cornaria*) in the Jalgaon district, North Maharashtra, India. The life cycle is completed by four developmental stages: egg, larva, pupa, and adult. The findings suggest that heavy infestations by the larvae of this moth weaken neem trees, which could lead to ecological problems and economic losses due to reduced tree productivity. These results highlight the need for effective pest control and more research to reduce the harmful impact of this infestation on neem trees and local ecosystems. Furthermore, the application of neem extracts on the growth, feeding behavior, and reproductive patterns make it an effective option for integrated pest management.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

Biswas, S. R. & Rahman M. A. (2001). Neem (*Azadirachta indica*): A critical review. Paper prepared for presentation at the First National Conference on “Neem: A tree for the 21st Century”, Bangladesh Council of Scientific and Industrial Research, Dhaka.

Paul, R., Prasad, M. & Sah, N. K. (2011). Anticancer biology of *Azadirachta indica* L. (Neem): A mini review. Free Radical Research, 12, 467-476. https://doi.org/10.4161/cbt.12.6.16850

Kumar, V. S. & Navaratnam, V. (2013). Neem (*Azadirachta indica*): Prehistory to contemporary medicinal uses to humankind. Asian Pacific Journal of Tropical Biomedicine, 3(7), 505-514. https://doi.org/10.1016/S2221-1691(13)60105-7

Alzohairy, M. A. (2016). Therapeutics role of *Azadirachta indica* (Neem) and their active constituents in diseases prevention and treatment. Evidence-Based Complementary and Alternative Medicine, 2016(1), 7382506. https://doi.org/10.1155/2016/7382506

Chandramohan, B., Murugan, K., Madhiyazhagan, P., Kovendan, K., Kumar, P. M. & Panneerselvam, C. et al. (2016). Neem by-products in the fight against mosquito-borne diseases: Biotoxicity of neem cake fractions towards the rural

malaria vector *Anopheles culicifacies* (Diptera: Culicidae). Asian Pacific Journal of Tropical Biomedicine, 6(6), 472-476.
https://doi.org/10.1016/j.apjtb.2015.11.013

Lokanadhan, S., Muthukrishnan, P. & Jeyaraman, S. (2012). Neem products and their agricultural applications. Journal of Biopesticides, 5 (Supplementary), 72-76.

Charmaine, L. A. C., Menon, T., & Umamaheshwari K. (2005). Anticandidal activity of *Azadirachta indica*. Indian Journal of Pharmacology. 37(6), 386- 389.
https://doi.org/10.4103/0253-7613.19076

Biswas, K., Chattopadhyay, I., Banerjee, R. K. & Bandyapadhyay, U. (2002). Biological activities and medicinal properties of neem (*Azadirachta indica*). Current Science, 82, 1336-1345.

Joseph, A. R., Premila, K. S., Nisha, V. G., Rajendran, S. & Mohan, S. (2010). Safety of neem products to tetragnathid spiders in rice ecosystem. Journal of Biopesticides, 3(1), 88-89.

Subapriya, R. & Nagini, S. (2005). Medicinal properties of neem leaves: A review. Current Medical Chemistry, Anticancer Agents, 5(2), 149-156. https://doi.org/10.2174/1568011053174828

Schmutterer, H. (1990). Properties and potential of natural pesticides from the neem tree, *Azadirachta indica*. Annual Review of Entomology, 35, 271-297.

Schmutterer, H. (1992). Observations on man and animals utilizing the fruits of neem tree, Azadirachta indica A. Juss. in Senegal and other parts of Africa. Anzeiger für Schädlingskunde, Pflanzenschutz, Umweltschutz, 65, 1-4. https://doi.org/10.1007/BF01905973

Boa, E. R. (1995). A guide to the identification of diseases and pests of neem (*Azadirachta indica*). RAP Publication (FAO). No. 1995/41.

Ciesla, W. M. (1993). Pests and diseases of neem, *Azadirachta indica*. In MD Read and JH French (Eds.), Genetic Improvement of Neem: Strategies for the Future (pp 95-109). Proceedings of an international consultation held at Kasetsart University, Bangkok, Thailand.

Kiyanthy, S. & Mikunthan, G. (2009). Association of Insect Pests with Neem, *Azadiracta indica* with Special Reference to Biology of Ash Weevils, *Myllocerus sp* in Jaffna, Sri Lanka. American-Eurasian Journal of Scientific Research, 4(4), 250-253.

Schmutterer, H. (1998). Some arthropod pests and a semi-parasitic plant attacking neem (*Azadirachta indica*) in Kenya. Anzeiger Fur Schadlingskunde Pflanzenschutz Umweltschutz, 71(2), 36-38. https://doi.org/10.1007/BF02770586

Sharma, M. (2016). Insect pests of forestry plants and their management. Int J. Adv. Res., 4(8), 2099-2116. https://doi.org/10.21474/ijar01/1427

Anand, S. & James, B. E. (2023). A review of different insects associated with the neem tree, *Azadirachta indica* (Meliaceae). Annals of Science and Allied Research, 1(1), 26-37. https://doi.org/10.5281/zenodo.10439547

Tewari, D. N. (1992). Monograph on neem (*Azadirachta indica* A. Juss.) (vi + 279 pp.), International Book Distributors, Dehra Dun.

Mishra, G. & Omkar, G. M. (2012). Neem: A wonder tree, under attack: A new major pest, *Cleora cornaria* (Lepidoptera: Geometridae), previously a minor pest of neem. Current Science, 102 (7), 969-970.

Singh, A., Brar, J. S. & Singh, K. (2017). Biology of *Cleora cornaria*, neem Looper (Lepidoptera: Geometridae) in Talwandi Sabo, Punjab. Journal of Entomology and Zoology Studies, 5(4), 1804-1807.

Singh, A., Singh, K. & Brar, J. S. (2017). Seasonal abundance of neem looper *Cleora cornaria* guenee (Lepidoptera: Geometridae) in Talwandi Sabo, Punjab. International Journal of Current Research, 9(10), 59561-59563.

Das, S., Mukopathyay, A. & Roy, S. (2010). Morphological diversity, development trails and seasonal occurrence of looper pests (Lepidoptera: Geometridae) on tea crop. Journal of Biopesticide, 3, 16-19.

Nair, K. S. S. (2007). Tropical forest insect pests: Ecology, impact & management. Cambridge University press, 404.

Thakur, V. & Kumar, P. (2015). Biodiversity of geometrid moths (Lepidoptera) of conifer forests of Saraj Valley of Himachal Pradesh, India. International Journal of Current Research, 7(01), 11426-11429.

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