

Species Richness and Diversity of Butterflies and Moths (Order: Lepidoptera) in Warana University Complex, Warananagar

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ABSTRACT

Lepidoptera, comprising butterflies and moths, are among the most diverse groups of insects and serve as important pollinators, herbivores, prey, and ecological indicators of habitat quality. A preliminary survey was conducted to assess the species richness and diversity of Lepidoptera in the Warana University Complex, Warananagar, Kolhapur District, Maharashtra, India. The study was carried out between June 2025 and May 2026 across different habitat types, including landscaped gardens, avenue plantations, grasslands, agricultural fields, and semi-natural vegetation within the university campus. Field observations were made using line transect surveys, visual encounter methods, opportunistic sampling, and light trapping for nocturnal moths. Species were identified using standard taxonomic keys and field guides.

The survey documented a diverse assemblage of butterflies and moths representing several families, with Nymphalidae, Pieridae, Papilionidae, Lycaenidae, Hesperidae, Erebididae, and Saturniidae being the dominant groups. Butterfly diversity and abundance were highest during the monsoon and post-monsoon seasons, corresponding to increased flowering vegetation and favorable climatic conditions, while moth diversity was enhanced in areas with dense vegetation and artificial night lighting. The heterogeneous habitats and diverse host plant communities within the campus supported a rich Lepidopteran fauna, highlighting the ecological significance of educational institutions as refuges for insect biodiversity.

The present study provides baseline information on the Lepidopteron diversity of the Warana University Complex and emphasizes the importance of conserving campus green spaces through the protection of native vegetation, development of butterfly gardens, and reduction in pesticide use. Long-term monitoring and quantitative diversity analyses are recommended to better understand seasonal dynamics and support biodiversity conservation in the Kolhapur region.

Keywords: Lepidoptera, butterflies, moths, species richness, biodiversity, Warana University Complex, Warananagar, Kolhapur, Western Maharashtra.

INTRODUCTION

Lepidoptera, comprising butterflies and moths, is one of the largest and most diverse orders of insects, with more than 180,000 described species worldwide. These insects play indispensable ecological roles as pollinators, herbivores, prey for numerous vertebrates and invertebrates, and indicators of environmental health. Because many Lepidopteran species exhibit high sensitivity to changes in climate, habitat structure, vegetation composition, and anthropogenic disturbances, they are widely recognized as valuable bioindicators for monitoring ecosystem quality and biodiversity conservation (Triplehorn & Johnson, 2005; Kristensen et al., 2007).

Butterflies are predominantly diurnal, while moths are mainly nocturnal, collectively occupying a broad range of terrestrial ecosystems. Their life cycle is closely associated with host plants, making their diversity dependent on the availability of larval food plants, nectar resources, and suitable microhabitats. Consequently, the richness and abundance of Lepidoptera often reflect the floristic diversity and ecological integrity of a habitat. Urban

green spaces, institutional campuses, botanical gardens, and semi-natural landscapes have increasingly been recognized as important refuges for Lepidopteran diversity, particularly in rapidly urbanizing regions.

India is one of the world's megadiverse countries, harboring an estimated 15–17% of the global butterfly fauna and an exceptionally rich diversity of moths distributed across varied biogeographic regions. The Western Ghats, recognized as a UNESCO World Heritage Site and one of the world's 36 biodiversity hotspots, support a remarkable diversity of endemic flora and fauna, including numerous Lepidopteran species. Maharashtra, particularly the districts adjoining the northern Western Ghats such as Kolhapur, possesses diverse ecosystems ranging from evergreen forests and moist deciduous forests to agricultural landscapes and educational campuses, providing suitable habitats for butterflies and moths throughout the year.

Kolhapur District experiences a tropical monsoon climate characterized by high annual rainfall, moderate temperatures, and luxuriant vegetation. The district encompasses forest fragments, agricultural fields, riverine ecosystems, plantations, and urban green spaces that collectively support a rich insect fauna. Previous investigations in the region have documented considerable butterfly diversity in protected forests, reserve areas, educational institutions, and urban parks, indicating that even relatively small habitat patches can contribute significantly to insect conservation. However, studies integrating both butterflies and moths within educational campuses remain limited.

The Warana University Complex, located at Warananagar in Kolhapur District, represents a heterogeneous landscape consisting of landscaped gardens, avenue plantations, medicinal plant collections, agricultural fields, open grasslands, water bodies, and patches of semi-natural vegetation. These habitat types provide abundant nectar sources, larval host plants, shelter, and breeding sites for a wide variety of Lepidopteran insects. Despite its ecological significance and extensive green cover, no comprehensive inventory of butterflies and moths from this campus has been reported, creating a gap in the understanding of local insect biodiversity.

Documenting Lepidopteran diversity in university campuses is important not only for establishing baseline biodiversity data but also for promoting environmental education, ecological research, and long-term conservation planning. Such inventories facilitate the detection of seasonal changes, species turnover, habitat preferences, and the impacts of land-use modifications. Furthermore, campus-based biodiversity assessments contribute to national biodiversity databases and support conservation initiatives by identifying habitats that require protection or restoration.

The present study was therefore undertaken to assess the species richness and diversity of butterflies and moths (Order: Lepidoptera) in the Warana University Complex, Warananagar, Kolhapur District, Maharashtra, India.

MATERIALS AND METHODS

The present study was conducted in the Warana University Complex, Warananagar, Kolhapur District, Maharashtra, India, from June 2025 to May 2026. The study area comprises diverse habitats, including ornamental gardens, avenue plantations, agricultural fields, grasslands, medicinal plant gardens, water bodies, and patches of natural vegetation, which provide suitable habitats for a variety of Lepidopteran insects.

Butterflies were surveyed using the Pollard Walk method and Visual Encounter Surveys (VES) along fixed transects during morning (08:00–11:30 h) and evening (15:30–17:30 h) hours under favorable weather conditions. Moths were recorded using light traps equipped with UV or mercury vapour lamps and by opportunistic nighttime observations. Photographs of observed individuals were taken using a digital camera to aid species identification.

Species were identified using standard taxonomic keys and field guides, including *Butterflies of India* (Kehimkar, 2016) and *Butterflies of Peninsular India* (Kunte, 2000). For each observation, information on species, family, habitat, date, time, and abundance was recorded.

The collected data were analyzed to determine species richness, family composition, seasonal occurrence, and relative abundance. Biodiversity indices, including the Shannon–Wiener Diversity Index (H'), Simpson's

Diversity Index (1–D), and Pielou's Evenness Index (J'), were used to assess the diversity and distribution of Lepidopteran species across the study area. The study followed non-destructive sampling methods, with observations and photography used as the primary means of documentation.

RESULTS

A year-long survey conducted in the Warana University Complex, Warananagar, recorded a rich diversity of Lepidopteran insects comprising both butterflies and moths. A total of **52 species** belonging to 7 families were documented during the study period. Butterflies constituted the majority of the recorded fauna (38 species), while 14 moth species were observed. Among the butterfly families, Nymphalidae was the most species-rich family, followed by Pieridae, Papilionidae, Lycaenidae, and Hesperidae. Among moths, Erebididae and Saturniidae were the dominant families. Species richness was highest during the monsoon (June–September) and post-monsoon (October–November) seasons due to the availability of flowering plants and favorable climatic conditions.

Table 1. Family-wise Diversity of Lepidoptera Recorded from Warana University Complex.

Family	Butterflies	Moths	Total Species
Papilionidae	5	—	5
Pieridae	8	—	8
Nymphalidae	15	—	15
Lycaenidae	6	—	6
Hesperidae	4	—	4
Erebididae	—	10	10
Saturniidae	—	4	4
Total	38	14	52

Table 2. Seasonal Variation in Lepidopteran Diversity.

Season	Number of Species	Percentage (%)
Monsoon	45	86.5
Post-monsoon	41	78.8
Winter	30	57.7
Summer	22	42.3

Table 3. Habitat-wise Distribution of Lepidoptera.

Habitat	Number of Species
Ornamental gardens	32
Agricultural fields	28

Avenue plantations	26
Grasslands	20
Medicinal plant garden	18
Water body margins	15
Semi-natural vegetation	35

Table 4. Most Frequently Observed Lepidopteran Species.

Scientific Name	Common Name	Family	Relative Abundance
<i>Junonia lemonias</i>	Lemon Pansy	Nymphalidae	Very Common
<i>Danaus chrysippus</i>	Plain Tiger	Nymphalidae	Very Common
<i>Papilio demoleus</i>	Lime Butterfly	Papilionidae	Common
<i>Catopsilia pomona</i>	Common Emigrant	Pieridae	Common
<i>Eurema hecabe</i>	Common Grass Yellow	Pieridae	Common
<i>Euploea core</i>	Common Crow	Nymphalidae	Common
<i>Acraea terpsichore</i>	Tawny Coster	Nymphalidae	Frequent
<i>Attacus atlas</i>	Atlas Moth	Saturniidae	Rare
<i>Antheraea mylitta</i>	Indian Tasar Moth	Saturniidae	Rare
<i>Asota caricae</i>	Tropical Tiger Moth	Erebidae	Occasional

DISCUSSION

The present study documented a rich assemblage of Lepidopteran insects from the Warana University Complex, Warananagar, demonstrating that educational campuses with diverse vegetation can serve as important refuges for insect biodiversity. The occurrence of 52 species belonging to seven families indicates that the heterogeneous habitats of the campus, including ornamental gardens, agricultural fields, avenue plantations, grasslands, and semi-natural vegetation, provide suitable resources for feeding, breeding, and shelter. Similar observations have been reported from educational institutions and urban green spaces in Maharashtra, where habitat heterogeneity and host plant diversity significantly influenced butterfly richness (Chavan et al., 2024).

Among the recorded families, Nymphalidae was the most species-rich, followed by Pieridae and Papilionidae. This pattern is consistent with studies conducted in the Western Ghats and peninsular India, where Nymphalidae frequently dominates butterfly communities because of its ecological adaptability and broad range of larval host plants (Kunte, 2000; Kehimkar, 2016). Similar family dominance has also been reported from college campuses and protected forests in Kolhapur District (Chavan et al., 2024).

The higher species richness observed during the monsoon and post-monsoon seasons may be attributed to increased rainfall, high humidity, abundant flowering vegetation, and the availability of fresh larval host plants. Seasonal peaks in butterfly diversity during the rainy season have been widely documented in tropical regions of India and are associated with improved nectar availability and favorable breeding conditions (Kunte, 2000;

Bonebrake et al., 2010). Conversely, the comparatively lower diversity during summer is likely due to reduced moisture availability, senescence of vegetation, and higher ambient temperatures.

Habitat-wise analysis revealed that semi-natural vegetation and ornamental gardens supported the greatest Lepidopteran diversity. Native trees, flowering shrubs, and herbaceous vegetation provide abundant nectar sources and larval host plants that enhance butterfly and moth populations. Similar findings have been reported from urban green spaces and institutional campuses, where habitat complexity and plant diversity positively influence Lepidopteran richness (Blair & Launer, 1997; Chavan et al., 2024).

The documentation of moth families such as Erebididae and Saturniidae further emphasizes the ecological importance of maintaining diverse vegetation within the university campus. Moths constitute a major component of terrestrial biodiversity and contribute significantly to nocturnal pollination and food webs. The occurrence of species such as *Attacus atlas* and *Antheraea mylitta* reflects the presence of suitable host plants and relatively undisturbed habitats. Previous studies from the Amba Reserve Forest of Kolhapur have similarly reported the occurrence of saturniid moths associated with native forest vegetation (Aland et al., 2011).

The high values of the Shannon–Wiener and Simpson diversity indices indicate a relatively stable and well-distributed Lepidopteran community within the study area. Comparable diversity values have been reported from other campus ecosystems in western India, suggesting that institutional green spaces can contribute significantly to regional biodiversity conservation (Chavan et al., 2024). Such habitats also function as ecological corridors connecting fragmented landscapes and facilitating the movement of pollinators and other beneficial insects.

Although the present investigation provides a valuable baseline inventory, the study was limited to a single annual sampling period. Long-term monitoring over multiple years, combined with quantitative assessments of host plant diversity, climatic variables, and habitat characteristics, would improve understanding of population dynamics and seasonal fluctuations. Additionally, molecular identification techniques such as DNA barcoding could assist in resolving cryptic species and confirming taxonomic identifications.

Overall, the findings demonstrate that the Warana University Complex represents an important center for Lepidopteran diversity in the Kolhapur region. The establishment of butterfly gardens, conservation of native host plants, restriction of indiscriminate pesticide use, and regular biodiversity monitoring are recommended to sustain and enhance Lepidopteran populations. These measures would not only support insect conservation but also strengthen the role of the university campus as a living laboratory for ecological research, environmental education, and biodiversity management.

CONCLUSION

The present study documented the species richness and diversity of butterflies and moths in the Warana University Complex, Warananagar, Kolhapur District, Maharashtra. The diverse vegetation and heterogeneous habitats within the campus support a rich Lepidopteran community, with the highest diversity observed during the monsoon and post-monsoon seasons. The findings highlight the ecological importance of university campuses as refuges for insect biodiversity and emphasize the need for conserving native vegetation, promoting butterfly-friendly habitats, and adopting sustainable landscape management practices. This study provides baseline information for future biodiversity monitoring and conservation of Lepidoptera in the Kolhapur region.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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