



Diversity of Lepidoptera species in Anna University, Chennai, Tamil Nadu

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Date of receipt: 26.01.2025

Date of acceptance: 04.05.2025

ABSTRACT

The objective to comprehend the diversity Lepidoptera, the current study was conducted at Anna University, Chennai, Tamil Nadu, between September 2023 and February 2024. Under the study, 72 species of butterflies from 13 families and 59 genera were identified. The Nymphalidae family had the highest relative abundance (23 species) when family-wise relative abundance was calculated. Erebidae were second (ten species) followed by Pieridae (nine species), Papilionidae (six species), Geometridae (five species), Crambidae and Lycaenidae (each four species), Noctuidae, Pterophoridae, Pyralidae and Sphingidae (each two species), Hesperidae and Riodinidae (each one species). It was clear from Pareto charts that the cumulative line was dominated by the Nymphalidae family. In recent times, research on Sepidoptera species has expanded on college and university campuses as well as research stations. The diverse range of butterflies and moths on college campuses are supported by the expansive campus with its trees, serene surroundings, and irrigated garden filled with host plants. This study will aid in the development of efficient conservation strategies and provided insightful information on the diversity of butterfly fauna in Anna University Campus, Tamil Nadu.

Key words: Anna University, butterflies,diversity, Lepidoptera, moths, nymphalidae

INTRODUCTION

In the order Lepidoptera, butterflies are among the most beautiful and seductive of all insects; they are often called “Flagship species” (Gandhi et al., 2018). It is believed that moths gave rise to butterflies, and this development is intimately related to the evolution of flowering plants (Kawahara et al., 2023). Throughout their lives, butterflies rely on a wide variety of host and nectar plants for growth and development. Therefore, a thorough understanding of the butterfly population requires a study of the abundance of hosts or nectar plants as well as their regeneration state.

Butterflies are examined as vital living ecological components and aid in the monitoring of climate change and environmental degradation.

They are valuable pollinators in the surrounding environment and have a significant part in the food chain. Although they are delicate organisms, changes in the environment and the configuration of their habitats have a significant impact on butterflies (Dey et al., 2017; Fang et al., 2024; Jan et al., 2024). They react to perturbations, alterations in the quality of the habitat, and changes in the topography (Choudhary and Chishty, 2020). It has been discovered that habitat enrichment is essential to the preservation of butterfly species and populations.

Butterflies are found all over the world, with over 45,000 species, most of which are found in the tropical belt and belong to six distinct families (Ehrlich, 2008). Antarctica is not home

to any butterfly species (Rayan et al., 2019). India is renowned for having a rich biological legacy and is one of the top ten countries with the most endemism. Approximately 1504 butterfly species were both identified and recorded in India (Kunte, 2000). Therefore, it is necessary to protect butterfly diversification from extinction and a loss in species diversity. It is remarkable to undertake research on the species of butterflies in and around the metropolis of India. These days, people take care of the gardens of schools, colleges, institutions, and places of worship. Since, it is the indicator species, preserving the diversity of butterflies is very beneficial in this area. To evaluate the diversity of butterflies at Anna University campus, the current study was conducted. It's a primary study which will lead to future research prospectives.

MATERIALS AND METHODS

Study site

The survey was carried out with focus on latest documentation of Lepidopteran distribution across the Anna University Campus, Tamil Nadu. Anna University occupies 189 acres (76.4856 hectares) and is situated in Tamil Nadu (Fig. 1) which separates the institution from Chennai's southern region by 3 kms. The lowest temperature range is 18-20°C, while the greatest temperature range is 38-42°C. Rainfall was 140 cm (1400 mm) on average. Numerous magnificent trees, such as Aalamaram (*Ficus benghalensis*), Aththi (*Ficus racemosa*), Copper pod (*Peltophorum pterocarpum*), Illavampanju (*Ceiba pentandra*), Nettiilingam (*Polyalthia longifolia*), Puliamaram (*Tamarindus indica*), Sarakonrai (*Senna fistula*), Savukku (*Casuarina equisetifolia*), Vaembu (*Azadirachta indica*), and Yanai pudukan (*Kigelia africana*), and others, were seen on this university campus. Lepidoptera prefer host plants and other flowering plants as their habitat in this campus.

Methodology

The data was gathered at the Anna University campus in Chennai, Tamil Nadu, from September 2023 to February 2024. Observations were between from 7 AM. until 6:30 PM. of each sampling day.

Since butterflies are diurnal, they are active during the day and sleep at night. During the entire field survey, only photographs were recorded. The photos were taken using the Nikon D850. To obtain a nice shot that would help identify the species, important characteristics with colour patterns, wingspan, manner of flight, etc. There was no butterflies and moths collected or preserved for identification. The same method had already been previously adopted by Vijayan and Anbalagan (2023) and Vijayan (2024). As Lepidoptera species play a crucial role in pollination.

Identification of Lepidoptera species

Identification was done based on accessible literature and already published research articles.

Relative abundance

To study the disparity between the overall number of individuals across all species and the overall number of individuals within a specific species, the following formula was used to determine the relative abundance of insects (Michael, 1986).

$$\text{Relative abundance} = \frac{\text{Total number of individuals of the species}}{\text{Total number of individuals all species}} \times 100$$

RESULTS AND DISCUSSION

Over the course of the research period, 72 species were identified. These 72 species were grouped into 59 genera, 13 families, and one order (Table 1; Fig. 2a, b). The Nymphalidae family accounted for 32.39% of all families. The majority of the Nymphalidae family members are polyphagous, or able to flourish in a range of environments, they have traditionally had a strong position in the tropical region (Elanchezhyan et al., 2017). Many species in this family are very active and can fly well, which may be useful for them while scouting for resources over wide stretches of ground. The high percentage of nymphalid species suggested notable host plant abundance. According to Kumar et al. (2019), the presence of flowers from plant families like Fabaceae, Rutaceae, Euphorbiaceae, Compositae, and Rubiaceae is associated with the species richness of Nymphalidae.

Table 1. Diversity in Lepidoptera species recorded at campus of Anna University

Scientific Name	Common Name	Family	IUCN
<i>Abisara bifasciata</i>	Double banded judy	Riodinidae	UN
<i>Acraea terpsicore</i>	Leathery winged	Nymphalidae	UN
<i>Acraea violae</i>	Tawny coster	Nymphalidae	UN
<i>Aedia leucomelas</i>	Eastern alchymist moth	Erebidae	UN
<i>Amata passalis</i>	Sandalwood defoliator moth	Erebidae	UN
<i>Appias albina</i>	Common albatross	Pieridae	UN
<i>Ariadne merione</i>	Common castor	Nymphalidae	UN
<i>Artaxa</i> sp.	Tussock moth	Erebidae	UN
<i>Belenoi saurota</i>	Pioneer white	Pieridae	LC
<i>Byblia ilithyia</i>	Spotted joker	Nymphalidae	LC
<i>Catopsilia pomona</i>	Common emigrant	Pieridae	UN
<i>Catopsilia pyranthe</i>	Mottled emigrant	Pieridae	UN
<i>Cephonodes hylas</i>	Pellucid hawk moth	Sphingidae	UN
<i>Cepora nerissa</i>	Common gull	Pieridae	UN
<i>Cigaritis vulcanus</i>	Silver-line butterfly	Lycaenidae	UN
<i>Cirrhochrsta brizoalis</i>	-	Crambidae	UN
<i>Cirrochroa thais</i>	Tamil yeoman	Nymphalidae	UN
<i>Cleora</i> sp.	Geometrid moth	Geometridae	UN
<i>Conogethes punctiferalis</i>	Yellow peach moth	Crambidae	UN
<i>Danaus genutia</i>	Common tiger	Nymphalidae	UN
<i>Dysgonia stuposa</i>	-	Erebidae	UN
<i>Elymnias hypermnestra</i>	Common palm-fly	Nymphalidae	UN
<i>Emmelina monodactyla</i>	T-moth	Pterophoridae	UN
<i>Endotricha flammealis</i>	Rose-flounced tabby moth	Pyalidae	UN
<i>Erice ialituraria</i>	-	Erebidae	UN
<i>Eudoci mamaterna</i>	Dot-underwing moth	Erebidae	UN
<i>Eudocima phalonia</i>	Common fruit-perching moth	Erebidae	UN
<i>Euploea core</i>	Common crow	Nymphalidae	LC
<i>Eurema hecabe</i>	Common grass yellow	Pieridae	UN
<i>Euthalia aconthea</i>	Common baron	Nymphalidae	UN
<i>Graphium agamemnon</i>	Tailed jay	Papilionidae	UN
<i>Hypolimnas bolina</i>	Great egg-fly	Nymphalidae	UN
<i>Hypolimnas misippus</i>	Danaid egg-fly	Nymphalidae	LC
<i>Hyposidra talaca</i>	Black looper moth	Geometridae	UN
<i>Hypsopygia phoealis</i>	Snout moth moth	Pyalidae	UN

<i>Junonia atlites</i>	Grey pansy	Nymphalidae	UN
<i>Junonia iphita</i>	Chocolate pansy	Nymphalidae	UN
<i>Junonia lemonias</i>	Lemon pansy	Nymphalidae	UN
<i>Junonia orithya</i>	Blue pansy	Nymphalidae	LC
<i>Lasiommata petropolitana</i>	Northern wall brown	Nymphalidae	LC
<i>Leptosia nina</i>	Psyche	Pieridae	UN
<i>Melanitis leda</i>	Common evening brown	Nymphalidae	LC
<i>Microloxia indecretata</i>	-	Geometridae	UN
<i>Neptis hylas</i>	Common sailor	Nymphalidae	UN
<i>Orgyia postica</i>	Cocoa tussock moth	Erebidae	UN
<i>Pachliopta aristolochiae</i>	Common rose	Papilionidae	LC
<i>Pachliopta hector</i>	Crimson rose	Papilionidae	LC
<i>Papilio demoleus</i>	Lime swallowtail	Papilionidae	NA
<i>Papilio paris</i>	Paris peacock swallowtail	Papilionidae	UN
<i>Papilio polytes</i>	Common mormon	Papilionidae	LC
<i>Pareronia hippia</i>	Indian wanderer	Pieridae	UN
<i>Parthenos sylvia</i>	Clipper butterfly	Nymphalidae	UN
<i>Patania ruralis</i>	Mother of pearl moth	Crambidae	UN
<i>Pelopidas mathias</i>	Dark small, branded swift	Hesperiidae	LC
<i>Peridroma saucia</i>	Variegated cutworm moth	Noctuidae	UN
<i>Pieris brassicae</i>	Large white	Pieridae	UN
<i>Rhesala moestalis</i>	-	Erebidae	UN
<i>Scopula immutata</i>	Lesser cream wave	Geometridae	UN
<i>Semiothisa eleonora</i>	-	Geometridae	UN
<i>Sphenarches anisodactylus</i>	Geranium plume moth	Pterophoridae	UN
<i>Spodoptera litura</i>	Tobacco cutworm moth	Noctuidae	UN
<i>Spoladea recurvalis</i>	Beet webworm moth	Crambidae	UN
<i>Symphaedra nais</i>	Baronet (BF)	Nymphalidae	UN
<i>Syntomoides imaon</i>	Handmaiden moth	Erebidae	UN
<i>Theretra silhetensis</i>	Brown-banded hunter hawk moth	Sphingidae	UN
<i>Tirumala limniace</i>	Blue tiger	Nymphalidae	UN
<i>Tirumala septentrionis</i>	Dark blue tiger	Nymphalidae	UN
<i>Vanessa cardui</i>	Painted lady	Nymphalidae	LC
<i>Zizina labradus</i>	Common grass blue	Lycaenidae	UN
<i>Zizina otis</i>	Lesser grass blue	Lycaenidae	UN
<i>Zizula hylax</i>	Tiny grass blue	Lycaenidae	UN

Abbreviation: LC - Least Concern, NA - Not Applicable and UN - Unknown

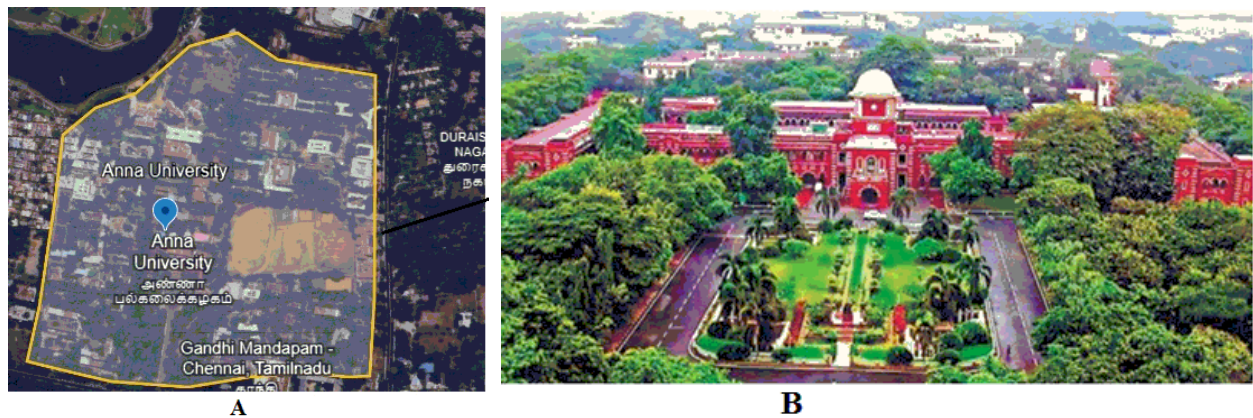


Fig. 1. Study site A) Location Google map, B) Aerial view



Fig. 2a. Photographic documentation of several distinct views of Lepidoptera recorded in the campus of Anna University- (A) *Acraea terpsicore*, (B) *Ariadne merione*, (C) *Artaxa* sp., (D) *Cleora* sp., (E) *Elymnias hypermnestra*, (F) *Emmelina monodactyla*, (G) *Euploea core*, (H) *Hypolimnas misippus*, (I) *Melanitis leda*, (J) *Orgyia postica*, (K) *Patania ruralis*, (L) *Peridroma saucia*, (M) *Pieris brassicae*, (N) *Spoladea recurvalis*, (O) *Tirumala septentrionis* and (P) *Zizina labradus*



Fig. 2b. (Q) *Aedia leucomelas*, R) *Amata passalis*, S) *Cephonodes hylas*, T) *Conogethes punctiferalis*, U) *Dysgonia stuposa*, V) *Endotricha flammealis*, W) *Ericeia lituraria*, X) *Eudocima materna*, Y) *Eudocima phalonia*, Z) *Eurema hecabe*, Aa) *Euthalia aconthea*, Ab) *Hypolimnas bolina*, Ac) *Hyposidra talaca*, Ad) *Hypsopygia phoealis*, Ae) *Junonia orithya*, Af) *Microloxia indecristata*, Ag) *Pachliopta hector*, Ah) *Papilio demoleus*, Ai) *Rhesala moestalis*, Aj) *Scopula immutata*, Ak) *Sphenarches anisodactylus*, Al) *Spodoptera litura*, Am) *Syntomoides imaon*, An) *Theretra silhetensis* and Ao) *Tirumala limniace*

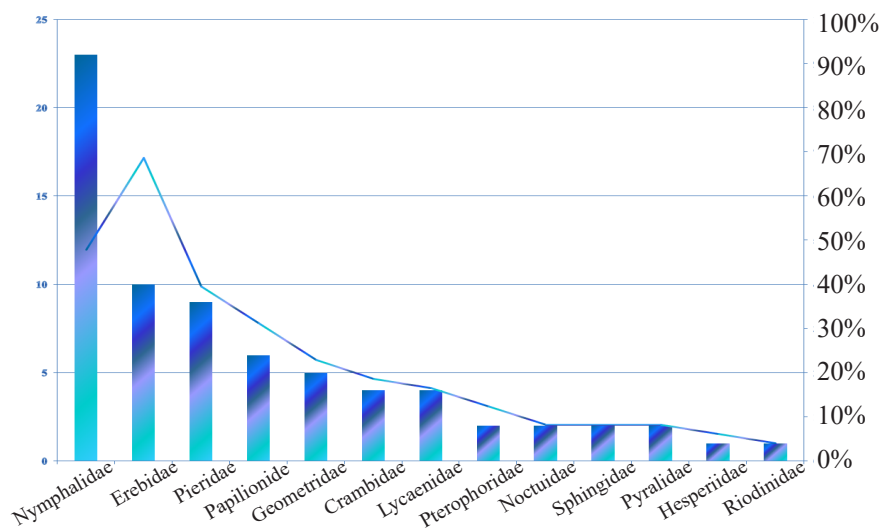


Fig. 3. Pareto chart plots the distribution of the data in descending order of frequency, with a cumulative line on a secondary axis as percentage

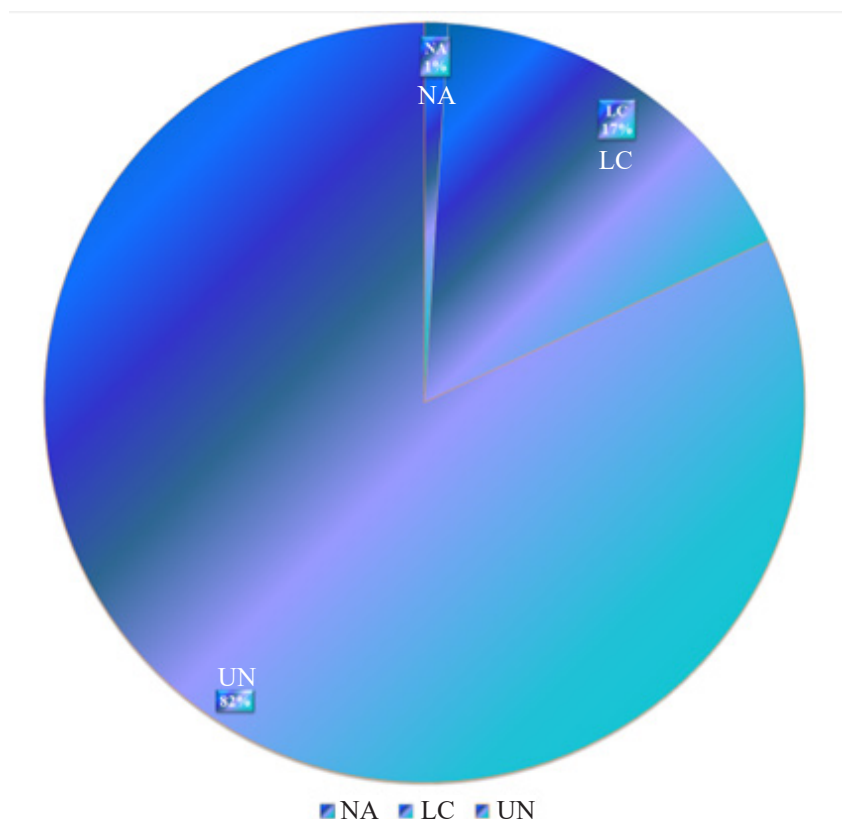


Fig. 4. A pie chart that makes it very evident as many species fall into the least concern or unknown groups

The assertions provided strong evidence that plant diversity enhances butterfly diversity. Because the research area is rich in a variety of plants, including trees, shrubs, and herbs, it serves as a host and provides nectar. Vijayan and Anbalagan (2023) stated that the large spacious campus's remarkable floral diversity supported a wide variety of animals. Furthermore, a diversity of animal habitats is hosted by diverse plants. Plots of Pareto charts made it evident that the family Nymphalidae dominated the cumulative line (Fig. 3).

According to numerous studies, the Nymphalidae family has higher species diversity than other families (Kurve et al., 2013; Subedi et al., 2021; Kumar et al., 2023). Erebidae was the second-largest family in this outcome, followed by Nymphalidae. The present study was highly supported to the previous research (Dabhadkar and Prajapati, 2020). Nine species recorded from Family Pieridae. In contrast, Ponmanickam et al.

(2022) listed just three species belonging to the Pieridae family from Sivakasi, Tamil Nadu.

The Nymphalidae family had the highest relative abundance (32.39%) when family-wise relative abundance was calculated. Erebidae were second (14.08%) followed by Pieridae (12.68%), Papilionidae (each 8.45%), Geometridae (7.04%), Crambidae and Lycaenidae (each 5.63%), Noctuidae, Pterophoridae, Pyralidae and Sphingidae (each 2.82%), Hesperidae and Riodinidae (each 1.41%). The distribution of butterflies and moths in various environments is influenced by environmental elements like humidity, precipitation, temperature, and the speed of the wind.

Erebidae are a family of moths. The family is among the largest families of the moths by species count and contains a wide range of well-known macro moth groups. Metilda and Livingstone (2022) and Bhuvaragavan et al. (2023), has previously reported Erebidae family were the largest species occupied

in the Chennai region. However, the results shown that the Erebidae family was the second largest group, unlike Metilda and Livingstone (2022) and Bhuvargavan et al. (2023). The study also revealed that Erebidae second important species group, but less species populations compared to Farooqui et al. (2020). Farooqui et al. (2020) reported that 59 species of Erebidae were found in urban area, but present study could found only 10 species of Erebidae. Because of compared to urban area than metro-city butterflies habitat loss. The growth of metro-city has led to the removal of host plants and the alteration of butterfly habitats, resulting in a decline in Erebidae family populations. This current study indicated that the host plant loss is greater in metropolitan areas than in urban areas, attributed to habitat degradation, climate change, and human disturbances. It has resulted in reduction of the moth's population in metropolitan areas compared to urban environments.

Butterflies are regarded as important indicators and belong to the order Lepidoptera. For depicting the proportions of a wholesome study pie chart was used. This plot uses it to display values that always add up to 100% and are tied to a bigger total in species level (Fig. 4). Given the current circumstances, it is reasonable to suggest that the landscape variations found in the campus grasslands, green garden, and CEG hostel have contributed to the variation in butterfly variety across the different locations. Moths and butterflies are crucial because of their important role in pollination on this campus. Therefore, there exists a lot of fruit plants on campus helping to maintain Lepidoptera species diversity.

This outcome was conclusively evidenced by the formation of seventy-two species. Other studies at various institutes of India recorded 60 species at agricultural college campus, Kilikulam, Tamil Nadu (Elanchezhyan et al., 2017); 53 species at Fakir Mohan University Campus, Balasore, Odisha, India (Panda et al., 2016); 40 species at M. N. College Campus, Visnagar, Gujarat (Dabhadkar and Prajapati, 2020); and the 28 species at Ayya Nadar Janaki Ammal College Campus, Sivakasi, Tamil Nadu (Ponmanickam et al., 2022). Despite high level of urbanization in the present study

area, 72 species of Lepidoptera were recorded. Students will become more interested in the value of preserving the biodiversity of Lepidoptera. Due of their sensitivity to different seasons and climates, butterflies are considered 'ecological indicators'. Additionally, butterflies contribute to plant diversity by serving as effective pollinators. Establishing a butterfly park and conserving host plants and butterfly diversity on college campuses can be of paramount importance at this juncture. This study is based on a current inventory of the Lepidoptera faunal diversity within the University Campus and will definitely will be helpful in continuing Lepidoptera research in this area.

CONCLUSION

As Lepidoptera species are essential to an ecological habitat due to their biological, artistic, and economic importance, their presence in an ecosystem affects a wide range of other coexisting life forms. Preservation of Lepidoptera diversity can be accomplished through the propagation of host plants in the areas that will have significant effect on butterfly diversity along with regulation of anthropogenic activity. To protect butterflies, sustainable development practices like keeping the environments essential for feeding, laying eggs, and other availability, such as nectar and host plants. The findings showed that the family Nymphalidae predominated at the study site, especially in the green garden. It was evident that butterfly communities vary greatly throughout habitats even within a small site. This initial checklist may be used as a guideline for upcoming research projects at the study location. Additionally, the study will add to the body of knowledge and information about Lepidoptera in the Anna University campus. Further researches are invited to learn more about the ecological and conservational features of Lepidoptera species.

ACKNOWLEDGEMENT

The author expresses his gratitude to the Director, National Centre for Sustainable Coastal Management, Chennai, for providing excellent support for the research, as well as to Anna University's pro-chancellor for extending permission to undertake the research in the campus.

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