IJBPAS, October, 2025, 14(10): 5303-5314

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

DIVERSITY OF BUTTERFLY SPECIES IN THE CAMPUS OF NIRMALA COLLEGE FOR WOMEN, COIMBATORE, TAMILNADU, INDIA

SINDHU S[1] AND DR. DHIVYA R[2*]

[1]Post Graduate Student, [2*]Assistant Professor,

Department of Zoology, Nirmala College for Women, (Autonomous), Coimbatore – 641018

***Corresponding Author: Dr. Dhivya R: E Mail: dhivya.adu@gmail.com**

Received 25th July 2024; Revised 8th Sept. 2024; Accepted 1st Oct. 2024; Available online 1st Oct. 2025

https://doi.org/10.31032/IJBPAS/2025/14.10.9457

ABSTRACT

Butterflies are one of the most conspicuous species of Earth's biodiversity. Being extremely responsive to any changes in their environment, namely, temperature, humidity, light, and rainfall patterns, these insects are identified as useful bioindicators. The present study aims to examine the diversity and distribution of butterflies. A total of 26 species of butterflies distributed under 5 families viz., Nymphalidae, Papilionidae, Pieridae, Hesperiidae, Lycaenidae were recorded during the study period. Nymphalidae was found to be the most dominant (42%) family represented by 11 species, followed by Papilionidae (30%) with 7 species, Pieridae (19%) with 5 species, Hesperidae (8%) with 2 species and Lycaenidae (4%) with 1 species was being reported. Among the 26 species of butterfly observed in the study area, six species were occasional, fourteen species were common and six species were rare. Population index of the butterflies was also carried out which showed, Shannon -Wiener index (H') Component for the selected study area to be 1.35. Evenness of the species in the selected site to be 0.841, Simpson's Index (D) to be as 0.27. Simpson's Diversity Index (1-D) for the study site was 0.73. The Simpson's Reciprocal Index (1/D) was recorded as 3.73. The study area is rich in butterfly diversity and further research could be conducted to obtain more details and documentation on butterfly diversity.

Keywords: Butterfly, Diversity, Species, Simpson's Index, Shannon -Wiener index

INTRODUCTION

Biodiversity is the diversity and uniqueness of living things on earth. It falls under the categories of species diversity, genus diversity, and ecological diversity. The different organisms are interconnected and remain in the atmosphere. A disruption in the linkage will result in a decrease in or eradication of the linked organism population. Therefore, it is crucial to continuously monitor the ecosystem and biodiversity. The most widely used insect bio-indicator for assessing the health of the ecosystem and the effects of climate change is the butterfly (Insecta: Lepidoptera) **[1-3]**.

With almost 160,000 known species worldwide, the order Lepidoptera is one of the largest groups of insects **[4, 5]**. It is a monophyletic order that contains moths, skippers, and butterflies. Butterflies are sometimes referred to as "insects of the sun" because of their vivid colors and delicate nature. People have appreciated their physical attractiveness for millennia. Studying moths and butterflies can provide valuable insights into population dynamics and community ecology. An indicator of the health of any particular terrestrial biotope is the diversity and presence of butterflies, which are essential to the ecosystem **[6]**.

A number of researchers have used numerous checklists to conduct studies on the diversity of butterflies. People have loved butterflies as symbols of elegance and beauty since the dawn of time. Their diurnal habits have made them well-known insects. Their vivid colors, shapes, and graceful flight, which pleases everyone, make them simple to identify **[7]**. Butterflies are highly valuable as they are among the world's most elegant and colorful animals. Butterflies are distinct from other insects due to their complex life cycle and influence on the environment. Consequently, studies and in-depth research on butterflies have been conducted. Butterflies are important in many aspects of ecology, most notably pollination. More than fifty crop species with significant commercial worth can be pollinated by them **[8]**.

Butterflies provides a good link between food chain and food webs. To preserve the diversity of flowers and plants, it would be beneficial to research the interactions between butterflies and plants. Given that butterflies are plant-dependent, urbanization-related deforestation and degradation has an impact on the diversity of butterflies **[9]**. Therefore, it is necessary to protect butterfly biodiversity from extinction and a loss in species diversity. Numerous

studies unequivocally show that in order to comprehend the effects of climatic conditions and the availability of food plants on the diversity of butterfly species, more research in a variety of terrestrial environments is necessary. The campus of Nirmala College for Women boasts an amazing medicinal garden with a diverse range of flora and fauna. Therefore, the goal of the current study was to evaluate the diversity of butterflies found in college campus.

MATERIALS AND METHODS

STUDY AREA

Present study on Butterfly diversity was carried out in Nirmala College Campus, Redfields Road, Coimbatore District, Tamilnadu, India. The Nirmala campus is rich in flora consisting of diverse species of different plants among various families. The geographical location of this study area is 11°00'01.4"N 76°59'04.2"E. This study area also contains herbaceous plants followed by Trees, Shrubs and Climbers that provide shelter to the butterflies.

The climate of the study area was wet and humid sometimes with brighter clouds. Temperature remains moderate and may be fluctuating throughout the year. The duration of the study is from August 2023 to January 2024. The city receives 952 mm of precipitation on average each year. October has the highest average rainfall of any month at 229 mm.

SAMPLING

Field surveying of butterfly fauna was conducted from August 2023 to January 2024. The study was carried out either from 8:00 am to 11 am or 3:00 pm to 5:00 pm. Every habitat in and around of this area was covered by random observations as well as opportunistic sampling during walking through the campus road, gardens and pathways, etc. At the moment of capture, butterflies were seen, photographed, recognized, and promptly released.

IDENTIFICATION

In the field, butterflies were recognised and captured on camera. The photos were taken using mobile phone, and also using digital camera. When collecting a specimen in a challenging situation, an aerial sweep net was used. The specimen was then moved to a plastic container and transported home for thorough identification **[10]**. The proper steps were followed to guarantee that the butterfly's wing scales were hurt as little as possible. The species was verified using the field guides by Kunte **[11]** and Kehimkar **[12]**. Identification was greatly aided by Kunte *et al*.'s **[13]** improved taxonomy and nomenclature. Identification of butterflies in the current study was with the help of the field

guide of Raju Kasambe, **[14]** i.e., Butterflies of the Western Ghats.

In addition to the photographs described by Sunil *et al*., **[15]** and Kumar *et al*., **[16]**, the color patterns, sizes, shapes, and designs of the butterflies were taken into consideration in order to identify the species of butterfly with the help of an entomologist and relevant literature.

DATA ANALYSIS

The butterflies that were seen during each survey were tabulated and classified down to the species level. The occurrence status was evaluated using the number of sightings of each species at the study sites. The classification of sightings in the study area was decided as follows: rare (R) - 1 to 2 sightings, occasional (O) - 5 to 10 sightings, and frequent (C) - 11 to 16 sightings.

POPULATION INDEX CALCULATION

The population diversity was calculated by using diversity indices namely: Simpson's index (D), (1-D), 1/D **[17]**, and Shannon-Wiener index (H') **[18]**.

1. Simpson's Index (D)

$$1- [n (n-1)] /N (N-1)$$

Whereas n = The total number of members of a specific species

N = Total number of organisms among all species

2.Shannon-Wiener index (E)

$$H'/1n S$$

Where, H'= Shannon-Wiener index

S= Species richness

RESULTS AND DISCUSSION

In the phylum Arthropod, a significant family of insects known as the order Lepidoptera includes butterflies. They are among the most noticeable species found in the Earth's biodiversity. Butterflies come in roughly 24,000 different species. Butterflies exhibit remarkable reactivity to alterations in their natural habitat, including variations in temperature, humidity, light levels, and precipitation patterns. They are known as bio-indicators because of these kinds of remarkable qualities. It is clear that butterflies have a variety of environments by looking at their diversity.

STUDY OF BUTTERFLY DIVERSITY IN THE SELECTED STUDY SITE

Present study on Butterfly diversity was carried out in the Campus of Nirmala College for Women, Coimbatore. The detail list of family, name of species and their common name is provided **Table 1**. Results of butterfly family diversity were depicted in the **Figure 1**.

Table 1: Butterfly Diversity in the Selected Study Site

Sl. No	Scientific name	Common name	Family	Occurrence (C, O, R)
1	*Melanitis leda*	Common evening brow	Nymphalidae	C
2	*Danaus chrysippus*	Plain tiger	Nymphalidae	C
3	*Elymnias hypermnestra*	Common palmfly	Nymphalidae	O
4	*Junonia lemonias*	Lemon Pansy	Nymphalidae	R
5	*Tirumala limniace*	Blue Tiger	Nymphalidae	R
6	*Mycalesis mineus*	Dark branded bursh brown	Nymphalidae	R
7	*Euploea core*	Common crow	Nymphalidae	C
8	*Vindula dejone*	Malay cruiser	Nymphalidae	C
9	*Ariadne merione*	Coomon castor	Nymphalidae	C
10	*Phalanta phalanta*	Common Leopard	Nymphalidae	C
11	*Acraea terpsicore*	Tawny coster	Nymphalidae	C
12	*Graphium sarpedon*	Blue bottle	Papilionidae	O
13	*Papilio polytes*	Common mormon	Papilionidae	O
14	*Papilio helenus*	Red helen	Papilionidae	R
15	*Pachliopta hector*	Crimson rose	Papilionidae	R
16	*Papilio demoleus*	Chequered swallowtaill	Papilionidae	C
17	*Papilio crino*	Banded peacock	Papilionidae	C
18	*Papilio polymnestor*	Blue mormon	Papilionidae	R
19	*Cepora nerissa*	Common gull	Pieridae	C
20	*Prioneris sita*	Painted Sawtooth	Pieridae	O
21	*Eurema hecabe*	Common grass yellow	Pieridae	C
22	*Pareronia hippia*	Indian wanderer	Pieridae	C
23	*Catopsilia pyranthe*	Mottled Emigrant	Pieridae	C
24	*Ancistroides folus*	Grass demon	Hesperidae	C
25	*Borbo cinnara*	Rice swift	Hesperidae	O
26	*Curetis thetis*	Indian sunbeam	Lycaenidae	O

(R – Rare, C – Common, O – Occasional)

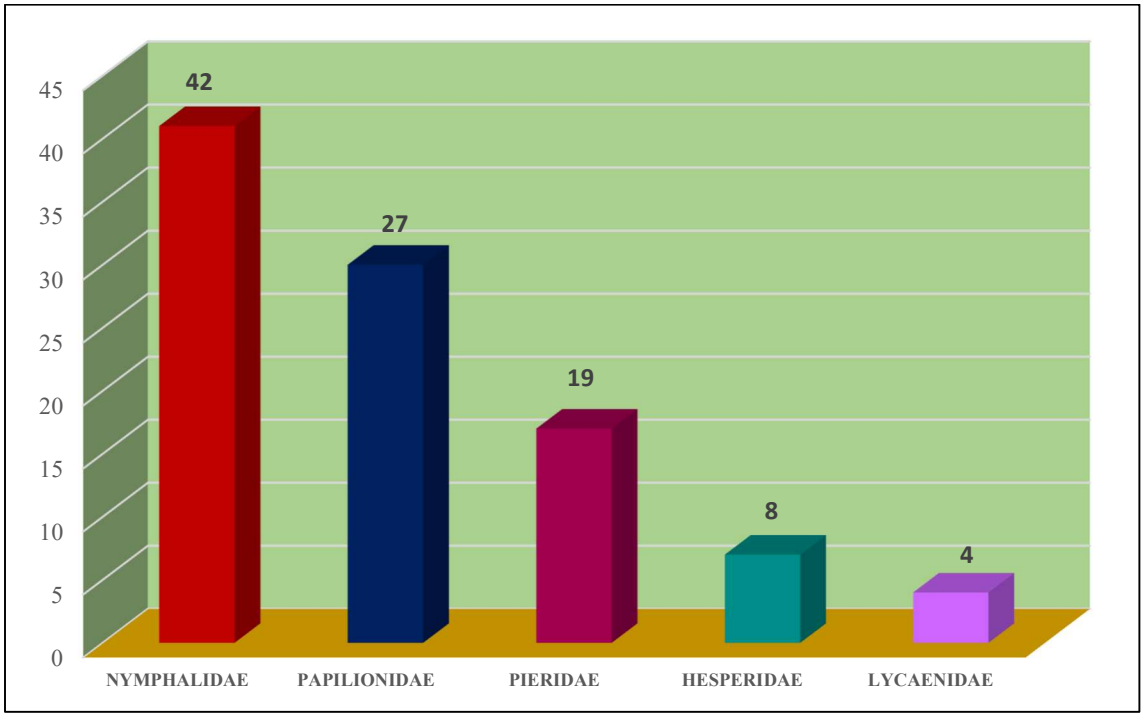

Figure 1: Graph Showing the Butterfly Family Diversity

During the course of present field investigations, 26 species of butterflies distributed under 5 families viz., Nymphalidae, Papilionidae, Pieridae, Hesperiidae, Lycaenidae have been reported. Many studies in parallel to the present investigation was carried out my many researchers. Baskaran and Solaiappan **[19]** studied the butterflies of Madurai, Tamil Nadu. In the investigation, 33 species were identified. Gunasekaran and Balasubramanain **[20]** has done a study on the butterfly diversity and its conservation in temple premises of Tamil Nadu. The study's primary goal was to catalog the butterflies linked to the Sthalavriksha (temple tree) and Nanthavana (flower garden) in the state's 1165 temples. There were 55 butterflies identified in all.

Nymphalidae was found to be the most dominant (42%) family represented by 11 species, followed by Papilionidae (27%) with 7 species, Pieridae (19%) with 5 species, Hesperidae (8%) with 2 species and Lycaenidae (4%) with 1 species was being reported. According to the results of the present study it was found that Nymphalidae and Papilionidae were the most frequently sighted groups during this survey. Status of all species are categorized depending on the direct sightings during the survey, which showed that 14 species (*Melanitis leda, Danaus chrysippus, Euploea core, Vindula dejone, Ariadne merione, Phalanta phalanta, Acraea terpsicore, Papilio demoleus, Papilio crino, Cepora Nerissa, Eurema hecabe, Pareronia hippia, Catopsilia pyranthe, Ancistroides folus*) out of 26 species were commonly sighted.

Six species (*Elymnias hypermnestra, Graphium Sarpedon, Papilio polytes, Prioneris sita, Borbo cinnara, Curetis thetis*) were occasional and six species viz., *Junonia lemonias, Tirumala limniace, Mycalesis mineus, Papilio Helenus, Pachliopta hector, Papilio polymnestor* were rare. This variation in the counts may be mainly due to climatic conditions, availability of host plants and adaptability character of the butterflies.

In the present study the most dominant family Nymphalidae consisted of 11 species viz., *Melanitis leda, Danaus chrysippus, Elymnias hypermnestra, Junonia lemonias, Tirumala limniace, Mycalesis mineus, Euploea core, Vindula dejone, Ariadne merione, Phalanta phalanta* and *Acraea terpsicore*. This was followed by Papilionidae family which included seven species such as *Graphium Sarpedon, Papilio polytes, Papilio helenus, Pachliopta hector, Papilio demoleus, Papilio crino* and *Papilio polymnestor*. Nymphalidae and Papilionidae was followed by family Pieridae with five species (*Cepora*

Nerissa, Prioneris sita, Eurema hecabe, Pareronia hippia and *Catopsilia pyranthe*), family Hesperidae with two species (*Ancistroides folus and Borbo cinnara*) and family Lycaenidae with one species (*Curetis thetis*).

The family Nymphalidae was believed to be the highest in the research region. Also, this finding is in close agreement with the findings of Charn, **[21]** who listed 54 species of butterfly belong to 7 families from the forest strip of Punjab. Nymphalidae family indicated as dominant during the study period with the highest number of the species of butterfly. In addition, the result is supported by Bubesh *et al*., **[22]** who observed 50 species of butterfly belong to 5 families. Nymphalidae and Lycaenidae families were the highest number of the species of butterfly in the study area. The results of this study were confirmed by Sayeswara **[23]**, who reported a higher percentage of Nymphalidae butterfly species (44.4%). Papilionidae came in second with 22.2%, Lycaenidae with 8.33%, and Hesperidae with the lowest percentage of butterfly species in the study area.

The type of plants and the availability of nectar determine the butterfly composition of a particular place. For them, the presence of trees, bushes, and creepers is crucial. Greater diversity is correlated with a more complex vegetation structure. The presence of Garden Land, flowering plants and lot of greenery, probably provided shelter and suitable foraging grounds for some butterflies. Trees surrounding the College campus provided different food sources, rich nectar resources and variety of flowers which further added to the diversity of butterflies in the campus. This is in accordance with the study conducted by Tiple *et al*., **[24]** who studied the butterfly species and their nectar host plant relationships from north central India.

In the present study the results showed that Nymphalidae family was followed by Papilionidae family which included seven species such as *Graphium Sarpedon, Papilio polytes, Papilio helenus, Pachliopta hector, Papilio demoleus, Papilio crino* and *Papilio polymnestor*. This result is consistent with that of Koneri and Nangoy **[25]**, who assessed the status of the butterflies on Sangihe Island and found that the Nymphalidae family contained the greatest number of species (53.81%), followed by Papilionidae (22.67%), Pieridae (15.57%), Lycaenidae 7.31%), and Hesperidae (0.64%) in the study area. Furthermore, the findings strongly agree with those of Sethy *et al*., **[26]**, who found that the Nymphalidae comprise 42.5% of the

dominating family in the study area. Papilionidae, at 21.2%, Lycaenidae, at 15.1%, Pieridae, at 14.1%, and Hesperidae, at 7.1%, are the next most prevalent families.

BUTTERFLY POPULATION DIVERSITY INDEX OF SELECTED STUDY SITE

During the investigation, a total of 26 butterfly species from 5 families were identified (photographed). The butterfly list along with their occurrence in the habitat is given in **Table 1**. Shannon -Wiener index (H') Component for the selected study area was found to be 1.35. Evenness of the species in the selected site was 0.841.

Table 2: Population Diversity Indices of the Selected Study Site

Simpson's Index (D)	Simpson's Index (1-D) of Diversity	Simpson's Reciprocal Index (1/D)	Shannon- Wiener Index(H)
0.27	0.73	3.73	1.35

The species diversity and abundance are shown by D in Simpson's index. As D increase diversity decrease and the Simpson's index is usually express as 1-D or 1/d. This measure is less responsive to species richness and has a major bias towards the most abundant species. Results of the present study shows Simpson's Index (D) to be as 0.27. Simpson's Diversity Index (1-D) for the study site was 0.73. The Simpson's Reciprocal Index (1/D) was recorded as 3.73.

Results of the present study shows Simpson's Index (D) to be as 0.27. Simpson's Diversity Index (1-D) for the study site was 0.73. The Simpson's Reciprocal Index (1/D) was recorded as 3.73. Previous studies reported by Ashok, **[27]** who was recorded high diversity of the species of butterfly from five habitats of Jhansi. Narayan bagh was the highest diversity (0.7440) and the lowest diversity was observed from Jhansi Gwalior (0.6916) in the study area. In addition, Savarimuthu *et al*., **[28]** also stated that the maximum Simpson index of diversity was observed in the month of April from river bank (0.9743) followed by crop area (0.9819) then forest area (0.9661) during the study period. Mohammed *et al*., **[29]** has reported the greatest Simpson index of diversity was observed in company bagh site (0.8) among the other sites, indicating that the study area is more diverse of the species of butterfly. However, the maximum number individual of butterflies recorded may lead to the greatest diversity of the species of butterfly in the study area.

Status of all species in the present study was categorized depending on the direct sightings during the survey, which showed that 14 species out of 26 species were

commonly sighted. Six species were occasional and six species were rare. The outcomes align with the research conducted by Kanagaraj and Kathirvely **[30]**, who documented and classified a range of butterfly species as very common (6), common (28), less common (16) and rare (2) respectively. Also, similar observation was made by Bora and Meitei (2014) who find out diversity of butterflies in Assam University campus and observed very common (20), common (34), uncommon (29), rare (9) and very rare (4) of the species of butterfly in the study area.

CONCLUSION

The present study is the first of this type of study in the area. Therefore, it is very difficult to say whether the diversity of butterflies in the area is increasing or decreasing. Therefore, it is suggested that the area under the study should be continuously monitored to observe any change in the discovery of butterflies, because the changes in the diversity can only observed through continuous monitoring and comparing the data of every year. Establishing residential colonies means cutting of trees and other supporting plants for shelter of butterflies, in turn increasing pollution, soil erosion etc. All these factors add up destruct the natural habitat. Occurrence of 26 species in the campus is a vital sign of healthy biodiversity. In order to maintain and further enhance the population of butterflies, it is necessary to conserve the biodiversity for achieving sustainable development.

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