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Butterfly Diversity in Sukuna Community Forest, Morang, Nepal

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Abstract

This study was carried out to explore the diversity of butterflies in Sukuna Community Forest, Morang, Nepal. Surveys were conducted from January to June 2025 (60 survey days) using the Pollard walk method along three 500 m line transects. We recorded 489 individuals from 31 species, 24 genera, and five families. The family Nymphalidae was dominant with 18 species and 297 individuals, while Hesperiidae was the least represented with one species and three individuals. Ecological indicators such as the Shannon-Weaver Index (H = 3.18), Pielou's evenness (E = 0.92), and Margalef's index (D = 4.84) revealed that the Sukuna community forest provides favourable habitat conditions, supporting high butterfly richness and abundance.

Keywords: Ecological indices, Entomofauna, Lepidoptera, Species richness, community forest

Introduction

Butterflies are the most attractive, colourful insects belonging to the order Lepidoptera and suborder Rhopalocera (Durairaj & Shina, 2015), having recognizable taxonomic traits, including two pairs of scaled wings, a coiled proboscis, clubbed antennae, and four sequential life stages: egg, larva, pupa, and adult (Bhardwaj et al., 2012; Lodh & Agarwala, 2016). They serve as pollinators

and environmental indicators of terrestrial ecosystems because they are sensitive to environmental changes, floral resource availability, and climate change (Parmesan et al., 1999; Sharma & Sharma, 2021; Tiple et al., 2007). Habitat components, such as canopy cover, wind speed and direction, vegetation types, and temperature, influence butterfly richness and abundance (KC, 2023). Butterflies are also sensitive to microhabitat conditions; warm and humid habitats generally support greater butterfly diversity by providing favourable conditions for feeding, breeding and thermoregulation (Bonebrake et al., 2010). Butterfly habitat deterioration, climate change, and overuse of pesticides contribute to the decline of butterfly populations (Smith, 1994).

Although several studies in mid-mountain areas of Nepal (Prajapati et al., 2000); protected areas and natural habitats, including Koshi Tappu Wildlife Reserve (Khanal, 2005), eastern Siwalik hill (Bhusal & Khanal, 2008), sacred forests in the Kathmandu Valley (Shrestha et al., 2018), eastern lowlands (Tamang et al., 2019) have documented butterfly diversity. Despite the ecological importance of butterflies, baseline data in community forest ecosystems remain scarce due to limited research.

Sukuna community forest supports diverse vegetation and habitat types in the lowland Terai of eastern Nepal, making it a suitable site for butterfly diversity and establishing baseline data. The findings from this study will provide the present status of the butterflies, which is crucial information to the Community Forest User Groups (CFUGs) regarding the ecological significance of butterflies and their habitats. This study, therefore, aimed to assess the present status of butterfly diversity in the Sukuna community forest area.

Material and Methods

Study area

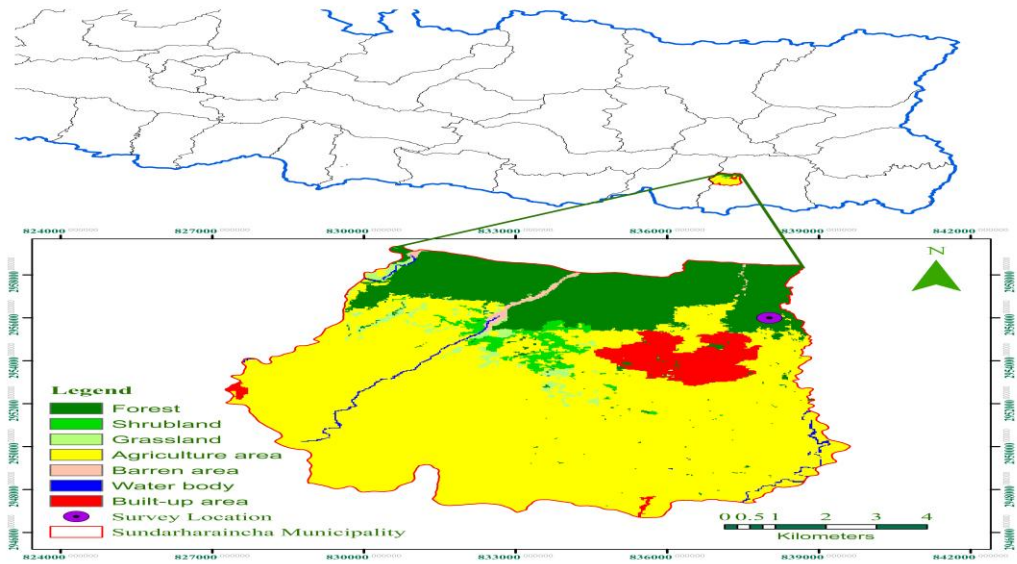
The present study was carried out in Sukuna Community Forest, Morang, Nepal, which is part of the Charkose Jhadi and has a tropical climate. It lies 26°40′54″ to

26°42′15″ N, and 87°18′56″ to 87°20′37″ E, at an elevation of 154 m above sea level. The total forest area covers 297.08 hectares, including Block A (156.30 hectares), Block B (133.56 hectares), and a wetland (7.22 hectares).

The study area has a rich mix of broadleaf trees, shrubs, and grasses managed by community forest user groups (CFUGs), offering ideal habitats for butterflies. The study area is primarily dominated by Sal (*Shorea robusta*), Asana (*Terminalia alata*), Karma (*Adina cordifolia*), Kumbhi (*Cochlospermum regiosum*), Khayar (*Acacia catechu*), Jamun (*Syzygium cumini*), Tatari (*Dillenia pentagyna*), Bot Dhayaro (*Lagerstroemia parviflora*), Hallude (*Lannea coromandelica*), Lati Karm (*Hymenodictyon excelsum*), and fruit trees such as Litchi (*Litchi chinensis*), Mango (*Mangifera indica*), Amla (*Phyllanthus emblica*), and Tamarind (*Tamarindus indica*). Additionally, in the study area, the invasive alien plant species *Lantana camara*, *Chromolaena odorata*, and *Mikania micrantha* are also present.

Figure 1

Map of the study area



Data collection and species identification

Butterfly surveys were carried out over a period of six months from January to June 2025, during which 10 survey days were covered in a month (60 survey days), using the Pollard walk method (Pollard, 1977). Three survey transects were established, each measuring 500 m in length. The surveys were conducted on both sides of each transect, covering up to 10 m, walking at a consistent slow pace between 10:00 AM and 2:00 PM on sunny days, when they are highly active. Butterflies were caught using a sweep net, photographed with a Samsung Galaxy A32 smartphone (Model: SM-A325F/DS), and were then released unharmed. Species were identified using the *Illustrated Checklist of Nepal's Butterflies* and *Butterflies of Nepal* (Smith, 2011). Species identification was based on external morphological characters, including wing colour, wing pattern, spots, bands, eyespots, venation, and body size. Butterfly abundance was recorded through direct observation and manual counting, ensuring that each individual was counted only once to minimize the sampling error.

Data analysis

Data analysis was conducted using Microsoft Excel (2010). Three diversity indices were calculated.

Shannon-Weaver Diversity Index (H'): Species diversity was calculated using the Shannon-Weaver Diversity Index (H) (Shannon & Weaver, 1949).

$H' = -\sum_{i=1}^{n} Pi \times \ln Pi$ where, Σ denotes the total sum, ln is the natural logarithm, and Pi is the proportion of individuals of the i^{th} species (n/N)

Pielou's Evenness (E): Species evenness (Pielou, 1969) was calculated using the following formula.

$E = \frac{H}{\ln(S)}$ where, H' is the Shannon-Weaver Diversity Index and S is the number of species.

Margalef's Richness Index (D): It measures species richness based on species abundance (Margalef, 1958).

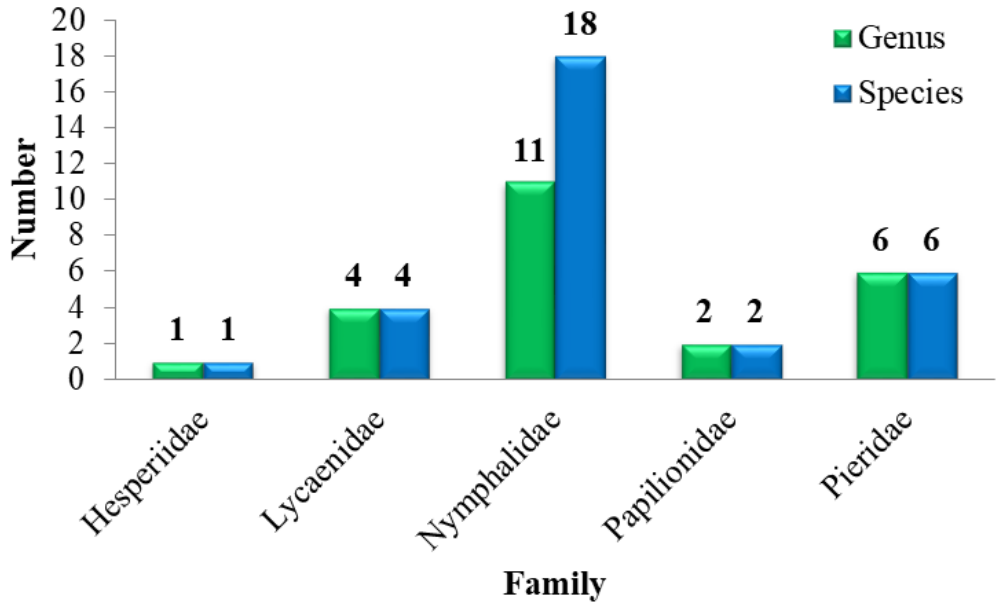
$D = \frac{S-1}{\ln(N)}$ where, S is the number of species and N is the number of individuals.

Results and Discussion

The present study documented a total of 489 butterflies, representing 31 species and 24 genera under five families (Appendix I). Among the five families, Nymphalidae was the dominant with 18 species, followed by Pieridae with six species, Lycaenidae with four, Papilionidae with two, and least by the family Hesperiidae with a single species (Figure 2).

Figure 2

Butterfly composition at family, genus, and species levels in the study area



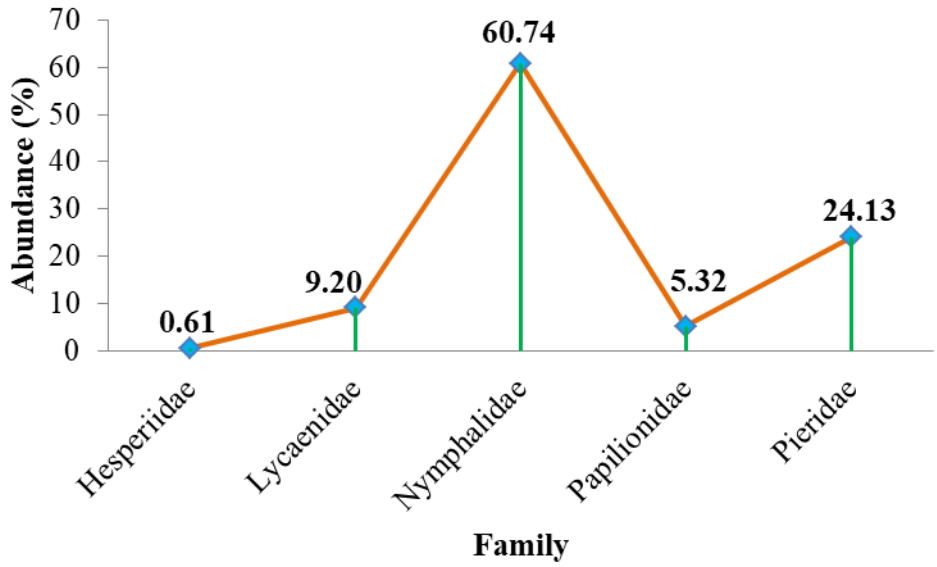
is the most diverse and dominant (Koneri & Nangoy, 2019; Sharma & Paudel, 2021; Neupane & Miya, 2021; Roy et al., 2022; Oli et al., 2023; Gupta & Kumar, 2024) due to their active flight capacity (Raut & Pendharkar, 2010), high dispersal ability (Dudley &

Adler, 1996), and rapid adaptation to environmental conditions (Jiggins et al., 1996). The dominance of Nymphalidae was also likely supported by the abundant nectar sources such as *Lantana camara, Mangifera indica*; a warm and humid microclimate and heterogeneous forest habitats, which provided suitable habitats for feeding and breeding. The present study documented the lowest species richness of the family Hesperiidae, which is consistent with previous studies (Koirala et al., 2020; Dar et al., 2022; Oli et al., 2023; Gupta & Kumar, 2024) due to their dependency on specific environmental conditions for survival (Siewert et al., 2014).

Among the 489 butterfly individuals recorded, the family Nymphalidae was dominant, representing 297 individuals (60.74%). It was followed by Pieridae with 118 individuals (24.13%), Lycaenidae with 45 individuals (9.20%), and Papilionidae with 26 individuals (5.32%), while Hesperiidae was the least abundant, with only three individuals (0.61%) (Figure 3).

Figure 3

Butterfly abundance across different families



The highest abundance was shown by the family Nymphalidae; consistent with the findings of Hailay et al. (2022), because of their high adaptability and ability to inhabit diverse habitats, including grasslands and disturbed forest areas (Ojianwuna & Akpan, 2021). The lowest abundance of the family Hesperiidae is similar to previous studies (Hailay et al., 2022; Gupta & Kumar, 2024), due to a lack of specific host plants and limited dispersal ability (Kehimkar, 2008).

In this study, the Shannon-Weaver Diversity Index (H') was 3.18, suggesting that butterfly diversity was relatively high (Fernando et al., 1998), indicating favourable environmental conditions in the Sukuna community forest, providing suitable habitats and food resources for various species. Pielou's evenness index (E) was 0.92, which is close to 1, indicating a balanced butterfly community ecosystem. This result indicates that individuals were distributed relatively evenly across species, with no species showing clear dominance. The Margalef's Richness Index (D) was found to be 4.84, showing moderate species richness (Hussain et al., 2012), which reflects favourable intermediate habitat conditions for butterflies.

Conclusions

The present study revealed that the Sukuna community forest provides a suitable and ecologically balanced habitat that supports a highly diverse butterfly community. In this study; the families Nymphalidae and Hesperiidae were the most abundant and least abundant respectively. These findings provide baseline information for future butterfly monitoring and conservation in the study area.

Conflicts of interest

The authors declare no conflict of interest.

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Appendix I

Table 1: Butterfly species documented in the study area

S.N.	Scientific name	Author & Year	Common name	Abundance
Family: Hesperiidae				
1	*Iambrix salsala*	Moore, 1866	Chestnut Bob	3
Family: Lycaenidae				
2	*Acytolepis puspa*	Horsfield, 1828	Common Hedge Blue	11
3	*Castalius rosimon*	Fabricius, 1775	Common Pierrot	7
4	*Jamides celeno*	Cramer, 1775	Common Cerulean	16
5	*Poritia hewitsoni*	Moore, 1866	Common Gem	11
Family: Nymphalidae				
6	*Danaus chrysippus*	Linnaeus, 1758	Plain Tiger	12
7	*Elymnias hypermnestra*	Linnaeus, 1763	Common Palmfly	3
8	*Euploea core*	Cramer, 1780	Common Indian Crow	23
9	*Euploea mulciber*	Cramer, 1777	Striped Blue Crow	5
10	*Junonia almana*	Linnaeus, 1758	Peacock Pansy	13
11	*Junonia altites*	Linnaeus, 1763	Grey Pansy	14
12	*Junonia hierta*	Fabricius, 1798	Yellow Pansy	8

13	*Junonia iphita*	Cramer, 1779	Chocolate Pansy	12
14	*Junonia lemonias*	Linnaeus, 1758	Lemon pansy	13
15	*Melanitis leda*	Linnaeus, 1758	Common Evening Brown	28
16	*Mycalesis mineus*	Linnaeus, 1758	Dark-brand Bushbrown	25
17	*Neptis clinia*	Moore, 1872	Clinia Sailer	11
18	*Neptis hylas*	Linnaeus, 1758	Common Sailer	10
19	*Orsotriaena medus*	Fabricius, 1775	Jungle Brown	10
20	*Pantoporia hordonia*	Stoll, 1790	Common Lascar	9
21	*Vanessa indica*	Herbst, 1794	Indian Red Admiral	4
22	*Ypthima baldus*	Fabricius, 1775	Common Five-Ring	66
23	*Ypthima huebneri*	Kirby, 1871	Common Four-Ring	31
Family: Papilionidae				
24	*Pachliopta aristolochiae*	Fabricius, 1775	Common Rose	18
25	*Papilio demoleus*	Linnaeus, 1758	Lime Butterfly	8
Family: Pieridae				
26	*Catopsilia pomona*	Fabricius, 1775	Common Emigrant	11
27	*Delias descombesi*	Boisduval,	Redspot Jezabel	5

		1836		
28	*Eurema hecabe*	Linnaeus, 1758	Common Grass Yellow	12
29	*Leptosia nina*	Fabricius, 1793	Psyche	20
30	*Pieris canidia*	Linnaeus, 1768	Indian Cabbage White	32
31	*Pontia daplidice*	Linnaeus, 1758	Bath White	38

Appendix II: Photographic records of butterfly species documented in the study area

Family: Hesperiidae

Iambrix salsala

Acytolepis puspa

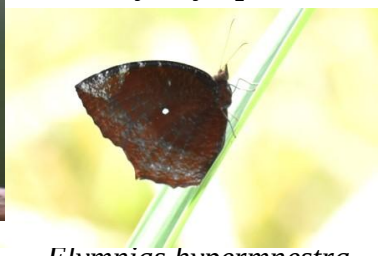
Castalius rosimon

Jamides celeno

Poritia hewitsoni

Family: Nymphalidae

Danaus chrysippus



Elymnias hypermnestra

Euploea core



Euploea mulciber	*Junonia almana*	*Junonia altites*



Junonia hierta	*Junonia iphita*	*Junonia lemonias*



Vanessa indica	*Ypthima baldus*	*Ypthima huebneri*



Melanitis leda	*Mycalesis mineus*	*Neptis clinia*



Family: Papilionidae

Pachliopta aristolochiae

Papilio demoleus

Family: Pieridae

Catopsilia pomona

Delias descombesi

Eurema hecabe

Leptosia nina

Pieris canidia

Pontia daplidice