
Research Article

Butterfly Diversity in the Campus Area of University of North Bengal, West Bengal, India

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Received 21 July 2023 | Reviewed 25 September 2023 | Accepted 05 October 2023 | Published 15 October 2023

Doi: <https://10.51200/jtbc.v20i.4520>

ABSTRACT

Butterflies play a crucial role as bio-indicators, signaling the health of ecosystems and biodiversity, making their conservation vital. The northern region of West Bengal in eastern India is renowned for its remarkable butterfly diversity. The University of North Bengal campus, spanning 315.99 acres at the Eastern Himalayan foothills (26°42'34.03"N; 88°21'14.96"E), is home to diverse flora and fauna. The surrounding area offers a variety of habitats, including forests, grasslands, tea gardens, and wetlands, which support numerous animal species. This study aimed to assess butterfly diversity in relation to their habitats and conservation needs within the university campus. Three distinct geographical sites within the university campus were selected, namely the tea garden area (dominated by tea and rubber plants), Salkunja (a forested area with a semi-perennial stream dominated by Sal trees), and Magurmari (an area with semi-perennial streams, ponds, ephemeral water bodies, paddy fields, and grasslands). Butterfly observations were conducted monthly from December 2021 to January 2023. The study documented 55 butterfly species from six families (Hesperiidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae, and Riodinidae), with Nymphalidae being the most prevalent and Riodinidae the least. Notably, the ecotone area of Magurmari exhibited the highest butterfly species diversity. Four species protected under the Wildlife (Protection) Act (WPA), 1972, were also identified. The study contributed a concise checklist and underscores the significant butterfly diversity found in the campus, emphasizing the urgent need for focused conservation actions.

Keywords: Butterfly; Diversity; University of North Bengal; Checklist; Lepidoptera

Introduction

Butterflies play a crucial role in maintaining the structure and function of almost all terrestrial ecosystems as they are commonly involved in pollination, herbivory and preyed upon by several predators. The aesthetic beauty of butterflies, along with their role as a key pollinator and an indicator of ecosystem health, makes them an integral part of both the natural and human

worlds. Globally, more than 19 thousand species of butterflies are reported (Westgate et al., 2016). There are more than 1500 species of butterflies reported from the Indian subcontinent (Tiple, 2011). Butterflies are crucial pollinators to support the world's food supply (Lindström et al., 2018). Since they are extremely sensitive to even minor environmental changes and shifts in the makeup of the forest, butterflies are thought to be excellent markers of the health of an ecosystem (Pollard, 1977). Numerous butterfly species are facing threat due to habitat loss, climate change and other anthropogenic activities (Brereton et al., 2011). To conserve and manage butterfly species effectively, it is crucial to have a comprehensive understanding of their distribution and diversity.

The northern part of West-Bengal encompasses a vast range of ecosystems, including forests, grasslands and wetlands, which support a variety of flora and fauna. Few systematic studies on butterflies were carried out in the Darjeeling hills (Pradhan & Khaling, 2020). The University of North Bengal (NBU) is located on a tract of land covering roughly 315.99 acres at the base of Eastern Himalaya, occupying the geographic coordinates of 26°42'34.03"N and 88°21'14.96"E (**Figure 1**). It is situated within the Siliguri sub-division of the Darjeeling district. The climate of this region is subtropical. The campus of the university is located in a forested region characterized by a diverse mixture of deciduous and evergreen trees. Additionally, the surrounding area comprises various habitats such as grasslands, forests and wetlands, which create an ideal environment for a variety of faunal species. Within the confines of the campus, two semi-perennial streams are present. Both of the streams are formed on an ecotone area among grasslands and riverside. During the monsoon season, a significant portion of the campus remains submerged. Previous studies have documented the presence of a diverse array of avian species as well as damselflies, dragonflies, and other taxa on the campus (Mukhopadhyay et al., 2015; Pal, 2017). This study sought to fill the knowledge gap on the diversity of butterflies and their pollinator plants in the campus of University of North Bengal. The goal of this study is to examine the diversity of butterflies and to make a checklist of their host and pollinator plants at the university campus. The knowledge obtained from the study is required to effectively and sustainably protect butterflies and their preferred host and pollinator plants. Although the current work is merely a first investigation, it offers a strong framework for future

investigations that are required to fully comprehend the importance of butterflies and plant interaction.

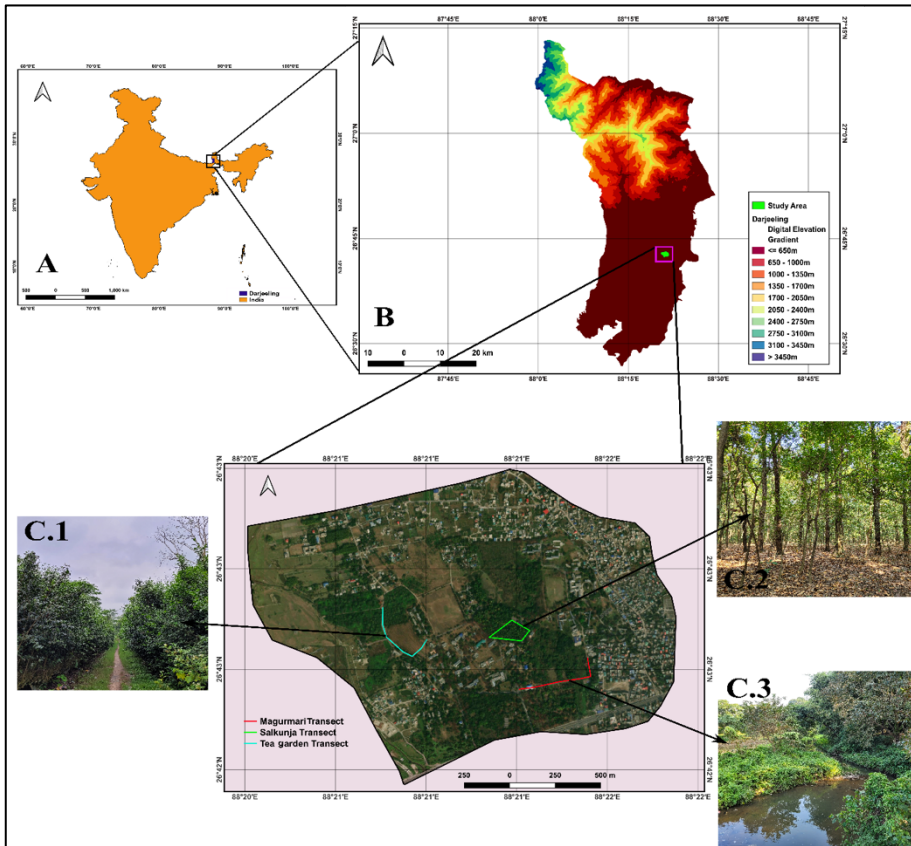


Figure 1. A) Map showing the location of Darjeeling in respect to India B) The elevation gradient of Darjeeling district and study area within C) the map of the University of North Bengal and the study area showing C.1) Tea garden area, C.2) Salkunja, C.3) Magurmari (This map was created using QGIS software version 3.22. Shapefiles were downloaded from: <https://www.naturalearthdata.com/>, <https://sedac.ciesin.columbia.edu/data/set/india-india-village-level-geospatial-socio-econ-1991-2001/data-download> and DEM file was downloaded from <https://bhuvan-app3.nrsc.gov.in/data/download/index.php>).

Material and Methods

The current study was conducted to understand the butterfly diversity from three geographically different study sites namely tea garden (TG), Salkunja (SK) and Magurmari (MM) of the campus. The tea garden area is mostly comprised of grassy plains where tea and rubber plants are the main vegetation. In contrast, Salkunja is a forested area with a semi-perennial stream, pre-dominated by Sal

trees. The Magurmari area contains various features such as a semi-perennial stream, ponds, temporary waterbodies and grasslands. The Pollard walk method (Pollard, 1977) was used to conduct this study between December 2021 to January 2023. Each study area was examined once a month. Observation of butterflies were conducted within a distance of 2.5 meters on either side of the transect line and 5 meters ahead of it. All three belt transects from Magurmari, Salkunja and tea garden were selected for the study and each transect was visited from 8am to 11am (**Figure 1**).

The study relied on photographs of the butterflies taken in their natural habitat using a DSLR camera in each study area. Common butterflies were identified immediately on the sampling sites by examining their colour patterns, size and wing designs. However, for most of the study, field guide books of butterflies (Smetacek, 2017), published literature (Mukherjee & Mondal 2020), relevant websites (<https://www.knowyourinsects.org/>.) and guides by entomological specialists were consulted to make a conclusive identification. Another survey was conducted to document larval host plants and nectar plants within the university campus for various butterfly families using previous published literature from this area (Saha & Das 2012).

Results and Discussion

This preliminary study reveals a total of 55 species of butterflies belonging to 6 families in the campus of the University of North Bengal (**Figure 2**). All the butterfly names with their family are in the **Table 1**. Among all the families recorded, Nymphalidae was the most dominant one, whereas Riodinidae was the least found. Other families recorded during the study were Hesperidae, Lycaenidae, Papilionidae and Pieridae. **Figure 3** illustrates the distribution of these families among all three study sites. Twenty-three (23) species from family Nymphalidae (making up 42% of the total), 10 species from Lycaenidae (18%), 9 species from Pieridae (16%), 7 species from Hesperidae (13%), 5 species from Papilionidae (9%) and 1 species from Riodinidae (2%) were recorded during the study (**Figure 3 and 4**).

Additionally, the highest variety of butterflies was recorded from the Magurmari area followed by tea garden and Salkunja. Out of all the butterflies observed, there were 41 species that were present in all three study sites. The butterflies *Zemeros flegyas* and *Chliaria othona* were exclusively observed in the Salkunja area, while the butterflies *Delias descombesi* and *Ampittia dioscorides* were exclusively recorded in the Magurmari area. Among all the recorded species,

four species were found to be protected under the Wildlife (Protection) Act (WPA), 1972.

Table 1. Checklist of the butterflies reported from North Bengal university campus.

SL. No	Family	Common name	Scientific name	Habitat	Occurrence	Wildlife (Protection) Act, 1972
1	Riodinidae	Punchinello	<i>Zemeros flegyas</i>	SK	+	—
2	Papilionidae	Common Jay	<i>Graphium doson</i>	TG, SK, MM	++	—
		Tailed Jay	<i>Graphium agamemnon</i>	TG, SK, MM	++	—
		Common Mormon	<i>Papilio polytes</i>	TG, SK, MM	+++	—
		Lime Butterfly	<i>Papilio demoleus</i>	SK, MM	+	—
		Common Rose	<i>Pachliopta aristolochiae</i>	TG, SK, MM	++	—
3	Hesperiidae	Fulvous Pied Flat	<i>Pseudocoladenia dan</i>	TG, SK, MM	+++	—
		Dark Palm Dart	<i>Telicota bambusae</i>	TG, MM	++	—
		Grass Demon	<i>Udaspes folus</i>	TG, SK, MM	++	—
		Straight Swift	<i>Parnara guttatus</i>	TG, SK, MM	++	—
		Rice Swift	<i>Borbo cinnara</i>	TG, SK, MM	++	—
		Chestnut Bob	<i>Iambrix salsala</i>	TG, SK, MM	++	—
		Common Bush Hopper	<i>Ampittia dioscorides</i>	MM	++	—
4	Pieridae	The Common Jezebel	<i>Delias eucharis</i>	TG, MM	+	—
		Red-Spot Jezebel	<i>Delias descombesi</i>	MM	+	—
		Striped Albatross	<i>Appias libythea</i>	TG, SK, MM	++	Schedule IV
		Common Emigrant	<i>Catopsilia pomona</i>	TG, SK, MM	++	—
		Mottled Emigrant	<i>Catopsilia pyranthe</i>	TG, SK, MM	+++	—
		Psyche	<i>Leptosia nina</i>	TG, SK, MM	+++	—
		Asian Cabbage White	<i>Pieris canidia</i>	TG, SK, MM	++	—
		Common Grass Yellow	<i>Eurema hecabe</i>	TG, SK, MM	+++	—
		Tree Yellow	<i>Gandaca harina</i>	TG, SK, MM	++	—
5	Lycaenidae	Common Imperial	<i>Cheritra freja</i>	TG, SK, MM	++	—

	Plains Cupid	<i>Chilades pandava</i>	TG, SK, MM	++	—	
	Common Pierrot	<i>Castalius rosimon</i>	TG, SK, MM	++	—	
	Red Pierrot	<i>Talicada nyseus</i>	TG, SK, MM	+++	—	
	Apefly	<i>Spalgis epius</i>	TG, MM	+	—	
	Slate Flash	<i>Rapala manea</i>	TG, SK, MM	++	—	
	Pale Grass-Blue	<i>Pseudozizeeria maha</i>	TG, SK, MM	+++	—	
	Common Hedge Blue	<i>Acytolepis puspa</i>	TG, MM	+	—	
	Common Cerulean	<i>Jamides celeno</i>	TG, SK, MM	++	—	
	Orchid Tit	<i>Chliaria othona</i>	SK	+	Schedule I (Part IV)	
	Common Four-ring	<i>Ypthima huebneri</i>	TG, SK, MM	+++	—	
6	Nymphalidae	Common	<i>Ypthima baldus</i>	TG, SK, MM	++	—
	Five-ring Striped Tiger	<i>Danaus genutia</i>	TG, SK, MM	++	—	
	Plain Tiger	<i>Danaus chrysippus</i>	TG, SK, MM	++	—	
	Blue Tiger	<i>Tirumala limniace</i>	TG, SK, MM	++	—	
	Tawny Coster	<i>Acraea terpsicore</i>	TG, MM	++	—	
	Painted Lady	<i>Vanessa cardui</i>	SK, MM	+	—	
	Commander	<i>Moduza procris</i>	TG, MM	++	—	
	Danaid Eggfly	<i>Hypolimnas misippus</i>	TG, SK, MM	++	Schedule II (Part II)	
	Great Eggfly	<i>Hypolimnas bolina</i>	TG, SK, MM	++	—	
	Common Sailor	<i>Neptis hylas</i>	TG, SK, MM	+++	—	
	Extra Lascar	<i>Pantoporia sandaka</i>	TG, SK, MM	++	—	
	Lemon Pansy	<i>Junonia lemonias</i>	TG, SK, MM	+++	—	
	Grey Pansy	<i>Junonia atlites</i>	TG, SK, MM	+++	—	
	Peacock Pansy	<i>Junonia almana</i>	TG, SK, MM	+++	—	
	Common Indian Crow	<i>Euploea core</i>	TG, SK, MM	++	Schedule IV	
	Common Baron	<i>Euthalia aconthea</i>	SK, MM	++	—	
	Common Bushbrown	<i>Mycalesis perseus</i>	TG, SK, MM	+++	—	
	Long-brand Bushbrown	<i>Mycalesis visala</i>	TG, SK, MM	++	—	
	Common Castor	<i>Ariadne merione</i>	TG, MM	+	—	
	Common Evening Brown	<i>Melanitis leda</i>	TG, SK, MM	+++	—	

Common	<i>Elymnias</i>	TG, SK,	++	—
Palmfly	<i>hypermnestra</i>	MM		
Common	<i>Phalanta</i>	TG, SK,	++	—
Leopard	<i>phalantha</i>	MM		

(+++)= Very Common; (++)= Moderate; (+)= Rare

TG: Tea garden area, SK: Salkunja, MM: Magurmari

According to this list, *Appias libythea* is listed under Schedule IV, *Chliaria othona* is listed under Schedule I (Part IV), *Hypolimnys misippus* is listed under Schedule II (Part II), and *Euploea core* is listed under Schedule IV. Species richness was highest in the Magurmari area. During the study, the number of recorded genera varied among different butterfly families. Nymphalidae had the highest number with 17 genera, followed by Lycaenidae (10), Hesperidae and Pieridae (7), Papilionidae (3) and Riodinidae (1) had only one genus. In total, 45 genera were recorded throughout the study.

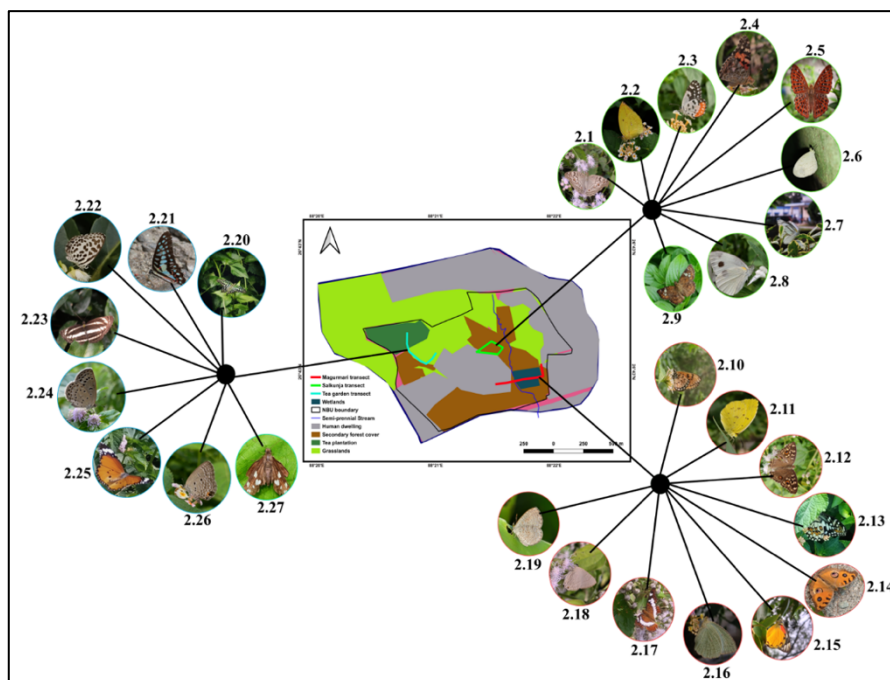


Figure 2. Different butterfly species recorded from the university campus. 2.1: *Junonia atlites*. 2.2: *Catopsilia pomona*. 2.3: *Talicauda nyseus*. 2.4: *Vanessa cardui*. 2.5: *Zemeros flegyas*. 2.6: *Leptosisa nina*. 2.7: *Appias libythea*. 2.8: *Pieris canidia*. 2.9: *Pseudocoladenia dan*. 2.10: *Acraea terpsicore*. 2.11: *Eurema hecabe*. 2.12: *Junonia lemonias*. 2.13: *Papilio demoleus*. 2.14: *Junonia almana*. 2.15: *Delias descombesi*. 2.16: *Catopsilia pyranthe*. 2.17: *Modusa procris*. 2.18: *Rapala manea*. 2.19: *Spalgis epius*. 2.20: *Graphium agamemnon*. 2.21: *Graphium doson*. 2.22: *Castalius rosimon*. 2.23: *Neptis hylas*. 2.24: *Pseudozizeeria maha*. 2.25: *Danaus chrysippus*. 2.26: *Chilades pandava*. 2.27: *Udaspes folus*.

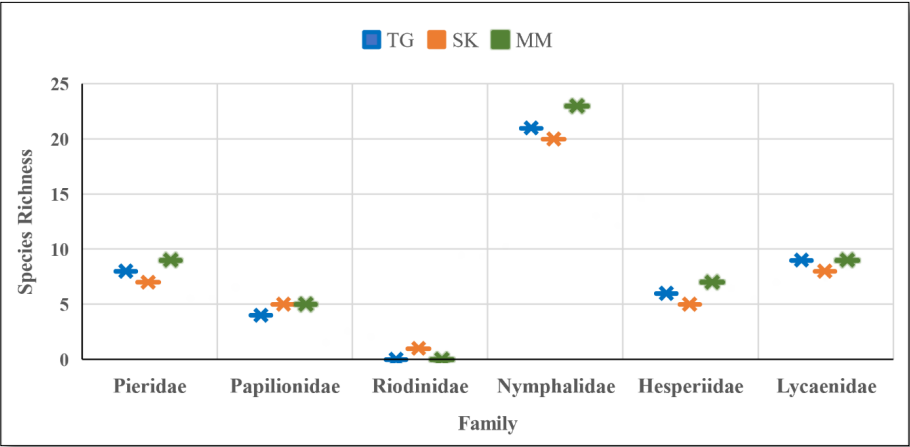


Figure 3. Comparative abundance of recorded butterfly species among different families from three study areas. (TG: Tea garden area, SK: Salkunja, MM: Magurmari).

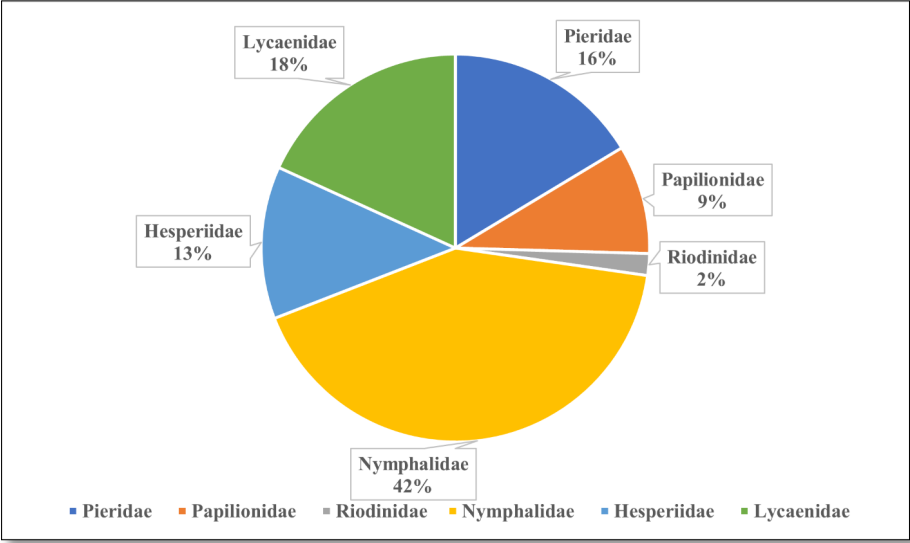


Figure 4. Family-wise percent distribution of butterflies from the university campus.

The university campus was found to be a significant habitat for butterflies as 55 different species of butterflies were observed during the preliminary study. The area contains a variety of cultivated and wild plant species that provide suitable hosts for egg laying, as well as nectar-producing plants that serve as a source of nectar. Previously, few studies regarding butterfly diversity were carried out in this district (Pradhan & Khaling, 2020). This study also reported similar types of butterfly species from this region.

Additionally, the butterfly families found in this study are consistent with previous research on the diversity of butterflies in West Bengal's diverse areas with comparable landscape patterns (Ghorai & Sengupta, 2014; Roy et al., 2022). Among all the families, Nymphalidae bore the highest number of species, maybe because the university campus provides a large number of their larval host plants (Table 2).

Table 2. Checklist of the larval host plant and nectar plant sources utilized by different families of butterfly reported from the University campus.

SL No.	Family	Larval Host Plants	Nectar Plants
01.	Riodinidae	<i>Maesa</i> spp.	-
02.	Papilionidae	<i>Polyalthia</i> sp., <i>Michelia</i> sp., <i>Annona</i> sp., <i>Citrus</i> spp., <i>Glycosmis</i> sp., <i>Aegle</i> sp., <i>Aristolochia</i> sp.	<i>Lantana</i> spp., <i>Ixora</i> sp., <i>Mussaenda</i> sp., <i>Jasminum</i> spp., <i>Cosmos</i> sp., <i>Zinnia</i> spp.
03.	Hesperiidae	<i>Achyranthes</i> sp., <i>Cocos</i> sp., <i>Oryza</i> sp., <i>Saccharum</i> sp., <i>Curcuma</i> spp., <i>Andropogon</i> sp.	<i>Lantana</i> spp., <i>Tridax</i> spp., <i>Vinca</i> sp., <i>Phaulopsis</i> sp., <i>Sida</i> sp.
04.	Pieridae	<i>Cleome</i> sp., <i>Bombax</i> sp. <i>Cassia</i> spp., <i>Cleome</i> sp., <i>Capparis</i> sp.	<i>Lantana</i> spp., <i>Ixora</i> sp., <i>Abutilon</i> sp., <i>Caesalpinia</i> sp., <i>Tridax</i> sp., <i>Bidens</i> sp., <i>Impatiens</i> spp., <i>Leucas</i> sp., <i>Crepis</i> spp.
05.	Lycaenidae	<i>Cinnamomum</i> sp., <i>Xylia</i> sp., <i>Cycas</i> sp., <i>Acacia</i> spp., <i>Ziziphus</i> sp., <i>Antidesma</i> sp., <i>Oxalis</i> sp., <i>Paracalyx</i> sp., <i>Saraca</i> sp., <i>Butes</i> sp., <i>Abrus</i> sp.	<i>Justicia</i> spp., <i>Sida</i> sp., <i>Tridax</i> sp., <i>Lantana</i> spp., <i>Glycosmis</i> sp.
06.	Nymphalidae	<i>Cynodon</i> sp., <i>Asclepias</i> sp., <i>Ceropegia</i> sp., <i>Cynanchum</i> spp., <i>Calotropis</i> sp., <i>Wattakaka</i> sp., <i>Passiflora</i> sp., <i>Artemisia</i> sp., <i>Blumea</i> sp., <i>Gnaphalium</i> sp., <i>Neolamarckia</i> sp., <i>Portulaca</i> sp., <i>Abutilon</i> sp., <i>Hibiscus</i> spp., <i>Moulluva</i> sp., <i>Dalbergia</i> sp., <i>Corchorus</i> sp., <i>Nerium</i> sp., <i>Ficus</i> sp., <i>Mangifera</i> sp., <i>Streblus</i> sp., <i>Oryza</i> sp., <i>Ricinus</i> sp., <i>Tragia</i> sp., <i>Panicum</i> sp., <i>Areca</i> sp., <i>Cocos</i> sp., <i>Calamus</i> spp., <i>Flacourtia</i> sp.	<i>Adelocaryum</i> sp., <i>Cipadessa</i> sp., <i>Zinnia</i> sp., <i>Tagetes</i> sp., <i>Lantana</i> sp., <i>Cosmos</i> spp., <i>Chromolaena</i> sp.

On the other hand, Riodinidae had the least number of butterfly species because of the lower number of larval host plants. **Table 2** describes the checklist of family-wise larval host plants and nectar plant sources reported from the campus. The area with the highest species richness was found to be Magurmari, which may be attributed to its ecotone characteristics and the presence of wetlands and ponds. Another contributing factor could be the presence of a medicinal garden, which provides a significant number of host and nectar plants. Conversely, Salkunja exhibited the lowest species richness, which may be linked to the dominance of Sal trees over other host plants. Notably, the majority of the recorded butterflies were observed during the nectar collection of *Lantana* plants. These findings support that the university campus is conducive for butterfly diversity. As previously mentioned, four butterfly species have been identified as protected under the Wildlife (Protection) Act (WPA) of 1972 and efforts should be made for proper conservation. To ensure their conservation, steps must be taken to safeguard their habitats and the plants they rely on for nourishment. Human activities such as deforestation and pollution may have a negative impact on their behaviour and should be addressed accordingly.

Conclusion

It is vital to comprehend how habitat, climate and other biogeographic factors impact the diversity of butterflies in order to conserve these significant pollinators and safeguard the ecosystem in which they reside. As this was a preliminary study, more research should be done to compile a compact check list from this region. Butterfly species diversity may vary to some extent compared to other parts of this region. This study not only assisted in the making a checklist of butterflies from this district, it also helps to identify the host and nectar producing plants for conservation of butterflies.

Acknowledgement

The authors express their sincere gratitude to the University authority for providing access to all the study sites and Head, Department of Zoology, University of North Bengal for the provision of research facilities.

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