

Diversity of Butterflies (Lepidoptera) in Moolia, Union Council Bakote, District Abbottabad

Omama Manzoor Abbasi¹, Ifra Nawaz¹, Azaz Ahmad²

¹ Government Postgraduate College for Women Mandian Abbottabad, Pakistan,

Corresponding Author's Email: omama3421@gmail.com

² Department of Entomology, The University of Agriculture, Peshawar

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Abstract

The present was conducted to assess the butterfly diversity, seasonal variation and habitat association in Moolia, union council Bakota, District Abbottabad from September 2025 to May 2026. Five habitat types were randomly selected for the collection butterfly specimens and identified up to species level. A total of 24 species under 209 genera of 11 sub-families and 4 families were recorded. The family Nymphalidae was the most dominant (50.5%) followed by Pieridae (32.4%), while *Pieris brassicae* was the most abundant species. Grassland represented highest species diversity of butterflies while the lowest species diversity was recorded in agricultural fields. September indicated highest butterfly abundance while the lowest abundance was noted in March. These results revealed a baseline information on butterfly diversity and highlighted the importance of conserving natural habitats and flowering vegetation to sustain butterfly populations and regional biodiversity.

Keywords: Butterfly, Habitat, Lepidoptera, Nymphalidae, Abbottabad.

Introduction

Butterfly belongs to order Lepidoptera that occupy wide range of terrestrial ecosystem worldwide. They are an important component of ecosystem due to its close association with flowering plants and an outstanding diversity (Hassan, 1997; Ehrlich & Raven, 1964). Butterflies are a significant pollinator and play an important role in food web and are broadly considered as reliable indicators of ecosystem health (Iqbal *et al.*, 2016; Thomas *et al.*, 1998). Butterflies respond quickly to climate variability and habitat degradation, thus often used to assess environmental conditions and biodiversity patterns (Clark *et al.*, 2007; Ghazoul, 2002). Vegetation structure, nectar resources, host plant availability and habitat heterogeneity are the primary factors that influence the butterfly richness and community composition (Ehrlich, 1984; Feeny, 1975). Moreover, supporting the butterfly richness can also provide necessary ecological information for monitoring and conserving biodiversity. Due to diverse vegetation zones and climatic conditions, the butterfly fauna of Pakistan is very rich. Several research works have been across different habitats of Khyber Pakhtunkhwa via Swat, Charsadda, Battagram, Haripur, Dir Lower and Upper and Azad Jammu and Kashmir to check the butterfly diversity (Din *et al.*, 2025; Bibi *et al.*, 2021; Haroon *et al.*, 2020; Abbasi *et al.*, 2019; Khan *et al.*, 2016). Despite these research works, numerous naturally important locations remain unexplored to check for butterfly diversity and habitat association in northern areas of Pakistan.

Materials and Methods

Study Area

The research work was conducted from September 2025 to May 2026 in Moolia, union council Bakote, Abbottabad for the collection of butterfly specimens across different environmental conditions. The research area is categorized by stream bank vegetation, agricultural fields, home gardens, grasslands and mountainous terrains, represented by 5 sampling sites

Butterfly Sampling

The butterfly specimens were collected by using sweep net, aerial net and hand picking. Repeated field visits were conducted throughout the study period to maximize species detection and document seasonal variation. Collected specimens were carefully handled, labelled, and preserved for subsequent identification.

Species Identification

The specimens were identified up to species level with the help of taxonomic keys provided by Evans (1932) and were further verified by taxonomic experts to check its accuracy.

Habitat Assessment

Habitat assessment was done by selecting 5 different habitat categories via stream bank, agricultural field, home garden, grassland and open woodland. The geographic coordinated and dominant vegetation linked with each sampling site was recorded to inspect the habitat preference and floral associations of species.

Table 1. Sampling sites and dominant vegetation.

Sites	Habitat type	Coordinates	Dominant vegetation
S1	Open woodland	34.126940 N, 73.478741 E	<i>Pinus roxburghii</i>
S2	Grassland	34.145026 N, 73.483689 E	<i>Cannabis sativa</i>
S3	Home garden	34.143337 N, 73.481953 E	<i>Hibiscus rosa-sinensis</i>
S4	Agricultural field	34.137461 N, 73.482795 E	<i>Zea mays</i>
S5	Stream bank	34.146150 N, 73.485427 E	<i>Mentha longifolia</i>

Diversity Analysis

Shannon–Wiener diversity index (H'), Simpson's diversity index ($1 - D$), and Pielou's evenness index (E) was used to asses the species richness and community diversity. Habitat-wise diversity indices were calculated to compare butterfly communities among different habitat types. Family-wise composition, relative abundance, and seasonal fluctuations in butterfly populations were also determined from the field data.

Results and Discussion

Butterfly Diversity and Taxonomic Composition

An extensive survey was conducted in District Abbottabad, Union Council Bakote, village Moolia for the collection of Butterfly specimens and to find its diversity. Table 2 indicated that a total of 105 specimens were collected representing 24 species under 20 genera of 11 sub-families and 4 families. The family Nymphalidae was the most diverse representing 5 sub-families and 13 species. The genus *Junonia* was the most speciose with species followed by *Papilio* and *Colias* each represented by 2 species. These results are in agreement with Khan *et al.* (2016) who reported 24 species within 7 families, including Papilionidae, Pieridae, Lycaenidae, Nymphalidae, Libytheidae, Danaidae, and Satyridae, in Lower Dir.

Table 2. Checklist of butterfly species recorded in the study area.

Family	Subfamily	Scientific Name
Nymphalidae	Satyrinae	<i>Lethe rohria</i>
		<i>Ypthima Asterope</i>
		<i>Hipparchia parisatis</i>
		<i>Lasiommata schakra</i>
	Nymphalinae	<i>Vanessa cardui</i>
		<i>Nymphalis polychloros</i>
		<i>Junonia hierta</i>
		<i>Junonia orithya</i>
	Heliconiinae	<i>Argynnis hyperbius</i>
		<i>Phalanta phalantha</i>
	Limenitidinae	<i>Neptis Sappho</i>
	Danainae	<i>Danaus chrysippus</i>
		<i>Tirumala limniace</i>
Papilionidae	Papilioninae	<i>Papilio polytes</i>
		<i>Papilio polyctor</i>
		<i>Papilio machaon</i>
Pieridae	Coliadinae	<i>Colias fieldi</i>
		<i>Colias erate</i>
	Pierinae	<i>Belenois aurota</i>
		<i>Delias eucharis</i>
		<i>Pieris brassicae</i>
Lycaenidae	Theclinae	<i>Deudorix epijarbus</i>
	Lycaeninae	<i>Lycaena phlaeas</i>
	Polyommatainae	<i>Zizina otis</i>

Family-wise Composition and Relative Abundance

Table 3 indicted that the family Nymohalidae was the most abundant with 53 individuals represented 13 species under 12 genera and relative abundance of 50.5% followed by family Pieridae. The family Pieridae was represented by 34 individuals came under 5 species and 5 genera with relative abundance of 32.4%. The species *Pieris brassicae* was the most abundant represented by 18 individuals followed by *Argynnis hyperbius* (13 individuals) and *Junonia orithya* (12 individuals).

Table 3. Family-wise diversity and relative abundance of butterflies.

Family	Genera	Species	Individuals	Relative abundance (%)
Nymphalidae	12	13	53	50.5
Pieridae	5	5	34	32.4
Papilionidae	1	3	10	9.5
Lycaenidae	3	3	8	7.6

Habitat-wise Distribution of Butterflies

Table 4 indicated the butterfly abundance in 5 different habitat types. The highest abundance was recorded in Grassland with 52 individuals, followed by streambank with 21 individuals while agricultural fields was found least abundant with 9 individuals. *Pieris brassicae* was found across all the habitats signifying substantial biological adaptability.

Table 4. Habitat-wise distribution of butterfly species.

Species	Garden	Grassland	Open woodland	Agricultural field	Stream bank	Total
<i>Lethe rohria</i>	0	0	1	0	0	1
<i>Ypthima asterope</i>	0	2	0	0	0	2
<i>Lasiommata schakra</i>	0	0	1	0	0	1
<i>Vanessa cardui</i>	0	0	0	1	0	1
<i>Hipparchia parisatis</i>	0	1	0	0	0	1
<i>Nymphalis polychloros</i>	0	0	1	0	0	1
<i>Phalanta phalantha</i>	0	4	0	0	3	7
<i>Junonia orithya</i>	0	8	4	0	0	12
<i>Junonia hierta</i>	0	0	0	2	0	2
<i>Neptis sappho</i>	0	2	0	0	7	9
<i>Danaus chrysippus</i>	0	1	0	1	0	2
<i>Argynnis hyperbius</i>	0	8	3	0	2	13
<i>Papilio polytes</i>	1	0	1	0	1	3
<i>Papilio polyctor</i>	4	0	2	0	0	6
<i>Papilio machaon</i>	0	1	0	0	0	1
<i>Colias fieldi</i>	0	6	0	0	0	6
<i>Colias erate</i>	0	4	0	0	2	6
<i>Belenois aurota</i>	0	1	0	2	0	3
<i>Deudorix epijarbus</i>	1	0	0	0	0	1
<i>Lycaena phlaeas</i>	0	2	0	0	0	2
<i>Zizina otis</i>	0	5	0	0	0	5
<i>Pieris brassicae</i>	4	5	0	5	4	18
<i>Tirumala limniace</i>	0	1	0	0	0	1
<i>Delias eucharis</i>	0	1	0	0	0	1
Total individuals	10	52	13	9	21	105

Diversity Indices

Table 5 represented varied butterfly diversity across all habitats. Grassland demonstrated highest diversity with a Shannon–Wiener index (1.944) and Simpson diversity index (0.726) while the diversity was noted in agricultural fields Shannon–Wiener index (1.268) and Simpson diversity index (0.654). The overall butterfly community exhibited high diversity, with a Shannon–Wiener index of 2.689, Simpson’s diversity index of 0.923, and an evenness value of 0.846, indicating a relatively even distribution of individuals among species.

Table 5. Habitat-wise diversity indices.

Habitat	Shannon–Wiener Index (H')	Simpson's Index (1 – D)
Open woodland	1.582	0.701
Grassland	1.944	0.726
Home garden	1.290	0.665
Agricultural field	1.268	0.654
Stream bank	1.582	0.701

Seasonal Variation in Butterfly Abundance

Table 6 revealed noticeable seasonal variations in butterfly abundance. The highest number of specimens was noted in September (47 individuals), followed by October (18 individuals). There was significant decline recorded in butterfly abundance during the colder months having 8 species recorded in March before increasing again in April (12 individuals) and May (20 individuals). Nymphalidae remained the dominant family.

Table 6. Monthly abundance of butterfly families.

Month	Nymphalidae	Pieridae	Papilionidae	Lycaenidae	Total
September	30	8	5	4	47
October	10	4	2	2	18
March	3	4	1	0	8
April	4	7	1	0	12
May	6	11	1	2	20

Floral Associations

Table 7 showed that Butterflies exhibited associations with a variety of flowering plants that served as nectar sources, basking sites, and temporary perching substrates. The most frequently utilized plant species included *Carduus acanthoides*, *Zinnia elegans*, *Hibiscus rosa-sinensis*, *Mentha spicata*, *Brassica campestris*, and *Lantana camara*. Nectar feeding was the predominant behavioral activity observed, emphasizing the importance of flowering vegetation in sustaining butterfly populations within the study area. Overall, the results demonstrate that Moolia supports a diverse butterfly community, with grassland habitats contributing the highest species richness and abundance, while seasonal fluctuations strongly influence butterfly occurrence and activity throughout the study period.

Table 7. Principal butterfly–plant associations observed in the study area.

Butterfly species	Associated plant	Ecological association
<i>Argynnis hyperbius</i>	<i>Carduus acanthoides</i>	Nectar source
<i>Pieris brassicae</i>	<i>Carduus acanthoides</i>	Nectar source
<i>Papilio polytes</i>	<i>Hibiscus rosa-sinensis</i>	Nectar source
<i>Danaus chrysippus</i>	<i>Zinnia elegans</i>	Nectar source
<i>Papilio polyctor</i>	<i>Zinnia elegans</i>	Nectar source
<i>Belenois aurota</i>	<i>Brassica campestris</i>	Nectar source
<i>Deudorix epijarbus</i>	<i>Lantana camara</i>	Nectar source
<i>Zizina Otis</i>	<i>Mentha spicata</i>	Nectar and perching site

Conclusion and Recommendations

The study concluded that Nymphalidae was the most dominant family with 53 individuals (50%), and *Pieris brassicae* was the most abundant species. The grassland supports the highest diversity of butterflies.

It is recommended that future studies should be conducted over larger geographical areas to obtain a more comprehensive understanding of butterfly diversity. The sample size and study duration should be increased to improve the reliability of the results. Furthermore, future researchers are recommended to consider environmental factors, such as climate change, effects of pesticides, herbicides, and urbanization that affect butterfly abundance and diversity.

References

- Abbasi, A.M., S. Nazer, A. Awan, N. Khan, N. Hamid, A.R. Abbasi & M. Altaf. 2019. Assessment of diversity of Butterflies in Dhirkot, Azad Jammu and Kashmir, Pakistan. *Journal of Wildlife and Ecology*. 3(3): 10-17.
- Bibi, M., S. Bibi, N. Akhtar, Z. Ullah, M.F. Khan, & I.Z. Qureshi. 2021. Butterfly (order lepidoptera) species Richness, diversity and distribution in different localities of Battagram, Pakistan. *Saudi Journal of Biological Sciences*. 29(4). **Page No missing**
- Clark, P.J., J.M. Reed & F.S. Chew. 2007. Effects of urbanization on butterfly species richness, guild structure, and rarity. *Urban Ecosystems*. 10(3): 321-337.
- Din, S.M. K. Asad, H.U. Rahman & A. Iqbal. 2025. Diversity of Butterflies (lepidoptera) in Kanju, District Swat, Khyber Pakhtunkhwa, Pakistan. *Journal of Bioresource Management*. 12(3): 21-31.
- Ehrlich, P.R. & P.H. Raven. 1964. Butterflies and Plants: A Study in Coevolution. *Evolution*. 18(4): 586-608.
- Ehrlich, P.R. 1984. The structure and dynamics of butterfly population. In *The Biology of Butterflies* (pp. 25-40). London: Academic Press.
- Feeny, P. 1975. Biochemical coevolution between plants and their insect herbivores. In L. G. Raven (Ed.), *Coevolution of Animals and Plants* (pp. 3-19). University of Texas Press.
- Ghazoul, J. 2002. Impact of logging on the richness and diversity of forest butterflies in a tropical dry forest in Thailand. *Biodiversity and Conservation*. 11(3): 521-541.
- Haroon, Z. Khan, F. Perveen, M.A. Rafi, S.W. Shah & Y.F. Meng. 2020. Biodiversity of Butterflies in Tangi Charsadda, Khyber Pakhtunkhwa, Pakistan. *Pakistan Journal of zoology*. 52(3): 835-841.
- Hassan, S.A. 1997. Biogeography and diversity of butterflies of North East Hamaliya. In S.A. Mufti, C.A. Woods & S.A. Hassan (Eds.), *Biodiversity of Pakistan* (pp. 181-204). Pakistan Museum of Natural History Islamabad.
- Iqbal, R., M.F. Malik, M. Hussain, M. Younas & M. Ghazanfar. 2016. Butterflies and their contribution in ecosystem. *Journal of Entomology and zoology studies*. 115(42): 115-118.
- Khan, M.I., H. Ullah, S. Saleem, M.A. Khan, F. Naz, M.A. Rafi & S.A. Mehmood. 2016. Diversity and Distribution of Butterflies (Insecta: Lepidoptera) of district Dir lower, Khyber Pukhtoonkhwa, Pakistan. *Arthropods*. 5(1): 11-22.
- Thomas, J.A., D.J. Simcox, J.C. Wardlaw, G.W. Elmes, R.T. Clarke & M.E. Hochberg. 1998. Effects of latitude, altitude and climate on the habitat and conservation of the endangered butterfly *Maculinea arion* and its *Myrmica* ant hosts. *Journal of insect Conservation*. 2(1): 39-46.