



RESEARCH ARTICLE

DIVERSITY OF BUTTERFLY IN WESTERN HIMALAYAN REGION, UTTARAKHAND

Bharati¹, Rajkumar Singh² and Shankar Kumar³

¹Research Scholar, SSJDVSSS GPGC, Ranikhet, Almora; ²Professor, Department of Zoology, Lal Bhadur Shastri GPGC, Halduchaur, Nainital; ³Assistant Professor, Department of Mathematics, SSJDVSSS GPGC, Ranikhet, Almora

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*Corresponding author:

Bharati

ABSTRACT

Butterflies are one of the most conspicuous, attractive and colour full insect of earth's biodiversity. Butterflies play various important contributions in maintenance of healthy ecosystem. Many others insects and small animals rely on butterflies as food source. Himalayan region are rich in flora and fauna. Himalayan regions are an eco-friendly region of Terai Arc landscape of India. It supports species of diversity by providing them verities of food source and habitat. The present research work conducted in Himalayan region of Uttarakhand to study diversity of butterfly. Uttarakhand Himalayan region are rich in fauna as well as flora probably due to their climatic conditions such as humidity, temperature, habitat and ecosystem, which supported diversity of butterflies. Uttarakhand is flourished by natural rivers namely Gola and Sharda rivers which also support diversity during summer seasons. Himalayan regions are an eco-friendly region of Terai Arc landscape of India. To study the diversity of butterflies two different elevation has been selected to study the diversity of butterflies; 01. Lower elevation of Western Himalayan (400-500) and 02. Moderate elevation (1000-1100) of Western Himalayan Uttarakhand (1000-1100). Three season have been selected monsoon (July- October), winter (November - march), summer (April-june) to study diversity of butterfly. Random survey has been done during the one and half year (March 2023- August 2024), a total 5 families have been recorded namely Nymphalidae, Pieridae, Lycaenidae, Papilionidae, Riodinidae, Hesperidae from the study area. Maximum abundance of species was observed of Nymphalidae family and least abundance of species was observed in Hesperidae.

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INTRODUCTION

Butterflies are one of the most beautiful and attractive insects belonging to the order Lepidoptera. It is an eye catching insect due to its attractive colour and its role in healthy ecosystem. Almost 17,200 species of butterflies has been reported worldwide, whereas India is the home of about 1501 species of butterflies (Kunte, 2000). Butterflies known as good pollinators whose feed on nectar and during pollination pollen stick on its scale as a result when butterflies visit on one flower to another, pollen also transport on stigma (Webb). Few Butterfly species migrates over long distance and share pollens far away which helps plants for being disease resistance (Kearney). They are used as indicator of a healthy ecosystem (Padhye et al. 2006). But in recent years diversity of butterflies drastically reduced due to environmental changes. The change in temperature probably caused by excessive use of pesticide, habitat destruction, deforestation, habitat destruction of food source and an unbalanced food chain of an ecosystem. Butterflies are very sensitive to atmospheric conditions, the dispersal of butterflies is affected by adaphic factors such as Temperature, habitat, vegetation

(availability of food plant and larval host plant) and climatic, ecological conditions (Spitzer et al., 2008). Protected areas are the best method to conserving environment, which help in maintenance of biodiversity and ecosystem services by reducing and diminish the pressure on ecosystem and their services (Margules and Pressey, 2020). They play crucial role in defend biodiversity against more remote that result anthropogenetic impacts on nature (Sharma et al., 2020a). Himalayan region are rich in fauna as well as flora probably due to their climatic conditions such as humidity, temperature, habitat and ecosystem, which supported diversity of butterflies. These factors affect the diversity of butterfly most. Rivers of Western Himalayan region also supports diversity of butterflies in summer season.

MATERIALS AND METHODS

Study area: The present research work conducted in Himalayan region of Uttarakhand to study diversity of butterfly.

It lies between 79° 40' 31.414 E, 29° 11' 2.792" N and 80° 0' 33.365" E, 29° 8' 20.375". The area covered different vegetation, tropical and subtropical vegetation dominated by woody species, viz. *Shorea robusta*, *Cassia fistula*, *Tecnonagrandis*, *Dalergiasisso*, *Ficus* sp., *Pinus roxurghii* etc. The common shrubs are *Ziziphusxylopyrus*, *Terminalia tomentosa*, *Adina cordifolia* and *Syzygium cumini*. *Glycosmispentaphylla*, *Lantana camera* With increasing altitude these plants are replaced by mixed deciduous forests.

Sampling method: Random survey has been done. Observation was done between 10:00am to 2:00 pm. Morphological character mainly primarily used for identification of butterfly species. Colour pattern, size, shape, and their body design etc were considered for identification of species of butterflies. Photos of butterflies were captured through using Canon EOS 200DII camera and identification of different species was done as suggested by Kehimkar (2008, 2016), Singh AP. (2010), Smetacek (2016), and Sondhi (2018), No samples were collected during this work.

Data analysis

Shannon-Wiener diversity Index

The species diversity was calculated using Shannon Wiener Index (W)

$$W(S) = -\sum_{p=1}^s pI \log pI$$

Where pI = fraction of total population made up of species I,
s= total number of species encountered
p = proportion of species

RESULTS AND DISCUSSION

Table 2. Shannon-Wiener Diversity indices of butterfly diversity in lower elevation of Western Himalayan region, Uttarakhand

Species	No. of species (p)	pI	ln(pI)	Pi*ln(pI)
Pieridae	12	0.27	-1.30	-0.351
Lycaenidae	7	0.16	-1.83	-0.292
Nymphalidae	18	0.41	-0.89	-0.364
Papilionidae	4	0.093	-2.37	-0.220
Hesperiidae	2	0.046	-3.07	-0.141
	43			-1.368

Species	No. of species (p)	pI	ln(pI)	Pi*ln(pI)
Pieridae	3	0.093	-2.37	-0.220
Lycaenidae	2	0.062	-2.78	-0.172
Nymphalidae	22	0.687	-2.67	-1.834
Papilionidae	1	0.031	-5.77	-0.178
Hesperiidae	1	0.031	-5.77	-0.178
Ridionidae	3	0.093	-2.37	-0.220
	32			-2.802

Species diversity and species richness which belongs to total fourteen hundred forty three individual observed belonging to 5 families in lower elevation of Western Himalayan region of Uttarakhand. Maximum abundance of species was observed of Nymphalidae followed by Pieridae, Lycaenidae, Papilionidae, Hesperiidae in lower elevation of Himalayan region, Uttarakhand whereas eight hundred forty-five individual observed belonging to 6 families in moderate elevation of Western Himalayan region of Uttarakhand.

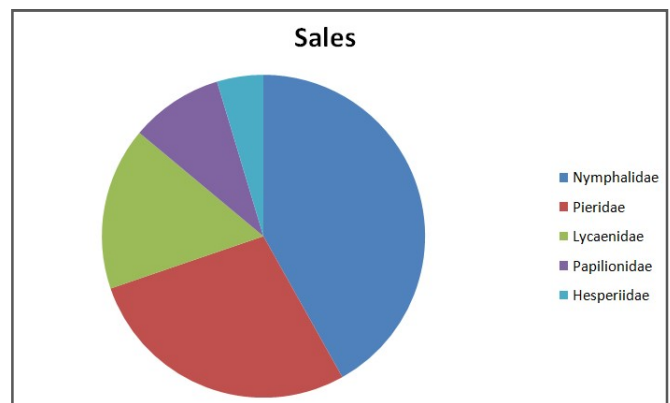


Fig. 1. Pie chart of Butterfly families were observed in lower elevation of western Himalayan region, Uttarakhand

Nymphalidae is dominant family followed by Pieridae, Lycaenidae, Riodinidae, Papilionidae, Hesperiidae in higher altitude of Western Himalayan region, Uttarakhand. Abundance of individual observed highest in post monsoon season. Nymphalidae family is the dominant species in lower as well as moderate elevation of Western Himalayan region. Butterfly's abundance is effects by Climatic conditions such as temperature, humidity. Vegetation and seasonality play major role in abundance and diversity of butterfly. These factors directly affect the composition of butterfly in Himalayan region. According to the observation in the study area butterflies abundance and diversity vary in each season. Temperature was the main factor regulates abundance of butterflies. In summer season (April-June) due to high temperature and less humidity less number of butterflies observed. Butterflies mainly observed near the water source, shores of rivers and on wet soil during summer season.

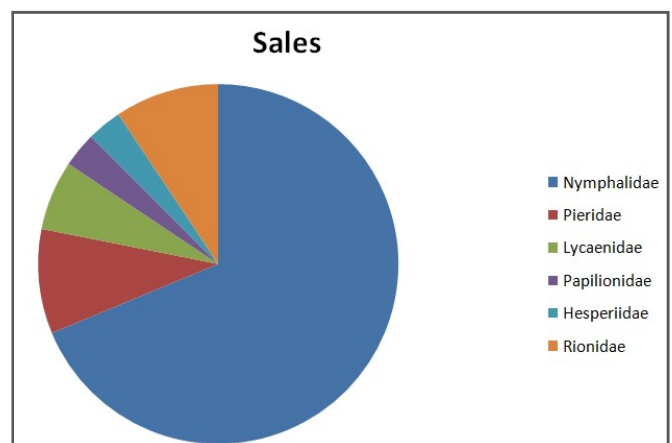


Fig. 2. Pie chart of Butterfly families were observed in moderate elevation of western Himalayan region, Uttarakhand.

In winter and monsoon temperature is low which also affect the species number of butterflies in study area. According to the data observation in post monsoon (October and November) shows peak species diversity of butterfly and abundance of butterflies vary elevation by elevation due to change in vegetation and environmental factors. Kunte (1997) have done great work on seasonality of butterfly and identified two seasons (March-April and October) as peaks. According to the observation some species shows seasonality peak at specific season and months namely *Junonia almanac*, *Melanitis leda*, *Neptis hylas*, *Pieris rapae* in lower elevation whereas *Junonia iphita*, *Neptis Sappho* in higher aitude of Himalayas.

Table 2. Species diversity in lower elevation of Himalayan region, Uttarakhand

Common Name	Monsoon	summer	winter	Total individuals
Family- Nymphalidae				
Blue pansy	+	+	+	20
Broad-banded Sailer	+	+	-	15
Common baron	+	+	+	30
Common evening brown	+	+	+	40
Chocolate pansy	+	+	+	36
Common castor bean	+	+	-	27
Common crow	+	+	+	22
Common eggfly	+	+	+	20
Common leopard	+	+	+	33
Common sailor	+	+	+	30
Common tiger	+	+	+	38
Grey pansy	+	+	+	25
Lemon pansy	+	+	+	40
Painted lady	+	+	-	6
Peacock pansy	+	+	+	25
Plain tiger	+	+	+	42
Striped blue crow	+	+	-	3
Striped tiger	+	+	+	38
Family- Pieridae				
Common emigrant	+	+	+	52
Common grass yellow	+	+	+	60
Common Gull	-	+	-	12
Common sailor	+	+	+	25
Eastern pale clouded yellow	+	+	+	10
Himalayan dark clouded yellow	-	+	-	2
Indian Cabbage white	+	+	+	52
Indian Wanderer	+	+	+	8
Large Cabbage white	+	+	+	48
Mottled emigrant	+	+	+	56
Small grass yellow	+	+	+	51
Spotless grass yellow	+	+	+	48
Family- Lycaenidae				
Common Cerulean	+	+	+	28
Dark grass blue	+	+	+	36
Lesser grass blue	+	+	+	32
Pea blue	+	+	+	48
Pale grass blue	+	+	+	55
Sorrel sapphire	-	+	-	2
Tiny grass blue	+	+	+	25
Family- Hesperidae				
Common straight swift	+	+	+	43
Lesser rice swift	+	+	+	46
Family- Papilionidae				
Common Bluebottle	+	+	-	10
Common Lime	+	+	+	42
Common Mime	+	+	+	45
Common Mormon	+	+	+	46

Table 3. Percent distribution of relative number of individuals and species of different families of butterfly observed in lower elevation of western Himalayan region, Uttarakhand

	Family	Total no. of species	% of species	Total no. of individual	% of individual
1	Pieridae	12	27.90%	424	29.38%
2	Lycaenidae	7	16.27%	226	15.66%
3	Nymphalidae	18	41.86%	561	38.87%
4	Papilionidae	4	9.30%	143	9.90%
5	Hesperidae	2	4.65%	89	6.16%
	total	43		1443	99.97%

Few specie are frequent throughout the year namely *Polyommatus icarus*, *Eurema hecabe*, *Papilio demoleus* and *Danus chrysipus* in lower elevation whereas *Dodona durga*, *Danaus genutia* in moderate elevation of Western Himalayas.

Table 4. Species diversity in moderate elevation of Himalayan region, Uttarakhand

Common Name				
Family- Nymphalidae				
Baron	+	+	-	10
Blue Tiger	+	+	+	15
Broad banded sailor	+	+	+	20
Common bush brown	-	+	-	5
Common crow	+	+	+	26
Common Four-ring	+	+	+	40
Common lascar	+	+	+	32
Chocolate pansy	+	+	+	45
Common sergeant	-	+	-	5
Common tiger	+	+	+	26
Lemon pansy	+	+	+	36
Glassy tiger	+	+	-	33
Indian red admiral	-	+	-	1
Himalayan Five-ring	+	+	+	20
Himalayan Rusty Sailer	+	+	+	25
Himalayan Yellow Coster	-	+	-	1
Indian Tortoiseshell	-	+	-	5
Large Three-ring	+	+	+	12
Northern Common Jester	+	+	+	38
Striped Blue Crow	+	+	+	28
Striped tiger	+	+	+	25
Peacock pansy	+	+	+	39
Family- Pieridae				
Common emigrant	+	+	+	45
Mottled emigrant	+	+	+	33
Three spot grass yellow	+	+	+	26
Family- Lycaenidae				
Common Pierrot	+	+	+	34
Sorrel sapphire	+	+	-	3
Family- Hesperidae				
Lesser rice swift	+	+	+	30
Family-Riodinidae				
Common Punch	+	+	+	58
Double-banded Judy	+	+	+	50
Punchinello	+	+	+	45
Family- Papilionidae				
Common Mime	+	+	+	34

+ = Present, -= Absent

Table 5. Percent distribution of relative number of individuals and species of different families of butterfly observed in moderate elevation of Western Himalayan region, Uttarakhand

	Family	Total no. of species	% of species	Total no. of individual	% of individual
1	Pieridae	3	9.37%	104	12.30%
2	Lycaenidae	2	6.25%	37	4.37%
3	Nymphalidae	22	68.75%	487	57.63%
4	Papilionidae	1	3.12%	34	4.02%
5	Hesperidae	1	3.12%	30	3.55%
	Riodinidae	3	9.37%	153	18.10%
	total	32	100%	845	

Few species are highly mobile in nature and their mobility affects its abundance and richness (Stevens et al. 2010) whereas Weather directly affect the species abundance and size (Roy et al. 2001; Franzen and Nilsson 2012).

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