

**DIVERSITY OF BUTTERFLY COMMUNITIES AT DIFFERENT
ALTITUDES OF KUMAON ZONE, UTTARAKHAND***Bharti¹, Rajkumar Singh², Shankar Kumar³***Abstract**

The order Lepidoptera is the second largest order of insects, including butterflies, moth, and skippers. Butterflies provide a wide range of environmental benefits, including pollination and natural pest control. The purpose of the study was to describe diversity of butterflies at various altitudes of Kumaon zone, Uttarakhand. Kumaon region is filled with biodiversity due to its suitable environmental condition and humid area. The present study covers altitude between 100-35000msl of Kumaon area. A total of 80 species of butterflies were observed at various altitudinal range. Among them Nymphalidae was the most dominant species. Whereas some other families recorded in study area was Papilionidae, Hesperidae, Pieridae, Lycaenidae. The significant difference in diversity of butterflies among the altitudes as indicated by the values of Shannon Weiner-index H' .

Key words: Diversity, Kumaon, Nymphalidae, Lepidoptera, Uttarakhand.

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Introduction

Insects play major role in biodiversity. Butterflies are critical pollinators, in fact, more than 80% of land plants are pollinated by butterflies. The number of butterflies varies from lowest altitude to highest altitude. Analysis of altitudinal changes can provide information about diversity of butterflies and its abundance in environment. More than 17,500 species of butterflies are found all over the world. Of these, India is home of 1500 species of butterflies. Across the country 500 butterfly species have been found. More than half the species are found in India only. This tells us that many species of butterflies still to be discovered. India's temperature and vegetation is great for growth of Butterflies. Several studies have concluded that the number of butterflies decline rapidly due to the habitat destruction, excessive use of pesticides, and human activities. This study was aimed to investigate the diversity of butterfly communities at different altitude. Butterflies are the wild indicators of the ecosystem; which tell about healthier ecosystem. The result of the study is to provide data for further studies and baseline to conserve butterflies.

Material and Methods

Study Site

The study was carried out at Kumaon zone of Uttarakhand, found at the coordinates of 29°44.6796"N and 79°9'7.8048"E. The vegetation of the area varied with altitude.

Survey Site

Various sites surveyed. The sites belonged to two groups, 1) Reserved forest area such as Pawalgarh forest, Ramnagar forest area and Nandhaur wildlife sanctuary, 2) Terai region of Kumaon Zone, Uttarakhand.

Sampling methods

The line transect method was used for the survey of butterflies. Sampling was done once in a month about 3 days. All transect were observed between 10:00am to 2:00 pm. Butterfly photos were captured through the camera. Morphological character mainly observed for identify butterfly species. Size, and shape, colour pattern, and their body design also will be considered in identification of species of butterflies. However in cases where the butterflies could not be identified directly in the field, it was identified with the help of available literature. Besides books, published paper, and articles was used as identification tools.

Identification of Butterflies

Images of butterflies were taken using digital cameras and identification was done as suggested by Kehimkar (2016), Smetacek (2016), and Sondhi (2018). Arrangement of various species and genera is primarily based on Varshney & Smetacek (2015).

Data Analysis

Shannon-Wiener diversity Index

The species diversity was calculated using Shannon Wiener Index (\bar{H})

$$\bar{H}(S) = -\sum_{i=1}^s p_i \log p_i$$

Where p_i = fraction of total population made up of species I ,

s = total number of species encountered

i = proportion of species

Margalef's Index

Species richness was calculated using Margalef's Index.

Margalef's Index = $(S-1)/ \ln N$

Where S = total number of species

N = total number of individuals in the sample

\ln = natural logarithm

Result

A total 80 species of butterflies were observed at various altitudinal range of Kumaon zone Uttarakhand. However, the population of butterfly found to be significantly higher inside forest region, which is most likely due to an undisturbed habitat in the protected forest area. During the present study, a total of 80 species of butterflies belonging to five families were collected. Out of these, 18 species each belonged to the families Pieridae and 19 species to Lycaenidae, 29 species to Nymphalidae, 10 species to Papilionidae and 5 species to family Hesperidae.

Table 1. Species richness of butterflies in different altitudes of Kumaon zone, Uttarakhand

Altitude	Species richness
100-7000	29
7000-14000	23
14000-21000	12
21000-28000	10
28000-35000	5
Total	80

Butterflies species richness were highest in low altitude due to diversity of nectar plants and lowest at a high altitudinal region due to low variation of nectar plants.

Family wise pattern

The recorded butterflies at different altitude present 5 families namely, Nymphalidae, Papiilionidae, Hesperidae, Pieridae, and Lycaenidae. Among these families, Nymphalidae is most dominant comprising maximum species (36.25%). Nymphalidae has highest species followed by Pieridae, Lycaenidae, Papiilionidae, Hesperidae. This indicates

that Nymphalidae dominated with highest species in all altitude of the study area. Hesperidae were the least in species richness (6.25%).

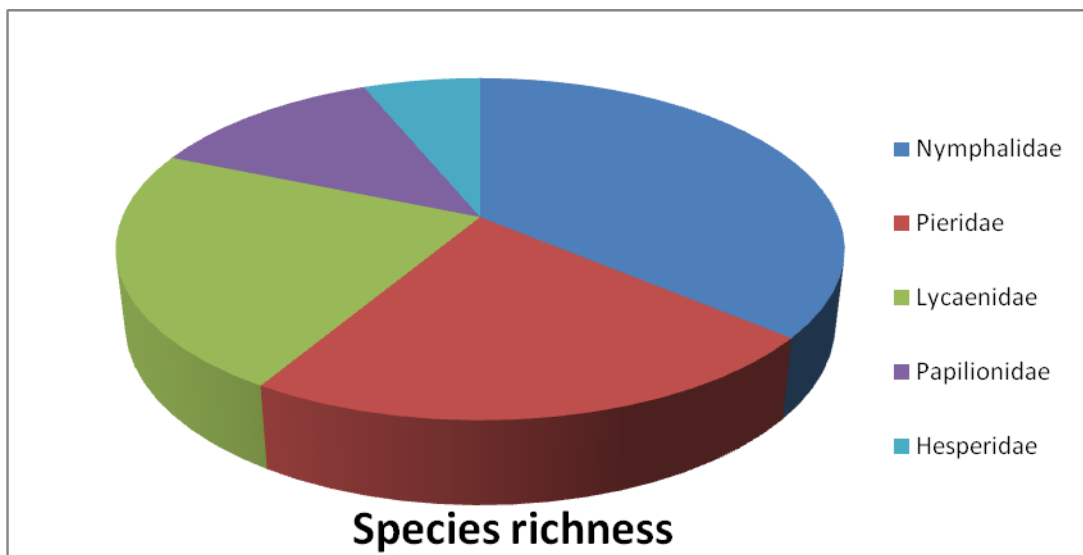


Table 2. List of butterflies at different altitude with their common name

S.N.	Family	Scientific name	Common name
1	Nymphalidae	<i>Euthelia aconthea</i>	Common baron
2	Papilionoidea	<i>Papilio clytia</i>	Common mime
3	Lycaenidae	<i>Lampides boeticus</i>	Pea blue
4	Nymphalidae	<i>Symbrenthia lilaea</i>	Common jester
5	Nymphalidae	<i>Junonia almana</i>	Peacock pancy
6	Lycaenidae	<i>Pseudozizeeria maha</i>	Pale grass blue
7	Nymphalidae	<i>Hypolimnas bolina</i>	Common eggfly
8	Pieridae	<i>Pieris brassicae</i>	Large cabbage white
9	Pieridae	<i>Pieris canidia</i>	Indian Cabbage White
10	Papilionoidea	<i>Papilio polytes</i>	Common mormon
11	Pieridae	<i>Catopsila pomona</i>	Common emigrant
12	Pieridae	<i>Catopsilia pyranthe</i>	Mottled Emigrant
13	Pieridae	<i>Eurema laeta</i>	Spotless grass yellow
14	Pieridae	<i>Eurema hecabe</i>	Common Grass Yellow
15	Pieridae	<i>Eurema Blanda</i>	Three Spot Grass Yellow
16	Pieridae	<i>Aporia agathon</i>	Great blackvein
17	Pieridae	<i>Delias belladonna</i>	Hill jezebel
18	Pieridae	<i>Pareronia hippia</i>	Indian Wanderer
19	Pieridae	<i>Eurema hecaba</i>	Common grass yellow

20	Nymphalidae	<i>Neptis hylas</i>	Common sailer
21	Nymphalidae	<i>Vaneesa cardui</i>	Painted lady
22	Nymphalidae	<i>Junonia lemonias</i>	Lemon pansy
23	Nymphalidae	<i>Phalanta phalanta</i>	Common leopard
24	Nymphalidae	<i>Athyma opalina</i>	Himalayan sergeant
25	Pieridae	<i>Aporia leucodice</i>	Himalayan blackvein
26	Papilionoidea	<i>Talicauda nyseus</i>	Red pierrot
27	Papilionoidea	<i>Graphium agamemnon</i>	Tailed jay
28	Pieridae	<i>Eurema brigitta</i>	Small grass yellow
29	Pieridae	<i>Pareronia valeria</i>	Common wanderer
30	Nymphalidae	<i>Vanessa caschmirensis</i>	Indian tortoiseshell
31	Nymphalidae	<i>Junonia iphita</i>	Chocolate pansy
32	Nymphalidae	<i>Danaus chrysippus</i>	Plain Tiger
33	Nymphalidae	<i>Melanitis leda</i>	Common evening brown
34	Nymphalidae	<i>Precis orithya</i>	Blue Pansy
35	Nymphalidae	<i>Phalanta phalantha</i>	Common Leopard
36	Nymphalidae	<i>Cyrestis Thyodamas</i>	Common Map
37	Nymphalidae	<i>Ariadne merione</i>	Common castor
38	Nymphalidae	<i>Kallima inachus</i>	Orange oakleaf
39	Nymphalidae	<i>Danaus genutia</i>	Striped Tiger
40	Nymphalidae	<i>Euploea core</i>	Common Crow
41	Nymphalidae	<i>Parantica aglea</i>	Glassy Tiger
42	Nymphalidae	<i>Tirumala Limniace</i>	Blue Tiger
43	Nymphalidae	<i>Parantica sita</i>	Chestnut tiger
44	Papilionoidea	<i>Pachliopta aristolochiae</i>	Common Rose
45	Papilionoidea	<i>Delias cucharis</i>	Common Jezebel
46	Lycaenidae	<i>Freyeria trochilus</i>	Grass Jewel
47	Lycaenidae	<i>Jamides celeno</i>	Common Cerulean
48	Lycaenidae	<i>Neopithecops zalmora</i>	Quaker
49	Lycaenidae	<i>Lampides boeticus</i>	Pea Blue
50	Lycaenidae	<i>Spindasis vulcanus</i>	Common Silverline
51	Lycaenidae	<i>Arhopala amantes</i>	Large Oakblue
52	Lycaenidae	<i>Arhopala atrax</i>	Indian Oakblue
53	Lycaenidae	<i>Flos adriana</i>	Variiegated Plushblue
54	Lycaenidae	<i>Castalius rosimon</i>	Common pierrot
55	Lycaenidae	<i>Prosotas nora</i>	Common Lineblue
56	Lycaenidae	<i>Curetis acuta</i>	Angled Sunbeam
57	Lycaenidae	<i>Megisba malaya</i>	Malayan
58	Lycaenidae	<i>Acytolepis puspa</i>	Common Hedge Blue
59	Lycaenidae	<i>Euchrysops cnejus</i>	Common Gram Blue
60	Lycaenidae	<i>Freyeria putli</i>	Lesser Grass Jewel
61	Lycaenidae	<i>Heliophorus sena</i>	Sorrel sapphire
62	Hesperidae	<i>Spialia galba</i>	Indian Skipper
63	Hesperidae	<i>Sarangesa dasahara</i>	Common Small Flat

64	Pieridae	<i>Leptosia nina</i>	Psyche
65	Pieridae	<i>Colias fieldii</i>	Dark Clouded Yellow
66	Pieridae	<i>Belenois aurota</i>	Pioneer
67	Pieridae	<i>Cepora nerissa</i>	Common Gull
68	Papilionoidea	<i>Graphium eurous</i>	Six-bar Swordtail
69	Papilionoidea	<i>Graphium sarpedon</i>	Common Bluebottle
70	Nymphalidae	<i>Vanessa indica</i>	Indian red admiral
71	Nymphalidae	<i>Mycalesis francisca sanatana</i>	Lilacine Bushbrown
72	Nymphalidae	<i>Callerebia annada</i>	Ringed Argus
73	Nymphalidae	<i>Euthalia patala</i>	Grand duchess
74	Nymphalidae	<i>Pantoporia hordonia</i>	Common Iascar
75	Nymphalidae	<i>Callerebia nirmala</i>	Common Argus
76	Hesperiidae	<i>Parnara spp.</i>	Parnara Swift
77	Hesperiidae	<i>Suastus gremius</i>	Indian Palm Bob
78	Hesperiidae	<i>Taractrocera maevius</i>	Common Grass Dart
79	Papilionoidea	<i>Papilio paris</i>	Paris peacock
80	Papilionoidea	<i>Graphium nomius</i>	Spot swordtail

Conclusion

The total number of 80 species, belonging to 5 families observed in study area. A large number of butterflies observed in forest conservative area. The wide variation in elevation in the forest habitat disturbances might have resulted in the variety of microhabitats and niche for the enhancing different species of biodiversity. The data indicates that diversity of butterflies reduces at high altitudes due to their atmospheric condition such as less variability of nectar plant and temperature exposure, whereas diversity of butterflies higher in lower altitudes due to abundance of different nectar host plant, and temperature.

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