

Preliminary Studies on Butterfly Fauna of Chail Wildlife Sanctuary, Shimla, Himachal Pradesh

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Abstract: Biodiversity is one of the important aspects of sustainable development and represents biological wealth of a nation but the world is facing its greatest ever biodiversity crisis and diversity in the living world is staggering, therefore it needs to be conserved and it would have been impossible to deal with enormous diversity if such a significant data is not timely classified and documented. In this envision, a one year study was carried out in Chail Wildlife Sanctuary of Himachal Pradesh during the March 2017 to Feb 2018. The study aims to make a checklist of butterflies so as to find the threatened taxa and make a preliminary note on their conservation strategy. Present study revealed that a total of 53 species of butterflies belonging to five families i.e. Nymphalidae, Papilionidae, Pieridae, Lycaenidae and Hesperidae were found. The family Nymphalidae was most dominant with 23 species followed by 12 species of family Pieridae, 11 species of the family Lycaenidae, 4 species of the family Papilionidae and 3 species of the family Hesperidae. Percentage composition showed that the family Nymphalidae constituted about 43 % of total butterfly fauna followed by Pieridae (23 %), Lycaenidae(21%), Papilionidae (8%) and of the family Hesperidae (5 %). Species diversity was found highest in the family Lycaenidae (2.31) and lowest in the family Pieridae (0.78), evenness was highest in the family Nymphalidae (7.77) and lowest in the family Hesperidae (1.22). Similarly species richness was highest in the family Papilionidae (0.93) and lowest in the family Nymphalidae (0.39). The study of butterfly fauna and their characters provide crucial information on the ecology of an area; they act as good bioindicators, play a major role in pollination of different flowering plants thus is an important group of ecology and conservation and can forecast the conservation status of any given area. So the studies on monitoring the species diversity and their abundance provide crucial information on their population dynamics and a detailed study of butterfly diversity in these areas is in progress.

Keywords: Butterfly, diversity, population, bioindicators, conservation

1. Introduction

Insects are the most diverse group among living organisms the order Lepidoptera is probably one of the most suitable groups for most quantitative comparisons between various insect fauna^[1,2]. Butterflies are taxonomically well studied group among insects which have received much attention among entomologists throughout the world^[3].

Approximately 19,000 species of butterflies have been documented throughout the world^[4] out of which 1,501 have been found in India^[5]. Among insects the butterflies occupy an important place in ecosystem as their diversity is a good indicator of health status of any terrestrial biotope^[6]. Most of them are monophagous and are very specific to their host plant^[7] hence they act as good indicators of any human impacted disturbance and habitat quality^[8]. The study of butterfly fauna and their characters provide crucial information on the ecology of an area; they act as good bioindicators because healthy environment is directly related to rich biodiversity and thus they can forecast the conservation status of any given area^[9]. Since highly sensitive to climatic changes, they are very much prone to be affected by minor disturbances in environment^[10] and their cospecificity with the host plants for feeding and egg laying renders them unable to adjust with the changed environmental conditions. Besides being a major part of the food chain they also play a major role in pollination of different flowering plants thus is an important group of ecology and conservation^[11,12]. Due to unscientific management, change in climatic conditions, increase in population, exploitation of food resources and environmental pollution the native butterflies are disappearing fast and their population may decline in the coming years^[13,14,15] and once the diversity is lost, it cannot

be recreated and is permanent damage to ecosystems. Biodiversity is one of the important aspects of sustainable development and represents biological wealth of a nation but the world is facing its greatest ever biodiversity crisis and diversity in the living world is staggering, therefore it needs to be conserved and it would have been impossible to deal with enormous diversity if such a significant data is not timely classified and documented. The focus on biodiversity indicator species becomes an important factor due to climatic changes as this could be useful for the organisations which are working on the diversity conservation. Efforts are therefore required to conserve the biodiversity and studies related to it are necessary for the sustainable development. It is thus encouraging that the butterflies are being included in biodiversity study and conservation programmes. Therefore, an attempt has been made to study the diversity and distribution of butterfly fauna of Chail wild life sanctuary, Shimla, Himachal Pradesh during 2017-2018.

2. Methodology

(a) Study Site

Himachal Pradesh lies in Indian Himalayas and is situated between 30°22' to 33°12' North latitude and 75°47' to 79°04' East longitude ranging from 350 to 7000 meters above main sea level (amsl). The present study was conducted in the Chail Wildlife Sanctuary of Himachal Pradesh. This Sanctuary is situated in the Himalayan ranges at an altitude ranging from 1980m to 2455m amsl. The latitude and longitude of the sanctuary is 30°22'N to 33°12' N and 75°45'E to 79°04'E respectively and has an area of 110 sq Km. The above area had been selected to study the butterfly diversity surveys were carried out during three different seasons (Premonsoon, Monsoon and Postmonsoon) during the year Feb 2017-Jan 2018.

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(b) Collection and preservation of specimen

Butterflies were collected by using Pollard walk method^[16,17]. A sweep net was used to trap the butterfly fauna appearing at the sites. To collect the butterflies, killing jars were used which had been thoroughly fumigated with 8-10 drops of ethyl acetate. After making sure that the specimen is dead it was pinned vertically in the middle of thorax. Method of Arora^[18] was used with necessary modifications for the stretching of specimen which were kept at safe place to allow the proper drying and preserved in fumigated insect storage boxes.

(c) Identification of butterflies

The butterfly species were identified from relevant literature^[19,20,21,22,23,24,25,26,27,28], and their comparison with reference collection housed at Forest Research Institute (F.R.I.), Dehradun.

(d) Diversity analysis

(i) Shannon-Wiener diversity Index : The species diversity will be calculated following ShannonWiener diversity Index (Shannon and Weiner,1949)^[29].

$$H = - \sum_{i=1}^S (N_i/N) \ln (N_i/N)$$

Where N_i = Number of individuals of species i and N = Total number of individuals of all the species.

(ii) Evenness index : Evenness Index was calculated using the method of Hill (Hill,1973)^[30].

$$E = H / \ln S$$

Where S = Total number of species, N = Total number of individuals of all the species, H = Index of diversity.

(iii) Margalef's Index : Margalef's index was used as a simple measure of species richness (Margalef,1970)^[31].

$$\text{Margalef's index} = (S-1) / \ln N$$

where S = Total number of species, N = Total number of individual in sample, \ln = Natural logarithm

3. Results and Discussion

The study revealed the presence of 53 species of butterflies in the study area. In terms of number of species composition family Nymphalidae was found to be dominant with 23 species, Pieridae 12 species, Lycanidae 11 species, Papilionidae 4 species and Hesperidae with 3 species. In terms of percentage composition (Fig. 1), Nymphalidae constituted about 43% of total butterfly fauna followed by 22% Pieridae, 21 % Lycanidae, 7% Papilionidae and 5% of Hesperidae. Species diversity was found highest in Lycanidae (2.31) and lowest in Family Pieridae (0.78), evenness was highest in family Nymphalidae (7.77) and lowest in Hesperidae (1.22). Similarly species richness was highest in family Papilionidae (0.93) and lowest in Nymphalidae (0.39). Similar pattern of distribution and predominance of Nymphalidae in Pakistan^[32]. In Assam out of 70 found species 40 species belonged to Nymphalidae^[33]. Similar results were also recorded for different families of butterflies in various parts of the India^[34] and predominance of family Nymphalidae has been found which indicated that nymphalid butterflies have a much higher diversity.^[35] Butterfly diversity depends upon the floral diversity thus study on ecologically important local butterflies in various habitats offer valuable information on their population

dynamics^[36,37]. Butterflies diversity represented by the family Papilionidae and Hesperidae was observed to be very low as compared to other families which is similar with the earlier studies.^[38] This is the first survey of butterfly fauna and documentary report of the mentioned area. The earlier researchers reported the butterfly fauna from different region of the country and other countries of the world. A total of 98 butterfly species were recorded from the different areas of the Kangra and Hamirpur Districts, which belong to five families i.e. Nymphalidae, Pieridae, Papilionidae, Lycaenidae and Hesperidae.^[39] A survey in Chansal Valley of District Shimla reported only 29 species of butterflies^[40]. 35 species were recorded in Mandi district of Himachal Pradesh in which maximum number of species belonged to family Pieridae followed by Nymphalidae^[41]. This difference may be due to the altitude variation or different weather conditions during collection periods but both the areas have much more similarities. The present investigation revealed that this Sanctuary is rich in both floral and faunal wealth including butterflies. However its biological diversity has not been documented till date. We cannot conclude whether the butterfly fauna of the area is increasing or decreasing. The area needs to be continuously monitored and efforts should be made to document its unknown floral and faunal wealth and there is essential need to have a vision document on the sustainable development and conservation of its rich biodiversity.

Table 1: Table showing the Butterfly Diversity, Richness and Evenness index of studied area

Family	No. of species	Species Diversity	Species Evenness	Species richness
Nymphalidae	23	1.09	7.77	0.39
Pieridae	12	0.78	4.13	0.41
Lycaenidae	11	2.31	3.73	0.41
Papilionidae	4	1.31	2.55	0.93
Hesperidae	3	0.69	1.22	0.66

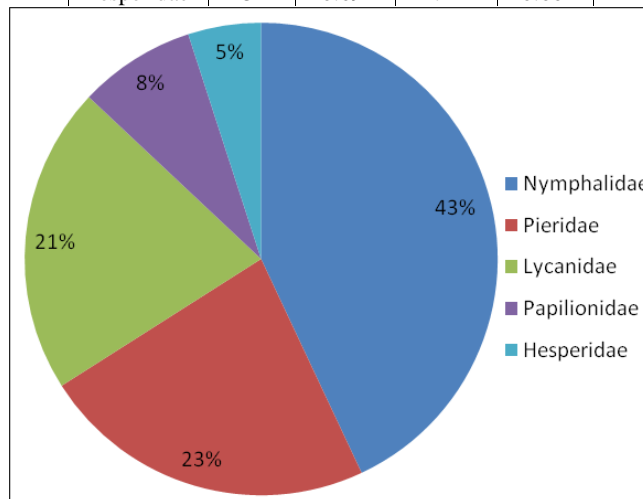


Figure 1: Pie chart showing percentage composition of different families of Butterfly species of study area

Table 2: Checklist of Butterfly species collected from Chail wildlife sanctuary of Shimla, Himachal Pradesh.

S.No.	Scientific Name	Common Name	Family
1	<i>Lethe rohria</i>	Common Tree Brown	Nymphalidae
2	<i>Tanacia jahnu</i>	Plain Earl	Nymphalidae
3	<i>Euthalia lubentina</i>	Gaudy Brown	Nymphalidae
4	<i>Kallima inachus</i>	Orange Oak Leaf	Nymphalidae
5	<i>Elymnias hypermnestra</i>	Common Palm Fly	Nymphalidae
6	<i>Argyreus hyperbius</i>	The Indian Fritillary	Nymphalidae
7	<i>Cupha erymanthis</i>	The Rustic	Nymphalidae
8	<i>Junonia hierta</i>	The Yellow Pansy	Nymphalidae
9	<i>Lethe naga</i>	Naga Tree Brown	Nymphalidae
10	<i>Phalantha phalantha</i>	The Common Leopard	Nymphalidae
11	<i>Issoria lathonia</i>	Queen Of Spain Fritillary	Nymphalidae
12	<i>Callerabia ananda</i>	Ringed Argus	Nymphalidae
13	<i>Parantica aglea</i>	Glassy Tiger	Nymphalidae
14	<i>Danaus chrysippus</i>	Plain Tiger	Nymphalidae
15	<i>Euploea klugii</i>	The King Crow	Nymphalidae
16	<i>Lassiommata schkara</i>	Common Wall	Nymphalidae
17	<i>Vanessa cardui</i>	Painted Lady	Nymphalidae
18	<i>Fabriciana adippe</i>	High Brown Fritillary	Nymphalidae
19	<i>Kaniska carnace</i>	The Blue Admiral	Nymphalidae
20	<i>Notocrypta fiesthmalli</i>	The Spotted Demon	Nymphalidae
21	<i>Athyma jina</i>	Bhutan Sergeant	Nymphalidae
22	<i>Junonia orithiya</i>	Blue Pansy	Nymphalidae
23	<i>Aglais cashmirensis</i>	Small Tortoise Shell	Nymphalidae
24	<i>Eurema hecabe</i>	Common Grass Yellow	Pieridae
25	<i>Eurema brigitta</i>	Small Grass Yellow	Pieridae
26	<i>Genopteryx rhamnii</i>	Common Brimstone	Pieridae
27	<i>Colias fieldii</i>	Dark Clouded Yellow	Pieridae
28	<i>Pieris brassicae</i>	Large Cabbage White	Pieridae
29	<i>Pieris rapae</i>	Cabbage White	Pieridae
30	<i>Colias erate</i>	Pale Clouded Yellow	Pieridae
31	<i>Pontia daplidice</i>	The Bath White	Pieridae
32	<i>Delias belladonna</i>	The Hill Jezebel	Pieridae
33	<i>Eurema laeta</i>	Spotless Grass Yellow	Pieridae
34	<i>Belenois aurota</i>	Pioneer White	Pieridae
35	<i>Aporia agathon</i>	Great Blackvein	Pieridae
36	<i>Lycaena pavanna</i>	White Bordered Copper	Lycanidae
37	<i>Heliophorus cena</i>	Soral Sapphire	Lycanidae
38	<i>Zizzeria karsandra</i>	Dark Glass Blue	Lycanidae
39	<i>Athene emolus</i>	The Ciliate Blue	Lycanidae
40	<i>Polyommatus icarus</i>	Common Blue	Lycanidae
41	<i>Pseudozizzeria maha</i>	Pale Grass Blue	Lycanidae
42	<i>Lycaena phaleus</i>	Common Copper	Lycanidae
43	<i>Heliophorus epicles</i>	Purple Sapphire	Lycanidae
44	<i>Celastrina lavendularis</i>	The Plain Hedge Blue	Lycanidae
45	<i>Arhopala rama</i>	Dark Oakblue	Lycanidae
46	<i>Aricia astrarache</i>	Orange Bordered Argus	Lycanidae
47	<i>Parnassius hardwickii</i>	Common Blue Appollo	Papilionidae
48	<i>Papilio machaon</i>	Common Yellow Swallowtail	Papilionidae
49	<i>Atrophaneura polyeuctus</i>	Common Windmill	Papilionidae
50	<i>Papilio clytia</i>	Common Mime	Papilionidae
51	<i>Celaenorhinus auritivitta</i>	Dark Yellow Banded Flat	Hesperidae
52	<i>Pseudocoladenia dandan</i>	Fulvous Pied Flat	Hesperidae
53	<i>Polanthus dara</i>	Himalayan Dart	Hesperidae

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