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Diversity of winter-flying butterflies in Shiwaliks of Hamirpur district (Himachal Pradesh)

Avtar kaur Sidhu[1], Gurinder Kaur Walia[2*], Jyoti Mahil[3]

[1] Officer In charge, Scientist-E, High Altitude Regional Centre, Zoological survey of India, Solan, Himachal Pardesh, India

[2] Associate Professor, Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India

[3] Research Scholar, Department of Zoology and Environmental Sciences, Punjabi University, Patiala, Punjab, India

Abstract
Butterflies diversity is rich in Himachal Pradesh due to varied altitudes and consequently the climatic conditions. Butterflies are also one of the most beautiful insects that also play an important role in sustaining environmental health as they are plant pollinators. Their sensitivity to environmental makes them indicator species for a variety of climates and habitat types. Butterflies are poikilothermic and hibernate in winter in pupal/larval/egg/adult stage. Only the hard species can survive in the winter temperatures. The present study has been conducted in the Hamirpur District of Himachal Pradesh on the abundance of butterfly fauna in winter season. A total of 16 species were recorded at low temperatures and humidity belonging to 3 families i.e. Nymphalidae 50%> Lycaenidae 37.5%> Pieridae 12.5%. 8 species of Nymphalidae, 6 species of Lycaenidae and 2 species of Pieridae were recorded. The minimum temperature and humidity noted was 3°C and 51% and the maximum temperature and humidity noted was 17°C and67% respectively. The most common species observed were *Junonia lemonias*, *Melanitis leda*, *Eurema hecabe* and *Pieris canidia.*

Keywords: butterflies, temperature, humidity, winter, lepidoptera

Introduction
There is ambiguity in the origin of word "Butterfly". In old English, the word for butterfly is "*buter-fleoge"*, in German, the word is "*butter-fliege"*, and in Dutch, the word is "*buter-fleoge"*. The explanation might be that butterflies emerge in spring which is coincided with butter producing time. Butterflies are the insects that belongs to class Insecta and order Lepidoptera. They are present throughout the world except Antarctica [5]. Order Lepidoptera comprises of approximately 15,578 Genera and 157,424 Species out of which nearly 19,000 species of butterflies and skippers are present worldwide. Superfamily Papilionoidea consist of 7 families of butterflies i.e. Papilionidae, Hesperiidae, Pieridae, Riodinidae, Lycaenidae, Nymphalidae, Hedylidae [3]. There are approximately 1,318 number of species of butterflies present in India of which nearly 12 genera and 89 species of family Papilionidae, 87 genera and 277 species of family Hesperiidae, 24 genera and 92 species of family Pieridae, 5 genera and 19 species of family Riodinidae, 135 genera and 380 species of family Lycaenidae and 120 genera and 461 species of family Nymphalidae are present in India[8].Various studies has been conducted on the diversity of butterflies in different parts of Himachal Pradesh. A total of 49 species are reported from Renuka Lake and its vicinity [6]. 29 species are reported from Chansal Valley of district Shimla [2]. 75 species are reported from Great Himalayan Conservation Landscape area of Himachal Pradesh [7], whereas recorded 77 species are recorded from Hamirpur District [1]. Lepidopterans are cold blooded creatures i.e. they cannot regulate their body temperatures. Minimum 30°C temperature is required for the active flight and to rise the body temperature, they acquire through various thermoregulation methods. Whereas moths have muscular body and they raise the body temperature by shivering, in butterflies due to less muscular body in addition to shivering, they also follow basking patterns. Mostly butterflies and moths hibernate in winter due to extreme cold in Himalayan region but only very few species survive in these cold temperatures. During present studies, the winter flying butterflies have been recorded in Hamirpur District of Himachal Pradesh.

Material and Methods
Study Area
Hamirpur district is the smallest district of Himachal Pradesh with an area of 1,118 KM². It is covered by Shivalik Range and lies in the South-West part of the state. It is located between 76°18' to 76°44' East Longitudes and 31°25' to 31°52' North Latitude. The elevation of the district ranges from 400 metres to 1100 metres and it lies in Shivalik range of Himalaya with mixed forests. A number of water streams are present in the district which are the tributaries of Sutlej and Beas River. The temperature varies from 20°C to 40°C in summer and 2°C to 20°C in winter. Total forest cover of the district is 354.90 KM². The fauna of the district include Sambhar, Monkeys, peacock, chakor, woodpecker, leopard, hare, wild boar etc.

Methods
Different areas from Hamirpur district were surveyed to assess the diversity of butterflies in winter season. The observations were made from a time period between 8:30 hrs. to 16:00 hr. The sites for collection were selected randomly within the district. Insect nets were used to catch the butterflies. Pollard walk method was also used

sometimes i.e. walking through a particular path on regular basis where butterflies were previously recorded [4].

Result and Observations

A total of 16 species of butterflies belonging to 15 genera were observed from the month of November to January from the study area. The maximum temperature noted during this duration was 19°C and minimum temperature noted was 3°C. Butterflies of 3 families and 15 genera were observed during the survey, that is, Nymphalidae, Lycaenidae, and Pieridae. 8 species from the family Nymphalidae belonging to 7 different genera and 5 subfamilies, 6 species from family Lycaenidae belonging to 6 different genera and 2 subfamilies, 2 species from family Pieridae belonging to 2 different genera and 2 subfamilies were observed. It has been observed that butterflies belonging to family Nymphalidae and Pieridae were present in maximum and minimum number respectively. No species from family Riodinidae, Hesperiidae and Papilionidae were observed. It has also been observed that butterflies were mostly active in the peak hours when the temperature was approximately 14°C to 17°C. The most common butterflies observed were *Junonia lemonias*, *Melanitis leda*, *Eurema hecabe* and *Pieris canidia.*

Table 1: List of collected species with temperature and humidity.

Sr. No.	Scientific name	Common Name	Family	Subfamily	Tribe	Temperature	Humidity
1.	*Euploea core* (Cramer, 1780)	Common Crow	Nymphalidae	Danainae	Euploeini	16°C	59%
2.	*Parantica aglea* (Stoll, 1782)	Glassy Tiger	Nymphalidae	Danainae	Danaini	17°C	61%
3.	*Phalanta phalantha* (Drury, 1773)	Common Leopard	Nymphalidae	Heliconiinae	Heliconiini	16°C	60%
4.	*Neptis hylas* (Linnaeus, 1758)	Common Sailer	Nymphalidae	Limenitidinae	Limenitidini	15°C	67%
5.	*Junonia lemonias*(Linnaeus, 1758)	Lemon Pansy	Nymphalidae	Nymphalinae	Junoniini	14°C	65%
6.	*Junonia iphita*(Cramer, 1780)	Chocolate Pansy	Nymphalidae	Nymphalinae	Junoniini	14°C	65%
7.	*Vanessa indica* (Herbst, 1794)	Indian Red Admiral	Nymphalidae	Nymphalinae	Nymphalini	17°C	51%
8.	*Melanitis leda*(Cramer, 1780)	Common Evening Brown	Nymphalidae	Satyrinae	Melanitini	14°C	65%
9.	*Syntarucus plinius* (Fabricius, 1793)	Zebra Blue	Lycaenidae	Polyommatinae	Polyommatini	14°C	65%
10.	*Nacaduba nora* (de Niceville, 1884)	Common line blue	Lycaenidae	Polyommatinae	Polyommatini	14°C	65%
11.	*Tarucus species*	Blue Pierrots	Lycaenidae	Polyommatinae	Polyommatini	17°C	59%
12.	*Acytolepis puspa* (Horsfield, 1828)	Common Hedge Blue	Lycaenidae	Polyommatinae	Polyommatini	14°C	65%
13.	*Pseudozizeeria maha* (Kollar, 1844)	Pale Grass Blue	Lycaenidae	Polyommatinae	Polyommatini	14°C	58%
14.	*Arhopala sp.*	Oak blues	Lycaenidae	Theclinae	Arhopalini	15°C	67%
15.	*Eurema hecabe*(Linnaeus, 1758)	Common Grass Yellow	Pieridae	Coliadinae	Euremini	16°C	60%
16.	*Pieris canidia* (Linnaeus, 1768)	Asian Cabbage White	Pieridae	Pierinae	Pierini	15°C	63%

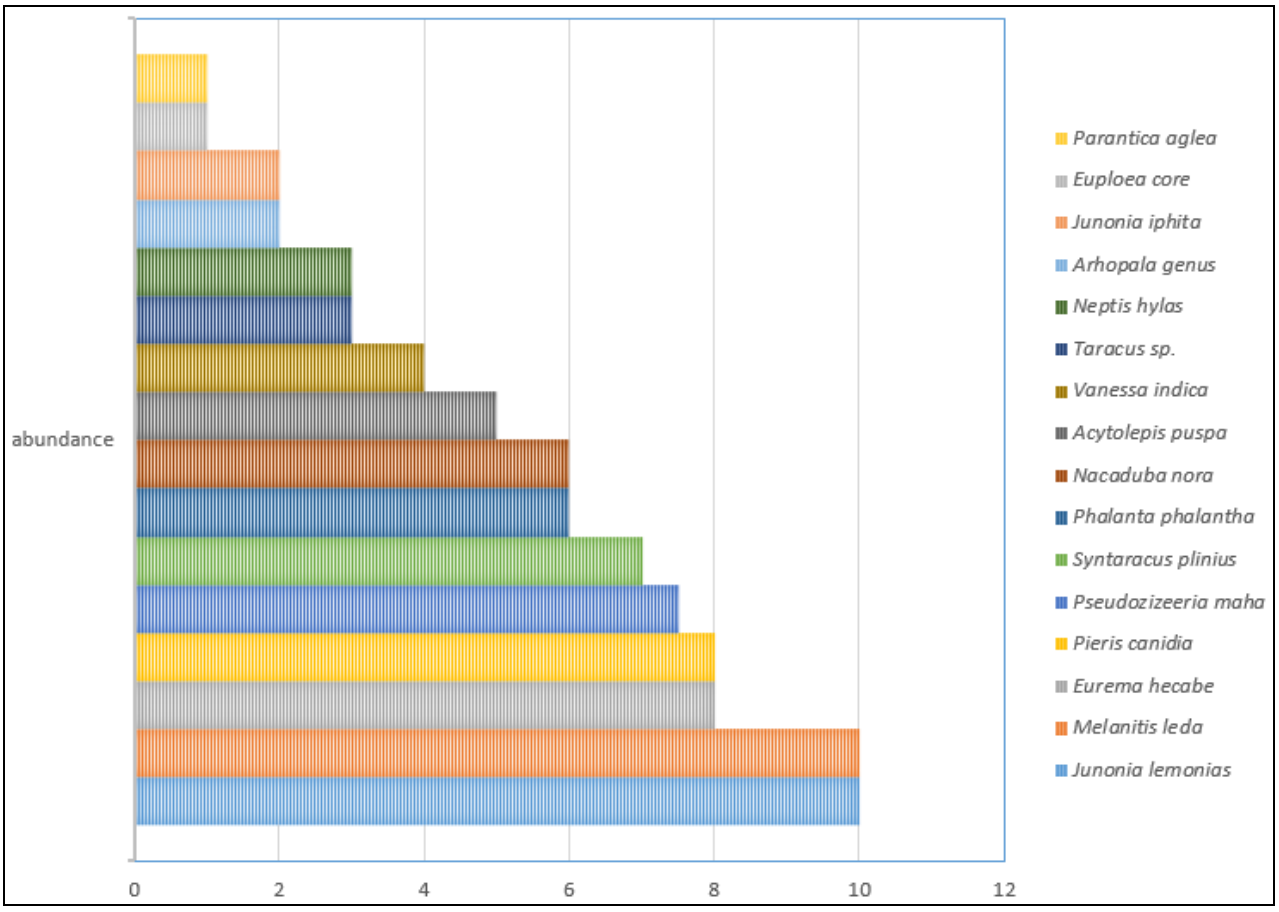

Fig 1: Species wise abundance

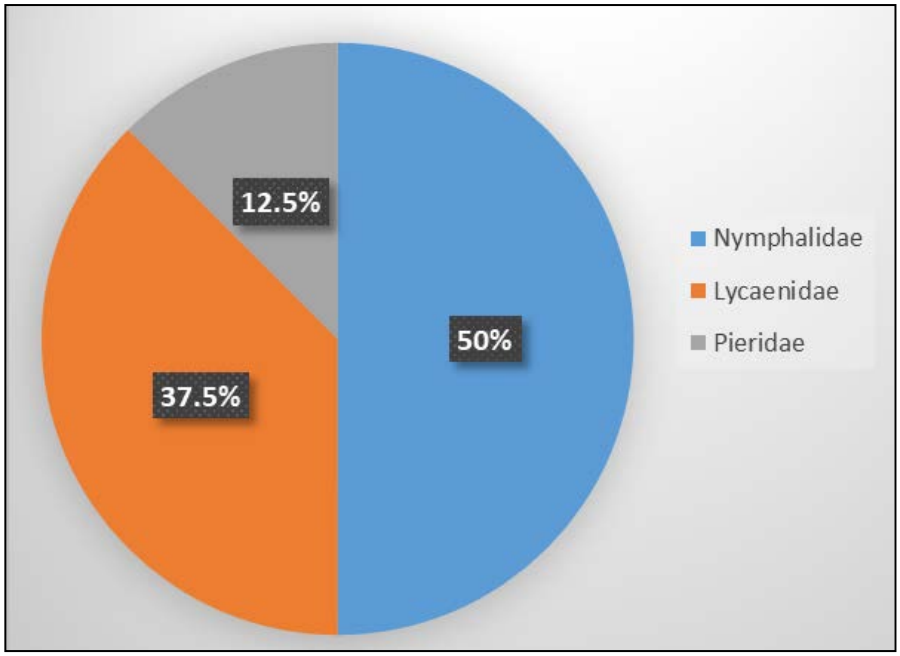

Fig 2: Family wise abundance

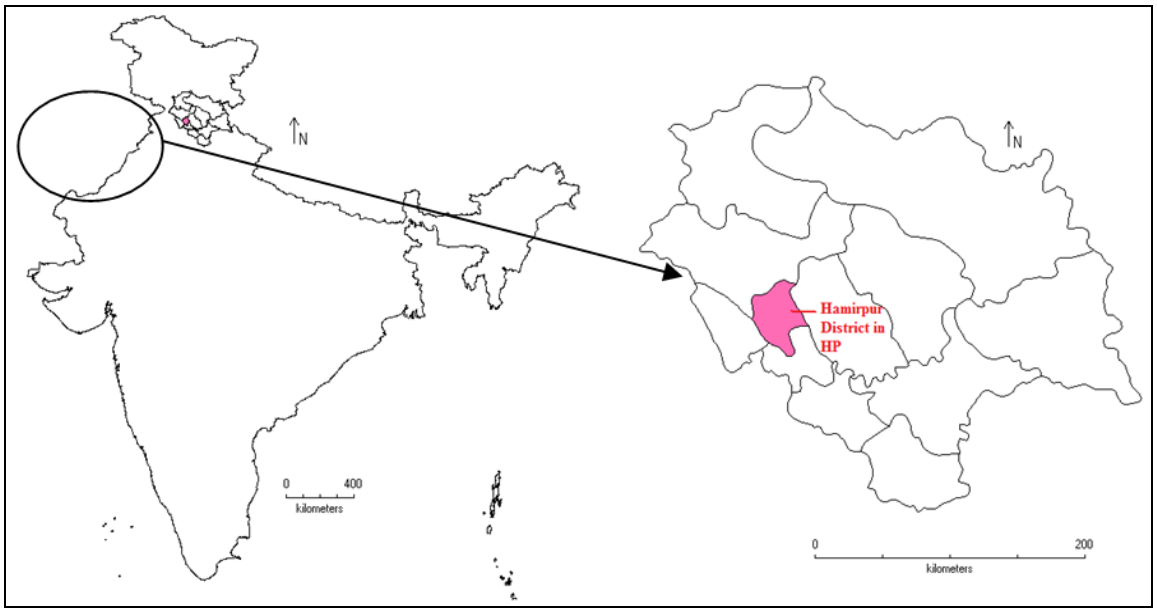

Fig 3: Location of Himachal Pradesh and District Hamirpur in India

Parantica aglea

Phalanta phalantha

Pieris canidia

Pseudozizeeria maha

Acytolepis puspa

Eurema hecabae

Junonia iphita

Junonia lemonias

Melanitis leda *Nacaduba nora*

Fig 4

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