

Butterfly Diversity from the Foothill Region of Dhauladhar Ranges Kangra Valley, North-West Himalaya, India

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ABSTRACT

The present study was carried out in the complex geo-botanical landscape of the Kangra valley located in the foothill region of Dhauladhar ranges, North-west Himalaya, India. The study aims to present the checklist of butterfly diversity recorded through some well-planned surveys in the year 2016 and opportunistic sighting from 2016-2020. A total of 88 butterfly species were identified belonging to 62 genera and 6 families. The family Nymphalidae was found most abundant containing 42 species, followed by Lycaenidae (13), Pieridae (12), Hesperidae (10), Papilionidae (9) and Riodinidae (2). The study also documented the presence of some of the rare butterfly species including, *Horaga onyx*, *Euchrysops cnejus* and *Hypolimnas misippus* the study area. The preliminary

checklist of the butterfly diversity will help to make a future connection between the changing climate and further to facilitate the conservation of the Himalayan ecosystem.

Keywords Conservation, Himalayan ecosystem, Lepidoptera, Species diversity.

INTRODUCTION

The role of the insects has been emphasized for the sustenance of the ecosystem and maintaining its ecological services. Insects have their functional role in pollination, pest control, nutrient decomposition and maintenance of the ecosystem (Losey and Vaughan 2006, Mukherjee *et al.* 2015). Butterflies are most commonly used as bio-indicator in ecological studies for monitoring the health of the ecosystem as they are charismatic and respond very quickly to habitat diversity and microclimate of the area (New *et al.* 1995, Koh 2007, Bonebrake *et al.* 2010, Harsh 2014,

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Kumar *et al.* 2020). Their taxonomy, distribution, short life span and day-flying behavior also make them a good subject to study the environmental quality. Several researchers and biologists also suggested the butterfly as a good bio-indicator and its role in the conservation of forest community (Bhardwaj *et al.* 2012). The diversity of butterflies can be beneficial for habitat management and a prerequisite for making future conservation strategies.

The Indian Himalayan Region (IHR) is identified

as a mega hot spot for biological diversity (Myer 2000, Kumar 2014). The unique geo-botanical assemblage is a boon in the area that encompasses a long history of climatic and tectonic oscillation for the present condition. The Himalayan mountainous ecosystem is even not untouched from overexploitation, habitat loss and illegal trade (Gupta and Mondal 2005). This region is also on the verge of modernization, urbanization and tourism activity that lead to degradation of natural habitat. Several studies have been carried out to access butterfly diversity in past covering north-western Hi-

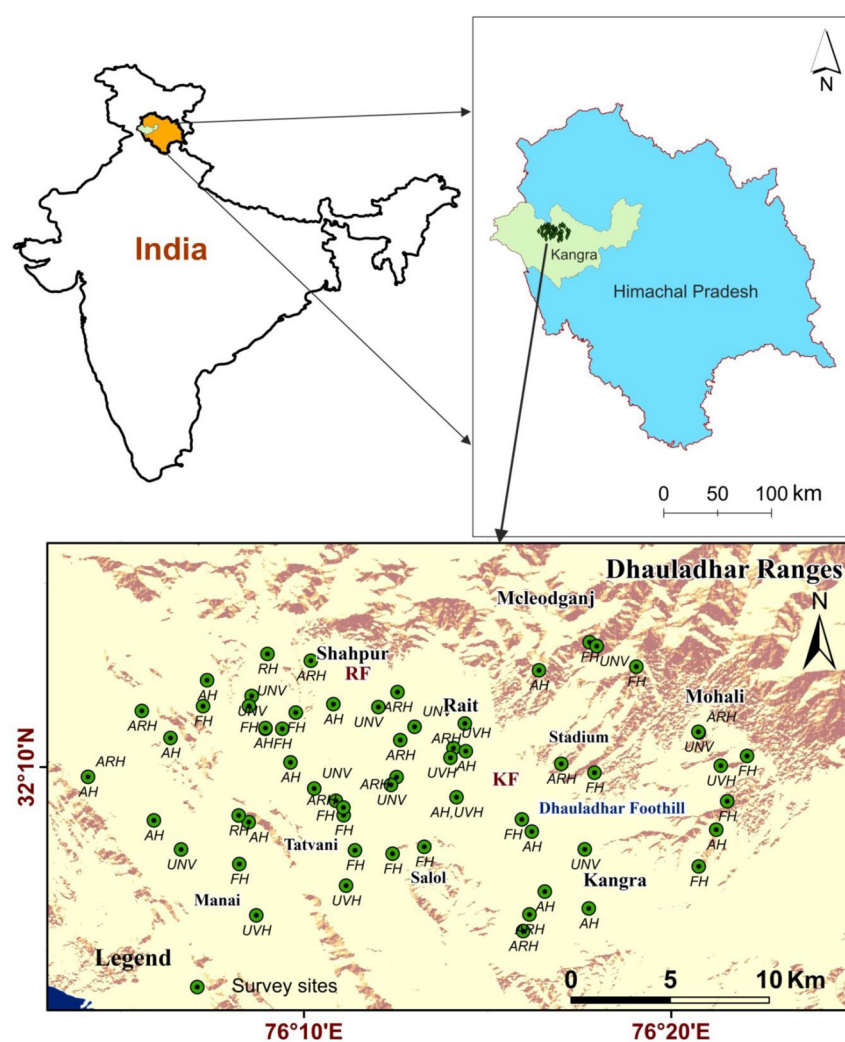


Fig. 1. Sites covered for butterfly documentation from the foothill region of Dhauladhar ranges, Kangra valley, north-western Himalaya, India. Abbreviation: AH= Agricultural habitat; FH= Forest habitat; RH= Rural habitat; ARH= Agricultural rural habitat; UNV= Urban area with less vegetation; UVH= Urban area with vegetation.

Table 1. Butterfly diversity in foothill region of Dhauladhar ranges, Kangra valley NW Himalaya, India. Abbreviation: C= Common, FC= Fairly common, UN= Uncommon, R= Rare.

Sl. No.	Common name	Scientific name	Abundance	Status under wildlife (Protection) Act 1972
Family: Hesperidae (10)				
1	Common Spotted Flat	<i>Celaenorrhinus leucocera</i> (Kollar 1844)	R	
2	Conjoined Swift	<i>Pelopidas conjuncta</i> (Herrich-Schäffer 1869)	FC	
3	Fulvous Pied Flat	<i>Pseudocoladenia dan</i> (Fabricius 1787)	FC	
4	Grass Demon	<i>Udaspes lolus</i> (Cramer 1775)	UN	
5	Indian Orange-tailed Awl	<i>Bibasis sena</i> (Moore 1866)	R	
6	Indian Palm Bob	<i>Suastus gremius</i> (Fabricius 1798)	UN	
7	Indian Skipper	<i>Spialia galba</i> (Fabricius 1793)	FC	
8	Spotted Small Flat	<i>Sarangesa dasahara</i> (Moore 1866)	C	
9	Spotted Snow Flat	<i>Tagiades menaka</i> (Moore 1866)	R	
10	Straight Swift	<i>Parnar a gunatus</i> (Bremer & Grey 1852)	UN	
Family: Lycaenidae (13)				
11	Common Copper	<i>Lycaena phlaeas</i> (Linnaeus 1761)	UN	
12	Common Flash	<i>Rapala nissa</i> (Kollar 1844)	UN	
13	Common Hedge Blue	<i>Acytolepis puspa</i> (Horsfield 1828)	FC	
14	Common Onyx	<i>Horaga onyx</i> (Moore 1858)	UN	Schedule II
15	Forget-me-not	<i>Catochrysops strabo</i> (Fabricius 1793)	UN	
16	Gram Blue	<i>Euchrysops cnejus</i> (Fabricius 1798)	R	Schedule II
17	Hill Hedge Blue	<i>Celastrina argiolus</i> (Linnaeus 1758)	FC	
18	Pale Grass Blue	<i>Pseudo zizeeria maha</i> (Kollar 1844)	FC	
19	Red Pierrot	<i>Talicaadanyses</i> (Guérin-Méneville 1843)	UN	
20	Slate Flash	<i>Rapala manea</i> (Hewitson 1863)	UN	
21	Sorrel Sapphire	<i>Heliophorus sena</i> (Kollar 1844)	R	
22	Veined Pierrot	<i>Tarucus venosus</i> (Moore 1882)	R	
23	Zebra Blue	<i>Leptotes plinius</i> (Fabricius 1793)	R	
Family: Nymphalidae (43)				
24	Anomalous Nawab	<i>Charaxes agrarius</i> (Swinhoe 1887)	R	
25	Bamboo Treebrown	<i>Lethe europa</i> (Fabricius 1775)	UN	
26	Banded Treebrown	<i>Lethe confusa</i> (Aurivillius 1898)	FC	
27	Blue Admiral	<i>Kaniska canace</i> (Linnaeus 1763)	R	
28	Blue Pansy	<i>Junonia orithya</i> (Linnaeus 1758)	C	
29	Blue Tiger	<i>Tirumala limniace</i> (Cramer 1775)	UN	
30	Broad-banded Sailer	<i>Neptis sankara</i> (Kollar 1844)	R	
31	Chocolate Pansy	<i>Junoni aiphita</i> (Cramer 1779)	FC	
32	Club Beak	<i>Libythea myrrha</i> (Godart 1819)	FC	
33	Common Baron	<i>Euthalia aconthea</i> (Cramer 1777)	C	
34	Common Castor	<i>Ariadne merione</i> (Cramer 1777)	C	
35	Common Crow	<i>Euploea core</i> (Cramer 1780)	C	
36	Common Evening Brown	<i>Melanitis leda</i> (Linnaeus 1758)	UN	
37	Common Fivering	<i>Ypthima baldus</i> (Fabricius 1775)	FC	
38	Common Jester	<i>Symbrenthia lila</i> (Hewitson 1864)	UN	
39	Common Leopard	<i>Phalanta phalantha</i> (Drury 1773)	C	
40	Common Map	<i>Cyrestis thyodamas</i> (Boisduval 1840)	R	
41	Common Sailer	<i>Neptis hylas</i> (Linnaeus 1758)	C	
42	Common Satyr	<i>Aulocera swaha</i> (Kollar 1844)	R	
43	Common Sergeant	<i>Athyma perius</i> (Linnaeus 1758)	C	
44	Common Threering	<i>Ypthima asterope</i> (Klug 1832)	FC	
45	Common Treebrown	<i>Lethe rohri</i> (Fabricius 1787)	R	
46	Danaid Eggfly	<i>Hypolimnas misippus</i> (Linnaeus 1764)	R	Schedule I and II
47	Dark-branded Bushbrown	<i>Mycalasis mineusmineus</i> (Linnaeus 1758)	FC	
48	Double Branded Crow	<i>Euploea sylvester</i> (Fabricius 1793)	UN	
49	Glassy Tiger	<i>Parantica aglea</i> (Stoll 1782)	UN	
50	Grey Pansy	<i>Junonia atlites</i> (Linnaeus 1763)	UN	

Table 1. Continued.

Sl. No.	Common name	Scientific name	Abundance	Status under wildlife (Protection) Act 1972
51	Himalayan Chestnut Tiger	<i>Parantica sita sita</i> (Kollar 1844)	R	
52	Himalayan Tortoiseshell	<i>Aglaia cashmirensis</i> (Kollar 1844)	FC	
53	Hybrid Argus	<i>Callerebia hybrida</i> (Butler 1880)	R	
54	Indian Fritillary	<i>Argyreus hyperbius</i> (Linnaeus 1763)	FC	
55	Indian Red Admiral	<i>Vanessa indica</i> (Herbst 1794)	UN	
56	Lemon Pansy	<i>Junonia lemonias</i> (Fruhstorfer 1758)	C	
57	Orange Oakleaf	<i>Kallima inachus</i> (Doyere 1840)	UN	
58	Painted Lady	<i>Vanessa cardui</i> (Linnaeus 1758)	UN	
59	Peacock Pansy	<i>Junonia almana</i> (Linnaeus 1758)	UN	
60	Plain Tiger	<i>Danaus chrysippus</i> (Linnaeus 1758)	R	
61	Striped Blue Crow	<i>Euploea mulciber</i> (Cramer 1777)	UN	Schedule IV
62	Striped Tiger	<i>Danaus sgenutia</i> (Cramer 1779)	R	
63	Tabby	<i>Pseudergolis wedah</i> (Kollar 1844)	R	
64	Vagrant	<i>Vagrans egista</i> (Cramer 1780)	UN	
65	Yellow Coster	<i>Acraea issoria anomala</i> (Kollar 1819)	UN	
66	Yellow Pansy	<i>Junonia hierta</i> (Fabricius 1798)	UN	
Family: Papilionidae (9)				
67	Common Bluebottle	<i>Graphium sarpedon</i> (Linnaeus 1758)	R	
68	Common Lime	<i>Papilio demoleus</i> (Linnaeus 1758)	R	
69	Common Mormon	<i>Papilio polytes</i> (Linnaeus 1758)	C	
70	Common Peacock	<i>Papilio bianor</i> (Cramer 1777)	UN	
71	Common Rose	<i>Pachliopta aristolochiae</i> (Fabricius 1775)	R	
72	Glassy Bluebottle	<i>Graphium cloanthus</i> (Westwood 1841)	UN	
73	Lesser Punch	<i>Dodona dipoea</i> (Hewitson 1866)	R	Schedule II
74	Spangle	<i>Papilio protenor</i> (Cramer 1775)	UN	
75	Yellow Swallowtail	<i>Papiliomachaon</i> (Linnaeus 1758)	UN	
Family: Pieridae (12)				
76	Common Brimstone	<i>Gonepteryx hamni</i> (Linnaeus 1758)	UN	
77	Common Emigrant	<i>Catopsilia pomona</i> (Fabricius 1775)	UN	
78	Common Grass Yellow	<i>Eurema hecabe</i> (Linnaeus 1758)	C	
79	Common Jezebel	<i>Delias eucharis</i> (Drury 1773)	R	
80	Dark Clouded Yellow	<i>Colia sfieldii</i> (Menetries 1855)	UN	
81	Great Blackvein	<i>Aporia agathon</i> (Gray 1831)	R	Schedule IV
82	Hill Jezebel	<i>Delias belladonna</i> (Fabricius 1793)	UN	
83	Indian Cabbage White	<i>Pieris canidia</i> (Linnaeus 1758)	C	
84	Mottled Emigrant	<i>Catopsilia pyranthe</i> (Linnaeus 1758)	UN	
85	Pioneer	<i>Belenois aurota</i> (Fabricius 1793)	UN	
86	Small Grass Yellow	<i>Eurema brigitta</i> (Stoll 1780)	FC	
Family: Riodinidae (2)				
87	Pulm Judy	<i>Abisara echerius</i> (Stoll 1790)	UN	
88	Common Punch	<i>Dodona durga</i> (Kollar 1844)	UN	

malaya, India (Wynter-Blyth 1940-46, Moore 1882, Mani 1986, deRhe-Philipe 1931, Thakur *et al.* 2008). Arora *et al.* (2009) reported 288 butterfly species under order Lepidoptera in Himachal Pradesh and out of which 152 species in Kangra District. Some butterflies cover a very large distance, so it is logically impossible to have a complete checklist. However, a regular assessment is required in the varied eco-

logical environment for making proper conservation strategies. The Dhauladhar ranges are located in the northern extreme of Kangra valley covering a large area with moderate topography in the foothill region. The unique geo-botanical assemblage coupled with varied habitat diversity prompted to record a checklist of butterflies in the Kangra valley under the rural and urban landscape.

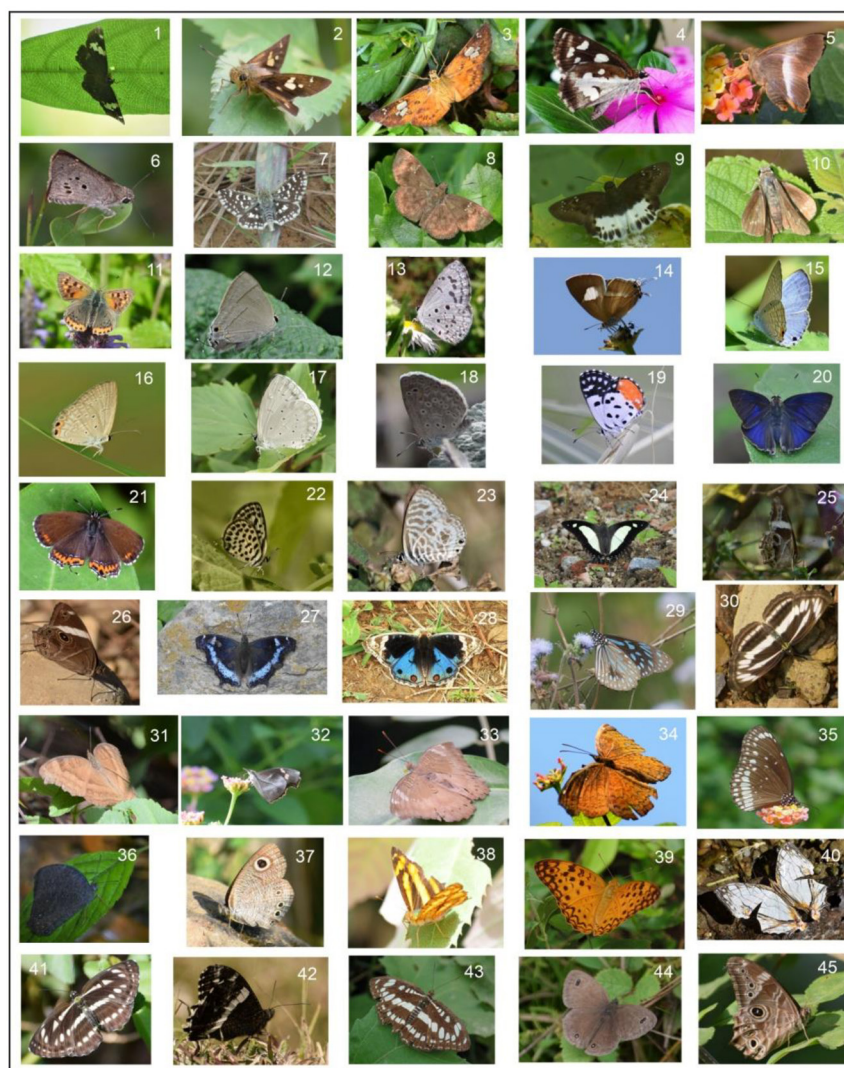


Fig. 2. Butterfly species recorded in Kangra valley, India 1) *Celaenorrhinus leucocera*, 2) *Pelopidas conjuncta*, 3) *Pseudocoladenia dan*, 4) *Udaspes lolus*, 5) *Bibasis sena*, 6) *Suastus gremius*, 7) *Spialia galba*, 8) *Sarangesa dasahara*, 9) *Tagiade smenaka*, 10) *Parnaragunatus*, 11) *Lycaena phlaeas*, 12) *Rapala nissa*, 13) *Acytotele pispuspa*, 14) *Horaga onyx*, 15) *Catochrysops strabo*, 16) *Euchrysops cnejus*, 17) *Celastrina argiolus*, 18) *Pseudozizeeri amaha*, 19) *Talicauda nyseus*, 20) *Rapala manea*, 21) *Heliophorus sena*, 22) *Tarucus venosus*, 23) *Leptotes plinius*, 24) *Charaxes agrarius*, 25) *Lethe europa*, 26) *Lethe confusa*, 27) *Kaniska canace*, 28) *Junonia orithya*, 29) *Tirumala limniace*, 30) *Neptis sankara*, 31) *Junonia iphita*, 32) *Libythea myrrha*, 33) *Euthalia aconthea*, 34) *Ariadne merione*, 35) *Euploea core*, 36) *Melanitis leda*, 37) *Ypthima baldus*, 38) *Symbrenthia lilaea*, 39) *Phalanta phalantha*, 40) *Cyrestis thyodamas*, 41) *Neptis hylas*, 42) *Aulocera swaha*, 43) *Athyma perius*, 44) *Ypthima asterope*, 45) *Lethe rohria*.

Study area

The sites are located in the area under the foothill region of Dhauladhar ranges characterized by snow-clad mountain covering the area under Dhauladhar

Wildlife Sanctuary in the north and wide fan area with moderate topography in the south extending up to the RAMSAR site viz. Pong dam lake. Fig.1 shows the variation in the habitat diversity and the site covered during the survey. The study area is characterized by

few structural terraces of moderate topography and a flat area of sediment infill (Mahajan and Kumar 2018). The study area reported the highest rainfall in the hilly state, where the vegetation varies from tropical to temperate. The tropical area covers the region of moderate topography having mixed vegetation, agricultural land and some patches of *Pinus* sp. forest in the center, whereas, the forest of *Rhododendron* spp., *Cedrus* spp. and the *Quercus* spp. are located in patches towards the northern extreme of the study area, which provide the unique floral assemblage for butterfly fauna. There are many host plant-available including *Adhatoda vasica*, *Carissa opaca*, *Berberis aristata*, *B. lyceum*, *Terminalia chebula*, *Flacourtia indica*, *Princepia utilis*, *Zizyphus mauritiana*, *Urtica dioica* and *Zanthoxylum armatum* in the Kangra valley.

MATERIALS AND METHODS

The study comprised a well-planned survey during the year 2016-17 in the month December to January covering 62 sites and some opportunistic sighting from 2016-2020 in the valley (Fig. 1). During the survey attempt was made for photographic documentation in the field and specimens were captured with the handheld sweep net in case of cryptic butterflies were necessary with the least disturbance and released after their identification with special care following Arora (1990). The Nikon 3300 DSLR, Nikon d90 and Nikon Coolpix p900 was used for photographic documentation of the butterfly species. The taxonomic identification and nomenclature of butterflies were carried out using available literature and published fauna (Kunte 2000, Kehimker 2008, Kehimkar 2016, Smetacek 2017, Kasambe 2018, Sondhi and Kunte 2018).

Butterflies were categorized into the different group based on their relative numbers i.e., common (C) species were available almost in whole year sighting between 20-30 times, fairly common (FC) were noticed in a few months of the year and sighted 10-20 times, uncommon (UN) are noticed in unique habitat and vegetation association and availability of the host

plant between 5-10 times and rare (R) were sighted 1-5 time in a year or during the opportunistic sighting.

RESULTS

In the present study, 88 species of butterflies were recorded from 62 genera and 6 families (Table 1, Figs. 2-3). The family Nymphalidae revealed the highest contribution followed by Lycaenidae, Pieridae, Hesperiidae, Papilionidae and Riodinidae (Fig. 4). The analysis of their relative abundance indicated 12 common species (13.64 %), 15 fairly common species (17.05 %), 36 uncommon (40.91 %) and 25 rare species (28.41 %). The study area covering hilly mountainous terrain and valley sub-region is at the verge of human and climatic disturbance, where the impact of climatic change can be easily observed.

DISCUSSION

Studies conducted for the assessment of butterflies in the north-western Himalayan regions like the study in the Great Himalayan Conservation Landscape (GHCL) of Kullu and Kinnaur area, where 75 species were reported by Uniyal (2007). Kumar and Mattu (2014) in their study from Mandi district (Balh valley) recorded 40 species and 50 species from Kangra District in the Bir-Billing area was noticed by Chandel *et al.* (2013). Singh and Banyal (2014) also observed 49 species of butterflies in Chamba District shearing similar physiography of hilly terrain in Himachal Pradesh, India. The butterfly diversity will help to establish the linkage of changing climate and biological phenomena as the area show a great variety of habitat and altitude when covering a small distance on the ground. Therefore, more investigations are also still required in different ecological regimes to conserve the terrestrial ecosystem of the Himalayan region.

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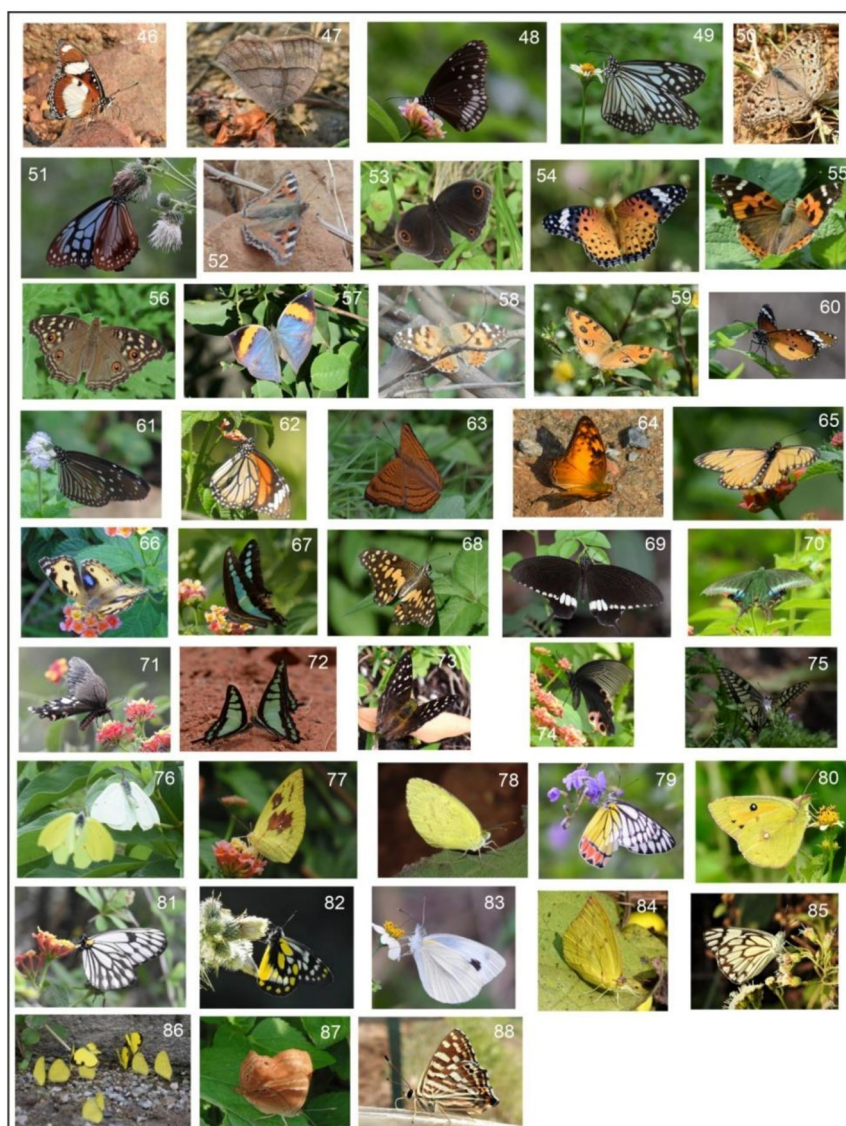


Fig. 3. Butterfly species recorded in Kangra valley, India 46) *Hypolimnasmisippus*, 47) *Mycalesis mineus mineus*, 48) *Euploea sylvester*, 49) *Parantica aglea*, 50) *Junonia atlites*, 51) *Parantica sita*, 52) *Aglais cashmirensis*, 53) *Callerebia hybrida*, 54) *Argyreus hyperbius*, 55) *Vanessa indica*, 56) *Junonia lemonias*, 57) *Kallima inachus*, 58) *Vanessa cardui*, 59) *Junonia almana*, 60) *Danaus chrysippus*, 61) *Euploea mulciber*, 62) *Danaus genutia*, 63) *Pseudergolis wedah*, 64) *Vagrans egista*, 65) *Acraea issoria anomala*, 66) *Junonia hierta*, 67) *Graphium sarpedon*, 68) *Papilio demoleus*, 69) *Papilio polytes*, 70) *Papilio bianor*, 71) *Pachliopta aristolochiae*, 72) *Graphium cloanthus*, 73) *Dodona dipoea*, 74) *Papilio protenor*, 75) *Papilio machaon*, 76) *Gonepte ryx rhamni*, 77) *Catopsilia pomona*, 78) *Eurema hecabe*, 79) *Delias eucharis*, 80) *Colias fieldii*, 81) *Aporia agathon*, 82) *Delias belladonna*, 83) *Pieris canidia*, 84) *Catopsilia pyranthe*, 85) *Belenois aurota*, 86) *Eurema rigitta*, 87) *Abisara echerius*, 88) *Dodona durga*.

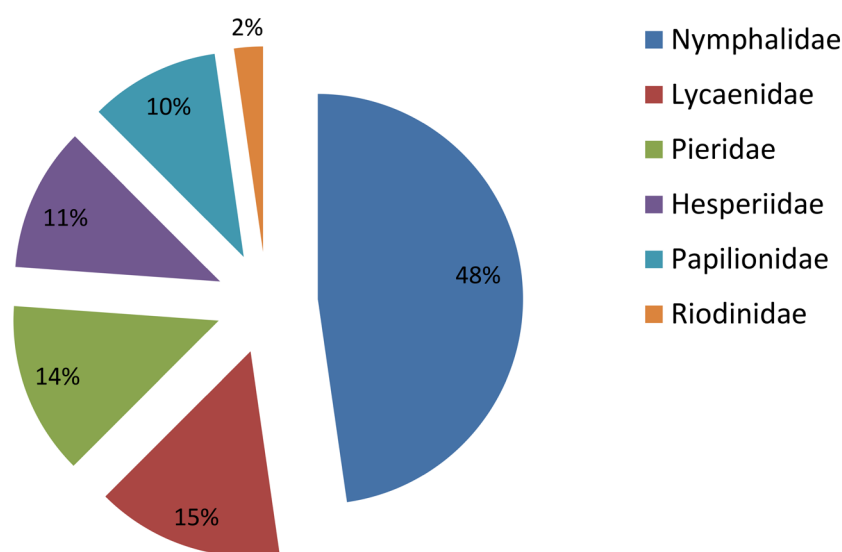


Fig. 4. Family wise representation of the butterfly in study area.

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