

An assessment and distribution of butterflies (Lepidoptera: Papilionoidea) in Sangla Valley (District Kinnaur: Himachal Pradesh)

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Summary

The present study was conducted to understand the butterfly diversity in the Sangla Valley of Kinnaur District of Himachal Pradesh, India from April 2015 to March 2018. A total of 40 species of butterflies belonging to 33 genera and five families were recorded from the present study. From the observed butterflies, the family Nymphalidae was the most dominant among the five families with 20 species, followed by Lycaenidae comprising 10 species, Pieridae with 07 species, Papilionidae with 02 species and Hesperidae with 01 species. The butterfly fauna of Sangla Valley has been documented for the first time. The diversity of butterflies is near lower altitudes as compared to alpine regions and Bhoj Patra forests in Chhitkul. Maximum diversity of butterflies exists in open spaces on wild vegetation. One species of Snow Apollo *i.e.* *Parnassius hardwickii* has been recorded for the first time from Sangla Valley landscape. The present study added valuable information on the diversity of butterfly fauna and will contribute in developing effective conservation measures in the Kinnaur district of Himachal Pradesh.

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Introduction

Butterflies belong to the superfamily Papilionoidea of order Lepidoptera and are taxonomically well known. They have great aesthetic value and are very sensitive to fractional changes in climate. These are regarded as good ecological indicators. The distribution and diversity of butterflies depend not only on the geography of an area but also on the ecological demands. Butterflies are insects that provide economic and ecological benefits to human society. In mountain ecosystems, the distribution of butterfly diversity is determined by its habitat and climatic stability. 690 species of butterflies have been recorded from the entire Himalayan region (Haribal 1992), of which 288 species occur in Himachal Pradesh (Arora et al. 1995, 2005). However, the butterfly diversity of Sangla Valley has been assessed for the first time. The identification literature and nomenclature followed is after (Evans 1932; Wynter-Blyth 1957; Varshney 1985, 1990, 1997, 2010; Haldhar et al. 2015). Although there are several checklists available on butterfly diversity, no study was conducted in Sangla Valley situated in the Kinnaur district of Himachal Pradesh, India. Hence, an attempt was made to understand the butterfly diversity in Sangla Valley through the present investigation.

Materials and Methods

Study Area

The Sangla (or the Baspa) valley is one of the most beautiful Valley positioned between 31°31'-36'N and

77°20'-27'E in the district Kinnaur of Himachal Pradesh. The altitude of the valley ranges from 2,200 to 5,486 m asl. Sangla Valley is bounded by districts Lahaul & Spiti in the North, Kullu in the North-West, Shimla in the South-West and the state of Uttarakhand in the South. It shares its international border on the East side with Tibet. The valley is about 95 km long. It starts from Karcham (1899 m) and ends at Chung Sakhago pass (5242 m). The Valley is characterized by rugged, precipitous peaks covered by perpetual snow cover (Deota et al. 2011). The topography of the Sangla Valley changes considerably at intervals of short distances. The lower hills of the valley have thick forests of Himalayan Cedar, Pine, and Oak forests, whereas the high hills are home to forests of Spruce, Alder and Bhojpatra trees. The valley's upper reaches have magnificent lofty peaks and the uppermost part of the mountain peaks are covered by snow permanently. These rugged, steep peaks represent two of the world's greatest mountain ranges *i.e.* the great Himalayan range and the Dhauladhar range. The Baspa River, a largest tributary flow through the middle of valley. The mountain ranges on the right bank of Baspa River form part of the Great Himalayan ranges and on the left bank form the Dhauladhar ranges. The main villages in the valley are Chhitkul, Rakcham, Batseri, Themgarang, Kamru, and Sapni. The village Chhitkul (3450 m) is the last inhabited village here at the India-Tibet border. It goes to Chung Saghgo pass and afterwards, Tibet (China) starts. The arid boulders, scrubland, flowers, pastures and mountains with glaciers are the unique habitats for the endemic fauna of the region. The Valley has a temperate climate due to its high elevations.

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Winters prevail long from October to May and summers are short from June to September.

Field data collection

The survey was carried out between April 2015 and March 2018 to assess the butterfly diversity of the region suitably. Most of the observations were recorded during

the day (9.30 am to 2.00 pm) and sometimes surveys were conducted between 4.30 pm to 6 pm for shade-loving butterflies. The surveys have been conducted in various habitats and various types of forests as given in the table below. The altitude covered was from 2500m to 4000 m asl.

Table 1. Survey localities with habitat, altitude and coordinates

S. No.	Localities	Habitat	Altitude (m asl)	Latitudes (in degree decimals)	Longitudes (in degree decimals)
1	Sangla Village-I	Scrubland across riverbed	2601 m asl	31.42169 N	78.27058 E
2	Sangla Village-II	Agriculture, Riverine Habitat and Grassy Pasture with wild vegetation	2593 m asl	31.4219N	078.27047E
3	Rakcham-I	Grassy water-lodged Pasture adjacent to mixed forest	3124 m asl	31.38357 N	78.35441 E
4	Rakcham-II	Open Grass ground with Seabuckthorn and mixed forest of kayal, Royai trees and Bhojpatra Forest	3122 m asl	31.38231N	078.35619E
5	Rakcham-Chhitkul WLS	Forest of Bhoj Patra, Roayai and Kayal	3436 m asl	31.35072N	078.43232E
6	Kandha-I	Dried pasture with mixed forest	3104 m asl	31.40544 N	78.24750 E
7	Kandha -II	Grassy pasture with Walnut, Deodar, Kayal and Royai and trees	3436 m asl	31.35072N	078.43232E
8	Kandha-III	Mix forest of Walnaut, Deodar, Chir, Roi, Apricot	3020 m asl	31.40730 n	78.24957E
9	Batseri; Kedar Cho	Riverine and Pine Forest	2616 m asl	31.41373 N	78.28313 E
10	Batseri Village	Apple orchards, Potato Beans, Maize agriculture fields.	2794 m asl	31.40615N	078.30126 E
11	Chhitkul	Scrub land & Rocky terrain	3375 m asl	31.34948 N	78.44656 E
12	Chhitkul and beyond	Dry scrub mountains with snow covered peaks and with windy & dry air	3842 m asl	31.30280N	078.52853E
13	Chansu and Rutarang	Slopy grass ground with wild vegetation and agricultural fields on both sides	2780 m asl	31.42843N	078.22507E
14	Rango Lake	Grassy Pasture & small agricultural fields on the sides of site, marshy area of Rango Lake with wild vegetation	2780 m asl	31.39760N	078.23405E
15	Kuppa & around	Scrubland and Agriculture field near the stream with Apricot trees.	2562 m asl	31.42821 N	78.25332 E

Results and Discussion

A total of 40 species of butterflies belonging to 33 genera and five families were recorded from the study area. The family Nymphalidae was the most dominant among the five families with 20 species (50.00%), followed by Lycaenidae comprising 10 species (25.00%), Pieridae with 07 species (17.50%), Papilionidae with 02 species (5.00%) and Hesperidae with 01 species (2.50%). The families Nymphalidae and Lycaenidae were the most frequently sighted groups during this survey. The status of all species is categorized depending on the direct

sightings during the survey, which showed 12 species out of 40 species (30.00%) were common (C), 16 (40.00%) species were uncommon (UC), 11 (27.50%) species were rare (R) and 01 species (02.50%) was scarce. During present studies, it has been observed that the lower altitude areas represent more butterfly diversity (37 species) than high altitude areas (06 species) in the Sangla Valley. One species of Snow Apollo *i.e.* *Parnassius hardwickii* has been recorded for the first time from Sangla Valley landscape from Kandha at an altitude of 3110 m asl.

Table 2. Checklist of the butterflies recorded in the study area

S. No.	Name of family	Species name	Common name	Locality in Sangla Valley	Status
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1.	Papilionidae	<i>Papilio machaon</i> Linnaeus, 1758	Common Yellow Swallowtail	Kandha, Chhitkul	UC
2.	Papilionidae	<i>Parnassius hardwickii</i> Gray, 1831	Common Blue Apollo	Kandha	VR
3.	Nymphalidae	<i>Aglaia cashmirensis</i> Kollar, 1844	Indian Tortoiseshell	Kandha, Rakchham, Chhitkul, Chansu, Sangla village, Rango Lake	C
4.	Nymphalidae	<i>Argynnis adippe</i> ([Schiffermüller], 1755)	High Brown Silverspot	Kandha, Sangla village	UC
5.	Nymphalidae	<i>Argynnis children</i> (Gray, 1831)	Large silver stripe	Kandha	UC
6.	Nymphalidae	<i>Phalanta phalantha</i> (Drury, [1773])	Common Leopard	Sangla village	UC
7.	Nymphalidae	<i>Aulocera saraswati</i> (Kollar, [1844])	Striated Satyr	Sangla village	UC
8.	Nymphalidae	<i>Aulocera swaha</i> (Kollar, [1844])	Common Satyr	Kandha, Rakchham, Chansu, Sangla village, Batseri, Kupa,	C
9.	Nymphalidae	<i>Callerebia nirmala</i> Moore, 1865	Common Argus	Ruthrang	R
10.	Nymphalidae	<i>Callerebia kalinda</i> Moore, 1865	Scarce Mountain Argus	Cchitkul	R
11.	Nymphalidae	<i>Cynthia cardui</i> (Linnaeus, 1758)	Painted Lady	Kandha, Chansu	UC
12.	Nymphalidae	<i>Vanessa indica</i> (Herbst, 1794)	Indian Red Admiral	Chansu, Sangla village	UC
13.	Nymphalidae	<i>Danaus chrysippus</i> (Linnaeus, 1758)	Plain Tiger	Chhitkul, Sangla village	UC
14.	Nymphalidae	<i>Fabriciana kamala</i> (Moore, 1857)	Common Silverstripe	Kandha	R
15.	Nymphalidae	<i>Issoria isaea</i> (Gray, 1846)	Himalayan Queen Fritillary	Kandha, Rango Lake	UC
16.	Nymphalidae	<i>Junonia orithya</i> (Linnaeus, 1758)	Blue Pansy	Kupa	R
17.	Nymphalidae	<i>Lasiommata menava</i> Moore, 1865	Dark Wall	Batseri	R
18.	Nymphalidae	<i>Lasiommata schakra</i> (Kollar, [1844])	Common Wall	Sangla village	R
19.	Nymphalidae	<i>Limentis trivena</i> (Moore, 1864)	Indian White Admiral	Kandha	R
20.	Nymphalidae	<i>Neptis mahendra</i> Moore, 1872	Himalayan Sailer	Kupa	R
21.	Nymphalidae	<i>Parantica tytia</i> (Gray, 1846)	Chestnut Tiger	Kandha	R
22.	Nymphalidae	<i>Polygonia agnicula</i> (Moore, 1872)	Nepalese Comma	Kandha	R
23.	Lycaenidae	<i>Aricia agestis</i> ([Schiffermüller], 1775)	Brown Argus	Kandha, Rakchham, Chhitkul, Chansu, Sangla village,	C
24.	Lycaenidae	<i>Chaetoprocta odata</i> (Hewitson, 1865)	Walnut Blue	Sangla village, Ruthrang	C
25.	Lycaenidae	<i>Lampides boeticus</i> (Linnaeus, 1767)	Pea Blue	Chansu, Sangla village, Kandha	C
26.	Lycaenidae	<i>Lycaena phlaeas</i> (Linnaeus, 1761)	Common Copper	Sangla village, Kandha, Chansu, Chhitkul, Rakchham, Ruthrang, Batseri, Kupa, Near fish farm, Sangla Valley, Rango lake	C

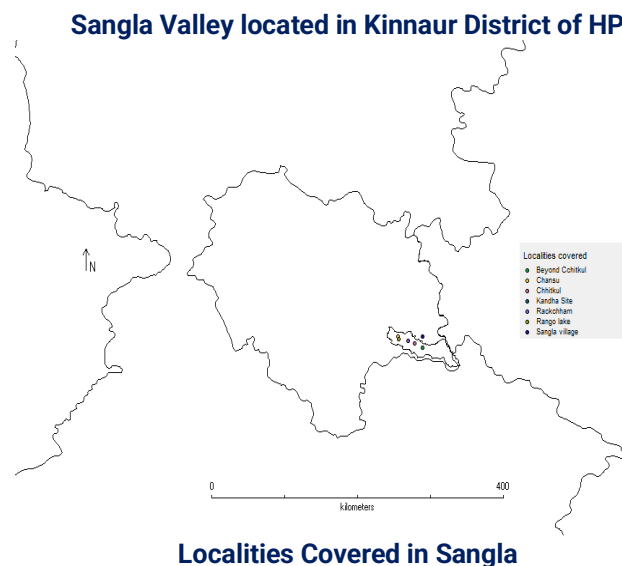
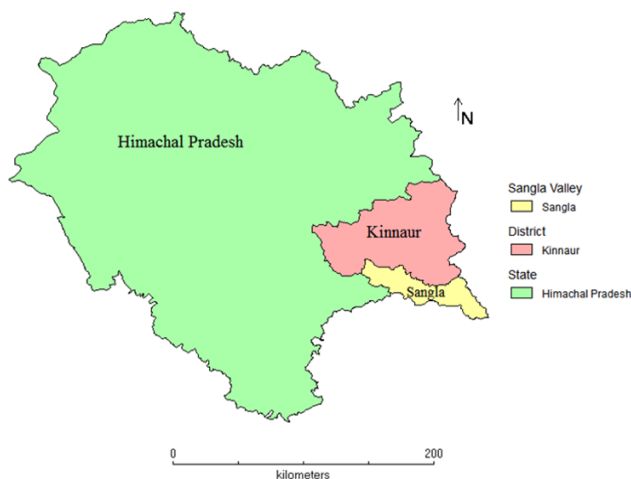
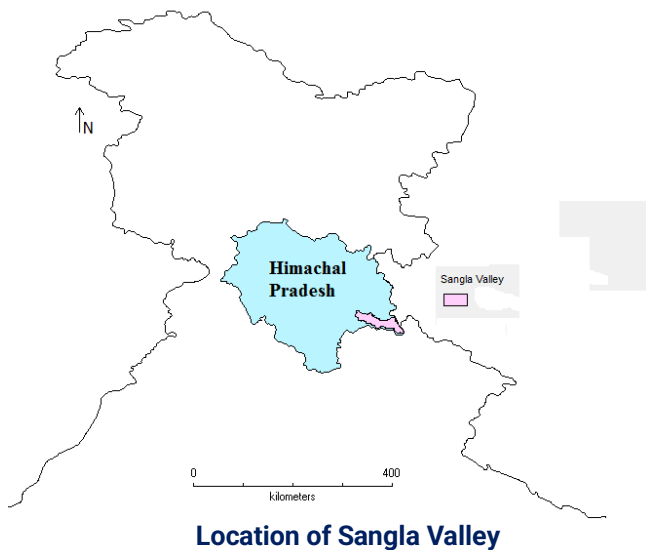
27.	Lycaenidae	<i>Oreolyce vardhana</i> (Moore, [1875])	Dusky Hedge Blue	Kandha, Rango	UC
28.	Lycaenidae	<i>Pseudophilotes vicrama</i> Moore, 1865	Chequered Blue	Sangla village	UC
29.	Lycaenidae	<i>Celastrina gigas</i> (Hemming, 1928)	Silvery Hedge Blue	Chansu, Kandha, Sangla Village	C
30.	Lycaenidae	<i>Rapala selira</i> (Moore, 1874)	Himalayan Red Flash	Kandha	R
31.	Lycaenidae	<i>Polyommatus stoliczka</i> (C & R Felder, [1865])	Himalayan Meadow Blue	Kandha, Rakchham, Chhitkul, Rango Lake	C
32.	Lycaenidae	<i>Heliophorus androcles</i> (Westwood, 1851)	Green Sapphire	Chansu	UC
33.	Pieridae	<i>Aporia nabellica</i> (Boisduval, [1836])	Dusky Blackvein	Kandha	UC
34.	Pieridae	<i>Colias erate</i> (Esper, [1805])	Pale Clouded Yellow	Kandha, Rango Lake	UC
35.	Pieridae	<i>Colias fieldii</i> Menetries, 1855	Dark Clouded Yellow	Kandha, Rakchham, Chhitkul, Chansu, Sangla village, Ruthrang	C
36.	Pieridae	<i>Gonepteryx rhamni</i> (Linnaeus, 1758)	Common Brimstone	Kandha, Rakchham, Chansu, Sangla village,	UC
37.	Pieridae	<i>Pieris brassicae</i> (Linnaeus, 1758)	Large Cabbage White	Kandha, Rakchham, Chhitkul, Chansu, Sangla village, Ruthrang, Rango Lake, Batseri, Dubling	C
38.	Pieridae	<i>Pieris canidia</i> (Linnaeus, 1768)	Indian Cabbage White	Kandha, Rakchham, Chhitkul, Sangla village, Ruthrang, Rango Lake, Batseri, Kupa	C
39.	Pieridae	<i>Pontia daplidice</i> (Linnaeus, 1758)	Large Cabbage White	Chhitkul, Chansu, Sangla village	C
40.	Hesperiidae	<i>Pelopidas mathias</i> (Fabricius, 1798)	Lesser millet skipper	Sangla village	UC

During the surveys undertaken in the valley (2015-2018), it has been observed that various prestigious habitats are gradually vanishing in this fragile Himalayan Ecosystem. It is losing its faunal habitats mainly due to land use changes for agriculture and tourism. It has been observed that the areas (Rango Lake, Kandha, Kuppa, and Adjacent area of Rakchham Chhitkul WLS) forests are being utilized for agriculture and horticulture. Tourism is progressively increasing in the area. Many of the hotels/ homestays are coming in the far-flung areas of the valley. Various visitor camps are being installed during tourist season near the forest area of the valley and thus disturbing the microhabitats of the vulnerable ecosystem of the region. It was not permitted to enter the valley to outsiders before 1989, without special permission from the Government of India due to its tactical position on the Indo-Tibet border, but now the picture has been changed entirely and tourism has become a significant source of income for the local people in the Valley. Negi (2017) reported that the area is rich in biodiversity and cultural diversity, attracting massive valley tourism. The excessive anthropogenic pressures mainly driven by tourism in this area, is causing habitat modification and destruction in recent times resulting in loss of biodiversity of the fragile ecosystem of this area. There are about 25 private and five guest houses under various Government of Himachal

Pradesh departments. The valley also has about nine tent houses in the area, providing the camping facility to visitors. Besides this, Government has introduced a scheme of Home Stay to prompt tourism in the area and the local people are adopting it. Further, the roads are being constructed in the various sites viz. Kandha, Rango, Rakcham-Chhitkul WLS and Chittkul. It has been observed that the road is being constructed beyond the ITBP Camp in Chhitkul. The road construction work was in full swing with the help of bulldozers as observed during surveys and the area was very dusty. The landslides occurred at various places and stones/boulders were shooting down. It is worth mentioning that forest cover is intact here. The Alpine meadows/ scrublands are present and in the near future habitat of the area should be taken care of. As per the local's information, the herds of Asiatic Ibex and Blue sheep are visible on the steep mountains near the glaciers. Huge quantity of insecticides is used in the apple orchards as empty bottles have been recorded at various sites i.e. at Karcham, Rakcham, Sangla Village. This ultimately washes away with rain in the rivers, disturbing and polluting the aquatic niche of the rivers. As a result, fauna in the valley is under threat due to various anthropogenic stresses viz. clearing of forest for agriculture, horticulture, overexploitation of medicinal plants, tourism, construction of roads, hydroelectric

projects, grazing by domestic animals, landslides, forest fire, natural disasters, climate change etc. The Valley is one of the most ecologically fragile biogeographical zones (Rodgers & Panwar 1990; Haldhar 2012; Haldhar & Singh 2014). Thus, in situ, conservation protection of the habitat is of utmost necessity, which will go a long way to protect the faunal wealth of the valley.

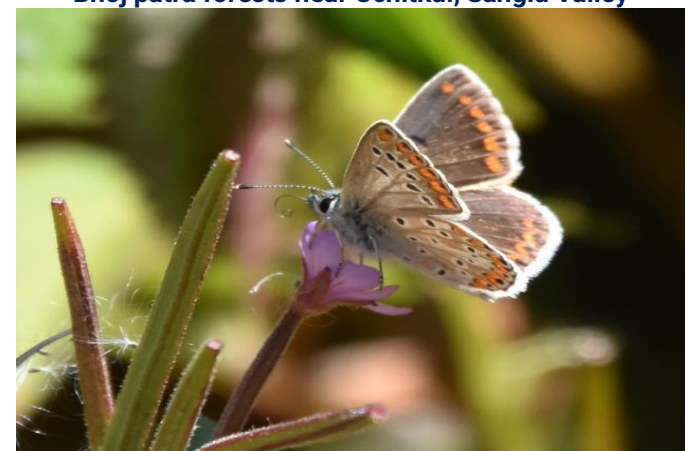
PLATE 1



Royi forest near Kandha in Sangla Valley



Bhoj patra forests near Chitkul, Sangla Valley



Aricia agestis



Aulocera saraswati



Aulocera swaha



Argynnis childreni



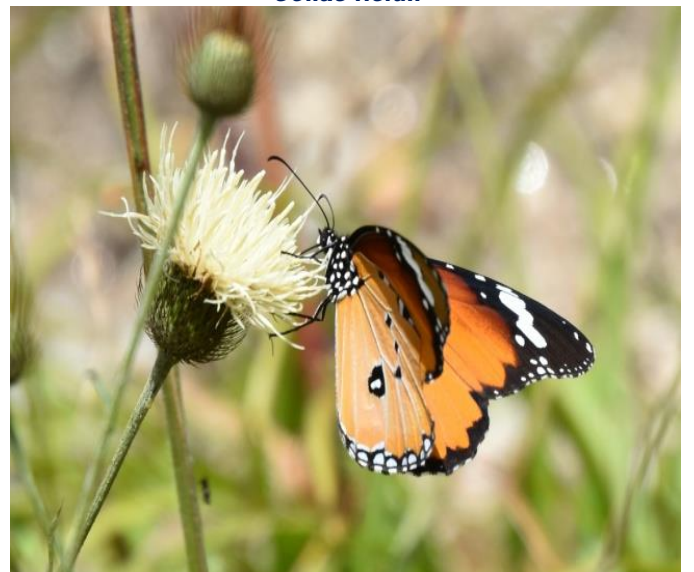
Callerebia kalinda



Colias fieldii



Celastrina gigas



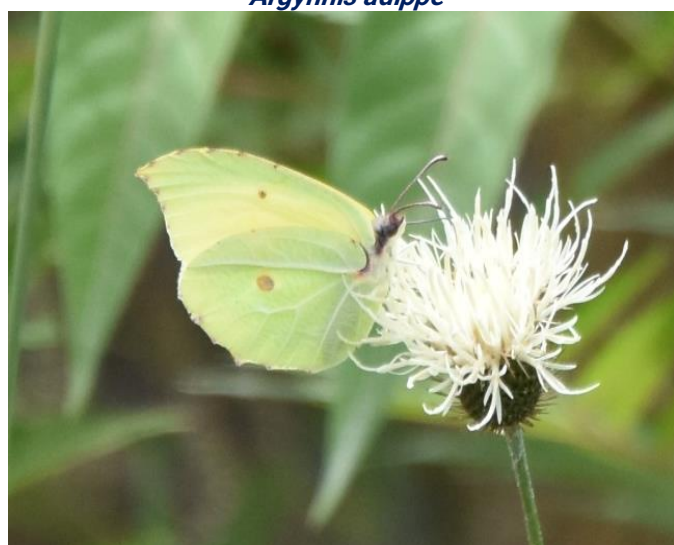
Danaus chrysippus



Argynnis adippe



Lampides boeticus



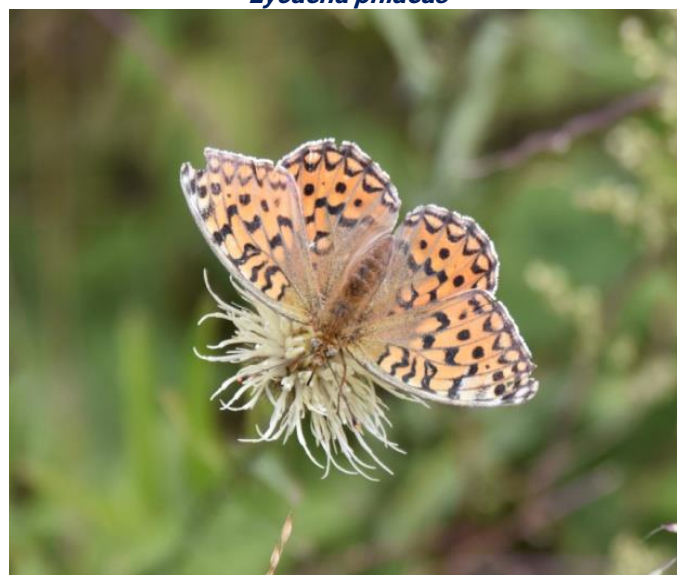
Gonepteryx rhamni



Lycaena phlaeas



Heliophorus androcles



Phalanta phalantha

*Pieris brassicae**Polyommatus stoliczka**Pontia daplidice**Pelopidias mathias*

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Declarations of interests

All authors of this manuscript declare that they have no conflict of interest.

Data sharing

All relevant data are within the manuscript.

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