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What flies in the far south of Croatia? The diversity of Rhopalocera in the Konavle region, southern Dalmatia (Lepidoptera: Papilionoidea)

Toni Koren, Matea Martinović & Dubravko Dender

Abstract

This research explores the diversity of Rhopalocera in the Konavle region, the southernmost part of Dalmatia. A total of 106 species were recorded, the majority of which were documented for the first time in this area due to the scarcity of previous surveys. Zoogeographical analysis indicated a high proportion of Euro-Siberian and Euro-Oriental species, with significant contributions from Holarctic and Mediterranean species. Compared to the surrounding areas in Bosnia and Herzegovina and Montenegro, between Trebinje and Mt. Orjen, a greater diversity of Rhopalocera was observed, with a Sorensen similarity index of 0.39, indicating a relatively distinct fauna. Most of the studied area falls within the Natura 2000 ecological network, where all species were recorded, including nearly all sites of conservation value based on the abundance of endangered species and species listed in the Habitats Directive. The northern part of the study area belongs to the Sniježnica mountain, which has been separately analysed, with 103 species recorded so far, more than on smaller mountains such as Mosor and Kozjak but fewer than larger and significantly higher mountains like Biokovo, Svilaja, and Dinara. Many interesting species were recorded during this survey and the presence of several of them was discussed in greater detail. Notes about the conservation of Rhopalocera in the surveyed areas are provided.
Keywords: Lepidoptera, Papilionoidea, Rhopalocera, faunistic, diversity, Konavosko polje, Sniježnica, Croatia.

¿Qué vuela en el extremo sur de Croacia? La diversidad de Rhopalocera en la región de Konavle, al sur de Dalmacia (Lepidoptera: Papilionoidea)

Resumen

Esta investigación explora la diversidad de Rhopalocera en la región de Konavle, la parte más meridional de Dalmacia. Se registraron un total de 106 especies, la mayoría documentadas por primera vez en esta zona debido a la escasez de estudios previos. El análisis zoogeográfico indicó una elevada proporción de especies eurosiberianas y euro orientales, con contribuciones significativas de especies holárticas y mediterráneas. En comparación con las zonas circundantes de Bosnia-Herzegovina y Montenegro, entre Trebinje y el monte Orjen, se observó una mayor diversidad de Rhopalocera, con un índice de similitud de Sorensen de 0,39, lo que indica una fauna relativamente distinta. La mayor parte de la zona estudiada pertenece a la red ecológica Natura 2000, donde se registraron todas las especies, incluidos casi todos los lugares con valor de conservación en función de la abundancia de especies amenazadas y de especies incluidas en la Directiva sobre hábitats. La parte norte de la zona de estudio pertenece a la montaña Sniježnica, que se ha analizado por separado, con

103 especies registradas hasta ahora, más que en montañas más pequeñas como Mosor y Kozjak, pero menos que en montañas más grandes y significativamente más altas como Biokovo, Svilaja y Dinara. Durante esta prospección se registraron muchas especies interesantes y se analizó con más detalle la presencia de varias de ellas. Se ofrecen notas sobre la conservación de los Rhopalocera en las zonas estudiadas.
Palabras clave: Lepidoptera, Papilionoidea, Rhopalocera, faunística, diversidad, Konavosko polje, Sniježnica, Croacia.

Introduction

The Konavle region is the southernmost part of Croatia, and borders two neighbouring countries, Bosnia and Herzegovina, and Montenegro. The country's border areas often pique the additional interest of entomologists, who see them as an opportunity to record rare or previously undocumented insect species that occur in the neighbouring countries. This was the case for the first author of this study, who first visited the area of southern Dalmatia in 2009 and has continued visiting ever since. Later, two additional authors, originally from neighbouring Dubrovnik, joined the field expeditions, and eventually began documenting the Rhopalocera of the area.

The Rhopalocera fauna of Konavle has never been systematically researched, and all existing knowledge mostly pertains to smaller areas or findings of individual species or a limited number of additional observations from the same locality (Mihoci et al. 2005). Still, the area is known to be very diverse with species like *Papilio alexanor* being observed there recently (Russell & Pateman, 2018). It is also the only area in Croatia where *Lycaena ottomanus* occurs (Koren et al. 2012; Mihoci et al. 2005). In addition, the species *Kirinia roxelana* was recently recorded here, 120 years after the last record in Croatia (Koren, 2015), and further research has documented the species in additional locations (Koren et al. 2019b). Most of the works deal with one or a small number of observed species while a systematic overview of the species occurring in this area is lacking.

The goal of this work is to provide the results of a long-term semi-systematic survey of Rhopalocera of the Konavle region, to give some insights about some rare and potentially endangered species and provide a basis for future monitoring and conservation measures in the area.

Materials and methods

Study area

The region of Konavle today administratively represents the southernmost municipality in the Republic of Croatia, and it is part of the Dubrovnik-Neretva County. The boundaries of the present region/municipality were defined back in the 15th century when the area was acquired by the then Dubrovnik Republic or Republic of Ragusa (Živković, 1998).

The landscape of Konavle is dominated by the centrally positioned Konavosko polje, a closed, karst depression surrounded by higher elevations on all sides. Consequently, there is no surface drainage of water into the sea, which regularly flooded the area in the past. Today, the excess water is drained directly into the sea through tunnels. Karst fields such as Konavle field represent alluvial deposits and are the most fertile areas in the Dinaric karst (Jelavić, 1974). Grassland habitats dominate it today, with a smaller portion under different crops. The surrounding area is predominantly limestone terrain. On the north-eastern side, the higher part is represented by Mt. Sniježnica (1234 m a.s.l.), which merges into the massif of Mt. Orjen (1895 m a.s.l.) after Mrcine - Grab ravine (Roglić & Baučić, 1958). A smaller part of Orjen, which is located in Croatia, is locally known as Bjelotina. Its highest peak in Croatia is 1089 m above sea level. The Konavle field is separated from the sea by a dolomite-limestone ridge stretching from Cavtat (ancient Epidaur) to Cape Oštro (the southernmost point of Croatia), with its highest elevation being 561 m above sea level and an average of 150-200 m above sea level. The main watercourses in the Konavosko polje are Ljuta River as the only permanent watercourse, and Kopačica and Konavočica, which have a more torrential character (Roglić & Baučić, 1958). The surrounding limestone area represents a combination of forest and grassland habitats interspersed with rural landscapes, consisting of small settlements and cultivated areas in the surroundings around them. Grassland habitats on rocky areas are the result of fires of natural

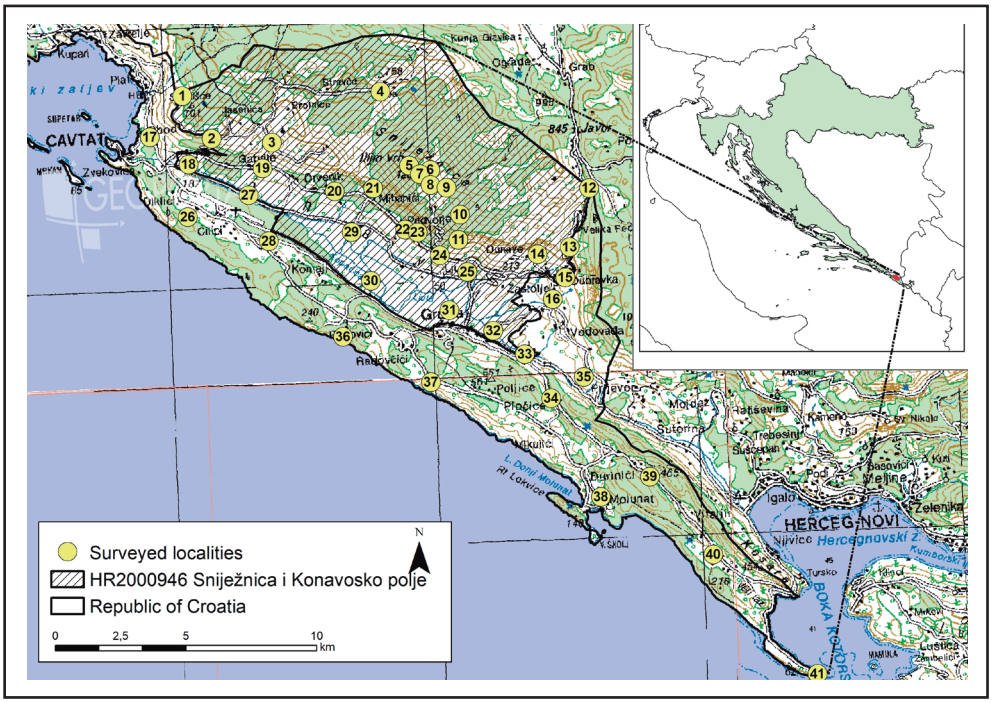
or anthropogenic origin, but also of formerly prevalent open grazing. Those on deeper soil are usually the result of existing or somewhat neglected agricultural production. Such areas are also found in the higher parts of Sniježnica and are called "do(l) - do(l)ci" by the locals.

According to the Köppen classification, the Konavle area has two climate types. The narrower coastal part is categorised as the Mediterranean climate with hot summers (Csa), while the larger part of the area falls into the category of Mediterranean climate with warm summers (Csb) (Filipčić, 1998). The main characteristics of the Mediterranean climate are mild winters and dry summers, with three times less precipitation in the driest summer month compared to the wettest (Seletković et al. 2011). Only in the highest parts of Konavle snow is not an uncommon phenomenon.

The area of Croatia with a Mediterranean climate belongs to the Mediterranean phytogeographical region. In a narrower sense, this region includes the *Oleo-Cerationion* and *Quercion ilicis alliances,* in which evergreen woody elements predominate. In a broader sense, the region also encompasses the deciduous broadleaved belt that continues from the mentioned coastal belt and extends deeper inland. This refers to the *Ostryo-Carpineon orientalis alliance*, who's main edificator in the southern part of the Croatian coast is *Quercus virgiliana*. In the higher parts of the coastal Dinarides, the belt is followed by the *Ostryo-Carpineon orientalis* alliance, indicating the so-called Mediterranean montane belt, with its main edificator being *Ostrya carpinifolia* (Trinajstić, 1998). Such stands in the higher parts of Konavle are most found at altitudes of over 1000 meters above sea level.

In all these belts, along with forest areas, various degraded forms (maquis, garigue, grasslands, etc.) are regularly present. The wetter parts of the karst fields, such as the Konavle field, are generally characterized by vegetation of floodplain thickets and forests of the *Populetalia albae* alliance and typical grassland habitats (Horvatić, 1963). Except in higher areas and more distinctly alluvial habitats, alongside native stands, there are also pine (*Pinus* spp.) and cypres (*Cupressus sempervirens*) plantations, often mixed with native vegetation.

Figure 1. Map of surveyed localities in the Konavle area. Localities are numbered from northeast to southwest direction and correspond to locality numbers in the Materials and Methods section.



A large part of the Konavle area, 11.250,06 ha is protected within the Ecological Network Natura 2000 as HR2000946 Sniježnica i Konavosko polje. All but 14 of the sites surveyed in this study are in this area. No target Lepidoptera species are listed in this area.

Data collecting

The field surveys were mainly conducted in the period from 2015 to 2023, but we also included unpublished records from earlier years. The fieldwork was not planned from the beginning, but rather most interesting areas were visited during the first years and additional localities later, to cover most parts of the study region. A total of 41 localities were visited during the survey (Figures 1, 2), the most interesting of those on several occasions to cover the entire Rhopalocera season. A part of the research was done during the most unfavourable period of the year for Rhopalocera from December to February, and data was collected on the activity of some species. Since standard Rhopalocera surveys generally do not include the coldest period of the year, data on the flight of individual species from that part of the year are usually missing. One of the few references to flight periods and the number of generations of individual species in Croatia can be found in Lorković's manuscript from 1954 (Lorković, 2009).

Figure 2. Selected habitats in the survey area. **a)** Typical view of Konavosko polje and southern slopes of Mt. Sniježnica. **b)** Karstic hills and Prapratni do field. **c)** Karstic grasslands on the northern parts of Mt. Sniježnica. **d)** Open grassland near Vitaljina settlement.

The spatial processing and visualization of the data was done within the program ARC GIS desktop. Rhopalocera were identified using standard field guides (Lafranchis, 2004; Tolman & Lewington, 2008). Identification of the *Hipparchia fagi/syriaca* complex was based on the examination of the male Julien organ in the field as well as in the laboratory from the collected specimens (Lorković, 1976). The specimens of the genera *Gegenes, Pyrgus* (*alveus-armoricanus*)*, Plebejus,* and *Leptidea* were identified by examining the male or female genital structures (Higgins, 1975). The nomenclature follows Lepiforum (Lepiforum e.V., 2024), while the nomenclature of the plant species follows Euro+Med PlantBase (2006+) The conservation value of each locality was calculated by weighting the species included in the red lists of Croatia (Šašić et al. 2015) or Europe (van Swaay et al. 2010): 2x for Near Threatened species (NT) and 3x for Vulnerable species (VU). In addition, species listed in Annexes II and/or IV of the European Habitats Directive were weighted 5x. Each species was counted only once with the highest available weight (Verovnik et al. 2023).

Comparisons of species composition between Konavle and the surrounding area in Bosnia and Herzegovina and Montenegro (Sijarić, 1983) were made based on biogeographical affiliations of the Rhopalocera, generally following Kudrna et al. (2015).

To assess the diversity within the Natura 2000 area HR2000946 Sniježnica i Konavosko polje for future management, species were additionally delimited using these borders to assess the diversity within the protected area in comparison with the wider Konavle region.

The same analysis was performed only from the northern part of Konavle, Mt. Sniježnica, and its fauna was compared to the fauna of other better-surveyed Dalmatian mountains Dinara (Koren & Lauš, 2013; Tvrtković et al. 2012), Kozjak (Koren, et al. 2019), Svilaja (Verovnik et al. 2023), Mosor (Koren et al. 2020), and Biokovo (Kačírek, 2017; Mihoci et al. 2011).

List of localities

The list contains localities arranged geographically from northwest to southeast, relevant toponyms, short description of habitats, altitude, and coordinates.

1. Mt. Sniježnica, towards and around Velji do village, rocky grasslands and arable lands surrounded by lower deciduous vegetation; 548 m a.s.l; 42º36’02.9”N, 18º14’50.7”E.
2. Mt. Sniježnica, N of Uskoplje, rocky grasslands and arable lands surrounded by lower deciduous vegetation; 473 m a.s.l; 42º35’08.7”N, 18º15’36.8”E.
3. Mt. Sniježnica, Vojski do, a wooded area interspersed with grasslands on deeper soil, surrounded by karst grasslands.; 421 m a.s.l; 42º35’01.3”N, 18º17’17.5”E.
4. Mt. Sniježnica, Duba Konavoska, around the village, karst grasslands and other forms of degraded forests with arable lands and grasslands on deeper soil (dolci); 468 m a.s.l; 42º35’58.9”N, 18º20’22.5”E.
5. Mt. Sniježnica, Sv. Ilija peak and the surroundings, rocky grasslands and rocky areas surrounded by lower deciduous stands; 1208 m a.s.l; 42º34’26.2”N, 18º21’06.2”E.
6. Mt. Sniježnica, SE of the Sv. Ilija peak, Rocky grasslands and rocky areas, as well as grasslands on deeper soil (dolci), surrounded by lower deciduous stands; 1004 m a.s.l; 42º34’19.6”N, 18º21’40.8”E.
7. Mt. Sniježnica, below the Sv. Ilija peak; 1130 m a.s.l,, rocky grasslands and rocky areas surrounded by lower deciduous stands; 42º34’15.0”N, 18º21’23.7”E.
8. Mt. Sniježnica, N of Kuna Konavoska, around the ponds and Velje br. Dolac, rocky grasslands and rocky areas, as well as grasslands on deeper soil (dolci), surrounded by forest fragments; 1007 m a.s.l; 42º34’01.0”N, 18º21’40.3”E.
9. Mt. Sniježnica, N of Kuna Konavoska, V. Jaje, rocky grasslands and rocky areas, along with grasslands on deeper soil (dolci), surrounded by fragments of forest; 920 m a.s.l; 42º33’57.0”N, 18º22’07.2”E.
10. Mt. Sniježnica, Kuna Konavoska, around and E of the village, rocky grasslands and rocky areas, along with grasslands on deeper soil (dolci), surrounded by fragments of forest; 800 m a.s.l; 42º33’23.0”N, 18º22’28.0”E.
11. Mt. Sniježnica, road towards Kuna Konavoska, karst plateau, karst grasslands and rocky areas with forest fragments; 589 m a.s.l; 42º32’51.8”N, 18º22’23.5”E.
12. Dubravka, Prapratni do, N part, Straža, grasslands and arable lands on deeper karst soil, surrounded by rocky grasslands and forest; 700 m a.s.l; 42º33’49.4”N, 18º26’06.2”E.
13. Dubravka, N of village, Prapratni Do, S part, grasslands and arable lands on deeper karst soil (dolci), surrounded by rocky grasslands and forest; 522 m a.s.l; 42º32’37.5”N, 18º25’29.5”E.
14. Dunave, around the cemetery, ruderal areas, grasslands, and arable lands on deeper karst soil, surrounded by rocky grasslands and forest; 432 m a.s.l; 42º32’30.2”N, 18º24’35.6”E.
15. Dubravka, around and S of the village, ruderal areas, grasslands, and arable lands on deeper karst soil, surrounded by rocky grasslands and forest; 460 m a.s.l; 42º32’00.1”N 18º25’20.3”E.
16. Vodovađa, north of the village, ruderal areas, grasslands, and arable lands on deeper karst soil, surrounded by rocky grasslands and forest; 310 m a.s.l; 42º31’34.1”N 18º24’57.7”E.
17. Zvekovica - Obod, between the villages, ruderal areas near settlements, arable lands surrounded by forest and degraded stands; 62 m a.s.l; 42º35’13.5”N 18º13’53.6”E.

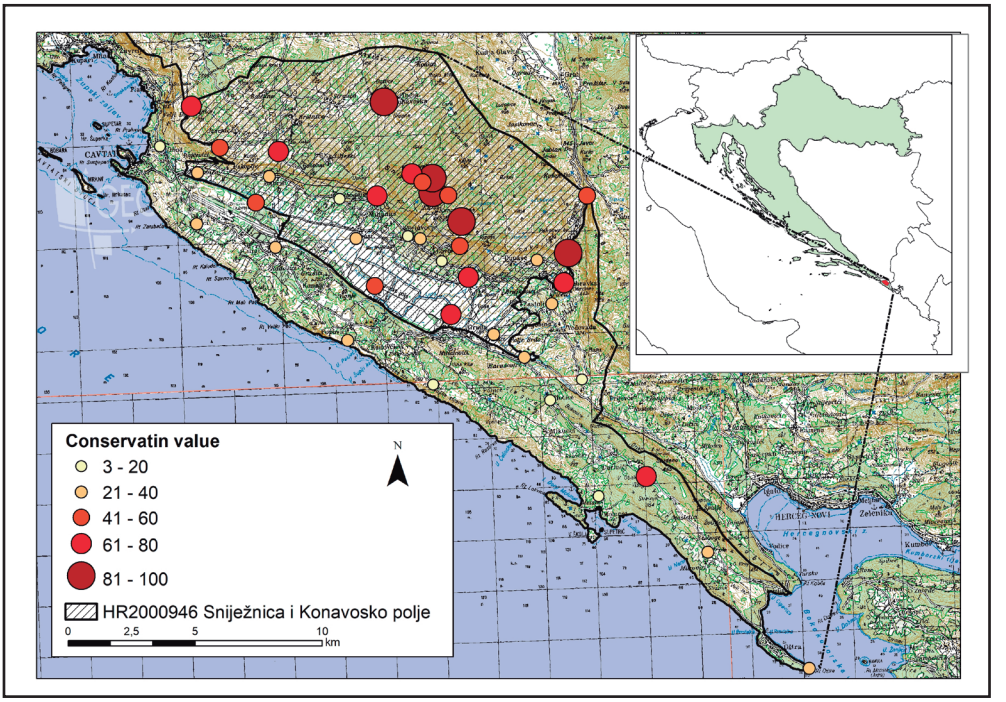
18. Uskoplje, around the village, a karst field with grasslands and arable lands, featuring ruderal areas and forest fragments; 122 m a.s.l; 42º34’38.2”N, 18º14’56.7”E.
19. Gabrili - Klečaci, between the villages, arable and ruderal areas surrounded by forest; 188 m a.s.l; 42º34’29.9”N, 18º17’00.3”E.
20. Drvenik, around the village, arable and ruderal areas surrounded by forest; 192 m a.s.l; 42º33’58.0”N, 18º18’59.6”E.
21. Mihanići, old railroad NW of the settlement, a karst field with arable lands and grasslands, surrounded by ruderal areas and forest.; 324 m a.s.l; 42º33’59.6”N, 18º20’04.1”E.
22. Pridvorje-Mihanići, fields between the villages, arable and ruderal areas surrounded by forest; 219 m a.s.l; 42º33’07.1”N, 18º20’54.8”E.
23. Lovorno, road N of the village, arable and ruderal areas surrounded by forest; 291 m a.s.l; 42º33’03.0”N, 18º21’16.1”E.
24. Lovorno, around the village and slopes, arable and ruderal areas surrounded by forest; 193 m a.s.l; 42º32’33.5”N, 18º21’51.5”E.
25. Gornja Ljuta - Konavoski Dvori, banks of river Ljuta, a karst field with arable lands and grasslands, surrounded by ruderal areas and forest.; 73 m a.s.l; 42º32’11.8”N, 18º22’36.3”E.
26. Močići, around the village, arable and ruderal areas surrounded by forest; 129 m a.s.l; 42º33’33.0”N, 18º14’52.0”E.
27. Uskoplje, Vlahutini, around the village, a karst field with arable lands and grasslands, surrounded by ruderal areas and forest.; 91 m a.s.l; 42º33’57.2”N, 18º16’35.5”E.
28. Čilipi, around and N of the village, arable and ruderal areas surrounded by forest; 159 m a.s.l; 42º32’59.6”N, 18º17’06.0”E.
29. Miljasi, around the village, a karst field with arable lands and grasslands, surrounded by ruderal areas and forest.; 58 m a.s.l; 42º33’06.6”N, 18º19’25.2”E.
30. Popovići, Konavosko polje NE of the settlement, a karst field with arable lands and grasslands, surrounded by ruderal areas and forest.; 44 m a.s.l; 42º32’05.6”N, 18º19’54.6”E.
31. Gruda, Konavosko polje around the settlement, ruderal areas and a karst field with grasslands, arable lands, and a river surrounded by forest; 52 m a.s.l; 42º31’25.5”N, 18º22’03.5”E.
32. Gruda, NW of Crnjegovina, banks and fields of Konavočica river, a karst field with grasslands, arable and ruderal areas, and forest fragments; 73 m a.s.l; 42º30’57.7”N, 18º23’15.8”E.
33. Gruda, banks of river Konavočica N of Karasovići, A karst field with arable lands and grasslands, surrounded by ruderal areas and forest.; 85 m a.s.l; 42º30’27.3”N, 18º24’06.9”E.
34. Pločice, S of the village, arable and ruderal areas surrounded by forest; 210 m a.s.l; 42º29’31.5”N, 18º24’48.6”E.
35. Palje Brdo, road verges S of the village, a karst field with arable lands and grasslands, surrounded by ruderal areas and forest; 242 m a.s.l; 42º29’56.0”N, 18º25’44.4”E.
36. Popovići, around the village, mediterranean evergreen forests, maquis, and garigue, as well as rocky grasslands with arable lands; 80 m a.s.l; 42º30’57.7”N, 18º19’04.2”E.
37. Radovčići - Poljice, field road S of the main road, mediterranean evergreen maquis and garigue, along with rocky grasslands and arable lands on deeper soil; 316 m a.s.l; 42º29’57.4”N, 18º21’28.2”E.
38. Molunat, W and N of the settlement, mediterranean evergreen forests, maquis, and garigue with ruderal areas; 57 m a.s.l; 42º27’27.0”N, 18º26’04.9”E.
39. Vitaljina, around Višnjići village, ruderal areas and arable lands surrounded by forest and degraded stands; 205 m a.s.l; 42º27’49.4”N, 18º27’28.3”E.
40. Vitaljina, Tripkovići, road N of the village, arable lands surrounded by forest and degraded stands; 140 m a.s.l; 42º26’10.0”N, 18º29’08.7”E.
41. Prevlaka, central part to Rt Oštro, mediterranean evergreen forests, maquis, and garigue with ruderal areas; 23 m a.s.l; 42º23’37.1”N, 18º31’54.9”E.

Results

During this survey, a total of 106 species were recorded in the Konavle region (Table 1). The most common species, recorded in 30 or more localities were *Iphiclides podalirius* (Linnaeus, 1758), *Colias croceus*

(Geoffroy, 1785 in Fourcroy), *Gonepteryx rhamni* (Linnaeus, 1758), *Polyommatus icarus* (Rottemburg, 1775), *Lasiommata megera* (Linnaeus, 1767), *Vanessa atalanta* (Linnaeus, 1758), *Vanessa cardui* (Linnaeus, 1758) and *Maniola jurtina* (Linnaeus, 1758).

Figure 3. Conservation value of individual localities in Konavle in relation to the designated Natura 2000 area HR2000946 Sniježnica i Konavosko polje.



The rarest species recorded in one or two localities were *Parnassius mnemosyne* (Linnaeus, 1758), *Gegenes nostrodamus* (Fabricius, 1793), *Lycaena tityrus* (Poda, 1761), *Brenthis daphne* (Bergsträsser, 1780), *Coenonympha rhodopensis* Elwes, 1900, *Danaus chrysippus* (Linnaeus, 1758) and *Aglais urticae* (Linnaeus, 1758). The species *Colias alfacariensis* Ribbe, 1905, which was recorded with only five solitary individuals during the years of research, should be also mentioned as a rarity. Since it is an easily noticeable species, it is quite possible that only individuals from nearby populations in the hinterland appear in the studied area, mostly in the fall.

Table 2. Comparison of the Rhopalocera diversity and the biogeographic composition (modified from Kudrna et al. 2015) between Konavle (this study) and the surrounding area Trebinje - Orjen (Sijarić, 1983). ES - Euro-Siberian, EO - Euro-Oriental, Mon - Montane or Boreo-Montane, Hol - Holarctic, EM - Euro-Meridional, MED - Mediterranean, Tro - Tropical, Cos - Cosmopolitan.

Researched area	No. of species	EO	ES	Hol	EM	Tro	MED	Mon	Cos
Konavle	**106**	41	40	7	6	5	5	1	1
Trebinje - Orjen	**85**	31	37	4	6	2	1	3	1

The comparison of Rhopalocera diversity and biogeographical composition between the areas of Konavle and Trebinje-Orjen revealed the prevalence of Euro-Siberian and Euro-Oriental species in both loculations (Table 2). Konavle had a higher number of Holarctic, Tropical, and Mediterranean species while Trebinje-Orjen had a higher number of montane species (Table 2). More species (106) were recorded at Konavle but additional 14 species not recorded in Konavle were recorded in the Trebinje-Orjen area. In total, from the Konavle-Trebinje-Orjen area 120 Rhopalocera species are known so far. The Sorensen's index between Konavle and Trebinje-Orjen is 0.391, which indicates a relatively low similarity between the two areas based on their species composition.

With one exception, all sites with a conservation value of more than 40 were located within the Natura 2000 site HR2000946 Sniježnica i Konavosko polje (figure 3). Also, all 106 recorded species within the Konavle area, were also found in the Natura 2000 site Sniježnica i Konavosko polje.

A total of 103 species were found on Mt. Sniježnica during this survey. The missing species are *Apatura metis* Freyer, 1829, *Cupido argiades* (Pallas, 1771) and *Gegenes nostrodamus* (Fabricius, 1793) which were recorded only in the Konavosko polje. Mt. Sniježica has fewer species than Mt. Dinara, Mt. Svilaja, and Mt. Biokovo but more than Mt. Mosor and Mt. Kozjak (Table 3). On Sniježnica, Euro-Siberian and Euro-Oriental species predominate with a considerable number of Holarctic and Mediterranean species (Table 3).

Table 3. Comparison of the Rhopalocera diversity and the biogeographic composition, modified from Kudrna et al. (2015), between selected mountain ranges of Dalmatia arranged in the northwest-southwest direction. The altitudinal span of the sampled localities in each mountain is added. ES - Euro-Siberian, EO - Euro-Oriental, Mon - Montane or Boreo-Montane, Hol - Holarctic, EM - Euro-Meridional, MED - Mediterranean.

Mountain	Altitudinal span (m)	No. of species	ES	EO	Mon	Hol	EM	MED	other
Dinara	250 - 1910	128	61	42	8	6	8	0	3
Svilaja	270 - 1508	112	52	40	2	7	8	1	2
Kozjak	110 - 740	87	35	34	0	7	6	1	4
Mosor	50 - 1100	96	38	41	1	7	5	1	3
Biokovo	90 - 1760	116	47	45	3	6	7	4	4
Sniježnica	150 - 1234	103	39	40	1	6	6	5	6

Discussion

During this research, a total of 106 species of Rhopalocera were recorded in a relatively small part of Croatia, with almost all species being recorded for the first time in the researched area.

Given that the Konavle region is bordered to the north by Bosnia and Herzegovina and to the east by Montenegro, it is meaningful to compare the fauna of these areas. The most comprehensive study on this region, which almost semi-circularly surrounds Konavle, focuses on researching Rhopalocera from Trebinje in Bosnia and Herzegovina to Mount Orjen in Montenegro. A total of 85 species of Rhopalocera are known from this area (Sijarić, 1984), but the author himself emphasises that not all areas were covered, as the research was predominantly ecological. Comparing the biogeographic affiliations between two areas, Konavle and Trebinje-Orjen, reveals a notable lack of systematic research in the spatially and altitudinally more diverse area between Trebinje and Orjen. This is also indicated by the relatively low result of the Sorensen's index of diversity, suggesting a moderate similarity between the surveyed areas. However, further research in these areas in Bosnia and Montenegro will significantly reduce these differences, although disparities in high-mountain species missing on Sniježnica and typical Mediterranean species likely absent in those areas will persist.

The analysis of the conservation value of Rhopalocera fauna of Konavle indicates that all localities with the conservation value of more than 40, except one, are located within the Natura 2000 area HR2000946

Sniježnica i Konavosko polje (Figure 2). In addition, all species recorded during this survey were recorded within the Natura 2000 area. Currently no Habitats Directive species are listed for the area HR2000946 Sniježnica i Konavosko polje, but during our survey we recorded several populations of Annex II species *Euphydryas aurinia.* The occurrence of this species in Dalmatia is mostly limited to its northern parts and that it occurs in southern Dalmatia was not known before this survey (Šašić et al. 2015). Accordingly, we propose including this species in the list of targeted species for the HR2000946 Sniježnica i Konavosko polje area. This could help the protection of the species and its habitat in the long term. Aside from it, four Annex IV of the Habitats Directive species were also recorded in the area *Apatura metis, Papilio alexanor, Parnassius mnemosynae,* and *Zerynthia polyxena*. While Natura 2000 areas are not ideal to protect all their biodiversity, they may have a positive impact on targeted (Kajzer-Bonk & Nowicki, 2022) as well as on non-targeted Rhopalocera species but with the improvement the habitat quality of the sites (Pellissier et al. 2020). Also, the effectiveness of Natura 2000 sites may depend on public perception of the network (Blicharska et al. 2016), human population size, and taxonomic group considered (Trochet & Schmeller, 2013). The recent study on three *Phengaris* species demonstrated that Natura 2000 sites fulfil their protective function in halting population loss of species of high conservation interest even in urban areas (Kajzer-Bonk & Nowicki, 2022).

In comparison with other well-researched mountains of Dalmatia (Table 2), Sniježnica follows the general trend dominated by Euro-Siberian and Euro-Oriental species (Verovnik et al. 2023), while mountainous species are sparse, like the case of Mt. Mosor (Koren et al. 2020). The area of Sniježnica predominantly experiences a Mediterranean climate, yet with relatively cold winters where the summit areas are often covered in snow, likely facilitating the survival of the only high mountain species present in the area, *Coenonympha rhodopensis*. However, it is not sufficiently high for the presence of the genus *Erebia*, which is one of the main high mountain elements of the Dinaric Mountains (Mladinov & Lorković, 1985). In comparison with other mountains, Sniježnica has the highest number of Mediterranean species, six in total, surpassing even Mount Biokovo, which rises practically from the sea level. This indicates the uniqueness of Sniježnica in the context of Croatian mountains and the need for further research and evaluation. In a recent study on orthoptera, significant diversity was highlighted on this mountain, with two new additions to the fauna of Croatia being recorded (Rebrina & Tvrtković, 2019).

During this research, several rare or significant species have been recorded, whose presence in the surveyed area requires further detailed discussion. Some species like *Kirinia roxelana* (Koren et al. 2019b)*, Danaus chrysippus* (Koren et al. 2019a)*, Aricia anteros* (Koren, 2012) and *Lycaena ottomanus* (Koren et al. 2012; Mihoci et al. 2005) have already been dealt with in other publications and will not be mentioned here.

PAPILIONIDAE

Papilio alexanor Esper, 1800 (Figure 4a)

The narrative surrounding this iconic species in Croatia has been recently comprehensively elucidated (Verovnik & Švara, 2016). However, it is remarkable how swiftly, following the initial recent discoveries, the species has been reencountered in both historical (Koren et al. 2019, 2020) and novel locations (Kačírek, 2017; Russell & Pateman, 2018). Within the surveyed region, this species exhibits a relatively broad distribution, albeit localised, intricately tied to the presence of its host plant, *Opopanax chironium* (L.) W. D. J. Koch. Even if a single plant is present there is a probability that eggs and/or caterpillars will be observed on it. On some locations, the species is not recorded each year which indicates that the species probably does not form permanent populations on each small habitat patch, but rather utilizes larger areas. While adults are always a sight to see, the presence of this species in an area is most easily established by the search for caterpillars. In Konavle, many localities where this species was recorded are not easily accessible, but others are located very near roads or hiking paths. This can potentially make them vulnerable for any habitat destruction or degradation. In addition, this may present an opportunity for illegal poaching that can be prevented either by the awareness raising of local communities or regular patrols by the rangers of the Public Institution for the Management of Protected Natural Areas of Dubrovnik-Neretva County.

Parnassius mnemosyne (Linnaeus, 1758)

This species is relatively common in the mountainous regions of central and northern Croatia, while in the

southern Dalmatia region, it has only been recorded in the Biokovo area so far (Mihoci et al. 2011). During this study, it was observed only once on the rocky part of Mount Snježnica, and the collected specimen was deposited in the Lepidoptera collection of Dubrovnik Natural History Museum. Despite numerous subsequent visits to the area, the species has never been recorded again. This raises the possibility that the observed individual may have flown in from surrounding border areas of Bosnia and Herzegovina or indicates its rarity in the surveyed area. Since this species is listed in Appendix IV of the Habitats Directive, Croatia is obligated to monitor the status of its populations, and targeted efforts may be needed in the future to determine whether *Parnassius mnemosyne* has a permanent population in the Konavle area or not.

PIERIDAE

Leptidea sinapis / juvernica complex

The genus *Leptidea* Billberg, 1820 is widely distributed across Croatia, with *L. sinapis* (Linnaeus, 1758) being present across the whole country while the presence of *L. juvernica* Williams, 1946 is mostly confined to central northern Croatia (Lorković, 1993) with some records also from the Mediterranean parts of the country (Kučinić et al. 2017). Accordingly, the distribution in some parts of the country remains rather unexplored. This is mostly due to the need to collect specimens and the examination of their genitalia to provide a correct species ID. Within this study, several dozen specimens were collected across the study area. Special attention was given to the borderland areas like northern montane parts or the more moist meadows in the Konavle field which would better suit the known ecological needs of this species (Lorković, 1993). All the examined specimens belonged to *L. sinapis*, which follows the general species' distribution in the Balkan peninsula (Shtinkov et al. 2016).

HESPERIIDAE

Gegenes pumilio and *Gegenes nostrodamus* (Figure 4b)

The story of these two extremely similar species of the genus *Gegenes* Hübner, [1819] in Croatia is still not fully clarified. Until the 1970s, it was believed that only the species *Gegenes nostrodamus* (Fabricius, 1793) lives across the Adriatic coast of Croatia (de la Nicholl, 1899; Mladinov, 1962; Steiner, 1938; Werner, 1895; Zerny, 1920). It was only through Lorković's analysis of available specimens that it was determined that the majority belong to the species *Gegenes pumilio* (Hoffmannsegg, 1804), with only an individual from Marjan, Split originating from Croatia, belonging to the species *G. nostrodamus* (Lorković, 1971). Accordingly, all previous findings of this genus before this publication should be taken with caution because it is not certain to which species they belong. In addition, Lorković also presented a good distinguishing feature for the males of both species, the fringes, or hairs on the front edge of the basal part of the hindwings that are sparse fine, and short in *G. pumilio* while dense long, and broad in *G. nostrodamus* (Lorković, 1971). While this is visible in the fresh specimen, we believe that the examination of male (Filipčić, 1998) or female genitalia (Cotutsis, 2012) is needed to confirm the species' identity without any doubt. All the collected specimens in the study area were analysed which revealed the current distribution. *Gegenes pumilio* is a widespread, but rarely very common species in the study area. The species flies from April until November in two to three consecutive generations with the second one being significantly more numerous. It can most easily be observed at the end of summer and at the beginning of autumn feeding on *Dittrichia viscosa* (L.) Greuter, a common Mediterranean ruderal plant that has its flowering peak during that period. It also seems that the population size to some extent varies between years. In early January, larvae were present on *Hyparrhenia hirta* (L.) Stapf growing along the roadside in close vicinity of Molunat. This record represents the first evidence of a host plant used by the species in Croatia. *H. hirta* is also reported from Greece as a hostplant of *G. pumilio*, together with two other Poaceae species, *Phragmites australis* (Cav.) Steud. and *Imperata cylindrica* (L.) Raeusch (Lafranchis, 2019). As both additional grass species occur in Croatia, it is likely that future research will reveal the presence of early developmental stages of *G. pumilio* on them as well.

On the other hand, *G. nostrodamus* is a very rare species and is for now limited to a single locality within the Konavosko polje. At the single locality, only *G. nostrodamus*, both males and females were observed and collected indicating the present population. This is indeed the first confirmed record of this species in Croatia

in more than 50 years. While the aim of this work is only southern Croatia, a note must be given to the rarity and potential endangerment of this species. From all other collected specimens across coastal Croatia, only another locality with *G. nostrodamus* was discovered, at Vransko Lake near Zadar. This shows that indeed this species is very scarce in Croatia, and it may even be endangered due to the small size of its area. While neither species is included in the current Red List of Rhopalocera of Croatia (Šašić et al. 2015), the status of both species should be assessed in the future and according to results *G. nostrodamus* should be placed under legal protection to protect the species, and its habitats. In the Climate risk atlas of European Rhopalocera *G. pumilio* is listed in the category HR (high climate change risk) meaning that climate change poses a high risk to the species because more than 70% of the grids with currently suitable climate may no longer be suitable in 2080 while *G. nostrodamus* is listed in HHHR (extremely high climate change risk) meaning that the climate change poses a very high risk to the species because more than 95% of the grids with currently suitable climate may no longer be suitable in 2080 (Settele et al. 2008).

LYCAENIDAE

Lycaena tityrus (Poda, 1761)

Alongside *Lycaena phlaeas* (Linnaeus, 1761), this is the most common species of this genus in Croatia (Lorković, 2009). However, it was thought that it is completely absent from the entire region of Dalmatia (Jakšić, 1988). For several decades, populations of this species have been known to exist in neighbouring Bosnia and Herzegovina, particularly in the southern Herzegovina area (Jakšić, 1988). Yet, previous research has never documented its presence in southern Dalmatia. This study has discovered a small population of this species in the Dubravka, Prapratni dol. During the field trip to locality 12, three females and two males of this species were found. Aside from this record, one male specimen of this species was also observed in the Imotsko polje on 1-V-2021 (obs. D. Dender) indicating that it may be present at some other habitually and climatically similar places in parts of Dalmatia bordering Bosnia and Herzegovina.

Plebejus idas (Linnaeus, 1761)

The distribution of two rather similar species *Plebejus idas* (Linnaeus, 1761) and *Plebejus argyrognomon* (Bergsträsser, 1779) across Croatia is still not very well known and almost no large-scale distribution analysis exists (Lorković, 2009). In Dalmatia, both species occur, for example in areas of more montane climate like Mt. Svilaja (Verovnik et al. 2023), while toward the south, e.g. on Mt. Biokovo, only *P. idas* is known (Kačírek, 2017). Within this study, we managed to collect only *P. idas* across the study areas, including the montane parts of Mt. Sniježnica where the species is not rare. In general, a large-scale integrative taxonomy analysis is needed for this genus in the region to assess the status of the present taxa in the region.

Polyommatus admetus (Esper, [1783]) (Figure 4c)

This is a rather local, but sometimes common species in Croatia, mostly distributed from the border parts of Mt. Velebit (Tvrtković et al. 2015), across southern parts of Lika and some parts of Dalmatia (Koren, 2010; Verovnik et al. 2023). So far, the southernmost record of this species in Croatia was from Mt. Mosor (Koren et al. 2020). During this survey we recorded this species mostly at the higher parts of Mt. Snježnica, expanding its distribution in Croatia significantly toward the south. On the south-facing slopes, this species was recorded from the elevations above 680 m asl and above 450 m a.s.l. on the north-facing slopes.

NYMPHALIDAE

Apatura metis Freyer, 1829 (Figure 4d)

The initial discovery of this species in the researched area was very surprising and unexpected. Generally, neither *A. metis* Freyer, 1829 nor its similar and related species *A. ilia* ([Denis & Schiffermïller], 1775) are found in the southern Dalmatia region. *Apatura metis* is predominantly associated with eastern Slavonia

and Baranja in Croatia (Lorković & Siladjev, 1982), while *A. ilia* has a broader distribution and is present also in the Mediterranean parts of Istria and very locally in Dalmatia, Sinjsko polje (Sijarić, 1971). However, if we look at the distribution of *A. metis* in Europe, we observe that this predominantly Pannonian species also has isolated populations in the Balkans, including Montenegro and Albania (Micevski et al. 2015). Therefore, the nearest population to the one in Konavle is located at Lake Skadar in Montenegro (Švara et al. 2015) and Albania, which is only 70 km away from Konavle. There is also an record of this species in the border areas of Bosnia and Herzegovina, from Hutovo blato (https://www.inaturalist.org/observations/28994619) but the validity of the identification should be further investigated as the identification based only on photography can be very misleading with this species. During our research it was regularly observed along the river Ljuta in Konavosko polje. Since this is the only record of this species in the Mediterranean region of Croatia, and the species itself is listed in Annex IV of the Habitats Directive, its location should be included in the species monitoring program in Croatia. The main threat to the survival of this species in the area would be the potential destruction of the willow belt in the vicinity of Ljuta river that could occur with the intensification of agricultural production in the Konavosko polje.

Melitaea ornata Christoph, 1893

This is a sister species to the more common and widespread *Melitaea phoebe* ([Denis & Schiffermüller], 1775) whose distribution in Croatia was established relatively recently (Koren & Štih, 2013). Its known distribution stretches from Istria in the north, inland Medvednica Mountain near the capital city Zagreb, and several locations along the Adriatic coast including northern Dalmatia (Verovnik et al. 2015), Mt. Mosor (Koren et al. 2020) and Mt. Svilaja (Verovnik et al. 2023). In the southernmost part of Dalmatia, both species are present with *M. ornata* being more common than *M. phoebe*. Seemingly in the area they also differ in the used habitat; *M. ornata* is mostly present in higher rocky areas while *M. phoebe* inhabits more humid habitats where deeper soil is present, mostly in the Konavosko polje.

Coenonympha rhodopensis Elwes, 1900

In the ecological sense, of particular significance are the findings of the high mountain species *Coenonympha rhodopensis*, which is locally represented by the subspecies *occupata* Rebel, 1903. This is the only high-mountain species that we recorded in the study area and only at the upper parts of Mt. Sniježnica. The discovery of this species was surprising, as the habitat is rather different from the one in other areas of Lika and Dalmatia where this species usually occurs (Kačírek, 2017; Mihoci et al. 2007; Verovnik et al. 2023). In Croatia the closest populations are in the upper zone of Mt. Biokovo where the species inhabits montane grasslands in the littoral beech forests zone (*Fagetum croaticum seslerietosum* Ht.). However, in the neighbouring area Trebinje-Orjen the species also occurs, and in similar habitats to the ones on Mt. Sniježnica. Both on Mt. Sniježnica and Trebinje-Orjen it occurs at approximately 1000 metres above sea level in the *Querco-Ostryetum carpinifoliae* association, in a very thermophilic habitat of thinned stands with the characteristics of a rocky area (Sijarić, 1983).

Aside from the observed species, some of the species that were expected to be recorded are missing from the region.

The distribution of *Tarucus balkanica* (Freyer, 1843) in Croatia has recently undergone revision (Koren et al. 2022), and notably, the species is absent from southern Dalmatia, including the Konavle area. This absence is quite surprising, given that the habitats, primarily open areas with its host plant *Paliurus spina-christi* Mill., are common in the region. Despite targeted searches and thorough surveys of numerous habitats, the species has never been observed here. Currently, we cannot speculate on the possible reasons for this.

Pyronia cecilia (Vallantin, 1894) is known in Croatia from Istria in the west (Koren et al. 2018) extending along the Adriatic coast of Dalmatia (Jakšić, 1988). However, its presence is notably lacking in southern Dalmatia. The single southernmost recorded instance in the area of Dubrovnik (Habeler, 1976; Seyer, 1938), situated north of Konavle. However, even there, it has never been confirmed with recent studies (authors, unpublished obs.).

The karstic areas of Mt. Sniježnica at first glance look like a good habitat for many rocks loving species

like *Arethusana arethusa* ([Denis & Schiffermüller], 1775), *Chazara briseis* (Linnaeus, 1764) or the genus *Hyponephele*, but alas, even after many targeted visits and surveys, those species were never recorded in the area. The reason for it is again unknown, especially due to the openness of the area suitable for many species that occur in the same habitats as the mentioned species, but just in middle Dalmatia like on Mt. Mosor (Koren et al. 2020). While the habitat at the first glance seems suitable for them, the lack of those species could be attributed to some still unexplained microclimatic factors so further studies are required. At least some of the mentioned species, *Chazara briseis* and *Hyponephele lupinus,* are also present in the neighbouring areas of Trebević-Orjen (Sijarić, 1983) indicating that at least some of wider area of this region are suitable for them.

Notes on the observed extended flight periods of selected species

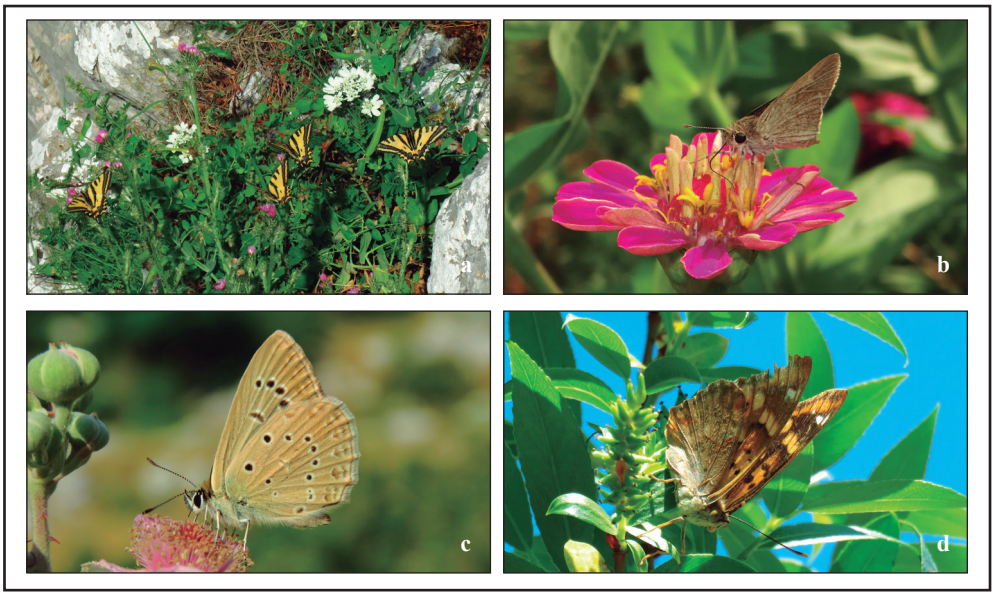
In this chapter we give some interesting winter observations on the flight period of several species. Due to the influence of the Mediterranean climate and mild winters, Rhopalocera become a common sight in the lower parts of this area as early as February, and this situation continues until November, at the end of which most species cease to be recorded. However, it is possible to see some species even during the most unfavourable period of the year (December-January), which, in addition to low temperatures, also means the shortest period of daylight and frequent rainfall. In the case of most species, such observations are local and few, and refer to south-oriented - thermophilic, lower positions where, because of anthropogenic influences (road edges, agricultural production, late mowing, etc.), flowering plant species are present. Few and irregular observations of species that overwinter in the imago stage are not surprising: *Gonepteryx rhamni* (Linnaeus, 1775), *Libythea celtis* (Laicharting, 1782), *Polygonia egea* (Cramer, 1775) and *Issoria lathonia* (Linnaeus, 1758). However, the observations of species that are unable to rest longer in the imago stage are interesting (Tolman & Lewington, 2008). The species *Colias croceus* (Geoffroy, 1785 in Fourcroy) was regularly observed in the mentioned habitats during December and January. On the 24th site, 16-I and 30-I-2022. recorded caterpillars in different stages of development, on *Colutea arborescens* L. bushes. Along with it, the following species were irregularly recorded in smaller numbers: *Pieris brassicae* (Linnaeus, 1758) (18-XII-2022 - locality 24; 25-XII-2022 - locality 19; 24-XII-2023 - locality 24), *Pieris rapae* (Linnaeus, 1758) (2-XII-2018 - locality 24; 10-XII-2018 - locality 24 - 3 individuals; 30-I-2022 - locality 24 - 3 individuals), *Pieris manni* (Mayer, 1851) (23-XII-2018, 18-XII-2023 and 25-XII-2023 - locality 24; 14-I-2022 - locality 17), *Pieris ergane* (Geyer, [1828] in Hübner) (30-I-2022 - locality 24), *Lassiomata megera* (Linnaeus, 1767) (30-I-2022 - locality 24; 23-XII-2023 - locality 19, 24-XII-2023 - locality 24) and *Lycaena phlaeas* (16-I-2022 - locality 24). All these observations indicate that in part of the area, at least during normal winters, the summer period of the mentioned species could be uninterrupted, or almost uninterrupted. Such observations partly differ from the data available so far on the flight time of some species (Lorković, 2009). In the mentioned localities, it is still possible to see the last specimens, the last annual generations of *Polyommatus icarus* (Rottemburg, 1775) (2-XII-2018 - locality 24), *Leptotes pirithous* (Linnaeus, 1767) (2-XII-2018 and 10-XII-2018 - locality 24), *Lampides boeticus* (Linnaeus, 1767) 18-XII-2022 and 25-XII-2022 - locality 24), *Colias alfacariensis* Ribbe, 1905 (23-XII-2018 - locality 24) and *Vanessa cardui* (Linnaeus, 1758). In the case of *Vanessa cardui*, the last sightings also come from the second half of December, but it is not clear whether they are maintained in the area throughout the whole year or whether migratory individuals from the south appear already in February. The situation is special with the species *Vanessa atalanta* (Linnaeus, 1758), which is primarily a relatively common sight in the settlements and their surroundings in the Konavle area during autumn and winter.

Threats to the Rhopalocera in the study area

Given that threats and pressures are most often not tied to individual species but rather to the impact on their habitat, which includes host plants, in this chapter, we will provide a collective overview of potential reasons for the endangerment of Rhopalocera in the Konavle area. Regarding the threats and pressures the entire area can be divided into two main parts: the area of Konavosko polje and the surrounding, mostly karstic area. The abandonment of agriculture generally leads to the advancement of woody vegetation, thereby causing habitat closure due to the disappearance of grassland habitats. This process is

present throughout the entire limestone area, from the seacoast to the higher parts of Mt. Sniježnica and is particularly relevant to rocky areas where there is no longer grazing, and fires, when they occur, are most often quickly extinguished due to increasingly efficient fire protection. In the area of Sniježnica, there is a visible trend of declining population density, manifested in the neglect of "do(l)ci" - karstic areas with deeper soil with meadows and agricultural land and the subsequent overgrowth and closure of habitats. Another potential but not easily solvable problem is climate change, which can primarily have a negative impact on mountainous and colder habitat species that could disappear from this area with further warming. These include species such as *Coenonympha rhodopensis* Elwes, 1900, *Aricia anteros* (Freyer, 1838) and *Carcharodus lavatherae* (Esper, 1783). However, with further warming, it is likely that Mediterranean species will become even more present and expand in this area.

Figure 4. Some of the most iconic species recorded during this survey. **a)** *Papilio alexanor* feeding on *Carduus pycnocephalus* L. **b)** *Gegenes nostradamus* feeding in a village garden. **c)** *Polyommatus admetus* from the higher part of Mt. Sniježnica. **d)** *Apatura metis* near Ljuta River.



In the Konavosko polje, the announced land consolidation poses a potential problem that will last for several years, with the aim of turning the Konavosko polje into a place of serious agricultural production as soon as possible. This could potentially endanger many species, especially *Lycaena ottomanus* (Lefèbvre, 1830), since Konavle region represents the only area where this species is present in Croatia and Konavosko polje represents the part of the region with the largest area of favourable habitats. The destruction of smaller parts of the habitat, such as some locations where the species was abundant a decade ago, has already been observed. However, progress cannot be fought against, but it can be directed. We hope that this work will at least slightly help in this regard and draw the attention of is important for the Public Institution for the Protection of Nature and Environment in the Dubrovnik and Neretva County and assist them in the better management of this Natura 2000 area.

Conclusions

Thanks to this research, the Konavle area has transitioned from being one of the least explored regions in Croatia to one of the best-explored areas, with 106 recorded species of Rhopalocera. Comparison with neighbouring regions, Trebinje - Orjen, revealed that approximately 120 species of Rhopalocera inhabit the entire area, yet the surrounding areas remain inadequately explored in comparison to the Konavle

region. In Konavle, most sites with high conservation value, as well as most recorded species, fall within the boundaries of the Natura 2000 ecological network, thereby increasing the long-term prospects for Rhopalocera protection and survival in the area. In the northern part of the region, on Mount Sniježnica, a unique composition of Rhopalocera has been documented, differing from other better-explored mountains in Dalmatia, primarily due to the presence of a greater number of Mediterranean species. Furthermore, numerous previously unknown populations of species listed in Annex II of the Habitat Directive, such as *Euphydryas aurinia* (Rottemburg, 1775), have been recorded in the surveyed area, along with four additional species listed in Annex II of the Habitat Directive.

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Conflict of Interest

The authors declare that there is no known financial interest or personal relationship that could have influenced the work presented in this article.

References

Blicharska, M., Orlikowska, E. H., Roberge, J.-M., & Grodzinska-Jurczak, M. (2016). Contribution of social science to large scale biodiversity conservation: A review of research about the Natura 2000 network. *Biological Conservation*, *199*, 110-122. https://doi.org/10.1016/j.biocon.2016.05.007

Cotutsis, J. G. (2012). A comparison between the female genitalia of *Gegenes pumilio* and those of *G. nostrodamus* (Lepidoptera: Hesperioidea). *Phegea*, *40*(1), 39-40.

de la Nicholl, B. M. (1899). Butterfly hunting in Dalmatia, Montenegro, Bosnia and Herzegovina. *The Entomologist's Record and Journal of Variation*, *11*(1), 1-8.

Euro+Med. (2006). [continuously updated] *Euro+Med PlantBase - the information resource for Euro-Mediterranean plant diversity*. http://www.europlusmed.org

Filipčić, A. (1998). Klimatska regionalizacija Hrvatske po Köppenu za standardno razdoblje 1961.-1990. U odnosu na razdoblje 1931-1960. *Acta Geographica Croatica*, *34*, 1-15.

Habeler, H. (1976). Beitrag zur Lepidopterenfauna Dalmatiens. *Acta Entomologica Jugoslavica*, *12*(1-2), 67-86.

Higgins, L. G. (1975). *The classification of European butterflies*. Collins.

Horvatić, S. (1963). Biljnogeografski položaj i raščlanjenje našeg primorja u svjetlu suvremenih fitocenoloških istraživanja, *Acta Botanica Croatica, 22*, 27-81.

Jakšić, P. (1988). Privremene karte rasprostranjenosti dnevnih leptira Jugoslavije. *Jugoslavensko Entomološko Društvo. Posebna Izdanja*, *1*, 214.

Jelavić, A. (1974). Pedološke prilike u mokrim krškim poljima Dalmatinske regije. *Glasilo Hrvatskog agronomskog društva*, *36*(5-6), 275-290.

Kačírek, A. (2017). Contribution to the knowledge of the butterfly fauna (Lepidoptera: Papilionoidea, Hesperioidea) of the Biokovo and Rilić mountain ranges (Croatia, Central Dalmatia). *Klapalekiana*, *53*, 27-50.

Kajzer-Bonk, J., & Nowicki, P. (2022). Butterflies in trouble: The effectiveness of Natura 2000 network in preventing habitat loss and population declines of endangered species in urban area. *Ecological Indicators*, *135*, 108518. https://doi.org/10.1016/j.ecolind.2021.108518

Koren, T. (2010). New data about the distribution of anomalous blue *Polyommatus admetus* (Esper, 1783) (Lepidoptera: Lycaenidae) in Croatia. *Acta Entomologica Serbica*, *15*(2), 221-226.

Koren, T. (2012). New records of three species of the genus *Aricia* Reichenbach, 1817 (Lepidoptera: Lycaenidae) in Croatia. *Acta Entomologica Slovenica*, *20*(2), 135-146.

Koren, T. (2015). The lattice brown, *Kirinia roxelana* (Cramer, 1777) (Lepidoptera: Nymphalidae), rediscovered in Croatia after more than a century. *Natura Croatica*, *24*(2), 317-321. https://doi.org/10.20302/NC.2015.24.21

Koren, T., Burić, I., Glavan, G., & Verovnik, R. (2019). Contribution to the knowledge of the butterfly fauna (Lepidop-

tera: Papilionoidea) of Mt Kozjak, Split, Croatia. *Natura Croatica*, *28*(1), 21-33.
Koren, T., Burić, I., Glavan, G., & Verovnik, R. (2020). The butterfly (Lepidoptera: Papilionoidea) diversity of Mt. Mosor in Dalmatia, Croatia. *Natura Sloveniae*, *22*(2), 43-68. https://doi.org/10.14720/ns.22.2.43-68
Koren, T., Dender, D., Ilić, B., & Martinović, M. (2019a). On the distribution and status of the African monarch (*Danaus chrysippus* (Linnaeus, 1758); Lepidoptera: Nymphalidae) in Croatia. *Nachrichten des Entomologischen Vereins Apollo. Neue Folgen*, *39*(3/4), 140-144.
Koren, T., Dender, D., Ilić, B., & Martinović, M. (2019b). On the distribution of the Lattice Brown, *Kirinia roxelana* (Cramer 1777) in Southern Croatia (Lepidoptera; Nymphalidae). *Acta Entomologica Serbica*, *24*(1), 41-45.
Koren, T., & Lauš, B. (2013). Dinara Massif-a new hotspot for the butterfly (Papilionoidea) diversity of the Dinaric Arc. *Nota lepidopterologica*, *36*(2), 109-126.
Koren, T., Laus, B., Burić, I., Štih, A., Kulijer, D., Dender, D., Kranželić, D., Schmidt, B., & Verovnik, R. (2022). New records of *Tarucus balkanicus* at the northern limit of its distribution along the Adriatic coast (Lepidoptera: Papilionoidea, Lycaenidae). *Fragmenta Entomologica*, *54*(1), Article 1. https://doi.org/10.13133/2284-4880/768
Koren, T., & Štih, A. (2013). On the occurrence of Eastern knapweed fritillary, *Melitaea ornata*(Lepidoptera: Nymphalidae) in Croatia. *Phegea*, *41*(3), 63-66.
Koren, T., Štih, A., Trkov, D., & Črne, M. (2012). New records of Grecian Cooper, *Lycaena ottomana* (Lefèbvre, 1830) (Lep.: Lycaenidae) in Croatia. *Entomologist's Record and Journal of Variation*, *124*(5), 215.
Koren, T., Withrington, D., Štih, A., & Gros, P. (2018). The butterflies of the Istria county (Istria, Croatia): A review of their distribution, status and conservation requirements (Lepidoptera, Rhopalocera). *Gortania*, *40*, 95-114.
Kučinić, M., Mihoci, I., Delić, A., Vajdić, M., & Marguš, D. (2017). Faunističke značajke danjih leptira (Lepidoptera, Rhopalocera) Nacionalnog parka "Krka." *Zbornik radova sa znanstveno-stručnog skupa Vizija i izazovi upravljanja zaštićenim područjima prirode u Hrvatskoj : Aktivna zaštita i održivo upravljanje u Nacionalnom parku "Krka",* 269-292.
Kudrna, O., Pennerstorfer, J., & Lux, K. (2015). *Distribution atlas of European butterflies and skippers*. Wissenschaftlicher Verlag - PEKS.
Lafranchis, T. (2004). *Butterflies of Europe. New field guide and key*. Diatheo.
Lafranchis, T. (2019). Notes on the biology of some butterflies in Greece (Lepidoptera: Papilionoidea). *Entomologist's Gazette, 70*(2), 113-134. https://doi.org/10.31184/G00138894.702.1710
Lepiforum e.V. (2024). *Lepiforum e.V. Bestimmung von Schmetterlingen und ihren Präimaginalstadien*. https://lepiforum.org/
Lorković, Z. (1971). *Gegenes nostrodamus* F. and *G. pumilio* Hffgg. On the eastern Adriatic coast. *Acta Entomologica Jugoslavica*, *7*(2), 56.
Lorković, Z. (1976). Taxonomische, ökologische und chorologische Beziehungen zwischen *Hipparchia fagi* Scop., *H. syriaca* Stgr. Und *H. alcyone* D. & S. (Lepidopt. Satyridae). *Acta entomologica Jugoslavica*, *12*(1-2), 11-33.
Lorković, Z. (1993). *Leptidea reali* Reissinger 1989 (=*lorkovicii* Real 1988), a new European species (Lepid., Pieridae). *Natura Croatica*, *2*(1), 1-26.
Lorković, Z. (2009). Fauna Rhopalocera Hrvatske s osobitim obzirom na faunu Plitvičkih jezera. *Entomologia Croatica*, *13*(1), 15-78.
Lorković, Z., & Siladjev, S. (1982). Der Erstfund der Raupe von *Apatura metis* (Freyer, 1829) in Europa und deren Biotop (Lep., Nymphalidae). *Atalanta*, *13*(2), 126-135.
Micevski, N., Franeta, F., Gascoigne-Pees, M., Micevski, B., & Verovnik, R. (2015). Butterfly surveys in Albania during 2014 including the discovery of two new species for the country. *Ecologica Montenegrina*, *3*, 1-12. https://doi.org/10.37828/em.2015.3.1
Mihoci, I., Hrsak, V., Kucinic, M., Micetic Stankovic, V., Delic, A., & Tvrtkovic, N. (2011). Butterfly diversity and biogeography on the Croatian karst mountain Biokovo: Vertical distribution and preference for altitude and aspect? *European Journal of Entomology*, *108*(4), 623-633. https://doi.org/10.14411/eje.2011.081
Mihoci, I., Šašić, M., & Vuković, M. (2007). Contribution to the butterfly fauna (Hesperoidea & Papilionoidea) of the Velebit mountain, Croatia. *Natura Croatica*, *16*(1), 29-62.
Mihoci, I., Tvrtković, N., & Šašić, M. (2005). Grecian Copper *Lycaena ottomanus* (Lefèbvre, 1830) (Lepidoptera, Lycaenidae) - a new species in the Croatian butterfly fauna. *Natura Croatica*, *14*(4), 255-262.
Mladinov, L. (1962). *Istraživanje faune leptira na otoku Pagu*. 22-25.
Mladinov, L., & Lorković, Z. (1985). Rasprostranjenje montanih Macrolepidoptera u fauni SR Hrvatske, Jugoslavija. *Acta Entomologica Jugoslavica*, *21*(1-2), 17-36.
Parolin, P., Ion Scotta, M., & Bresch, C. (2013). Notes on the phenology of *Dittrichia viscosa*. *Journal of Mediterranean Ecology, 12*, 27-35.
Pellissier, V., Schmucki, R., Pe'er, G., Aunins, A., Brereton, T., Brotons, L., Carnicer, J., Chodkiewicz, T., Chylarecki,

P., del Moral, J., Escandell, V., Evans, D., Foppen, R., Harpke, A., Heliölä, J., Herrando, S., Kuussaari, M., Kühn, E., Lehikoinen, A., Lindström, Å., Moshøj, C., Musche, M., Noble, D., Oliver, T., Reif, J., Richard, D., Roy, D., Schweiger, O., Settele, J., Stefanescu, C., Teufelbauer, N., Touroult, J., Trautmann, S., van Strien, A., van Swaay, C., van Turnhout, C., Vermouzek, Z., Voříšek, P., Jiguet, F., & Julliard, R. (2019). Effects of Natura 2000 on nontarget bird and butterfly species based on citizen science data. *Conservation Biology*, *34*, 666-676. https://doi.org/10.1111/cobi.13434 PMid:31701577

Rebrina, F., & Tvrtković, N. (2019). First overview of Orthoptera and Mantodea of the Sniježnica Konavoska Mountain. *Natura Croatica*, *28*(1), 131-146. https://doi.org/10.20302/NC.2019.28.11

Roglić, J., & Baučić, I. (1958). Krš u dolomitima između Konavoskog polja i morske obale. *Geografski glasnik, 20*, 129-137.

Russell, P., & Pateman, J. (2018). A southward extension to the currently known range of *Papilio alexanor* Esper, 1799 (Lepidoptera: Papilionidae) in Croatia. *Entomologist's Gazette*, *69*(1), 15-17. https://doi.org/10.31184/G00138894.691.1654

Šašić, M., Mihoci, I., & Kučinić, M. (2015). *Crvena knjiga danjih leptira Hrvatske*. Ministarstvo zaštite okoliša i prirode, Državni zavod za zaštitu prirode, Hrvatski prirodoslovni muzej.

Seletković, Z., Tikvić, I., Vučetić, M., & Ugarković, D. (2011). Klimatska obilježja i vegetacija sredozemne Hrvatske. *Akademija šumarskih znanosti*, 142-161.

Settele, J., Kudrna, O., Harpke, A., Kühn, I., Swaay, C., Verovnik, R., Warren, M., Wiemers, M., Hanspach, J., Hickler, T., Kühn, E., van Halder, I., Veling, K., Vliegenhart, A., Wynhoff, I., & Schweiger, O. (2008). *Climate Risk Atlas of European Butterflies* (Vol. 1). Pensoft. https://doi.org/10.3897/biorisk.1

Seyer, H. (1938). Einige Erlebnisse von meiner Jugoslawienfahrt und der Fang einer neuen *Papilio podalirius* L. - Monstrosität (*partitus?*). *Entomologische Rundschau*, *55*(54), 629-657.

Shtinkov, N., Kolev, Z., Vila, R., & Dincă, V. (2016). The sibling species *Leptidea juvernica* and *L. sinapis* (Lepidoptera, Pieridae) in the Balkan Peninsula: Ecology, genetic structure, and morphological variation. *Zoology*, *119*(1), 11-20. https://doi.org/10.1016/j.zool.2015.12.003 PMid:26763758

Sijarić, R. (1971). Faunistička istraživanja *Rhopalochera* (Lepidoptera) na kompleksu Hercegovačkih visokih planina (Prenj, Čvrsnica i Čabulja). *Glasnik Zemaljskog muzeja Bosne i Hercegovine u Sarajevu*, *10*, 163-184.

Sijarić, R. (1983). Sastav i struktura populacija Rhopalocera (Lep.) u ekosistemima krša jugoistočne Hercegovine i Orjena. *Glasnik Zemaljskog Muzeja Bosne i Hercegovine*, *22*, 81-93.

Sijarić, R. (1984). Istraženost Rhopalocera (Lepidoptera) u Crnoj Gori. *Glasnik Odjeljenja Prirodnih Nauka*, *4*, 163-175.

Steiner, S. (1938). Der heutige Stand der Rhopalocera-Und Hesperiidae-Arten für die Lepidopterenfauna Kroatiens. *International Entomologische Zeitschrifft*, *51*, 373-375.

Švara, V., Zakšek, B., & Verovnik, R. (2015). *Contribution to the knowledge of the butterfly fauna of Montenegro (Lepidoptera: Rhopalocera), 23*(1), 37-48.

Tolman, T., & Lewington, R. (2008). *Collins butterflies guide the most complete field guide to the butterflies of Britain and Europe*. Collins.

Trinajstić, I. (1998). Fitogeografsko raščlanjenje klimazonalne šumske vegetacije Hrvatske, *Šumarski list, 122*(9-10), 407-421.

Tvrtković, N., Šašić, M., Mihoci, I., Vuković, M., & Bjelić, M. (2012). Review of the butterfly fauna (Hesperioidea & Papilionoidea) of the Dinara mountain range. *Natura Croatica : Periodicum Musei Historiae Naturalis Croatici*, *21*(2), 471-481.

Tvrtković, N., Verovnik, R., Lovrenčić, L., Vuković, M., & Šašić, M. (2015). New contributions to the butterfly fauna of Mt Velebit and the neighbouring area of Lika (Croatia). *Natura Croatica*, *24*(2), 281-292. https://doi.org/10.20302/NC.2015.24.18

van Swaay, C., Cuttelod, A., Collins, S., Maes, D., López Munguira, M., Šašić, M., Verovnik, R., Versrtael, T., Warren, M., Wiemers, M., & Wynhoff, I. (2010). *European Red List of Butterfies*. Publications Office of the European Union. https://data.europa.eu/doi/10.2779/83897

Verovnik, R., Glavan, G., Burić, I., & Koren, T. (2023). Butterfly fauna (Lepidoptera: Papilionoidea) of Svilaja Mountain, Dalmatia. *Natura Croatica*, *32*(1), 127-142. https://doi.org/10.20302/NC.2023.32.8

Verovnik, R., Koren, T., & Glavan, G. (2015). Contribution to the knowledge of the butterfly and skipper fauna of northern Dalmatia mainland. *Natura Croatica*, *24*(2), 265-280. https://doi.org/10.20302/NC.2015.24.17

Verovnik, R., & Švara, V. (2016). Confirmed recent occurrence of the Southern Swallowtail (*Papilio alexanor* Esper, 1799) in Croatia (Lepidoptera: Papilionidae). *SHILAP Revista de lepidopterología*, *44*(176), 547-552.

Werner, O. (1895). Bilješke o makro-lepidopterima, prikupljenim na poluostrvu Pelješcu. *Glasnik Zemaljskog Muzeja*, *2*, 207-214.

Zerny, H. (1920). III. Lepidoptera. In: Beiträge zur Kenntnis der Fauna Dalmatiens, besonders der Insel Brazza. Bericht über die zweite zoologische Reise des naturwissenschaftlichen Vereins an der Universität Wien nach Dalmatien. Juli 1912. C. Spezieller Teil. Bearbeitung des gesammelten Materials. *Zoologische Jahrbücher, Abteilung Für Systematik, Geographie Und Biologie Der Tiere*, *42*, 195-204.

Živković, P. (1998). Ustupanje Konavala Dubrovčanima, Konavle u prošlosti, sadašnjosti i budućnosti I, Dubrovnik. *Zavod za povijesne znanosti HAZU, Dubrovnik,* 77-81.

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Table 1. List of species observed from Konavle with the locality numbers corresponding to the list of localities in Materials and methods section.

List of species	Locality number
Gegenes nostrodamus (Fabricius, 1793)	25
Gegenes pumilio (Hoffmannsegg, 1804)	1, 21, 25, 31, 36, 37, 38, 39, 40, 41
Carcharodus alceae (Esper, [1780])	1, 2, 3, 4, 11, 12, 13, 14, 16, 19, 25, 28, 30, 31, 32, 38, 39, 41
Muschampia lavatherae (Esper, [1783])	4, 6, 8, 9, 10, 15
Muschampia orientalis Reverdin, 1913	1, 4, 5, 6, 8, 10, 11, 12, 13, 15, 16, 25, 41
Erynnis tages (Linnaeus, 1758)	1, 4, 5, 6, 8, 10, 13, 15, 29, 30, 31
Pyrgus armoricanus (Oberthür, 1910)	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 16, 25, 26, 30, 31, 39, 40
Pyrgus malvae (Linnaeus, 1758)	1, 4, 5, 8, 9, 10, 15, 28, 31, 36
Pyrgus sidae (Esper, 1784)	3, 4, 5, 6, 8, 9, 10, 15, 21, 27, 28
Spialia orbifer (Hübner, [1823])	2, 6, 8, 9, 10, 11, 13, 15, 16, 18, 26, 33
Thymelicus acteon (Rottemburg, 1775)	1, 3, 4, 5, 6, 8, 10, 11, 12, 14, 15, 17, 18, 21, 24, 25, 26, 27, 28, 30, 31, 32, 33, 36, 39
Thymelicus lineola (Ochsenheimer, 1808)	6, 8, 10, 15
Thymelicus sylvestris (Poda, 1761)	1, 2, 3, 4, 6, 8, 10, 12, 13, 15, 21, 22, 28, 30, 31, 32, 39, 40, 41
Ochlodes sylvanus (Esper, 1777)	4, 6, 8, 10, 12, 13, 15, 23, 31
Parnassius mnemosyne (Linnaeus, 1758)	5
Iphiclides podalirius (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 36, 39, 40, 41
Papilio alexanor Esper, 1800	4, 5, 9, 10, 11, 13, 14, 17, 21, 24, 32
Papilio machaon Linnaeus, 1758	1, 3, 4, 5, 8, 9, 11, 13, 15, 18, 21, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 36, 38, 39, 40
Zerynthia polyxena ([Denis & Schiffermüller], 1775)	3, 4, 8, 9, 10, 15, 30, 31, 39
Leptidea sinapis (Linnaeus, 1758)	1, 2, 3, 4, 6, 8, 10, 12, 13, 15, 16, 19, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33, 36, 39
Anthocharis cardamines (Linnaeus, 1758)	1, 2, 8, 9, 10, 12, 13, 15, 22, 23, 26, 28, 30, 31, 34
Aporia crataegi (Linnaeus, 1758)	2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 15, 19, 21, 22, 25, 26, 28, 30, 31, 33, 39, 40
Pieris balcana Lorkovic, 1970	3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 21, 23, 25, 27, 29, 31, 41
Pieris brassicae (Linnaeus, 1758)	1, 2, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 17, 19, 21, 23, 25, 26, 27, 28, 30, 31, 33, 36, 38, 39, 40, 41
Pieris ergane (Geyer, [1828])	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 18, 19, 21, 23, 25, 26, 27, 31, 32, 36, 37, 39, 40, 41
Pieris mannii (Mayer, 1851)	2, 4, 6, 8, 9, 10, 11, 12, 13, 14, 15, 17, 19, 21, 22, 25, 26, 27, 28, 31, 32, 39, 40, 41

Pieris rapae (Linnaeus, 1758)	1, 2, 3, 4, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 27, 30, 31, 32, 36, 39, 40, 41
Euchloe ausonia (Hübner, 1804)	23, 38, 39, 41
Pontia edusa (Fabricius, [1777])	1, 2, 3, 4, 13, 15, 18, 21, 26, 27, 28, 29, 30, 31, 32, 39
Colias alfacariensis Ribbe, 1905	4, 14, 30
Colias croceus (Geoffroy in Fourcroy, 1785)	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 35, 36, 37, 38, 39, 40, 41
Gonepteryx cleopatra (Linnaeus, 1767)	1, 2, 6, 7, 25, 39
Gonepteryx rhamni (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 38, 39, 40, 41
Lycaena ottomanus (Lefèbvre, 1831)	3, 4, 5, 6, 8, 10, 11, 12, 13, 16, 21, 25, 30, 31, 39, 41
Lycaena phlaeas (Linnaeus, 1761)	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 21, 25, 26, 27, 29, 30, 31, 38, 39, 40, 41
Lycaena tityrus (Poda, 1761)	12
Callophrys rubi (Linnaeus, 1758)	4, 5, 8, 10, 12, 15, 26, 27, 28, 30, 31, 36, 38, 39
Favonius quercus (Linnaeus, 1758)	3, 4, 7, 8, 13, 25, 39
Satyrium acaciae (Fabricius, 1787)	4, 6, 8, 13, 31, 39
Satyrium ilicis (Esper, 1779)	1, 2, 3, 4, 6, 7, 8, 10, 12, 13, 14, 15, 18, 21, 23, 25, 27, 32, 33, 39, 40, 41
Satyrium spini ([Denis & Schiffermüller], 1775)	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 18, 21, 25, 32, 33, 39, 40, 41
Lampides boeticus (Linnaeus, 1767)	1, 4, 5, 12, 13, 16, 25, 31, 32, 39, 41
Leptotes pirithous (Linnaeus, 1767)	1, 3, 11, 13, 14, 16, 17, 23, 25, 26, 28, 29, 30, 31, 36, 37, 38, 39, 40, 41
Cacyreus marshalli Butler, 1898	1, 27, 28
Cupido argiades (Pallas, 1771)	25, 29, 30, 31
Cupido minimus (Fuessly, 1775)	1, 4, 5, 6, 7, 8, 9, 10, 11, 13, 15, 21, 27, 28, 31, 33
Cupido osiris (Meigen, 1829)	1, 8, 15, 33
Celastrina argiolus (Linnaeus, 1758)	3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 17, 23, 25, 26, 27, 29, 30, 31, 32, 33, 38, 39, 41
Pseudophilotes vicrama (Moore, 1865)	1, 4, 6, 7, 8, 10, 11, 13, 15, 21, 31, 40
Scolitantides orion (Pallas, 1771)	1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 21, 23, 27, 31, 39, 40, 41
Glaucopsyche alexis (Poda, 1761)	1, 2, 4, 5, 8, 10, 15, 21, 24, 25, 27, 28, 30, 31, 39, 40
Iolana iolas (Ochsenheimer, 1816)	3, 8, 10, 13, 15, 21, 22, 23, 30, 31, 32, 33, 36
Plebejus argus (Linnaeus, 1758)	1, 4, 6, 8
Plebejus idas (Linnaeus, 1761)	2, 3, 4, 5, 6, 7, 8, 10, 15
Aricia agestis ([Denis & Schiffermüller], 1775)	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 39, 40, 41
Aricia anteros (Freyer, [1838])	4, 6, 8, 9, 10
Cyaniris semiargus (Rottemburg, 1775)	4, 5, 6, 7, 8, 10, 15

Lysandra bellargus (Rottemburg, 1775)	1, 2, 3, 4, 6, 8, 11, 12, 15, 16, 18, 25, 26, 28, 31, 32, 33, 39, 40
Lysandra coridon (Poda, 1761)	4, 6, 8, 12, 13
Polyommatus admetus (Esper, [1783])	4, 6, 8, 10
Polyommatus daphnis ([Denis & Schiffermüller], 1775)	4, 6, 8, 13
Polyommatus dorylas ([Denis & Schiffermüller], 1775)	4, 5, 6, 7, 8, 12, 13, 15
Polyommatus escheri (Hübner, [1823])	2, 7, 18, 31
Polyommatus icarus (Rottemburg, 1775)	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 21, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 38, 39, 40, 41
Polyommatus thersites (Cantener, 1835)	2, 3, 4, 6, 7, 8, 10, 11, 13, 21
Libythea celtis (Laicharting, 1782)	1, 3, 4, 6, 8, 9, 10, 11, 13, 14, 15, 19, 21, 22, 23, 24, 25, 27, 29, 30, 31, 33, 36
Charaxes jasius (Linnaeus, 1767)	1, 2, 11, 23, 31, 36, 39, 40, 41
Danaus chrysippus (Linnaeus, 1758)	14, 41
Apatura metis Freyer, 1829	25, 30, 31
Argynnis pandora ([Denis & Schiffermüller], 1775)	11, 21, 25
Argynnis paphia (Linnaeus, 1758)	3, 4, 6, 8, 12, 13, 16, 25
Fabriciana adippe ([Denis & Schiffermüller], 1775)	5, 6, 12, 13
Fabriciana niobe (Linnaeus, 1758)	2, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15
Issoria lathonia (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 17, 18, 21, 25, 26, 28, 31, 39, 40
Vanessa atalanta (Linnaeus, 1758)	1, 2, 3, 4, 5, 7, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 35, 36, 37, 38, 39, 40, 41
Vanessa cardui (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, 34, 36, 37, 39, 40, 41
Brenthis daphne (Bergsträsser, 1780)	4, 13
Brenthis hecate ([Denis & Schiffermüller], 1775)	4, 5, 6, 7, 8, 10, 13, 15
Aglais io (Linnaeus, 1758)	4, 13, 15, 25, 27, 30, 31, 39
Aglais urticae (Linnaeus, 1758)	5
Nymphalis antiopa (Linnaeus, 1758)	3, 4, 7, 8, 13, 15, 20, 23, 25, 27, 29, 30, 31, 32, 39
Nymphalis polychloros (Linnaeus, 1758)	3, 4, 6, 8, 10, 11, 13, 15, 17, 21, 23, 25, 26, 27, 30, 31, 39
Polygonia c-album (Linnaeus, 1758)	13, 15, 25, 30, 31
Polygonia egea (Cramer, 1775)	1, 4, 10, 11, 13, 19, 21, 22, 23, 25, 26, 31, 36, 39
Melitaea cinxia (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 19, 21, 26, 27, 28, 29, 30, 31, 39, 40, 41
Melitaea didyma (Esper, 1778)	1, 2, 3, 4, 5, 7, 8, 12, 13, 15, 18, 21, 25, 27, 28, 30, 31, 39, 40
Melitaea ornata Christoph, 1893	1, 2, 3, 6, 7, 8, 9, 30
Melitaea phoebe ([Denis & Schiffermüller], 1775)	12, 13, 15, 27, 30, 31

Euphydryas aurinia (Rottemburg, 1775)	1, 6, 7, 8, 9, 10, 12, 13, 21
Limenitis reducta Staudinger, 1901	1, 3, 4, 5, 6, 8, 10, 11, 12, 13, 15, 18, 21, 23, 25, 26, 27, 28, 29, 31, 33, 34, 36, 39, 40, 41
Lasiommata maera (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 21, 26, 39
Lasiommata megera (Linnaeus, 1767)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 36, 37, 38, 39, 40, 41
Pararge aegeria (Linnaeus, 1758)	1, 3, 4, 6, 8, 9, 13, 15, 16, 17, 18, 23, 25, 26, 27, 28, 30, 31, 36, 38, 41
Coenonympha arcania (Linnaeus, 1761)	1, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 15, 18, 28
Coenonympha pamphilus (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 15, 16, 18, 21, 25, 26, 27, 28, 29, 30, 31, 32, 33, 39, 40
Coenonympha rhodopensis Elwes, 1900	5, 7
Kirinia roxelana (Cramer, [1777])	4, 6, 15
Pyronia tithonus (Linnaeus, 1767)	4, 12, 13, 16, 31, 32
Maniola jurtina (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 33, 39, 40, 41
Melanargia galathea (Linnaeus, 1758)	4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 30, 31
Melanargia larissa (Geyer, [1828])	1, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 21, 29, 31
Satyrus ferula (Fabricius, 1793)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 18, 19, 21, 22, 24, 25, 26, 27, 31, 32, 33, 36, 39, 40, 41
Hipparchia semele (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 8, 19, 21, 25, 27, 28, 29, 30, 36, 39, 41
Hipparchia statilinus (Hufnagel, 1766)	1, 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 15, 21, 26, 39
Hipparchia syriaca (Staudinger, 1871)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 19, 21, 22, 23, 25, 27, 29, 36, 37, 39, 41
Brintesia circe (Fabricius, 1775)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 15, 18, 19, 21, 22, 23, 25, 28, 31, 33, 39, 40