

Faunistic notes on butterflies (Lepidoptera: Hesperioidea, Papilionoidea) from selected localities in Montenegro

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Abstract

A short-term faunistic survey of butterflies was conducted at six localities in Montenegro during May 2026. The surveyed localities represented a mosaic of habitat types, including wetland habitats, riverine vegetation, montane meadows, ecotonal habitats, and semi-natural rural landscapes distributed across continental and mountainous regions of the country. A total of 75 individuals belonging to 20 taxa and 6 families were recorded. Nymphalidae was the most abundant family (26 individuals), followed by Lycaenidae (22 individuals) and Pieridae (18 individuals). The highest species richness was recorded at Etno Selo Vrelo (Berane) in northeastern Montenegro, where 10 taxa and 24 individuals were observed, whereas Pošćensko jezero (Durmitor NP) and Plav yielded the lowest diversity, each with a single species. The most abundant species was *Coenonympha pamphilus* (12 individuals), followed by *Leptidea sinapis* and *Polyommatus icarus* (9 individuals each). Several taxa were restricted to a single locality, including *Papilio machaon*, *Carterocephalus palaemon*, and *Glaucopsyche alexis*, each recorded from a single locality. The assemblage was dominated by Palaearctic and West Palaearctic faunistic elements; the Pontomediterranean *Cupido decolorata* was noteworthy as an indicator of the xerothermic character of certain investigated habitats and the presence of south-eastern European biogeographical affinities in the studied area. Despite the limited sampling period, the study contributes additional distributional and ecological data on the butterfly fauna of Montenegro and expands current knowledge of butterfly diversity in the investigated region.

Key words: butterflies, Lepidoptera, Hesperioidea, Papilionoidea, faunistics, biodiversity, Montenegro, short-term survey, species diversity

Introduction

Butterflies are among the best-studied insect groups in Europe and serve as important bioindicators due to their sensitivity to habitat alteration and their dependence on specific host plants and habitat conditions (Erhardt & Thomas 1991; Fox 2013). Consequently, butterfly assemblages are widely used to assess the conservation status and ecological integrity of terrestrial ecosystems.

In recent decades, butterfly populations throughout Europe have declined mainly because of habitat loss, agricultural intensification, abandonment of traditional land use, urbanisation, fragmentation of semi-natural habitats, and climate change (Maes & Van Dyck 2001; Sánchez-Bayo & Wyckhuys 2019). These negative trends affect both habitat specialists and widespread generalist species, leading to substantial reductions in regional biodiversity and ecosystem functioning. Similar patterns have also been reported from the Balkan Peninsula, where many ecologically valuable grassland and mountain habitats are increasingly threatened by land-use changes and succession processes.

Despite its relatively small territory, Montenegro represents one of the biologically most diverse countries in the Balkan Peninsula due to its pronounced geomorphological heterogeneity, climatic variability, and the presence of diverse habitat types ranging from Mediterranean coastal ecosystems to mountainous continental environments (Franeta 2018). These environmental conditions create suitable habitats for a remarkably rich butterfly fauna. According to the most recent checklist, 192 butterfly

species have been recorded in Montenegro, representing a substantial proportion of the European butterfly fauna (Franeta 2018).

Research on the butterfly fauna of Montenegro dates to the late nineteenth century, with the pioneering faunistic observations of Nicholl (1899). More systematic investigations were subsequently conducted by Rebel (1913), Rebel & Zerny (1931), Carnelutti & Michieli (1958), Sijarić (1984), and Jakšić (1988), while additional faunistic and distributional data were later supplemented by numerous regional studies (Franeta 2018). Although the butterfly fauna of Montenegro has been relatively well documented (Franeta 2018), additional local faunistic surveys continue to provide valuable distributional and ecological records that complement existing knowledge of the country's butterfly fauna. Recent conservation assessments indicate increasing threats to butterfly diversity in Montenegro. The Red List of Butterflies of Montenegro evaluated all 192 recorded species in the country, of which 35 species were classified within threatened categories or considered regionally vulnerable (Roganović & Malidžan 2023). The importance of butterflies as ecological indicators and conservation targets has therefore gained increasing attention within biodiversity monitoring and nature protection programmes.

The present study provides faunistic notes on butterflies recorded during a short-term survey conducted in selected localities of Montenegro in May 2026. The study aimed to document species composition, relative abundance, habitat affiliation, and faunistic characteristics of the recorded

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butterfly assemblages and to contribute additional data to the knowledge of Montenegrin butterfly fauna.

Materials and methods

Study area

The field survey was conducted on 19 and 20 May 2026 at six investigated localities in Montenegro (Figures 1 and 2). The investigated sites represented a mosaic of habitat types, including montane meadows, river valleys, wetland habitats, forest edges, canyon habitats, and anthropogenically influenced rural areas. The surveyed localities covered both continental and mountainous regions of Montenegro and ranged from lowland habitats to montane lake surroundings.



Figure 1. Investigated localities of butterfly sampling in Montenegro. Localities: L1 – Pošćensko jezero; L2-L3 transect – Komarnica; L4 – Šavnik; L5 – Camp Vrbnica; L7A – Brezojevica; L7B – Plav; L8 – Etno Selo Vrelo.

Locality L1 – Durmitor National Park (Pošćensko jezero; 43.0916 N, 19.1099 E; ca 1,487 m a.s.l.): was situated in the vicinity of Pošćensko Lake and represented a wetland habitat with surrounding mesophilous vegetation. Butterfly sampling at this locality was conducted between 08:00 and 09:00 h.

L2 to L3 transect (Komarnica; 42.9900 N, 19.0689 E; ca 950–1,000 m a.s.l. and 42.9821 N, 19.0683 E; ca 930–980 m a.s.l.): the transect were located near fishpond habitats and riverine vegetation in the Komarnica region. Butterfly sampling at these localities was carried out between 10:00 and 12:00 h and included observations and sampling both directly at the investigated sites and along the route connecting the two localities sampled as a continuous unit.

Locality L4 (Šavnik; 42.9562 N, 19.0929 E; ca 830–875 m a.s.l.): was situated near a river corridor with adjacent meadow vegetation. Sampling was conducted between 12:30 and 13:30 h.

Locality L5 (Camp Vrbnica; 43.161680 N, 18.779737 E; ca 520–560 m a.s.l.): represented a riverine habitat with anthropogenically influenced surroundings near a campsite area. Sampling was conducted between 16:15 and 17:15 h.

Locality L6 (Tara Canyon; 43.127990 N, 19.310080 E; ca 700–750 m a.s.l.): was visited during the field campaign; however, no butterfly sampling was conducted at this site because the locality was excluded from the butterfly survey. The numbering was retained to ensure consistency with parallel studies on other invertebrate groups conducted within the same expedition.

Locality L7A (Brezojevica; 42.6177 N, 19.9378 E; ca 930–970 m a.s.l.): represented ecotonal habitats near cemeteries and a mountain pass. Sampling was carried out between 11:40 and 12:00 h.

Locality L7B (Plav; 42.5914 N, 19.9154 E; ca 900–930 m a.s.l.): was situated near riverine habitats in the surroundings of a local farm. Sampling was conducted between 12:30 and 13:30 h.

Locality L8 (Etno Selo Vrelo (Trpezi, Berane Municipality) 42.9006 N, 20.0092 E; ca 700–750 m a.s.l.): represented semi-natural meadow and rural habitats associated with traditional land use. Sampling was conducted between 15:10 and 16:20 h.

Sampling and species identification

Sampling was carried out using standard entomological methods, including direct observation and capture using an entomological net. All observed and captured individuals were identified directly in the field using standard identification guides and publications (e.g., Slamka 2004; Laštůvka 2008; Franeta 2018). Voucher material was not collected, except for specimens of the genus *Leptidea*, which were taken for subsequent dissection and examination of genital structures for species determination. Individuals that could not be reliably identified to species level under field conditions were recorded only to genus level. The observed *Colias* individual could not be identified to species level, as it was recorded only in flight.



Figure 2. Habitats surveyed for butterflies: wetlands, rocky xerothermic sites, fishpond surroundings, riverine habitats, forest edges, ecotonal meadows, and traditionally managed semi-natural meadows at localities L1–L8.

Taxonomic arrangement and nomenclature of the recorded taxa followed the checklist of butterflies of Montenegro published by Franeta (2018), which currently represents one of the most comprehensive overviews of the Montenegrin butterfly fauna.

Ecological and faunistic classification

Based on habitat affiliation, butterfly species were assigned to ecological categories following Macek et al. (2015). The habitat categories used were ubiquitous species (U), mesophilous meadow species (M1), woodland-edge and forest-margin species (M2), forest species (M3), xerothermophilous grassland species (X1), forest-steppe and shrubland species (X2), and hygrophilous wetland species (H1). In cases where species exhibited two habitat optima, only the primary habitat affiliation was considered in subsequent analyses.

According to faunistic distribution type, species were classified into the following categories modified after Macek et al. (2015): Cosmopolitan (KOS), Holarctic (HOL), Palaearctic (PAL), Euro-Siberian (ESI), West Palaearctic (WPA), and European (EUR).

Butterfly mobility categories followed the classification proposed by Bartoňová et al. (2014), ranging from extremely sedentary species to extremely mobile species: extremely sedentary (1), very sedentary (2), sedentary (3), rather sedentary (4), less sedentary (5), willing to disperse (6), mobile (7), very mobile (8), extremely mobile (9).

Threat categories were assigned according to the *Red List of Butterflies of Montenegro* (Roganović & Malidžan 2023). Conservation status followed the IUCN classification system. Among the recorded taxa, only the categories Least Concern (LC) and Near Threatened (NT) were represented, whereas no species belonging to the categories Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Data Deficient (DD), or Not Evaluated (NE) were confirmed during the present survey.

Results and Discussion

During the short-term survey conducted on 19 and 20 May 2026, a total of 20 butterfly taxa belonging to six families were recorded from six investigated localities in Montenegro, including two localities surveyed as paired sampling sites (L2/L3 and L7A/L7B), with an overall

abundance of 75 individuals (Tables 1–3). The recorded assemblage represents approximately 10.4% of the 192 butterfly species currently known from Montenegro (Franeta 2018; Roganović & Malidžan 2023). Despite the limited temporal extent of the survey, the recorded assemblage comprised a relatively diverse spectrum of butterflies associated mainly with open and semi-natural habitats, including grasslands, ecotones, riverine vegetation, and traditionally managed rural landscapes typical of the western Balkan Peninsula.

The highest species richness was recorded within the families Pieridae and Lycaenidae, each represented by six taxa, corresponding to 30.0% and 11.5% of the species currently known from Montenegro, respectively. Nymphalidae, represented by four taxa (4.4% of the national fauna), was the most abundant family with 26 recorded individuals (Tables 1 and 3). Hesperidae comprised two taxa (8.7% of the national fauna), whereas Papilionidae and Riodinidae were each represented by a single species, corresponding to 16.7% and 100% of the species currently known from Montenegro, respectively. Comparable dominance of Nymphalidae, Pieridae and Lycaenidae has previously been reported from meadow and forest-edge habitats in Montenegro (Franeta 2018). The predominance of these families in the present study most likely reflects the prevalence of open and semi-natural habitats among the investigated localities rather than the overall composition of the Montenegrin butterfly fauna. Despite the limited sampling effort, the survey captured a relatively broad taxonomic spectrum of the country's butterfly fauna.

The recorded assemblage was dominated by widespread and ecologically tolerant species, including *Vanessa cardui*, *Pieris rapae*, *Polyommatus icarus* and *Coenonympha pamphilus*, reflecting the predominance of common spring species associated with open and semi-natural habitats (Table 2). These species are capable of occupying a broad spectrum of environmental conditions (Macek et al. 2015). Habitat specialists and stenotopic mountain species were represented only marginally, which is likely attributable to the short sampling period and the habitat types investigated.

Table 1. Overview of butterfly species recorded at individual localities in Montenegro.

Species	L1	L2–L3 transect	L4	L5	L7A area	L7B area	L8	Total
Hesperiidae								
<i>Pyrgus malvae</i> L.	–	1	1	–	2	–	1	5
<i>Carterocephalus palaemon</i> Pall.	–	–	–	–	–	–	1	1
Papilionidae								
<i>Papilio machaon</i> L.	–	–	1	–	–	–	–	1
Pieridae								
<i>Pieris rapae</i> L.	–	1	–	1	–	–	–	2
<i>Pieris napi</i> L.	–	–	–	1	–	–	–	1
<i>Colias</i> sp.	–	1	–	–	–	–	–	1
<i>Gonepteryx rhamni</i> L.	–	–	1	1	–	–	–	2
<i>Leptidea sinapis</i> L.	–	–	–	2	–	–	7	9
<i>Anthocharis cardamines</i> L.	–	–	–	–	–	–	3	3
Riodinidae								
<i>Hamearis lucina</i> L.	–	–	–	1	–	–	1	2
Lycaenidae								
<i>Polyommatus icarus</i> Rott.	–	4	4	–	1	–	–	9
<i>Arícia agestis</i> Den. et Schiff.	–	1	–	–	–	–	–	1
<i>Cupido decolorata</i> Staud.	–	1	–	–	1	–	2	4
<i>Lysandra bellargus</i> Rott.	–	–	–	1	–	–	–	1
<i>Celastrina argiolus</i> L.	–	–	–	–	–	–	1	1
<i>Glauropsyche alexis</i> Poda	–	–	–	–	–	–	6	6
Nymphalidae								
<i>Vanessa cardui</i> L.	3	3	1	–	–	–	–	7
<i>Coenonympha pamphilus</i> L.	–	6	–	–	3	2	1	12
<i>Erebia medusa</i> Den. et Schiff.	–	5	–	–	1	–	–	6
<i>Pararge aegeria</i> L.	–	–	–	–	–	–	1	1
Total	3	23	8	7	8	2	24	75

Numbers indicate the abundance of recorded individuals at individual localities. Locality codes correspond to the study sites listed in the Materials and Methods section.

Analysis of habitat affiliation demonstrated that ubiquist species (U), together with species associated with mesophilous meadows (M1) and woodland margins (M2), represented the dominant ecological groups within the recorded assemblage (Table 2). Ubiquist species included *P. machaon*, *P. rapae*, *P. napi*, *P. icarus*, and *V. cardui*. Mesophilous and ecotonal habitats were represented mainly by *C. pamphilus*, *Anthocharis cardamines*, and *Erebia medusa*. Xerothermophilous species (X1), particularly among Lycaenidae and Hesperidae, also formed an important component of the assemblage and included *Pyrgus malvae*, *Arícia agestis*, *Glauropsyche alexis*, and *Cupido decoloratus*. Strictly forest-associated species (M3) were represented only by *Pararge aegeria*. Overall, the ecological structure of the assemblage reflects

the predominance of open-habitat and ecotonal species within the investigated landscape mosaic.

The most abundant species recorded during the survey was *C. pamphilus* with 12 individuals, followed by *Leptidea sinapis* and *P. icarus* with nine individuals each (Table 1). *L. sinapis* was recorded predominantly at locality L8, where semi-natural meadow habitats and traditionally managed rural vegetation probably provided suitable habitat conditions. The relatively high abundances of *C. pamphilus* and *E. medusa* further indicate the presence of structurally diverse grassland habitats with relatively preserved vegetation continuity and suitable nectar resources.

Table 2. Ecological and faunistic characteristics of recorded butterfly species in Montenegro.

Species	Habitat affinity	Faunistic element	Mobility	Red List MNE
Hesperiidae				
<i>Pyrgus malvae</i> L.	X1	PAL	3	LC
<i>Carterocephalus palaemon</i> Pall.	M2	HOL	3	LC
Papilionoidea				
<i>Papilio machaon</i> L.	U	HOL	5	NT
Pieridae				
<i>Pieris rapae</i> L.	U	KOS	7	LC
<i>Pieris napi</i> L.	U	PAL	7	LC
<i>Colias</i> sp.	–	–	–	LC
<i>Gonepteryx rhamni</i> L.	M2	PAL	7	LC
<i>Leptidea sinapis</i> L.	X2, M2	PAL	6	LC
<i>Anthocharis cardamines</i> L.	M1	PAL	4	LC
Riodinidae				
<i>Hamearis lucina</i> L.	M2	EUR	3	LC
Lycaenidae				
<i>Polyommatus icarus</i> Rott.	U	PAL	3	LC
<i>Aricia agestis</i> Den. et Schiff.	X1	PAL	4	LC
<i>Cupido decolorata</i> Staud.	X1	PME	2	LC
<i>Lysandra bellargus</i> Rott.	X1	WPA	2	LC
<i>Celastrina argiolus</i> L.	M2	PAL	5	LC
<i>Glaucopsyche alexis</i> Poda	X1	PAL	3	LC
Nymphalidae				
<i>Vanessa cardui</i> L.	U	KOS	9	LC
<i>Coenonympha pamphilus</i> L.	M1	WPA	3	LC
<i>Erebia medusa</i> Den. et Schiff.	M2	ESI	3	LC
<i>Pararge aegeria</i> L.	M3	WPA	4	LC

Habitat affinity categories – U: ubiquist species, M1: mesophilous meadow species, M2: woodland edge and forest-margin species, M3: forest species, X1: xerothermophilous grassland species, X2: forest-steppe and shrubland species. Faunistic elements – KOS: Cosmopolitan, HOL: Holarctic, PAL: Palaearctic, ESI: Euro-Siberian, WPA: West Palaearctic, EUR: European. Mobility categories – 1: extremely sedentary, 2: very sedentary, 3: sedentary, 4: rather sedentary, 5: less sedentary, 6: willing to disperse, 7: mobile, 8: very mobile, 9: extremely mobile. Threat categories – LC: Least Concern, NT: Near Threatened.

Locality L8 exhibited the highest diversity, with 10 recorded taxa and 24 individuals (Table 3). The locality represented a mosaic of semi-natural meadows, rural habitats and ecotonal vegetation associated with traditional land use. Such habitat heterogeneity probably contributed to the occurrence of several ecologically distinct taxa, including *G. alexis*, *C. decoloratus*, *L. sinapis* and *A. cardamines*. Semi-natural extensively managed grasslands are generally considered important habitats for butterfly assemblages because they provide diverse nectar resources, larval host plants and favourable microclimatic conditions. However, it should be emphasised that the investigated localities were selected primarily for ichthyological research rather than butterfly surveys; therefore, the observed diversity should not be regarded as representative of the regional butterfly fauna. By contrast, localities L1 and L7B exhibited very low

diversity, each yielding only a single recorded species. These low values may reflect the short sampling duration, local weather conditions, lower habitat heterogeneity, or temporary phenological mismatches between butterfly emergence and the survey period.

From a faunistic perspective, the recorded assemblage was dominated mainly by Palaearctic (PAL) and West Palaearctic (WPA) elements (Table 2). Palaearctic taxa included *P. malvae*, *L. sinapis*, *P. icarus* and *G. alexis*, whereas West Palaearctic elements were represented mainly by *C. pamphilus* and *P. aegeria*. Holarctic (HOL) species were represented by *P. machaon* and *Carterocephalus palaemon*, while Mediterranean (MED) elements occurred only sporadically, represented by *Lysandra bellargus*. Cosmopolitan species (KOS), including *P. rapae* and *V. cardui*, reflected the presence of ecologically tolerant taxa with broad geographical

distributions. The assemblage also included a Pontomediterranean (PME) element represented by *C. decoloratus*, a species associated mainly with xerothermic habitats of south-eastern Europe. Its occurrence further supports the xerothermic character of some investigated habitats and reflects the south-eastern European biogeographical affinities of the Montenegrin butterfly fauna. The predominance of broadly distributed faunistic elements corresponds well with previous studies conducted in Montenegro and neighbouring Balkan regions (Jakšić 1998; Franeta 2018).

Table 3. Summary of butterfly records by family from Montenegro.

Family	Number of taxa	Number of individuals
Hesperiidae	2	6
Papilionidae	1	1
Pieridae	6	18
Riodinidae	1	2
Lycaenidae	6	22
Nymphalidae	4	26
Total	20	75

Mobility analysis indicated a predominance of species with low to intermediate dispersal ability, particularly those belonging to mobility categories 3–5 (Table 2). Sedentary and rather sedentary taxa included *P. malvae*, *C. decoloratus*, *G. alexis* and *E. medusa*, whereas highly mobile species were represented mainly by *V. cardui* (mobility category 9), *P. rapae* and *P. napi* (mobility category 7). This pattern suggests that many recorded species are closely associated with local habitat conditions and highlights the importance of maintaining habitat continuity within semi-natural landscapes.

Several taxa exhibited localised occurrence patterns. *P. machaon* was recorded exclusively at locality L4, whereas *C. palaemon* and *G. alexis* were observed only at locality L8 (Table 1). Although these records originate from a short-term survey, they provide valuable distributional data and contribute to current knowledge of butterfly distribution in Montenegro.

From a conservation perspective, most recorded species belonged to the Least Concern (LC) category according to the Red List of Butterflies of Montenegro (Roganović & Malidžan 2023). Only *P. machaon* belonged to the Near Threatened (NT) category. Nevertheless, the occurrence of species associated with traditionally managed grasslands and ecotonal habitats underlines the conservation value of semi-natural landscape mosaics in Montenegro. Although no nationally threatened butterfly species were recorded, the survey provides additional faunistic records from six investigated localities, several of which have received relatively little lepidopterological attention.

Although Montenegro is recognised as one of the biodiversity hotspots of the Balkan Peninsula, the butterfly assemblages recorded during the present survey were

dominated by widespread and ecologically tolerant species. This pattern most likely reflects the short duration of the survey, its restriction to a single sampling period, and the fact that the investigated localities were selected primarily for ichthyological rather than lepidopterological research. Consequently, the recorded assemblage should not be considered fully representative of the butterfly diversity of the investigated region.

Nevertheless, habitat loss, abandonment of traditional land use, vegetation succession, agricultural intensification and landscape fragmentation have been identified as major drivers of butterfly declines throughout Europe, including the Balkan Peninsula (Van Swaay et al. 2006; Kuussaari et al. 2007; Van Dyck et al. 2009; Ekroos et al. 2010; Warren et al. 2021). Similar threats have also been recognised in Montenegro, where the conservation of semi-natural grasslands and traditionally managed landscapes is considered essential for maintaining butterfly diversity (Franeta 2018; Roganović & Malidžan 2023).

The surveyed localities retained many characteristics of well-preserved semi-natural grasslands, ecotonal habitats and riverine landscape mosaics, indicating that suitable conditions for diverse butterfly assemblages are still present in parts of Montenegro. Although no nationally threatened species were recorded during the present survey, the study provides additional faunistic and ecological information from six investigated localities and complements the current knowledge of butterfly distribution in the country. Future surveys covering the entire flight season and targeting a broader spectrum of habitats will be necessary to obtain a more comprehensive assessment of butterfly diversity and to improve our understanding of species distribution and habitat associations in Montenegro.

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