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BUTTERFLY FAUNA (HESPEROIDEA & PAPILIONOIDEA) OF MOUNTAIN BORJA, BOSNIA AND HERZEGOVINA

FAUNA DNEVNIH LEPTIRA (HESPEROIDEA & PAPILIONOIDEA) PLANINE BORJA, BOSNA I HERCEGOVINA

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Abstract

The paper deals with the fauna of butterflies of Borja Mt, located in the northern part of the Republic of Srpska (Bosnia and Herzegovina), to the west of the town of Teslić. Although the mountain is situated in a favorable and accessible geographical position, its fauna of butterflies has remained almost unexplored. During two years of research, a total of 63 species of butterflies were identified on 21 locations. Even though the recorded number represents only 34% of the butterfly fauna of Bosnia and Herzegovina, it is important to point out that 36 of them are registered for the first time with regard to Borja Mt.

Keywords: butterfly, Čemernica Mt., distribution, diversity, insects, Uzlomac Mt.

1. INTRODUCTION / UVOD

The research of butterflies in Bosnia and Herzegovina has a long tradition that dates back to 1882. (Mitis, 1882).

The next systematic research of butterflies was done by Rebel in 1904, during which he explored, among other areas, Central Bosnia, from the city of Sarajevo to Vlašić Mt. (Rebel, 1904).

In the late 1970s and early 1980s, areas of Western Bosnia (Sijarić, 1977), Northern Bosnia (Sijarić, 1986/1987), and Central Bosnia (Sijarić, 1982) were explored, but the area of Borja Mt was left out. The first explorations of Borja Mt were done in 1990, when Sijarić visited the wider area of Borja Mt, Uzlomac Mt, Čemernica Mt, and the Ugar valley and registered 27 butterfly species (Sijarić, 1996). Although incomplete, this research is very important because it provides the first data about the butterfly fauna of this very interesting area.

The aim of this paper is to present the new data on the butterfly fauna of the wider area of Borja Mt.

1. MATERIAL AND METHODS / MATERIJAL I METODE

2.1 Study area / Područje istraživanja

The area of research, Borja Mt (Figure 1) belongs to Central Bosnia and lies between the Velika Usora River and its tributaries the Penava, the Mala Usora, and the Usorica. Regarding its geographical position, the area is located in the northern part of the Republic of Srpska (Bosnia and Herzegovina), west of Teslić. The highest

peak of the area is Velika Runjevica with 1078 m a.s.l, which is located on the western end of Borja Mt., while the highest peak in the central part is Tajan (1007 m a.s.l.). It has characteristic geomorphology, with steep slopes and deep river gorges.

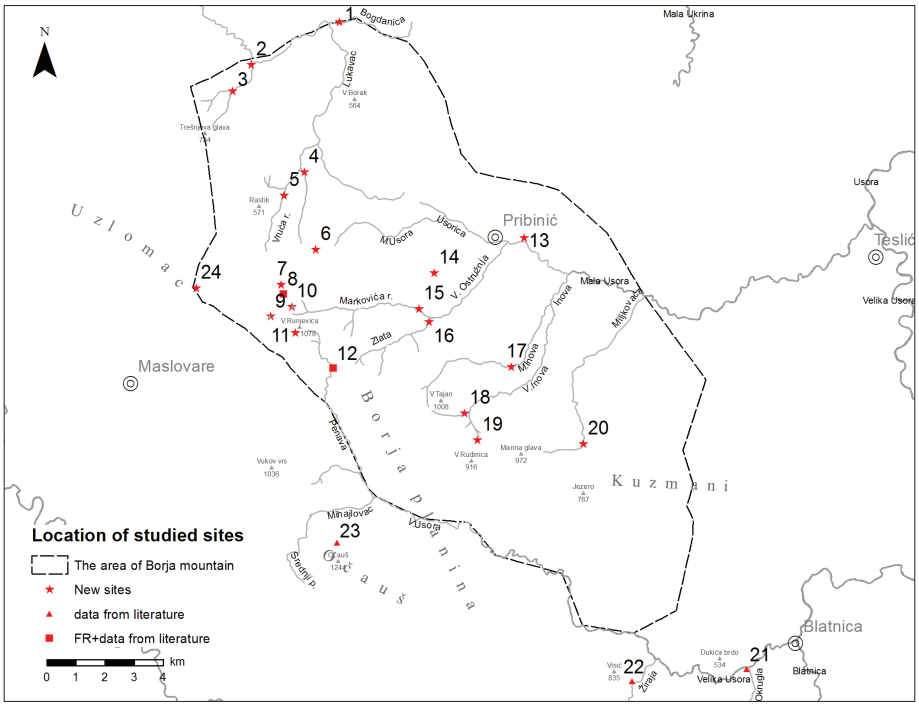

Figure 1. Geographical location of the study area at Borja Mt. with localities where butterfly data were collected (stars - only new data from field research (FR), squares - new data from field research (FR) and data from literature, triangles - only data from literature). For three sites featuring only literature records with no specified coordinates only approximate position was given / **Slika 1**. Geografski položaj istraživanog područja i lokaliteti na području planine Borja sa kojih su pokupljeni podaci o leptirima (zvijezda - samo novi podaci sa terenskih istraživanja (FR), kvadrati - podaci sa terenskih istraživanja (FR) i podaci iz literature, trouglovi - samo podaci iz literature). Položaj tri lokaliteta iz literature za koje nisu mogle biti tačno utvrđene lokacije prikazane su približno

A total of 21 sites were visited during 2018 and 2019. When selecting the location, we try to select as diverse habitats as possible in terms of location, vegetation, geomorphology, and hydrography, and within maximum limits of time and resources available. The location numbers match those in the text. These localities are:

1. The Bogdanica creek, upstream from the mouth with the Lukavac, elevation 330 m, coordinates 44.677694° E and 17.622415° N, visited on 04/26/2019 - it is mainly a habitat of *Fagus sylvatica* and *Abies alba* forests on deep soil on peridotite. On the left bank of the stream there are smaller areas of *Quercus petraea* forest and *Pinus nigra* plantations. The ground cover is mostly made of *Rubus* sp., *Erica carnea* and *Calluna vulgaris*.
2. The Mlinski potok creek, downstream to the water mill all the way to the mouth with the Lukavac stream, elevation 280 m, coordinates 44.664393° N and 17.584289° E, visited on 08/06/2018 - this location is characterised by woodland clearing, which is sometimes covered with *Robinia pseudoacacia, Carpinus betulus*, and *Salix alba*. The dominant species in the herb layer is *Urtica dioica*.

3. The Mlinski potok creek, upstream from the hunting lodge, elevation 330 m, coordinates 44.656027 N and 17.576303 E, visited on 05/08/2018 and on 05/25/2018 - this is a more humid forest of *Fagus sylvatica* and *Abies alba* with a denser structure on deep soils. On woodland clearings, species such as *Poa pratensis, Brachypodium sylvaticum*, and *Bromus erectus* are observed.

4. The Lipljašnica creek, upstream of the regional road towards the settlement of Liplje, elevation 400 m, coordinates 44.631152° N and 17.607518° E, visited 08/13/2018 – the area is characterised with partly abandoned meadows and mild slopes that are shed by fragments of *Fagus sylvatica* forests on deeper soil. The banks of the stream are covered with *Robinia pseudoacacia* and *Salix alba*.

5. The Vruća rijeka creek, the mouth with the Studentski potok creek, elevation 430 m, coordinates 44.623903° N and 17.598807° E, visited 04/24/2019 - abandoned meadows and pastures along the edge of the degraded *Fagus sylvatica* forest. Along the stream, there are individual trees of *Salix alba, Alnus glutinosa, Robinia pseudoacacia*, and *Carpinus betulus*.

6. The locality of Osoje Borići, near the settlement of Klupe, near the Banja Luka-Teslić major road, elevation 545 m, coordinates 44.607291° N and 17.612656° E, visited on 04/25/2019 - this locality is characterised by grassy and flowery clearings within *Pinus nigra* and *Pinus sylvestris* plantations at a slightly higher altitude. Plant species from genera *Viola, Potentilla*, and *Rubus* are noticed on this site.

7. The locality of Rudinjak, SW from the locality of Hajdučka voda, elevation 810 m, coordinates 44.596321° N and 17.597637° E, visited on 08/20/2018 - a sunny, woodland clearing with bushy margins inside a *Pinus sylvestris* forest that are under strong anthropogenic influence.

8. The locality of Hajdučka voda, next to a water well, elevation 790 m, coordinates 44.593426° N and 17.598753° E, visited on 04/20/2018 and on 06/26/2018 - woodland clearings covered with blackberries inside *Fagus sylvatica* and *Abies alba* forests on the serpentines. Species from genus *Festuca* are also noticed on this site.

9. The locality of Solila, near the locality of Hajdučka voda, a forest path to Velika Runjevica, elevation 875 m, coordinates 44.586575° N and 17.593207° E, visited on 06/26/2018 - a habitat of *Fagus sylvatica* and *Abies alba* forests with fragments of areas under *Pinus nigra* plantations densely covered with *Erica carnea*. *Hedera helix* is very often found on *Pinus nigra* trees, and on the herb layer there are species such as *Viola beckiana* and *Daphne blagayana*.

10. Mala Runjevica, peak and the west slope below the peak, elevation 1034 m, coordinates 44.589506° N and 17.602382° E, visited on 06/26/2018 - clearings in the forest zone of *Fagus sylvatica* and *Abies alba* with an elevation above 1000 m a.s.l.

11. Velika Runjevica, peak, southwestern ridge to the Penava, elevation 1050 m, coordinates 44.581554° N and 17.603998° E, visited on 08/21/2018 - covered with grassy vegetation from 1078 m a.s.l. to a lower altitude. Trees of *Abies alba, Fagus sylvatica*, and *Pinus nigra* appear in fragments.

12. The Penava Creek, along the way from thre locality of Đubrine bare, elevation 775 m, coordinates 44.570575° N and 17.620391° E, visited on 8/21/2018 - steeper rocky slopes covered with rare plantations of *Pinus nigra* and *Pinus sylvestris* trees. *Festuca* and *Bromus* species noticed on grassy clearings.

13. The locality of Mednjak, near the village of Pribinić, elevation 380 m, coordinates 44.611152° N and 17.702914° E, visited on 08/21/2018 - a dry, rocky, and warm serpentine habitat with very steep slopes and scarce vegetation. Some rare species are also noticed here, such as *Halacsya sendtneri, Bromus erectus, Gypsophila spergulifolia*, and *Silene armeria*.

14. The Mišića rijeka creek, next to a water spring and not far from the village of Mišići, elevation 430 m, coordinates 44.600207° N and 17.664016° E, visited on 08/09/2018 - abandoned orchards and meadows covered with species from *Rubus* genera, *Rosa canina*, and many species from the *Poaceae* family.
15. The Markovića rijeka creek, close to the locality of Lazin točak, elevation 495 m, coordinates 44.589126° N and 17.657429° E, visited on 08/17/2018 - bushy woodland margins of *Fagus sylvatica* and *Abies alba* forests. Several trees of *Robinia pseudoacacia, Frangula alnus*, and *Alnus glutinosa* have been observed.
16. The Zlata creek, near to the Markovića rijeka stream, elevation 460 m, coordinates 44.600207° N and 17.664016° E, visited on 08/09/2018 and on 08/16/2018– rocky serpentine banks in woodland margins of a *Fagus sylvatica* forest. Species from genera *Rubus, Festuca*, and *Dactylis* are present.
17. The Mala Inova creek, a forest path to Badnjine, elevation 420 m, coordinates 44.571264° N and 17.697425° E, visited on 05/25/2018 and on 06/26/2018 - abandoned orchards and meadows, with the next upstream habitat inhabited by high forests of *Fagus sylvatica* and *Abies alba*. *Prunus spinosa, Prunus domestica, Malus domestica, Craetegus monogyna*, and *Salix alba* are also present.
18. The Velika Inova creek, close to Tajan, elevation 660 m, coordinates 44.556844° N and 17.677383° E, visited on 07/06/2018 and on 06/17/2018 - degraded forests of *Pinus nigra* with steep slopes intersected by water streams. The extremely steep, craggy, and dry habitats are covered with rare grassy vegetation.
19. The Velika Inova creek, close to a hunting lodge – a forest path to the village of Očauš and village of Stakovići, elevation 800 m, coordinates 44.578660° N and 17.682992° E, visited on 07/06/2018 and on 06/17/2018 - the habitat is characterised by grassy vegetation with individual *Pinus nigra* trees. In addition, very steep, craggy, and dry slopes.
20. The Miljkovača creek, near the mouth with the Jelovi potok creek, elevation 600 m, coordinates 44.547445° N and 17.728777° E, visited on 07/11/2018 – a steep, craggy, serpentine habitat covered with plantations of *Pinus nigra* and *Pinus sylvestris*. Observed species of *Festuca amethysina, Melica nutans, Poa angustifolia*, and *Bromus erectus*.
21. The Marinska kosa slope, direction to Liplje monastery, elevation 900 m, coordinates 44.595159° N and 17.560974° E, visited on 08/02/2018 - both sides of the mountain ridge were damaged by fire in 2015, resulting in scarce vegetation in this area. Consequently, a small number of species are recorded here. *Centaurea* species are observed in a slightly larger number at the beginning of the ridge.

3. RESULTS / REZULTATI

During a two-year faunal survey of Borja Mt, a total of 63 butterfly species were recorded. The recorded number represents only 34% of the butterfly fauna of Bosnia and Herzegovina (Lelo, 2016), but 36 of them are registered for the first time on this site.

The systematic list of species along with their presence on each locality is shown in Table 1.

Some species, such as *Leptidea sinapis, Gonepteryx rhamni, Papilio machaon, Argynnis paphia, Hipparchia fagi*, and *Maniola jurtina* are very abundant on most of the localities. On the other hand, for some species, such as *Nymphalis antiopa* (found near the stream of Mala Inova on dry rocks gullies) and *Zerynthia polyxena* (found near the stream of Bogdanica) only a single specimen was recorded at the respective location.

Table 1. Butterfly species identified in the area of Borja Mt with an overview of the finding sites and data source. New localities for the species are printed in bold font. Abbreviations: FR - new data from field research / **Tabela 1**. Leptiri planine Borja sa pregledom lokaliteta za registrovane vrste i izvorom podataka. Podebljani brojevi označavaju nove lokalitete pronalaska vrste. Korištene skraćenice: FR - podaci prikupljeni terenskim istraživanjem

No	**Species name** / Ime vrste	**Locality** / Lokalitet	**Source of data** / Izvor podataka
	Hesperiidae		
1	*Carcharodus alceae* (Esper, 1780)	**6**	FR
2	*Carcharodus lavatherae* (Esper, 1783)	**17**	FR
3	*Erynnis tages* (Linnaeus, 1758)	**4,5,6,**12	FR+ Sijarić, 1992-1995
4	*Hesperia comma* (Linnaeus, 1758)	**12**	FR
5	*Heteropterus morpheus* (Pallas, 1771)	**8,18,20**	FR
6	*Ochlodes sylvanus* (Esper, 1771)	**11,12,13,19,20**	FR
7	*Pyrgus alveus* (Hübner, 1802)	8**,12**	FR+ Sijarić, 1992-1995
8	*Pyrgus malvae* (Linnaeus. 1758)	**1,5,6,16**	FR
9	*Spialia orbifer* (Hübner, 1823)	**4**	FR
10	*Thymelicus lineola* (Ochsenheimer, 1808)	**12,16,24**	FR
11	*Thymelicus sylvestris* (Poda, 1761)	**8,16**	FR
	Lycaenidae		
12	*Celastrina argiolus* (Linnaeus,1758)	**18**	FR
13	*Cupido argiades* (Pallas, 1771)	**6,16**	FR
14	*Cupido minimus* (Füssly, 1775)	**4**	FR
15	*Plebejus argus* (Linnaeus, 1758)	**4,17**	FR
16	*Polyommatus bellargus* (Rottemburg, 1775)	**4,17**	FR
17	*Polyommatus icarus* (Rottemburg, 1775)	12**,17**	FR+ Sijarić, 1992-1995
18	*Scolitantides orion* (Pallas, 1771)	**8,16,18,20**	FR
	Nymphalidae		
19	*Aglais urticae* Linnaeus 1758	12	FR+ Sijarić, 1992-1995
20	*Aphantopus hyperantus* Linnaeus 1758	**9,**12**,19**	FR+ Sijarić, 1992-1995
21	*Araschnia levana* Linnaeus 1758	**2,**12**,14,15,16**	FR+ Sijarić, 1992-1995
22	*Argynnis adippe* Linnaeus, 1767	**14**	FR
23	*Argynnis aglaja* (Linnaeus, 1758)	**9,16**	FR
24	*Argynnis paphia* (Linnaeus, 1758)	**4,7,12,14,15,16,19,21**	FR
25	*Boloria dia* (Linnaeus, 1767)	**5,6**	FR
26	*Brenthis daphne* (Denis & Schiffermüller, 1775)	**21**	FR
27	*Brenthis hecate* (Denis & Schiffermüller, 1775)	**9**	FR
28	*Brenthis ino* (Rottemburg, 1775)	**19,20**	FR
29	*Coenonympha arcania* Linnaeus 1761	**3,9,**12**,20**	FR+ Sijarić, 1992-1995
30	*Coenonympha glycerion* Borkhausen 1788	**3,4**	FR

continued / nastavak na sljedećoj stranici

nastavak Tabele 1 / continuation of Table 1

No	**Species name** / Ime vrste	**Locality** / Lokalitet	**Source of data** / Izvor podataka
31	*Coenonympha pamphilus* Linnaeus 1758	**4,5,11,**12	FR+ Sijarić, 1992-1995
32	*Erebia aethiops* Esper 1777	**8,11,**12,**19,20**	FR+ Sijarić, 1992-1995
33	*Erebia ligea* Linnaeus 1758	**9**	FR
34	*Hipparchia fagi* Scopoli 1763	**4,8,9,10,**12,**13,15,16, 19,20,21**	FR+ Sijarić, 1992-1995
35	*Hyponephele lycaon* Rottemburg 1775	**20**	FR
36	*Issoria lathonia* Linnaeus, 1758	**2,8,**12,**18,20**	FR+ Sijarić, 1992-1995
37	*Lasiommata maera* Linnaeus 1758	**9,14,16,17,21**	FR
38	*Maniola jurtina* Linnaeus 1758	**4,8,**12,**14,16,18,21**	FR+ Sijarić, 1992-1995
39	*Melanargia galathea* (Linnaeus, 1758)	8,12,**18,20**	FR+ Sijarić, 1992-1995
40	*Melitaea athalia* Rottemburg 1775	**2,4,8,17**	FR
41	*Melitaea aurelia* Nickerl 1850	**13,21**	FR
42	*Melitaea phoebe* Denis & Schiffermüller 1775	**2,17,21**	FR
43	*Minois dryas* Scopoli 1763	**12,13**	FR
44	*Neptis rivularis* Scopoli 1763	**15,17,18**	FR
45	*Neptis sappho* Pallas 1771	**4,13,14,15,16,17,21**	FR
46	*Nymphalis antiopa* Linnaeus 1758	**17**	FR
47	*Nymphalis io* Linnaeus 1758	**6,16,17,20,21**	FR
48	*Pararge aegeria* (Linnaeus, 1758)	**3,11,15**	FR
49	*Polygonia c-album* Linnaeus 1758	**2,15,18**	FR
50	*Vanessa atalanta* Linnaeus 1758	**9,18,20,21**	FR
51	*Vanessa cardui* Linnaeus, 1758	**9,**12	FR+ Sijarić, 1992-1995
	Papilionidae		
52	*Iphiclides podalirius* (Linnaeus, 1819)	**1,2,8,17,18,21**	FR
53	*Papilio machaon* Linnaeus 1758	**5,**8,**11,**12,**13,14,18**	FR+ Sijarić, 1992-1995
54	*Zerynthia polyxena* Denis & Schiffermüller 1775	**1**	FR
	Pieridae		
55	*Anthocharis cardamines* Linnaeus 1785	**5,19**	FR
56	*Aporia crataegi* (Linnaeus, 1758)	**8,17**	FR
57	*Colias croceus* (Geoffroy, 1785)	**1,2,4,7,12**	FR
58	*Gonepteryx rhamni* (Linnaeus, 1758)	**1,2,4,5,14,16,17,18,20**	FR
59	*Leptidea sinapis* (Linnaeus, 1758)	**1,4,5,6,7,**8,12,**13,15,16, 17,18,20,21**	FR+ Sijarić, 1992-1995
60	*Pieris ergane* (Geyer, 1828)	**18**	FR
61	*Pieris mannii* (Mayer, 1851)	**8,12,16,17,20**	FR
62	*Pieris napi* (Linnaeus, 1758)	**14,16**	FR
63	*Pieris rapae* (Linnaeus, 1758)	**12,18**	FR

4. CONCLUSION / ZAKLJUČAK

Borja Mt is located in Central Bosnia, characterised by a mixture of habitat types, and also strong anthropogenic impact. This is a typical serpentine area mostly covered by Pinus sylvestris and Pinus nigra forests and mixed forests of Fagus sylvatica and Abies alba. Some of the sites, like Hajdučka Voda and Solila, are almost completely altered due to tourism expansion. In addition, this area is under the constant impact of the forest industry for timber needs.

As butterflies are a very sensitive group of organisms and a reliable bio-indicator of the condition of the environment, especially when it comes to pollution and disturbance of habitats (Jakšić, 2008), we might conclude that expansion of tourism and the impact of the forest industry certainly have a negative effect on the autochthonous butterfly fauna.

There are few previous studies conducted on Borja Mt and the neighboring mountains, and they are rather incomplete. For example, with regard to Uzlomac Mt, only 19 species have been registered so far, while 39 species are registered on Čemernica Mt (Sijarić, 1996). Vlašić Mt has been better explored, but there is no comparison with this mountain in this regard, due to their different geographical and ecological characteristics (Sijarić, 1982). Borja Mt is an extremely serpentine region with specific vegetation, which is significantly different from Vlasic Mt and Čemernica Mt.

Comparing this study of Borja Mt with the previous one, we come to the following conclusion: 36 butterfly species are registered for the first time on this site. Of 27 species found by Sijarić in 1990, only two were not confirmed in this study. These species are Thymelicus acteon and Lycaena virgaureae, and both were registered at the location of Očauš (Sijarić, 1996). The reason we did not visit this location is because it is located south of the Velika Usora river, and this area geographically does not belong to the Borja Mt area.

However, it is clear that the fauna of these insects in this area of Bosnia is still insufficiently researched into and that future activities will certainly lead to the discovery of new species.

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Sažetak

Iako je fauna dnevnih leptira centralne Bosne u više navrata istraživana, planina Borja (Slika 1), uprkos svom relativno povoljnom geografskom položaju, ostala je skoro neistražena. Prvi i jedini rad koji se tiče dnevnih lepira planine Borja rezultat je terenskih istraživanja koje je uradio Sijarić 1990. godine u sklopu istaživanja faune dnevnih leptira bosanskog pobrđa (Sijarić, 1992-1995).

Svrha ovog rada je da prikaže pregled faune Lepidoptera planine Borja. Rad je rezultat terenskih istraživanja autora i analize pronađenih literaturnih podataka. Ukupan broj registrovanih vrsta dnevnih leptira (*Hesperoidea* i *Papilionoidea*) je 63 (Tabela 1), što predstavlja 34% od ukupnog broja registrovanih dnevnih leptira u Bosni i Hercegovini (Lelo, 2016). Terenskim istraživanjem provedenim u toku 2018. i 2019. godine obuhvaćen je 21 lokalitet na užem području planine Borja i konstatovano ukupno 36 novih vrsta za ovo područje. U radu su, takođe, i prezentovani podaci sa tri lokaliteta koje je posjetio Sijarić 1990. godine, a koja, geografski gledano, pripadaju širem području planine Borja (Slika 1).

Na osnovu ovog istraživanja i prikazanih rezultata, može se konstatovati da su opravdana očekivanja da će nova istraživanja rezultovati dodatnim novim nalazima za prostor planine Borja i ujedno doprinjeti boljem poznavanju ove grupe insekata za Bosnu i Hercegovinu.

Ključne riječi: Čemernica, diverzitet, insekti, leptiri, rasprostranjenje, Uzlomac.