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STATUS OF BUTTERFLIES (LEPIDOPTERA, PAPILIONOIDEA) IN THE ŠAR MOUNTAINS IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract – We focused on the Macedonian part of the Šar mountain range, by gathering and checking literature data, including data from two entomological collections, and adding the results and observations from our recent intensive field research on the butterfly fauna performed during the last 6 years (2014-2019). As a result, 179 species are reported in the Šar Mountains. They belong to 6 families: Hesperiidae with 21 species, Papilionidae with 6 species, Pieridae with 20 species, Riodinidae with 1 species, Lycaenidae with 51 species and Nymphalidae with 80 species. We selected 39 of them as key species for the protection of this national natural heritage. The data of these species are detailed in the paper. These species can be monitored in the future to foresee the trend of the evolution of the biodiversity in this mountain range. In addition, it is a tool to contribute to the zoning of the most important areas to be protected within the Šar Mountains.

KEY WORDS: Butterflies, Šar Mountains, check-list, indicators, endemism.

Izvleček – STANJE METULJEV (LEPIDOPTERA, PAPILIONOIDEA) NA ŠAR PLANINI V SEVERNI MAKEDONIJI

Z zbiranjem in preverjanjem podatkov iz literature, vključno s podatki iz dveh entomoloških zbirk, smo se osredotočili na makedonski del pogorja Šar planine in dodali rezultate in opazovanja nedavnih intenzivnih terenskih raziskav favne metuljev, opravljenih v zadnjih 6 letih (2014 – 2019). Posledično je na Šar planini zabeleženih 179 vrst iz 6 družin: Hesperiidae z 21 vrstami, Papilionidae s 6 vrstami, Pieridae z 20 vrstami, Riodinidae z 1 vrsto, Lycaenidae z 51 vrstami in Nymphalidae z 80 vrstami. Med njimi smo jih 39 izbrali kot ključne vrste za varstvo te nacionalne naravne dediščine. Podatki o njih so podrobno opisani v prispevku. S spremljanjem teh vrst v prihodnosti je mogoče predvidevati trend spreminjanja biotske raznovrstnosti v tem gorskem območju. Poleg tega so orodje, ki prispeva k določanju najpomembnejših območij, ki jih je treba zaščititi v pogorju Šar planine.

KLJUČNE BESEDE: Metulji, Šar planina, seznam vrst, kazalci, endemizem.

Introduction

Butterflies (Lepidoptera, Papilionoidea) are represented by 204 species in the Republic of North Macedonia. We focused on the species present in the Macedonian part of the Šar mountain range. From a faunistic point of view, the Šar Mountains are characterized by a high degree of diversity with many beautiful and different natural landscapes. The impact of the two climates (moderate Mediterranean and continental), the presence of numerous plant communities as well as the diversity of biotopes, have contributed to the emergence and presence of abundant and varied animal life. There are a greater number of species, especially in the world of butterflies which, with their various shapes and colours, particularly attract human attention.

In the early stages, most of the research on butterfly fauna in the Republic of North Macedonia was partial, with scarce information about their distribution. The first summary has been done by Thurner who gathered all previous data for Macedonia and published them in the book printed in 1964: "Die Lepidopterenfauna Jugoslavisch Mazedoniens – I. Rhopalocera, Grypocera und Noctuidae". More than two decades later, in 1989, Paul Schaider and Predrag Jakšić published a book with data, illustrations and distribution maps for the whole country: "Die Tagfalter von jugoslawisch Mazedonien".

The first butterfly records from the Šar Mountains were published just before the World War I by Rebel (1913). Then, the following authors have published their records from the studied region: Doflein (1921), Rebel and Zerny (1931); Daniel et al. (1951); Lorković (1953); Michieli (1963). Thurner (1964), Dufay (1973, 1977), Arnscheid and Arnscheid (1980); De Freina (1983); Schaider (1980, 1984); Jakšić (1988; 1989, 1998a, 1998b, 2001); Schaider and Jakšić (1989); Kocak (1989); Beshkov (1996); Melovski (2003, 2004); Abadjiev (2006); Krpač et al. (2008); Kolev (2010); Huemer et al. (2011); Krpač and Darcemont (2012); Krpač et al. (2013); Abdija et al.

(2013a; 2013b; 2013c; 2013d; 2017; 2019a; 2019b); Louy et al. (2013; 2014); Varga (2014), Melovski and Božinovska (2014).

During 6 years, we performed a research on the Šar Mountains butterflies (2014-2019) to assess the current status of the butterfly's fauna in this mountain range.

Materials and methods

We included in this paper data from two entomological collections (Macedonian Museum of Natural History - SKO and Institute of Ecology and Technology - IET), data from the literature and the results of our field research.

Under the term "Authors unpublished data" are all the data collected in-situ during our 6 years study 2014-2019.

The following abbreviations used in this paper are: v. (village) and r. (river)

Concerning the literature, some names of localities and some erroneous data have been corrected.

During our research, we used the classic avio-entomofauna hunting method with an entomological net (catcher) (Fig. 1). All the material captured was deposited in the Macedonian Museum of Natural History (SKO) or in the collection of the Institute of Ecology and Tehnology (IET), for a total of 4380 butterflies.

For a few species, genitalia were checked (*Leptidea sinapis/juvernica, Hipparchia semele/volgensis, Melitaea athalia/aurelia,* etc.). We still have ambiguous literature

Fig. 1. Collecting with entomological net

data for records anterior to the description of some close species, and in this paper we have chosen to keep old data potentially ambiguous.

The coordinates of the localities are given in Annex II and the location on a map can be done using http://geem06.free.fr/SharMt/localities.html

The butterfly systematics is in accordance with Wiemers et al. (2018). The synonyms of the species have been corrected and clarified as well.

The endangerment of each species is given in accordance with IUCN European Red List, Van Swaay et al. (2010), Maes et al. (2019, 2020) and Macedonian Red List by Krpač and Darcemont (2012).

Area of investigation

The Šar Mountains are located in the northwest part of Republic of North Macedonia. The massif extends northeast-west-southwest direction in length of 80 km,

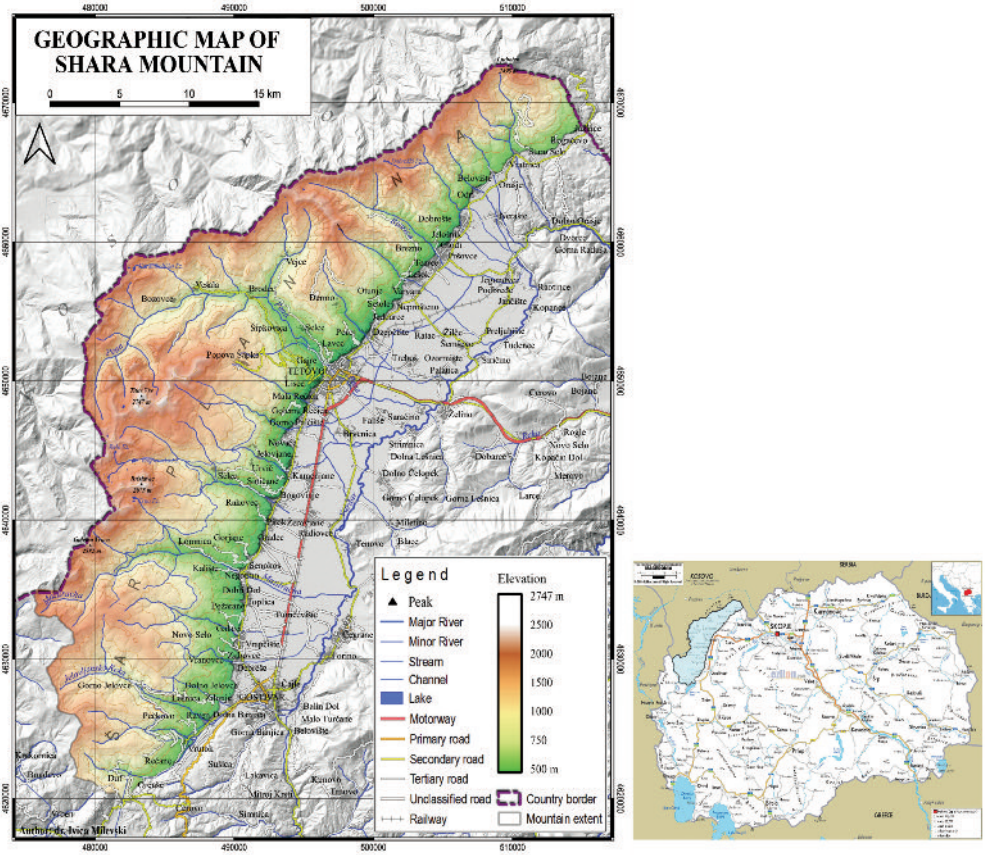

Fig. 2. Area of investigation located in north-west of the Republic of North Macedonia.

over an area of 1600 km^2 (Fig. 2).This mountain range has a large number of peaks over 2000 m above sea level, and about twenty over 2500 m.

The Šar Mountains extend also in Kosovo, with large number of peaks on the border between the two countries. In this paper, under the name ″Šar Mountains″, we will refer to Macedonian part of the massive.

The Šar Mountains form a region of a particular natural beauty. It is known in Europe as a hotspot of biological diversity.

The vegetation is composed of elements of sub-Mediterranean and subarctic flora. The vegetation storeys are of the south-alpine type, with a predominance of mountain and subalpine belts, up to 2700 m above sea level, the highest point of these mountains.

The Šar Mountains can be divided into three belts: up to 1000-1200 m, there are traditional agricultural lands, fields with hedges, and deciduous forests of oak, beech and chestnut (foothills belt). Above this belt and up to a height of about 1700 m, it is the mountain belt, composed of clearings and edges of deciduous or mixed forests (beech-fir), hay grasslands, wet and mesophilic meadows, drier pastures often grazed. Still above and up to the highest peaks, we are in the subalpine belt. This higher altitudinal belt covers a significant part of the Šar mountain range. Above 1800 m, more or less grazed pastures are predominant. In some places, they form macro-mosaics with mainly thickets with *Juniperus communis nana* or heaths with *Vaccinium myrtillus*. There is enough water on all the mountains and the overflows of the high lakes favour the formation of small more humid areas where grows a more dense herbaceous vegetation.

The fauna and flora differ according to the altitude and some of their representatives are very characteristic of these different vegetation belts.

Results

In total 179 species of butterflies (Lepidoptera, Rhopalocera) are recorded from the Šar Mountains, which is 88% of the total number of the known species (204) in the Republic of North Macedonia. The list of the taxa is given in Annex I.

The 41 butterfly species detailed below are threatened (according to Macedonian Red List) and some of them have a low ecological valence (relationship with specific biotopes) and can indicate the current quality of habitats of the area and could be used among the tools to determine the zoning of the future protected area within the Šar Mountains.

Fam. Hesperiidae Latreille, 1809

1. *Carcharodus floccifera* (Zeller, 1847)

syn. *Carcharodus altheae* (Hübner, 1803) in Daniel et al (1951); Thurner (1964)

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT.

Present in foothills and montane zones, in meadow, rocky meadow, mesophilic grassland, forest edge or clearing habitats.

Literature data: Šar Mountains, v. Brodec (Pena r.), v. Lešok as *Carcharodus altheae* in Daniel et al. (1951); v. Brodec, Crn Vrv as *Carcharodus altheae* in Thurner

(1964: 49); Jakšić (1988); Šar Mountains, Kocak (1989); v. Brodec, Jakšić (1998a); Mavrovo Radika r. Abdija (2013d); Gorno Lukovo Pole, Krpač et al (2013).

Collection data (IET): v. Staro Selo, 817 m, 01.07.2013; 1♂ 1♀; v. Rakovec, 962 m, in 2013; Bistrica, (v. Tearce), 769 m, in 2013; v. Gajre - v. Lisec, 1204 m, in 2013; v. Belovište, 785 m, in 2013, (leg. Xh. Abdija).

Authors unpublished data: northeast of v. Vratnica near Kosovo border, 725 m, 25.06.2012, meadows.

2. *Muschampia proto* (Ochsenheimer, 1808)

syn. *Sloperia* (*Hesperia*) *proto* (Ochsenheimer, 1808) in Thurner (1964)

In Macedonian Red List: Near Threatened (NT).

Only one old datum in foothills zone reported at Vratnica (700 m asl) by Josef Thurner (1964). This datum (from Franz Daniel) is very old but undated. The current presence of the species on the Šar Mountains has not been confirmed. We cannot use this species as indicator for this area.

Literature data: v. Vratnica, 700 m, (leg. F. Daniel) as *Sloperia* (*Hesperia*) *proto* in Thurner (1964); in Jakšić (1988).North_est of v.

3. *Pyrgus andromedae* (Wallengren, 1853)

In Macedonian Red List: Near Threatened (NT).

Present in subalpine zone in meadow, rocky meadow, and low shrubbery habitats.

Literature data: Jakšić (1988); Meanče, Jakšić (1998a); Šar Montanes, Kolev (2010); Borislavec, Abdija et al (2013d).

Collection data (IET): Crno Lake, 2122 m, in 2013; Borislavec, 1679 m, in 2013, (leg. Xh. Abdija).

4. *Spialia phlomidis* (Herrich and Schäffer, 1845)

In Macedonian Red List: Near Threatened (NT).

Present in foothills zone, in meadow and rocky meadow habitats.

Literature data: v. Jažince (668) in Abdija (2013d: 49).

Collection data (IET): v. Jažince, 677 m, 26.06.2012, 1♂ 1♀; v. Jažince, 720 m, 26.07.2013, (leg. Xh. Abdija).

Authors unpublished data: northeast of v. Vratnica near Kosovo border, 725 m, 25.06.2012; v. Vratnica, 742 m, 25.07.2013.

5. *Carterocephalus palaemon* (Pallas, 1771)

In Macedonian Red List: Near Threatened (NT).

Present in foothills and montane zones, in forest edge or clearing habitats.

Literature data: Jakšić (1988).

Authors unpublished data: v. Brodec, 1040 m, 12.06. 2019.

Fam. Papilionidae Latreille, 1802

6. *Zerynthia polyxena* ([Denis and Schiffermuller], 1775)

as *Zerynthia polyxena demnosia* Freyer, 1833 in Daniel et al (1951)

In Macedonian Red List: Near Threatened (NT), in Bern Convention appendice II and Habitat directive annex IV.

Present in foothills and montane zones, in mesophilic grassland, forest edge or clearing and riparian vegetation habitats.

Literature data: v. Vratnica, Lešok Monastery, as *Zerynthia polyxena demnosia* Daniel et al (1951); Jakšić (1988); v. Gajre, v. Lisec, Abdija et al (2019); Gostivar, v. Vrutok, springs of Vardar r. Krpač et al (2013).

Collection data (IET): Lešok Monastery, 600 m, 02.08.2011. (leg. V. Krpač); v. Stenče, 575 m, 01.06.2012, 2♂ 4♀; v. Jelovjane, 1142 m, in 2013; Mazdrača v. Lomnica, 750 m, in 2013; above v. Vratnica, 910 m, in 2013, (leg. Xh. Abdija)

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7. *Zerynthia cerisy* (Godart, [1824])

as *Zerynthia cerisy ferdinandi* in Daniel et al (1951)

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT.

Present in foothills and montane zones, in mesophilic grassland, forest edge or clearing habitats.

Literature data: Tetovo, v. Lešok as *Zerynthia cerisy ferdinandi* in Daniel et al (1951); Tetovo, v. Orašje, v. Lešok, v. Vratnica in Thurner (1964); Jakšić (1988); v. Vratnica, v. Lešok Jakšić (1998a); v. Gajre, v. Lisec in Abdija et al (2019).

Collection data (SKO): v. Varvara, 850 m, 06.06.1978. (leg. J. Čingovski).

Collection data (IET): v. Nerašte, 536 m, 20.05.2012, 1♂ 1♀; v. Jelovjane, 1142 m, in 2013; Mazdrača v. Lomnica, 750 m, in 2013; v. Rakovec, 962 m, in 2013; v. Vratnica 910 m, in 2013, (leg. Xh. Abdija);v. Lisec, 1188 m, 24.05.2019, 1 ex (leg. V. Krpač).

Authors unpublished data: v. Vrutok, 710 m, 24.05.2010; v. Vratnica, 700 m, Lešok Monastery, 600 m, spring of Vardar r, 710 m, 24.05.2010.

8. *Parnassius mnemosyne* (Linnaeus, 1758)

as. *Parnassius mnemosyne bureschi* in Daniel et al (1951); *Parnassius mnemosyne parvasi* in Thurner (1964)

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT, in Bern Convention appendices II and IV, in Habitat directive annex IV.

Present in foothills zone, in mesophilic grassland and forest edge or clearing habitats.

Literature data: Ljuboten Rebel (1913); Ljuboten Rebel and Zerny (1931); v. Lisec as *Parnassius mnemosyne bureschi* in Daniel et al (1951); in the area of Šar Mountains as ssp. *parvasi* in Thurner (1964); Jakšić (1988); Ljuboten near mountain refuge, Jelak - Crn Vrv Melovski (2002); Radika r. Lukovo Pole, Mavrovi Anovi to v. Vrben, Crn Kamen Lukovo Pole Krpač et al (2013); Mazdrača Abdija (2017); v. Gajre, v. Lisec Abdija et al (2019).

Collection data (SKO): Radika r. Lukovo Pole 25.05.1995. (leg. V. Krpač).

Collection data (IET): Lukovo Pole, 1527 m, 26.05.2010. (leg. Krpač); v. Pirok, 645 m, 25.05.2012; v. Belovište, 785 m, in 2013; Borislavec, 1679 m, in 2013; v.

Kalište, 728 m, in 2013; Popova Šapka, 1436 m, in 2013; v. Rakovec, 962 m, in 2013, (leg. Xh. Abdija).

Authors unpublished data: v. Vrben, 1335 m, 18.06.2010; road to v. Vrben, 1350 m, 18.06.2010; near Kosovo border, 1530 m, 18.06.2010; Crn Kamen, 1536 m, 18.06.2010; Popova Šapka, 1719 m, 26.06.2013; near v. Šipkovica, 1208 m, 09.06.2014.

9. *Parnassius apollo* (Linnaeus, 1758) ssp. *macedonicus* Bollow, 1931

as. *Parnassius apollo dardanus* in Rebel and Zerny (1931); *Parnassius apollo macedonicus* in Daniel et al (1951)

In IUCN Red List: Near Threatened (NT), in Macedonian Red List: Vulnerable (VU), in Bern Convention appendices II and IV, in Habitat directive annex IV, in CITES list.

Present in montane and subalpine zones, in meadow, rocky meadow, low shrubbery, mesophilic grassland and forest edge or clearing habitats.

Literature data: Kobilica, Ljuboten Rebel (1913); as *Parnassius apollo dardanus* in Rebel and Zerny (1931); as *Parnassius apollo macedonicus* in Daniel et al (1951); Šar Mountains Radika r. Michieli (1963); Crn Vrv, Kobilica, Ljuboten Thurner (1964); Radika r. v. Trnica Dufay (1973); Jakšić (1988); Ljuboten, Kobilica in Jakšić (1998a); v. Melovo near the river Bistrica, Ljuboten over v. Staro Selo, Čaušica, Ljuboten over Elezova Rupa, Jelak – Crn Vrv, Jelak Mountain Lodge Melovski (2002); Radika valley around bridge 10 km NNW Sveta Voda Huemer et al (2011); canyon of Radika r. v. Trnica, Radika r. Pilana, Radika r., v. Ničpur, Strezimirska River near Sveta Voda, Adžina River II, canyon of Radika r. close to Sveta Voda Krpač et al (2013).

Collection data (SKO): Ceripašina, 2500 m, 26.07.1952. (leg. J. Čingovski); Radika r., 942 m, 12.07.1975. (leg. S. Jakonov); Ljuboten, 2460 m, 28.08.1976. (leg. S. Jakonov); Radika r. upper course, 1527 m, 04.07.1995; v. Ničpur, 986 m, 11.08.2004; Kobilica Gornovica, 2450 m, 26.07.2007; above Sveta Voda, 1573 m, 14.08.2011. (leg. V. Krpač).

Collection data (IET): v. Vešala, 23.06.2012; Popova Šapka, 1436 m, in 2013; v. Staro Selo, 1655 m, in 2013; v. Brodec, 1090 m, in 2013, (leg. Xh. Abdija); Popova Šapka, 1745 m, 23.07.2016; under Karanikoličko Lake, 1766 m, 04.08.2017; Dolna Lešnica, 1476 m, 18.08.2018; Jelak, 1823 m, 08.08.2019. (leg. V. Krpač).

Authors unpublished data: v. Ničpur, 1086 m, 11.08.2004; Kobilica, 2360 m, 26.07.2007; Kobilica Gornovica, 2450 m, 26.07.2007; Radika r. v. Trnica, 942 m, 21. 07.2009; Radika r. Lukovo Pole, 1550 m, 26.05.2010; Mavrovo, 1750 m, 16.06.2010; Mavrovo - mountain northwest of v. Ničpur, 2105 m, 20.08.2010; Mavrovo - mountain northwest of v. Ničpur, 1945 m, 20.08.2010; Šar Mountains south 1540 m, 22.08.2010; Mavrovo Adžina River II - north mountain of v. Brodec, 1540 m, 22.08.2010; spring of Strezimirska River near Sveta Voda, 1247 m, 01.08.2012; mountain above Popova Šapka Ceripašina, 2382 m, 05.08.2012; Ljuboten, 1960 m, 06.08.2012; Ljuboten, 1963 m, 06.08.2012; Jelak 1780 m, 22.07.2016; Lešnica,1432 m, 24.07.2016; Plat mountain, 1820 m, 24.07.2016; near Lešnica, 1820

m, 24.07.2016; Krivošija, 2139 m, 27.07.2016; road to Tri Vodi, 1614 m, 08.07.2017; Gorna Lešnica, 1776 m, 15.07.2017; Gorna Lešnica, 2018 m, 03.08.2017; Krivošija, 1880 m, 03.08.2017; road to Karanikola, 1754 m, 04.08.2017; Jelak - Crn Vrv, 1752 m, 11.08.2019.

Fam. Pieridae Swainson, 1820

10. *Pieris krueperi* Staudinger, 1860

In Macedonian Red List: Near Threatened (NT), in Bern Convention appendix II.

Present in foothills zone, in meadow, rocky meadow, low shrubbery habitats.

Collection data (IET): close to v. Jažince, 677 m, 25.06.2012, 1ex (leg. V. Krpač).

Authors unpublished data: near v. Jažince, 739, 25.06.2012; northeast of v. Vratnica near the Kosovo border, 725 m, 25.06.2012.

11. *Anthocharis gruneri* Herrich-Schäffer, 1851

In Macedonian Red List: Near Threatened (NT).

Present in foothills and montane zones, in meadow, rocky meadow, low shrubbery, forest edge or clearing habitats.

Literature data: Schaider and Jakšić (1989); v. Nerašte, Abdija (2013a); Adžina River Torbeški Most 1390 m, Adžina River, 1549 m, in Krpač et al (2013).

Collection data (SKO): v. Vratnica, 715 m, 29.06.1975, 1ex (leg. S. Jakonov).

Collection data (IET): v. Radiovce, 515 m, 17.04.2013, 2♂ (leg. Xh. Abdija).

Authors unpublished data: Radika r. Lukovo Pole, 1550 m, 26.05.2010; Torbeški Most - Adžina River, 1390 m, 26.05.2010; Ljuboten, 1963 m, 06.08.2012.

12. *Colias caucasica* Staudinger, 1871 ssp. *balcanica* Rebel, 1903

In Macedonian Red List: Near Threatened (NT).

Present in montane zone, in meadow, low shrubbery, mesophilic grassland, forest edge or clearing, riparian vegetation habitats.

Literature data: Jakšić (1988); v. Gorno Jelovce (Dedel Beg), v. Gorno Jelovce, Bojkov Kamen Melovski (2002); v. Ničpur 986 m, Mavrovi Anovi to v. Vrben, Mavrovi Anovi from v. Bogdevo to v. Krakornica, Crn Kamen Lukovo Pole, Crn Kamen Dolno Lukovo Pole Krpač et al (2013).

Collection data (SKO): v. Ničpur, 986 m, 11.08.2004, 1ex; v. Bogdevo – v. Krakornica, 1412 m, 18.06.2010, 1ex; Crn Kamen Lukovo Pole, 1536 m, 18.06.2010, 1ex (leg. V. Krpač).

Authors unpublished data: Radika r. Lukovo Pole, 1550 m, 26.05.2010; v. Vrben, 1335 m, 18.06.2010; Dolno Lukovo Pole Crn Kamen, 1539 m, 03.07.2010; road after v. Vrben, 1380 m, 18.06.2010; proximity to the Kosovo border, 1530 m, 18.06.2010.

13. *Gonepteryx farinosa* (Zeller, 1847)

In Macedonian Red List: Near Threatened (NT).

There are only two old reports observed by De Freina, published by Schaider (1980), and De Freina (1983): 2 males found the 15 and 16 July 1979 above Vratnica between 1000 and 1100 m asl (foothills zone). We cannot use this species as indicator because its preferred biotopes are outside this area.

Literature data: Ljuboten, v. Vratnica Shaider (1980); v. Lešok De Freina (1983); Jakšić (1988); Schaider and Jakšić (1989).

Fam. Lycaenidae Leach, 1815

14. *Thecla betulae* (Linnaeus, 1758)

as *Zephyrus betulae* Linnaeus 1758 in Daniel et al (1951)

In Macedonian Red List: Near Threatened (NT).

Present in foothills and montane zones, in forest edge or clearing, riparian vegetation habitats.

Literature data: Crn Vrv, as *Zephyrus betulae* Daniel et al (1951); Crn Vrv, Thurner (1964); Jakšić (1988); Kobilica, in Jakšić (1998a); Popova Šapka, Abdija (2013).

Collection data (IET): Popova Šapka, 1056 m, 19.08.2011, 1♂ 1♀; Bistrica (v. Tearce), 769 m, in 2013; v. Gajre - v. Lisec, 1204 m, in 2013, (leg. Xh. Abdija).

15. *Satyrium pruni* (Linnaeus, 1758)

In Macedonian Red List: Near Threatened (NT).

Present in foothills zone, in low shrubbery, forest edge or clearing habitats.

Literature data: v. Negotino - v. Lomnica Abdija (2013c); Mazdrača Abdija et al (2017).

Collection data (IET): v. Kalište, 729 m, 12.06.2012, 1♂ (leg. Xh. Abdija).

16. *Lycaena dispar* ([Haworth], 1802) ssp. *rutila* (Werneburg, 1864)

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT, in Bern Convention appendices II and IV, in Habitat directive annex II and annex IV.

Present in foothills and montane zones, in mesophilic grassland and riparian vegetation habitats.

Literature data: v. Pršovce, 475 m, Abdija (2013c); Mazdrača, Abdija et al (2017); v. Gajre, v. Lisec, Abdija et al (2019).

Collection data (IET): v. Pršovce, 475 m, 01.08.2011, 1♂1♀; v. Jažince, 720 m, 26.07.2013; v. Vrutok, 787 m, in 2013; Mazdrača v. Lomnica, 750 m, in 2013; v. Rakovec, 962 m, in 2013; Bistrica (v. Tearce), 769 m, in 2013; v. Gajre - v. Lisec, 1204 m, in 2013; Kalište, 728 m, in 2013; above v. Vratnica, 910 m, in 2013; Popova Šapka, 1436 m, in 2013, (leg. Xh. Abdija).

17. *Phengaris alcon* ([Denis and Schiffermüller], 1775) ssp. *rebeli* (Hirschke, 1904)

as *Glaucopsyche* (*Maculinea*) *alcon sevastios* in in Daniel et al (1951); in Thurner (1964); as *Maculinea alcon* in Jakšić (1998a)

In Macedonian Red List: Near Threatened (NT).

Present in montane and subalpine zones, in meadow, low shrubbery, mesophilic grassland, forest edge or clearing habitats.

Literature data: Crn Vrv, as *Glaucopsyche* (*Maculinea*) *alcon sevastios* in Daniel et al (1951); Crn Vrv, Ljuboten, as *Maculinea alcon* sevastios in Thurner (1964); Jakšić (1988); Ljuboten, as *Maculinea alcon* in Jakšić (1998a); v. Ničpur Sveta Voda, Reč springs of Strezimirska River, valley of Radika r. Pilana in Krpač et al (2013).

Collection data (SKO): v. Ničpur Sveta Voda, 980 m, 03.07.2010; 1ex; Reč springs of Strezimirska River, 1254 m, 22.08.2010, 1ex (leg. V. Krpač).

Collection data (IET): Crno Lake, 2284 m, 22.06.2016, 1 ex (leg. V. Krpač).

Authors unpublished data: Strezimirska River, 1254 m, 03.07.2010.Reč springs of Strezimirska River, 1234 m, 03.07.2010;Reč, 1232 m, 01.08.2010.

18. *Phengaris arion* (Linnaeus, 1758)

as *Lycaena arion* (L.) in Rebel and Zerny (1931); as *Glaucopsyche* (*Maculinea*) *arion antension* in Daniel et al (1951) and Thurner (1964); *Maculinea arion* in Jakšić (1998a); Abdija et al (2013c; 2017)

In IUCN Red List Europe: Endangered (EN), in Macedonian Red List: Near Threatened (NT), in Bern Convention appendices II and IV, in Habitat directive annex IV.

Present in all vegetation belts (foothills, montane and subalpine), in meadow, rocky meadow, low shrubbery mesophilic grassland and forest edge or clearing habitats.

Literature data: Ljuboten, as *Lycaena arion* (L.) in Rebel and Zerny (1931); v. Brodec, Crn Vrv as *Glaucopsyche* (*Maculinea*) *arion antension* in Daniel et al (1951); v. Brodec, v. Vratnica as *Maculinea arion* antensionin Thurner (1964); Jakšić (1988); v. Vratnica, v. Brodec, as *Maculinea arion* in Jakšić (1998a); Radika valley around bridge 10 km NNW Sveta Voda, Huemer et al (2011); v. Negotino – v. Lomnica, as *Maculinea arion* in Abdija et al (2013c); Mazdrača, as *Maculinea arion* in Abdija et al (2017); Reč springs of Strezimirska River, Krpač et al (2013).

Collection data (IET): v. Negotino, 668 m, 02.06.2012, 2♂ 1♀ (leg. Xh. Abdija).

Authors unpublished data: Reč springs of Strezimirska River, 1234 m, 03.07.2010.

19. *Agriades optilete* (Knoch, 1781)

as *Polyommatus* (*Vacciniina*) *optilete* in Daniel et al (1951); as *Vacciniina optilete* in Michieli (1963); Arnscheid and Arnscheid (1980); Jakšić (1998a)

In Macedonian Red List: Near Threatened (NT).

Present in montane and subalpine zones, in mesophilic grassland, forest edge or clearing habitats.

Literature data: Crn Vrv, as *Polyommatus* (*Vacciniina*) *optilete* in Daniel et al (1951); Crn Vrv, as *Vacciniina optilete* in Thurner (1964); Ceripašina, as *Vacciniina optilete* in Michieli (1963); Šar Mountains, as *Vacciniina optilete* in Arnscheid and

Arnscheid (1980); Jakšić (1988); Piri Beg, Popova Šapka, Jelak, Jakšić (1998a); Popova Šapka, as *Vacciniina optilete* in Jakšić (1998a).

Collection data (SKO): Popova Šapka, 1700 m, 24.07.1975, 1ex (leg. S. Jakonov).

Collection data (IET): Popova Šapka, Ambasadorska Livada, 1525, 08.07.2017, 1ex; Gorna Lešnica, 1776 m, 15.07.2017, 7ex (leg. V. Krpač).

20. *Agriades dardanus* (Freyer, 1843)

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT.

This species is insufficiently studied. We did not find it recently. So far, only one site is known. This species occurs in subalpine zone, in rocky meadow habitats. Despite the lack of data, we keep this species as indicator for this area and recommend to increase the study effort on these slopes.**Literature data:** under Karabunar, Jakšić (1988) and Shaider and Jakšić (1989).

21. *Polyommatus eros* (Ochsenheimer, 1808) ssp. *eroides* (Frivaldszky, 1835)

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT.

Present in foothills and montane zones, in meadow, rocky meadow and mesophilic grassland habitats.

Literature data: Crn Vrv, Daniel et al (1951); Crn Vrv, Ljuboten, Thurner (1964); Jakšić (1988); Ljuboten, Jakšić (1998a); Popova Šapka, Abdija (2013c).

Collection data (IET): Popova Šapka, 1436 m, in 2013, 1ex (leg. Xh. Abdija); Popova Šapka, 1947 m, 22.06.2016, 1♂; Popova Šapka, 1719 m, 07.07.2016, 1ex (leg. V. Krpač).

22. *Polyommatus ripartii* (Freyer, 1830)

as *Agrodiaetus ripartii* in Melovski (2002)

In Macedonian Red List: Near Threatened (NT).

Present in the three vegetation belts, in meadow, rocky meadow, low shrubbery and forest edge or clearing habitats.

Literature data: Ljuboten, as *Agrodiaetus ripartii* in Melovski (2002); v. Rakovec – Borislavec, Abdija (2013c); v. Ničpur, Radika r., v. Trnica, Strezimir Reč, in Krpač et al (2013).

***C*ollection data (SKO):** v. Ničpur, 986 m, 11.08.2004, 1ex; v. Ničpur, 1086 m, 11.08.2004. 2ex; Radika r., 942 m, 21.07.2009, 1ex (leg. V Krpač).

***C*ollection data (IET):** v. Pirok, 637 m, 27.07.2012, 2ex; v. Rakovec, 962 m, in 2013,(leg. Xh. Abdija); Bogovinjsko Lake, 1949 m, 24.09.2016, 1ex (leg. V. Krpač).

Authors unpublished data: Ljuboten, 1963 m, 06.08.2012; Ljuboten Mountain Lodge, 1623 m, 06.08.2012; Bogovinjsko Lake, 1950 m, 24.09.2016.

Fam. Nymphalidae Rafinesque, 1815

23. *Kirinia climene* (Esper, 1783)

In Macedonian Red List: Vulnerable (VU).

Present in foothills zone, in forest edge or clearing habitats. *K. climene* has been mentioned only in one locality over v. Vrapčište. Despite the lack of data, we keep this species as indicator for this area.

Literature data: over v. Vrapčište in Jakšić (1988); Schaider and Jakšić (1989).

24. *Erebia epiphron* (Knoch, 1783) ssp. *roosi* Arnscheid & Sterba, 1978

as *Erebia epiphron otientalis* in Doflein (1921); as *Erebia epiphron retyetzatensis* in Daniel et al (1951); Jakšić (1998a)

In Macedonian Red List: Near Threatened (NT).

Present in subalpine zone, in meadow and rocky meadow habitats.

Literature data: Kobilica as *Erebia epiphron otientalis* Doflein (1921); Kobilica as *Erebia epiphron retyetzatensis* in Daniel et al (1951); Titov Vrv, Michieli (1963); Jakšić (1988); Piribeg as *Erebia epiphron retyetzatensis* in Jakšić (1998a); Kučibaba under Kule, v. Melovo near the river Bistrica, Melovski (2002).

Collection data (SKO): Ljuboten 2460 m, 28.08.1976, 1 ex. (leg. S. Jakonov); Kobilica Gornovica, 2450 m, 26.07.2007, 1ex (leg. V Krpač).

Collection data (IET): Karabunar, 2382 m, 31.07.2014, 1♂ 1♀, (leg. Xh. Abdija); Karabunar, 2490, 31.07.2014, 1ex; Gorna Lešnica, 1820 m, 15.07.2017, 1ex; under Karanikoličko Lake, 1754 m, 04.08.2017, 5ex (leg. V. Krpač).

Authors unpublished data: Karabunar – Titov Vrv, 2373 m, 31.07.2014; Titov Vrv, 2747 m, 02.08.2014.

25. *Erebia albergana* (Prunner, 1798)

In Macedonian Red List: Near Threatened (NT).

Present in montane and subalpine zones, in meadow and forest edge or clearing and riparian vegetation habitats.

Literature data: Jakšić (1988); Ljuboten over Elezova Rupa, Čaušica, v. Melovo near the river Bistrica, Melovski (2002).

Collection data (IET): Ljuboten, 1945 m, in 2013, (leg. Xh. Abdija).

26. *Erebia gorge* (Hübner, [1804])

In Macedonian Red List: Near Threatened (NT).

This species occurs in rocky open habitats of the Šar Mountains in subalpine belt.

Literature data: Jakšić (1988); Mala Vraca, Jakšić (1998a); Šar Mountains, Varga (2014).

Collection data (SKO): Ceripašina, 1700-2000 m, 26-28.07.1952, 1ex (leg. T. Petkovski).

Collection data (IET): Karabunar,2382 m, in 2013, (leg. Xh. Abdija); Titov Vrv Karabunar, 2373 m, 31.07.2014, 1ex (leg V. Krpač).

Authors unpublished data: Karabunar - Titov Vrv, 2373 m, 31.07.2014; Titov Vrv, 2747 m, 02.08.2014.

27. *Erebia rhodopensis* Nicoll, 1900

In Macedonian Red List: Near Threatened (NT).

This species occurs in open mesic habitats of the Šar Mountains in subalpine belt: mesic meadows, high mountain pastures.

Literature data: Kobilica, as *Erebia typhon* f. *rhodopensis* Doflein (1921); Kobilica, Daniel et al (1951); Kobilica, Ljuboten, Thurner (1964); Jakšić (1988); Ljuboten, Schaider and Jakšić (1989); Ljuboten, Mala Vraca, Kobilica, Popova Šapka, Jelak, Jakšić (1998a); Piribeg, Jakšić (1998a); Čaušica, Dedel Beg, Idrizova Rupa, Melovski (2002); Popova Šapka, Abdija et al (2013b); Šar Mountains, Varga (2014).

Collection data (IET): Popova Šapka, 1966 m, 21.07.2012, 3ex; Crno Lake, 2200 m, in 2013; Karabunar, 2382 m, in 2013, (leg. Xh. Abdija); Titov Vrv, Karabunar, 2373 m, 31.07.2014, 1ex; Crno Lake, 2177 m, 24.06.2016, 2ex (leg. V. Krpač).

Authors unpublished data: Titov Vrv, 2747 m, 02.08.2014.

28. *Erebia pronoe* (Esper, 1780)ssp. *fruhstorferi* Warren, 1933

as *Erebia pronoe fruhstorferi* in Daniel et al (1951); Michieli (1963); Thurner (1964)

In Macedonian Red List: Near Threatened (NT).

Present in subalpine zone, in meadow, mesophilic grassland and forest edge or clearing habitats.

Literature data: Kobilica, Doflein (1921); Kobilica, as *Erebia pronoe fruhstorferi* in Daniel et al (1951); Titov Vrv, as *Erebia pronoe fruhstorferi* Michieli (1963); Jakšić (1988); Kobilica, as *Erebia pronoe fruhstorferi* in Thurner (1964); Kobilica, Jakšić (1998a).

Collection data (IET): Borislavec, 1509 m, 17.07.2012, 1ex; Karabunar, 2382 m, in 2013, (leg. Xh. Abdija).

Authors unpublished data: Karabunar - Titov Vrv, 2373 m, 31.07.2014; Titov Vrv, 2747 m, 02.08.2014.

29. *Erebia pandrose* (Borkhausen, 1788)

as *Erebia pandrosa lappona* in Thurner et al (1964)

In Macedonian Red List: Near Threatened (NT).

Present in montane and subalpine zones, this species occurs in open and semi-open mesic habitats of the Šar Mountains such as meadows, clearing or edge of beech or spruce forests.

Literature data: Ljuboten, as *Erebia pandrosa lappona* Thurner et al (1964); Jakšić (1988); Ljuboten, Jakšić (1998a); Čaušica, Ljuboten, Jelak Mountain Lodge, Melovski (2002).

Collection data (SKO): Šar Mountains, 1700, 28.07.1939. (leg. A. Fadeev).

Collection data (IET): Titov Vrv, Karabunar, 2488 m, 22.06.2016; Crno Lake, 2177 m, 24.06.2016, 5ex; Ambasadorska Livada, 1525 m, 08.07.2017, 4ex; Gorna Lešnica, 1820 m, 15.07.2017, 6ex (leg. V. Krpač).

Authors unpublished data: towards Titov Vrv, 1949 m, 22.06.2016.

30. *Limenitis populi* (Linnaeus, 1758)

In Macedonian Red List: Near Threatened (NT).

Present in montane zone, in forest edge or clearing, and riparian vegetation habitats.

Literature data: Jakšić (1988); v. Gorno Jelovce, Šarski Vodi around the Mountain Lodge, beetwin v. Brezno - Tri Vodi, Melovski (2002); Mavrovi Anovi, Trnica, Krpač et al (2013); v. Lisec, Abdija et al (2019).

Collection data (IET): near stream v. Lisec, 1160 m, 24.06.2019, 1ex (leg. V. Krpač).

Authors unpublished data: Mavrovi Anovi, 1272 m, 16.06.2010; Trnica, 1003 m, 16.06.2010.

31. *Neptis rivularis* (Scopoli, 1763)

as *Limenitis rivularis* in Daniel et al (1951).

In Macedonian Red List: Near Threatened (NT).

In montane zone, in riparian vegetation habitats. However it is only mentioned in literature data (collected by Walter Forster in July 1939, from 1000 to 1500 m, near rivers). This species has to be searched to confirm if it is still present. The data being so old, we cannot use this species as indicator for this area.

Literature data: v. Brodec (Pena r.), Crn Vrv, as *Limenitis rivularis* in Daniel et al (1951).

32. *Neptis sappho* (Pallas, 1771)

In Macedonian Red List: Vulnerable (VU).

Present in foothills and montane zones, in forest edge or clearing and riparian vegetation habitats.

Literature data: over v. Tearce near the river Bistrica Melovski (2002); v. Stenče, Abdija et al (2013b).

Collection data (IET): v. Pirok, 645 m, 13.08.2012, 2♂; v. Rakovec, 962 m, in 2013 (leg. Xh. Abdija).

33. *Araschnia levana* (Linnaeus, 1758)

In Macedonian Red List: Near Threatened (NT).

Present in foothills and montane zones, in mesophilic grassland, forest edge or clearing and riparian vegetation habitats.

Literature data: Tri Vodi around the Mountain Lodge Melovski (2002); Kučibaba (Tri Vodi), Melovski (2004); v. Tearce, Abdija et al (2013b); Mazdrača, Abdija et al (2017), v. Gajre, v. Lisec, Abdija et al (2019).

Collection data (IET): v. Kalište, 729 m, 30.04.2012, 1♂; v. Kalište, 728 m, in 2013; above v. Vratnica, 910 m, in 2013; Borislavec, 1679 m, in 2013; Popova Šapka, 1436 m, in 2013 (leg. Xh. Abdija); road to v. Lisec, 1160 m, 23.07.2016, 1♀ (leg. V. Krpač).

34. *Nymphalis xanthomelas* ([Denis & Schiffermüller], 1775)

In Macedonian Red List: Near Threatened (NT).

Present in foothills zone, in forest edge or clearing and riparian vegetation habitats.

Literature data: v. Pirok, Abdija et al (2013b); Adžina River, Krpač et al (2013).

Collection data (IET): v. Tearce, 759 m, 18.03.2012, 1♀; v. Vratnica, 910 m, in 2013, (leg. Xh. Abdija).

35. *Brenthis ino* (Rottemburg, 1775)

In Macedonian Red List: Near Threatened (NT).

Present in montane zone, in meadow, mesophilic grassland, forest edge or clearing habitats.

Literature data: Jakšić (1988).

Authors unpublished data: Ski resort road north of v. Lisec, 1420 m, 31.07.2011.

***Boloria pales* ([Denis & Schiffermüller], 1775)**

as *Argynis pales contempta* in Doflein (1921); as *Argynis* (*Brenthis*) *pales contempta* in Daniel et al (1951)

In Macedonian Red List: Near Threatened (NT).

Present in subalpine zone, in meadow, rocky meadow, high altitude pasture habitats.

Literature data: Kobilica as *Argynis pales contempta* in Doflein (1921); Ljuboten, in Rebel and Zerny (1931); Crn Vrv, as *Argynis* (*Brenthis*) *pales contempta* in Daniel et al (1951); Ceripašina, Michielli (1963); Crn Vrv, Thurner (1964); Jakšić (1988); Bistravec, Abdija et al (2013b); Šar ms, Varga (2014).

Collection data (IET): Borislavec, 1679 m, 08.08.2012, 1♂; Borislavec, 1679, in 2013; Crno Lake, 2200, in 2013, (leg. Xh. Abdija).

37. *Boloria graeca* (Staudinger, 1870)

as *Argynis* (*Brenthis*) *graeca balcanica* in Rebel and Zerny (1931); as *Boloria graeca balcanica* in Daniel et al (1951); Michielli (1963); Jakšić (1998a); as *Boleria* (*Argynis*) *graeca balcanica* in Thurner (1964)

In Macedonian Red List: Near Threatened (NT).

Present in subalpine zones, in high altitude pastures.

Literature data: Ljuboten, Kobilica, as *Argynis* (*Brenthis*) *graeca balcanica* in Rebel and Zerny (1931); Crn Vrv, Kobilica, as *Boloria graeca balcanica* in Daniel et al (1951); Popova Šapka (1800-2000) as *Boloria graeca balcanica* in Michielli (1963); Crn Vrv, Kobilica, Ljuboten as *Boleria* (*Argynis*) *graeca balcanica* in Thurner (1964); Šar Mountains in Arnscheid and Arnscheid (1980); Popova Šapka, Jakšić (1988); Šar Mountains Piribeg, as *Boloria graeca balcanica* in Jakšić (1998a); Ljuboten, Kobilica, Jelak, Jakšić (1998a); Ljuboten, Ljuboten over Elezova Rupa, Ljuboten near mountain refuge, Jelak - Crn Vrv, Melovski (2002); Borislavec, Abdija et al (2013b); Šar Mountains, Varga (2014).

Collection data: (SKO) Ceripašina, 2500 m, 26.07.1952, 3ex (leg. T. Petkovski); Ljuboten, 2460 m, 28.08.1976, 7ex (leg. S. Jakonov).

Collection data (IET): Borislavec, 1679 m, 08.08.2012, 1♂; Crno Lake, 2200 m, in 2013, (leg. Xh. Abdija); Popova Šapka, 1745 m, 12.07.2016, 1ex; Krivošija, 1766 m, 27.07.2016, 1♂; under Karanikoličko Lake, 1754 m, 04.08.2017, 2 ex (leg. V. Krpač).

Authors unpublished data: Mavrovo - mountain northwest of v. Ničpur, 2105 m, 20.08.2010, Popova Šapka Ceripašina, 2382 m, 05.08.2012; Crno Lake, 2174m, 07.08.2012, Crno Lake, 2284 m, 07.08.2012; Titov Vrv, 2747 m, 02.08.2014; Popova Šapka, 1719 m, 12.07.2016; Krivošija 2139 m, 27.07.2016, under Karanikoličko Lake, 1754 m, 04.08.2017.

38. *Melitaea arduinna* (Esper, 1783) ssp. *rhodopensis* Freyer, 1836

In Macedonian Red List: Near Threatened (NT).

Present in montane and subalpine zones, in meadow, low shrubbery and mesophilic habitats.

Literature data: Mavrovi Anovi, from v. Bogdevo to v. Krakornica, 1412 m, Krpač et al (2013); v. Lakavica, 585 m, Abdija et al (2013b).

Collection data (IET): v. Lakavica, 585 m, 30.06.2012, 1♂, (leg. Xh. Abdija).

Authors unpublished data: v. Vrben, 1335 m, 18.06.2010; v. Bogdevo – v. Krakornica, 1412 m, 18.06.2110; Crn Vrv, 936 m, 01.06.2013.

39. *Melitaea aurelia* Nickerl 1850

In IUCN Red List Europe: Near Threatened (NT), in Macedonian Red List: NT.

Present in foothills and montane zones, in meadow, rocky meadow, low shrubbery and mesophilic grassland habitats.

Literature data: v. Pršovce, Abdija et al (2013b).

Collection data (IET): v. Pršovce, 475 m, 08.09.2011, 1♂ 1♀; Mavrovo, 1026 m, 05.05.2012, 1ex; v. Negotino, 668 m, 03.06.2012, 4ex; v. Jažince, 720 m, 26.07.2013; v. Vrutok, 787 m, in 2013; Mazdrača v. Lomnica, 750 m, in 2013; v. Rakovec, 962 m, in 2013;v. Belovište, 785 m, in 2013; v. Jelovjane, 1142 m, in 2013; Bistrica (v. Tearce), 769 m, in 2013; Gajre - v. Lisec 1204 m, in 2013; v. Kalište, 728 m, in 2013; v. Vratnica, 910 m, in 2013; Popova Šapka, 1436 m, in 2013, (leg. Xh. Abdija).

Authors unpublished data: v. Lisec (1188) 24.05.2019.

40. *Euphydryas aurinia* (Rottemburg, 1775) ssp. *bulgarica* (Fruhstorfer, 1917)

In Macedonian IUCN Red List: Near Threatened (NT), in Bern Convention appendix II.

Present in all vegetation belts, in meadow, low shrubbery mesophilic grassland and forest edge or clearing habitats.

Literature data: Bunec, Adžina Reka, Melovski (2002); Mavrovi Anovi to v. Vrben, Krpač et al (2013); Mavrovo, Abdija et al (2013b).

Collection data (SKO): v. Vratnica, 21.07.1971, 16ex (leg. J. Čingovski); v. Vratnica, 26.07.1971, 14ex (leg. J. Čingovski).

Collection data (IET): Šar Mountains Mavrovo, 991 m, 05.05.2012, 1♂ 1♀, (leg. Xh. Abdija); Ulivérica, 1750 m, 25.05.2019, 2ex (leg. M. Černila, V. Krpač).

Authors unpublished data: mountain above Mavrovi Anovi, 1680 m, 16.06.2010; Mavrovo, 1270 m, 16.06.2010; mountain above Mavrovo, 1750 m, 16.06.2010; road to v. Vrben, 1350 m, 18.06.2010; v. Vrben, 1335 m, 18.06.2010; road between v. Vrben and v. Bogdevo, 1550 m, 18.06.2010; v. Vrben proximity to the Kosovo border, 1530 m, 18.06.2010; Šar Mountains south, 1540 m, 22.08.2010; Uliverica, 1790 m, 25.05.2019.

41. *Euphydryas maturna* (Linnaeus, 1758)

as *Euphydryas maturna macedonica* in Dufay (1977)

In IUCN Red List Europe: Vulnerable (VU), in Macedonian Red List: VU, in Bern Convention appendices II and IV.

Present in foothills zone, in forest edge and riparian vegetation habitats.

Literature data: Radika r. v. Trnica, Dufay (1973); Radika r. v. Trnica as *Euphydryas maturna macedonica* in Dufay (1977); Jakšić (1988); Radika r., Jakšić (1998a); Radika r. near v. Trnica, Radika r. v. Ničpur Sveta Voda, Krpač et al (2013).

Collection data (SKO): Radika r., 942 m, 12.07.1975, 2ex (leg. S. Jakonov); Radika r. v. Ničpur Sveta Voda, 980 m, 03.07.2010, 1ex (leg. V. Krpač).

To the above list, we could add ***Nymphalis vaualbum* (Denis & Schiffermüller, 1775)**, found in the country and published after the publication of the Red list for North Macedonia. It was found the 14 July 2009 at Lešnica, at 1500 m elevation, at the edge of beech forest and published in 2014 (Dime Melovski and Emilija Božinovska). This species has to be searched for along the Pena river, at lower altitude, to confirm if it is still present, or the individual caught was a vagrant.

Among the 41 species on the Red list for Macedonia, reported in this area, we kept 38 species as indicators to monitor the evolution of the biodiversity of this area. At these 38 species, we added *N. vaualbum*, considered up to now with a data deficient status for the country.

Conclusion

According to the species richness of butterflies of the Šar Mountains (179 taxa) with 39 species important for the valorization of the investigated area, we can confirm that the Šar mountain range is a hot spot of biodiversity in the Republic of North Macedonia.

The species richness, or at least, the 39 target species listed in this paper can be monitored in the future to foresee the trend of the evolution of the biodiversity in this mountain range. In addition, it is a tool to contribute to the zoning of the most important areas to be protected within the Šar Mountains.

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ANNEX I
Check-list of butterflies in the Šar Mountains

Fam. Hesperiidae Latreille, 1809

Carcharodus alceae (Esper, 1780)
Carcharodus floccifera (Zeller, 1847)
Carcharodus orientalis Reverdin, 1913
Erynnis tages (Linnaeus, 1758)
Muschampia proto (Ochsenheimer, 1808)
Pyrgus malvae (Linnaeus, 1758)
Pyrgus serratulae (Rambur, 1839)
Pyrgus armoricanus (Oberthür, 1910)
Pyrgus alveus (Hübner, [1803])
Pyrgus cinarae (Rambur, 1839)
Pyrgus sidae (Esper, 1784)
Pyrgus carthami (Hübner, [1813])
Pyrgus andromedae (Wallengren, 1853)
Spialia orbifer (Hübner, [1823])
Spialia phlomidis (Herrich and Schäffer, 1845)
Carterocephalus palaemon (Pallas, 1771)
Thymelicus acteon (Rottemburg, 1775)
Thymelicus lineola (Ochsenheimer, 1808)
Thymelicus sylvestris (Poda, 1761)
Hesperia comma (Linnaeus, 1758)
Ochlodes sylvanus (Esper, 1777

Fam. Papilionidae Latreille, 1802

Zerynthia polyxena ([Denis and Schiffermuller], 1775)
Zerynthia cerisy (Godart, [1824])
Parnassius mnemosyne (Linnaeus, 1758)
Parnassius apollo (Linnaeus, 1758)
Iphiclides podalirius (Linnaeus, 1758)
Papilio machaon Linnaeus, 1758

Fam. Pieridae Swainson, 1820

Leptidea duponcheli (Staudinger, 1871)
Leptidea sinapis (Linnaeus, 1758)
*Leptidea juvernica*Williams 1946
Aporia crataegi (Linnaeus, 1758)
Pieris krueperi Staudinger, 1860
Pieris rapae (Linnaeus, 1758)
Pieris mannii (Mayer, 1851)
Pieris ergane (Geyer, [1828])

Pieris napi (Linnaeus, 1758)
Pieris balcana Lorković, [1979]
Pieris brassicae (Linnaeus, 1758)
Pontia edusa (Fabricius, 1777)
Euchloe ausonia (Hübner, [1804)]
Anthocharis cardamines (Linnaeus, 1758)
Anthocharis gruneri Herrich-Schäffer, 1851
Colias crocea (Geoffroy, 1785)
Colias alfacariensis Ribbe, 1905
Colias caucasica Staudinger, 1871
Gonepteryx rhamni (Linnaeus, 1758)
Gonepteryx farinosa (Zeller, 1847)

Fam. Riodinidae Grote, 1895

Hamearis lucina (Linnaeus, 1758)

Fam. Lycaenidae Leach, 1815

Favonius quercus (Linnaeus 1758)
Thecla betulae (Linnaeus, 1758)
Callophrys rubi (Linnaeus, 1758)
Satyrium acaciae (Fabricius, 1787)
Satyrium ilicis (Esper, 1779)
Satyrium spini ([Denis and Schiffermüller], 1775)
Satyrium w-album (Knoch, 1782)
Satyrium pruni (Linnaeus, 1758)
Lycaena phlaeas (Linnaeus, [1760])
Lycaena dispar ([Haworth], 1802)
Lycaena candens (Herrich-Schäffer, 1844)
Lycaena thersamon (Esper, 1784)
Lycaena alciphron (Rottenburg, 1775)
Lycaena virgaureae (Linnaeus, 1758)
Lycaena tityrus (Poda, 1761)
Lampides boeticus (Linnaeus, 1767)
Leptotes pirithous (Linnaeus, 1767)
Cupido alcetas (Hoffmannsegg, 1804)
Cupido argiades (Pallas, 1771)
Cupido decoloratus (Staudinger, 1886)
Cupido osiris (Meigen, 1829)
Cupido minimus (Fuessly, 1775)
Iolana iolas (Ochsenheimer, 1816)
Glaucopsyche alexis (Poda, 1761)
Phengaris alcon([Denis and Schiffermüller], 1775)
Phengaris arion (Linnaeus, 1758)
Celastrina argiolus(Linnaeus, 1758)
Scolitantides orion (Pallas, 1771)
Pseudophilotes vicrama (Moore, 1865)
Kretania sephirus (Frivaldzky, 1835)
Plebejus argus (Linnaeus, 1758)
Plebejus idas (Linnaeus, [1760])
Plebejus argyrognomon (Bergsträsser, 1779)
Agriades optilete (Knoch, 1781)
Agriades dardanus(Freyer, 1843)
Eumedonia eumedon (Esper, 1780)
Aricia agestis (Denis and Schiffermüller, 1775)
Aricia artaxerxes (Fabricius, 1793)
Aricia anteros (Freyer, 1838)
Cyaniris semiargus(Rottemburg, 1775)
Polyommatus amandus (Scheider, 1792)
Polyommatus dorylas ([Denis and Schiffermūller], 1775)
Polyommatus icarus (Rottemburg, 1775)
Polyommatus thersites (Cantener 1835)
Polyommatus eros (Ochsenheimer, 1808)
Polyommatus daphnis ([Denis and Schiffermüller], 1775)
Polyommatus ripartii (Freyer, 1830)
Polyommatus admetus (Esper, 1783)
Polyommatus damon ([Denis and Schiffermuller], 1775)
Lysandra bellargus (Rottemburg, 1775)
Lysandra coridon (Poda, 1761)

Nymphalidae Rafinesque, 1815

Libythea celtis (Laicharting, 1782)
Kirinia roxelana (Cramer, 1777)
Kirinia climene (Esper, 1783)
Pararge aegeria (Linnaeus, 1758)
Lasiommata maera (Linnaeus, 1758)
Lasiommata petropolitana (Fabricius, 1787)
Lasiommata megera (Linnaeus, 1767)
Coenonympha arcania (Linnaeus, [1760])
Coenonympha leander (Esper, 1784)
Coenonympha pamphilus (Linnaeus, 1758)
Coenonympha rhodopensis Elwes, 1900
Pyronia tithonus (Linnaeus, 1771)
Maniola jurtina (Linnaeus, 1758)
Hyponephele lycaon (Kühn, 1774)
Hyponephele lupina (Costa, 1836)
Aphantopus hyperantus(Linnaeus, 1758)

Erebia ligea (Linnaeus, 1758)
Erebia euryale (Esper, 1805)
Erebia epiphron (Knoch, 1783)
Erebia albergana (Prunner, 1798)
Erebia medusa ([Denis & Schiffermüller], 1775)
Erebia gorge (Hübner, [1804])
Erebia rhodopensis Nicoll, 1900
Erebia neleus(Freyer, 1832)
Erebia ottomana Herrich & Schaffer, 1847
Erebia melas (Herbst, 1796)
Erebia pronoe (Esper, 1780)
Erebia oeme (Hübner, [1804])
Erebia pandrose (Borkhausen, 1788)
Chazara briseis(Linnaeus, 1764)
Brintesia circe (Fabricius, 1775)
Hipparchia semele (Linnaeus,1758)
Hipparchia volgensis (Mazochin-Porshnjakov, 1952)
Hipparchia fagi (Scopoli, 1763)
Hipparchia syriaca (Staudinger, 1871)
Hipparchia statilinus (Hufnagel, 1766)
Arethusana arethusa ([Denis & Schiffermüller], 1775)
Satyrus ferula (Fabricius, 1793)
Melanargia galathea (Linnaeus, 1758)
Melanargia larissa (Geyer, [1828])
Apatura ilia ([Denis & Schiffermüller], 1775)
Apatura iris (Linnaeus, 1758)
Limenitis populi (Linnaeus, 1758)
Limenitis reducta Staudinger, 1901
Neptis rivularis (Scopoli, 1763)
Neptis sappho (Pallas, 1771)
Araschnia levana(Linnaeus, 1758)
Vanessa atalanta (Linnaeus, 1758)
Vanessa cardui (Linnaeus, 1758)
Polygonia c-album (Linnaeus, 1758)
Polygonia egea (Cramer, 1775)
Aglais io (Linnaeus, 1758)
Aglais urticae(Linnaeus, 1758)
Nymphalis polychloros (Linnaeus, 1758)
Nymphalis xanthomelas ([Denis & Schiffermüller], 1775)
Nymphalis vaualbum ([Denis & Schiffermüller], 1775)
Nymphalis antiopa (Linnaeus, 1758)
Fabriciana niobe (Linnaeus, 1758)
Fabriciana adippe ([Denis & Schiffermuller], 1775)
Speyeria aglaja (Linnaeus, 1758)
Argynnis paphia (Linnaeus, 1758)
Argynnis pandora ([Denis & Schiffermuller], 1775)
Brenthis ino (Rottemburg, 1775)
Brenthis daphne ([Denis & Schiffermüller], 1775)
Brenthis hecate ([Denis & Schiffermüller], 1775)
Issoria lathonia (Linnaeus, 1758)
Boloria euphrosyne (Linnaeus, 1758)
Boloria dia (Linnaeus, 1767)
Boloria pales ([Denis & Schiffermüller], 1775)
Boloria graeca (Staudinger, 1870)
Melitaea phoebe ([Denis & Schiffermüller], 1775)
Melitaea arduinna (Esper, 1783)
Melitaea didyma (Esper, 1778)
Melitaea trivia ([Denis & Schiffermüller], 1775)
Melitaea diamina (Lang, 1789)
*Melitaea aurelia*Nickerl 1850
Melitaea athalia (Rottemburg, 1775)
Melitaea cinxia (Linnaeus, 1758)
Euphydryas aurinia (Rottemburg, 1775)
Euphydryas maturna (Linnaeus, 1758)

ANNEX II
Geographic coordinates of localities

Name	**Latitude**	**Longitude**
Adžina Reka	41.818021	20.648169
Am Crni vrh	42.09819444	20.9215
Ambasadorska Livada	42.0233333	20.9016667
Baschina (Bašina planina)	42.0958333	20.85
Belovište	42.1399860	21.099774
Bistrica (Tearce)	42.0953220	21.041878
Bojkov Kamen	41.789394	20.813086
Borislavec	41.923298	20.835234
Bozovce	42.0521111	20.8170833

Bogovinjsko lake (Bogovinjsko Ezero)	41.9538889	20.7922222
Brodec	42.059781	20.883884
Brodeč, (Pena river)	42.0569444	20.8905556
Čaušica	42.124232	21.00078
Ceripašina Planina	42.0152778	20.8565556
Crni vrh	42.1022222	20.9302778
Crno Lake (Crno Ezero)	41.9255000	20.7906944
Dolna Lešnica	42.021	20.7961667
Gajre-Lisec	42.0200600	20.918916
Gorna Lešnica	42.0247222	20.8594444
Gorno Jelovce	41.807343	20.790089
Gorno Jelovce (Dedel Beg)	41.809733	20.786726
Idrizova Rupa	41.83446	20.741049
Jažince	42.1443580	21.127964
Jelak	42.0323333	20.8595278
Jelak - Crn Vrv	42.035166	20.860434
Jelak – Vrn Vrv	42.0305556	20.8575000
Jelak, pl. Dom	42.02764	20.86508
Jelovjane	41.9563400	20.89228
Kalište	41.8796340	20.868623
Karabunar	41.9837070	20.805233
Karabunar pod Titov Vrv	41.9850000	20.6680556
Karanikola	42.0755556	20.6805556
Karanikoličko lake (Ezero)	42.0733333	20.7922222
Kobeliza (Kobilica Šar planina)	42.096	20.885
Krivošija	42.075	20.7958333
Kučibaba, under Kule	42.103417	20.995722
Lesak	42.0668889	21.028
Leshnitsa (Lešnica)	42.0276389	20.7883056
Leshok	42.0604278	21.0326278
Lešok Monastery	42.066619	21.27459
Lisec	42.0007222	20.9151389
Ljuboten	42.1932500	21.1283333
Ljuboten over Elezova Rupa	42.183968	21.13967
Ljuboten over Staro Selo	42.158355	21.123783
Ljuboten, near mountain refuge	42.184981	21.127322
Lukovo Pole	41.8547222	20.6266667
Mavrovo: r. Radika, s. Trnica	41.7322917	20.6703417
Mavrovo: s. Ničpur	41.743825	20.6729472
Mazdrača (Lomnica)	41.8912020	20.852505
Melovo near the river Bistrica	42.112759	21.003119
Negotino	41.880430	20.878472
Nerašte	42.111455	21.097749
Ničpur Sveta Voda	41.743993	20.673012

Pirok	41.913087	20.905845
Plat Mt	42.0320833	20.8301944
Popova Šapka	42.0131667	20.8848333
Radika	41.7322917	20.6703444
Radika: Goren tek	41.8525306	20.622625
Radika: Lukovo Pole	41.8525306	20.622625
Rakovec	41.9179560	20.892557
Šar Planina south	41.8480278	20.6229722
Šarski Vodi	41.803607	20.802555
Šipkovica	42.0211111	20.9208333
Spring of Vardar river	41.764169	20.836941
Staro Selo	42.1830110	21.138322
Tearce near the river Bistrica	42.089179	21.05147
Titov Vrv	41.9920000	20.7983333
Tri Vodi	42.109377	21.002286
Varvara	42.063440	21.016557
Vešala	42.0658333	20.8333333
Vratnica	42.1470720	21.098746
Vrben	41.7105556	20.7330556
Vrutok	41.7643333	20.8375000