

# On the extremely rich butterfly fauna (Lepidoptera: Rhopalocera) of the south-eastern foothills of Stara Planina Mts in Serbia

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**Abstract.** The Stara Planina Mts. region in Serbia has already been recognized as one of the most butterfly rich regions in Europe with good populations of several rare and threatened species. However, so far the southern part of Stara Planina has been poorly studied. We therefore focused our field surveys on that region visiting 22 sites over a period of seven years. A total of 136 species of butterflies was recorded and new records of several rare species confirm and append our knowledge of the high diversity of Stara Planina. We have confirmed the presence of *Muschampia cribrellum* in Serbia and extended its known range from Mt. Vidlič to the foothills of the Stara Planina massif. Additionally we found rare species like *Leptidea duponcheli*, *Plebejus sephirus*, *Erebia albertanus*, *Melitaea arduinna* and *Nymphalis xanthomelas* at several new sites. Despite sufficient legislative protection, the butterfly fauna of the region is under threat due to infrastructural developments and abandonment.

**Samenvatting.** Over de extreem rijke vlinderfauna (Lepidoptera: Rhopalocera) van de zuidoostelijke uitlopers van het Stara Planina gebergte in Servië

Het Stara Planina gebergte in Servië wordt reeds erkend als een van de meest vlinderrijke gebieden in Europa met sterke populaties van verscheidene zeldzame en bedreigde soorten. Nochtans werden de zuidelijke uitlopers van dit gebergte tot nu toe nauwelijks bestudeerd. Wij hebben ons onderzoek daarom toegespitst op dit gebied en bezochten 22 lokaliteiten gedurende 7 jaar. In het totaal werden 136 dagvlindersoorten genoteerd en nieuwe gegevens bevestigen en vervolledigen onze kennis van de hoge diversiteit van de Stara Planina. We bevestigden de aanwezigheid van *Muschampia cribrellum* in Servië en verlegden de grens van Mt. Vidlič tot aan de uitlopers van de Stara Planina. Verder troffen we in verscheidene nieuwe vindplaatsen zeldzame soorten aan zoals *Leptidea duponcheli*, *Plebejus sephirus*, *Erebia albertanus*, *Melitaea arduinna* en *Nymphalis xanthomelas*. Ondanks voldoende wetgeving, is de vlinderfauna in dit gebied bedreigd door de ontwikkeling van infrastructuur en door verwaarlozing.

**Résumé.** Sur la faune des papillons (Lepidoptera: Rhopalocera), extrêmement riche, des pentes sud-est de la Montagne Stara Planina en Serbie

La Montagne Stara Planina, en Serbie, est déjà reconnue comme une des régions les plus riches d'Europe en ce qui concerne les papillons, avec des populations riches de diverses espèces rares et menacées. Néanmoins, la partie sud-est de cette montagne reste peu étudiée. Nous avons donc concentré nos études dans cette région en visitant 22 localités pendant 7 années. Au total 136 espèces de papillons furent notées et plusieurs données nouvelles ont enrichi nos connaissances de la biodiversité du Stara Planina. Nous avons confirmé la présence de *Muschampia cribrellum* en Serbie et élargi son aire de dispersion du Mt. Vidlič vers les pentes du Stara Planina. De plus, nous avons trouvé dans plusieurs localités nouvelles des espèces rares comme *Leptidea duponcheli*, *Plebejus sephirus*, *Erebia albertanus*, *Melitaea arduinna* et *Nymphalis xanthomelas*. Malgré une législation de protection suffisante, la faune des papillons dans cette région reste menacée par le développement des infrastructures et la négligence.

**Key words:** diversity – endangerment – Nature park – Prime Butterfly Areas

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## Introduction

The Stara Planina mountain range is situated in the north-eastern part of the Balkan Peninsula and is shared between Serbia and Bulgaria. It is a long mountain chain with diverse geology, large altitudinal range, complex types of soil and very diverse plant and animal life (Lakušić & Četković eds. 2007). The geological formations in the southern part of Stara Planina are either karstic or a mixture of karst with dolomite (Anđelković 1976), making the whole region very dry and xeric. Further north, karst areas are in some places replaced by water-rich silicate ground. Compared to northern parts of the mountain chain, the vegetation, especially on the southern slopes in this region, is noticeably more thermophilous, with large areas of open, dry grasslands and rocky habitats.

Stara Planina is also the largest Prime Butterfly Area (PBA) in Serbia, where a total of 134 butterfly species

have been recorded, including 14 target species (Jakšić ed. 2008). It is separated from Dimitrovgrad PBA (114 species, 15 target species) by Mt. Vidlič, not included in any of these areas. Geologically and orographically most parts of Dimitrovgrad PBA, Mt. Vidlič and southern Stara Planina belong to the same mountain system (Anđelković 1976), and are therefore treated as the southern part of the Stara Planina mountain chain in this paper, an approach already adopted by Lakušić & Četković eds. (2007).

The extraordinarily rich butterfly fauna is a good indicator of a generally high diversity of insects living in open grasslands of this mountain range. Stara Planina therefore deserves to be treated as a site of high importance for conservation of the biodiversity in Europe. Although most of the range in Serbia is protected as a Nature park (Official Gazette of the Republic of Serbia, No. 23/09), the current enlargement of the ski resort at Babin Zub is already threatening the

existence of relict *Boloria eunomia* (Esper, 1799) populations, discovered there only recently (Jakšić *et al.* 2007). On the other hand, the region as a whole is extremely underdeveloped and therefore experiencing negative demographic trends, leaving large parts of grasslands abandoned and already in different stages of overgrowing.

The first studies of the butterflies of the Serbian part of Stara Planina began in 1907 (Gradojević 1931), and were continued by Miodrag Zečević in 1961 with a detailed research of the butterfly and moth fauna of a wider area of eastern Serbia (summarized in Zečević 2002), but covering only the northern part of Stara Planina. During the 90's, the butterfly fauna was studied thoroughly by Jakšić (1999), but again the very south of the mountain chain remained unexplored. The first data from the southern part of Stara Planina were published by van Swaay *et al.* (2007) who visited Dimitrovgrad just south of the surveyed area and found a total of 28 species in a single day. Other published data include the works of Stojanović-Radić (2007) and Anđus (2008), who mention 5 butterfly species in the region. All known records were summarized in the publication "Prime Butterfly Areas: A tool for nature conservation in Serbia" (Jakšić ed. 2008), but without information on precise localities of the recorded butterflies. A good indication of the potentially specific butterfly fauna of the surveyed region was the discovery of *Muschampia cribrellum* (Eversmann, 1841) in 2007 on Mt. Vidlič (Dinca *et al.* 2010). The list of recorded species was supplemented by two recent publications (Popović & Đurić 2010, Đurić & Popović 2011).

Over the last seven years, several surveys by the authors were focused on this poorly studied region in order to compensate for the lack of previous studies and provide additional proof of the high conservation value of the Stara Planina Mts. and justification of its protection. One of the main goals of the surveys was also the confirmation of the presence of *M. cribrellum* in Serbia and the potential extension of its known range.

## Material and Methods

The authors used Google Earth satellite images to select potentially interesting sites for butterflies, and visited Stara Planina on several occasions, starting from 2006. Butterflies were netted for identification in the field, and released. Only a few specimens that could not be identified with certainty were collected for further analysis, and are now preserved in the authors collections. The nomenclature and taxonomy follows the European Red List of Butterflies (van Swaay *et al.* 2010).

During the surveys the following localities were visited (Fig. 1):

1. Pirot, Krupac, fringes of a shallow lake with high water vegetation cover and partially overgrown, calcareous, rocky slopes; 399–440 m; 43°6'20" N, 22°41'31" E.
2. Pirot, pine forest plantation half-way on the road to Rsovci, mixture of pine, beech forests and small open areas near the road; 1025–1076 m; 43°10'51" N, 22°42'27" E.
3. Rsovci, small gorge W of the village, rocky slopes and tall herbs along a small stream; 720–800 m; 43°10'22" N, 22°45'43" E.
4. Rsovci, village and sandy river banks just below the village, pastures and rocky slopes; most butterflies were observed imbibing minerals on the sandy bank; 660–800 m; 43°10'24" N, 22°46'38" E.
5. Dojkinci, above the mountain hut, pastures and forest clearings near the road; 885–1000 m; 43°14'2" N, 22°46'50" E.
6. Dojkinci, NE slopes above the village, dry pine forest and bare eroded ground; 920–1300 m; 43°13'51" N, 22°47'41" E.
7. Dojkinci, Arbinje, above Čedina česma, pastures, forest and forest clearings along Dojkinačka reka valley; 960–1100 m; 43°15'23" N, 22°46'32" E.
8. Dojkinci, Arbinje, Skripčanova česma, meadows, pastures and forest clearings along Dojkinačka reka valley; 1070–1200 m; 43°16'53" N, 22°45'54" E.
9. Dimitrovgrad, at the turn for village Bačevo, partially overgrown, dry, southern, rocky slopes; 700–780 m, 43°1'44" N, 22°49'10" E.
10. Smilovci, small village in the Odorovačko valley surrounded by agricultural fields, meadows and pastures; 710–775 m; 43°5'5" N, 22°51'3" E.
11. Smilovci, Odorovačko valley, large plain between mountains, mostly agricultural land, meadows and pastures; 690–760 m; 43°5'14" N, 22°49'8" E.
12. Protopopinci, water tap N of the village, fragmented wet meadows near the stream, agricultural fields and dry grasslands; 685–710 m; 43°4'15" N, 22°52'4" E.
13. Vlkovija, eastern part of Mt. Vidlič, along the road near the pass, dry rocky pastures, partially overgrown with bushes and pine plantations; 900–1100 m; 43°4'59" N, 22°54'30" E.
14. Gornji Krivodol, gorge N of the village, partially overgrown rocky slopes and small pastures along the stream; 900–1100 m; 43°7'1" N, 22°57'42" E.
15. Boljev Dol, gorges NE of the village, dry rocky slopes with sparse vegetation, abandoned pastures at lower elevations; 875–1100 m; 43°7'28" N, 22°55'47" E.
16. Kamenica, forest near the small river and rocky terrains in the hills, overgrown by limited vegetation; 785–940 m; 43°8'26" N, 22°54'6" E.
17. Senokos, overgrown pastures N of the village, 890–1000 m; 43°8'44" N, 22°55'36" E.
18. Slavinja and Rosomačko vrelo, partially overgrown rocky slopes and pastures; 730–880 m; 43°8'51" N, 22°51'17" E.
19. Visočka Ržana, open rocky meadows and pastures; 700 – 1000 m; 43°9'18" N, 22°48'47" E.
20. Vrelo, open, mesophilous rocky meadows and pastures near the creek; 755–900 m; 43°10'53" N, 22°49'46" E.
21. Jelovica, the valley N of the village, forest road and small clearings in mixed woods; 850–950 m; 43°13'57" N, 22°50'47" E.
22. Široke luke, dense beech forest with small clearings along the road; 1000–1100 m; 43°14'57" N, 22°50'47" E.

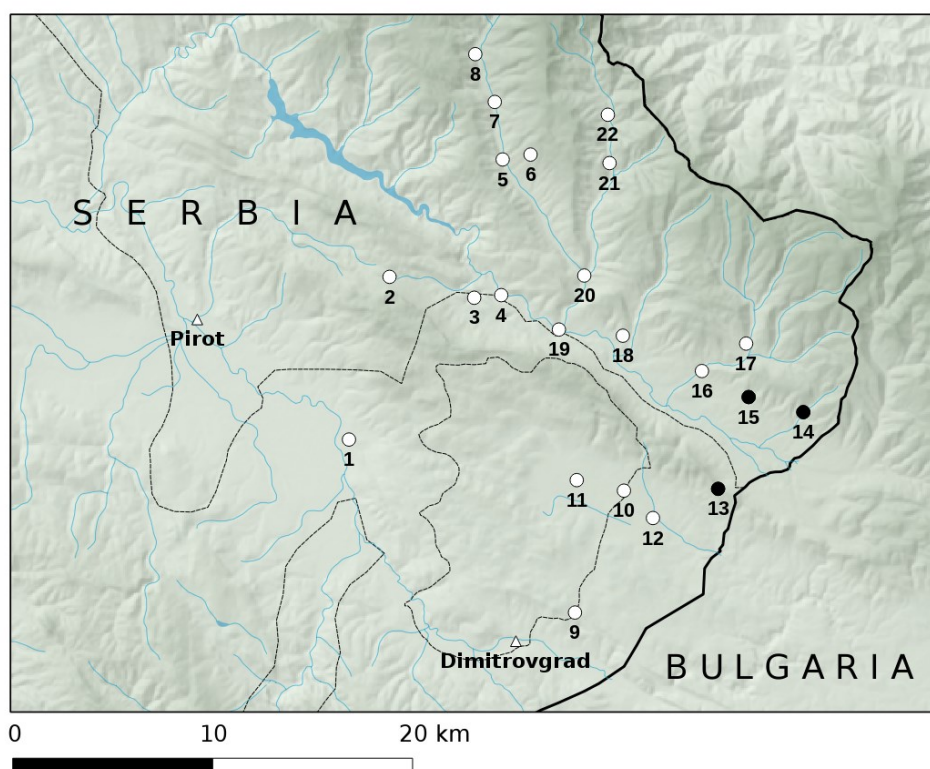


Fig. 1. Map of the surveyed localities in the southern part of the Stara Planina Mts. The border between Serbia and Bulgaria is indicated by a thick line, while the PBAs are delimited by dashed lines. The localities are numbered according to the list of localities in the Methods section. Solid circles indicate the presence of *Muschampia cribrellum*.

## Results

List of the butterfly species recorded in the studied region. The localities are numbered according to the list of localities in the Methods section (see for more details [http://webh01.ua.ac.be/vve/Phegea/Appendices/Phegea41-4\\_page\\_76.pdf](http://webh01.ua.ac.be/vve/Phegea/Appendices/Phegea41-4_page_76.pdf)):

### Hesperiidae

*Carcharodus alceae* (Esper, 1780): 1, 3, 13, 14  
*Carcharodus floccifera* (Zeller, 1847): 4, 5, 8, 22  
*Carcharodus lavatherae* (Esper, 1783): 4, 13  
*Carterocephalus palaemon* (Pallas, 1771): 1, 2, 4, 5, 7, 16  
*Erynnis tages* (Linnaeus, 1758): 1, 4, 7, 8, 9, 12, 13, 16, 18, 20  
*Muschampia cribrellum* (Eversmann, 1841): 13, 14, 15  
*Ochlodes sylvanus* (Esper, 1777): 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18  
*Pyrgus alveus* (Hubner, 1803): 4, 5, 7, 8  
*Pyrgus armoricus* (Oberthur, 1910): 7, 21  
*Pyrgus carthami* (Hubner, 1813): 2, 3, 4, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18  
*Pyrgus malvae* (Linnaeus, 1758): 1, 3, 4, 5, 6, 9, 13, 15, 16, 17, 19  
*Pyrgus sidae* (Esper, 1784): 2, 3, 4, 13  
*Spialia orbifer* (Hubner, 1823): 3, 4, 5, 6, 8, 9, 13, 14, 15, 16, 17  
*Thymelicus acteon* (Rottemburg, 1775): 5, 14, 15, 16, 18  
*Thymelicus lineola* (Ochsenheimer, 1808): 3, 4, 5, 10, 12, 13, 14, 15, 18, 20, 21, 22  
*Thymelicus sylvestris* (Poda, 1761): 3, 4, 5, 6, 7, 9, 11, 13, 14, 15, 17, 18

### Lycanidae

*Aricia agestis* (Denis & Schiffermuller, 1775): 1, 4, 7, 12, 13, 14  
*Aricia anteros* (Freyer, 1838): 4, 14, 17  
*Aricia artaxerxes* (Fabricius, 1793): 3, 4, 5, 6, 8, 10, 14, 16, 21, 22  
*Callophrys rubi* (Linnaeus, 1758): 7, 13  
*Celastrina argiolus* (Linnaeus, 1758): 1, 3, 4, 7, 8, 12, 13, 16, 17, 20, 22  
*Cupido alcetas* (Hoffmannsegg, 1804): 4, 7

*Cupido argiades* (Pallas, 1771): 3, 4, 12, 13, 18  
*Cupido decoloratus* (Staudinger, 1886): 20  
*Cupido minimus* (Fuessly, 1775): 2, 3, 4, 5, 6, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20  
*Cupido osiris* (Meigen, 1829): 3, 4, 8, 12, 13, 14, 15, 16, 17, 18  
*Cyaniris semiargus* (Rottemburg, 1775): 4, 5, 7, 8, 9, 13, 14, 15, 16, 17, 19, 21  
*Favonius quercus* (Linnaeus, 1758): 9  
*Glaucopsyche alexis* (Poda, 1761): 1, 4, 5, 7, 9, 13, 16, 19, 20  
*Lycaena alciphron* (Rottemburg, 1775): 4, 5, 8, 15, 22  
*Lycaena candens* (Herrich-Schaffer, 1844): 6, 20  
*Lycaena dispar* (Haworth, 1802): 5, 7, 8, 14  
*Lycaena phlaeas* (Linnaeus, 1761): 4, 22  
*Lycaena tityrus* (Poda, 1761): 4, 5, 7, 12  
*Lycaena virgaureae* (Linnaeus, 1758): 5, 6, 8, 13, 21  
*Phengaris alcon* (Denis & Schiffermuller, 1775): 4, 10, 13, 14, 17  
*Phengaris arion* (Linnaeus, 1758): 4, 8, 13, 14, 17, 18  
*Plebejus argus* (Linnaeus, 1758): 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21  
*Plebejus argyrognomon* (Bergstrasser, 1779): 4, 8, 13, 14, 15, 17, 18  
*Plebejus idas* (Linnaeus, 1761): 2, 3, 4, 6, 7, 8, 9, 12, 13, 14, 15, 19, 20  
*Plebejus sephirus* (Frivaldzky, 1835): 2, 4, 9, 13  
*Polyommatus admetus* (Esper, 1783): 3, 13  
*Polyommatus amandus* (Schneider, 1792): 2, 4, 5, 6, 7, 8, 13, 14, 15, 17, 19, 20, 21  
*Polyommatus bellargus* (Rottemburg, 1775): 9, 13  
*Polyommatus coridon* (Poda, 1761): 4, 7

*Polyommatus daphnis* (Denis & Schiffermuller, 1775): 3, 4, 12, 13, 14, 16, 18, 20  
*Polyommatus dorylas* (Denis & Schiffermuller, 1775): 3, 4, 7, 9, 13, 14, 15, 21  
*Polyommatus eros* (Ochsenheimer, 1808): 3, 5, 7, 8, 13, 14, 15, 17  
*Polyommatus icarus* (Rottemburg, 1775): 1, 3, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21  
*Polyommatus ripartii* (Freyer, 1830): 3, 4, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20  
*Polyommatus thersites* (Cantener, 1835): 4, 9, 13, 15, 18, 20  
*Pseudophilotes vicrama* (Moore, 1865): 1, 3, 4, 5, 9, 10, 12, 13, 14, 16, 17  
*Satyrus acaciae* (Fabricius, 1787): 4, 13, 15  
*Satyrus ilicis* (Esper, 1779): 4, 15  
*Satyrus pruni* (Linnaeus, 1758): 9, 17  
*Satyrus spini* (Denis & Schiffermuller, 1775): 4, 9, 10, 11, 13, 14, 15  
*Scolitantides orion* (Pallas, 1771): 4, 9, 14

### Nymphalidae

*Aglaia io* (Linnaeus, 1758): 2, 4, 5, 6, 7, 8, 13, 14, 16, 17, 18, 20, 21, 22  
*Aglaia urticae* (Linnaeus, 1758): 2, 3, 4, 5, 7, 8, 10, 13, 16, 18, 21  
*Apatura ilia* (Denis & Schiffermuller, 1775): 3, 4, 5, 8, 12, 14, 15, 17, 18, 20, 21  
*Apatura iris* (Linnaeus, 1758): 4, 5, 8, 14, 17, 20, 21  
*Aphantopus hyperantus* (Linnaeus, 1758): 4, 5, 6, 7, 9, 10, 12, 13, 16, 18, 20  
*Araschnia levana* (Linnaeus, 1758): 2, 4, 5, 7, 10, 12, 14, 18, 20, 22  
*Argynnis adippe* (Denis & Schiffermuller, 1775): 4, 5, 6, 8, 13, 14, 16, 17, 18, 20, 21, 22  
*Argynnis aglaja* (Linnaeus, 1758): 3, 4, 5, 6, 8, 9, 11, 13, 18, 21  
*Argynnis niobe* (Linnaeus, 1758): 3, 4, 7, 8, 9, 13, 14, 15, 21  
*Argynnis pandora* (Denis & Schiffermuller, 1775): 8, 13, 22  
*Argynnis paphia* (Linnaeus, 1758): 4, 5, 8, 9, 11, 13, 14, 15, 16, 18, 21, 22  
*Boloria dia* (Linnaeus, 1767): 4, 9, 10, 13, 16, 18  
*Boloria euphrosyne* (Linnaeus, 1758): 5, 7, 13, 21  
*Brenthis daphne* (Bergstrasser, 1780): 2, 4, 8, 10, 12, 13, 14, 18, 21, 22  
*Brenthis hecate* (Denis & Schiffermuller, 1775): 2, 4, 6, 9, 11, 12, 13, 18  
*Brintesia circe* (Fabricius, 1775): 3, 4, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21  
*Chazara briseis* (Linnaeus, 1764): 18  
*Coenonympha arcania* (Linnaeus, 1761): 2, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, 17, 18, 21  
*Coenonympha glycerion* (Borkhausen, 1788): 4, 5, 7, 8, 13, 14, 15, 17, 18, 22  
*Coenonympha leander* (Esper, 1784): 2, 4, 5, 7, 9, 13, 14, 15, 16, 17  
*Coenonympha pamphilus* (Linnaeus, 1758): 1, 3, 4, 5, 7, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19  
*Coenonympha rhodopensis* Elwes, 1900: 7  
*Erebia aethiops* (Esper, 1777): 5, 6, 18, 21  
*Erebia albertanus* (de Prunner 1798): 6, 7, 8, 13, 17, 18, 20  
*Erebia euryale* (Esper, 1805): 7  
*Erebia ligea* (Linnaeus, 1758): 7, 8, 20, 21  
*Erebia medusa* (Denis & Schiffermuller, 1775): 2, 4, 5, 7, 9, 13, 14, 16, 19, 20  
*Erebia oeme* (Hubner, 1804): 8, 17, 20  
*Erebia ottomana* Herrich-Schaffer, 1847: 7  
*Hipparchia fagi* (Scopoli, 1763): 4, 20  
*Hipparchia volgensis* (Mazochin-Porshnjakov, 1952): 4, 6, 13, 14, 15, 16, 18, 20, 21  
*Hyponephele lycaon* (Rottemburg, 1775): 14, 18  
*Issoria lathonia* (Linnaeus, 1758): 1, 4, 5, 6, 8, 12, 13, 14, 18  
*Lasiommata maera* (Linnaeus, 1758): 4, 7, 8, 13, 14, 22  
*Lasiommata megera* (Linnaeus, 1767): 1, 4, 9, 13, 16  
*Lasiommata petropolitana* (Fabricius, 1787): 8  
*Limenitis camilla* (Linnaeus, 1764): 8, 10, 13, 20, 21  
*Limenitis populi* (Linnaeus, 1758): 6, 21  
*Limenitis reducta* Staudinger, 1901: 4, 7, 8, 13, 14, 15  
*Maniola jurtina* (Linnaeus, 1758): 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21

*Melanargia galathea* (Linnaeus, 1758): 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21  
*Melitaea arduinna* (Esper 1783): 34, 5, 8, 13, 21, 22  
*Melitaea athalia* (Rottemburg, 1775): 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 16, 18, 20, 21, 22  
*Melitaea aurelia* Nickerl, 1850: 3, 4, 6, 10, 12, 13, 14, 15, 16, 17, 18  
*Melitaea cinxia* (Linnaeus, 1758): 1, 2, 4, 8, 9, 14, 16, 18, 20  
*Melitaea diamina* (Lang, 1789): 4, 5, 8, 13  
*Melitaea didyma* (Esper, 1778): 3, 4, 5, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21  
*Melitaea phoebe* (Denis & Schiffermuller, 1775): 3, 4, 5, 8, 13, 14, 15, 16, 18, 19, 20, 22  
*Melitaea trivia* (Denis & Schiffermuller, 1775): 5, 13, 14, 18, 21  
*Neptis rivularis* (Scopoli, 1763): 4, 5, 6, 8, 20, 21  
*Neptis sappho* (Pallas, 1771): 5, 9, 20, 21  
*Nymphalis antiopa* (Linnaeus, 1758): 4  
*Nymphalis polychloros* (Linnaeus, 1758): 2, 5, 21  
*Nymphalis xantomelas* (Esper, 1781): 5  
*Nymphalis vaualbum* (Denis & Schiffermuller, 1775): 8  
*Pararge aegeria* (Linnaeus, 1758): 5, 7, 13, 18, 21  
*Polygonia c-album* (Linnaeus, 1758): 2, 3, 4, 5, 7, 8, 14, 15, 16, 18, 20, 21  
*Satyrus ferula* (Fabricius, 1793): 4, 9, 12, 13, 14, 15, 16, 18, 20  
*Vanessa atalanta* (Linnaeus, 1758): 3, 4, 5, 6, 7, 8, 13, 16, 18, 20, 21  
*Vanessa cardui* (Linnaeus, 1758): 1, 4, 5, 7, 11, 13, 14, 18

### Papilionidae

*Iphiclus podalirius* (Linnaeus, 1758): 1, 2, 3, 4, 5, 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22  
*Papilio machaon* Linnaeus, 1758: 1, 4, 13, 14, 15, 16, 18  
*Parnassius mnemosyne* (Linnaeus, 1758): 9, 22  
*Zerynthia cerisy* (Godart, 1824): 5, 10  
*Zerynthia polyxena* (Denis & Schiffermuller, 1775): 1

### Pieridae

*Anthocharis cardamines* (Linnaeus, 1758): 1, 4, 8, 9, 13, 16, 19, 20  
*Aporia crataegi* (Linnaeus, 1758): 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 20, 21, 22  
*Colias alfacariensis* Ribbe, 1905: 1, 5, 9, 12, 13, 15, 16, 18, 19  
*Colias croceus* (Fourcroy, 1785): 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21  
*Gonepteryx rhamni* (Linnaeus, 1758): 1, 3, 4, 5, 8, 13, 16, 20, 21, 22  
*Leptidea duponcheli* (Staudinger 1871): 9, 13, 14, 15, 18  
*Leptidea sinapis* (Linnaeus, 1758) /  
*Leptidea reali* Reissinger 1990: 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21  
*Pieris balcana* Lorkovic, 1970: 2, 3, 4, 5, 7, 14, 16, 21  
*Pieris brassicae* (Linnaeus, 1758): 4, 21  
*Pieris mannii* (Mayer, 1851): 5, 14, 15, 22  
*Pieris napi* (Linnaeus, 1758): 4, 5, 9, 13, 16, 20  
*Pieris rapae* (Linnaeus, 1758): 4, 5, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20  
*Pontia edusa* (Fabricius, 1777): 8, 13, 14, 15, 17, 18

### Riodinidae

*Hamearis lucina* (Linnaeus, 1758): 20



During the surveys in recent years a total of 136 species of butterflies was found. *Lasiommata petropolitana* was recorded for the first time in the entire surveyed region, increasing the total number of butterfly species of Stara Planina Mts. to 152. Looking at Stara Planina PBA separately, the number of newly recorded species is 10.

Among the observed species, 25 are protected in Serbia and 83 are included in the Red Data Book of Serbian Butterflies (Jakšić 2003). At a continental scale, six species are included in the Annexes of the Habitats Directive and 15 species are listed in the Red Data Book of European butterflies (van Swaay & Warren 1999).

The species richness is not evenly distributed, with ten sites hosting more than 50 species. The butterfly richest site is Rsovci village where 95 species were observed during five, mostly short visits. The other species-rich site is Vidlič Mt. south of Vlkovija village, hosting 88 butterfly species, but being more intensively studied during seven visits. The most promising butterfly-rich localities proved to be the gorges above the Gornji Krivodol and Boljev Dol villages, where 70 and 53 species were recorded respectively, during a single short visit.

## Discussion

The surveys in the southern part of the Stara Planina region proved to be very successful, providing records for several rare and threatened species in Serbia. The total number of species observed on the Stara Planina Mts. has been raised to 152, more than three quarters of all species known in Serbia (Popović & Đurić 2011). This in itself provides all necessary argumentation for a more rigorous protection of the region and proves its high importance for the conservation of the biodiversity both at a regional and continental scale. The region of Stara Planina has the status of Nature park (Official Gazette of the Republic of Serbia, No. 23/09). It is proposed to be listed as an Emerald site (Council of Europe, No. T-PVS/PA (2011) 6) and a Natura 2000 site after the Serbian accession to the EU. This status is more than sufficient, from the legislative point of view, for protection of the precious habitats and species. But in practice, devastation of some of the most important sites continues due to building of infrastructure for a large ski resort in the middle of the park.

As species richness is not evenly distributed in the surveyed region, sites such as Mt. Vidlič, Gornji Krivodol, Boljev Dol and Rsovci should be priority targets for active conservation and monitoring. In most of these sites abandonment and overgrowing are the main concern for conservation, as open sparsely vegetated rocky terrain provides habitat for many rare and threatened habitat specialists. Such trends can be reversed only by an active management based on light grazing, which represents the traditional use of this land in past centuries.

Among the observed species several require additional attention:

### *Muschampia cribrellum*

This species is considered extremely rare and localized in Europe (Dinca *et al.* 2010). It was discovered in Serbia at Mt. Vidlič (Fig. 2) in 2007, close to the sites in Bulgaria, where the species is more widespread on southern and eastern foothills of the Stara Planina Mts. (Dinca *et al.* 2010). Due to the similarity with other hesperiids from the genus *Pyrgus* and low densities of adults, the species can be easily overlooked, which is probably one of the reasons why it is known only from a few sites in Europe. A good example for this are the repeated visits to the Mt. Vidlič site in 2008, 2010, 2011 and 2012, with only a single observation of three fresh males in 2011 (Fig. 3).



Fig. 2: The butterfly-rich habitat on Mt. Vidlič south-east of the village of Vlkovija.



Fig. 3: Male of *Muschampia cribrellum* found at Mt. Vidlič.

On June 30<sup>th</sup>, 2012 the authors recorded the species in two additional localities (Fig. 1). Both localities are part of a large calcareous mountain massif stretching in parallel and to the north of Mt. Vidlič extending into Bulgaria. A single male was observed visiting flowers along the path in the gorge north of the village Gornji Krivodol (loc. 14). Here the vegetation along the stream is dominated by willows, while the slopes of the gorge are steep and rocky with only sparse grassy and bushy vegetation (Fig. 5). At the second site above village Boljev Dol (loc. 15) at least three specimens were seen patrolling along the stream (Fig. 4). Here the gorge is more open, but again with very sparse vegetation (Fig.

6). The new findings are in line with the distribution of the species in Bulgaria (Dinca *et al.* 2010) and indicate a possibly even wider distribution of *M. cribrellum* in Serbia with potentially suitable habitats extending westwards towards Rsovci village (loc. 3 and 4).



Fig. 4: Male of *Muschampia cribrellum* found at the Boljev Dol gorge.



Fig. 5: The habitat in the gorge close to the village of Gornji Krivodol.



Fig. 6: The habitat in the gorge close to the village of Boljev Dol.

### ***Plebejus sephirus***

It is a rare and local butterfly in Serbia with only few strongholds (see the map in Popović & Đurić 2011). It was recorded at four new sites during our surveys and these populations seem to be stable, although not as numerous as in some other parts of the country, especially the Deliblato sands and Preševo valley (authors, pers. observation). They fly in open, partially

rocky or sandy grasslands where its host plant *Astragalus excapus* L. grows (Tolman & Lewington 2008).

### ***Leptidea duponcheli***

The distribution of this species in Serbia is limited to just a few localities with particularly thermophilous vegetation. Even there the species is very local and sparse (Đurić *et al.* 2010). Unlike that, numerous specimens were observed in both localities where *M. cribrellum* was found (loc. 14 and 15) underlining the thermophilous character of these sites. In addition, several other thermophilous butterfly species were abundant at those sites: *Cupido osiris*, *Pieris mannii*, *Polyommatus ripartii*, and *Satyrus ferula*.

### ***Melitaea arduinna***

The distribution of this species in Serbia was recently reviewed by Gascoigne-Pees *et al.* (2012). Although it has been recorded for Serbia only recently (Jakšić & Grozdanović 2007, Jakšić 2011) it is evident that the Stara Planina region with adjacent localities presents one of the prominent strongholds of the species in Europe (Đurić *et al.* 2010, Popović & Đurić 2010). We found the species at six new sites, extending its known range even more eastwards. This is a good indication for its probable presence on the Bulgarian side, where the species is considered extremely local (Abadijev 2001), known only from three UTM squares. Interestingly, none of these sites is in proximity of the western Stara Planina Mts.

### ***Erebia alberganus***

This species has an extremely fragmented distribution in the mountains of the Balkan Peninsula. It is known from the central and western part of Stara Planina Mts. in Bulgaria (Abadijev 2001) and Serbia (HabiProt 2012a) and from Mt. Korab in Macedonia (Tolman & Lewington 2008). In Stara Planina it can be the most abundant *Erebia* species in July, flying over silicate high-mountain grasslands and humid meadows in the forest belt. Its presence on Mt. Vidlič (loc. 13) on calcareous rocky terrain was therefore a huge surprise. Only three females were observed flying close to the pine plantations in a more sheltered part of the habitat. As especially females are rather sedentary and the nearest known sites are at least 7 km away towards the main ridge of the Stara Planina Mts., it is likely that there is a small isolated population present on Mt. Vidlič.

### ***Nymphalis xanthomelas***

This species inhabits only the eastern part of Europe, being rare in most of the countries (Tolman & Lewington 1998). Until recently, only a few historical records were known for Serbia (Jakšić 1988, Andus 2008), but in the last decade the butterfly was recorded more frequently (Jakšić ed. 2008, Đurić & Franeta 2011, HabiProt 2012b). That is similar to the situation of *N. vaualbum* (Popović & Đurić 2010), although *N. xanthomelas* seems to be even more scarce in Serbia (authors, pers. observ.). The species is also more easily overlooked as it is very similar to the common *N. polychloros* (Popović & Đurić 2011). During our surveys only a single specimen was seen close



to Dojkinci village (loc. 5) resting on the forest road (Fig. 7). Given the wide distribution of suitable habitats the species should be more widespread across central and southern Serbia.



Fig. 7: *Nymphalis xanthomelas* observed close to the village of Dojkinci.

Despite the given effort, the surveys of the southern part of Stara Planina Mts. were mostly unsystematic, centered on easily accessible sites with specific habitats. This leaves room for improvement as there are still gaps to be filled both in terms of geography and phenology. Given the thermophilous character of some of the sites, species such as *Lampides boeticus* (Linnaeus, 1767), *Leptotes pirithous* (Linnaeus, 1767) and *Euchloe ausonia* (Hubner, 1804) could be expected. Additional target

species for new surveys should be *Muschampia tessellum* (Hübner, 1803) which commonly flies syntopically with *M. cribrellum* in Europe (Rákossy & Goia 1997, Hoejgaard & Beshkov 2011, pers. observ. in Macedonia). Its presence in the region is likely also due to the discovery of the larval host plant *Phlomis tuberosa* L. near Vlkovića on the Vidlič Mt.

In general we have more than confirmed the pivotal role of the Stara Planina Mts. in conservation of butterfly diversity in Serbia as well as several rare and local species with distribution limited to this region. The new localities visited also show that Stara Planina and Dimitrovgrad PBAs should be revised, as some of the important sites for butterfly conservation are excluded, and some of the most important sites are on the PBA borders with no buffer zone. We propose that both PBAs are joined to cover the butterfly rich region in between, including Mt. Vidlič.

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