Jelašnica gorge – a 'hot spot' of butterfly diversity in Serbia

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Abstract. Jelašnica gorge is only 2 km long, but hosts one of the richest butterfly fauna in Serbia. A total of 110 species were observed during a three year survey. The presence of some rare and threatened species like *Maculinea arion*, *Nymphalis vaualbum*, *Melitaea arduinna* is discussed. Twenty six species present in Jelašnica have some sort of endangerment status either on European or national level giving this site together with overall high diversity a high conservation priority.

Samenvatting. De Jelašnica kloof – een hot spot voor dagvlinderdiversiteit in Servië
De Jelašnica kloof is slechts 2 km lang maar ze bevat een van de rijkste dagvlinderfaunas in Servië. Gedurende een driejarig onderzoek werden 110 soorten vastgesteld. Het voorkomen van enkele zeldzame en bedreigde soorten zoals *Maculinea arion*, *Nymphalis vaualbum* en *Melitaea arduinna* wordt besproken. Zesentwintig van de aanwezige soorten in de Jelašnica kloof bezitten een bedreigingsstatus op nationaal of Europees niveau wat, samen met een algemene hoge diversiteit, aan het gebied een belangrijke beschermingsprioriteit geeft.

Résumé. La gorge de Jelašnica – un 'hot spot' de diversité en papillons en Serbie
La gorge de Jelašnica n'a qu'une longueur de 2 km, mais elle est héberge une des plus riches faunes de papillons en Serbie. Pendant une étude de trois ans 110 espèces de papillons furent observées. La présence de quelques espèces rares et menacées, comme *Maculinea arion*, *Nymphalis vaualbum* et *Melitaea arduinna*, est discutée. Vingt-six espèces de cette gorge possèdent un statut de protection au niveau national ou européen, ce qui suggère, vu la biodiversité générale de cet endroit, une importante priorité de protection.

Key words: Lepidoptera – Rhopalocera – butterfly conservation – faunistics

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Introduction

The butterfly fauna in Serbia is relatively well studied with local faunistic surveys for many regions (see the overview in the additional material on CD in Jakšić 2008). In recent years a publication of the Red Data Book of Serbian butterflies (Jakšić 2003) and a national level project for selection of Prime butterfly areas (PBA) in Serbia has brought the knowledge a step further combining the historical information with new surveys. The results are presented in the PBA in Serbia book (Jakšić 2008) and additional papers (van Swaay *et al.* 2007, Jakšić *et al.* 2007). In total 193 butterfly species are known from Serbia (Jakšić 2008) with high butterfly diversity in the mountain areas, especially Stara planina (Parker & Jakšić 1996, Jakšić 1999, Jakšić *et al.* 2007), Šar Planina (Jakšić 1998, Jakšić & Živić 1999) and Kopaonik (Jakšić & Đurić 2006), and gorges (Jakšić 1987, Jakšić & Živić 1999, Dodok 2003, Jakšić 2008). Gorges in particular are known to host a high diversity and relict elements of fauna and flora that survived the glacial periods of Pleistocene in the microclimatically favourable conditions on southern exposed slopes of the gorges. Low human

impact, high level of habitat structuring and slope exposition has helped maintaining the high butterfly diversity in the gorges in Serbia.

In this paper we present the butterfly fauna of the very tiny Jelašnica gorge situated approximately 15 km E of the Niš city in southern Serbia (Fig. 1). Due to the vicinity of the much larger and more renown Sićevo gorge just 5 km NW of it, its butterfly fauna has remained poorly studied with no more than 11 species collectively mentioned for Jelašnica gorge in two wider area coverage studies (Jakšić 2003, Stojanović-Radić 2007). This only about 2 km long gorge is well known however for its rich flora with 687 recorded plant species including 65 Serbian endemic or subendemic species (Filipović & Đurđić, 2005). Most interesting are *Ramonda serbica* Pančić 1874 and *Ramonda nathaliae* Pančić & Petrović 1882, two of the only three European representatives in this genus, for which the Jelašnička gorge is one of only two places where they grow together. Apart from that, only the birds of the gorge have been studied (Anonymous 1993). Due to the high plant diversity and attractive rock formations Jelašnica gorge has gained a status of Special Nature Reserve (Anonymous 1995).

The Jelašnica gorge is positioned in NW-SE direction with both slopes forming steep, in some places even vertical rocky faces. The altitudinal span is from 293 to 850 m. The ground is predominantly calcareous; therefore extremely dry steppic grasslands developed on the southern exposed slopes. In the valley, where the Jelašnica river is flowing, the plant communities are more mesophilous with several wet sandy spots where butterflies aggregate. Currently there are no iminent threats for habtat destruction in Jelašnica gorge, however free climbing, low intensity traffic on the road through the gorge and limited grazing could have some impact on butterfly populations. In the long run the spreading of invasive ailanthus trees (*Ailanthus altissima*) could pose the biggest threat, especially in more humid parts of the gorge.

The rich butterfly fauna of the gorge was discovered during three visits by the first author in 2007. Therefore additional surveys in 2008, 2009, and 2010 were organized to sample the entire flight activity of the butterflies in the region. With this paper we wish to point out the high natural value of the Jelašnica gorge which would hopefully help its inclusion in the NATURA 2000 network and its long term protection.

Materials and methods

The majority of butterflies were netted with an entomological net and released after identification. The Tolman & Lewington field guide (1997) was used for identification. Some specimens were collected for further examination. Taxonomical order and nomenclature are according to the Europena Red list of Butterflies (van Swaay *et al.* 2010).

Butterflies were observed along the main road in the gorge, accessible parts of the steep southern exposed slopes, and wet patches along the Jelašnica river. The majority of species was found in the upper part of the valley at the beginning of the gorge, close to the village of Čukljenik. In this part the southern slopes are less steep and numerous wet places are present along the road and the Jelašnica river (43°16'33.45"N, 22° 4'8.72"E). Additionally, a site near Jelašnica village, at the end of the gorge, had large, mud puddling congregations of butterflies until a mini hydro-electric power station was built in 2010.

Table 1. List of butterfly species observed in Jelašnica gorge in years 2007 to 2009 and their threat status. RDBS –Red Data Book of Serbian Butterflies (Jakšić 2003), Red Data Book of European Butterflies (van Swaay & Warren 1999), Habitats directive (92/43/EEC), Bern (Convention on the conservation of European wildlife and natural habitats, Bern, 1979).

Species	Observation dates	RDBS (2003)	RDBE (1999)	Habitats directive	Bern (annex II)
Erynnis tages	27.6.07, 16.7.07, 16.4.09, 26.4.09, 28.4.10				
Carcharodus alceae	27.6.07, 16.4.09, 23.5.09, 18.6.09				
Carcharodus lavatherae	30.5.08				
Spialia orbifer	30.5.08, 8.6.10				
Pyrgus carthami	27.6.07, 25.5.10				
Pyrgus sidae	12.5.07, 30.5.08	VU			
Pyrgus malvae	16.7.07, 30.5.08, 16.4.09, 26.4.09, 23.5.09, 28.4.10 25.5.10				
Pyrgus armoricanus	12.5.07				
Carterocephalus palaemon	12.5.07	NT			
Thymelicus lineola	16.7.07, 10.6.10				
Thymelicus sylvestris	27.6.07, 18.6.09				
Thymelicus acteon	27.6.07, 18.6.09		VU		
Hesperia comma	16.7.07				
Ochlodes sylvanus	27.6.07, 30.5.08, 18.6.09, 8.6.10				
Zerynthia polyxena	23.5.09	VU		annex IV	+
Zerynthia cerisy	30.5.08, 23.5.09, 25.5.10, 8.5.10		LR(nt)		
Iphiclides podalirius	12.5.07, 27.6.07, 16.7.07, 30.5.08, 16.4.09, 26.4.09, 23.5.09, 28.4.10, 25.5.10, 8.6.10				
Papilio machaon	27.6.07, 30.5.08, 26.4.09, 18.6.09	EN			
Leptidea sinapis	12.5.07, 27.6.07, 16.7.07, 30.5.08, 16.4.09, 26.4.09, 23.5.09, 18.6.09, 2.8.09, 28.4.10, 25.5.10, 8.6.10				
Leptidea duponcheli	27.6.07				

Species	Observation dates	RDBS (2003)	RDBE (1999)	Habitats directive	Bern (annex II)
Anthocharis cardamines	12.5.07, 16.4.09, 26.4.09, 23.5.09, 28.4.10, 8.6.10				
Aporia crataegi	12.5.07, 27.6.07, 30.5.08, 23.5.09, 18.6.09, 25.5.10, 8.6.10				
Pieris brassicae	18.6.09	VU			
Pieris rapae	12.5.07, 27.6.07, 16.7.07, 30.5.08, 16.4.09, 26.4.09, 23.5.09, 18.6.09, 2.8.09, 8.6.10				
Pieris ergane	27.6.07, 18.6.09, 2.8.09, 10.6.10				
Pieris napi	12.5.07, 27.6.07, 30.5.08, 16.4.09, 26.4.09, 23.5.09, 18.6.09, 8.6.10				
Pontia edusa	16.7.07, 30.5.08				
Colias croceus	27.6.07, 16.7.07, 30.5.08, 16.4.09, 18.6.09, 2.8.09, 14.11.09, 8.6.10				
Colias alfacariensis	12.5.07, 27.6.07, 16.7.07, 30.5.08, 26.4.09, 23.5.09, 2.8.09, 14.11.09, 28.4.10, 25.5.10, 8.6.10				
Gonepteryx rhamni	12.5.07, 27.6.07, 30.5.08, 16.4.09, 26.4.09, 23.5.09, 18.6.09, 14.11.09, 28.4.10, 8.6.10				
Hamearis lucina	12.5.07, 26.4.09, 23.5.09		LR(nt)		
Lycaena phlaeas	27.6.07, 18.6.09				
Lycaena dispar	12.5.07, 27.6.07, 10.6.10	VU		annex II, IV	+
Lycaena virgaureae	27.6.07				
Lycaena tityrus	8.6.10				
Lycaena alciphron	18.6.09, 2.8.09				
Favonius quercus	14.11.2009 (ova)				
Callophrys rubi	27.6.07, 26.4.09, 23.5.09, 18.6.09, 28.4.10, 10.6.10				
Satyrium w-album	27.6.07, 18.6.09	EN			
Satyrium pruni	30.5.08				
Satyrium spini	27.6.07				
Satyrium ilicis	27.6.07, 18.6.09				
Satyrium acaciae	27.6.07	VU			
Cupido minimus	12.5.07, 27.6.07, 30.5.08, 23.5.09, 18.6.09	VU			
Cupido osiris	27.6.07, 30.5.08, 25.5.10, 8.6.10				

Fig. **1**.– The Jelašnica gorge viewed from the upper part towards NW; **2**.– Majority of *Pyrgus sidae* in Jelašnica gorge have a much darker and more brownish coloration replacing the yellow bands on the uderside of the hindwing; **3**.– A fresh female of *Nymphalis vaualbum* observed in the upper part of the Jelašnica gorge; **4**.– Males of *Melitaea arduinna* are fond of mud puddling.

Species	**Observation dates**	**RDBS (2003)**	**RDBE (1999)**	**Habitats directive**	**Bern (annex II)**
Cupido argiades	27.6.07, 16.7.07, 16.4.09, 26.4.09, 18.6.09, 2.8.09, 10.6.10				
Cupido decolorata	27.6.07				
Celastrina argiolus	27.6.07, 26.4.09, 18.6.09				
Pseudophilotes vicrama	30.5.08, 16.4.09, 26.4.09, 23.5.09	EN	VU		
Scolitantides orion	12.5.07, 27.6.07, 16.7.07, 30.5.08, 26.4.09, 23.5.09, 18.6.09, 28.4.10, 25.5.10, 8.6.10		VU		
Glaucopsyche alexis	12.5.07, 16.4.09, 26.4.09, 23.5.09, 28.4.10		VU		
Phengaris arion	27.6.07, 16.7.07	VU	EN	annex IV	+
Plebeius argus	12.5.07, 27.6.07, 16.7.07, 30.5.08, 23.5.09, 18.6.09, 25.6.10, 8.6.10				
Plebeius idas	16.7.07, 30.5.08, 23.5.09, 18.6.09, 2.8.09, 25.5.10, 8.6.10				

Species	Observation dates	RDBS (2003)	RDBE (1999)	Habitats directive	Bern (annex II)
Plebeius argyrognomon	27.6.07, 30.5.08, 18.6.09, 2.8.09, 8.6.10	VU	LR(nt)		
Aricia agestis	12.5.07, 27.6.07, 16.7.07, 30.5.08, 23.5.09, 8.6.10				
Cyaniris semiargus	12.5.07, 23.5.09, 18.6.09, 25.5.10, 8.6.10				
Polyommatus dorylas	25.5.10, 10.6.10				
Polyommatus amandus	30.5.08, 23.5.09, 25.5.10, 8.6.10				
Polyommatus thersites	27.6.07, 25.5.10				
Polyommatus icarus	12.5.07, 27.6.07, 16.7.07, 30.5.08, 23.5.09, 18.6.09				
Polyommatus daphnis	27.6.07, 16.7.07, 18.6.09				
Polyommatus bellargus	12.5.07, 27.6.07, 16.7.07, 30.5.08, 23.5.09, 18.6.09, 25.5.10, 8.6.10				
Polyommatus coridon	27.6.07, 16.7.07				
Polyommatus admetus	27.6.07, 16.7.07				
Polyommatus ripartii	27.6.07				
Argynnis paphia	27.6.07, 16.7.07, 18.6.09				
Argynnis aglaja	27.6.07, 16.7.07				
Argynnis adippe	27.6.07, 16.7.07, 30.5.08				
Argynnis niobe	27.6.07				
Issoria lathonia	27.6.07, 30.5.08, 26.4.09, 23.5.09, 28.4.10				
Brenthis daphne	27.6.07, 30.5.08, 18.6.09, 8.6.10				
Boloria euphrosyne	12.5.07				
Boloria dia	12.5.07, 26.4.09, 18.6.09				
Vanessa atalanta	12.5.07, 30.5.08, 18.6.09, 25.5.10				
Vanessa cardui	23.5.09				
Aglais io	16.4.09, 26.4.09, 18.6.09, 28.4.10				
Polygonia c-album	27.6.07, 16.7.07, 30.5.08, 18.6.09, 14.11.09, 8.6.10				
Polygonia egea	16.6.07	VU			
Araschnia levana	12.5.07, 27.6.07, 18.6.09				
Nymphalis antiopa	27.6.07, 23.5.09	EN			
Nymphalis polychloros	26.4.09, 18.6.09				
Nymphalis vaualbum	16.4.09, 18.6.09	EN	EN	annex II, IV	
Melitaea cinxia	12.5.07, 30.5.08, 23.5.09, 8.6.10				
Melitaea phoebe	30.5.08, 23.5.09				
Melitaea arduinna	30.5.08, 18.6.09, 8.6.10				

Species	Observation dates	RDBS (2003)	RDBE (1999)	Habitats directive	Bern (annex II)
Melitaea trivia	27.6.07, 25.5.10, 10.6.10				
Melitaea didyma	27.6.07, 16.7.07, 30.5.08, 23.5.09, 18.6.09, 8.6.10				
Melitaea aurelia	27.6.07, 16.7.07, 18.6.09	VU	VU		
Melitaea athalia	12.5.07, 30.5.08, 23.5.09, 8.6.10				
Limenitis reducta	8.6.10				
Neptis sappho	27.6.07, 16.7.07, 30.5.08, 23.5.09, 25.5.10, 10.6.10		LR(nt)		
Apatura ilia	30.5.08	VU			
Pararge aegeria	12.5.07, 27.6.07, 30.5.08, 26.4.09, 23.5.09, 18.6.09, 28.4.10, 25.5.10, 8.6.10				
Lasiommata megera	27.6.07, 26.4.09, 25.5.10				
Lasiommata maera	16.7.07, 30.5.08				
Coenonympha arcania	12.5.07, 27.6.07, 30.5.08, 18.6.09, 25.5.10, 8.6.10				
Coenonympha leander	12.5.07, 27.6.07, 30.5.08, 23.5.09, 18.6.09, 25.5.10, 8.6.10				
Coenonympha glycerion	Jakšić (2003)				
Coenonympha pamphilus	12.5.07, 27.6.07, 16.7.07, 30.5.08, 26.4.09, 23.5.09, 18.6.09, 25.5.10, 8.6.10				
Aphantopus hyperantus	27.6.07				
Maniola jurtina	27.6.07, 16.7.07, 30.5.08, 18.6.09, 2.8.09, 8.6.10				
Erebia medusa	12.5.07, 30.5.08, 23.5.09, 25.5.10		VU		
Melanargia galathea	27.6.07, 16.7.07, 18.6.09				
Satyrus ferula	27.6.07, 18.6.09	VU			
Hipparchia fagi	27.6.07				
Hipparchia volgensis	2.8.09	VU			
Arethusana arethusa	16.7.07				
Brintesia circe	27.6.07, 18.6.09, 2.8.09				

Discussion

The 110 observed species in such a small surveyed area is certainly extraordinary, not only at Serbian level but also wider in the Balkan Peninsula, and corresponds well with the term 'hot spot' of the butterfly diversity. In Serbia the fauna of several gorges is relatively well studied and among them only Đetinja gorge has the same number of species recorded, however this gorge is seven times longer and has been intensively studied for 10 years (Dodok 2003). The nearby Sićevo gorge has 77 recorded species (Jakšić 2008) including 12 species that were not found in Jelašnica gorge. The most prominent among these

are Mediterranean species like *Pieris mannii* (Mayer, 1851), *Euchloe ausonia* (Hübner, 1804), *Lycaena thersamon* (Esper, 1784), *Lampides boeticus* (Linnaeus, 1767), and *Leptotes pirithous* (Linnaeus, 1767), that could perhaps be found also in the Jelašnica gorge, given the availability of suitable habitat. In the study of the Suva planina mountain area, in which Jelašnica gorge was covered also, 80 species are mentioned, some only from old published data (Jakšić 2003). Among these, only 9 species in the list were not found in Jelašnica gorge. The new records from Jelašnica gorge thus provide a sizable addition to the knowledge of the fauna of Suva Planina region with 38 new species recorded.

Among the species found in Jelašnica gorge the following records are of particular interest:

Pyrgus sidae (Esper, 1784) – this species is very sparsely distributed in Serbia, with just a few records from E and SW Serbia and historical records from Fruška Gora in the Pannonian basin (Jakšić 2003). A single specimen was recorded on 12.5.2007 and at least three specimens on 30.5.2008. Both times they were found near the stream, visiting flowers or wet patches of ground. It is interesting to note that in some specimens the typical yellow coloration on the underside of the wings is replaced by a darker, more brownish colour (Fig. 2).

Leptidea duponcheli (Staudinger, 1871) – this species is limited to the southernmost parts of Serbia and reaches its northern limit in the Niš region. It has also been reported for Suva planina region (Jakšić 2003) and nearby Sićevo gorge (Jakšić 2008). The species was observed in Jelašnica only by Ivan Dodok on 27.6.2007.

Maculinea arion (Linnaeus, 1758) – this is one of the most threatened species in Serbia with reported declines of 50-80% (Jakšić 2003). Although it used to be widespread in Serbia there are no recent records of this species from the Niš region (Jakšić 2003). Several specimens were observed on southern exposed slopes in the upper part of the Jelašnica gorge on 27.6.07 and 16.7.07.

Polyommatus admetus (Esper, 1785) and *Polyommatus ripartii* (Freyer, 1830) – these two species inhabit SE part of Serbia. Records of both species to the north and to the west of Jelašnica gorge are rare.

Nymphalis vaualbum (Denis & Schiffermüller, 1775) – this species has been recorded in Serbia just around Belgrade and Fruška Gora (Jakšić 2003), therefore its presence so far south was hardly expected. A single overwintering specimen was found basking close to the rivulet bank on 16.4.09. Additionally, a fresh female (Fig. 3) was observed on 18.6.09 proving that the species is stationary in this area.

Polygonia egea (Cramer, 1775) – it has been found only once by Ivan Dodok on 16.6.2007. The species is extremely localized in Serbia and is known only from 5 areas (Jakšić 2003).

Melitaea arduinna (Esper, 1783) – this species was only recently discovered in Serbia and is know only from 4 sites, all in the eastern part of the country (Jakšić 2007). At least 10 fresh males were observed on 30.5.2008 along the road, especially in the upper part of the gorge. In 2010 the presence of more than

30 males was noted on 8 June. They were flying along the road or imbibing minerals on wet sands next to it (Fig. 4).

Apart from the high butterfly diversity the conservation value of Jelašnica gorge for butterflies is further amplified by the presence of several threatened or protected species. All 26 species present in Jelašnica have some sort of threat status (Table 1). Among these *Lycaena dispar* (Haworth, 1802) and *Nymphalis vaualbum* are qualifying for designation of NATURA 2000 sites. Additionally *Zerynthia polyxena* (Denis & Schiffermüller, 1775) and *Maculinea arion* are also considered as high priority species for conservation, both being listed in annex IV of the Habitats directive. This, together with the presence of a rich flora and threatened bird species (Trajković & Branković 2007) well justifies Jelašnica gorge as one of the nationally important areas for conservation. Despite recent intensive surveys Jelašnica gorge might still hold some additional interesting butterfly species and therefore future surveys are welcomed.

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