

New Records of *Drusus siveci* Malicky, 1981 (Trichoptera, Limnephilidae, Drusinae) from the Balkan Peninsula, with Ecological Notes

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Abstract: *Drusus siveci* Malicky, 1981 is a rare Balkan endemic species described from a single specimen collected from Montenegro. After more than 30 years it is found for the first time outside Montenegro, in the Republic of Kosovo. *Drusus siveci* is the eighth recorded species of the genus *Drusus* from the Republic of Kosovo. It has been found from two localities in the Bjeshkët e Nemuna Mountains: the spring area of the Lumbardhi i Pejës River and the upstream section of the Lloqani River. The biology and ecology of *Drusus siveci* has been unknown until now. In this paper we present notes on its flight period, habitat requirements and abundance at the investigated stations. *Drusus siveci* is a spring-dwelling species and, similar to some other endemic species of the genus *Drusus*, inhabits spring areas and headwaters of mountain streams. Limnochemical analyses at the sampling stations reveal excellent water quality without significant organic pollution. Both localities are heavily impacted by illegal felling and construction of touristic facilities.

Keywords: Caddisflies; Balkan Peninsula; Kosovo; Drusinae

Introduction

According to the present databases, 14,548 extant caddisfly species are known globally today (MORSE 2009). The European fauna consists of more than 1,000 species (e.g. MALICKY 2004) with new species and records being registered continuously (e.g. IBRAHIMI *et al.* 2012a, 2012b, 2013, KUČINIĆ *et al.* 2013, OLÁH *et al.* 2013a, 2013b, RUIZ-GARCIA *et al.* 2013). Today extant Drusinae taxa comprise more than 100 species with the highest diversity occurring on the Balkan Peninsula (KUČINIĆ *et al.* 2008, 2011, WARINGER *et al.* 2013). *Drusus* species usually inhabit spring areas and crenal sections of mountain streams and rivers. These habitats are characterised with low water temperature and small annual varia-

tions and, therefore accelerate speciation which in turn creates high diversity and limited species distribution (MARINKOVIĆ-GOSPODNETIĆ 1979, PREVIŠIĆ *et al.* 2009, KUMANSKI 1988, MALICKY 2004, 2005).

Many rivers and streams in Kosovo do not meet the water quality standards of the European Union, especially in their middle and lower reaches. Their status is aggravated further by uncontrolled removal of sand and gravel from riverbeds. High concentrations of cyanide, nitrates, zinc and phenols exceeding the EU standards are detected occasionally (MESP 2010). Plants for treatment of sewage effluents do not exist in any urban center and the few industri-

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al plants available are not functional. In addition, mountain stream and river spring areas are heavily impacted by water removal for villages and settlements all over Kosovo. Many important habitats of endangered caddisfly species are damaged permanently in this way. Caddisfly assemblages, together with other groups of aquatic insects in Kosovo, are heavily impacted by such activities and restoration and conservation measures are urgently needed.

Five years ago we have started a systematic collection of adult caddisflies from all parts of the Republic of Kosovo. This paper is an outcome of these collection efforts. The aim of this investigation is to advance further the knowledge on the taxonomy and biogeography of caddisfly fauna of Kosovo which is one of the least investigated areas on the Balkan Peninsula.

Material and Methods

Data sampling and processing

Adult caddisflies were collected using an ultraviolet light trap and an entomological net at two stations which belong to the Adriatic Sea drainage basin in Kosovo (Figure 1, Table 1). The sampling was carried out between April and September 2010. A pyramid-type ultraviolet light trap with white sheet was placed on the stream banks right after dusk and operated for one hour and fifteen minutes. Specimens were collected manually and were preserved in 80 % ethanol. The specimens were identified using a stereomicroscope following the keys of MALICKY (2004) and KUMANSKI (1985, 1988). The collection was deposited at the Laboratory of Zoology of the Faculty of Mathematical and Natural Sciences, University of Prishtina, Republic of Kosovo.

The habitat assessment procedures were made according to PLAFKIN *et al.* (1989) and BARBOUR *et al.* (1999) and were modified in order to present the habitat conditions at the sampling sites.

Study area

The first investigation site (1) is located in Haxhaj village in the spring area of one of the biggest tributaries of the Lumbardhi i Pejës River, near the border with Montenegro. The second investigation site (2) is located in the Lloqan River in the Lloqan Mountains several kilometers upstream of Deçan town. The sampling site is located at a small spring which discharges into the river.

Both sampling stations belong to the Bjeshkët e Nemuna massive which is a mountain range on

the Balkans that extends from northern Albania to Kosovo and eastern Montenegro. The highest point of this range is situated in Albania (Jezercë, 2,694 m a.s.l.) and is the highest peak in the entire Dinaric Alps.

Results

Habitat assessment and physical and chemical parameters

Both investigated stations were from third stream order. Their epifaunal substrate (Table 1) was optimal: up to 50% of it consisted of gravel, cobble and

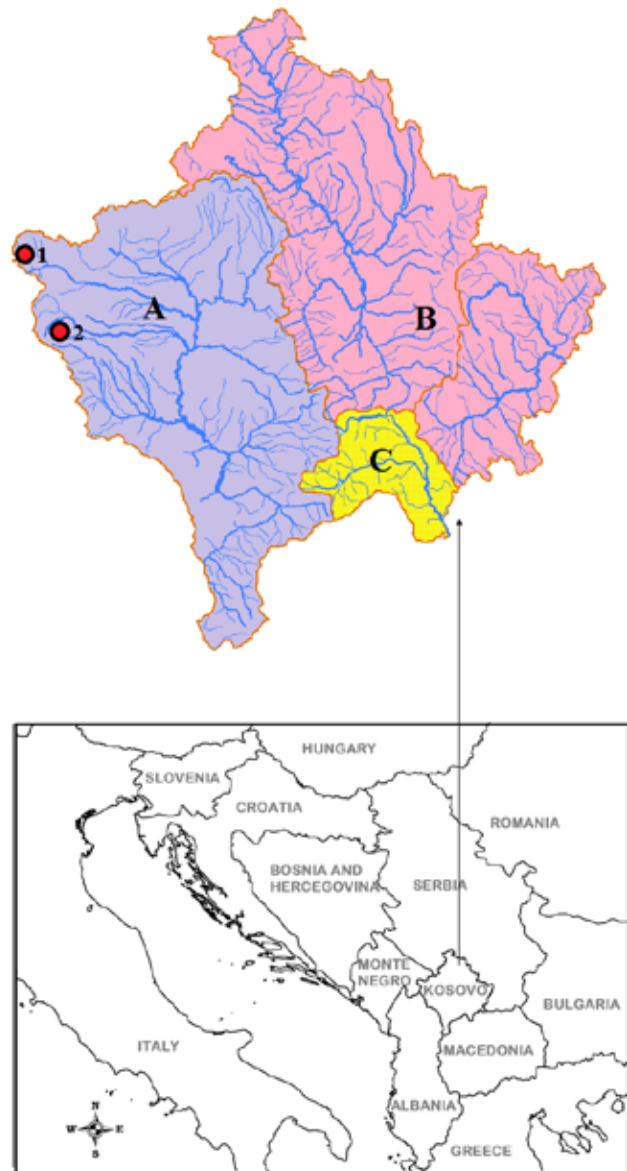


Fig. 1. Map of Kosovo with river basins: A) Black Sea Basin, B) Adriatic Sea Basin and C) Aegean Sea Basin, and investigated sites: 1) Station 1 – Haxhaj and 2) Station 2 – Lloqan

Table 1. Locality and habitat assessment data after Plafkin *et al.*, (1989) and Barbour *et al.*, 1999) for the two studied stations: 1 – Haxhaj and 2 – Lloqan

Parameters	Sampling stations	
	1 (Haxhaj)	2 (Lloqan)
	Lumbardhi i Pejës River	Lloqan River
Latitude °N	42.7098	42.5518
Longitude °E	20.0513	20.1624
Altitude m	1266	1666
Distance from source (m)	5	200
Stream width (m)	2.5	2.9
Stream depth (cm)	30	47
Epifaunal substrate/ Available cover	40-70% of stream bed and lower banks covered with a mix of substrates favorable for epifaunal colonisation and fish cover.	40-70% of stream bed and lower banks covered with a mix of substrates favorable for epifaunal colonisation and fish cover.
Embeddedness	Gravel, cobble and boulder particles are 20-50% surrounded by fine sediment.	Gravel, cobble and boulder particles are 20-50% surrounded by fine sediment.
Sediment deposition	Bar formation by gravel, sand or fine sediments; 5-30% of the bottom affected; slight deposition in pools.	Bar formation by gravel, sand or fine sediments; 5-30% of the bottom affected; slight deposition in pools.
Flow status	Water fills > 75% of the available channel.	Water fills > 75% of the available channel.
Bank stability	Banks stable; evidence of erosion absent or minimal; <5% of bank affected.	Banks stable; evidence of erosion absent or minimal; <5% of bank affected.
Bank vegetation protection	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 cm or less in average stubble height.	70-90% of the streambank surfaces covered by native vegetation, disruption evident but not affecting full plant growth potential to a great extent; more than one half of the potential plant stubble height remaining.
Riparian vegetative zone width	Width of riparian zone <8 m with signs of continuous human activities; absent on left side.	Width of riparian zone more than 30 m; human activities and grazing have impacted the area around sampling station only minimally, but are considerably present in other segments of the stream.

boulder fractions. Flow conditions and bank stability were within the optimal range. Riverbed riparian vegetation was considerably damaged at Station 1, as was the surrounding forest owing to illegal forest cutting. A large portion of the spring water was extracted directly from the source for water supply of the nearby village. The rest of the water discharged into the Lumbardhi i Pejës River flowing through Kuqishte village. Riverbed riparian vegetation at Station 2 was rich but the surrounding forested area was continuously damaged through illegal felling. For details on habitat assessment data, see Table 1; for physical and chemical parameters, see Table 2.

Faunistic results

In total, 13 species were found at Station 1 and nine species at Station 2. They belonged to six families: Rhyacophilidae, Philopotamidae, Hydropsychidae, Brachycentridae, Limnephilidae and Lepidostomatidae (Tables 3, 4). *Drusus*

siveci was found in June at Station 1 and in July at Station 2. The highest number of species at both stations belonged to the family Rhyacophilidae. Only two species of Station 1 belonged to Limnephilidae, all of them were Drusinae. Four species at Station 2 were Limnephilidae, two of them of the genus *Drusus*.

Discussion

The caddisfly fauna of Kosovo is still insufficiently known (IBRAHIMI, GASHI 2008, IBRAHIMI *et al.* 2007, 2012a, b, 2013, MALICKY 1986, 1999, MARINKOVIĆ-GOSPODNETIĆ 1975, 1980, OLÁH 2010, OLÁH *et al.* 2013a, b, PONGRACZ 1923). This investigation is a contribution focusing on the completion of the species inventory of Kosovo caddisflies and adds some ecological information for *Drusus siveci* at the studied area.

Drusus siveci is a rare Balkan endemic species described in 1981 from a single speci-

Table 2. Physical and chemical parameters at the two sampling stations (Station 1: Haxhaj; Station 2: Lloqan)

	Measuring date	Mean water temperature (°C)	Air temperature during the night sampling (°C, max/min)	Dissolved O ₂ (mg/l)	Dissolved O ₂ (%)	Electric conductivity (Ms/cm)	Ph	Free CO ₂ (mg/l)	Alkalinity (mgCaCO ₃ /l)	Humidity during the night sampling (%)
Station 1	12.04.2010	9.6	13.1/10.8	11.59	105.3	211	7.02	19.5	132.7	75
	19.05.2010	10.1	13.9/11.8	11.54	111.6	251	7.02	32.1	156.3	64
	21.06.2010	11.1	13.4/11.4	12.54	120.3	244	7.03	25.9	167.2	69
	15.07.2010	10.8	16.7/14.6	11.7	120.1	280	7.04	42.9	170.1	61
	19.09.2010	11.4	17.3/14.4	13.51	134.1	340	7.02	44.3	152.1	87
Station 2	17.07.2010	10.2	18.1/14.6	12.91	119.2	231	7.09	32.8	110.2	75
	13.08.2010	11.9	17.1/13.5	11.98	127.4	244	7.1	41.5	113.1	76
	19.09.2010	11.4	17.9/14.3	12.44	116.9	254	7.1	29.7	119	64

men collected in Montenegro. After more than 30 years it is found for the first time outside Montenegro. This represents its first country record for the Republic of Kosovo and thus its area of distribution is considerably enlarged. The record of *Drusus siveci* in Kosovo represents the south-easternmost point of its known distribution. Our samples are part of a larger caddisfly investigation where in total 43 sampling sites belonging to all three river drainage basins all over Kosovo were studied during 2009-2010. In addition, during the last three years (2011-2014) more than 40 other stations all over Kosovo were sampled but *Drusus siveci* has not been found any more (HALIL IBRAHIMI, unpublished results). During all these years, *Drusus siveci* was found only at two stations within the Adriatic Sea drainage basin. Both stations belong to the Bjeshkët e Nemuna Mountains situated in Kosovo, Montenegro and Albania and which are known for many rare plant and animal species (e.g. UNEP 2010, LAKUŠIĆ *et al.* 2012, LJUBISAVLJEVIĆ *et al.* 2007).

Our study shows that *Drusus siveci* is a spring-dwelling caddisfly. Similar to some other Balkan endemic Drusinae, *Drusus siveci* inhabits cold water spring areas and headwaters of mountain streams. The physical and chemical analyses show that at both stations the stream conditions are within the optimal range. However, human activities at both stations increase, especially illegal felling, which may impact directly the stream and consecutively the presence of *Drusus siveci*, as well. At Station 1 the water level decreases due to water removal directly from the source which may also affect the physical and

chemical conditions in this stream and directly impact the presence of *Drusus siveci*. These observations correspond to previous studies demonstrating the vulnerability of caddisfly species to fluctuations in water levels (POWER *et al.* 2008, EVTIMOVA, DONOHUE 2014).

Drusus siveci is the eighth recorded species of the genus from the Republic of Kosovo. Previously, the following species were recorded: *Drusus botosaneanui* Kumanski, 1968, *D. krusniki* Malicky, 1981, *D. discolor* (Rambur, 1842), *D. tenellus* (Klapalek, 1898), *D. schmidi* Botosaneanu, 1960, *D. bigutattus* (Pictet, 1834) and *D. discophorus* Radovanovic, 1942 (MARINKOVIĆ-GOSPODNETIĆ 1975, 1980, OLÁH 2010, IBRAHIMI *et al.* 2012a, IBRAHIMI *et al.* 2014). Except for *Drusus botosaneanui*, all the other species have a very limited distribution, mainly confined to spring areas and headwater streams and are vulnerable to habitat deterioration and water pollution. *Drusus botosaneanui*, on the other hand, except being widely distributed in Kosovo is also notorious for being present in a wide variety of freshwater bodies: from spring areas to typical downstream river segments which are impacted by sewage effluents.

The population density of *Drusus siveci* at both localities is very low. Considering the rarity of the species on the Balkan Peninsula and the environmental hazards imposed by human activities we suggest the species to be given legal protection in Kosovo and Montenegro. The species may be expected to be present at other localities in the Bjeshkët e Nemuna Mountains on the Balkan Peninsula as well, but only in low densities.

Table 3. Caddisfly species inventory collected at Station 1 (Haxhaj)

Sampling date	12.04.2010			19.05.2010			21.06.2010			15.07.2010			19.09.2010		
	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ
<i>Rhyacophila armeniaca</i> Guerin Meneville,, 1843								4	4				5	11	16
<i>Rhyacophila bosnica</i> Schmid, 1970										2	2				
<i>Rhyacophila laevis</i> Pictet, 1834								2	2						
<i>Rhyacophila mocsaryi</i> Klapalek, 1898								2	2						
<i>Rhyacophila obliterata</i> McLachlan, 1863								2	2						
<i>Rhyacophila palmeni</i> McLachlan, 1879								1	1						
<i>Philopotamus montanus</i> (Donovan, 1813)	3	23	26	5	9	14									
<i>Hydropsyche peristerica</i> Botosaneanu & Marinkovic-Gospodnetic, 1968										2	2				
<i>Hydropsyche instabilis</i> (Curtis, 1834)					2	2									
<i>Hydropsyche</i> sp.				13		13	13		13	8		8			
<i>Micrasema minimum</i> McLachlan, 1876								4	4						
<i>Drusus krusniki</i> Malicky, 1981								4	12	16					
<i>Drusus siveci</i> Malicky, 1981								1	1						
<i>Lepidostoma basale</i> (Kolenati, 1848)					2	2	13		13				25	19	44

Table 4. Caddisfly species inventory collected at Station 2 (Lloqan)

Sampling date	17.07.2010			13.08.2010			19.09.2010		
	♀	♂	Σ	♀	♂	Σ	♀	♂	Σ
<i>Rhyacophila armeniaca</i> Guerin Meneville, 1843		6	6		1	1			
<i>Rhyacophila balcanica</i> Radovanovic, 1953	2	5	7		2	2			
<i>Rhyacophila loxias</i> Schmid, 1970	11	34	45		5	5		1	1
<i>Rhyacophila tristis</i> Pictet, 1834	5	11	16		5	5		2	2
<i>Philopotamus montanus</i> (Donovan, 1813)		15	15	4	11	15			
<i>Drusus botosaneanui</i> Kumanski, 1968		6	6		2	2			
<i>Drusus siveci</i> Malicky, 1981		1	1						
<i>Limnephilus auricularis</i> (Curtis, 1834)	2	9	11	4	2	6	1	3	4
<i>Rhadicoleptus alpestris macedonicus</i> Botosaneanu & Riedel, 1965		2	2						

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