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NEW RECORDS OF *HELICOPSYCHE BACESCUI* (TRICHOPTERA, HELICOPSYCHIDAE) FROM THE BALKAN PENINSULA WITH NOTES ON ITS HABITAT

ŽIVIĆ, I.[1], MARKOVIĆ, Z.[2], SIMIĆ, V.[3] and KUČINIĆ, M.[4]

[1]*Faculty of Biology, University of Belgrade, 11000 Belgrade Serbia*
E-mail: ivanas@bf.bg.ac.rs
[2]*Faculty of Agriculture, University of Belgrade, 11000 Belgrade Serbia*
[3]*Faculty of Science, University of Kragujevac, 34 000 Kragujevac Serbia*
[4]*Department of Biology, Faculty of Science, University of Zagreb*
Rooseveltov trg 6, 10000 Zagreb, Croatia

The species *Helicopsyche bacescui* in Europe has a disjunct area that is mainly situated south of 45° N latitude and east of 22° E longitude with an isolated smaller part in southwestern Hungary. Recent investigations on the territory of Serbia documented the presence of *H. bacescui* at 39 localities south of the Danube. The known area of the species is thereby enlarged by about 30%, while its western boundary is relocated by about 440 km.
H. bacescui is primarily found in lowlands at elevations of less than 200 m above sea level, frequently in streams that periodically run dry. In Serbia, on the other hand, it is found in permanent highland streams at localities with average elevation of 467±35 m above sea level. The highest locality at which this species has been found is the spring of the Obudojevica (Western Serbia), which lies at an elevation of 1060 m above sea level.
H. bacescui belongs to specific benthic communities that differ from typical macrozoobenthos assemblages found in similar habitats in Serbia by the pronounced dominance of Gammaridae, significant presence of *Pisidium* species, and absence of other groups of Trichoptera (above all, members of the family Hydropsychidae).

Key words: *Helicopsyche bacescui*, disjunct area, Serbia, Balkan Peninsula

INTRODUCTION

The species *Helicopsyche bacescui* was originally described in 1953 in Romania (ORGHIDAN & BOTOSĂNEANU 1953). It was later found at several more localities in Romania (CIUBUC 1993), Bulgaria (KUMANSKI 1988), Hungary (NÓGRÁDI 1998, NÓGRÁD & UHERKOVICH 2001), Greece (MALICKY 2004*a*), and the European part of Turkey (SIPAHILER & MALICKY 1987, MORSE 2008).

This species is characterized by a disjunct area (Fig. 1). Its hitherto known distribution is mainly based on investigations of BOTOSĂNEANU (1956, 1961, 1993), ORGHIDAN and BOTOSĂNEANU (1953), BOTOSĂNEANU and MALICKY (1978), CIUBUC (1993), KUMANSKI (1988, 1997), MALICKY (2004*a, b*) and SIPAHILER and MALICKY (1987). The northern boundary of this part of the area of *H. bacescui*

in Europe is defined by latitude 45° N (i.e., the southern slopes of the Carpathians), the western boundary by longitude 22° E (i.e., the borders between Romania and Serbia, Serbia and Bulgaria, and Serbia and former Yugoslav Republic of Macedonia), and the southern and eastern boundaries by the Aegean and Black Seas, respectively. The second part of the area is located in southwest Hungary and is confined to the small region of Somogyudvarhely with only three localities at which *H. bacescui* was found (NÓGRÁDI 1998, NÓGRÁD & UHERKOVICH 2001). This part is located about 800 km west and 200 km north of the main part of the area of *H. bacescui*. The question arises whether this disjunct distribution is a consequence of inadequate investigation of the separating territory (Croatia, Bosnia and Herzegovina, and Serbia) . It should be noted that this species has not been found in Croatia or Bosnia and Herzegovina and up to now only one single male has been reported from Serbia near the Bulgarian border by MARINKOVIĆ-GOSPODNETIĆ (1975).

Relatively little is known about the ecosystem inhabited by *H. bacescui*. Larvae of *H. bacescui* are recorded from short shallow watercourses or swamps in lowland regions of Hungary, Romania, and Bulgaria which may dry up (CIUBUC 1993, KUMANSKI 1988, NÓGRÁDI 1998). Data on the macrozoobenthocenoses to which *H. bacescui* belongs are even more scarce and it can only be generally asserted that it belongs to crenal and rhithral communities (NÓGRÁDI 1998) without any additional details about their composition and structure.

Over the past 15 years, extensive investigations were carried out on the macrozoobenthos of watercourses in Serbia, and larvae of *H. bacescui* were found at a number of localities. The paper at hand presents an update of the distribution of the species and reviews characteristics of its ecosystem.

MATERIAL AND METHODS

Hydrobiological investigations carried out on springs in highland regions of Serbia (from 1989 to 1996), rivers and brooks of Serbia (the Đetinja River in 1988; the Kolubara, Obnica, Jablanica, Gradac, and Reka Banja Rivers from 1991 to 1991; the Svrljiški Timok River in 1990, 1991 and 2004; the Toplica River, the Kudoški and the Jelenački and Borkovački Brooks in 2000–2001; the Trešnjica River in 2003–2004; the Arnauta River in 2004; the Vranovac Brook in 2005 and 2007; the Ladne Vode Brook in 2007; and the Sakinac Brook in 2006 and 2007), and rivers in the watershed of the Southern Morava (from 1998 to 2003) enabled us to sharpen the western and northern boundaries of the known area of *H. bacescui* on the territory of Serbia in the central part of the Balkan Peninsula. Material was collected using a Surber-sampler (sampling area of 300 cm^2, mesh size of 250 μm). Altogether, 2752 samples were taken and fixed in field with 96% alcohol or 4% formalin respectively. Determination of *H. bacescui* was performed using the keys of SEDLAK (1980), WARINGER & GRAF (1997) and LECHTHALER & STOCKINGER (2005).

RESULTS AND DISCUSSION

Data of 566 localities in 145 watercourses were analyzed during this study; further data of 139 localities in 20 watercourses were taken from literature (BARAČKOV 1973, KONTA 1997, REH *et al.* 1997, ĐURKOVIĆ *et al.* 1998, PAUNOVIĆ 2001, MILJANOVIĆ 2001, SIMIĆ & SIMIĆ 2002, 2003, MARTINOVIĆ-VITANOVIĆ *et al*. 2004*a, b*, ŽIVIĆ *et al*. 2004*a, b*, KOSTIĆ & ŽIVIĆ 2005). These localities are evenly distributed throughout the territory of the Republic of Serbia south of the Danube. Except for the region around the hill Vršački Breg, territory north of the

Fig. 1. Area of *Helicopsyche bacescui* in Europe. The main part of the area prior to investigation of the territory of Serbia is hatched in black, while expansion of the main part of the area after investigation of the territory of Serbia is hatched in gray. Part of the area in Hungary is marked with an arrow. Black dots indicate localities at which *H. bacescui* was collected

Danube was not investigated. Larvae of the species *H. bacescui* were found in 64 samples from 39 localities in 19 watercourses (Fig. 2, Tables 1–2).

The new records of *H. bacescui* in Serbia, enlarge the known area considerably. The northern boundary remains along latitude 45°E. However, as the terri-

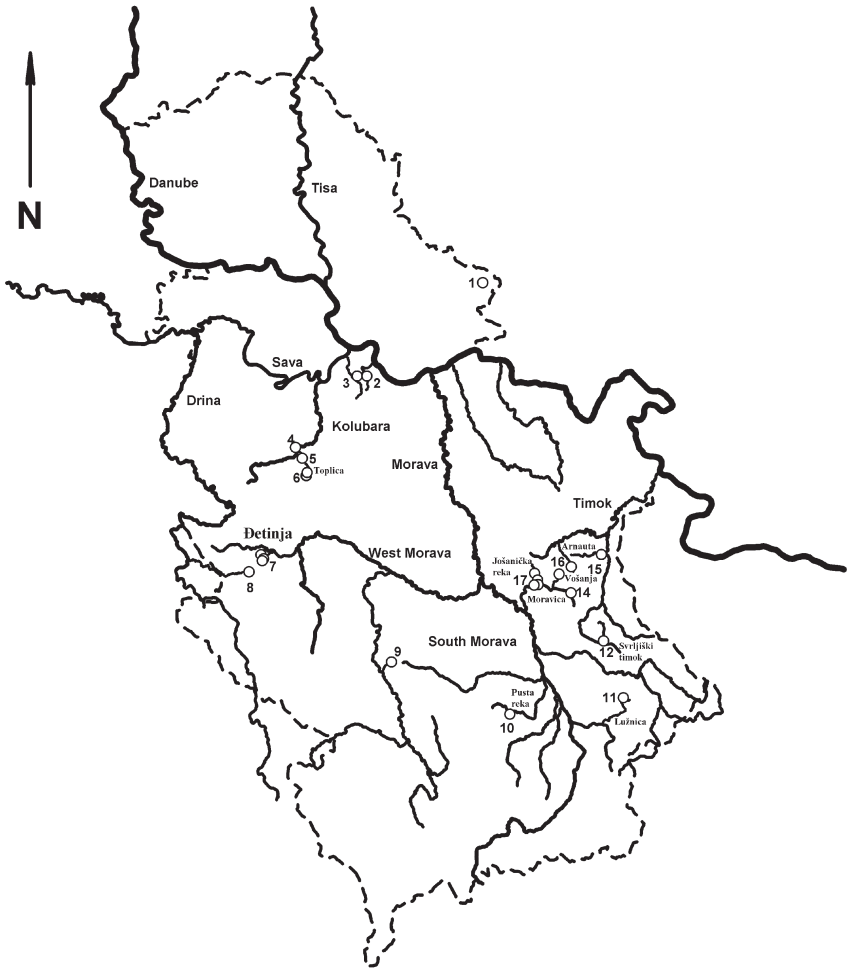

Fig. 2. Distribution of *Helicopsyche bacescui* in Serbia. Open circles indicate localities at which *H. bacescui* was found. Arabic numerals next to them refer to names of the localities, viz: 1 = brook on Vršački hill; 2 = brooks Vranovac and Ladne vode on Mt. Avala; 3 = brook Sakinac on Mt. Avala; 4 = well near Slovac; 5 = Toplica River, locality 7; 6 = Toplica River, localities 2, 3 and 4; 7 = the source of the Bukovac brook–2, Živkovića well and Kurčubića well; 8 = the sping of the Obudojevica; 9 = Lisinski brook (Mt. Kopaonik); 10 = Vujanovačka Reka River; 11 = Lužnica River; 12 = Svrljiški Timok River; 13 = Tisovik River; 14 = Grošnička River; 15 = Arnauta and Vošanja Rivers; 16 = Moravica and Jošanička rivers

tory of Serbia north of the Danube (with the exception of a few localities on the Tisza and Danube Rivers) has remained virtually uninvestigated, it can be expected that new research will lead to a northward extension of the main part of the area. The western boundary of the main part of the area has been extended by about 400 km as a result of the Serbian findings. *H. bacescui* was found at nine localities along the western border of Serbia (i.e., the region covered in the present study) and because Mt. Zlatibor (on which *H. bacescu* was found at five localities) is part of the Dinaric Area (which occupies the greater part of Bosnia and Herzegovina), it can be expected that investigations in Bosnia and Herzegovina will lead to a further westward extension of the known distribution of this species. Our findings support the supposition that the disjunct nature of the area of *H. bacescui* is simply a consequence of inadequate investigation, and that more detailed investigations in the southern part of the Pannonian Plain and in the Dinaric Mountains will reveal a continuous distribution area.

In contrast to the northern and western boundaries of the area of *H. bacescui* in Serbia, its southern boundary may be stable because this part of Serbia has been thoroughly investigated and it fits well with the southernmost records in Bulgaria. There is a slight trend in northern direction from east to west, which should be kept in mind when investigating the distribution of this species in Bosnia and Herzegovina.

The distribution of this species in Serbia is discontinuous (as in the rest of the area), i.e., *H. bacescui* is found at localities separated by considerable distances (Fig. 2). A significant grouping of localities is observed in only four cases. Such concentrations of records are most striking in the area of Mt. Rtanj, where *H. bacescui* was found at nine localities in five streams, and at Mt. Zlatibor (five localities on three watercourses), in the Toplica River (four localities), and at Mt. Avala (17 localities on three brooks).

The Serbian habitats of *H. bacescui* are characterized by several common features. First of all the streams are relatively short with average length of 14±3 km. Only in shorter than average streams with the aforementioned high concentration of localities (the Jošanička River on Mt. Rtanj, the brooks on Mt Avala, and Berkovački Brook, a component of the Toplica River) the species was found along the whole length of the watercourse. In the remaining streams, it was restricted to the source region (seven out of 39 localities were wellsprings) or to the upper course of the river up to 14 km downstream from the source. The only exceptions were localities at the Moravica River, which belong to the river's middle course and which significantly difer from the rest of the sites in other characteristics as well (stream depth, flow velocity, water temperature). The localities at the River Moravica are situated directly downstream the mouth of the Jošanička River,

Table 1. Number of collected specimens of *Helicopsyche bacescui* larvae at investigated localities.

Localities	Date															
	12.10. 1953	15.09. 1990	25.10. 1990	16.11. 1990	18.12. 1990	16.01. 1991	23.03. 1991	19 .04. 1991	6.03. 1994	23.05. 1995	22.10 1995	16.06. 2004	28.07. 2004	25.05. 2000	01.04. 2005	3.11. 2007
Lisinski brook	4															
Svrljiški Timok River		2	1	3	1	5	2	1					3			
Arnauta River												12				
Well near Slovac									2							
Spring of the Obudojevica										1						
Source of the Bukovac brook											2					
Well of the Živkovića											1					
Well of the Kurčubića											2					
Brook of the Vršački hill														1		
Brook Vranovac 2																1
Brook Vranovac 3																56
Brook Vranovac 4																23
Brook Vranovac 5															1	23
Brook Vranovac 6																15
Brook Vranovac 7															12	
Brook Vranovac 8															19	

Table 2. Number of collected specimens of *Helicopsyche bacescui* larvae at investigated localities.

Localities	Dates															
	29.04. 2000	19.10. 2000	4.07. 2000	30.01. 2001	29.04. 2001	1.05. 2001	31.07. 2001	27.10. 2001	5.02. 2002	27.04. 2002	24.07. 2002	19.10. 2002	2.03. 2003	25.10. 2006	8.08. 2007	1.05. 2007
Toplica River 2				1												
Toplica River 3				1												
Toplica River 4	4		2	2												
Toplica River 7		1														
Moravica River 4										2		3				
Moravica River 5						1										
Tisovik River 2								1	2							
Jošanička River 2												1				
Jošanička River 3										5	20	5	3			
Jošanička River 4										51		49	22			
Vošanja River						11	3	5								
Vujanovačka Reka River								1								
Lužnica River					14		4	10	26							
Brook Ladne vode 2															1	
Brook Ladne vode 3															2	
Brook Ladne vode 5															5	
Brook Ladne vode 6															11	
Brook Sakinac 1														1		
Brook Sakinac 2																11
Brook Sakinac 3														2		11
Brook Sakinac 4														7		30
Brook Sakinac 5														5		27
Brook Sakinac 6																9

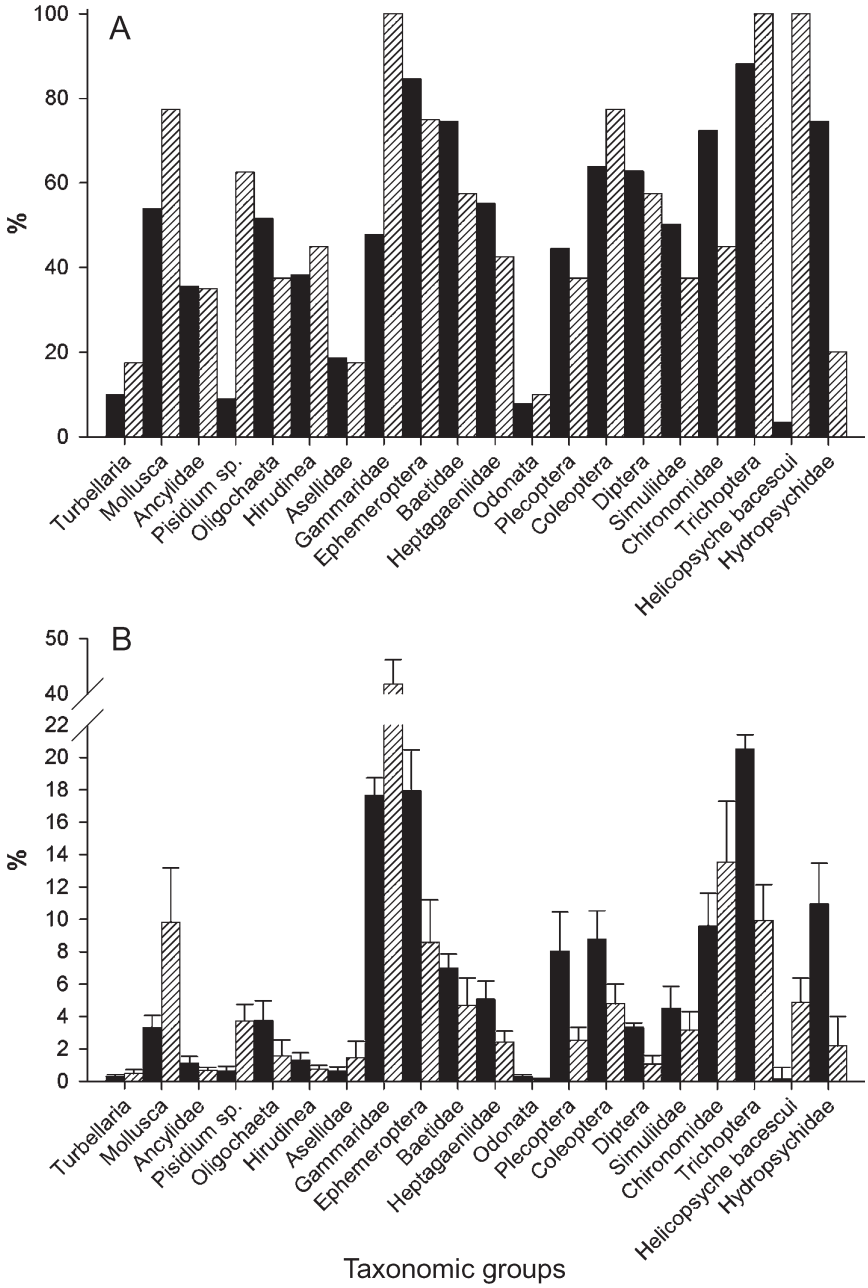

Fig. 3. Site constancy (A) and mean percentage (B) (+ standard error) of the main groups of zoobenthos found at localities where *H. bacescui* was recorded (hatched columns) and at all investigated localities (black columns) on the territory of Serbia

which has the highest density of *H. bacescui* populations (240±110 ind/m^2 at locality Jo4) and it can be hypothesized that their presence at these localities are due to of drift phenomena.

All of the localities in Serbia are characterized by low flow velocity and shallow water depth (0.09±0.008 m). With respect to these characteristics, the habitats in Serbia correspond well with data from literature (CIUBUC 1993, NÓGRÁDI 1998) except altitudinal distribution. However, while this species in the rest of its area is found primarily in flat regions (at elevations of less than 200 m above sea level) and often in streams that periodically run dry, our findings are from permanent highland streams at localities with an average elevation of 467±35 m above sea. Thus, the locality of the Obudojevica's spring at an elevation of 1060 m above sea level represents the highest record of this species in its whole area. In Serbia larvae of *H. bacescui* dwell on rocky substrates (present at 85% of the localities) in relatively cold and clean water (with average temperature of 9.9±0.8°C and with average saprobity index values of 1.57±0.03). In localities that were monitored all year long (16 out of 39), larvae of *H. bacescui* were most seldom found during summer (14% of samples), while in the other three seasons (spring, fall, and winter) they were found with equal frequency (in about 30% of samples). This is in accordance with data indicating that adults of this species are on the wing from May to October (KUMANSKI 1988).

Hitherto, no data on the species inventory of macrozoobenthos at *H. bacescui* sites were available. At our localities, the total number of macrozoobenthic species was 116, the average number of species per sample was 14±1, and the Sörensen similarity index was 35.3±0.7% (ŽIVIĆ 2005) which indicates that the composition of macrobenthocenoses was relatively heterogeneous. Nevertheless, several common and specific features are discernible. The site constancy and abundance of the most important macrozoobenthic groups at the locations where *H. bacescui* was found were used to describe the composition and structure of macrozoobenthocenoses. In order to discern the specificity of this composition, it was compared with the site constancy and abundance of the same zoobenthic groups at all investigated localities from 200 to 1100 m above sea level (Figs 3A & B). By all odds, the most important characteristic of benthocenoses of *H. bacescui* sites was the absolute dominance of Gammaridae, which was the only group found in all samples (its site constancy thereby comprising 100%) and which was also dominant quantitatively, with average relative abundance of 42±4% specimens (ŽIVIĆ 2005). Thus, Gammaridae were the dominant group in as many as 69% of the samples, while they were subdominant in 28%. These values deviate significantly from average values for all other investigated localities in the study area, since the site constancy of Gammaridae at those localities is 49%, while their participation in total abun-

dance is 18±1%. Although the other most abundant groups (Trichoptera, Ephemeroptera and Chironomidae) were rarer at these sites, their relative ratios remained approximately the same (Fig. 3A). Only in Mollusca both a significant increase of site constancy and percentage was observed. The main reason for this was the high density of *Pisidium* species, which were found in 62.5% of the samples (versus 9.0% for the whole study area) and with a percentage of 4±1% (versus 0.6±0.3% for the whole study area). In addition, the low abundance of Hydropsychidae (2±1%) in relation to their abundance for the whole study area (11±3%) and their low site constancy (20% versus 74%) was very obvious. At *H. bacescui* sites, moreover, this species was dominant within the Trichoptera, showing a percentage of up to 62±7% of total Trichoptera abundance.

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