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New subterranean freshwater gastropods of Montenegro (Mollusca: Gastropoda: Hydrobiidae)

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Abstract

New stygobiont species of Hydrobiidae were described. Both new species and one new genus, *Plagigeyeria lukai* n. sp. and *Zeteana ljiljanae* n. gen. et n. sp., have been collected in a spring from village Pričelje near Pogorica. An updated checklist of hydrobiids snails from Montenegro is given.

Key words: Hydrobiidae, new genus, new species, taxonomy, Montenegro.

Introduction

The family Hydrobiidae Troschel, 1857 is one of the largest gastropod families with more than 500 genera (Kabat and Hershler 1993). Nevertheless Hydrobiids from Montenegro have been studied by several authors (e.g., Schütt 1959, 1960, Bole 1961, Radoman 1973, 1983, Reischütz and Reischütz 2008, Glöer and Pešić 2010, Pešić and Glöer 2012, 2013), our knowledge is far from being complete.

To date, 28 hydrobiid species and subspecies belonging to 10 genera have been recorded in Montenegro (Table 1). Worth noting that 92% of these species are endemic for Montenegro.

Because of accessing and sampling in hypogean habitats is difficult, subterranean hydrobiids have been collected mainly as empty shells and very few living animals have been ever found. Preferred sampling sites are where the subterranean networks surfaces as springs which flows directly out of the ground (Pešić and Glöer 2012). Thus, as regard most of species, the delimitations and/or ecological status (strict vs. occasional subterranean) are still unclear and subject to various opinions.

Recently, the junior author collected in a spring near Podgorica two hydrobiid snails which did not correspond to any already known species. Descriptions of these taxa are given in this paper.

Material and Methods

The specimens of the new species were collected from April to mid-May, 2014, in a spring (42°30'17.52" N, 19°13'17.93" E, Fig. 1) in the Pričelje village, central part of Montenegro. The spring is located roughly 150 m of the Zeta river. In order to collect live specimens, the spring sediments were transported into the laboratory, soaked in tap water and left in the dark for a few days in order to let live animals to reach the

surface of the sediment. As expected, samples which revealed living hypogean animals were collected immediately after the period of a strong rain.

The living specimens were fixed in 95% ethanol. The animals were analyzed both morphometrically and anatomically. Images of the shell, soft body and genitalia were photographed with a Leica digital camera system. The studied material is stored in the Zoological Museum of Hamburg (ZMH).



Figure 1. Sampling site: spring in the Pričelje village near Podgorica: A = spring with spring outlet. B = spring source. Photos. V. Pešić

Systematics

Family Hydrobiidae Troschel, 1857

Genus *Zeteana* gen. nov.

Diagnosis. Shell elongated conical with a large ovoid aperture. The lower edge of the aperture moved forwards and the outer margin is sinuated from lateral view. Surface slightly ribbed, with broad ribs and thin interspaces. The animal is whitish, without eyes. The penis is broad at the base and pointed at the top and the sperm duct takes a lateral course. Anatomy of females is unknown.

Type species. *Zeteana ljiljanae* n. sp.

Etymology. Named after Zeta River.

Differential diagnosis. Conchologically, snails of the new genus are similar to *Paladilhiopsis* Pavlović (1913) sensu Radoman, but species of this genus have a rectangular broad penis which is attenuated at the top. However the shell surface of the latter genus is smooth and not ribbed (Radoman 1983).

Shells of *Plagigeyeria* Tomlin, 1930 are ribbed but the new genus clearly differs by the shape of the shell (see under *Plagigeyeria lukai* n. sp.), as well as by the shape of the ribs, which are broad in *Zeteana* n. gen. vs. thin and sharp in *Plagigeyeria*. Moreover, the penis in *Plagigeyeria* is awl-like (Radoman 1983: fig. 55) and more slender compared with *Zeteana* n. gen. Species of the genus *Lanzaia* Brusina, 1906, in addition to awl-like penis, differs in having rare and strong axial and weaker spiral sculptures (Radoman 1983).

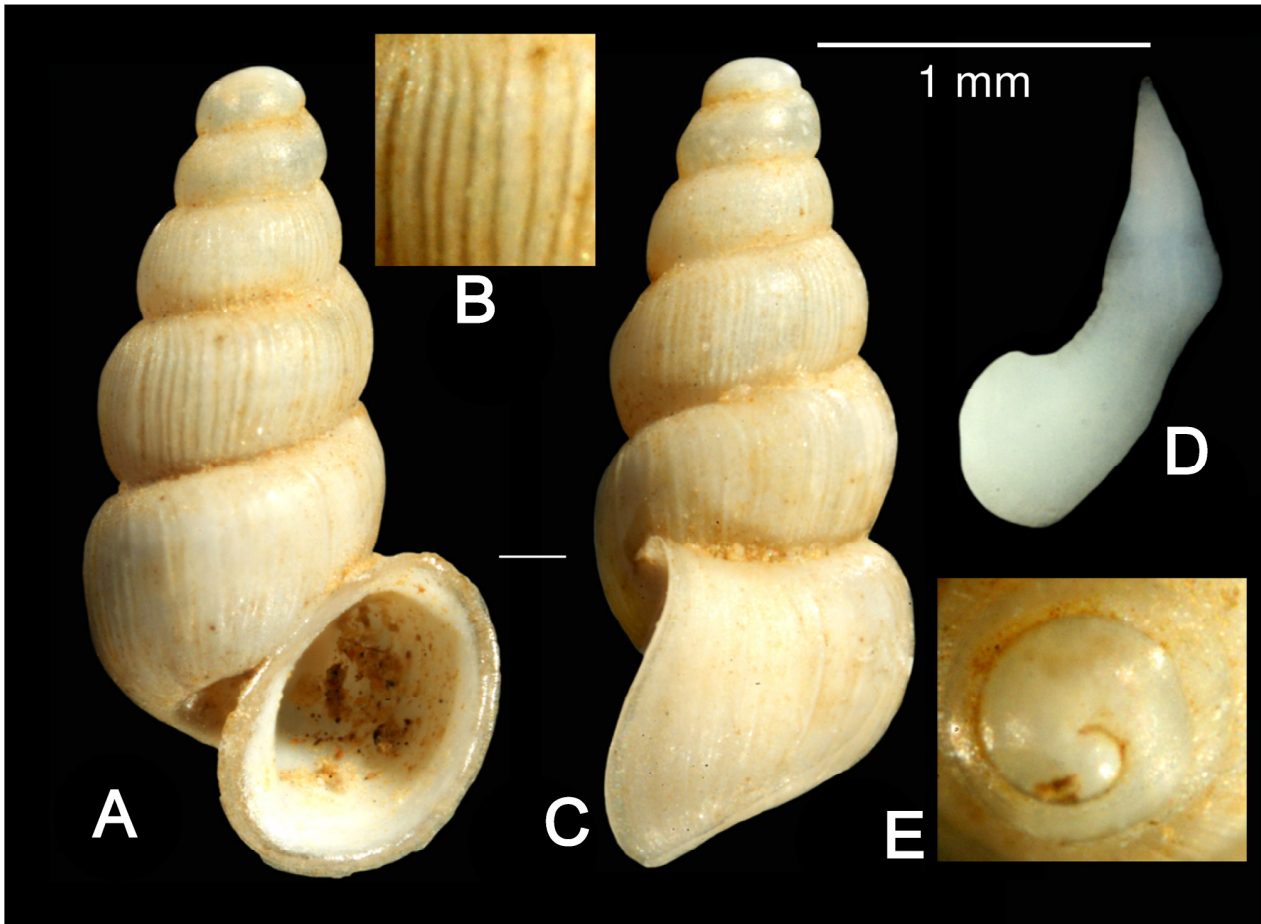


Figure 2. *Zeteana ljiljanae* n. sp. (holotype). A = shell, B = surface sculpture, C = shell from lateral view, D = penis, E = apex.

Distribution. The genus is endemic to Central Montenegro and includes the only species: *Zeteana ljiljanae* n. sp. from its type locality only. The diagnostic characters of the new species coincide with those of the new genus.

***Zeteana ljiljanae* n. sp.**

(Figs. 2A-E)

Type series. Holotype (ZMH 79703): Shell height 2.5 mm, shell width 1.5 mm; Montenegro, Podgorica, spring in village Pričelje, 39 m asl., 20.iv.-25.v. 2014 Pešić. Paratypes: 10 ex. ZMH 79704; 40 ex. coll. Glöer, 2 specimens destroyed by dissection, same data and locality as holotype.

Locus typicus. Montenegro, Pogorica, spring in the Pričelje village, 42°30'17.52" N, 19°13'17.93" E.

Etymology. Named after Dr Ljiljana Tomović (Faculty of Biology, Belgrade), in appreciation of her studies on Montenegrin biodiversity.

Description.

Shell. Shell elongated conical with a large and broad apex (Figs. 2A, C, E). The regularly growing 5.5 whorls are slightly convex with a deep suture. Shell surface slightly ribbed (Fig. 2B). The aperture is large, the lower edge of the aperture is moved forwards, and the outer margin is sinuated from lateral view (Fig. 2C). The outer margin of the aperture is flanged. The umbilicus is open and deep. The shell height 2.0 – 2.5 mm ($\sigma = \pm 0.4$), shell width 1.1 – 1.3 mm ($\sigma = \pm 0.3$), apertural/shell height ratio 0.4.

Body. The animal is whitish, without eyes. Penis is broad at the base and pointed at the top (Fig. 2D).

Distribution. Montenegro; known only from the type locality.

***Plagigeyeria lukai* n. sp.**

(Figs. 3A-C)

Type series. Holotype (ZMH 79705): Shell height 1.3 mm, shell width 0.9 mm; Montenegro, Podgorica, spring in village Pričelje, 39 m asl., 20.iv.-25.v. 2014 Pešić. Paratypes: 1 ex. (ZMH 79706), same data and locality as holotype.

Locus typicus. Montenegro, Pogorica, spring in the Pričelje village, 42°30'17.52" N, 19°13'17.93" E.

Etymology. The species is named after Luka Pešić, the four-year old son of the author.

Description

Shell. Shell elongated conical with a large and broad apex (Figs. 3A-B). The regularly growing 4.5 whorls are convex with a deep suture. Shell surface ribbed (Fig. 3C), with thin and sharp ribs with broad interspaces. The aperture is large, the lower edge of the aperture is moved forwards, and the outer margin is sinuated from lateral view. The outer margin of the aperture is flanged. The umbilicus is open and deep. The shell height 1.3 mm, shell width 0.9 mm, apertural/shell height ratio 0.4.

Body: unknown.

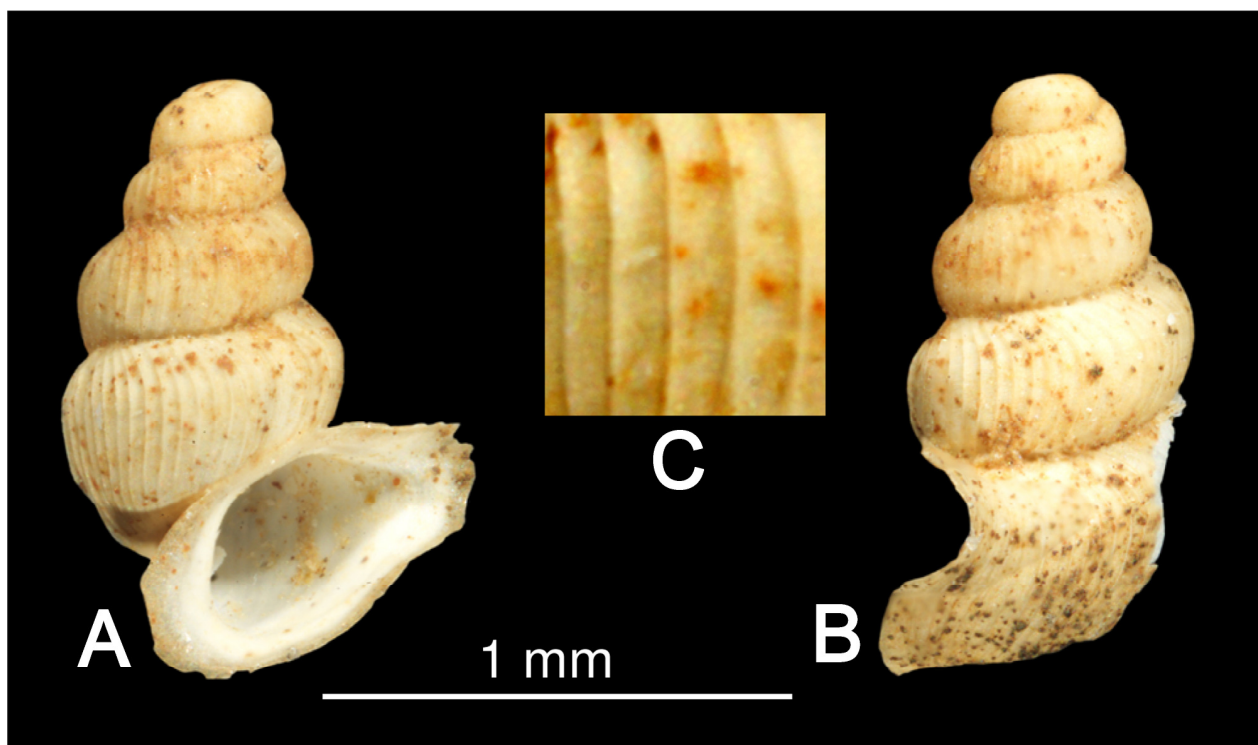


Figure 3. *Plagigeyeria lukai* n. sp. (holotype). A = shell, B = shell from lateral view, C = shell surface.

Differentiating features. *Plagigeyeria lukai* n. sp. is the smallest species of this genus in Montenegro. The dimensions of other *Plagigeyeria* species from Montenegro varying in height from 2.0 to 2.8 mm (Schütt 1960). The lower edge of the aperture in the new species from Pričelje is moved forwards stronger than in all other *Plagigeyeria* spp. known so far. In addition only in *Plagigeyeria lukai* n. sp. the lower border of the aperture is on the right side attenuated. From *P. zetaprotogona* Schütt, 1960 and its subspecies known from several springs along Zeta river, the new species differs by the lower apertural/shell height ratio, which is in *P. zetaprotogona* 0.54 and in *P. zetadidyma* 0.64.

Distribution. Montenegro; known only from the type locality.

Table 1. Checklist of freshwater gastropods of the family Hydrobiidae of Montenegro.

	Red List Category (after Cuttelod <i>et al.</i> 2011)	Endemic
Hydrobiidae		
<i>Radomaniola</i> Szarowska, 2006		
<i>Radomaniola curta curta</i> (Küster, 1852)	Least Concern	
<i>Radomaniola lacustris</i> (Radoman, 1983)	Critically Endangered	+
<i>Radomaniola elongata</i> (Radoman, 1973)	Critically Endangered	+
<i>Radomaniola montana</i> (Radoman, 1973)	Least Concern	+
<i>Karucia</i> Glöer & Pešić, 2013		
<i>Karucia sublacustrina</i> Glöer & Pešić, 2013		+
<i>Vinodolia</i> Radoman, 1973		
<i>Vinodolia gluhodolica</i> (Radoman, 1973)	Endangered	+
<i>Vinodolia matjasici</i> (Bole, 1961)	Critically Endangered	+
<i>Vinodolia zetaevalis</i> (Radoman, 1973)	Data Deficient	+
<i>Vinodolia scutarica</i> (Radoman, 1973)	Endangered	+
<i>Vinodolia vidrovani</i> (Radoman, 1973)	Least Concern	+
<i>Bracenicia</i> Radoman, 1973		
<i>Bracenicia spiridoni</i> Radoman, 1973	Endangered	+
<i>Antibaria</i> Radoman, 1973		
<i>Antibaria notata</i> (Frauenfeld, 1865)	Least Concern	+
<i>Litthabitella</i> Boeters, 1970		
<i>Litthabitella chilodia</i> (Westerlund 1886)	Least Concern	
<i>Saxurinator</i> Schütt 1960		
<i>Saxurinator montenegrinus</i> (Schütt, 1959)	Endangered	+
<i>Saxurinator orthodoxus</i> Schütt, 1960	Critically Endangered	+
<i>Montenegrospeum</i> Pešić & Glöer, 2013		
<i>Montenegrospeum bogici</i> (Pešić & Glöer, 2013)		+
<i>Zeteana</i> n. gen		
<i>Zeteana ljiljanae</i> n. sp.		+
<i>Paladilhiopsis</i> Pavlovic 1913		
<i>Paladilhiopsis tarae</i> Bole & Velkovich, 1987	Data Deficient	+
<i>Plagigeyeria</i> Tomlin, 1930		
<i>Plagigeyeria montenigrina</i> Bole, 1961	Critically Endangered	+
<i>Plagigeyeria lukai</i> n. sp.		
<i>Plagigeyeria zetaprotogona zetaprotogona</i> Schütt, 1960	Endangered	+
<i>Plagigeyeria zetaprotogona vitoja</i> Reischütz & Reischütz, 2008	Endangered	+
<i>Plagigeyeria zetaprotogona pageti</i> Schütt, 1961	Endangered	+
<i>Plagigeyeria zetaprotogona zetadidyma</i> Schütt, 1960	Endangered	+
<i>Plagigeyeria zetaprotogona zetatrityma</i> Schütt, 1960		+
<i>Bythinella</i> Moquin-Tandon 1856		
<i>Bythinella dispersa</i> Radoman, 1973		+
<i>Bythinella luteola</i> Radoman, 1976		+
<i>Bythinella taraensis</i> Glöer & Pešić, 2010		+

Discussion

For Montenegro a total of 28 freshwater hydrobiid gastropods are reported (Table 1). Three species are listed as Extinct by Regnier *et al.* (2009): *Antibaria notata* (Frauenfeld, 1865), *Bracenicia spiridoni* Radoman, 1973 and *Vinodolia gluhodolica* (Radoman, 1973). The two latter species, presumed to be subterranean forms, recently have been re-discovered by Pešić and Glöer (2013) so the statement of Regnier *et al.* (2009) should be partially rejected.

The most diverse genera are *Plagigeyeria* with 7 taxa (3 species and 5 subspecies), followed by *Vinodolia* Radoman, 1973 with 6, and *Radomaniola* Szarowska, 2006 with 4 species. Schütt (1972) made a taxonomic revision of the genus *Plagigeyeria* based on conchological features and divided *Plagigeyeria zetaprotogona* into four subspecies (*P. z. zetaprotogona*, *P. z. zetadidyma*, *P. z. zetatrityma*, *P. z. pageti*). However these subspecies could be found living syntopically in several springs along Zeta river (the spring

near Straganik and Tunjevo, spring near Studeni near Danilovgrad and spring between Slap and Bog in the upper Zeta valley) suggesting that they represents separate species. However, taxonomic status of these taxa should be clarified by checking additional material. The systematic status of *Radomaniola curta* and its subspecies is still problematic. Falnowski *et al.* (2012) studied the morphology of the shell, penis, and female reproductive organs, as well as the mitochondrial COI and ribosomal 18S in 17 populations of *Radomaniola* from Skadar Lake drainage and shows that the molecular differentiation was not reflected in morphology. They postulated morphostatic evolution, as a result of non-adaptive radiation characterized by the rapid proliferation of species without morphological and ecological differentiation (Gittenberger 1991).

At the species level, 92 % of the total hydrobiid fauna appears to be endemic for Montenegro. Most of endemic species are found in Adriatic Sea catchment area, and only three species (all of the genus *Bythinella*) occur in the Black Sea catchment area. Members of the latter genus are absent from Adriatic drainage area, with the exception of one locality in the upper part of Morača river, close to the watershed of the two drainage sea areas (Glöer and Pešić 2010). The Skadar lake basin is the region with the highest number of endemic species, the adjusted rate of gastropod endemism estimated at 37.5 % (Pešić and Glöer 2013). The endemism occurs also at genera level and Montenegro harbors three endemic and monotypic hydrobiid genera, *Karucia* Glöer & Pešić, 2013, *Montenegrospeum* Pešić & Glöer, 2013, and *Zeteana* n. gen.

The IUCN Red List of Threatened Species (Cuttelod *et al.* 2011) includes 19 hydrobiid species from Montenegro. Five of them are assessed as Critically Endangered, 8 as Endangered, 2 as Data Deficient and 5 as Least Concern in the IUCN Red List of endangered species (see: Table 1). Furthermore, the six species: *Vinodolia zetaevalis*, *V. scutarica*, *V. matjasici*, *Radomaniola lacustris*, *R. elongata* and *Bracenicia spiridoni* are protected in Montenegro by national legislation (Službeni list RCG, br. 76/06, 2006).

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