

## THE FRESHWATER SNAILS OF THE GENUS *BYTHINELLA* MOQUIN-TANDON (GASTROPODA: RISSOOIDEA: HYDROBIIDAE) FROM MONTENEGRO

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**Abstract** - New records of freshwater snails of the genus *Bythinella* Moquin-Tandon from Montenegro are presented. *Bythinella dispersa*, 1973 and *B. luteola* Radoman, 1976 are recognized and defined as separate species; *B. taraensis* n. sp., which lives partially sympatric with *B. dispersa* in the canyon of the River Tara, is described as new. All *Bythinella* spp. in Montenegro inhabit the Dinaric part of the Black Sea drainage area, while it is practically absent from the Adriatic drainage area.

**Key words:** Montenegro, *Bythinella dispersa*, *Bythinella luteola*, *Bythinella taraensis* n. sp.

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### INTRODUCTION

The freshwater snails of the genus *Bythinella* are widely distributed throughout southern, central and eastern Europe and western Asia, from the uplands of Germany (Boeters, 1981) and Poland (Falniowski, 1987) in the north, to the Mediterranean and Northern Africa (Algeria; Kristensen, 1985) in the south, and from the Iberian Peninsula in the southwest to the Ukraine in the east (Son, 2006) and Turkey in the southeast (Yıldırım, 2006).

Species of the genus *Bythinella* occur predominantly in springs and spring-fed brooks, but can be found in crevices (Boeters, 1998), or, exceptionally, in caves (Locard, 1902). Most of the members of the genus are stenothermal species which prefer temperatures of 6-10°C. The genus *Bythinella* is well-defined by a cylindrical shell and a penis that bears a penial appendix with a flagellum. However, the species determination in the genus *Bythinella* is problematic. For example, species which are anatomically distinct (e.g., *B. robiciana* (Clessin, 1890) vs. *B. opaca* (Gallenstein, 1848) cannot be distinguished genetically (Haase et al., 2007). On the other hand, species that differ only by the marginal teeth of the radula (e.g., *B. angelitae* Haase, Wilke &

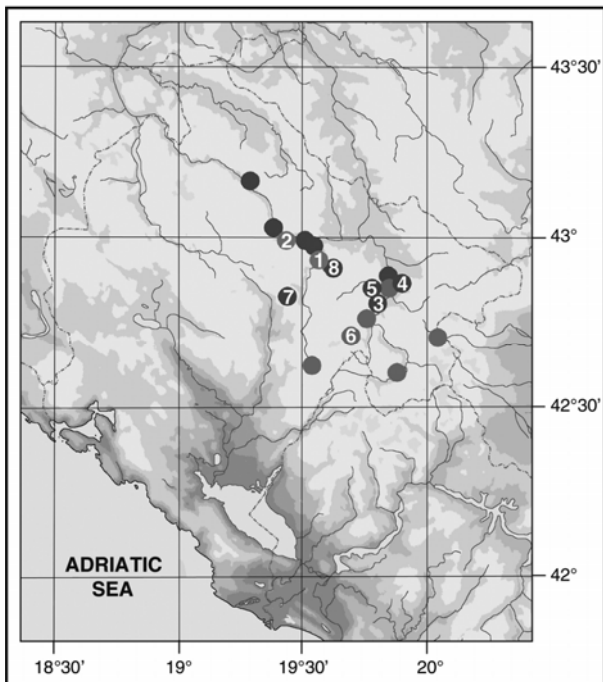
Mildner, 2007 vs. *B. opaca*) can be distinguished by sequencing CO1 fragments (Haase et. al. 2007).

Only two taxa of the genus *Bythinella* Moquin-Tandon, *B. opaca dispersa* (Radoman, 1976), and *B. opaca luteola* (Radoman, 1976), are known from Montenegro (Radoman, 1983). Karaman (2007) mentioned two species for Montenegro: *Bythinella opaca dispersa* and *B. serborientalis* Radoman, 1978. However, the latter is known only from Serbia (spring Vrelo in E Serbia, see: Radoman, 1983).

The aim of this paper is to give an review of the *Bythinella* spp. in Montenegro, and to describe the new species *B. taraensis* n. sp.

### MATERIAL AND METHODS

In 2005-2008 the junior author collected freshwater molluscs in Montenegro (see Fig. 1 for sampling localities). The snails were collected by hand-netting, sorted on the spot from living material and preserved in 75% ethanol. The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope (Zeiss); the photographs were made with a digital camera system (Leica R8).



**Fig. 1.** The sampling sites of *Bythinella* spp. in Montenegro. *Bythinella luteola* (red dot), *B. dispersa* (blue dot), *B. taraensis* n. sp. (green dot). 1. Canyon of River Tara, Polja village near Mojkovac, 03.05.2008 - 2. Canyon of River Tara, Ljevok stream near Ljevok village, 30.04.2008 - 3. Stream between Berane and Andrijevica, 26.05.2008 - 4. Berane, rheocrenic spring in Petnjik village, 20.10.2006 - 5. Berane, spring near Monastir Djurdjevi Stupovi, 25.05.2008 - 6. Komovi Mt., Štavna, rheocrenic spring, 27.05.2008. 7. Kolašin, Bistrica stream, 30.04.2008 - 8. National Park Biogradska Gora, Bjelasica Mt., rheohelocrenic spring near Biogradsko Lake, 01.06.200. - Sampling sites without numbers are from literature (Radoman 1983).

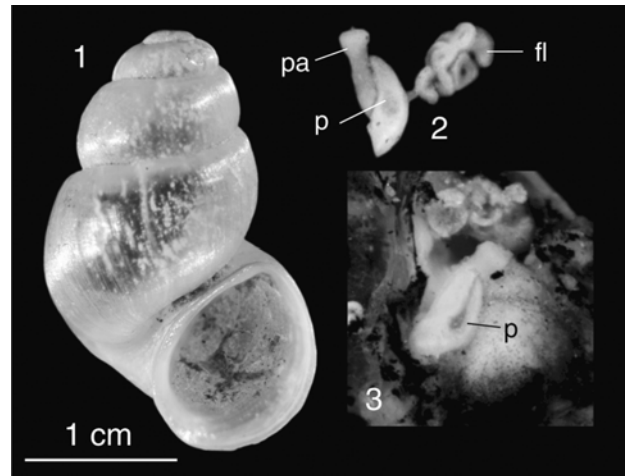
The holotype and the paratypes are deposited in the Zoological Museum of Hamburg (ZMH). In terminology of penis morphology we follow Ponder (2003) but use for simplification the name “penial appendix” instead of his “an accessory lobe with a sucker (as an attach organ) on its distal end”.

## RESULTS

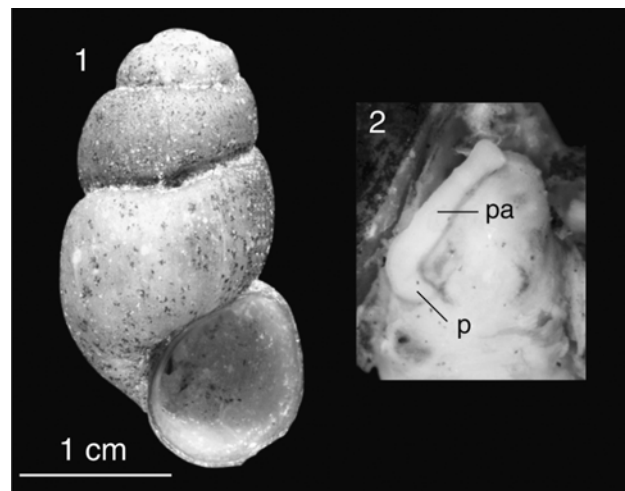
### GENUS *BYTHINELLA* MOQUIN-TANDON, 1855

#### *BYTHINELLA DISPERSA* RADOMAN, 1973

(Figs. 2.1-2.3, 4.1, 7.1-7.3)



**Fig. 2.** *Bythinella dispersa* Radoman, 1973. 1: shell, 2: penis (p) with penial appendix (pa) and flagellum (fl), 3: head with penis in situ.



**Fig. 3.** *Bythinella luteola* Radoman, 1976. 1: shell, 2: head with penis (p) and penial appendix (pa) in situ.

### Description

The 4.5 whorls of the conically oval shell are slightly convex with a deep suture. The shells are grey and opaque, with a glossy and smooth surface. The umbilicus is closed to a slit. The apex is broad and obtuse. The aperture is oval, slightly angled at the top, with a thickened periostome, especially at the columella. The shell is 2.7–2.8 mm high and 1.6–1.7

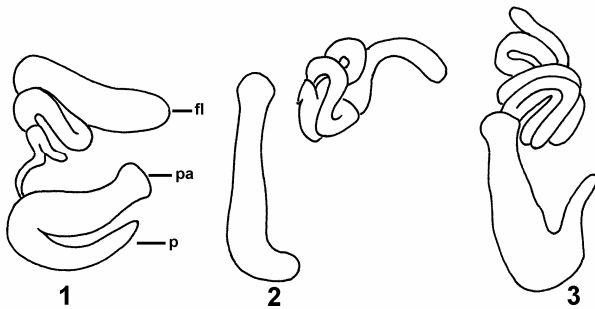


Fig. 4. Penis morphology of the *Bythinella* spp. of Montenegro. 1: *Bythinella dispersa* (after Radoman 1983); 2: *Bythinella luteola*; 3: *Bythinella taraensis* n. sp. – fl = flagellum, pa = penial appendix, p = penis.

mm broad. The ratio of shell height to aperture height is 1.7–2.1.

#### Anatomy

The penis is about 3/4 of the length of the penial appendix. The flagellum is thin at the distal end and broad at the proximal end. The renal oviduct possesses one coil.

#### Remarks

Radoman (1983) defined *Bythinella dispersa* as a subspecies of *B. opaca* (Gallenstein, 1848) (syn. *B. schmidti*). However *Bythinella dispersa* can be distinguished from *B. opaca* by its thicker and shorter penis (the penis of *B. opaca* is longer than the penial appendix and more slender – see: Glöer & Georgiev, 2009). There is no reason to support the assignment of this taxon as a subspecies of *B. opaca*.

#### Distribution

Montenegro and Serbia; the drainage areas of the Drina (the valleys of Tara, Lim and Uvac rivers) and Ibar rivers.

#### BYTHINELLA LUTEOLA RADOMAN, 1976

Figs. 3.1-3.2, 4.2, 7.4-7.6

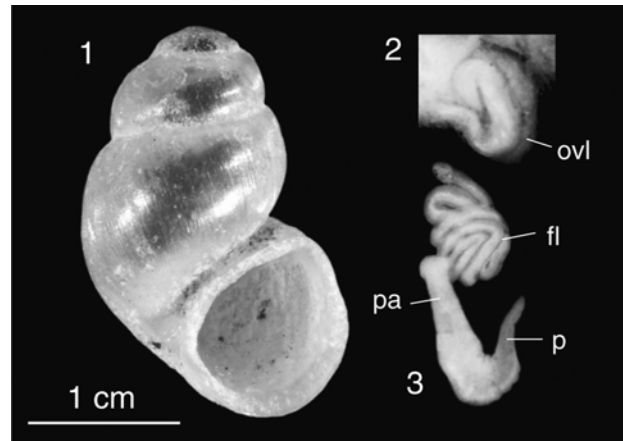


Fig. 5. *Bythinella taraensis* n. sp. 1: shell, 2: oviductal loop (ovl), 3: penis (p) with penial appendix (pa) and flagellum (fl).



Fig. 6. Ljevok stream, the type locality of *Bythinella taraensis* n. sp.

#### Description

The 4.5 whorls of the cylindrical shell are slightly convex with a clear suture. The shells are yellowish,



Fig. 7. Shells of *Bythinella* spp. of Montenegro. 1-3: *B. dispersa*, 4-6: *B. taraensis* n. sp., 7-10: *B. luteola*.

finely striated, and silky. The umbilicus is closed. The apex is broad and obtuse. The aperture is oval in shape. The shell is 2.8–3.0 mm high and 1.4–1.5 mm broad. The ratio of shell height to aperture height is 2.3–2.5.

#### *Anatomy*

The penis is very short, about a quarter of the penial appendix. The flagellum is long and medium in width.

*Remark*

Radoman (1983) defined *Bythinella luteola* as a subspecies of *B. opaca* (Gallenstein, 1848) (syn. *B. schmidtii*). *Bythinella luteola* can be easily distinguished from the latter species by its penis morphology (the penis is very short, with a flagellum which is long and medium in width in *B. luteola* - Glöer & Pešić, 2006). There is no reason to support the assignment of this taxon as a subspecies of *B. opaca*.

*Distribution*

Montenegro; drainage areas of the rivers Tara and Lim and upper part of Morača river valley.

*BYTHINELLA TARAENSIS* N. SP.

Figs. 4.3, 5.1-5.3, 7.7-7.10

*Material examined*

Canyon of the River Tara, Ljevok stream, 30.04.2008 7 ex.; Canyon of the River Tara, small spring in Polja village, 05.05.2008 45 ex.

*Holotype*

Shell 2.7 mm high, width 1.8 mm; ZMH 51408.

*Paratypes*

5 ex., ZMH 51409.

*Locus typicus*

Canyon of the River Tara, Ljevok stream.

*Etymology*

The species is named after the River Tara where this species was collected.

*Description*

The 4–4.5 whorls of the conically cylindrical shell are slightly convex with a clear to deep suture. The shells are horn-colored to grey with a glossy and smooth surface. The umbilicus is closed to a slit.

The apex is small but broad and obtuse. The aperture is oval, slightly angled at the top, with a thickened periostome at the columella. The shell is 2.5–2.7 mm high and 1.8–1.9 mm broad. The ratio of shell height to aperture height is 2.1–2.2.

*Animal*

The mantle is pigmented in black.

*Anatomy*

The penis is about 1/3 shorter than the penial appendix. The flagellum is long and thin. The renal oviduct is coiled twice (Fig. 5.2).

*Remarks*

The new *Bythinella* species can be distinguished from the other two closely related *Bythinella* species known from the same region, *B. dispersa* Radoman and *B. luteola* Radoman, by its shell's shape and anatomy (see Table 1 for the distinguishing features).

*Distribution*

Montenegro; known only from the two localities in the Tara river canyon.

## DISCUSSION

In Montenegro, the members of the genus *Bythinella* are practically absent from the Adriatic drainage area, and are limited in their distribution to the Dinaric part of the Black Sea drainage area (with the exception of one locality in the upper part of River Morača, close to the watershed of the two sea drainage areas). The reason for this was perhaps that the direction of Dinarides in its central part prevented the spread of ancestral populations from the west into the Adriatic area of the central and most of the eastern Dinarides (Radoman 1985). The species of the genus *Bythinella* in Montenegro mostly inhabit cold (stenothermic) karstic springs and the uppermost courses of small streams where they can form large populations.

The distribution pattern of the three species in Montenegro show that they live sympatrically in the valleys of the rivers Tara and Lim. It is not unusual that more than one *Bythinella* sp. occurs in the same region (eg., *Bythinella magna* Radoman, 1976 and *B. kapelana* Radoman, 1976 in close springs in Gacko Polje, Bosnia and Hercegovina – see: Radoman, 1983), and in some cases two *Bythinella* spp. can even be found in the same spring (Boeters & Falkner 2008).

During the last Ice Age the region of the *Bythinella* spp. of Montenegro was glaciated (Huges et al., 2006) so these species have been introduced post-glacially, and it would be interesting from where these species originate. The interesting questions that arise regarding the genetic isolation and origin of these species will ultimately require the application of molecular methods. The Balkan Peninsula undoubtedly was an important refugium for malacofauna during the Pleistocene Ice Ages.

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СЛАТКОВОДНИ ПУЖЕВИ РОДА *BYTHINELLA* MOQUIN-TANDON (GASTROPODA:  
RISOOIDEA: HYDROBIIDAE) ИЗ ЦРНЕ ГОРЕ

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У раду су дати нови налази слатководних пужева рода *Bythinella* Moquin-Tandon из Црне Горе. *Bythinella dispersa*, 1973 и *B. luteola* Radoman, 1976 су препознате и дефинисане као посебне врсте; *B. taraensis* n. sp., која делимично живи у симпатрији са врстом *B. dispersa* у кањону реке Таре је описана

као нова врста за науку. Све врсте рода *Bythinella* у Црној Гори насељавају динарски дио црноморског слива, и практично одсуствују (са изузетком једног локалитета који се налази у горњем делу реке Мораче, у непосредној близини развођа два слива) са подручја јадранског слива.

