

The *Bithynia* species from Skadar Lake (Montenegro) (Gastropoda: Bithyniidae)

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> Abstract

Malacological investigations in Montenegro have provided new information on the taxonomic status of *Bithynia mostarensis* Moellendorf, 1873, and *B. cettinensis* Clessin, 1887 which are distinct to *B. tentaculata* (Linnaeus 1758). By comparing the shells and the anatomy of the *Bithynia* material collected, we introduce three new species, *B. radomani* n. sp., *B. zeta* n. sp., and *B. skadarskii* n. sp. Besides we designate a lectotype for *B. mostarensis*.

> Kurzfassung

Malakologische Untersuchungen in Montenegro haben neue Informationen zum taxonomischen Status von *Bithynia mostarensis* Moellendorf, 1873 und *B. cettinensis* Clessin 1887 ergeben, die unterschiedlich sind zu *B. tentaculata* (Linnaeus 1758). Durch den Vergleich der Gehäuse sowie der Anatomie des gesammelten *Bithynia*-Materials, können wir drei neue Arten vorstellen, *B. radomani* n. sp., *B. zeta* n. sp. und *B. skadarskii* n. sp. Außerdem legen wir einen Lectotypus von *B. mostarensis* fest.

> Key words

Bithynia radomani n. sp., *Bithynia zeta* n. sp., *Bithynia skadarskii* n. sp., *Bithynia mostarensis*, *Bithynia cettinensis*, Skadar Lake, Montenegro.

Introduction

The only *Bithynia* species so far recorded in Montenegro is *Bithynia tentaculata* (Linnaeus, 1758) (= *B. majewskyi* Frauenfeld, 1862, = *B. mostarensis* Moellendorf, 1873, see SCHÜTT 1988) (WOHLBEREDT 1909; JAECKEL et al. 1958; JOVANOVIĆ 1997). In the Albanian part of the Skadar Lake DHORA & WELTER-SCHULTES (1997) also mentioned *B. tentaculata*. Recent research activity in Montenegro discovered three previously undescribed species, *B. radomani* n. sp., *B. skadarskii* n. sp., and *B. zeta* n. sp. Additionally we provide new information on the taxonomic status of *B. mostarensis*, and *B. cettinensis*, which are distinct to *B. tentaculata* because both have an opened umbilicus. *B. majewskyi* could not be found by our recent investigations, but we believe that the locus typicus of this species mentioned by SCHÜTT (1988) is not the type locality of this species. If *B. majewskyi* and *B. cettinensis* are distinct species in fact or if *B. majewskyi* is a juvenile of *B. cettinensis* has to be solved in a later paper.

Material and methods

The snails were collected with a sieve from the study area. The samples were put into 75% ethanol. The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope; the photographs were made with a digital camera (Nikon D70). All type material is stored in the Zoological Museum of Hamburg (ZMH). To clear the status of the *Bithynia* species described from the Dinaric region we have lend the syntypes of *B. cettinensis* and *B. mostarensis* of the Senckenberg Museum.

Study Area

The Skadar Lake drainage basin is located between 18° 41' and 19° 47' East and 42° 58' and 40° 10' North. Skadar Lake, located in a karst terrain in the outer part of the southeastern Dinaric Alps, is the largest of the

Balkan lakes and has a surface area which fluctuates seasonally from approximately 370 to 600 km². The lake's water level also varies seasonally from 4.7 to 9.8 m above sea level. The lake is extending in the NW-SE direction, and it is approximately 44 km long. The Bojana River connects the lake with the Adriatic Sea, and the Drim River provides a link with the Ohrid Lake. The exact origin of the lake is unknown but it probably originated by solution and tectonic processes during the Pleistocene.

The southern and southwestern sides of the lake are rocky, barren and steep having bays, in which the sublacustrine springs, so called "okos", are usually found. On the northern side there is an enormous inundated area, the boundaries of which change as water levels fluctuate. The climate at the Skadar Lake drainage basin is typically Mediterranean, with a long, hot summer at lower and medium altitudes and a short winter with heavy and abundant rainfall.

Results

The *Bithynia* species of the subgenus *Bithynia* described from the Dinaric region are *B. majewskyi*, *B. cettinensis*, and *B. mostarensis*. All the three species have an opened umbilicus, explicitly mentioned in the original descriptions by the authors. The lectotype of *B. majewskyi* was not available for our studies because the Natural History Museum Vienna does not lend type material via mail. But we got a draft photo of this species, made by Karl Edlinger. SCHÜTT (1988) mentioned "Dobra voda 5 km S Bar" in Montenegro near Benkovac as the locus typicus, but he did not check this type locality in fact. Our investigations in this region revealed no *B. majewskyi*, we could only find *B. radomani* n. sp. in this region which is distinct to *B. majewskyi* because the latter has an opened umbilicus. We believe that the type locality of *B. majewskyi* is situated in Croatia.

Bithynia mostarensis von Möllendorf, 1873

- *Bithynia mostarensis*, Möllendorff, O. von (1873): Beiträge zu Fauna Bosniens. Inauguraldissertation. Görlitz, p. 58.
- *B. mostarensis* – Westerlund 1886, Wohlberedt 1909.
- Locus typicus: Mostarsko blato, a temporary lake near Mostar.

Original description (translated): Shell conical, thin, glossy, fine striated, light yellowish. 5 convex

whorls, deep suture. Aperture ovate on the upper side acuminate, white lip. Umbilicus slit-like opened. Shell height 8.5–12.5 mm, width: 6.75–8.5 mm.

Original differential diagnosis (translated): In contrast to *B. tentaculata* the spire is blunt and shorter, the whorls increase more rapidly and the suture is much deeper. The umbilicus is opened.

In the collection of the Senckenberg Museum were two lots (SMF 4061 and SMF 4062) with four adult syntypes. SMF 4061 with one syntype and operculum (shell height = 9.0 mm, shell width = 6.4 mm, operculum height: 4.2 mm) and SMF 4062 with three syntypes (height/width [mm]: 9.4/7.0; 10.2/7.0; 11.2/8.0).

In former times this species was mentioned as a form of *B. tentaculata* (e.g. SCHÜTT 1988) or was not listed besides *B. tentaculata* (e.g. DHORA 1975, 2002; JACOBI 1981; JOVANOVIĆ 1997). The syntypes (Fig. 2) are conspicuous distinct to *B. tentaculata* considering the shell characters, so we designate the specimen SMF 4061 as the lectotype of *B. mostarensis* and the specimens of SMF 4062 as paralectotypes.

Bithynia cettinensis Clessin, 1887

- *Bithynia cettinensis*, Clessin (1887): Beitrag zur Fauna der Binnen-Mollusken Dalmatiens. Malakologische Blätter N. F. pl. ix, p. 62.
- Locus typicus: Cettina near Almissa.

Original description (abridged version): Shell conical, thin, glossy, fine striated, light brown. 6 whorls, deep suture, regularly growing. Body whorl takes 2/5 of shell height. Apex blunt, aperture ovate on the upper side acuminate. Umbilicus slit-like opened.

Original differential diagnosis: The species can be distinguished from *B. tentaculata* by the more swollen whorls, the stout shape of the shell and more widened umbilicus. – The near related *B. mostarensis* has a shorter spire with more rapid increased whorls, so the last whorl reaches the half of shell height. – *B. majewskyi* is smaller. Because it has only 4 whorls it seems to be a juvenile shell.

In the collection of the Senckenberg Museum was one lot (No. 4070) with two syntypes, 1 adult (height = 9.5 mm) and 1 juvenile specimen (height = 6.6 mm).

Important features to determine *Bithynia* species are besides the shell characters the morphology of the penis and the length of the flagellum.

The morphology of the penis

The penis in *Bithynia* species is situated in the neck behind the right tentacle. In dorsal view on the left



Fig. 1. Map of Skadar Lake with sampling sites of *Bithynia* spp. 1 = Krnjice; 2 = Podhum; 3 = Vrnjina; 4 = island Kom; 5 = village Vrnjina; 6 = sublacustrine spring Karuč; 7 = Vrnjina near Monastir; 8 = Virpazar; 9 = Tanki Rt; 10 = island Grmožur; 11 = Malo Blato.

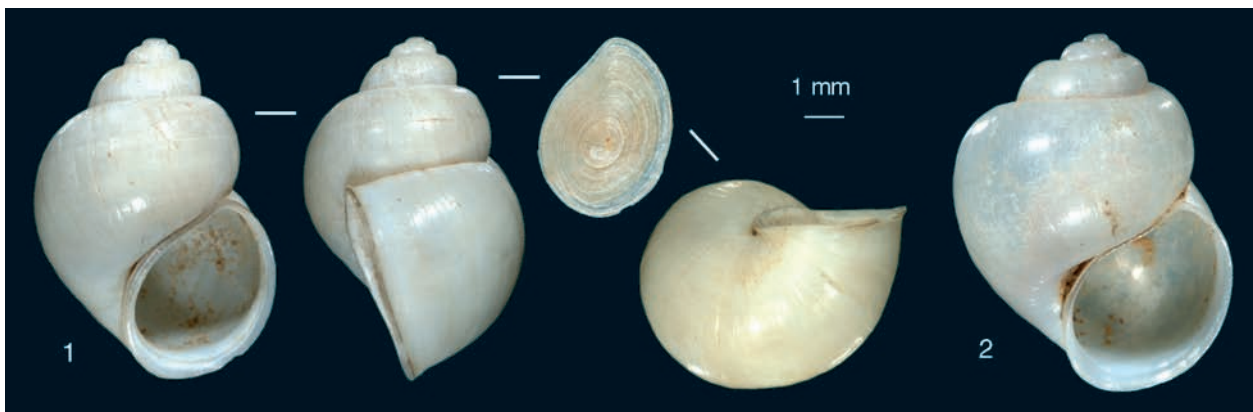


Fig. 2. 1: Lectotype of *B. mostarensis*, 2: Paralectotype of *B. mostarensis*.

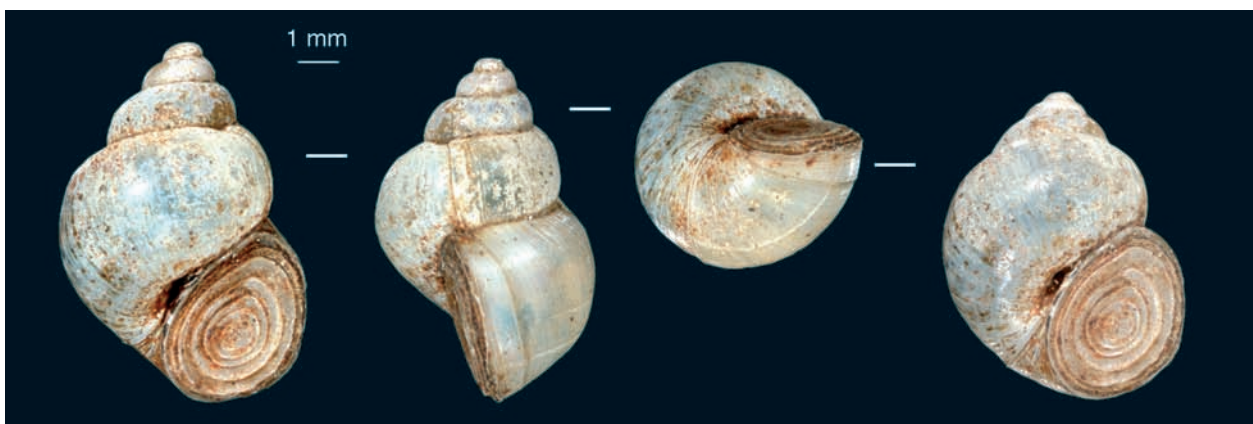


Fig. 3. *Bithynia cettinensis* (Syntype SMF 4070a).

side a penial appendix branches off with a sucker at the distal end and a flagellum (accessory gland after PONDER 2003) at the opposite end in the cephalic

cavity. The penial appendix subdivides the penis into two parts, the proximal (ppp) and the distal (dpp) part (Fig. 4).

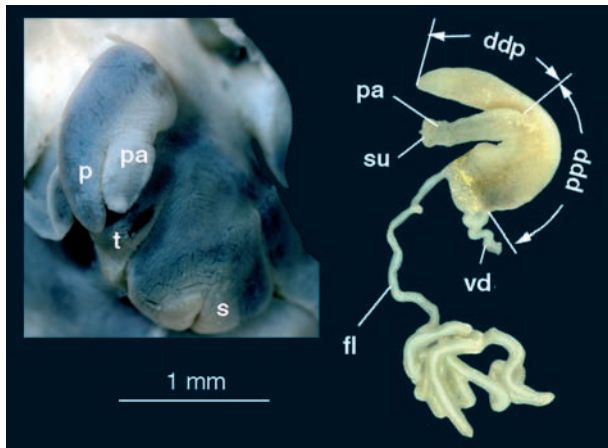


Fig. 4. The Morphology of the penis and the head of *Bithynia* species (*B. mostarensis*). fl = flagellum, ddp = distal part of the penis, p = penis, pa = penial appendix, ppp = proximal part of the penis, s = snout, su = sucker, t = tentacle, vd = vas deferens.

Bithynia zeta n. sp.

Material examined: 18 Ex. (Tanki Rt), 8 Ex. (Malo Blato), 2 Ex. (Vranjina), 2 Ex. (sublacustrine spring Karuč). Outside the Skadar Lake we found 3 Ex. in Bar, spring GornjeVrelo (19° 5.62' E, 42° 5.18' N).

Holotype: Shell 5.0 mm high, 3.2 mm wide. ZMH 4881, ZMH 4882 (penis in ethanol).

Paratypes: 3 Ex. from locus typicus ZMH 4883 (in ethanol), and the rest of the examined material in the collection of the senior author.

Locus typicus: Skadar Lake, Tanki Rt (19° 6.82' E, 42° 16.05' N), Montenegro.

Habitat: Lives under the stones at mud substrate in the littoral zone.

Etymology: Zeta is the name of the first country which existed in the area around Skadar Lake in 11th to 13th century.

Description: Shell yellowish horn-coloured, 4.5 convex whorls, the first whorl lies in one plane. Suture deep, aperture oval with a blunt angle, umbilicus closed. Height 4.0–5.0 mm, width 2.5–3.4 mm. The width of the shell is variable (see Fig. 5); no dimorphism is recognisable.

Male copulatory organ: Flagellum not very long (1.5 times longer than the penis), distal part of the penis slim, tapered, and at the tip pointed, penial appendix shorter than the penis (Fig. 5.1), ratio of ppp : dpp = 1 (n=5).

Bithynia skadarskii n. sp.

Material examined: 28 Ex. (island Kom), 12 Ex. (village Vranjina), 2 Ex. (sublacustrine spring Karuč).

Holotype: Shell 6.2 mm high and 3.7 mm broad, ZMH 4884, ZMH 4885 (penis in ethanol).

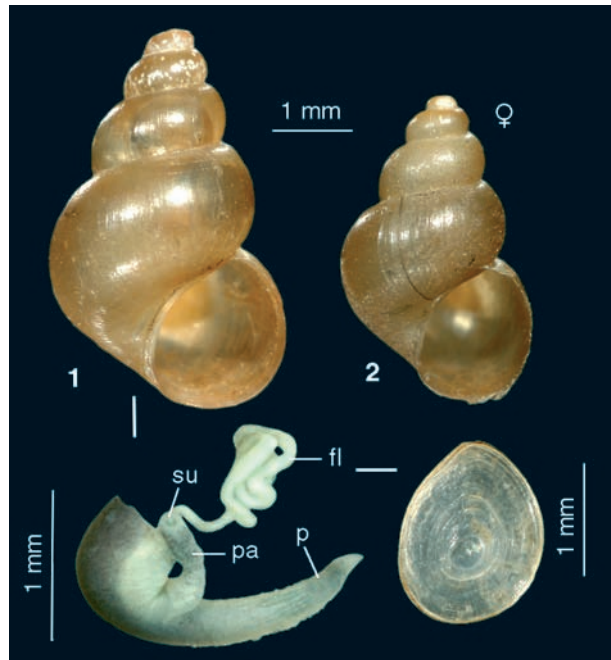


Fig. 5. *Bithynia zeta* n. sp. 1: Holotype (ZMH 4881), penis (ZMH 4882). 2: Skadar Lake, Malo Blato (Pos. 11). fl = flagellum, p = penis, pa = penial appendix, su = sucker.

Paratypes: 3 Ex. from locus typicus ZMH No. 4886 (in ethanol), and the rest of the examined material in the collection of the senior author.

Locus typicus: Skadar Lake, island Kom (19° 6.46' E, 42° 17.50' N).

Habitat: Lives in emergent (*Scirpus lacuster*, *Phragmites communis*, *Typha angustifolia*) and floating (*Nymphaea alba*, *Nuphar luteum*, *Trapa natans*) vegetation.

Etymology: *skadarskii*, from the montenegrin name for the Skadar Lake, Skadarsko Jezero. This species lives possibly endemic in the Skadar Lake.

Diagnosis: Shell yellowish horn-coloured, with 4.5–5.5 whorls, suture shallow, aperture oval with a blunt angle, umbilicus closed. Height 7.1–8.0 mm, width 5 mm. There is no dimorphism recognisable (Fig. 6).

Male copulatory organ: Flagellum 2 times longer than the penis, distal part of the penis thick and at the tip rounded, penial appendix shorter than the penis (Fig. 6.1), ratio of ppp : dpp = 1 (n=7).

Bithynia radomani n. sp.

Material examined: 52 Ex. (Vranjina), 32 Ex. (Virpazar). **Holotype:** Shell 10.4 mm high and 6.8 mm broad, ZMH 51014.

Paratypes: 3 Ex. from locus typicus ZMH No. 51015 (in ethanol), and the rest of the examined material in the collection of the senior author.

Locus typicus: Skadar Lake, Vranjina (19° 6.85' E, 42° 16.55' N), Montenegro.



Fig. 6. *Bithynia skadarskii* n. sp. **1:** Holotype (ZMH 4884), penis (ZMH 4885). **2:** Skadar Lake, Malo Blato (Pos. 11). fl = flagellum, p = penis, pa = penial appendix, su = sucker.



Fig. 7. Holotype of *Bithynia radomani*. fl = flagellum, p = penis, pa = penial appendix.

Habitat: Lives in emergent (*Scirpus lacuster*, *Phragmites communis*) and floating (*Nymphaea alba*, *Nuphar luteum*) vegetation in the littoral zone in Skadar Lake.

Etymology: *radomani*, after the outstanding expert on hydrobiid snails PAVEL RADOMAN, living at the Skadar Lake, who did so much to our knowledge about the Hydrobiidae of the Balkans.

Distribution: This species is very common in Montenegro.

Diagnosis: Shell yellowish horn-coloured, glossy, with 5.5 whorls, suture shallow, aperture oval with a blunt angle, umbilicus closed. Height 9.0–11 mm, width 5.5–6.6 mm.

Male copulatory organ: Flagellum 4 times longer than the penis (see Fig. 8.1, in Fig. 7 a part of the flagellum is cut), distal part of the penis thick and at

the tip rounded, penial appendix of the same length as the distal part of the penis, ratio of ppp : dpp = 1.5 (n=10).

Discussion

The penis of each particular *Bithynia* species mentioned here shows intraspecific variation (e.g. different penis morphology of the same species in Figures 7, 8.1), but there are some characters of the penis which are formed species specific, as the distal part of the penis (broad or narrow, tapered or not tapered), the tip of the penis (rounded or pointed), the flagellum length (1–10 times longer than the penis), the relative length of the penial appendix to the distal part of the penis (short or approximate the same length), and the relations between the proximal (ppp) and the distal part of the penis (dpp).

Differential diagnosis

Comparison between *Bithynia tentaculata* (Linnaeus, 1758) (conical form, Fig. 8.2) and *B. radomani* (Fig. 8.1) shows difference in the morphology of the shells and the penis. While the distal part of the penis of *B. tentaculata* is narrow and tapered with a pointed tip, in *B. radomani* it is broad with a rounded tip. The significant difference of the shells is the height to width ratio which is greater in *B. tentaculata* as compared to *B. mostarensis* (1.60 ± 0.10 vs. 1.44 ± 0.12 , t-test $p < 0.01$).

The shells of *B. zeta* n. sp. (Fig. 6.4) and *B. pre-sensis* Hadžišče, 1963 (Fig. 8.5, a species living in

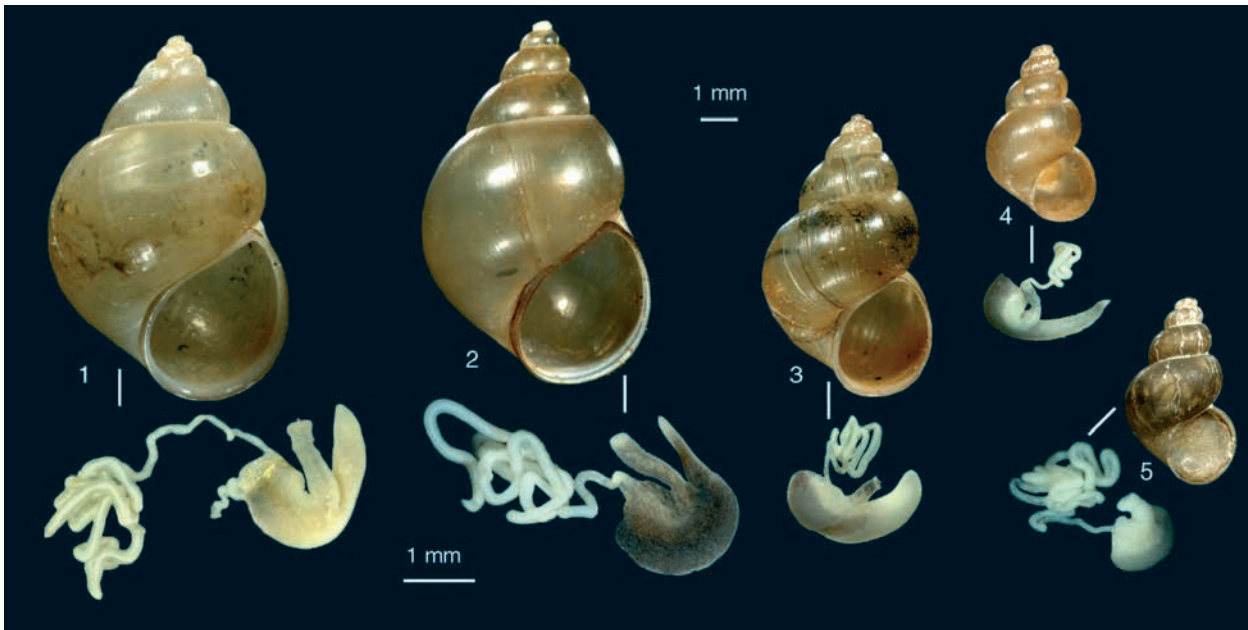


Fig. 8. 1: *Bithynia radomani*, 2: *Bithynia tentaculata*, conical form (Hamburg, Germany), 3: *Bithynia skadarskii* n. sp., 4: *Bithynia zeta* n. sp., 5: *Bithynia prespensis* (Lake Prespa).

the neighbouring country Albania in the Prespa Lake) look similar, but the different morphology of the penes shows that they are not conspecific. The tip of the penis of both species is pointed (not visible on figure 8.5., it lies behind the penial appendix), but the flagellum of *B. zeta* n. sp. is short, whereas the flagellum of *B. prespensis* is very long. The proportion between ppp and dpp is ca. 1.0 in *B. zeta* and 2.0 in *B. prespensis*.

The distinctness of *B. skadarskii* n. sp. to the other mentioned *Bithynia* species is shown by the morphology of the shell as well as by the penis (Fig. 8.3).

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