Enigmatic *Bythinella* species in Bükk Mountains with the description of *Bythinella thermophila* n. sp. (Gastropoda: Amnicolidae)

PETER GLÖER¹, ANDRÁS VARGA² & ALEXANDER C. MRKVICKA³

¹ Biodiversity Research Laboratory, Schulstr. 3, D-25491 Hetlingen, Germany. Email: gloer@malaco.de
² Mátra Museum of the Hungarian Natural History Museum, Kossuth Lajos u. 40, H-3200 Gyöngyös, Hungary. E-mail: avarga46@freemail.hu
³ Marzgasse 16/2, A-2380 Perchtoldsdorf, Austria. E-mail: alex@mrkvicka.at

Received 19 August 2015 │ Accepted 25 August 2015 │ Published online 27 August 2015.

Abstract
The junior authors collected in the Bükk Mountains in the rivulet in Kács a *Bythinella* species new to science. From this region only *B. pannonica* was known which is endemic to the southeastern part of the Northern Carpathian Mountains (Fehér et al. 2013). This rivulet is fed by two springs, a cold one and a hypothermal spring. Only in the hypothermal branch the new *Bythinella* sp., described here as *Bythinella thermophila* n. sp., occurs. Both species are in its shell shape very different from other *Bythinella* spp. known from Europe and Asia Minor so far. In addition to the description the shells of the holotype and paratypes are depicted, as well as the type localities and living specimens. For comparison a photo of *B. pannonica* is provided.

Key words: *Bythinella*, new description, Gastropoda, Hungary.

Introduction
In Northern Hungary to Southern Slovakia occurs *Bythinella pannonica* (v. Frauenfeld, 1865), a species which has been described originally as *Lithoglyphus pannonica*, but the author was not sure that this species belongs to *Lithoglyphus* in fact but the thickened peristome in the region of the columella led him to his decision (Frauenfeld 1865: 7). Later authors assigned this species to the genus *Sadleriana* because of shell shape (e.g. Richnovsky & Pintér 1979: 54, Lisický 1991: 226, Fehér & Gubányi 2001: 51, Glöer 2002: 144). Clessin (1887: 668) reports on investigations of the radula by Hazay, who found that this species has to be assigned to the genus *Bythinella*. In 1972 the species was allocated to the genus *Bythinella* by Bole (cited after Szawrowska & Wilke (2004: 56)). Szawrowska & Wilke (2004) studied *Lithoglyphus pannonica* by anatomy and DNA sequencing and could point out that it belongs to the genus *Bythinella*. Since that time the species has been reported as *Bythinella pannonica* by several authors (e.g. Horsák et al. 2013: 45, Falkner 2015, Bank 2015).

The junior authors collected in a thermal spring and rivulet in Kács (Hungary) a *Bythinella* sp. which is in shell shape very different from *Bythinella* and only the penis morphology revealed that it belongs to this genus.

This paper is intended to describe the *Bythinella thermophila* n. sp.
Material and Methods

The snails were recently collected in Hungary (Fig. 1) by AV (30.01.2013) with a sieve and by AM (19.08.2012) with hand and fixed 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).

The following abbreviations are used: HNHM (Hungarian National History Museum, Budapest), MGY (Mátra Museum of the HNHM, Gyöngyös), NHMW (National History Museum Wien), ZMH (Zoological Museum Hamburg).

Figure 1. Sampling sites of Bythinella pannonica (black dots, after Lisický 1991, Fehér & Gubányi 2001 and Pintér & Suara 2004) and Bythinella thermophila n. sp. (red star).

Systematics

Family Amnicolidae Tryon, 1863

Genus Bythinella Moquin-Tandon, 1856

Type species: Bulimus viridis Poiret, 1801

Bythinella thermophila n. sp.

Holotype: 2.75 mm height, 1.7 mm width, HNHM 99564.

Paratypes: 26 specimens from type locality (30. 01. 2013, A. Varga & T. Kovács leg.) HNHM 99565, 10 specimens MGY 74549, 5 specimens in ZMH 79918, 5 sp. in coll. Glöer, 10 sp. in coll Varga, 8 specimens from the rivulet in the village Kács (47°57.653’ N, 20°36.652’ E; A. Mrkvicka leg. 19.08.2012) NHMW Mollusca 111257. 4 specimens from Kácsfürdő (1994 L. Drimmer leg) MGY 74550, 2 specimens Kácsfürdő, Kácsi-patak (04. 02. 2007, S Ötvös leg.) MGY 70909.

Type locality: warm branch (ca. 22 °C, 30.01.2013) of the hypothermal spring of the rivulet in Kács, 47°57.794’ N, 20°36.309’ E, 189 m alt.

Etymology: “thermophila” because the species lives in thermal waters.

Description: The yellowish-brown shell has 4.5 whorls which are slightly convex. The shell is elongated conical. The aperture is ovate, in some specimens slightly angled at the top. The perioistome is thickened at
the columella. Umbilicus open or closed. Aperture height to shell height: 0.44-0.48, shell height 2.5-2.8 mm, width 1.6-1.8 mm. Juvenile specimens are globular.

Male copulatory organ: The penial appendix is longer than the penis. The tubular gland is regularly thick over the whole length.

Figures 2-7. *Bythinella thermophila* n. sp. 2: Holotype, 3-5: Paratypes, 6: head with penis in situ, 7: penis with tubular gland. Abbreviations: e: eye, p: penis, pa: penial appendix, s: snout, su: sucker, t: tentacle, tg: tubular gland (flagellum). (Photos: PG).

Differentiating features: From *Bythinella pannonica* (Fig. 15) it can be distinguished by the shell shape which is in *B. pannonica* globular and not conical. In addition the penis is shorter than the penial appendix while in *B. pannonica* both are of the same length.

Associated species: *Theodoxus prevostianus*, *Fagotia daudebartii*, *Pisidium casertanum*

Ecology: *Bythinella thermophila* n. sp. inhabits thermal springs and rivulets with stony ground. In the village of Kács the rivulet is trained with stones and concrete walls. The growth of algae on the surfaces of stones provides nutrition to abundant *Theodoxus prevostianus* and *Fagotia daudebartii* which browse the surface, while *Bythinella thermophila* n. sp. is mainly found on stones in shady places under bridges, in crevices and under stones.

Distribution: Only known from the warm branch of the rivulet of Kács and the rivulet itself, Hungary.
Figure 8. The type locality of *Bythinella thermophila* n. sp. (red dot, hypothermal branch) and the cold branch (blue dot) where *B. pannonica* lives.

Figures 9-10. 9: Hypothermal (left) branch and cold (right) branch of the rivulet. 10: Kács hypothermal spring, in background Benedictine monastery. (Photos AV).

Discussion

Usually *Bythinella* species have a more or less characteristic cylindrical shell with an ovate aperture with a sharp periostome. There are only a few exceptions: *Bythinella viridis* from France, originally described as *Bulimus*, and *B. robiciana* (Clessin, 1887), originally described as *Lithoglyphus*, from Slovenia. Only in Bükk Mountains in the region of Kács there occur two atypical *Bythinella* species, *B. pannonica* and *B. thermophila* n. sp.

The populations of *B. pannonica* show by COI sequences a high diversity of 34 distinct haplotypes and two deeply diverged haplogroups (Fehér et al. 2013). The COI of three *B. thermophila* n. sp. specimens
(haplotypes Bythe-01 to Bythe03, GenBank KT581249-KT581251) was identical with that of the syntopically living B. pannonica (haplotype bypa100 in Fehér et al. 2013, HQ149608). This might be explained by introgression but needs further study. On the other hand it is known that COI alone is not suitable to distinguish between distinct species (Ballard & Whitlock 2004).

The rivulet in Kács is fed by two branches from a cold and a hypothermal spring (22 °C in January 2013). In the cold branch Bythinella pannonica occurs and in the warm branch lives B. thermophila. The populations are highly vulnerable to changes in the habitats due to tapping of the spring, construction works in the rivulet, use of agrochemicals in the vicinity etc., the species is therefore endangered.

![Rivulet in Kács](image11.png)
![Stones with Theodoxus prevostianus](image12.png)
![Bythinella thermophila](image13.png)

**Figures 11-14.** 11: Rivulet in the village of Kács; 12: Stones with *Theodoxus prevostianus* in the rivulet; 13-14: *Bythinella thermophila* (Photos: AM)

**Acknowledgements**
We would like to express our thanks to Tamás Dely for the photos of living *Bythinella pannonica*, and to Zoltán Fehér and Virág Krízsik for helpful informations concerning COI sequences of the materials studied. In addition we like to thank two anonymous reviewers for their helpful comments.
Figures 15-17. Bythinella pannonica. 15: Shell (Photo: PG), 16-17: living specimens of B. pannonica (Photos: Tamás Dely).

References

Ballard, J.W.O. & Whitlock, M.C. (2004) The incomplete natural history of mitochondria. Molecular Ecology, 13, 729–744

Bank, R. (2015) Fauna Europaea. http://www.faunaeur.org

Clessin, S. (1887) Die Molluskenfauna Oesterreich-Ungarns und der Schweiz, 858 pp.

Falkner, G. (2013) Bythinella pannonica. The IUCN Red List of Threatened Species. Version 2015.2. <www.iucnredlist.org>. Downloaded on 01 August 2015.

Fehér, Z. & Gubányi, A. (2001) The catalogue of the Mollusca Collection of the Hungarian Natural History Museum. In: Fehér, Z. & Gubányi, A. (Eds.) A magyarországi puhatestűek elterjedése [Distribution of the Hungarian molluscs] I. Magyar Természettudományi Múzeum, Budapest, 466 pp.

Fehér, Z., Major, Á. & Krizsik, V. (2013) Spatial pattern of intraspecific mitochondrial diversity in the Northern Carpathian endemic spring snail, Bythinella pannonica (Frauenfeld, 1856) (Gastropoda: Hydrobiidae). Organisms, Diversity & Evolution, 13(4), 569–581.

Frauenfeld, G. von (1865) Zoologische Miscellen. Verhandlungen d. k. k. zoologisch-botanischen Gesellschaft in Wien, xiv, 525–536, pl. viii-xxii.

Glöer, P. (2002) Die Süßwassergastropoden Nord- und Mitteleuropas. Die Tierwelt Deutschlands, 73, 327 pp.

Horsák, M, Juřičkova, L & Picka, J. (2013) Molluscs of the Czech and Slovak Republics, 264 pp.

Lisiecky, M. (1991) Mollusca Slovenska, 341 pp.

Pintér, L. & Suara, R. (2004) Magyarországi puhatestűek katalógusa hazai malakológusok gyűjtései alapján [Catalogue of the Hungarian molluscs based on the collectings of Hungarian malacologists]. In: Fehér, Z. & Gubányi, A. (Eds.), A magyarországi puhatestűek elterjedése [Distribution of the Hungarian molluscs] II. Magyar Természettudományi Múzeum, Budapest, 547 pp.

Richnovszky, A. & Pintér, L. (1979) A vizesisgák és kagylók (Mollusca) kishatározója. Vízügyi Hidrobiológia 6. Vízügyi Dokumentációs és Továbbképző Intézet, 6, 1–205. Budapest.

Szawrowska, M. & Wilke, T. (2004) Sadleriana pannonica (Frauenfeld, 1865): A lithoglyphid , hydrobiid or amnicolid taxon? Journal of Molluscan Studies, 70, 49–57.