

HISTORIA NATURALIS BULGARICA

ISSN 2603-3186 (online) · ISSN 0205-3640 (print)

Volume **44** · Issue **4**



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Published online **30 May 2022** by:
National Museum of Natural History, Bulgarian Academy of Sciences
1 Tsar Osvoboditel Blvd, 1000 Sofia, Bulgaria
<https://www.nmnhs.com/historia-naturalis-bulgarica/>

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Research article

Bythinella fabiae n. sp., a new spring-snail species (Gastropoda: Rissooidea) from the Belasitsa Mountains, South-West Bulgaria

Dilian Georgiev¹, Ulrich E. Schneppat², Ivaylo Dedov³

(1) Department of Ecology and Environmental Conservation, University of Plovdiv, 24 Tsar Assen Street, 4000 Plovdiv, Bulgaria, diliangeorgiev@gmail.com ; <https://orcid.org/0000-0003-2885-4895> 

(2) Sennereiweg 8, CH-7074 Churwalden-Malix, Switzerland, u.schneppat@gmail.com 

(3) Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Street, 1113 Sofia, Bulgaria, idedov@gmail.com 

<http://zoobank.org/E123EB69-91DA-4D1C-9C12-DE70487A8650> 

Abstract: A new species of the genus *Bythinella* is described. Its type locality is: South-West Bulgaria, Belasitsa Mountains, Leshnishki Waterfall, northern slope of Kongur Peak. Because of its locality position it was compared and with Greek and Macedonian species.

Keywords: Balkan Peninsula, *Bythinella*, new species

Introduction

The freshwater spring-snails *Bythinella* Moquin-Tanton, 1856 (Gastropoda: Rissooidea: Hydrobiidae) consists of around 80 valid taxa known from Europe (Bichain et al., 2007). They are only absent from Scandinavia, in north-eastern Europe (Baltic republics and Belarus), and perhaps Portugal (Wilke et al., 2010). Members of this genus are minute (2–4 mm in shell length) and live mainly in small springs and rarely in running waters of hypogean habitats localised in the mountains (Boeters, 1979). These gastropods are often characterised by small geographical ranges and a lot of species are endemics (Benke et al., 2009). The evolution of this genus went on the way of the non-adaptive radiations, because the *Bythinella* species have no clear niche differentiations, they usually have low degree of phenotypical variation, and species usually evolve in allopatry (or peripatry) (Wilke et al., 2010).

The papers of Glöer et Pešić (2006) and Glöer et Georgiev (2009, 2011) showed that the species diversity of the genus *Bythinella* in Bulgaria is higher as

yet known, and needs detailed investigations. Up to now there are 20 species described as new in Bulgaria (Georgiev, 2011a). However molecular studies of Falniowski et al., 2009a, 2012 and Falniowski & Szarowska (2012) showed low molecular distinctness of some Bulgarian *Bythinella* populations, and proposed low diversity of this genus in the country studying cytochrome oxidase subunit I (COI). Such projects are now in progress and possibly will throw some light on the phylogeny and radiation of these minute snails. Many questions were raised as for example how the small, egg-shape shelled strictly stygobiotic species from the Rhodope Mountains, *Bythinella markovi* Glöer & Georgiev, 2009 can be conspecific with the larger, dark pigmented *Bythinella hansboetersi* Glöer & Pešić, 2006 from a surface spring at the crest of Stara Planina Mountains.

In this paper we describe a new species of the genus *Bythinella* from the Belasitsa Mountains. This area in Bulgaria, as well the nearby bordering areas of Greece and Macedonia, remains almost without research for Rissooidea. Our studies comprise both morphology and anatomy of the reproductive organs.

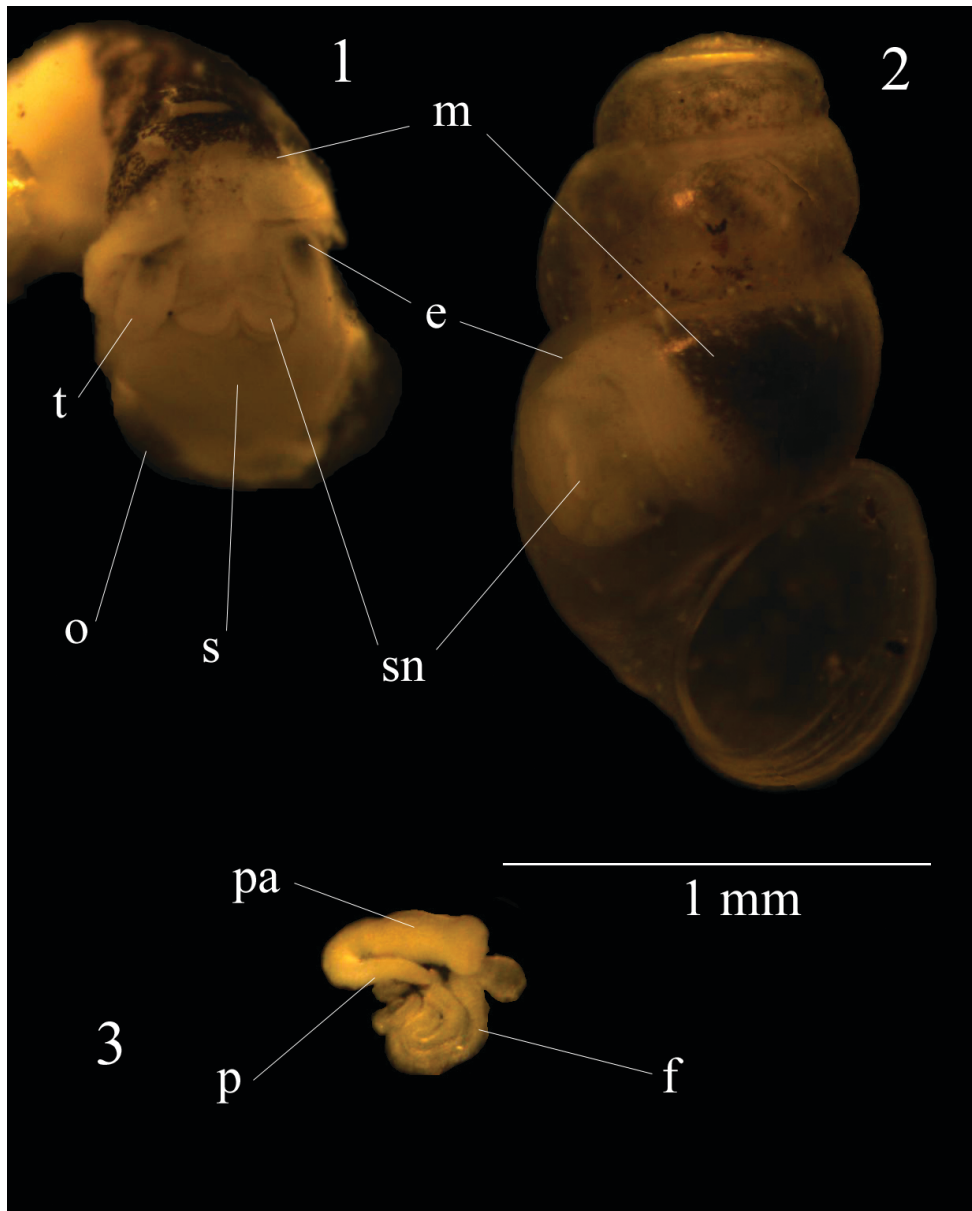


Fig. 1. Shell of the holotype, soft body and penis of *Bythinella fabiae* n. sp.: e – eye, s – sole, t – tentacle, sn – snout, m – mantle, p – penis, pa – penial appendix, f – flagellum.

Material and methods

The living snails were collected by hand and preserved in 75% ethanol. The dissections and measurements of the shells were carried out by means of a CETI stereo microscope and an eye-piece micrometer; some photographs were made with a camera system with a digital adapter. The holotype and 3 paratypes are stored in the Hungarian Natural History Museum, additional paratypes are stored in the Naturhistorisches Museum Bern, Switzerland.

For species differentiation we accept as main characters the ratio of the penis to the penial appendix, the length and the shape of the flagellum, penis and penial appendix, the soft body pigmentation, and the shell shape, and size (Boeters, 1980, Schütt, 1980, Radoman, 1983, Falniowski et al., 2009b, Glöer & Georgiev, 2011, Glöer, 2013). Habitat data was also considered.

Abbreviations used: H – shell height, W – shell width, AH – aperture height, AW – aperture width, LH – last whorl height, HNHM – Hungarian Natural His-

tory Museum, NMBE – Naturhistorisches Museum Bern, NMNH – National Museum of Natural History Sofia.

Results and discussion

Bythinella fabiae n. sp.

Material examined: 30 ex. from the type locality (27 ad., 3 juv., 2 ad. males dissected, 7 shells measured), 10.10.2012, Fabia Knechtle Glogger, Ulrich E. Schneppat, Ivailo Dedov, Dilian Georgiev leg.

Holotype: H = 1.98 mm, W = 1.16 mm, AH = 0.92 mm, AW = 0.73 mm, LH = 1.49 mm, HNHM 98831. Paratypes: 3 ex., HNHM 98832; 3 ex., NMBE; 9 ex., NMNH.

Locus typicus: South-West Bulgaria, Belasitsa Mountains, Leshnishki Waterfall, Municipality of Petrich, northern slope of Kongur Peak, 41° 21' 42.91" N 23° 10' 52.22" E, 707 m alt.

Etymology: The species was named after Fabia Knechtle Glogger who firstly found that the Leshnishki waterfall was inhabited by freshwater snails and has collected a lot of the material.

Description: Shell: The shell is cylindrical, pale greenish-yellow, with 3.5–4.5 whorls. The apex is obtuse to flat and the aperture is ovoid. The operculum is brown-yellowish, soft and translucent. Shell measurements (Table 1): H = 1.88–2.31 mm, W = 1.09–1.29 mm, AH = 0.89–0.97 mm, AW = 0.73–0.89 mm, LH = 1.49–1.72 mm, W/H = 0.48–0.68, AH/H = 0.39–0.53, LH/H = 0.70–0.88.

Soft body morphology: The mantle is grey with white border, other soft parts are yellowish-white with small patches of dark pigment, in some specimens concentrated around the eyes (Fig. 1). Tentacles are a little longer than the snout, with rounded apical parts.

Penis: The penis is as long as the penial appendix, regularly broad with rounded apex. The flagellum is long and irregularly broad, having thinner proximal part and thicker distal one with rounded top. The colour of all these structures is yellowish-white.

Diagnosis: The new species differs from the single other species of *Bythinella* known from this mountain area, *B. slaveyae* Glöer & Georgiev, 2009, by its longer penis and flagellum. Both structures are quite shorter and also thicker in the *B. slaveyae*.

From the other 7 Bulgarian species from this genus, having penis:penial appendix ratio 1:1 (Glöer &

Pešić, 2006, Georgiev, 2009, 2011b, Georgiev & Glöer, 2013, Glöer & Georgiev, 2009, 2011, Georgiev & Stoycheva, 2011) like in *B. fabiae* n. sp., (Table 1, 2) the new species differs by:

- *Bythinella markovi* Glöer & Georgiev, 2009 (locus typicus Gargina Dupka Cave, West Rhodope Mountains) – by its larger shell and longer flagellum (also the species discussed is a stygobiont);
- *Bythinella srednogorica* Glöer & Georgiev, 2009 (locus typicus Sashtinska Sredna Gora Mountains, small stream west of Dylevo Village in *Carpinus orientalis* and *Quercus* spp. forest) – by its narrower penial appendix, smaller shell size and grey mantle;
- *Bythinella smolyanica* Glöer & Georgiev, 2011 (locus typicus small creek at meadows near Smolyanski Lakes, West Rhodope Mountains) – by its smaller shell size, not so much pointed distal part of flagellum, and a thinner proximal part;
- *Bythinella elenae* Glöer & Georgiev, 2011 (locus typicus karst spring at a cave near Malko Tarnovo Town, Strandzha Mountains) – by its thinner penis with apex less pointed, and the flagellum morphology (regularly broad in *B. elenae*);
- *Bythinella margritae* Glöer & Georgiev, 2011 (locus typicus a spring at water source near village of Mladezhko, Strandzha Mountains) – by its irregularly broad and longer flagellum;
- *Bythinella kleptuzica* Glöer & Georgiev, 2011 (locus typicus Kleptuza Spring, Velingrad Town, West Rhodopes Mountains) – by its rounded penis apex, not so broad penial appendix, thick distal part of the flagellum and smaller shell height;
- *Bythinella rhodopensis* Glöer & Georgiev, 2011 (locus typicus spring near Modar Peak, West Rhodopes Mountains) – by its less thickened and less rounded part of flagellum.

All these species live in different habitats from this one of the new species: small streams (*B. srednogorica* and *B. smolyanica*), spring areas not far from few meters from the source (*B. elenae*, *B. margritae* and *B. kleptuzica*) or a cave stream (*B. markovi*).

In addition *B. elenae* and *B. margritae* have a dark spot on the penes which discern these species from all other species discussed.

It has to be noted and that the first loop of the flagellum of *B. fabiae* n. sp. is very close to the penis, while in *B. srednogorica* it is far away from it.

Because Belasitsa Mountains are bordering with two more countries as Greece and Macedonia, we com-

Table 1. Shell measurements (in mm) and proportions of *Bythinella fabiae* n. sp.

N	H	W	AH	AW	LH	W/H	AH/H	LH/H
1 (holotype)	1.98	1.16	0.92	0.73	1.49	0.58	0.47	0.75
2	1.98	1.16	0.92	0.83	1.65	0.58	0.47	0.83
3	2.28	1.09	0.92	0.83	1.58	0.48	0.41	0.70
4	1.88	1.29	0.92	0.89	1.65	0.68	0.49	0.88
5	2.31	1.22	0.89	0.86	1.72	0.53	0.39	0.74
6	1.85	1.22	0.97	0.76	1.62	0.66	0.53	0.88
7	1.85	1.19	0.89	0.79	1.58	0.64	0.48	0.86
Average	2.02	1.19	0.92	0.81	1.61	0.59	0.46	0.80

Table 2. Morphological and anatomical distinguishing features of *Bythinella* spp. known in Bulgaria which have penis:penial appendix ratio 1:1 (with habitat data). Abbreviations: P – penis: 0 – regularly broad, 1 – broad based; PT – penis tip: 0 – rounded, 1 – pointed; PP – penis pigmentation: 0 – white, 1 – white with a dark spot; PA – penial appendix: 0 – as broad as the penis, 1 – two times broader than the penis, 2 – three times broader than the penis; FP – flagellum, proximal: 0 – very slim, 1 – thin, 2 – regularly broad, 3 – broad; FD – flagellum, distal: 0 – regularly slim, 1 – slightly thickened, 2 – club shaped, 3 – regularly broad, 4 – thickened; FL – length of the flagellum: 0 – short, 1 – medium sized, 2 – long; MP – mantle pigmentation: 0 – white, 1 – uniformly dark grey, 2 – grey with white border, 3 – black with white border; SH – shell shape: 0 – normal, 1 – slim, 2 – broad body whorl; H – height of the shell: 0 – <2.5 mm, 1 – >2.5<3.0 mm, 2 – >3.0 mm.

<i>Bythinella</i> species	P	PT	PP	PA	FP	FD	FL	MP	SH	H	Habitat
<i>B. fabiae</i> n. sp.	0	0	0	1	1	4	2	2	0	0	creek
<i>B. markovi</i> Glöer & Georgiev, 2009	0	0	0	0	3	1	0	0	2	0	cave stream
<i>B. srednogorica</i> Glöer & Georgiev, 2009	0	0	0	2	1	0	2	1	0	2	stream
<i>B. smolyanica</i> Glöer & Georgiev, 2011	0	0	0	2	2	2	1	2	1	2	stream
<i>B. elenae</i> Glöer & Georgiev, 2011	1	1	1	0	2	1	1	3	0	1	spring
<i>B. margritae</i> Glöer & Georgiev, 2011	0	0	1	0	2	0	1	3	0	1	spring
<i>B. kleptuzica</i> Glöer & Georgiev, 2011	1	0	1	2	1	2	1	2	1	1	spring
<i>B. rhodopensis</i> Glöer & Georgiev, 2011	0	0	0	1	0	3	0	3	1	2	spring

pared the new species with the known *Bythinella* species from these countries.

Greece

In Greece the only species described from the main land was *Bythinella charpentieri* (Roth, 1855) but only on the shell morphology (Schütt 1980, Reischütz 1988, Bank 2006). *B. fabiae* n. sp. is different from this species by its quite smaller shell (according Schütt (1980). In *B. charpentieri* the shell is 3 mm in height and 1.8 mm wide. The smaller number of whorls in *B. charpentieri* is also characteristic – it has 4.5–5 whorls versus 3.5–4.5 in the new species.

All other species else known from Greece are considered to be endemics on single islands (Schütt 1980, Reischütz 1988, Bank 2006, Glöer & Georgiev 2012,

Falniowski et al. 2016): *B. cabirius* (Reischütz, 1988) from Samothraki Island, *Bythinella cretensis* Schütt, 1980 from Crete, *B. kosensis* Schütt, 1980, from the island of Kos, and *Bythinella walensae* Falniowski, Hofman & Rysiewska 2016) from Naxos.

Falniowski & Szarowska (2011) recognised 10 molecularly distinct species in continental Greece but those are not described up to now. Some of them have similar characters (penis:penial appendix ratio, flagellum length and shape) as *B. fabiae* n. sp. and occur far south to its type locality (approximately at the level of the Korfu Island).

Republic of North Macedonia

From *B. drimica* Radoman, 1976 *B. fabiae* n. sp. differs by its larger size (according Radoman (1983) the

biggest specimens of *B. drimica* hardly exceed 2 mm in shell height), and the soft body colour (in the species discussed it can be uniformly black or white in the subterranean form).

From *B. melovskii* Glöer & Slavevska-Stamenković, 2015 it differs by the penis:penial appendix ratio. The penis is shorter in *B. melovskii* (Glöer & Slavevska-Stamenković, 2015).

B. golemoensis Glöer & Mrkvicka, 2015 is quite larger than the new species (H = 2.7–2.9 mm, W = 1.6–1.7 mm) and has a shorter flagellum (Glöer & Mrkvicka, 2015).

Distribution: Up to now known only from the type locality.

Habitat: Small mountain stream on silicate rocks, surrounded by broad-leaf forest of *Castanea sativa*, *Fagus sylvatica*, *Carpinus betulus*, *Tilia* sp. The species was found to live on wet moss, under dead leaves of *Castanea sativa* and under stones in the creek.

Associated molluscs: The *B. fabiae* was found to live together with *Ancylus fluviatilis* and an unidentified species of the genus *Grossuana*.

Identification key to *Bythinella* spp. known in Bulgaria which having penis:penial appendix ratio 1:1

- 1. Penis uniformly white 2.
- Penis white with a dark spot 3.
- 2. Flagellum distally thickened *B. fabiae* n. sp.
- Flagellum distally regularly slim, slightly thickened, club shaped or regularly broad 4.
- 3. Penis regularly broad with rounded tip, flagellum distally regularly slim *B. margritae*
- Penis broad based with pointed tip, flagellum distally slightly thickened *B. elenae*
- 4. Shell with broad body whorl, mantle white *B. markovi*
- Shell normal or slim, mantle with dark pigmentation 5.
- 5. Flagellum short, black with white border *B. rhodopenensis*
- Flagellum medium sized or long, mantle grey 6.
- 6. Flagellum long, mantle uniformly grey *B. srednogorica*
- Flagellum medium sized, mantle grey with white border 7.

- 7. Penis tip pointed, flagellum proximal thin *B. kleptuzica*
- Penis tip rounded, flagellum proximal regularly broad *B. smolyanica*

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