CONTRIBUTION TO THE MORPHOLOGY OF 
THE BULGARIAN STYGOBIONT TRUNCATELLOIDEA 
(CAENOGASTROPODA)

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abstract: The paper deals with morphology of the representatives of an entirely stygobiont, molecularly 
distinct and ancient clade of Bulgarian Truncateelloidea. Ten nominal species of seven genera (two of them 
new: Devetakia Georgiev and Stoyanovia Georgiev) are analysed; six of them (except four 
Pontobelgrandiella 
species) are re-described. The knowledge of subterranean stygobiont gastropods is still limited; cave-
dwelling species are mostly known only from empty shells found on the surface. The study includes all 
the Bulgarian stygobiont truncateelloideans known not only from empty shells. Their shells, soft part 
pigmentation, female reproductive organs and penes are presented. The results are compared with 
fragmentary data from the literature.

key words: Hydrobiidae, stygobiont, new genus, shell, pigmentation, reproductive organs, Bulgaria

INTRODUCTION

The knowledge of subterranean, stygobiont gastropods is still limited. Especially cave-dwelling spe-
cies are usually known only from empty shells found on the surface. Many species and genera of subterra-
near truncateelloideans have recently been described from Bulgaria, as a result of the regular exploration 
of the cave fauna (BERON 2007). RADOMAN (1978) described the genus Pontobelgrandiella, designating P. 
nitida (Angelov, 1972) as the type species; its shell, soft part morphology and anatomy were described by 
RADOMAN (1983) and SZAROWSKA (2006). Later, several nominal species of Pontobelgrandiella (often as Belgrandiella Wagner, 1927) were described from Bulgaria (GEORGIEV 2011a, 2013), based exclusively 
on the shell and penial morphology. This study deals with ten species of seven genera (Pontobelgrandiella 
has been presented elsewhere: RYSIEWSKA et al. 2016); the paper deals with all the nominal taxa of 
stygobiont gastropods known from Bulgaria and available not only as empty shells. Many of these 
taxa are known from one site each: Balkanica yankovi Georgiev, 2011, Balkanospesm schniebsae (Georgiev, 
2011), Devetakia krushunica Georgiev et Glöer, 2011 and Devetakia mandrica Georgiev, 2012 (GEORGIEV 
2011b, GEORGIEV & GLÖER 2011, GEORGIEV 2012). Some are known from two sites: “Bythiospeum” stoyano-
vi Georgiev, 2013, “Bythiospeum” devetakium Georgiev et Glöer, 2013 and Cavernisa zaschevi (Angelov, 1959) 
(Georgiev 2013, Georgiev & Glöer 2013); only Pontobelgrandiella is widely distributed (RYSIEWSKA et al. 
2016). There are also records of a new species of Bythiospeum Bourguignat, 1882, but the occur-
rence of the representatives of this genus in Bulgaria has never been confirmed. Several representatives of the Moitessieriidae, like *Paladilhiopsis* Pavlovic, 1913, or *Iglica* Wagner, 1927, are erroneously assigned to *Bythiospeum* (e.g. SLAPNIK 1995). Moreover, nearly any truncatelloid with a tiny, turritiform shell, found in a spring or cave, may be described as “*Bythiospeum*”, despite the fact that it definitely does not belong to the family Moitessieriidae, and represents Hydrobiidae/Sadlerianinae (e.g. FALNIOWSKI et al. 2014). The small number of specimens available – some nominal species represented by single empty shells – coupled with the rudimentary knowledge of their anatomy, biology, distribution, etc., resulted in dozens of nominal species, whose distinctness and phylogenetic relationships are doubtful.

Our molecular study of the obligatory stygobiont Bulgarian truncatelloids revealed a monophyletic, highly supported lineage, including five distinct clades of presumably generic level (OSIKOWSKI et al. in press). The stygobiont snails live in populations composed of extremely small number of specimens, and are not easy to collect. Thus many species are known as empty shells only, or a few fixed specimens. The aim of this paper is to re-describe the truncatelloidean taxa inhabiting caves of Bulgaria.

**MATERIAL AND METHODS**

**SAMPLE COLLECTION AND FIXATION**

Snails were collected from 13 cave localities in Bulgaria either by hand or with a sieve (Fig. 1, Table 1). The snails were washed in 80% ethanol and left to stand in it for about 12 hours. The ethanol was then changed twice during 24 hours.

**MORPHOLOGICAL TECHNIQUES**

The shells were cleaned with an ultrasonic cleaner, and photographed with a CANON EOS 50D digital camera. The snails were dissected and their penes photographed under a NIKON SMZ18 stereoscopic microscope with dark field and phase contrast, and a CANON EOS 50D digital camera. The female reproductive organs were drawn with a NIKON drawing apparatus. Original descriptions were used for comparisons (RADOMAN 1983, GEORGIEV 2011b, 2012, 2013, GEORGIEV & GLOER 2011, 2013).

![Fig. 1. Localities of the studied cave gastropods in Bulgaria (see: Table 1)]
RESULTS AND DISCUSSION

*Balkanica* Georgiev, 2011

*Balkanica yankovi* Georgiev, 2011

**Material**: Sulari and Yantra villages, Izvora (Padaloto, Yantra) cave, Stara Planina Mts (locality 1).

**Shell** (*Figs 2–8*) very small (1.3 mm high), broad and ovate-conical with a moderately high spire formed by 3.5 relatively fast growing whorls separated by a moderately deep suture. Aperture oval to pyriform, surrounded by a well-marked continuous lip (*Fig. 2*). Shell yellowish and translucent. Soft parts unpigmented (*Fig. 2*), eyes absent. Female reproductive organs (*Fig. 9*), unknown until now, include a short and broad pallial accessory gland complex, a large bursa copulatrix with a moderately long duct, a broad loop of oviduct and one receptaculum seminis, small and cylindrical in shape, in the position of rs (after *Radoman* 1973, 1983, *Szarowska* 2006). Penis (*Figs 10–12*) simple, bent at half its length, and gradually narrowing, with a glandular outgrowth on its left side, at approximately half penis length.

*Pontobelgrandiella* Georgiev, 2012

*Balkanospeum schniebsae* (Georgiev, 2011)

**Material**: Zdravkovets village, Machanov Trap cave, Stara Planina Mts

**Shell** (*Figs 13–15*) elongate-conical, with a rather high spire formed by 4.5–5 regularly growing whorls, moderately convex and separated by a moderately deep suture. Aperture oval, surrounded by a well-marked continuous lip (although less developed than in *Balkanica*). Shell whitish, shiny and translucent. Soft parts unpigmented (*Figs 13–15*), eyes absent (*Fig. 16*). Female reproductive organs similar to those of *Balkanica*. Penis (*Figs 16–17*) simple, bent, long and narrow, with a characteristic outgrowth on its left side, approximately at half penis length.

*Devetakia* Georgiev et Glöer, 2011

GEORGIEV & GLÖER (2011) described a new genus *Devetakia*, with two species: *D. krushunica* Georgiev et Glöer, 2011 from Urushka Maara cave (type species) (locality 4) and *D. pandurskii* Georgiev
et Glöer, 2011 from Devetashka cave (locality 6). It should be noted that GEORGIEV (2011c) described, also from Devetashka cave, Belgrandiella pandurskii Georgiev, 2011, which actually represents the genus Pontobelgrandiella and should not be confused with Devetakia pandurskii. The shells of the two nominal species of Devetakia were practically identical. All the descriptions were based on the shells alone, thus the species distinctness of these taxa resulted mainly from a belief that cave fauna must be isolated and inevitably speciates without any stasis. Later, GEORGIEV (2012) described a third nominal species of Devetakia, D. mandrica Georgiev, 2012, from Mandrata cave. The shell of D. mandrica was different from those of its two congeners, as the latter had much deeper sutures and more convex whorls. In this paper, all the morphological data concern D. mandrica, since the material of the remaining species was not sufficient.

**Devetakia mandrica** Georgiev, 2012

**Material:** Chavdartsi village, Mandrata cave, N foothills of Stara Planina Mts (locality 3).

**Shell** (Figs 18–24) cylindrical or nearly cylindrical, with 4–4.5 flat whorls separated by a shallow suture.
Contribution to the Bulgarian stygobiont Truncatelloidea

Figs 13–15. Shells of *Balkanospeum schniebsae*, bar equals 1 mm

Figs 10–12. Penes of *Balkanica yankovi*, asterisks indicate the glandular outgrowth, bars equal 0.1 mm

Figs 16–17. Soft parts of male *Balkanospeum schniebsae*, bar equals 0.2 mm: 16 – eyeless head with penis, visible left cephalic tentacle and radula; 17 – penis; asterisks indicate the outgrowth on the left side
Spire high, apex flat. Aperture oval, peristome continuous, umbilicus slit-like, outer lip slightly developed; shell translucent, fragile and shiny. Soft parts unpigmented (Figs 18–24), eyes absent. Female reproductive organs (Fig. 25), unknown so far, with a moderately broad pallial accessory gland complex, a small and spherical bursa copulatrix with a long duct, broad loop of oviduct and one receptaculum seminis, small and spherical in shape, in the position of rs. Penis (Figs 26–27) bent, long and narrow, gradually and regularly narrowing to the tip, with an outgrowth close to the base on its left side; this outgrowth was overlooked by GeorGiev (2012).

Fig. 25. Female reproductive organs of Devetakia mandrica, bar equals 0.5 mm (BC – bursa copulatrix, CBC – duct of bursa copulatrix, GA – albuminoid gland, GN – nidamental gland, GP – gonoporus, OV – oviduct, OVL – loop of (renal) oviduct, RS – receptaculum seminis (in position of RS₁, close to duct of bursa joining oviduct), VC – ventral channel)
Contribution to the Bulgarian stygobiont Truncatelloidea

Cavernisa Radoman, 1978

_Cavernisa zaschevi_ (Angelov, 1959)

**Material**: Tserovo village, Vodnata cave (locality 12) and Tserovo village, Yamata cave (locality 13).

At locality 12, a few specimens were found (Figs 28–34) with very small (slightly above 1 mm) shells resembling the ones from Yamata cave (locality 13). Operculum thin and colourless, except for the orange nucleus. Soft parts unpigmented, eyes absent.

Figs 26–27. Penis of _Devetakia mandrica_: 26 – in situ, with right cephalic tentacle; 27 – under cover slip; bar equals 0.1 mm; asterisks indicate the outgrowth on the left side

Figs 28–34. Shells of _Cavernisa zaschevi_, locality 12, bar equals 1 mm
Penis (Fig. 35) simple and bent, without any outgrowths. Radoman (1983) drew a blunt and narrow outgrowth on the left side of the penis. Female reproductive organs include a large bursa copulatrix and one receptaculum seminis, in the position of rs1.

At locality 13, six specimens were found with barrel-shaped shells (Figs 36–39) with 4.5 convex whorls separated by a rather deep suture. Aperture oval, peristome continuous, with a slightly marked outer lip, umbilicus in the form of broad slit. Shell white, thin-walled and translucent. Soft parts unpigmented (Figs 36–39), eyes absent. Female reproductive organs resemble the ones from locality 12 and consist of one receptaculum (in the position of rs1) and a large bursa copulatrix with a short duct. Penis simple, with a small outgrowth on its left side.

**Devetakiola Georgiev n. gen.**

Type species: Bythiospeum devetakium Georgiev et Glöer, 2013; monotypic genus

The diagnosis and description are identical with those presented for Bythiospeum devetakium by Georgiev & Glöer (2013). The shells resemble those of Pontobelgrandiella, the soft part morphology and anatomy are unknown. Devetakiola is recognised on molecular basis (Osikowski et al. in press), as it forms a molecularly distinct clade (Fig. 40), evidently no less distinct than the other taxa representing the genera included in this study. Thus, as long as we do not consider all those taxa as congeneric, Devetakiola deserves a genus rank.

**Devetakiola devetakium** (Georgiev et Glöer, 2013)

**Material:** Alexandrovo, Brashlyanskata cave, N foothills of Stara Planina Mts, (locality 10) and Prevala

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Fig. 35. Penis of Cavernisa zaschevi, bar equals 0.1 mm

Figs 36–39. Shells of Cavernisa zaschevi, locality 13, bar equals 1 mm
village, spring near Vreloto cave, N foothills of Stara Planina Mts (locality 11).

At localities 10 (Figs 41–42) and 11 (Fig. 43), three snails were collected, illustrated in the corresponding figures. Their soft part morphology and anatomy remain unknown; more material is needed for morphological studies.

**Stoyanovia Georgiev n. gen.**

Type species: *Bythiospeum stoyanovi* Georgiev, 2013; monotypic genus

The diagnosis and description are identical with those presented for *Bythiospeum stoyanovi* by Georgiev (2013). Shell conical, with the narrowest and most...
slender spire among the taxa discussed in this paper. *Stoyanovia* forms a molecularly distinct clade (Fig. 40), evidently no less distinct than the other genera included in this study (Osikowski et al. in press). Thus, as long as we do not consider all those taxa as congeneric, *Stoyanovia* deserves a genus rank.

**Stoyanovia stoyanovi** (Georgiev, 2013)

**Material:** Bezhanovo village, Parnitsite cave, N foothills of Stara Planina Mts. (locality 9).

**Shell** (Figs 44–48) ovate-conical with a high spire formed by 4–4.5 rather flat and rapidly growing whorls separated by a rather shallow suture. Aperture small and oval, peristome continuous, with a slightly marked outer lip, umbilicus absent. Shell thin-walled, whitish and slightly translucent. Soft parts unpigmented (Figs 44–48), eyes absent. Female reproductive organs unknown (no well-fixed female specimens were available), penis simple, conical, tapered distally, with a rounded tip.

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