

# TAURINELLUSHKA BABUGANA GEN. NOV., SP. NOV. (STYLOMMATOPHORA: PRISTILOMATINAE) FROM THE CRIMEAN MOUNTAINS (UKRAINE) AND REVISION OF CRIMEAN MEDITERRANEA (OXYCHILINAE)

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*Abstract* Taurinellushka babugana gen. nov., sp. nov., from Crimea, is described on the basis of shell and anatomical characters. Taurinellushka babugana is close to and compared with Troglavitrea Negrea & Riedel 1968 from the caves of Romania, but is distinguished by the unusual inner structure of the penis and position of the elongated perivaginal gland. The shell is similar to the several other species of Pristilomatinae and Oxychilinae, necessitating a revision of Crimean Mediterranea. Both Hyalina kamia Puzanov 1925 and Hyalinia iphigeniae Lindholm 1926 are confirmed to be the junior synonyms of Mediterranea hydatina (Rossmässler 1838). Taurinellushka babugana is most numerous in the beech forests on the southern slopes of the Babugan mountainous massif. Empty shells were found on the northern slopes, and also on Gurzuf, Chatyr-Dag and Demerdji massifs. All findings were made between 1050–1545 m altitude, contrasting with the coastal distribution of the similar M. hydatina. Taurinellushka babugana is less variable, smaller (up to 3.8 mm against 6.2 mm), with a narrower umbilicus, wider last whorl and lower spire, and is less striated and not pigmented. Nevertheless the shells are very similar to some juveniles of M. hydatina.

*Key words* Taurinellushka babugana, Mediterranea, Zonitidae, Crimea, Ukraine

## INTRODUCTION

The Crimean Mountains run parallel to the Black Sea coast on the south of the Crimean Peninsula (southern Ukraine), and are 160 km long, 50 km wide and reach an altitude of 1545 m (Fig. 1). Faunistically the Crimean mountains are connected with the Caucasus, the northern Pontic Mountains and the eastern Balkan Peninsula. Each mountain system contains very diverse habitat conditions, and some invertebrate populations exist in very restricted areas. Therefore additions to the malacofauna continue to be made including probably native species such as *Vertigo moulinsiana* (Dupuy 1849), *Deroceras subagreste* (Simroth 1892), *Boettgerilla pallens* Simroth 1912 and *Selenochlamys* cf. *ysbryda* Rowson & Symondson 2008 that were recorded for the first time in Crimea in 2009–2012 (Gural-Sverlova *et al.*, 2009; Balashov & Palatov, 2011; Balashov, 2012; Balashov & Baidashnikov, 2012). The 104 species of terrestrial molluscs currently registered in Crimea include 21 endemics (Balashov & Gural-Sverlova, 2012; Balashov, 2012; Balashov & Baidashnikov, 2012, 2013).

This study of the anatomy of minute Crimean zonitid snails represents the latest finding of a new species and a new genus of Pristilomatinae.

The newly discovered species has a very specific anatomy (see below), but its shell is similar to that of several other species of Pristilomatinae and Oxychilinae. One of these species, *Mediterranea hydatina* (Rossmässler 1838), occurs in Crimea with similar nominal taxa introduced by Puzanov (1925) and Lindholm (1926). *Mediterranea hydatina* can be clearly determined only by its anatomy but this has not been confirmed from Crimean material. Consequently this species is revised to avoid confusion with the new taxon.

## MATERIAL AND METHODS

The majority of studied specimens are housed in the I.I. Schmalhausen Institute of Zoology, Kiev (IZ). Most specimens were collected by Dr. A.A. Baidashnikov (IZ) between 1987–1989 with others by the author between 2011–2012. Syntypes of *Hyalinia iphigeniae* Lindholm 1926 were studied in collection of Zoological Institute of Russian Academy of Sciences, Saint Petersburg (ZIN).

## RESULTS

### SYSTEMATICS

#### Zonitidae Mörch 1864

The Oxychilinae and Pristilomatinae are regarded, by some, as subfamilies of Zonitidae

(Riedel, 1980, 1998; Schileyko, 2003), as followed here. In the classification of Bouchet & Rocroi (2005) they are raised to family level and placed within the Gastrodontoidea Tryon 1866.

**Oxychilinae** Hesse 1927

***Mediterranea*** Clessin 1880

*Hyalina* (*Vitrea* (*Mediterranea*)) Clessin, 1880: 207.  
*Oxychilus* (*Riedelius*) Hudec, 1961: 110, species typical *Hyalina inopinata* Uličný 1887; Riedel, 1969: 98.

*Oxychilus* (*Mediterranea*) – Giusti *et al.*, 1985: 21; Riedel, 1990: 529; Riedel, 1998: 45; Schileyko, 2003: 1435.

*Mediterranea* – Cianfanelli *et al.*, 2005: 646.

*Species typica* *Helix hydatina* Rossmässler 1838 subsequently designated by Forcart, 1957: 121.

**Diagnosis** Inner surface of penis with numerous regularly placed papillae provided with very small sharp thorns (Fig. 2). Penis slightly swollen, almost cylindrical or fusiform. Epiphallus relatively short and wide. Shell relatively small (up to 7 mm), *Vitrea*-like, umbilicus very narrow.

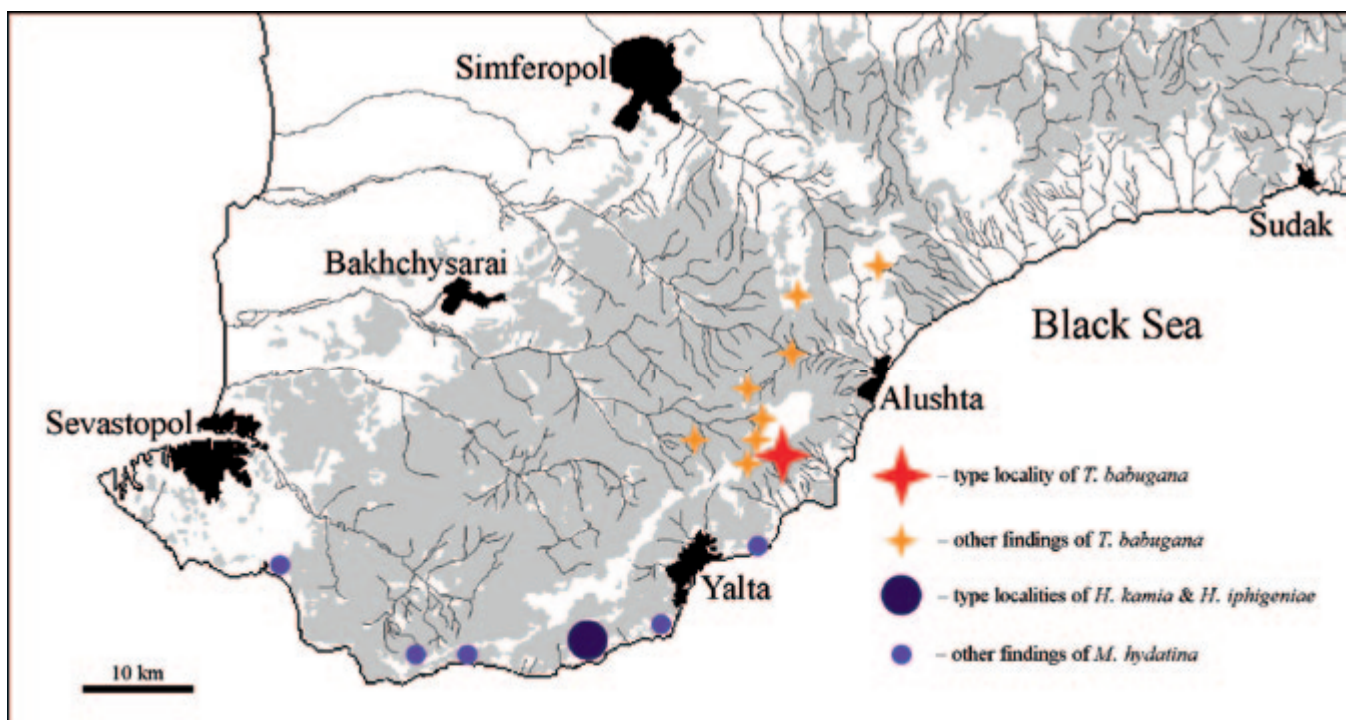
**Distribution** Mediterranean region from Canary Islands to Crimea; Central and southeastern Europe. About 7 species.

**Remarks** Schileyko (2003) revised the Oxychilinae using the inner structure of the penis to establish as separate genera some groups that previously were considered subgenera of *Oxychilus* Fitzinger 1833. Schileyko (2003) retained *Mediterranea* as a subgenus of *Oxychilus* despite the presence of thorns inside the penis (Hudec, 1961; Riedel, 1969; Giusti *et al.*, 1985; Riedel, 1990, 1998) (Fig. 2). This group is considered to be close with *Riedeliconcha* Schileyko 2003 (syn. *Riedelius* Hudec 1961 sensu Riedel, 1998) (Hudec, 1961; Riedel, 1969; Giusti *et al.*, 1985; Riedel, 1990, 1998; Cianfanelli *et al.*, 2005) and could be aggregated as genus *Mediterranea* with subgenus *Riedeliconcha*. But viewing them as the two separate close genera seems to be more reasonable if following the system of Schileyko (2003). *Mediterranea* was listed as a separate genus, for the first time, by Falkner *et al.* (2001), but they give no argumentation or explanation. Cianfanelli *et al.* (2005) viewed *Mediterranea* as a separate genus, together with *Riedeliconcha* and this arrangement is accepted here.

***Mediterranea hydatina*** (Rossmässler 1838)

Fig. 2, 3a, b, 4

*Helix hydatina* Rossmässler, 1838: 36, taf. 39 fig. 529.



**Figure 1** Distribution of *Taurinellushka babugana* and *Mediterranea hydatina* in Crimea.

*Hyalina (Crystallus) Kamia* Puzanov, 1925: 56, fig. 11, fig. 7 2, (Kamia Mountain above Simeiz town, Yalta city council, southern coast of Crimea; location of holotype is unknown).

*Hyalinia iphigeniae* Lindholm, 1926: 167 ("Srednija Limeny", currently Goluboj Zaliv village near Simeiz town, Yalta city council, southern coast of Crimea; syntypes in ZIN).

*Vitrea subeffusa* var. *depressa* non Boettger 1889 – Likharev & Rammelmeyer, 1952: 264 (partim).

*Vitrea iphigeniae* – Likharev & Rammelmeyer, 1952: 267.

*Oxychilus hydatinus* – Riedel, 1962: 221, abb. 1–3; Riedel, 1968: 495, abb. 25–30; Riedel, 1983: 374, abb 4–7; Giusti *et al.*, 1985: 21, fig. 2, pl. 2 A, 3 B; Riedel, 1998: 46, fig. 326–332. Schileyko, 2003: 1436, fig. 1868; Welter-Schultes, 2012: 384.

*Oxychilus iphigenia* [sic] – Sysoev & Schileyko, 2009: 129, fig. 65 D.

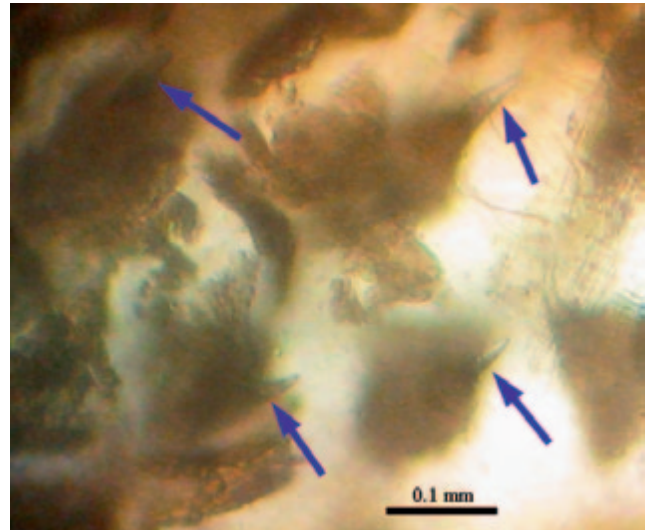
*Type locality* Corfu Island, Greece.

*Types* Unknown.

*Material* Two specimens preserved in alcohol and 44 dry shells, sites in vicinity of Simeiz town, Yalta city council (1988–1989); 2 shells, Cape Ay Todor, Yalta city council (08.10.1988); 2 shells, Cape Martyan Reserve, Yalta city council (10–11.05.1987); 1 shell, vicinity of Oliva village, Yalta city council (11.06.1989); 2 shells, southern vicinity of Orlineo village, Sevastopol city council (17.06.1989); 1 shell, Balaklava, Sevastopol city council (17.06.1988); syntypes of *Hyalinia iphigeniae* (ZIN).

*Shell* Depressed, thin, translucent, colourless to yellowish, of 4.5–5.5 whorls. Surface usually elegantly, more or less regularly, striated. Striations rather variable, sometimes very clear, sometimes weak. Upper part of last whorl, before aperture, is 1.5–2 times wider than visible part of penultimate whorl. Spire relatively high, in adult shells 1/3–1/4 of height, in juveniles may be less. Umbilicus very narrow, sometimes partly closed, width about 1/12–1/16 of shell's width. Shell height 2.5–3 mm; width 5–6.2 mm (outside Crimea 6.5 mm); aperture height to 2.3 mm, width to 3.2 mm.

*Reproductive system* Penis almost fusiform, more extended in proximal part, internally with numerous, regularly placed, papillae each



**Figure 2** Inner structure of penis in *Mediterranea hydantina* from vicinity of Simeiz Town. Thorns are marked by arrows.

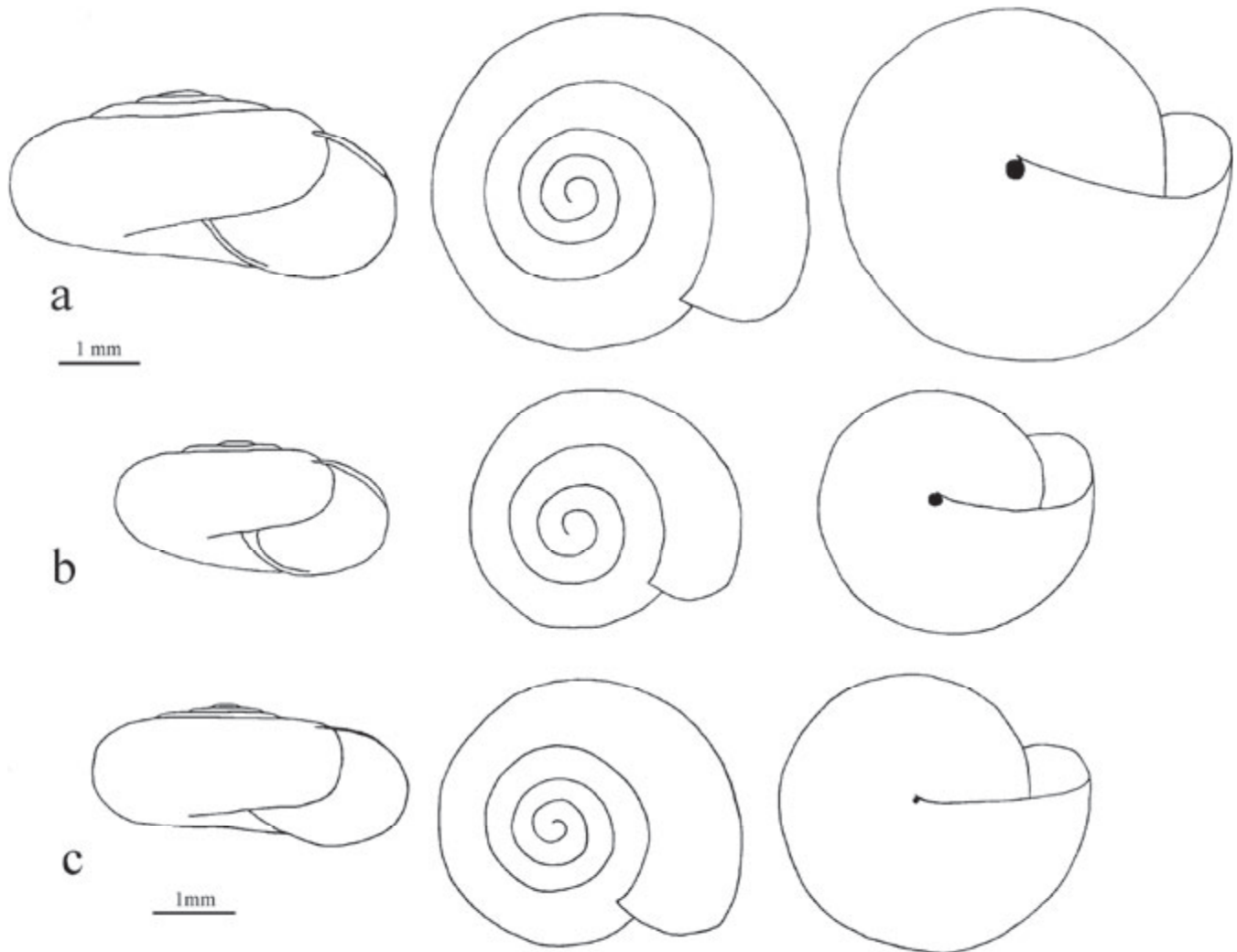
provided with very small sharp thorns (fig. 2). Penial sheath short, restricted to distal base of penis. Epiphallus shorter and thinner than penis, but relatively wide, gradually extended to proximal end, beginning of vas deferens clearly pronounced. Flagellum (or penial caecum by some authors) short, conical, not projecting, gradually turned into penis. Penial retractor single, thin, attached to proximal end of flagellum. Vas deferens thin, long. Vagina shorter and slightly wider than penis. Perivaginal gland not large, located on the one side of vagina, oviduct free, bursa copulatrix projecting (according to literature may be smaller or larger and placed otherwise, including inversely with bursa copulatrix). Free oviduct relatively short, wide. Duct of bursa copulatrix short, wide, narrowed to reservoir. Reservoir not large, elongated, oval.

*Distribution* Canary Islands, throughout Mediterranean region to Crimea; Central Europe, north to Slovakia. In Crimea (fig. 1) – coastal area between Balaklava town and Cape Martyan Reserve, mainly near Simeiz town.

*Habitats* Relatively dry rocky forests and grasslands. In Crimean Mountains up to 500 m.

*Comments* In the Crimean specimens no differences from the literature descriptions of *M. hydantina* were revealed and the anatomy conforms well with the detailed description by Giusti *et al.* (1985) from Corsica. Consequently, there are no





**Figure 3a–b** Shells of *Mediterranea hydatina* (2.3×4.9 mm and 1.7×3.3 mm) from vicinities of Simeiz town; c – paratype of *Taurinellushka babugana* (1.7×3.7 mm).

reasons to establish a Crimean population as a separate species or even a subspecies.

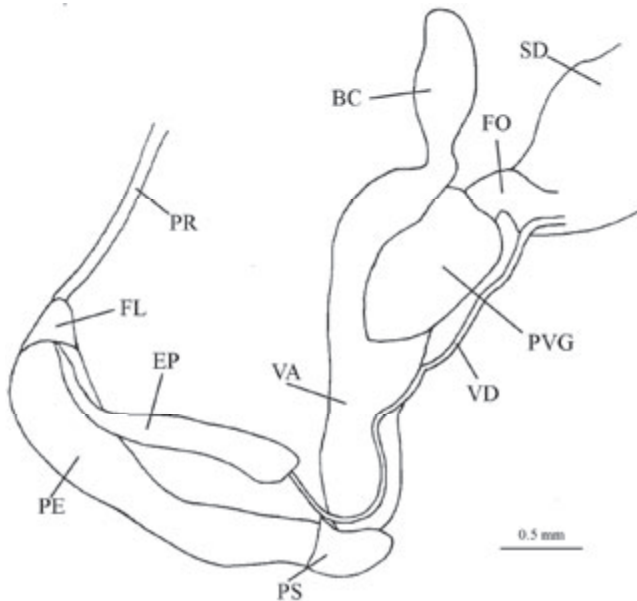
*Hyalina kamia* Puzanov (1925) and *Hyalinia iphigeniae* Lindholm (1926) were described from closely situated locations near the town of Simeiz at altitudes between 400–500 m. The holotype of the former is lost but syntypes of the latter were examined.

An examination of the reproductive system and a study of the shell variability in populations from close to these type localities of these forms clearly shows that both names are junior synonyms of *Helix hydatina* Rossmässler 1838.

A reason that *Hyalina kamia* and *Hyalinia iphigeniae* were attributed to different species is the divergent interpretations of the shell sculpture. Lindholm (1926) listed “elegantly striated” as a main characteristic of his new species and

this character was restated by Likharev & Rammelmeyer (1952) and Sysoev & Schileyko (2009). Puzanov (1925) stated that his shell was smooth despite the distinct sculpture shown in his illustration (Puzanov, 1925, fig. 7.2). Moreover this study has shown, above, that these striations are variably expressed. Lindholm (1926) noticed that “spire is slightly elevated” and Puzanov (1925) that “spire is flat, only slightly elevated”, but on the above mentioned drawing we can see that the spire is not flat at all. There is no doubt that both authors described the same species, and almost from the same place.

The restricted distribution on the coastal area from Balaklava to Cape Martyan is not unusual, and known in other species of terrestrial molluscs including the endemic *Vitrea nadejdae* Lindholm, 1926. This region of Crimea is considered to be



**Figure 4** Reproductive system of *Mediterranea hydatina* from vicinity of Simeiz Town. PE – penis; EP – epiphallus; FL – flagellum; PS – penial sheath; PR – penial retractor; VD – vas deferens; VA – vagina; PVG – perivaginal gland; FO – free oviduct; BC – bursa copulatrix; SD – spermoviduct.

subtropical in contrast to the temperate climate of the remainder of Crimea.

*Mediterranea inopinata* (Uličný, 1887) occurs in the western and south-western Ukraine, in the Carpathians, on the Podolian Upland and the Black Sea Lowland (Balashov & Gural-Sverlova, 2012; Balashov *et al.*, 2013). As the Crimean Peninsula is connected with Black Sea Lowland, it is possible that *M. inopinata* is also occurs in Crimea.

#### **Pristilomatinae** Cockerell 1891

##### *Taurinellushka* gen. nov.

*Species typica* *Taurinellushka babugana* sp. nov.  
Monotypic.

**Etymology** An arbitrary combination of letters, based on „tauri“, an Ancient Greek’s name for Crimean native people; feminine, diminutive, accent on “e”.

**Diagnosis** Shell *Vitrea*-like, colourless, up to 3.8 mm, umbilicus very narrow. Foot with undivided sole. Penis internally with two opposite high axial folds that are U-like gradually becoming connected at the proximal end. Penial sheath very thin. Epiphallus short and large. Flagellum

(penial caecum) is present. Perivaginal gland elongated as a wide and long cylindrical tube between the vagina and free oviduct at distal end and a short bursa copulatrix at proximal end.

**Remarks** Among the Zonitoidea only the Pristilomatinae have an undivided sole of the foot (Schileyko, 2003). Comparisons of *Taurinellushka* with *Mediterranea hydatina* (Oxychilinae) and *Vitrea contracta* (Wersterlund, 1871) (Pristilomatinae) showed that the foot is undivided and therefore placement of *Taurinellushka* in the Pristilomatinae is proposed. This is supported by characters of the genitalia, notably the small bursa copulatrix (Riedel, 1980; Schileyko, 2003).

About 12 genera are recognized in this group, 5 of them from Western Palaearctic (Riedel, 1980; Schileyko, 2003). *Taurinellushka* differs from all American and East Asian genera by the much shorter and wider epiphallus and the bursa copulatrix.

Unlike *Taurinellushka*, none of the following four genera have a penial caecum and differ further as outlined. In *Vitrea* Fitzinger 1833, the most speciose and widespread of the Pristilomatinae, there are stimulators inside the penis and the bursa copulatrix is absent or rudimentary (Riedel, 1966, 1980; Schileyko, 2003). In *Gyralina* Andreae 1902, from the Balkans, there are numerous thorns inside the penis, the epiphallus is long and thin, the umbilicus is broad (Riedel, 1980, 1985, 1990, 1998; Riedel & Subai, 1993; Schileyko, 2003). In the monotypic *Spinophallus* Riedel 1962 from Bulgaria there are numerous papillae and stimulator inside the penis (Riedel, 1960, 1980; Schileyko, 2003). In *Lindbergia* Riedel 1959 from Greece and Turkey there is a very long epiphallus and no folds inside the penis (Riedel, 1959, 1960, 1977, 1980; 1981a, b, 1984, 1990, 1998; Schileyko, 2003).

Among the Pristilomatinae of the Western Palaearctic only the Romanian *Troglovitrea* Negrea & Riedel 1968 has an axial fold inside the penis and a flagellum (penial caecum). Also *Troglovitrea* has a short and wide epiphallus, a small bursa copulatrix and a similar shell to *Taurinellushka*. These shared characters make *Troglovitrea* most similar to *Taurinellushka* among all other known genera. It is a monotypic troglobiotic genus from the caves of Romania, consisting of *Troglovitrea argintarui* Negrea & Riedel 1968 (Negrea & Riedel, 1968; Riedel, 1980; Schileyko, 2003; Deli & Subai,



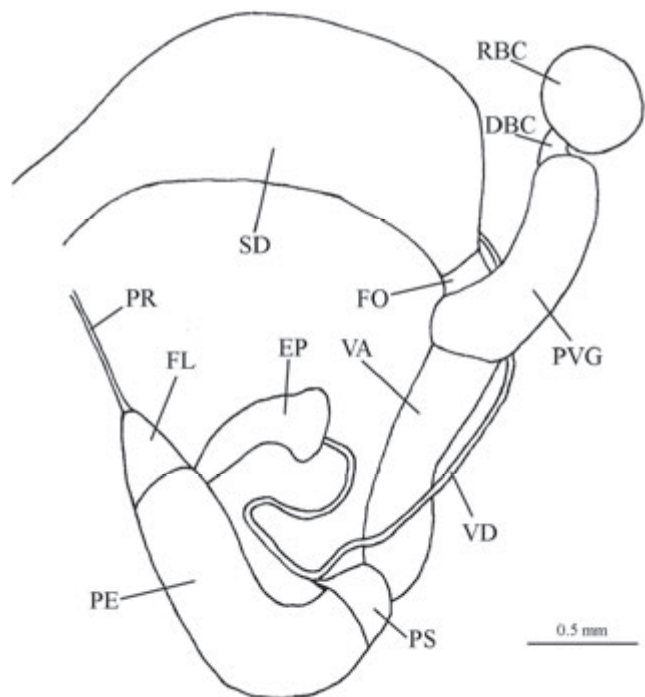
**Figure 5** Holotype of *Taurinellushka babugana* (1.6×3.2 mm).

2011; Welter-Schultes, 2012). Unfortunately the inner structure of the penis in this species was not illustrated, but only described in words: there is a single long axial fold (Negrea & Riedel, 1968; Riedel, 1980; Schileyko, 2003). So it is still quite different from the double fold in *Taurinellushka*. It also differs by its smaller than usual perivaginal gland, absence of a penial sheath, the non spherical reservoir of the bursa copulatrix, much more prominent flagellum (penial caecum) and wide penial retractor. In all Pristilomatinae other than *Taurinellushka*, the perivaginal gland is located differently with respect to the bursa copulatrix. It is placed in a similar way only in a few Oxychilinae: some species in the subgenus *Longiphallus* Riedel 1958 of *Oxychilus* (Riedel, 1966) and in the monotypic genus *Cellariopsis* Wagner, 1914 (Schileyko, 2003). But even in these species the perivaginal gland is still not so greatly displaced towards the bursa copulatrix. Consequently, the specific inner structure of the penis and the unusual position of the perivaginal gland necessitate placing this new species in a separate new genus. This genus is perhaps related to the Balkan *Troglovitrea* and/or *Lindbergia*, but probably not very closely or directly.

*Taurinellushka babugana* sp. nov.

Fig. 3c, 5, 6, 7

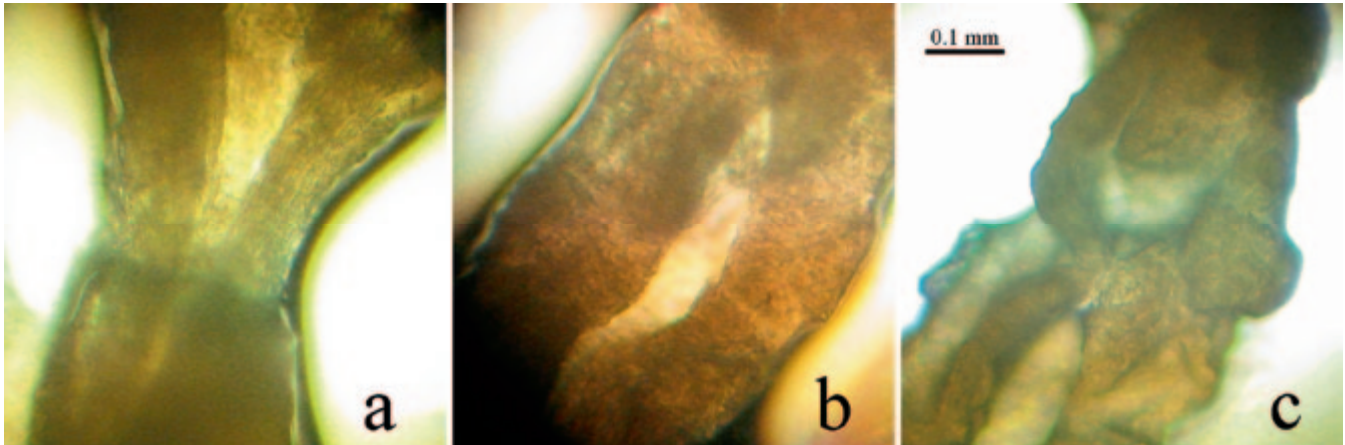
*Type locality* A deep rocky ravine with beech forest among the Crimean pine forests on the southern slope of the Babugan mountainous massif (fig. 1, 8). 44°35'42"N 34°15'27"E, 1150 m (from GPS). Nearest settlement (4.5 km to the east) – Zaprudne village (Alushta city council, Crimea, Ukraine).



**Figure 6** Reproductive system in paratype of *Taurinellushka babugana*. PE – penis; EP – epiphallus; FL – flagellum; PS – penial sheath; PR – penial retractor; VD – vas deferens; VA – vagina; PVG – perivaginal gland; FO – free oviduct; DBC – duct of bursa copulatrix; RBC – reservoir of bursa copulatrix; SD – spermoviduct.

*Material* Holotype, dry shell (1.6×3.2 mm, fig. 5, IZ 3983). Paratypes 10 dry shells (IZ 3984) from type locality (08–09.08.2012); 7 specimens in 70% alcohol (4 are dissected) and 125 dry shells from around the type locality on the southern slope of Babugan (08–10.10.1987, 03.10.1988, 06.06.1989, IZ 3985–3990). The labels of these paratypes are not precise enough so it is quite possible that some of these specimens (including preserved in





**Figure 7** Dissected penis in paratype of *Taurinellushka babugana*: a – distal part of penis, folds in side view, walls of penis partly removed; b – middle part of penis, folds in side view, walls of penis removed; c – proximal part of penis, left fold in frontal view, walls of penis removed.

alcohol) were collected exactly at the type locality and habitat.

*Other materials* 1 shell from the peak of Roman-Kosh Mountain, highest point of Babugan and Crimea, 1545 m, open steppe (29.05.1988); 1 shell from vicinity of Kacha river's source on northern slope of Babugan, about 1100 m, beech forest (28.05.1987); 3 shells from Bolshaya Chuchel Mountain, north to Babugan, about 1300 m, beech forest (02.06.1987); 1 shell from Gurzuf saddle, between Babugan and Gurzuf massifs, about 1380 m, open steppe (03.06.1989); 5 shells from Basman Mountain, north to Gurzuf massif, about 1100 m, Kokh's pine forest (01.06.1989, 922); 1 shell from vicinity of Rozovyy settlement between Babugan and Chatyr-Dag massifs, oak forest (31.05.1987); 2 shells from upper plateau of Chatyr-Dag, about 1500 m, open steppe (01.05.2011); 1 shell from vicinity of Dzhurla river's source in Demerji massif, about 1050 m, beech forest (25.04.2011).

*Etymology* From the type locality, Babugan massif, feminine, noun, unchangeable, accent on second "a".

*Shell* Depressed, thin, translucent, colourless, of 3.5–4.5 whorls. Surface is smooth to weakly striated. Upper part of last whorl before aperture is in 2–2.5 times wider than visible part of penultimate whorl. Suture weak. Spire not high, about 1/5–1/6 of shell's height. Umbilicus very narrow, sometimes partly closed, width about 1/20–1/30 of shell's width. Height of shell 1.4–1.8 mm,

width of shell 3.1–3.8 mm. Height of aperture 1.2–1.4 mm, width of aperture 1.6–1.8 mm.

*Body* Sole of foot undivided, relatively narrow and long, pointed at caudal end. Caudal foss very weak. Back keeled. Upper tentacles relatively long and wide, slightly pigmented on upper parts. Right tentacle retractor lies between male and female parts of reproductive system.

*Reproductive system* (four paratypes) Penis cylindrical to fusiform, internally with two long opposite high axial folds gradually connected in the proximal end of the penis (fig. 7). Therefore it can also be said that this is one long U-shaped fold. It stretches almost the whole length of the penis, not in flagellum. Height of the fold may reach to half of the penis width. In the different parts of penis the height of the fold can be about 3–5 times greater than its width. Penial sheath very weak and thin, around distal base of penis. Epiphallus about two times shorter than penis, but almost of same width, broad at the proximal end, so that the beginning of the vas deferens is clearly pronounced. Flagellum (or penial caecum of some authors) is short, conical, gradually turning into penis. Penial retractor single, very thin and long, attached to proximal end of flagellum. Vas deferens thin and long. Vagina close in size to penis, with weak axial structure inside. The perivaginal gland is elongated as a wide and long cylindrical tube around the proximal end of vagina and distal duct of bursa copulatrix. It covers the surface between the vagina and free oviduct at the distal end and a short bursa



**Figure 8** Type locality of *Taurinellushka babugana*.

copulatrix at the proximal end. Free oviduct short and wide. Duct of bursa copulatrix moderately short, covered by perivaginal gland, its open part much narrower than proximal end of perivaginal gland, but still quite wide, slightly narrowed to reservoir. Reservoir is relatively large, properly spherical.

*Distribution* Central Crimean Mountains (fig. 1): Babugan, Gurzuf, Chatyr-Dag and Demerdji mountainous massifs, mainly Babugan.

*Habitats* Found mainly under rocks, therefore seems to be subterranean. Most findings are in the beech forests (fig. 8), some also in the pine forests, oak forests and in the open mountainous steppe at relatively high altitudes between 1050–1545 m.

*Remarks* The shell of *T. babugana* in comparison to *Mediterranea hydatina* is less variable, smaller,

with narrower umbilicus, a wider last whorl and lower spire, is less striated and not pigmented. However some juveniles of *M. hydatina* are very similar to adult or subadult *T. babugana*. The shell of *T. babugana* is even more similar to those of *Vitrea subrimata* (Reinhardt 1871) and *Mediterranea inopinata* that occur in Eastern Europe, but these are not known in the Crimean Mountains (Balashov & Gural-Sverlova, 2012; Balashov *et al.*, 2013).

Other land molluscs have similar restricted distributions in Crimea and specifically to the beech forests of Babugan. These include *Oxychilus kobelti* and *Selenochlamys* cf. *ysbryda* (Balashov, 2012). The Crimean endemics *Thoanteus ferrarii* and *Mentissa velutina* are also mainly restricted to Babugan. *Taurinellushka babugana*, *O. kobelti* and *S.* cf. *ysbryda* live in cavities among the rocks and can be collected mainly by turning over the rocks. Maybe these species also inhabit



deeper crevices and the many caves in this karst area.

The conservation status of *T. babugana* is not clear as its biology and distribution are inadequately studied. It is rarely found and restricted to undisturbed habitats suggesting that it may be vulnerable to anthropogenic disturbance. The southern slopes of Babugan are not a protected area, the main disturbance factors are the regulation of the streams to provide fresh water in the coastal area and forestry activity. The remainder of Babugan is included in the Crimean Nature Reserve and therefore at least some habitats of *T. babugana* are protected. Consequently, the conservation status of "Near Threatened" is suggested.

#### ACKNOWLEDGEMENTS

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