

***Borumastus* gen. nov. (Gastropoda, Pulmonata, Enidae),  
a new land snail genus from Turkey**

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*Borumastus* gen. nov. is described as a new genus of the family Enidae and compared conchologically and as regards the genitalia with similar genera. The new genus is characterized by an elongated shell with only a palatal tooth in its aperture, an S-shaped penile verge, longitudinal folds covering the inside walls of the penis and by the lack of a penile appendix. The only species included in the new genus is *Borumastus yildirimi* (Schütt), known from the Province of Isparta, Turkey.

Key words: Gastropoda, Pulmonata, Enidae, *Borumastus*, *Ena*, Turkey, systematics.

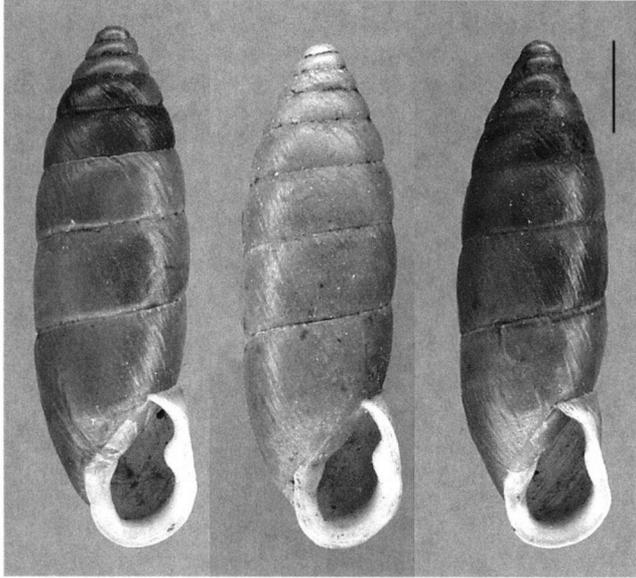


Fig. 1. Three shells of *Borumastus yildirimi* showing the variation in the prominence of the palatal tooth. All are from Kavacık Çeşmesi, Keçiborlu, Isparta (CM 66886). Scale bar 3 mm.

## INTRODUCTION

In the land snail family Eridae there are several genera with similar looking shells. As a result, the assignment of species to the correct genera requires the examination of their genitalia. The anatomy of the genitalia of *Ena yildirimi* Schütt, 1995, known only from an approximately 20-km long mountainous area between Keçiborlu and Uluborlu, Province of Isparta, in southwestern-central Turkey (Yıldırım & Schütt, 1997), has not been published before. Hausdorf (2001) did not include *E. yildirimi* in his revision of the Turkish species of *Ena* Turton, 1831, but noted, without an explanation, that it belonged to *Meijeriella* Bank, 1985. We have characterized *E. yildirimi* according to the morphology of the genitalia and conchologically and are describing a new genus, *Borlumastus*, to accommodate it.

## MATERIAL AND METHODS

We examined more than 50 adult specimens of *E. yildirimi* collected at various stations between Keçiborlu and Uluborlu, Isparta, Turkey. Sixteen specimens, three dissected, have been deposited in the Carnegie Museum of Natural History, Pittsburgh, PA, USA (CM 66886). The dimensions ( $H_t$ , total height and  $D$ , diameter) of adult shells with fully formed lips were measured. The sample means are given with sample standard deviations. To calculate the ratio of the total shell height to the aperture height ( $H_t/H_a$ ), the aperture height was measured from the bottom of the lip to the level of the insertion point of the outer lip at the upper right hand corner of the parietal wall. In the descriptions of the genitalia the term distal designates parts closest to the genital opening.

*Borlumastus* gen. nov.

Diagnosis. – Shell much higher than wide. Upper palatal lip with one tooth; parietal wall without angular tooth. Penis without appendix, penile retractor inserts at penis, penile verge S-shaped, plump, abruptly tapering. Inside walls of penis with distinct, narrow, longitudinal folds. Epiphallus with caecum and flagellum.

Type species. – *Ena yildirimi* Schütt, 1995. Presently, this is the only species in the new genus.

Etymology. – A combination of the suffix "borlu" in the names of the towns Keçiborlu and Uluborlu, the locations of which seem to delimit the range of the type species and *Mastus*, to which the new genus is related. Gender: masculine.

*Borlumastus yildirimi* (Schütt, 1995) (figs 1-3)

*Ena yildirimi* Schütt, 1995: 164, fig. 5, type locality: Akdağ, Keçiborlu, Isparta.

Shell. – As in Schütt (1995). In occasional shells the palatal tooth is less prominent than usual (third shell in fig. 1).

Measurements. Kavacık Çeşmesi, Keçiborlu, Isparta (CM 66886,  $N = 16$ ):  $H_t = 14.1-16.5$  mm, mean =  $15.6 \pm 0.6$  mm;  $D = 4.6-5.1$  mm, mean =  $4.7 \pm 0.1$  mm; mean  $H_t/H_a = 3.3$ . Various locations between Keçiborlu and Uluborlu ( $N = 42$ ):  $H_t = 12.0-17.0$  mm, mean =  $15.0 \pm 1.2$  mm;  $D = 4.0-5.1$  mm, mean =  $4.8 \pm 0.3$  mm. The 18.2 mm long holotype (SMF 318788) appears to be an unusually large specimen.

Genitalia. – Penis lacks an appendix (fig. 2). The retractor muscle of the penis attaches to the penis slightly below the junction of the epiphallus and penis. The penile verge (~0.63 mm long) is S-shaped, plump and has numerous deep grooves on its surface; toward its dis-

tal end it abruptly tapers to a point (fig. 3). The verge sits inside a roughly spherical cavity in the proximal half of the penis. Inside walls of the cavity have shallow undulating folds that turn into the straight and higher longitudinal folds covering the walls of the distal half of the penis (fig. 3). These folds continue through the vagina to the free oviduct and bursa copulatrix. Epiphallus has a small caecum (~0.3 mm long) and a flagellum (~0.6 mm long).

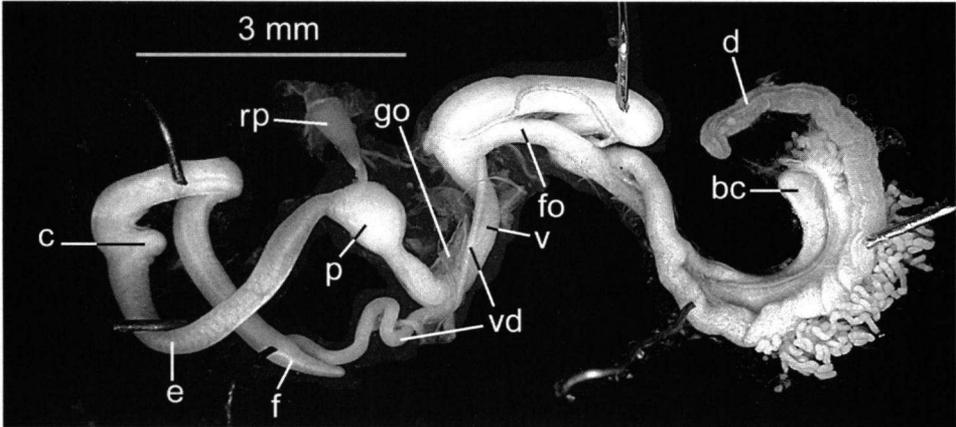


Fig. 2. Distal genitalia of *Borlumastus yildirimi*. Abbreviations: bc = bursa copulatrix, c = caecum, d = diverticulum, e = epiphallus, f = flagellum, fo = free oviduct, go = genital opening, p = penis, rp = retractor of penis, v = vagina, vd = vas deferens, ve = verge.

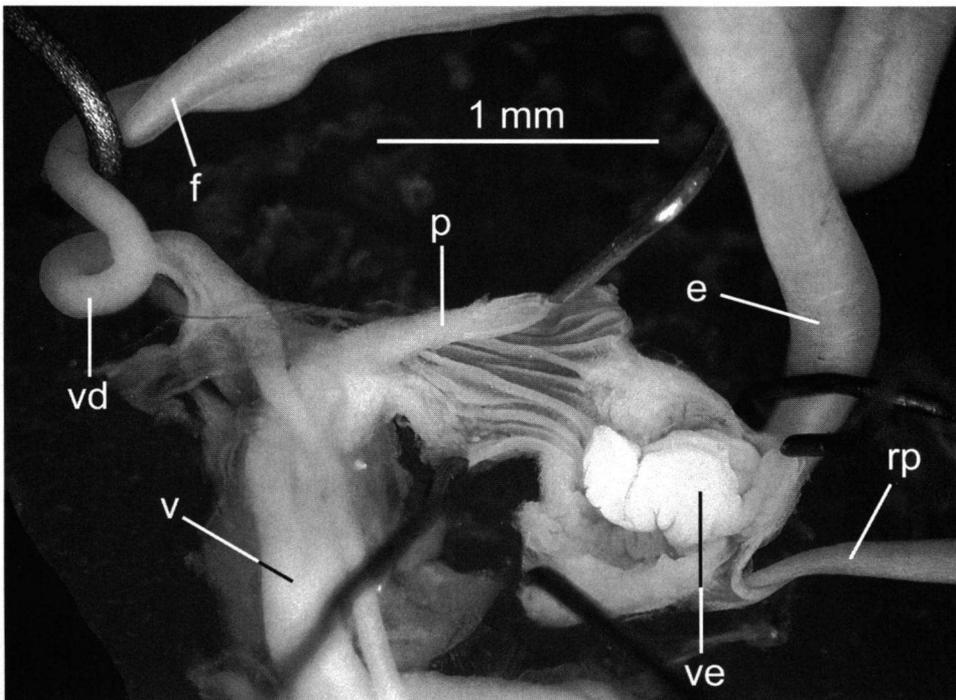


Fig. 3. Opened penis of *Borlumastus yildirimi*.

## DISCUSSION

In the genus *Ena*, the penis has an appendix and the shell aperture lacks teeth (Schileyko, 1998; Hausdorf, 2001). Therefore, the species Schütt (1995) described as *Ena yildirimi*, which has a palatal tooth (fig. 1) and lacks a penile appendix (fig. 2), does not belong to *Ena*. In addition to *Borlumastus* gen. nov., there are five enid genera without a penile appendix (the first four given as subgenera of *Chondrula* in Schileyko, 1998): *Mastus* Beck, 1837; *Chondrula* Beck, 1837; *Eubrephulus* A.J. Wagner, 1927; *Amphitrorsus* Kimakowicz, 1890; *Meijeriella* Bank, 1985. *Borlumastus* gen. nov. differs from all of these genera in having only one palatal and no other apertural teeth. In 54 shells of *B. yildirimi* with thickened lips that we examined, there was not one shell with an angular tooth, although in less than half of the examined shells, a very small, white protuberance near the junction of the parietal wall with the palatal lip was observed.

In addition to the differences between their apertural dentitions, *B. yildirimi* and *Meijeriella canaliculata* Bank, 1985, further differ from each other in the proportions of their shells. In the original description of *E. yildirimi*, Schütt (1995) gave  $H_v/H_a$  as 4, but later on changed it to approximately 3 (Schütt, 2001). We calculated the mean  $H_v/H_a$  of 16 specimens of *B. yildirimi* as 3.3, closer to Schütt's later value. In comparison, Bank (1985) gave the same ratio in *M. canaliculata* as 4. The latter species appears to be unique among the species of the genera discussed here in having an aperture that is much shorter relative to the total shell height. Furthermore, *M. canaliculata* has a spiral groove on its body whorl (Bank, 1985) that is absent in *B. yildirimi*.

An additional difference between *B. yildirimi* and *M. canaliculata* is the location of the attachment point of the penis retractor. In *B. yildirimi* the retractor attaches to the penis slightly below the junction of the epiphallus and penis (figs 2-3), whereas in *M. canaliculata* the retractor attaches uniquely to the epiphallus itself (Bank, 1985).

Based on the illustrations in the literature, the penile verge in the species of *Chondrula*, *Eubrephulus*, *Amphitrorsus* and *Mastus* is shaped somewhat like a straight carrot root (Hesse, 1933; Forcart, 1940; Maassen, 1995; Schileyko, 1998). Likewise, Bank (1985) described the penile verge of *M. canaliculata* as sausage-shaped and pointed. In comparison, the penile verge of *B. yildirimi* has an S-shaped morphology (fig. 3). Because no other verge with a similar shape seems to have been reported in the genera considered here, this anatomy may be unique to *Borlumastus* gen. nov.

The inner walls of the penis of *Mastus*, *Chondrula*, *Eubrephulus* and *Amphitrorsus* are covered with papillae that Schileyko (1998) referred to as 'prismoconic tubercles'. In some *Mastus* species these papillae are replaced by longitudinal folds towards the distal end of the penis that continue through the vagina into the free oviduct and bursa copulatrix (Örstan, unpublished). In comparison, the inside walls of the penis of *B. yildirimi* are lined, not with papillae, but with distinct, narrow, longitudinal folds that are low and undulating in the cavity of the verge and more prominent and straighter in the distal half of the penis (fig. 3). As in *Mastus*, these folds continue through the vagina into the free oviduct and bursa copulatrix.

Bank & Neubert (1998) noted that *Mastus*, *Meijeriella*, *Chondrula* and *Eubrephulus* are closely related to each other. *Borlumastus* gen. nov. also belongs to this group. If the distributional range of *Borlumastus* gen. nov. turns out to be limited to the mountains between Keçiborlu and Uluborlu, a detailed study of its phylogenetic relations with the other genera, taking into account the palaeogeography of its range, will help us understand the evolutionary history of this group.

REFERENCES

- BANK, R.A., 1985. Eine neue Enide von der griechischen Insel Mytilini (Gastropoda: Pupillacea). — *Heldia* 1: 41-44.
- BANK, R.A., & E. NEUBERT, 1998. Notes on Buliminidae, 5. Systematic position of Arabian Buliminidae (Gastropoda Pulmonata) with the description of a new genus. — *Basteria* 61: 73-84.
- FORCART, L., 1940. Monographie der türkischen Enidae. — *Verhandlungen der Naturforschenden Gesellschaft in Basel* 51: 106-263.
- HAUSDORF, B., 2001. The genus *Ena* in Turkey, with remarks on its phylogenetic relationships (Gastropoda: Buliminidae). — *Journal of Natural History* 35: 1627-1638
- HESSE, P., 1933. Zur Anatomie und Systematik der Familie Enidae. — *Archiv für Naturgeschichte (NF)* 2: 145-224.
- MAASSEN, W.J.M., 1995. Observations on the genus *Mastus* from Crete (Greece), with descriptions of twelve new species (Gastropoda: Pulmonata: Buliminidae). — *Basteria* 59: 31-64.
- SCHILEYKO, A.A., 1998. Treatise on Recent terrestrial pulmonate molluscs 2. — *Ruthenica Supplement* 2: 129-261.
- SCHÜTT, H., 1995. Diagnosen türkischer Eniden (Gastropoda: Buliminoidea: Buliminidae). — *Malakologische Abhandlungen* 17: 161-166.
- SCHÜTT, H., 2001. Die türkischen Landschnecken. — *Acta Biologica Benrodis Supplementband* 4: 1-549.
- YILDIRIM, Z., & H. SCHÜTT, 1997. Verbreitung der Enidae im Seengebiet SW-Anatoliens (Gastropoda Pulmonata: Buliminoidea). — *Club Cochylia Informationen* 29: 47-55.