

REVISION OF THE TURKISH *RAMUSCULUS* TAXA WITH DESCRIPTION OF *AYNA* GEN. NOV. (GASTROPODA: PULMONATA: ENIDAE)

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Abstract The Turkish members of *Ramusculus* are revised. *Ayna* is described as a new genus. It is characterized by an extremely slender shell with only a single angular denticle in the aperture, the lack of a diverticulum of the bursa copulatrix and by the inner structure of the penis by the presence of two longitudinal rolls. The monospecific genus *Ayna* (*A. mienisi* (Gittenberger 1986)) is known only from northeastern Anatolia.

Key words Turkey, *Enidae*, *Ramusculus*, *Ayna*, taxonomy

INTRODUCTION

Gittenberger (1986) described a dextral buliminid from northeastern Anatolia as *Zebrina* (*Ramusculus*) *mienisi*. Schütt (1995) described a geographically adjacent sinistral form as *Ramusculus laevitor-tus*. However, with no preserved material of the *Ramusculus* taxa then available, the systematic position of these forms remained unclear. Recently collected living material has clarified their systematic position.

A new genus of the family *Enidae* for the Turkish taxa assigned to *Ramusculus* is proposed, with the dextral and the sinistral forms synonymized.

SYSTEMATICS

Ayna gen. nov.

Diagnosis The extremely slender dextral or sinistral shell of over 10 whorls, is five times as high as broad, with a single angular denticle in the aperture (Fig. 1). The diverticulum of the bursa copulatrix is absent, there are two longitudinal rolls in the lumen of the penis. The remainder the penis wall is smooth (Figs 2–3).

Differential diagnosis The genus *Ramusculus* Lindholm 1925 (type species: *Bulimus subulata* Rossmässler 1837) living in the Crimea Peninsula (Zilch, 1959: 189), is phylogenetically close to the genus *Zebrina* according to both shell and genital

characters (Schileyko, 1984: 361). Dark, transverse streaks on the shell are usual for *Zebrina* and *Ramusculus*, whereas these are missing in *Ayna*. The new genus differs from *Ramusculus* and *Zebrina* by the shorter vagina, the much longer penis, and the absence of small papillae on the penis wall. *Ramusculus* and *Zebrina* have very strong diverticulum of the bursa copulatrix, which is lacking in *Ayna*.

The new genus differs from *Clausilioides* (see Hesse, 1933) by the longer bursa copulatrix, the longer and cylindrical penis (not short and pear-shaped as in *Clausilioides*) and the different inner structure of the penis, which is irregularly wrinkled and lobed in *Clausilioides* (Fig. 4). Hesse (1933) described a slim and short diverticulum for *Clausilioides biplicatus* (Retowski 1889). A specimen dissected by me (leg. L. Németh, TR, Vil. Artvin, Ardanuç W, big gorge under the castle, 30/5/2005), did not have a diverticulum. That specimen is probably of an undescribed species of *Clausilioides* (R.A. Bank, personal communication). This provides additional support for the statement of Bank and Neubert (1998: 75), namely that the systematic significance of the presence or absence of a diverticulum is probably very low. In face of this, most genera of the family *Enidae* are characterized by the presence or absence of the diverticulum, and this characteristic can be used as a distinguishing mark in addition to other characters. The differences between their anatomy, together with the shell characters (*Clausilioides* has a columellar lamella, which is absent in the new genus), seem to justify the establishment of *Ayna* as an independent genus. However, these two genera are

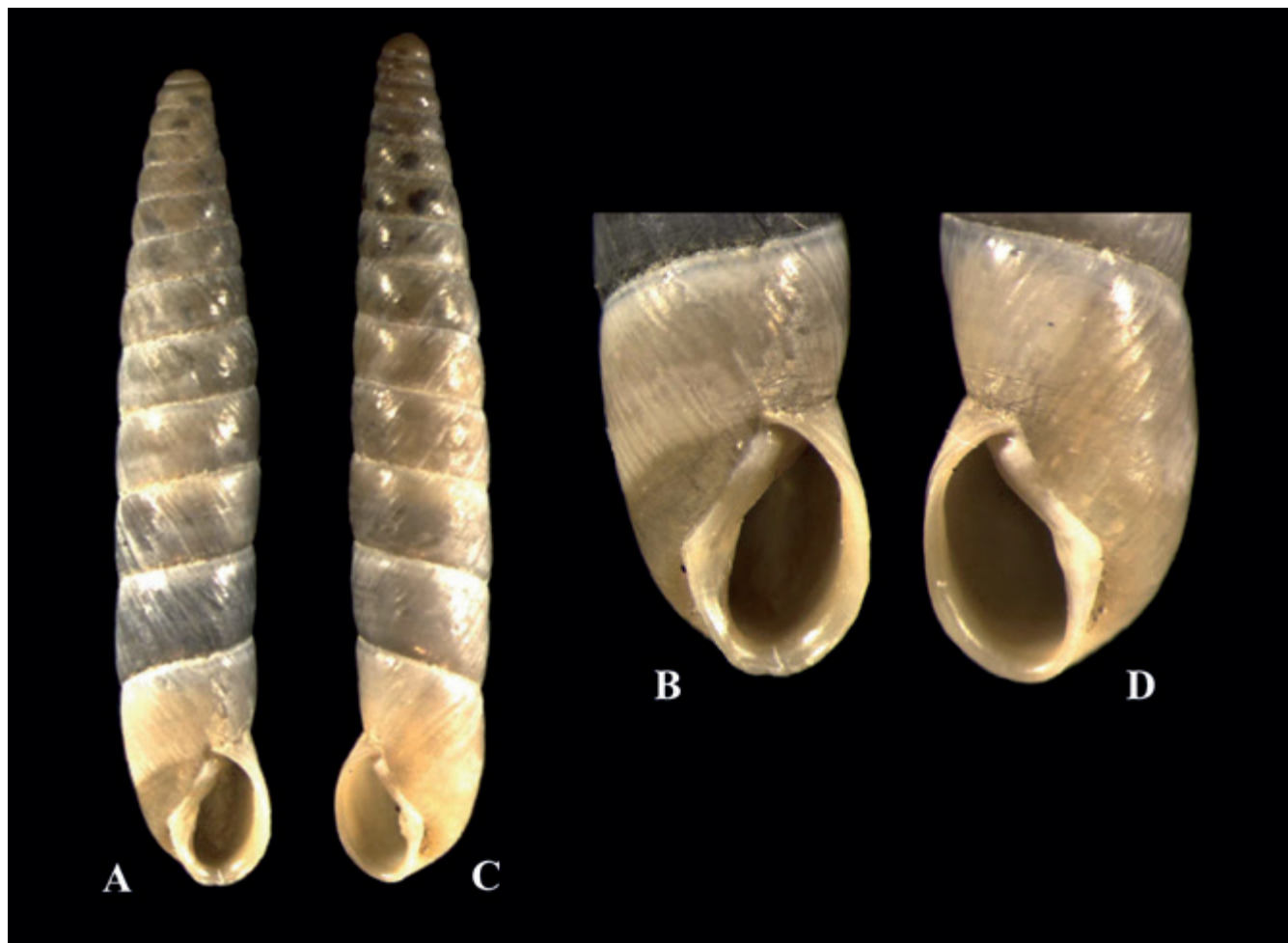


Figure 1 A–D *Ayna mienisi* (Gittenberger 1986) from Vil. Artvin: Su Kavusumu. A,B: shell referable to *mienisi*; C,D: shell referable to *laevitortus*.

closely related to each other. An additional difference between *Clausilioides* and *Ayna* is the white surface-layer of the shell of the new genus, which is brown in *Clausilioides*. The shells of the living *Clausilioides* specimens are often enfolded by mud.

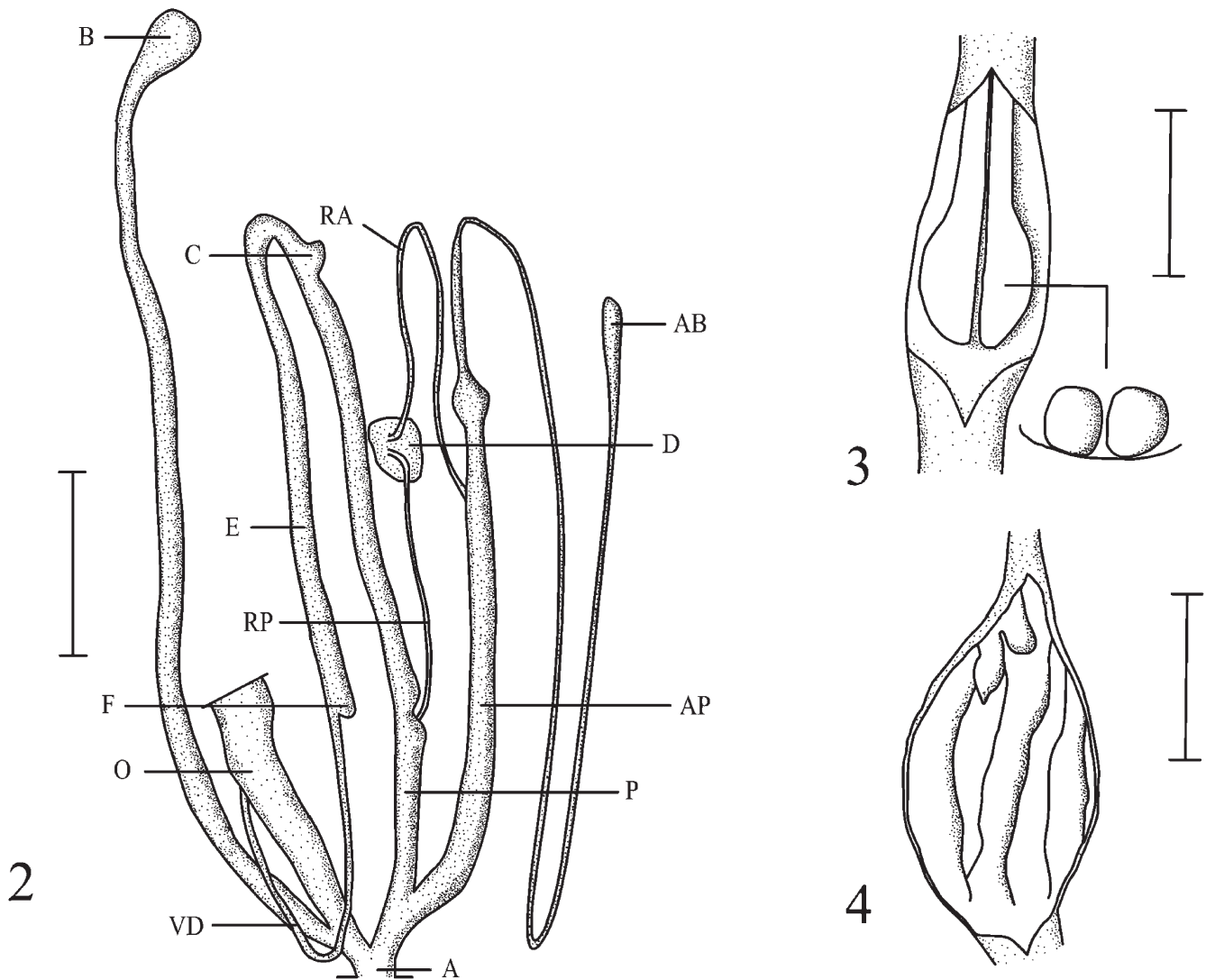
The diverticulum of the bursa copulatrix is absent in the genera *Ljudmilena* Schileyko 1984, *Imparietula* Lindholm 1925 (= *Pseudochondrula* Hesse 1933, see Hausdorf, 1999), *Subzebrinus* Westerlund 1887, *Triangustoma* Schileyko 1984 and *Megalena* Hausdorf 1999 of the subfamily Eninae, as in *Ayna*, but these have quite different shell characters (much less cylindrical shell with, in the majority of cases, teeth in the aperture). *Pseudochondrula blanda sebastiana* Forcart 1940 is characterized by shells which are less slender, as in *Ayna*. Additionally, the aperture of the shells is different in the two taxa (such as the presence of a parietal denticle in *P. blanda*). *Megalena* lacks a

diverticulum, has only a singular angular tooth, and there are also two strong longitudinal rolls which delimit a groove in the proximal section of the penis, but the only known species of this genus (*M. crassa* (Retowski 1887)), is living in northwestern Anatolia and is characterized by a large, elongated, oval shell. The inner structure of the penis is also different: in *Ayna* the parallel rolls are tapering towards the end, which is not the case in *Megalena*. In addition, there are weaker longitudinal rolls present in *Megalena*, which are lacking in *Ayna*.

Etymology The Turkish ayna (= mirror) refers to the mirror-like coiled (dextral/sinistral) shells. This word is originated from Farsi.

Type species (by monotypy):

Ayna mienisi (Gittenberger 1986)



Figures 2–4 2–3 *Ayna mienisi* (Gittenberger 1986) from Vil. Artvin, Su Kavusumu (genitalia of a dextral specimen). 4 *Clausilioides* sp. from Vil. Artvin, Ardanuc. (2) genital system; (3, 4) inner structure of the penises. Scale bars 1 mm (Fig. 2) and 0.2 mm (Fig. 3, 4). Abbreviations: A, atrium; AB, bursa of the penial appendix; B, bursa of the bursa copulatrix; C, caecum; D, diaphragm; E, epiphallus; F, flagellum; O, oviduct; P, penis; RA, retractor muscle of the penial appendix; RP, retractor muscle of the penis; V, vagina; VD, vas deferens.

Zebrina (Ramusculus) mienisi Gittenberger 1986, Zool. Meded., **60**: 210–211, fig. 1 (shell), 2 (distribution). Type locality: “Turkey, province of Erzurum, 5 km N. of Tortum, UTM GE16; 1600 m alt.”.

Ramusculus laevitortus Schütt 1995, Malak. Abh. staatl. Mus. Tierk. Dresden, **17**: 165, fig. 6 (shell). Type locality: “Türkei: Vilayet Artvin: 3 km N Su kavuşumu am linken Ufer des Çoruh Nehri”.

Material studied Turkey, Vilayet Artvin, Su Kavusumu 3 km toward Artvin, László

Németh leg., 20/05/2007. The species was collected live between grassroots on dry rock surfaces.

Description of the genital structure (Figs 2–3) 6 specimens were dissected (3 dextral and 3 sinistral). There is an extremely long, complicated penial appendix with its own retractor muscle, inserted in the distal part of the A1 segment of the penial appendix. This muscle is longer than the retractor muscle of the penis. Both muscles insert close to each other at the diaphragm. The penial appendix inserting at the distal section of the penis is almost twice as long as the penis

and epiphallus combined. The proximal part of the appendix (A1) is very long, and its thickness is equable till a small knot (A2), and after which the appendix becomes slim, and very slowly tapers towards the end (A3+A4+A5). There is no marked boundary between the sections A4 and A5. The sections A3+A4+A5 are more than two times as long as the sections A1+A2. Distal to the insertion of the penial retractor muscle there is a slight swelling in the cylindrical penis. There are two strong longitudinal rolls in the lumen of the short penis. There is no penial papilla. The cross-sectional view of these rolls is round; the rolls being linked to the wall of the penis. The remaining wall of the penis is smooth. The epiphallus is characterized by a small caecum and a flagellum. The vas deferens is short. The bursa copulatrix is extremely long and as thick as the epiphallus. It is tapered toward the distal end. There is no diverticulum.

Taxonomic position Forcart (1940) reviewed the historical division of the Enidae and proposed to split this family into two subfamilies (Eninae and Chondrulinae) on the basis of the presence or absence of a penial appendix. In following this, *Ayna* gen. nov. belongs to the subfamily Eninae. However, in more recent taxonomical works (Gittenberger, 1978: 11–12; 1983: 339; Bank, 1985: 41) these subfamilies are not used, because of the penial appendix having been independently lost in at least six groups (Bank & Neubert, 1998: 74–84), resulting in polyphyletic subfamilies. Bank & Neubert (1998) is here followed; dividing the family Enidae into the subfamilies Buliminusinae Kobelt 1880 and Eninae Woodward 1903 (for the nomenclature see Opinion 2018). The subfamily Buliminusinae is characterized by the presence of a penial caecum, the presence of a long to relatively long epiphallar flagellum, and the lack of an epiphallar caecum. The splitting of the Enidae into eight subfamilies by Schileyko (1984: 361; 1998) is not followed; some of the subfamilies are now recognized as tribes within the Eninae (Bouchet & Rocroi 2005: 265). The genital system of *Ayna* gen. nov. lacks a penial caecum, it has a short epiphallar flagellum, and has an epiphallar caecum. With these characters, *Ayna* belongs to the subfamily Eninae.

The anatomical preparations stored in 70% ethanol are in my own collection (Mosonmagyaróvár,

Hungary). The shells are in the private collection of László Németh (Budapest, Hungary).

Remarks There are no anatomical differences between the two forms (i.e. the sinistral shells and the dextral shells). In the diagnosis of Schütt (1995) *R. laevitortus* differs not only by the opposite coiled shell but also by a higher shell compared to *Z. mienisi*. In our material (collected at or near the type locality of *R. laevitortus*) the sinistral and dextral shells were collected together, and the shells show no conchological differences: they are mirror-like (Fig. 1). The height of 30 adult shells from both forms was measured. The mean and standard deviation for the sinistral (left handed) form were 14.22 \pm 0.895 mm respectively, and for dextral (right handed) shells it was 14.06 \pm 1.119 mm. The Wilcoxon rank sum test with continuity correction to test for differences in central tendency was used. Left and right handed snails were not significantly different ($W = 458.5$, $p\text{-value} = 0.9058$, c.f. Fig. 5). The two forms occur sympatrically as well as alone (Schütt, 2001: 132–133). Since there are no conchological and anatomical differences, I propose *R. laevitortus* as a synonym of *Z. mienisi*.

The monotypical *Ramusculus* genus (*R. subulatus*) lives in the Crimea Peninsula (Zilch, 1959: 189; Schileyko, 1984: 360–361), whereas *Ayna* lives in northeastern Anatolia. There seems to be no zoogeographical relationships between the two areas, as was previously thought based on the malacofauna (Schütt, 2001).

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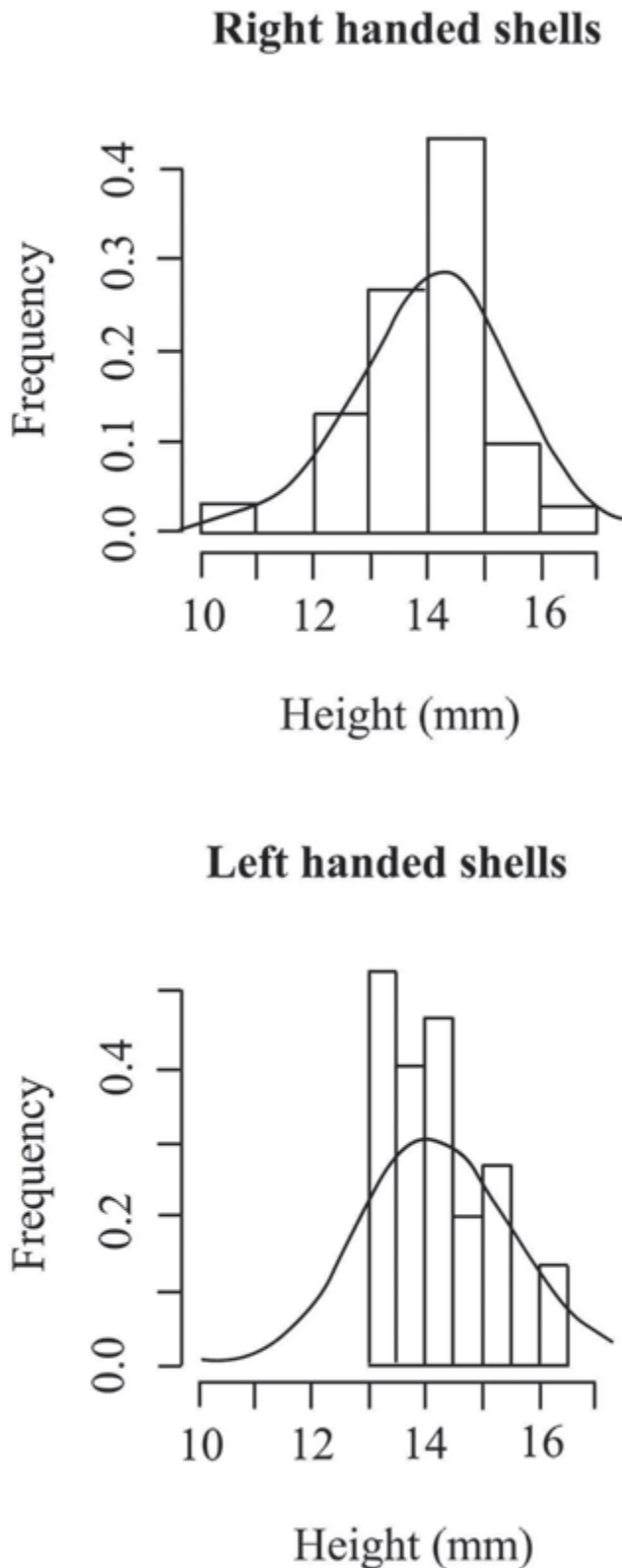


Figure 5 Shell height distribution for the measured 30 sinistral and 30 dextral specimens. Curves indicate fitted normal distributions.

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