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Two new freshwater mollusk species of the genus *Graecoanatolica* Radoman, 1973 from Turkey (Gastropoda: Hydrobiidae)

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Abstract

Two species of the hydrobiid genus *Graecoanatolica* Radoman, 1973 were described from Turkey as new to science. The new species are characterized by a larger dimension of the shell. A comparative table of shell dimensions and features of penes to the species known for Turkey are provided. The total number of species of genus *Graecoanatolica* tallies now 12 species.

Key words: *Graecoanatolica*, new species, taxonomy, Turkey.

Introduction

Turkey is a hot spot for hydrobiid snails both in regard of species diversity and endemism (Şahin *et al.* 2012). To date, 46 hydrobiid species have previously been described from Turkey (Şahin *et al.* 2012), including at least seven genera endemic to Anatolia (Yıldırım 1996, Yıldırım *et al.* 2006, Şahin *et al.* 2012, Glöer & Georgiev 2012).

Graecoanatolica Radoman, 1973, is an endemic genus for Balkan (Macedonia and Greece) and Turkey, characterized at the first line by the conic (*sensu* Hershler & Ponder 1998: p. 6, Fig. 1f) shell. This genus originally was described by Radoman (1973), with *Hydrobia vegorriticola* Schütt 1962, as the type species. In addition to the two species known from the Balkans, i.e. *Graecoanatolica vegorriticola* Schütt, 1962 (Lake Vegoritis, Greece) and *G. macedonica* Radoman & Stankovic, 1979 (Dojran Lake, Macedonia), the latter has been declared extinct (Ryan & Griffith 2001, Albrecht *et al.* 2006, 2013), eight species of the genus have been reported from Turkey (Kebapçı *et al.* 2012). Most of these species occur in the Lakes Region of Turkey (Kebapçı *et al.* 2012), and with exception of *Graecoanatolica lacustriturca* and *G. tenuis*, they are restricted to a small distribution areas from which some of them were described only by shell features (Schütt 1962; Kebapçı *et al.* 2012); two of these species (*G. brevis* and *G. conica*) are declared as extinct (Kebapçı *et al.* 2012).

Some studies showed that hydrobiid genera can be distinguished among their congeners by combining the description of anatomical structures, in first line morphology of the penis, but also the female sex tract, with the morphology of the shell (Delicado *et al.* 2015). The species of the genus *Graecoanatolica* are uniform in their female sex tract, and characterized by the absence of receptacula. Based on the shell

characters and features of penis, taxonomic status of the species of the genus *Graecoanatolica* can be postulated (see Table 1)

In this paper two species of the genus *Graecoanatolica* were described. One of these species was collected by Karl-Otto Nagel from south-western Turkey (Province Muğla, Gökova Bay near Akyaka) and ascribed to the genus by the features of shell and female sex tract. The second species has been collected by the junior author during his survey at the Turkish Black Sea coast (Sarıkum Lake, Sinop Province). Descriptions of these species are given in this paper.



Figure 1. Sampling sites of *Graecoanatolica nageli* n. sp. (Akyaka) and *G. yildirimi* n. sp. (Lake Sarıkum).

Material and Methods

The snails were collected by hand and fixed in 60% ethanol. The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope (ZEISS). Measurements of shell height (H), shell diameter (D) and aperture height (h) are given in millimeters. The photographs were taken with a digital camera system (Leica R8).

Holotypes and paratypes of new species are deposited in Senckenberg Museum in Frankfurt (SMF) and Zoological Museum of Hamburg (ZMH).

Systematics

Family Hydrobiidae Troschel, 1857

Genus *Graecoanatolica* Radoman, 1973

Type species: *Graecoanatolica vegorriticola* Schütt, 1962

Graecoanatolica nageli n. sp.

(Figures 2-9)

Holotype: Shell: 3.3 mm height, 1.7 mm width, SMF 347165.

Paratypes: SMF 347166/1 (Fig. 8 orig.) + 10 specimens, SMF 347510/10 (in ethanol; 5 specimens in coll. Nagel, 5 specimens in coll. Glöer, 3 specimens destroyed by dissection) from the type locality; SMF 347167/1 (Fig. 9 orig.) + 80 specimens SMF 347168/80 (in ethanol; 5 specimens in Coll. Nagel, 5 specimens in Coll. Glöer, 10 specimens destroyed by dissection), Turkey, Province Muğla, Gökova-Akyaka, a small bay before camping site, karst spring W of village, 37°02'56,70" N, 28°17'59,40" E, leg. K.-O. Nagel.



Figures 2-3. The sampling site of *Graecoanatica nageli* n. sp. **2** Gökova Bay near Akyaka, karst spring. **3** Small bay before camping site (photos from <http://www.gokovayucelen.com>).

Type locality: Turkey, Province Muğla, karst spring, Gökova Bay near Akyaka, 37°03'09,80" N, 28°19'23,35" E, leg. K.-O. Nagel.

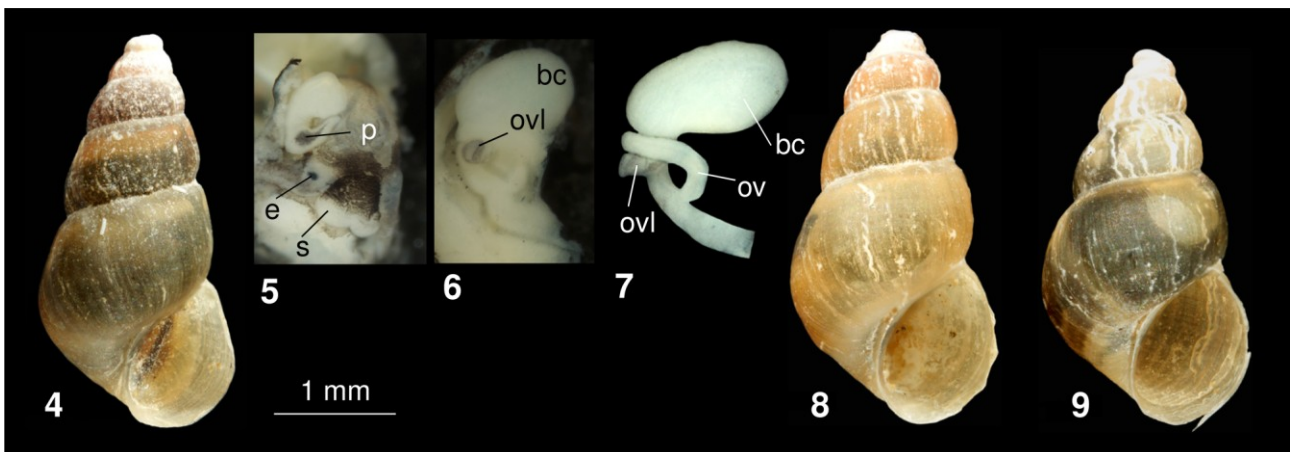
Etymology: Named after Karl-Otto Nagel who collected the new species.

Description: The horn-colored shell with 5.5 (6.5; see: Remark) slightly convex whorls with a deep suture. Shell conic in shape, with a smooth surface. The lateral line of the shell nearly straight. Aperture ovate and angled at the top. Peristome sharp and not thickened at the columella. Umbilicus closed. Aperture height to shell height: 0.35-0.43, height of body whorl to height of spire 1.6-1.9, shell height 3.2-3.3 mm (3.6 mm, see remarks), width 1.6-1.7 mm (up to 1.8 mm; see: Remark).

Animal: Mantle black, snout white, tentacles thick and long. Head dark brown, whitish around the eyes. Eye spots are visible.

Female sex tract: Bursa copulatrix large and ovate; oviductual loop dark pigmented, receptacula missing.

Male copulatory organ: Penis simple, without any outgrowth, triangular in shape with a broad basis, in some specimens bent in the middle part (possibly due to the fixation). The distal part of the penis is black pigmented, at the tip acute.



Figures 4-9. *Graecoanatica nageli* n. sp. **4** holotype, **5** penis in situ, **6-7** female sex tract, **8** paratype from type locality, **9** paratype from a karst spring with brackish water (a small bay before camping site, Gökova-Akyaka). Abbreviations: bc = bursa copulatrix, e = eye, ov = oviduct, ovl = oviductual loop, p = penis.

Table 1. Measurements and pigmentation of penes of extant species of the genus *Graecoanatolica* from Turkey (data combined from Schutt 1965, Kebapçı *et al.* 2012 and our study).

Species	H	D	D/H	h	h/H-h	penis
<i>G. anatolica</i>	2.7-3.2	1.6-1.8	0.56-0.59	1.2-1.3	0.68-0.8	unknown morphology
<i>G. dinarica</i>	1.81-2.56	0.91-1.25	0.41-0.53	0.59-0.81	0.46-0.48	pigmented
<i>G. kocapinarica</i>	1.67-2.76	1-1.39	0.46-0.63	0.64-0.94	0.62-0.92	poorly pigmented
<i>G. lacustriturca</i>	1.59-2.63	0.90-1.38	0.46-0.68	0.53-0.91	0.5-0.53	slightly pigmented juv. unpigmented
<i>G. pamphylica</i>	2.37-3.94	1.12-1.68	0.40-0.53	0.78-1.09	0.38-0.49	unpigmented
<i>G. tenuis</i>	1.5-2.6	0.66-1.19	0.35-0.59	0.53-0.94	0.55-0.58	slightly pigmented
<i>G. nageli</i> n. sp.	3.2-3.3	1.6-1.7	0.50-0.52	1.1-1.3	0.35-0.43	pigmented at tip
<i>G. yildirimi</i> n. sp.	2.7-3.0	1.6-1.7	0.55-0.59	1.1-1.3	0.69-0.76	unpigmented

Differentiating features: The combination of a large dimension of the shell and a penis pigmented at the tip separates *Graecoanatolica nageli* n. sp. from all other species of the genus known from Turkey. See also discussions for *Graecoanatolica yildirimi* n. sp.

Remark: A few specimens of *Graecoanatolica nageli* n. sp. reached a shell with 6.5 whorls and height of 4.3 mm. In prosobranch mollusks it is known that species which survive a year longer usually will continue to grow.

Habitat: The snails were taken from a karst spring (with brackish water) near the beach (Fig. 2) and from an outflow (Fig. 3; located near the hotel complex Yücelen, www.youtube.com/watch?v=edVlmHK1Wuw). Associated species: *Theodoxus fluviatilis*.

Distribution: Turkey; only known from the type localities.

***Graecoanatolica yildirimi* n. sp.**
(Figures 10-14)

Holotype: Shell: 3.0 mm height, 1.7 mm width, ZMH 119326.

Paratypes: 66 specimens, ZMH 119327, 12 specimens in coll. Glöer, 6 specimens destroyed by dissection) from the type locality.

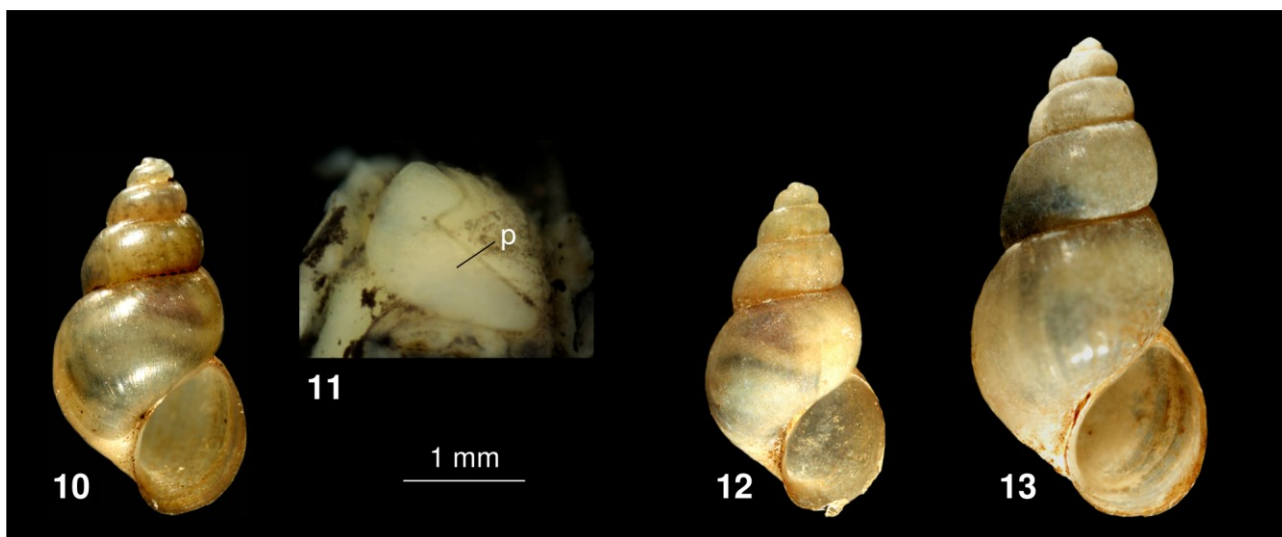
Type locality: Turkey, Sinop Province, Sarikum Lake, 42°0'42.61"N, 34°55'47.71"E, leg. V. Pešić.

Etymology: Named after Prof. Dr. Mehmet Zeki Yıldırım in appreciation of his research on the freshwater mollusks of Turkey.

Description: The horn-colored shell with 5.5 (6.5; see: Remark) slightly convex whorls with a deep suture. Shell conic in shape, with a smooth surface. Aperture ovate and angled at the top. Peristome sharp and not thickened at the columella. Umbilicus closed. Aperture height to shell height: 0.33-0.44, height of body whorl to height of spire 1.6-2.0, shell height 2.7-3.0 mm (up to 4.0 mm; see: Remark), width 1.6-1.7 mm (up to 2 mm; see: Remark).

Animal: Mantle black, tentacles thick and long. Head dark brown, whitish around the eyes. Eye spots visible.

Male copulatory organ: The broad penis simple, without any outgrowth, triangular in shape and not pigmented. Penis at the tip acute.



Figures 10-13. *Graecoanatica yildirimi* n. sp. 10 holotype, 11 penis in situ, 12-13 paratypes.

Differentiating features: Due to the large dimensions of the shell the new species from Sarikum Lake resembles *Graecoanatica nageli* n. sp. From the latter species *Graecoanatica yildirimi* n. sp. can be easily distinguished by having an unpigmented penis and a smaller height of shell, and consequently a higher D/H and h/H-h ratios (see: Table 1).

Remark: We found some specimens with a higher shell and one additional whorl (see remark under *G. nageli* n. sp. for further discussion).

Habitat: Sarikum Lake is a shallow brackish coastal lake (184 ha) which discharges through a channel (300 m long) into the sea at period of high water level (Akbulut *et al.* 2002). Associated species: *Theodoxus fluviatilis*.



Figure 14. Photograph of Sarikum Lake, locus typicus of *Graecoanatica yildirimi* n. sp. Photo. V. Pešić.

Distribution: Turkey; only known from the locus typicus (Fig. 14).

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