REDESCRIPTION OF GYRAULUS ARGAEICUS (STURANY 1904) WITH THE DESCRIPTION OF TWO NEW GASTROPOD SPECIES FROM TURKEY (MOLLUSCA: GASTROPODA: BITHYNIIDAE, PLANORBIDAE)

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Abstract New records of freshwater snails from Turkey are presented. Two species new for science Bithynia yildirimi and Gyraulus nedyalkovi are described. In addition the junior author collected Gyraulus argaeicus from its type locality, so the anatomy of this species is provided for the first time. Furthermore, new record of Anisus leucostoma, confirmed by the study on its anatomy, is given.

Key words Bithynia, Gyraulus, Gyraulus argaeicus, redescription, new species, Turkey.

INTRODUCTION

Six species of genus Bithynia are known from Turkey (Gloer & Yildirim, 2006; Yildirim, 1999): B. tentaculata (Linnaeus 1758), B. leachii (Sheppard 1824), B. pseudemmericia Schutt 1964, B. phialensis (Conrad 1852), B. badiella (Kuester 1852), and B. pesici Gloer & Yildirim 2006. The closely related genus Pseudobithynia is represented in Turkey by P. pantheri (Sturany 1904) (Gloer & Yildirim, 2006).

According to Yildirim et al. (2008) six Gyraulus species are known from Turkey: Gyraulus albus (O.F. Muller 1774), G. laevis (Alder 1838), G. piscinum (Bourguignat 1852), G. ehrenbergi (Beck 1837), G. euphraticus (Mousson 1874), G. parvus (Say 1817), G. cristae (Linnaeus 1758), and G. hebraicus (Bourguignat 1852). In addition, Gloer & Rahlle (2009) recently described Gyraulus parvus Gloer & Rahlle 2009 from Turkey.


This paper is aimed at redescribing Gyraulus argaeicus and describing two new species: Bithynia yildirimi n. sp. and Gyraulus nedyalkovi n. sp.

MATERIAL AND METHODS

The snails where collected with a sieve from the banks of the relevant waters. Sampling sites are given in Fig. 1.

The samples were put into ethanol (75%). The dissections and measurements of the genital organs and the shells were carried out using a stereo microscope (Zeiss, Germany). The

Figure 1 The map of study area with marked sampling sites. Sampling sites: 1 Bithynia yildirimi n. sp., Gyraulus nedyalkovi n. sp., Anisus leucostoma; 2 Gyraulus argaeicus.
photographs were made with a digital camera system (Leica R8).

The type material will be deposited in the Zoological Museum Hamburg (ZMH), Germany.

RESULTS

Conchological and anatomical investigations revealed two new species which belong to the genera Bithynia and Gyraulus, respectively.

Family Bithyniidae Troschel 1857
Genus Bithynia Leach 1818
Type species: Bithynia tentaculata (Linnaeus 1758)

Bithynia yildirimii n. sp.

Material examined 23 exx. from type locality.

Holotype Shell height 4.8 mm, width 2.9 mm, Zoological Museum Hamburg ZMH 79174.

Paratypes 5 exx., ZMH 79175.

Locus typicus Turkey, Mediterranean Sea coast, a swamp east of Kazanli village, N36°48'24.7" E34°47'34.8", 13.08.2009 D. Georgiev leg.

Habitat A swamp near the Mediterranean coast, densely occupied by water and bank vegetation as Phragmites australis, and various bush and trees. Some parts of the swamp completely drying during summer.

Etymology Named after Prof. Dr M.Z. Yıldırım (Eğridir, Isparta), the outstanding expert on freshwater molluscs of Turkey.

Diagnosis The yellowish shell is slim, of 4–5 convex whorls with clear sutures (Fig. 2a). Aperture, also the operculum (Fig. 2b), shows an obtuse angle. Umbilicus slit-like to closed. Nucleus of operculum eccentric. Clear sexual dimorphism shown (Fig. 2a,c). Male shells 4.7–5.1 mm high, 2.9–3.0 mm wide; female shells larger, 5.1–5.4 mm high, 3.6–3.7 mm wide.

Anatomy Penial appendix branches off from distal third of penis and is twice longer than distal part of the penis (Fig. 2d). Flagellum short (Fig. 2e).

Remarks We do not believe that Bithynia leachi occurs in Turkey (Yıldırım et al., 2006). This species is distributed in the lowlands of western Europe towards Russia, and the southernmost records known are from Hungary (Glöer & Fehér, 2004). Thus we have to compare Bithynia yildirimii sp. nov. with three other Bythinia species known from Turkey, i.e. B. pescii, B. phialensis, and B. badiella. The suture in B. pescii

Figure 2 Bithynia yildirimii n. sp.: a holotype, male, shell; b operculum; c paratype, female, shell; d penis in situ; e penis with flagellum. Parts: fl flagellum; p penis; pa penial appendix.
is very deep and the whorls are swollen, easily distinguishing the latter species from B. yildirim. Furthermore, the flagellum of B. pesicii is much shorter than in B. yildirimi. The shell of B. badiella is spherical, distinct from B. yildirimi. The suture of B. phialensis is more flattened and the shell is broader than in B. yildirimi. It is worth mentioning that the presence of both the aforementioned species, i.e. B. phialensis (type locality in Palestine) and B. badiella (type locality: Beirut) in Turkey, are doubtful.

Genus Gyraulus Charpentier 1837
Type species: Planorbis albus O.F. Müller 1774
Gyraulus argaeicus (Sturany 1904)

Material examined 11 exx. from type locality.

Locus typicus Turkey, Lake of Soysali village, 12.08.2009, D. Georgiev leg.

Habitat The Soysali Lake is situated on volcanic rocks, and fed by a big spring with the waters emerging on its northern bank. The water is clear and the lake bottom is covered mainly by gravel with very few sandy or muddy zones. Pollution from garbage from the village of Soysali and cattle watering was observed. The surrounding habitat is typical of steppe in the Anatolian Plateau.

Description The light-coneous shell nearly dull and transparent with fine growth lines. The shell consists of 3–4 whorls, which regularly and rapidly increase with a clearly visible to deep suture. The last whorl is slightly deflected (Fig. 3a). The first whorls are immersed on the underside, forming a deep umbilicus. The shell is 6.1–7.1 mm in diameter and 1.5–1.8 mm in height.

Animal The animal is light grey with a diffuse mantle pigmentation. The prostate gland bears

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**Figure 3** Gyraulus argaeicus (Topotype): a the shell; b sex tract; pr prostate gland; pht phallotheca; prp praepustium; vd vas deferens.
1. *Planorbis (Gyraulus) argaeicus* n. sp. — Schale flach, oben und unten etwas konvex, nahezu glanzlos, von grünlich-gelber Farbe, mit vier rasch anwachsenden, durch eine seichte Naht getrennten Windungen, mit zarten und dicht aneinander gerückten Anwachsstreifen und feinsten Spirallinien; letzter Umgang zuweilen in der Mitte gekielt; Mündung schief ovelförmig, Obergang stark vorgezogen und mit dem genäherten Spindelrande durch einen Callus verbunden.

   Schalenbreite 7, Schalenhöhe 2.2 mm; Mündung 3 mm breit und 2.7 mm hoch.

   Fundort: Soisaly im Erdschlagsgebiete, Kleinasië (leg. Penterer).

Figure 4 Facsimile of the original description (Sturany, 1904: 115–116).

20–22 long diverticles. The phallotheca is nearly twice as long as the praeputium (Fig. 3b).

Remarks *Gyraulus argaeicus* (Sturany 1904), described from Turkey (Soisaly), has not been mentioned since its original description (Sturany, 1904: 115). It was not possible to compare our material with the type material, because the Vienna Museum does not lend holotypes or paratypes for scientific studies. However, the original description (Fig. 4) corresponds well with our specimens.

*Gyraulus nedjalkovi* n. sp.

Fig. 5a–d

Material examined 14 exx. from type locality.

Holotype Shell height 1.4 mm, width 4.4 mm, Zoological Museum Hamburg ZMH 9176.

Paratypes 5 exx., ZMH 79177.

Locus typicus Turkey, Mediterranean Sea coast, a swamp east of Kazanli village, N36 48 24.7 E34 47 34.8, 13.08.2009 D. Georgiev leg.

Figure 5 *Gyraulus nedjalkovi* n. sp.: a holotype (photographed in ethanol), shell; b paratype, shell; c male copulatory organ; d bursa copulatrix and prostate gland. Parts: bc bursa copulatrix; m muscle; pr prostate gland; pht phallotheca; prp praeputium; vd vas deferens.
Figure 6 The shells of Gyraulus species from the Near East region: 1 G. pamphylicus; 2 G. hebraicus; 3 G. euphraticus; 4 G. argaeicus (topotype); 5 G. homensis; 6 G. ehrenbergi; 7 G. huwaizahensis; 8 G. piscinarum; 9 G. bekaensis; 10 G. nedyalkovi n. sp.

Table 1 Distinguishing characteristics of Gyraulus spp. from the Near East region.

<table>
<thead>
<tr>
<th>Taxon, type country</th>
<th>max. diameter D [mm]</th>
<th>height of last whorl h [mm]</th>
<th>ratio D: h</th>
<th>keel</th>
<th>no. of whors</th>
<th>last whorl prominent</th>
<th>umbilicus</th>
<th>no. of prostate diverticules</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. nedyalkovi n. sp.</td>
<td>3.9</td>
<td>1.0</td>
<td>3.9</td>
<td>no</td>
<td>3–4</td>
<td>yes</td>
<td>wide</td>
<td>18–22</td>
</tr>
<tr>
<td>Turkey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. pamphylicus, Turkey</td>
<td>7.0</td>
<td>1.0–1.2</td>
<td>7.0–5.8</td>
<td>yes</td>
<td>4</td>
<td>yes</td>
<td>narrow</td>
<td>16–18</td>
</tr>
<tr>
<td>G. argaeicus, Turkey</td>
<td>7.0</td>
<td>2.2</td>
<td>3.2</td>
<td>slight</td>
<td>4</td>
<td>yes</td>
<td>wide</td>
<td>18–22</td>
</tr>
<tr>
<td>G. hebraicus, Syria</td>
<td>5.0</td>
<td>1.2</td>
<td>4.2</td>
<td>no</td>
<td>4</td>
<td>no</td>
<td>narrow</td>
<td>11–15</td>
</tr>
<tr>
<td>G. homensis, Syria</td>
<td>5.0</td>
<td>1.0</td>
<td>5.0</td>
<td>slight</td>
<td>4.5</td>
<td>yes</td>
<td>wide</td>
<td>20–22</td>
</tr>
<tr>
<td>G. piscinarum, Lebanon</td>
<td>4.4</td>
<td>1.1–1.2</td>
<td>4.0–3.7</td>
<td>no</td>
<td>3.5</td>
<td>yes</td>
<td>wide</td>
<td>12–16</td>
</tr>
<tr>
<td>G. bekaensis, Lebanon</td>
<td>5.7</td>
<td>1.4–1.5</td>
<td>4.1–3.8</td>
<td>yes</td>
<td>3.5</td>
<td>yes</td>
<td>narrow</td>
<td>18</td>
</tr>
<tr>
<td>G. ehrenbergi, Egypt</td>
<td>4.5</td>
<td>1.0</td>
<td>4.5</td>
<td>no</td>
<td>3.5</td>
<td>yes</td>
<td>narrow</td>
<td>14–19</td>
</tr>
<tr>
<td>G. huwaizahensis, Iraq</td>
<td>3.0–3.5</td>
<td>1.0</td>
<td>3.0–3.5</td>
<td>no</td>
<td>3.75</td>
<td>yes</td>
<td>narrow</td>
<td>9</td>
</tr>
<tr>
<td>G. euphraticus, Iraq</td>
<td>7.0</td>
<td>1.0</td>
<td>7.0</td>
<td>slight</td>
<td>4.5</td>
<td>no</td>
<td>narrow</td>
<td>9–18</td>
</tr>
</tbody>
</table>

Habitat A small canal with soil banks occupied with Phragmites australis in the surroundings of the village near a group of blocks of flats and greenhouse agricultural lands. Pollution by artificial materials, mainly plastic, was observed.

Etymology Named after the mammalogist Nedko Nedyalkov (National Natural History Museum, Sofia, Bulgaria).

Description Shell pale conoicous, glossy, transparent with fine growth lines (Fig. 5a,b). Comprises 3–4 whorls, which increase rapidly, regularly with clearly visible to deep suture. Last whorl not deflected. First whorls immersed on both sides. Size small, 3.5–4.4 mm in diameter, 1.0–1.4 mm in height.

Animal Animal light grey with diffuse mantle pigmentation. Prostate gland bears 18–22 long diverticules (Fig. 5d). Phallotheca as long as praeputium (Fig. 5c). Bursa copulatrix cylindric (Fig. 5d).

Remarks Due to the small shell (3.5–3.9 mm in diameter) (Fig. 6, Table 1) Gyraulus nedyalkovi n.
Figure 7 *Anisus leucostoma*, swamp east of Kazanli village: shell.

sp. resembles *G. piscinarum*, *G. ehrenbergi*, and *G. huanzahensis*. The new species differs especially in the numbers of prostate diverticulae, the main distinguishing feature between species in the genus *Gyraulus* (see: Meier-Brook, 1983), but also in shell characteristics.

*Anisus leucostoma* (Millet 1813)

**Material examined** Four specimens from a swamp east of Kazanli village (N36°48'24.7" E34°47'34.8"*, fig. 1.3). A dissection revealed that the prostate gland bears 19 diverticulae. This is in accord with Glöer & Meier-Brook (2008: 94) for *Anisus leucostoma*.

**Remarks:** Yıldırım et al. (2006) listed *Anisus spiorbis* from Eastern Anatolia and cited Boettger (1957) for reference. However, in their reference list they mentioned only O. Boettger (1905), overlooked C. R. Boettger (1957), who reported *Anisus spiorbis* from a swamp in Erzurum Province.

**Acknowledgement**

We thank Nedko Nedyalkov (National Natural History Museum, Sofia, Bulgaria) who first took Diliyan Georgiev on an expedition to Turkey on April 2009, and attracted his interest on investigations of the Turkish fauna. In addition we express our thanks to an anonymous reviewer how corrected the English and gave helpful comments which improved our paper.

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