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Pseudamnicola species and other freshwater gastropods (Mollusca, Gastropoda) from East Anatolia (Turkey), the Ukraine and the Lebanon

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The occurrence of new *Pseudamnicola* species and other freshwater hydrobiid gastropods from East Anatolia, Turkey, is discussed. The geological history of the area, starting from the Miocene Tethys Sea and its shores, is summarized. In this context the endemic character of the molluscan fauna of the Gölbaşi lake area near Adiyaman is mentioned, and a new *Gyraulus* subspecies is described from that region. Additionally, two new species of hydrobiids are described, from the Ukraine and the Lebanon, respectively. Altogether six new species and one new subspecies are introduced, viz. *Pseudamnicola bilgini* spec. nov., *P. intranodosa* spec. nov., *Orientalina caputlacus*, spec. nov., *Belgrandiella edessana* spec. nov., *B. nemethi* spec. nov., *B. libanica* spec. nov., and *Gyraulus piscinarum acutissimus* subspec. nov. The anatomy of most of these was studied and evaluated.

Key words: Gastropoda, Prosobranchia, Hydrobiidae, Pulmonata, Planorbidae, freshwater snails, anatomy, taxonomy, Turkey, Ukraine, Lebanon.

INTRODUCTION

According to our actual knowledge, the spring-inhabiting snails of the genus *Pseudamnicola* Paulucci, 1878, have a circummediterranean distribution, occurring in Spain (Boeters, 1988: 241), France (Germain, 1931: 607), Italy (Alzona, 1971: 34), Greece (Schütt, 1980: 132), western Turkey (Schütt & Bilgin, 1970: 152), Israel (Tchernov, 1971: 201), and North Africa (Boeters, 1976: 94). If the taxon *Adrioinsulana* Radoman, 1973, is synonymized with this genus, it is also represented in the former Yugoslavia (Radoman, 1978: 35; 1983: 35). One species occurs in the Netherlands (Janssen & De Vogel, 1965: 40). Additionally, the genus is distributed with several species from Iran (Starmühlner, 1961: 91; 1965: 172) to Central Asia (Zhadin, 1952: 230).

This type of distribution and the fact that some species of *Pseudamnicola* are known at least since the Oligocene (Wenz, 1926: 2090) suggests that this genus has a Tethyan pattern of distribution. About 20 million years ago, the Tethys Sea linked the Atlantic and Pacific Oceans. Later on, the Paratethys Sea developed and Lower Mesopotamia with Iraq and parts of Iran came into being (Hsü, 1978: 56). At that time *Pseudamnicola* already inhabited the areas around the Tethys Sea.

The genus is relatively well characterized by a not extremely small shell, with a more or less broad oval shape, and by quite uniform genitalia, with a flat and usually broad but pointed, male copulatory organ, without appendages or stimulatory parts, a simple loop of the oviduct with one stalked receptaculum seminis, as well as only a moderate

number of gill leaflets (not over about 22). A revised diagnosis of the genus was given by Boeters (1971: 176; 1988: 196).

During joint excursions in East Anatolia the authors found in nearly all springs and wells great numbers of comparatively small hydrobiid species, which according to their conchological and anatomical characters, should be classified in the genus *Pseudamnicola*. They are not uniform and must be seen as more than only a single species. Until now, hydrobiid species have not been described at all from this East Anatolian area, though it is rich in springs and wells. This area is interesting, because the precipitation in the higher mountains of East Anatolia, especially in the parts with calcareous rocks, seeps away and the water gathers in subterranean streams and re-appears in numerous springs and wells at the northern limits of the Syrian plateau. The frontier between Turkey, Syria and Iraq runs at the northern limits of the Syrian plateau south of Urfa (Şanliurfa) from Mardin to Cizre. Because of the semi-arid climate in the plain, many rivers and brooks disappear gradually before they reach the great streams Euphrates (Firat) and Tigris (Dicle). But in their springs, which are on Turkish territory, there exists a varied fauna with several mollusc species, which, among others, always contains representatives of *Pseudamnicola*. Here it must be taken into consideration that the mountains on the Turkish side of the frontier have existed since the Miocene (Ponikarow, 1969: 115), so that endemic species could develop.

For collections the following abbreviations are used: Nem, H. Németh, Budapest; NNM, Nationaal Natuurhistorisch Museum, Leiden; Sch, H. Schütt, Düsseldorf; SMF, Senckenberg Museum, Frankfurt am Main.

SYSTEMATIC PART

Pseudamnicola Paulucci, 1878

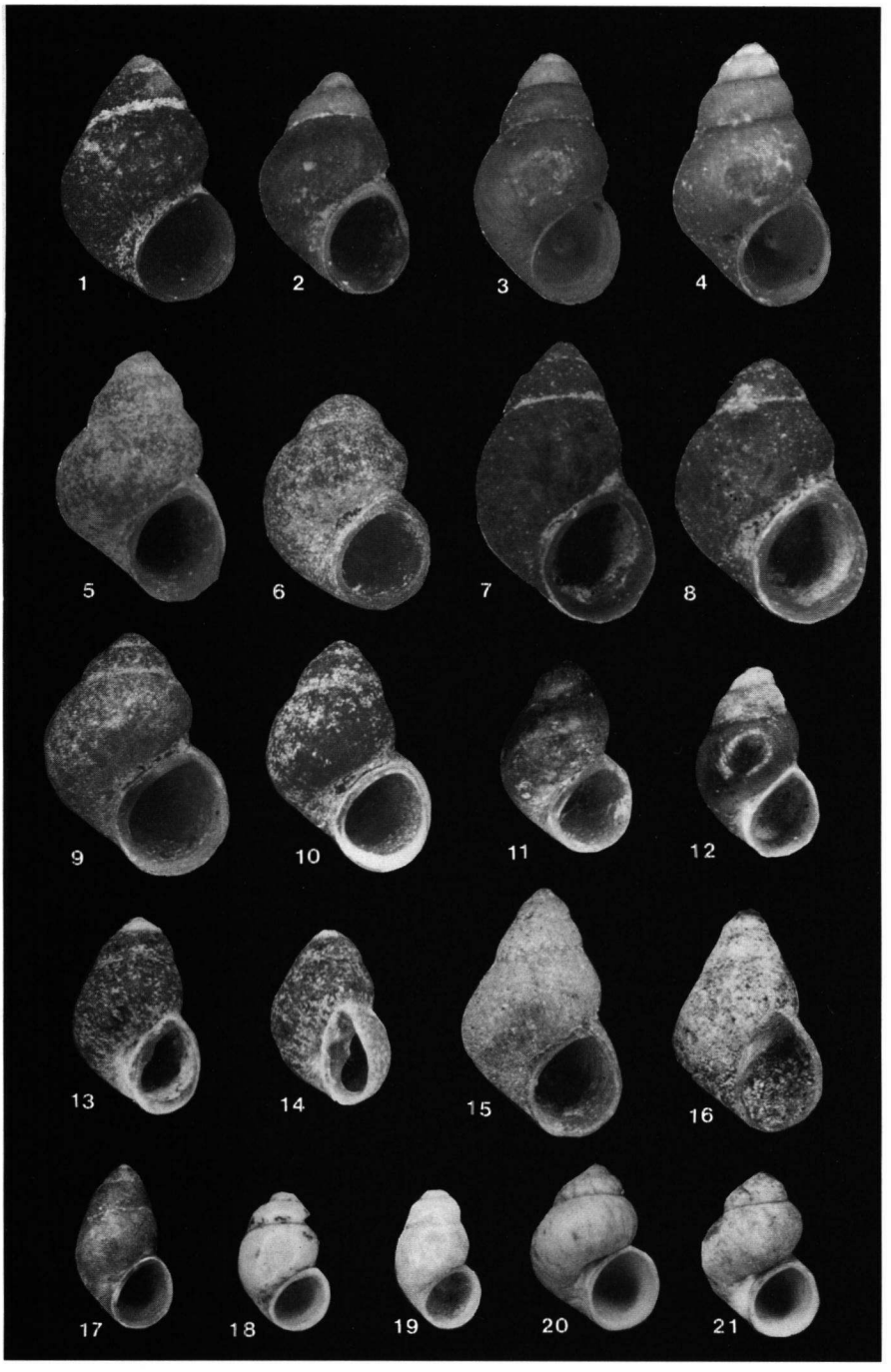
Pseudamnicola bilgini spec. nov. (figs. 1-11, 22a, b)

Pseudamnicola bilgini Şeşen, 1992: 37, pl. 2. Nomen nudum.

Diagnosis. — Characterized by its relatively small size, comparatively slender shell, and compared with its geographical neighbour *P. kotschyi* Frauenfeld, 1863, by a substantially narrower umbilicus.

Description. — Shell relatively small, oval, with a broad conical spire, solid, transparent, corneous; spire initially strongly, later on more evenly, increasing in width; 4-4 1/2 inflated whorls with deep sutures; aperture less than half the height of the shell, broadly

Figs. 1-21. Shells of hydrobiid species. 1-11, *Pseudamnicola bilgini* spec. nov.: 1, holotype, Afari (SMF 309880); 2, paratype, locus typicus (SMF 309881); 3, 4, 10 km NE. of Kiziltepe, Amrud spring, male (3: SMF 309882) and female (4: SMF 309883); 5, 6, 30 km N. of Nusaybin, brook Çağçağ, male (5: SMF 309884) and female (6: SMF 309885); 7, 8, Gribye near Sögütlü, male (7: SMF 309886) and female (8: SMF 309887); 9, Kaplica, brook Çermik (SMF 309888); 10, Tahtabaş (SMF 309889); 11, 3 km S. of Zunaçi near Şambayat (SMF 309890). 12-14, *Pseudamnicola intranodosa* spec. nov.: 12, Diphizar (SMF 309892); 13, 14, holotype, frontal and oblique view, respectively, Diphizar (SMF 309891). 15-16, *Orientalina caputlacus* spec. nov.: 15, holotype, Azapli lake (SMF 309894); 16, Gölbaşi lake (SMF 309895). 17, *Belgrandiella edessana* spec. nov., Gönüllü (SMF 309897). 18, *Belgrandiella nemethi* spec. nov., Rosswet (SMF 309898). 19, *Belgrandiella adsharica* (Lindholm, 1913), 5 km N. of Borçka (SMF 309900). 20, 21, *Belgrandiella libanica* spec. nov.: 20, holotype, Baalbek (SMF 309901); 21, paratype, ibidem (SMF 309892). All photographs (× 16): W. Hohorst.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oval, palatal lip more clearly rounded than the columellar border, which is incrassate and broadly attached; umbilicus narrow to rimate; operculum thin, paucispiral, light-brown transparent with a little eccentric nucleus.

Dimensions of the holotype (mm): height 2.1, width 1.5, height of the aperture 1.0, width of the aperture 0.8.

Soft parts strongly pigmented to black, with the exception of the mantle-border, the gill leaflets, the osphradium and the genitalia; about seven broad gill leaflets and a relatively large osphradium; male copulatory organ broad, acute at the top, curved to the left and folded at the left side; bursa copulatrix broad, oviduct unpigmented; only one stalked receptaculum seminis; radula teeth typical for the genus.

Material (paratypes, unless stated otherwise) and occurrence. — East-Anatolia. Vilayet Siirt: One of the springs of the Zarova brook, 30 km N. of Şirnak along the main road Şirnak-Siirt, between the Mesindaği pass and Eruh, Schütt & Şeşen leg. (Sch 1412a/21). Vilayet Mardin: spring in the village Afari with the Kurdish name Yurderi, 12 km N. of Kiziltepe, Schütt & Şeşen leg. (NNM 56814/39, alc. 9363/60; Sch 1391a/>100; SMF 309880/holotype, 309881/1, 309881/>25); Amrud spring (Kurdish name) or Beşdeğirmen fountain, 10 km NE. of Kiziltepe, Schütt & Şeşen leg. (NNM 56833/>25; Sch 1391b/>100; SMF 309882/1, 309883/1, 309883/>25); spring of the "white water" arm of the brook Çağçağ (= Çaçak), c. 30 km N. of Nusaybin, Schütt & Şeşen leg. (NNM alc. 9377/23; Sch 1385/>100; SMF 309884/1, 309885/1, 309885/>25); spring in the village Serkani near Mardin, Paydak leg. (Sch 739-109/9); spring in the village Tezharap near the main road Mardin-Nusaybin, Paydak leg. (Sch 739-33/1); spring of the brooklet Suruç in the hamlet Gribye near the village Söğütlü, 20 km E. of Nusaybin, south of the road to Cisre, Schütt & Şeşen leg. (NNM 56834/>25; Sch 1384/>100; SMF 309886/1, 309887/1, 309887/>25); irrigation canal Sulama north of the main road Mardin-Nusaybin, Paydak leg. (Sch 739-36/10); spring in the village Sersin near Oğuz north and the road Mardin-Nusaybin, Paydak leg. (Sch 739-99/10). Vilayet Diyarbakır: Kaplica, cold spring of the Çermik brook called Kirkgöz, Schütt & Şeşen leg. (NNM alc. 9378/>25; Sch 1392/>100; SMF 309888/>25); fountain below the village Eğil on the way to the Dicle (= Tigris) river, Paydak leg. (Sch 755-174/2); ibidem, leg. Schütt & Şeşen (NNM alc. 9379/24; Sch 1349/>100; SMF 309886/>25); spring in the village Tahtabaş near Diyarbakır town, Paydak leg. (Sch 755-174/4; SMF 309889/10; fountain in the small town Dicle E. of Ergani, Paydak leg. (Sch 739-20,2/4); spring in the village Nasiri near the small town Hani E. of Ergani, Paydak leg. (Sch 739-110,1/1). Vilayet Adiyaman: spring 3 km S. of the village Zurnaçi near Şambayat (= Şambat) along the road Adiyaman-Gölbaşi, Şeşen leg. (Sch 1390/>50; SMF 309890/1). Vilayet Şanliurfa (= Urfa): large spring complex called Alankoz near the village Gönüllü, 12 km W. of the town Siverek, Schütt & Şeşen leg. (NNM 56842/>25; Sch 1393/>50).

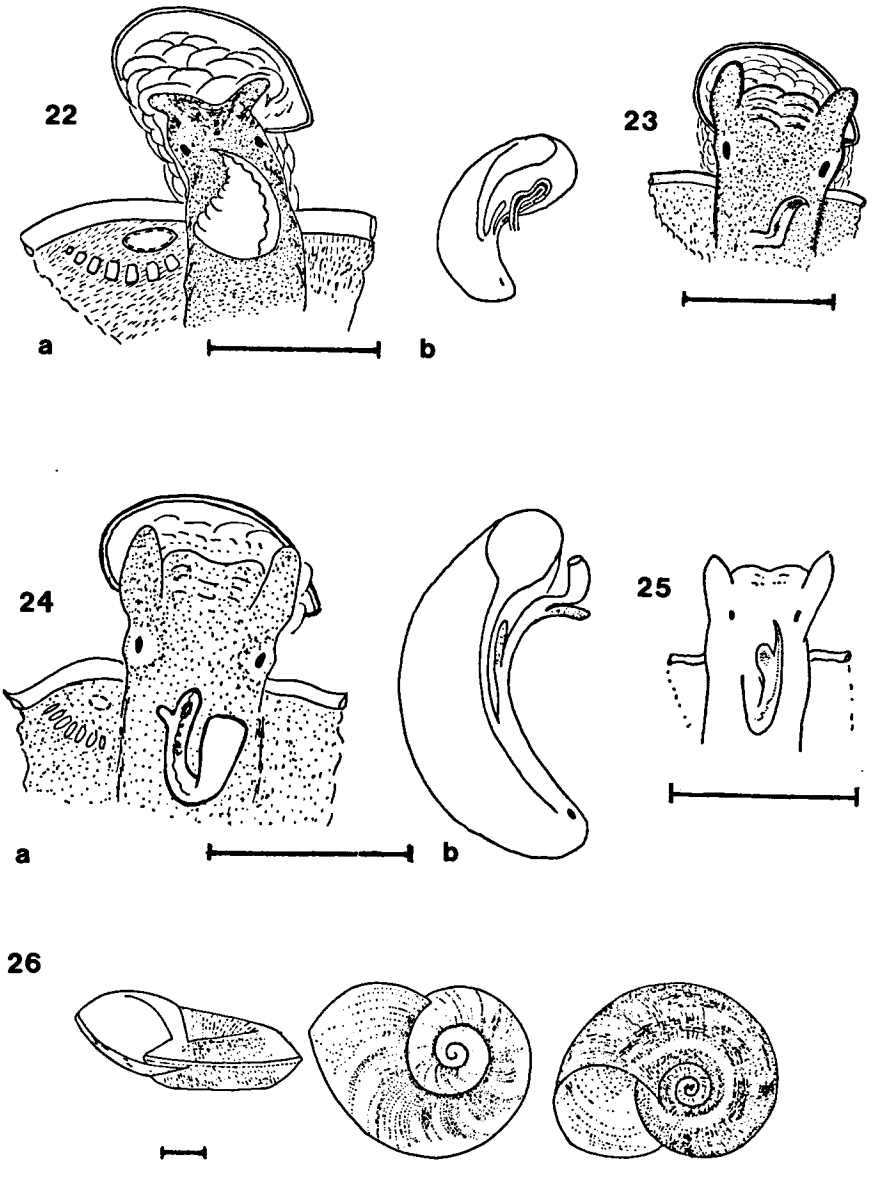
Notes. — This new species is known from various localities in East Anatolia.

Etymology. — *Pseudamnicola bilgini* is dedicated to Dr. F. H. Bilgin.

Pseudamnicola intranodosa spec. nov. (figs. 12-14, 23)

Pseudamnicola intranodosa Şeşen, 1992: 38, pl. 2. Nomen nudum.

Diagnosis. — Characterized by its small and slender shell, which has a tubercle on the inner side of the columella.



Figs. 22-26. 22, *Pseudamnicola bilgini* spec. nov., male (a) and female (b) from Afari; 23, *Pseudamnicola intranodosa* spec. nov. male, Diphizar; 24 *Orientalina caputlacus* spec. nov., male (a) and female (b) from the Azapli lake; 25, *Belgrandiella edessana* spec. nov., male, Gönüllü; 26, *Gyraulus piscinarum acutissimus* spec. nov., holotype, Gölbaşi lake (SMF 309903).

Description. — Shell comparatively small, elongated oval with a somewhat turreted spire, solid, bright corneous, transparent; spire initially strongly, later on more slowly, increasing in width; about four moderately inflated whorls with moderately deep sutures; aperture about half as high as the shell, oval, columellar border incrassate, broadly attached, columella with a tubercle which is visible only in oblique view; umbilicus very narrow. Operculum thin, paucispiral, corneous, transparent, nucleus slightly eccentric.

Dimensions of the holotype (mm): height 1.9, width 1.25, height of the aperture 0.95, width of the aperture 0.7.

Soft parts strongly pigmented, with the exception of the mantle-border and the slender penis, which has two pigmented dots and is curved to the right. Female specimens are not known.

Material (paratypes, unless stated otherwise) and occurrence. — Vilayet Şanliurfa (= Urfa): Big spring in the village Diphizar, 7 km NW. of Kabahaydar, 20 km E. of Akziyaret, Schütt & Şeşen leg. (NNM 56813/34, alc. 9362/33; Sch 1394/>100; SMF 309891/holotype, 309892/1, 309893/>50); spring between Gölpinar and Kabahaydar, Schütt & Şeşen leg. (Sch 1394b/>100).

Notes. — This is an endemic species with a small range.

Etymology. — Latin: *intra* = inside, *nodosus* = knotted.

Orientalina Radoman, 1978

Orientalina caputlacus spec. nov. (figs. 15, 16, 24)

Diagnosis. — Characterized conchologically by its flattened whorls and shallow sutures, and anatomically by pigmented spots on the male copulatory organ.

Description. — Shell small, elongated oval with a more or less conical spire, transparent, corneous; 4 1/2-5 flattened whorls with shallow sutures, regularly increasing in width; surface with irregularly distant growth-lines; aperture regularly ovoid, at the upper edge somewhat acute; apertural margins not very sharp but incrassate at the columellar side; umbilicus closed. Operculum thin, transparent, paucispiral; nucleus eccentric.

Dimensions of the holotype (mm): height 2.2, width 1.3, height of the aperture 1.0, width of the aperture 0.8.

Penis slender, not very acute and with one, exceptionally two, outgrowths on the left side; female genitalia with two receptacula seminis.

Material (paratypes, unless stated otherwise) and occurrence. — Vilayet Adiayaman: Beach springs at the western shore of the Azapli lake in the Gölbaşi lake system, about 50 km W. of Adiyaman (NNM 56843/>25; Sch 1415/>100; SMF 309894/holotype, 309895/1, 309896/>50); Gölbaşi lake, shore near Gölbaşi (Sch 1414/>50).

Notes. — The hitherto known species of *Orientalina*, about half a dozen, live on the Balkans as far south as Greece.

Etymology. — The epithet *caputlacus* is formed after the geographic name Gölbaşi: göl = sea = *lacus*; baş = head = *caput*.

Belgrandiella A. J. Wagner, 1927

Belgrandiella edessana spec. nov. (figs. 17, 25)

Diagnosis. — Characterized by its small size and a slender shape with a relatively high body whorl.

Description. — Shell small, spindle-shaped, not solid, light-brown; umbilicus closed; four equally inflated whorls with deep sutures, body whorl comparatively large, occupying 2/3 of the height of the shell; apex rounded; surface of the shell smooth; aperture oval, somewhat oblique and protruding; margins of the aperture sharp, at the columellar side somewhat incrassate. Operculum transparent with an eccentric nucleus.

Dimensions of the holotype (mm): height 1.5; width 0.9, height of the aperture 0.7, width of the aperture 0.55.

Penis slender, with a lateral outgrowth, and pigmented at several points. No females were available for examination.

Material (paratypes, unless stated otherwise) and occurrence. — Vilayet Şanliurfa (= Urfa); village Gönüllü, 12 km W. of the town Siverek, living on stones in clear water of the nearby great spring-complex "tahlik havuz", which means 'empty pool' (NNM 56812/1; Sch 1393/2; SMF 309897/holotype).

Notes. — The genus *Belgrandiella* is wide-spread in S. Europe from Spain (Boeters, 1988: 224) via France and Italy to the Balkans. Only one species is known from Turkey, viz. *B. cavernica* C. R. Boettger (1957: 70, fig. 2) from a lake in a cave near Insirti near Ereğli in the Vilayet Zonguldak at the western Pontus shore of Anatolia. *B. edessana* differs from this species by a shorter spire, smaller dimensions, a relatively higher body whorl and in total about one whorl less. The new species does not live in a cave but in a great spring system which is far distant from the type locality of *B. cavernica*.

Etymology. — The epithet *edessana* is formed after 'Edessa orientalis', the Latin name of the vilayet Şanliurfa (= Urfa).

I (Schütt) take the opportunity to describe two more new *Belgrandiella* species, given to me for description by L. Németh, Budapest, and Drs. Z. Moubayed, Toulouse, and A. Dia, Beyrouth.

Belgrandiella nemethi Schütt spec. nov. (fig. 18)

Diagnosis. — Characterized by its width and an incrassate apertural lip.

Description. — Shell small, solid, broadly oval with an acute apex, bright transparent to yellowish; 4-4 1/2 moderately inflated whorls with deep sutures; upper spire conical; aperture measuring about 1/3 of the shell height, broadly oval, thickened inside, with a sharp edge, which is straight and continuous, not reflected; rimate.

Dimensions of the holotype (mm): height 1.2, width 0.8, height of the aperture 0.5, width of the aperture 0.55.

No soft parts available.

Material (paratypes, unless stated otherwise) and occurrence. — Ukraine, Sotschi area: Hosta (= Khosta), valley near the village Rosswet, spring of a brook, H. Németh leg. 20.vi.1988 (Nem 10690/>50; NNM 56811/23; Sch 1461/10; SMF 309898/holotype, 309899/>10).

Notes. — The new species should be compared to the following two species:

(a) *Belgrandiella adsharica* (Lindholm, 1913) [*Bythinella*] from Georgia, province Batum, near Adsharis-Zchali, shortly before the mouth of the brook with the same name into the Çoruh river (Lindholm, 1913: 67). We found shells of this species in Turkey, Vilayet Artvin, in a spring near the shore of the Çoruh nehri about 5 km N. of Borčka. This species has no thickened bulge in the aperture, additionally it is smaller, noticeably more slender, and more thin-shelled than the new species. The figure in Zhadin (1952: fig. 154) does not show a typical specimen.

(b) *Belgrandiella elbursensis* (Edlauer, 1957) (in Starmühlner, 1957: 444, pl. 1 fig. c) [*Frauenfeldia*] from Iran, Gelandoah, 60 km NE. of Teheran in the Elburs Mts., in a running brook. This species has a conical spire and distinctly more flattened whorls with shallower sutures, as compared to the new species, and is more thick-shelled, as seen in the figure of the holotype (Boeters, 1970: 145, pl. 9 fig. 33).

Etymology. — This new species is dedicated to Mr. H. Németh.

Belgrandiella libanica Schütt spec. nov. (figs. 20, 21)

Belgrandiella n. sp. Moubayed, 1986: 126, 128.

Diagnosis. — Characterized by its very small, solid shell with strongly inflated whorls and a low spire.

Description. — The shell is very small, solid, clear transparent to white, shortly oval, with a blunt apex; four strongly inflated, rapidly increasing whorls with deep sutures; surface without sculpture; aperture nearly circular, with a sharp, continuous straight border, which is somewhat detached and protruding below; narrowly rimate. Operculum yellowish, colour in the centre more intense than at the border, paucispiral, transparent Pallial organs: 7-9 gill leaflets, osphradium short, elliptic. Penis with a very broad base, long, very slender and tapering, with a lateral outgrowth. There is one receptaculum seminis, situated near the bursa copulatrix.

Dimensions of the holotype (mm): height 1.2, width 0.9, height and width of the aperture 0.6.

Material (paratypes, unless stated otherwise) and occurrence (all localities are in the Lebanon). — Baalbek, main spring in the ruins of the Roman bath, 1000 m alt., Moubayed leg. 25.ix.1981 (NNM alc. 9365/22; Sch 1248/9; SMF 309901/holotype, 309902/5). Further material, after Dia (1983: 33) (no type specimens): Karstic springs of Elain, 950 m alt., and Labwé, 1000 m alt., both in the spring area of the Nahr el-Assi (Orontes); spring near the village Youfoufa, 1200 m alt.; spring Nabaa Abou Kharma, draining over the Ouâdi el-Blaîet between the villages Hâret Jandal and Bâter ech-Chouf to the river Aouali, which flows into the Mediterranean Sea south of Beyrouth, 850 m alt.

Notes. — According to the shell morphology, this species has to be classified with the genus *Belgrandiella*, which is in agreement with the anatomical characters, especially the form and lateral bulge of the unpigmented penis and the absence of a second receptaculum (Giusti & Bodon, 1984; 158).

Gyraulus Charpentier, 1837

Gyraulus piscinarum acutissimus subspec. nov. (fig. 26)

Diagnosis. — Differing from the nominate subspecies of *G. piscinarum* (Bourguignat, 1852) by the presence of a sharp peripheral keel, a thicker shell, and a prominent reticulate sculpture on the upper side of the whorls.

Description. — The shell is of medium size, 5-6 mm in diameter, and relatively high, not only due to an obliquely deflected last whorl but also because of a relatively thick disk of the shell with a height of 2.5 mm; the three to four whorls are rapidly increasing, the whorls are hardly flattened, but have a sharp keel on the periphery and an obtuse edge around the upper umbilicus; the under side is convex, hardly umbilicate and

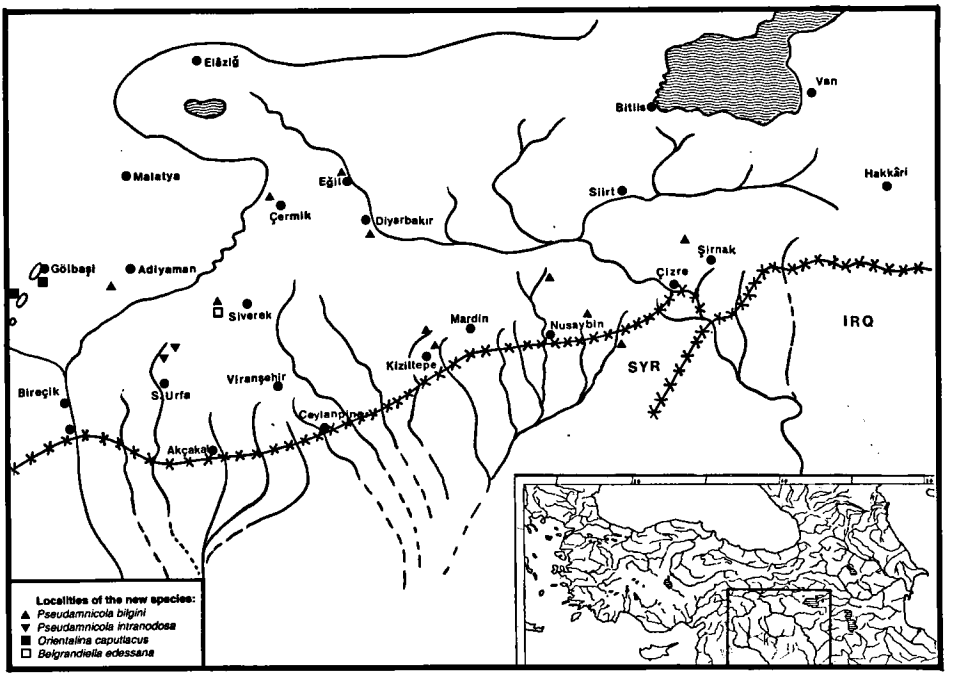


Fig. 27. Localities in East Anatolia (Turkey) of some new species discussed here.

sculptured with clearly visible spiral stripes crossed by growth-lines, resulting in a reticulate sculpture; the aperture is very large and oblique, nearly as broad as long.

Material and occurrence. — Turkey, Vilayet Adiyaman, Azapli lake near the village Gölbaşi, 50 km W. of Adiyaman, Schütt & Şeşen leg. (NNM 56810/4; Sch 1415/8; SMF 309903/holotype).

Notes. — This is not a subspecies of *Gyraulus albus* (Müller, 1774), because only one side of the shell is concave, the other convex. We further refer to the revision of *Gyraulus euphraticus* (Mousson, 1861) and *G. piscinarum* by Meier-Brook (1983: 48, 52). This author examined animals from Diyarbakır both conchologically and anatomically and found these identical with *G. piscinarum*, in spite of some morphological differences as compared to the populations of the type locality Baalbek in the Lebanon. We also note differences between the shells from the type locality and those from SE. Anatolia. Nevertheless, it can be accepted that the Turkish populations belong to *G. piscinarum*. The new subspecies is keeled more prominently than the Pleistocene *Gyraulus piscinarum kaiseri* Schütt, 1973, from the Damascus basin and has a thicker disk of the shell. *Gyraulus euphraticus* (type locality: Samawa, Euphrates in S. Iran) is more flat, without such a large and oblique aperture and never has a reticulate sculpture.

We know many populations of *G. p. piscinarum* from SE. Anatolia, but none has shells with anything like such a sharp keel as the shells in the Gölbaşi lake and the nearby Azapli lake. So we consider the animals in question to represent an endemic faunal

element of the Gölbaşi lakes. They experienced a development similar to that of the manyfold *Gyraulus* species in the Ohrid lake in Macedonia resulting in endemic forms. We can refer to the sarmatian development of *G. trochiformis* (Stahl, 1824) in the Steinheim Basin, too, which was demonstrated by Mensink (1984: 48, fig. 25). The normal, weakly keeled typical subspecies of *G. piscinarum* is known to us from various localities in SE. Anatolia.

In our search for freshwater hydrobiid snails in the Gölbaşi lakes (Gölbaşi, Azapli and Inekli lake, near Adiyaman) we recognized the endemic character of the lake system, in which at least three endemic forms exist. These are marked with an asterisk in the following table of all molluscan species found living there:

Theodoxus (*Neritaea*) *anatolicus* (Récluz, 1841),
Valvata (*Cincinna*) *piscinalis* (Müller, 1774),
Bithynia spec.,
**Orientalina caputlacus* spec. nov.,
Melanopsis praemorsa ferussaci Roth, 1839,
Galba truncatula (Müller, 1774),
Stagnicola palustris (Müller, 1774),
Radix auricularia (L., 1758),
Planorbis carinatus (Müller, 1774),
**Gyraulus piscinarum acutissimus* subspec. nov.,
Oxyloma elegans (Risso, 1826),
Unio crassus bruguierianus Bourguignat, 1853,
Unio elongatulus eucirrus Bourguignat, 1857,
Potomida littoralis delesserti (Bourguignat, 1852),
**Dreissena caputlacus* Schütt, 1993,
Sphaerium corneum (L., 1758),
Pisidium casertanum (Poli, 1795).

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