Arch. Moll. | 100 | (3/4) | 151—158 | Frankfurt a. M., 31. 8. 1970

Pseudamnicola geldiayana n. sp., a spring-inhabiting snail of the Anatolian Plateau.

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A series of hydrobiid snails is to be found in the freshwater-spring-biotopes in the western part of the anatolian plateau with its low-lying spurs. The common characteristic of these species is their strikingly small size. Certain types of snails have already been described as far back as the mid 19th century. This has given rise to a more accurate study of the district with a view to learning more about these small Prosobranchian snails. Recent studies have shown, that there are more genera and species than was previously assumed. A thorough study of this district by the Ege Üniversitesi, Fen Fakültesi, Bornova-Izmir[1]), has brought a further equally small *Pseudamnicola*-species to light. It is this new species that is to be described in this article. It has become necessary also to differentiate a new geographically separated subspecies.

In 1853, KÜSTER, from CHARPENTIER collection, described Bursa's *Pseudamnicola natolica [Paludina]* as well as the *Sadleriana byzanthina* of the same locality. FRAUENFELD published a work on *Sadleriana affinis* a short time later in 1863 from Kurdistan. Later NÄGELE described *Horatia parvula [Lithoglyphus]* in 1894 and in 1903 the *Sadleriana minuta.* Only recently has a further series of small hydrobiids become known. Firstly through C. BOETTGER (1957) and later through SCHÜTT (1964 and 1965).

The study of available collections on this subject has convinced us that *Pseudamnicola natolica* from locus typicus, that is to say of the springs of Vilayet Bursa is not identical in shape with that of the district of Izmir, as was, among others, disclosed by BILGIN (1967: 24, 26) as *Bythinella byzanthina.*

In order to clarify the matter the original material had to be studied. The kind assistance of Dr. AUBERT, Lausanne, made it possible for us to compare syntypes from the CHARPENTIER collection, to select a lectotype of the *natolica* and to copy them (Fig. 1). As a result it became necessary to differentiate between the *natolica*-form and that of the Izmir district. At present it has not been possible to make a complete analysis of the forms living in the interregional zones which could even prove to be a species in itself.

[1]) This study is a part of the research project Nr. TBAG 37, supported by Scientific and Technical Research Council of Turkey.

Pseudamnicola natolica smyrnensis n. subsp.

Fig. 2.

1965 *Pseudamnicola (P.) natolica,* — SCHÜTT, Zool. Mededel., **41**: 61, Abb. 5. (partim).
1967 *Bythinella byzanthina,* — BILGIN, Ege Üniversitesi Fen Fakültesi Ilmi Raporlar serisi **36**: 24, Abb. 3, T. 1 F. 5.
1967 *Pseudamnicola (P.) natolica,* — BILGIN, loc. cit.: 25.

Diagnosis: A subspecies of *Pseudamnicola natolica* (KÜSTER 1853) *[Paludina]*. Apart from its geographical distribution, this distinguishes itself from the basic form through a more rounded spiral surface and wider shell base, the start of the spiral being more pointed.

Description: The shells of this subspecies have a widened oval habitus with a cone-shaped apex and low rounded turns. These are wider than those of the basic form. Furthermore they are mainly thin-shelled and mostly coloured with a brown tone. Four low rounded spirals are separated by deep sutures. The mouth is round to oval with a sharp edge, as opposed to that of the basic form which is thicker. The umbilicus is very close and the shell has a fine irregular growth-sculpture.

Size of Type: (in mm): A = 2·0; D = 1·5; aperture 1·0 : 0·8.

Material: Holotype SMF 197100; Paratypes in Ege Üniversitesi Bornova-Izmir; SMF 197101/24; Nat. Hist. Mus. Vienna; Rijksmuseum Natuurlijke Historie Leiden; coll SCHÜTT.

Locus typicus: Bornova-Mansuroğlu place, between Izmir and Bornova.

Localities: 44 Tire, Akyurt village (between Tire and Selçuk, in Akyurt). — 45 Tire, Akşehir village (in the village). — 47 Tire, Kurşak (in the village). — 49 Tire, Halkapınar village (in the village). — 54 Çeşme, Ildırı village (north of village). — 55 Urla, Balıklıova subdistrict (in Balıklıova). — 69 Dikili, Çandarlı subdistrict (between Çandarlı and Dikili). — 80 Değirmendere, Bulgurca village (in the Kavalalı Huseyın farm). — 88 Değirmendere, Gümüldür village (source of Gümüldür). — 97 Buca, Kaynaklar village (south of village). — 98 Buca, Belenbaşı village (in the ruins of the old village). — 110 Tire, Gökçen subdistrict (in Gökçen). — 116 Bergama, Kozak subdistrict (between Bergama and Kozak).

All these localities are in the Izmir district, but there are also localities in the Aydın district. The animals can be found on stones and leaves in the water, sometimes abundantly. Associated fauna: *Melanopsis praemorsa* (LINNAEUS) and *Theodoxus* sp.

Relations: The hitherto known territory of *n. natolica* lies in the provinces of Bursa and Bileçik. The new subspecies *n. smyrnensis* is established in the provinces of Izmir and Aydın. East of Izmir and Aydın a further *Pseudamnicola-species,* which is clearly distinguishable from the known forms, has been discovered in several localities in the province of Denizli.

The differences to types belonging to other species will be dealt with below.

Pseudamnicola geldiayana n. sp.

Figs. 3-8.

Diagnosis: A small species of the genus *Pseudamnicola* PAULUCCI 1878 with high cone-shaped shell and only slightly rounded spiral turns.

Description: The shell is, relatively speaking, very small and hard, high cone-shaped with a green-yellow transparent shimmer. The apex is pointed, 4½

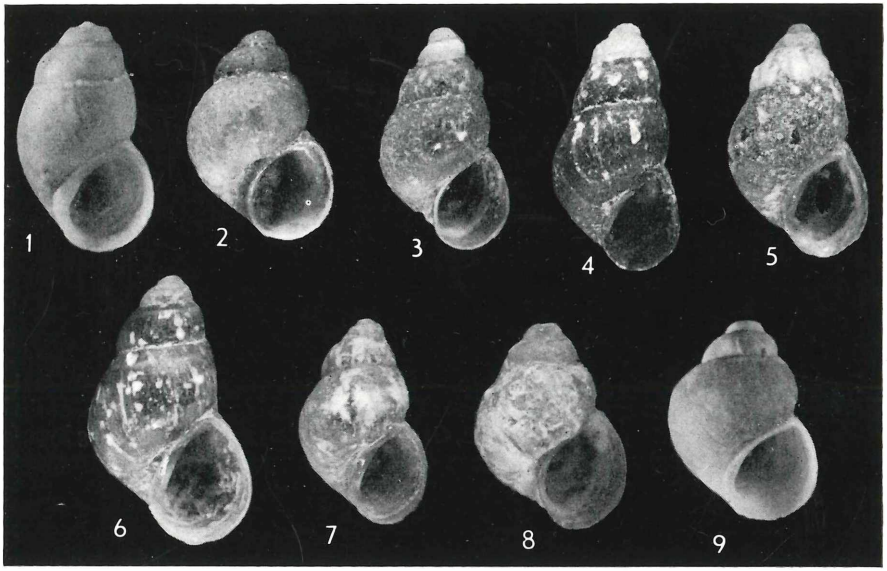


Fig. 1. *Pseudamnicola natolica natolica* (KÜSTER). Lectotype of *Paludina natolica* KÜSTER 1853. Brussa [coll. CHARPENTIER, Mus. Lausanne].

Fig. 2. *Pseudamnicola natolica smyrnensis* n. subsp. — Bornova-Mansuroğlu [Holotype SMF 197100].

Figs. 3-8. *Pseudamnicola geldiayana* n. sp. — 3) Akpinar [Holotype SMF 197102]. — 4) Gökpinar [Paratype SMF 197104a]. — 5) Muttasipinar [Paratype SMF 197105a]. — 6) Böceli [Paratype SMF 197106]. — 7) Yapağili [Paratype SMF 197107a]. — 8) Taşlica [Paratype SMF 197108a].

Fig. 9. *Sadleriana byzanthina* (KÜSTER). Lectotype of *Paludina byzanthina* KÜSTER 1853. Brussa [coll. CHARPENTIER, Mus. Lausanne].

Figs. 1-9: ×15; Figs. 2-8: phot. Senckenberg-Museum (E. HAUPT).

relatively high turns which increase rather evenly. The last turn takes up approx. $^2/_3$ of the total height of the shell. Generally the turns are not very rounded; however in certain localities slightly rounded with correspondingly slightly indented suture. The mouth measures less than half the height of the shell. It is oval and is drawn out at a sharp angle at the top. The edge is sharp, closely fitted with the outside edge protruding, the spindle edge slightly thickened. The shell has a half covered umbilicus. It is not sculptured, but has at least a rough surface rather influenced by growth lines.

The species shows a remarkable variability in the height of the shell. Even when dealing with unquestionably related specimens in the Denizli basin, short and elongated shells are to be observed. Under these circumstances it is appropriate to include even the out of the way situated locality Taşlıca between Beyşehir and Aseki into the variability of the new species. These individual specimens are extremely short and have the known shell characteristics.

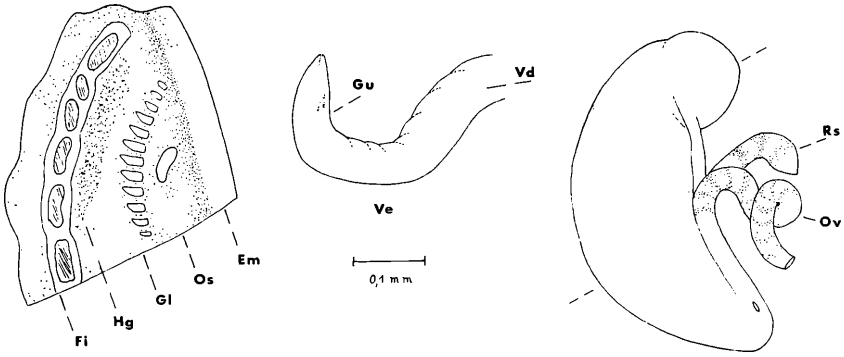


Fig. 10. *Pseudamnicola geldiayana* n. sp. — Pallial organs, verge and parts of feminal reproductive system. — Glossary of terms: *B* bursa copulatrix, *Em* end of the mantle cavity, *Fi* final intestine, *Gl* gill leaflets, *Gu* glandular units, *Hg* hypobranchial gland, *Os* osphradium, *Ov* oviduct, *Po* pallial oviduct, *Rs* seminal receptacle, *Ve* verge, *Vd* vas deferens.

The operculum (Fig. 11) of the shell is coloured yellow-orange, paucispiral and elongated oval form which is drawn out at a sharp angle on the top. The nucleus is very eccentric. The shape is predominently determined by the slightly curved inner structure. The corresponding outher structure is nevertheless also recognizable. The adjoining muscle is narrowly elongated on the proximal side of the operculum.

The female is by and large more strongly built and has on the average half a turn more than that of the male. Males are more numerous than females. The experienced observer can define the sex through the difference of the shell.

From the base up, the body of the species is strongly pigmented on the upper side as well as beneath. Inner organs are not visible, the sack of the intestines is black.

The pallial organs are typical for this genus. The mantle is very short in relation to the shelless specimen. In the front, the height of the mantle cavity is open to extremity. On the outside edge there is an almost unpigmented part.

The osphradium lies on the left side of the mantle and has an elongated oval form. It is surrounded only on one side by about 14 rather large gill leaflets. Arrangement and form of the ctenidium are typically hydrobiid.

Male reproductive system: The verge is a worm shaped organ, is firmly attached to the right side of the neck and curved to the left. On the concave side of the curve are a few clusters of spherical glandular units, which are coloured pale green. The vas deferens has only slight undulating curves. It is slightly thickened at the end. The prostata is oval and the upper sperm accumulating part of the vas deferens, which has irregular loops, is situated on the testis.

Female reproductive system: The upper part of the outgoing passage of the ovarys glandular substance is narrow, thin-walled and thin-tissued. The lower part of the oviduct below the gonopericardial side passage is extruded and surrounded by a relatively strong muscular coating. Furthermore there is an oblong

and bent seminal receptacle capsuled in this muscular coating, which branches off in the form of a looped passage. The bursa copulatrix, which branches off later, is fairly large, club-shaped and rather thin-walled. The pallial oviduct, which is not noticably separated from the glandular substance, is simply constructed.

The radula (Fig. 12) is taenoglossate and has a length of about 540 μ and a width of about 80 μ. There are 60-70 rows of teeth with about 10 rows of teeth in the formative stage. Each row has 7 teeth of a typical hydrobiid habitus. The central tooth has a strong inflected edge with extremely short denticles and two strong basal cusps. Lateral, inner and outer marginal teeth have also only very short denticles. Rhachis has a width of 20 μ. Radula cusp formula:

$$21 \quad 17 \quad 4\text{-}1\text{-}3 \quad \frac{3\text{-}1\text{-}3}{1\text{-}1} \quad 3\text{-}1\text{-}4 \quad 17 \quad 21.$$

Likewise denticles of teeth of the praeradula are remarkably short.

Size of Type (in mm): A = 1·9; D = 1·1; aperture 0·8 : 0·7.

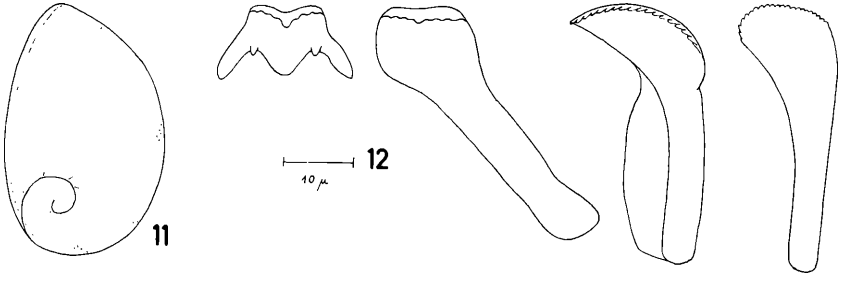
Material: Holotype SMF 197102; Paratypes in Ege Üniversitesi Bornova-Izmir, SMF 197103-5; Nat. Hist. Mus. Vienna, Rijksmuseum Natuurlijke Historie Leiden; coll. SCHÜTT.

Locus typicus: 298 Akpınar (Denizli, garden of the teaching school).

Localities: 299 Muttasıpınar (in Denizli). — 300 Fesliganpınar (in Denizli). — 301 Kuşpinar (in Denizli). — 302 Water source of Denizli. — 303 Gökpınar (between Denizli and Tavas, near Denizli). — 306 Böceli village (between Denizli and Çardak). — 307 Koçabas village (between Denizli and Çardak). — 315 Yapağılı village or Çerkez (between Dinar and Çivril). — 344 Taşlıca village Murtiçi place (between Beyşehir and Akseki).

Distribution: The localities mentioned lie mostly in the range of the Denizli basin. There are no stations known further west, which connect these localities with *P. natolica smyrnensis*. It seems, that sporadicly distributed stations join in the eastern and southeastern territory.

Habitat: All localities are springs or small lakes, inundated by springs, with clean water, mostly flowing swiftly, with stony bottom and stones covered with moss. Water temperature in September 15°C, p_H max. 7·5. Associated fauna: *Theodoxus subthermalis* ISSEL, *Melanopsis praemorsa* (LINNAEUS).



Figs. 11-12. *Pseudamnicola geldiayana* n. sp. — 11) Operculum; 12) Radula, half-row.

Ethiology: The species is dedicated to Prof. Dr. R. GELDIAY, Bornova-Izmir, as a sign of gratitude for his valuable contribution to the way in which he conducted the studies of the one of us.

Relations: In spite of having only one seminal receptacle it seems to be necessary to classify the new species on account of the relations of its shell structure and the other anatomical opinions into the genus *Pseudamnicola*. Here it joins quite well to the hitherto known forms of that genus from Anatolia. This is more delicate and can be differenciated easily from *P. lindbergi* C. BOETTGER 1957 which even with corroded apical turns is still higher and above all broader. Moreover, *lindbergi* is more narrowly umbilicated and more bellied and has an obtused angle at the top of the mouth and inhabits eastern Turkey near Elbistan, Vilayet Malatya. *P. lindbergi* always seems to be related with our new species and it remains to be seen, whether transition forms will be discovered in the 700 km district between the two localities.

GÖTTING (1963: 32) announced *P. lindbergi* from Uludagh at Bursa. Comparison with the original material collected by SCHWEIGER (SMF 167855/3) stated, that this is a *Bythinella*, the same species, reported by SCHÜTT (1965: 58) from Orman Belgrad near Istanbul. This is the first known occurence of a *Bythinella* in Anatolia.

On this occasion we wish to correct a wrong determination by SCHÜTT (1965: 63) from the Aksu at Maraş. According to altitude, convexity of turns and shape of mouth, the material is *P. lindbergi*, but with uncorroded apical turns. Its coarse structure distinguishes it from *P. geldiayana*, which is more tender.

The new species can be separated by its higher cone-shaped shell and the higher turns from *n. natolica* and *n. smyrnensis*, whose difference in form is to be seen in the appended illustrations. Likewise it cannot be confused with *Sadleriana byzanthina* (KÜSTER 1853) [*Paludina*], whose spiral is remarkably shorter and where the height of the shell is at most 1·6 mm. In course of our investigations it was possible also to compare the uniform material of the collection CHARPENTIER, to select a lectotype out of the three syntypes of that species and to illustrate them (Fig. 9). The distribution of that *byzanthina* seems to be disjunct over greater parts of Turkey, since we know them besides the locus typicus Bursa also from the vicinity of Izmir and in a characteristic specimen from Merseba, Syria, leg. v. MALTZAN, May 1883 (SMF 142165).

Extremely short forms of *Hydrobia anatolica* SCHÜTT 1965 can show a superficial resemblance with our new species. The *Hydrobia*-species is more towered and thick-shelled.

Hydrobia longiscata BOURGUIGNAT 1856 from Sidon (Saida) in the Lebanon, specimens of which are in our possession also from other localities in Galilee, Israel, are twice as large as our new species and are higher towered. Likewise *„Bithinella" contempta* and *„B." palmyrae* DAUTZENBERG 1894 from Syria are throughout greater and broader, but may be related.

Pseudamnicola iraquensis (PALLARY 1939) [*Paludestrina*] likewise is larger than our new species and it is possible, that this and *lindbergi* are identical.

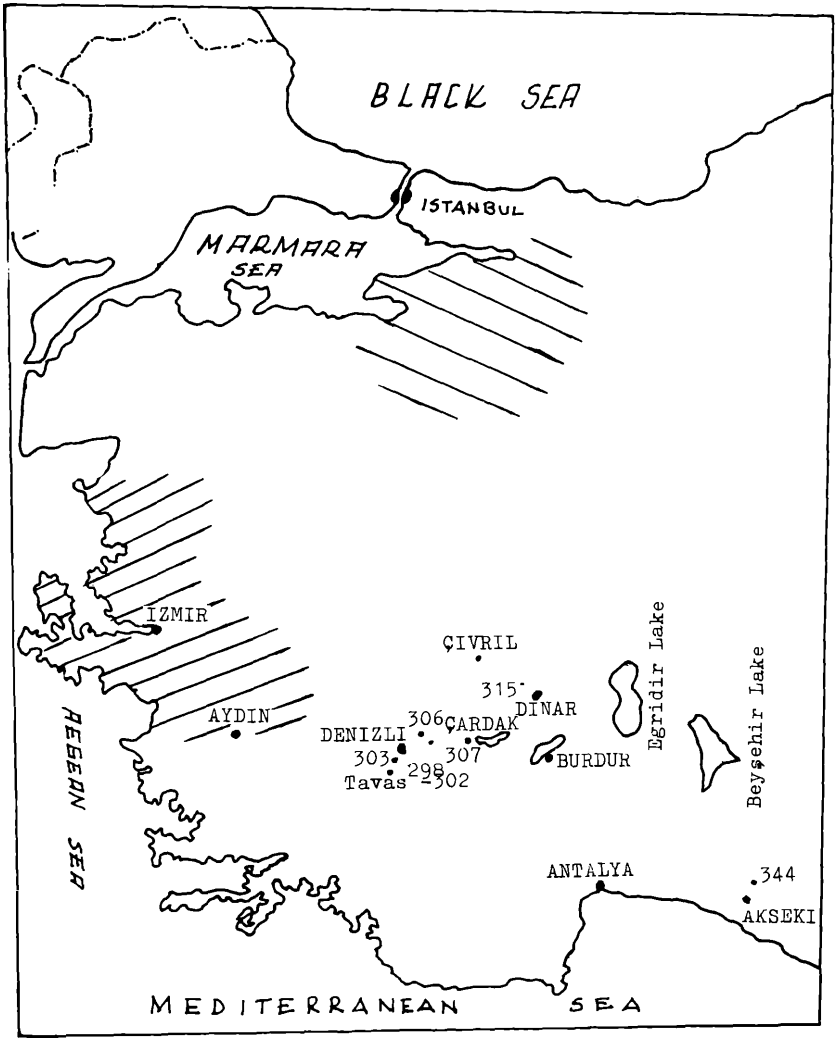


Fig. 13. Sketch of spread: \\\\\\ *Pseudamnicola n. natolica* (KÜSTER); ////// *Pseudamnicola n. smyrnensis* n. subsp.; 298-344 *Pseudamnicola geldiayana* n. sp.

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