

## Revision of the genera *Pseudamnicola* PAULUCCI 1878 and *Mercuria* BOETERS 1971 from Algeria with particular emphasis on museum collections

(Gastropoda: Prosobranchia: Hydrobiidae)

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### Abstract

An extensive investigation of newly collected samples and more than 140 samples of museum collections (Museum Paris and Geneva) of *Pseudamnicola* spp. as well as of *Mercuria* spp. of Algeria and Tunisia has been carried out. Nine of the formerly described *Pseudamnicola* spp. of which we believe that four species are synonyms of *Pseudamnicola dupotetiana*, could be found in the collections. In addition, nine *Pseudamnicola* spp. and two *Mercuria* spp. are described here as being new: *Pseudamnicola boucheti* n. sp., *P. chabii* n. sp., *P. ghamizii* n. sp., *P. algeriensis* n. sp., *P. gerhardfalkneri* n. sp., *P. calamensis* n. sp., *P. fineti* n. sp., *P. liniae* n. sp., *P. rouagi* n. sp., *Mercuria bourguignati* n. sp., and *M. gauthieri* n. sp.

**Key words:** Gastropoda, Hydrobiidae, *Pseudamnicola*, *Mercuria*, Algeria, revision, new species.

### Introduction

In the 19<sup>th</sup> century, the molluscan fauna of Algeria was intensively studied. The most extensive malacological investigations in Algeria have been carried out by BOURGUIGNAT (1862, 1864) and LETOURNEUX (1870). In the course of these investigations, 14 *Pseudamnicola* species have been described as being new, in addition to the already known species *Pseudamnicola dupotetiana* (FORBES 1838), and *P. luteola* (KÜSTER 1852).

In the 20<sup>th</sup> Century PALLARY (1921: 202) reported on *Amnicola lanceolata* PALADILHE 1869, and *A. similis* DRAPARNAUD 1805 from MOFOCCO. GERMAIN (1908: 269–273), however, mentioned only *Bythinia numidica* BOURGUIGNAT 1864, *B. orsinii* DE CHARPENTIER 1852, and *Amnicola dupoteti* FORBES 1838 from the neighbouring country Tunisia.

The species diversity in the genus *Pseudamnicola* mentioned by BOURGUIGNAT (1864) and LETOURNEUX (1870) decreased in the course of time by means of taxonomic lumping down to one species, *P. dupotetiana*, mentioned by VAN DAMME (1984: 17), KRISTENSEN (1985: 7), and BROWN (1994: 70).

When BOETERS (1971) designated the new genus *Mercuria*, which he separated from the genus *Pseudamnicola*, it was not clear which species of this new genus occur in Algeria. From Tunisia BOETERS (1976) mentioned *Mercuria confusa* (FRAUENFELD 1863) and *M. punica* (LETOURNEUX & BOURGUIGNAT 1887). Merely *Mercuria conovula* has been mentioned from Algeria by VAN DAMME (1984: 18).

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GIUSTI et al. (1995: 132–138) comprehensively discussed the problems involved in species determination within the genus *Pseudamnicola* and *Mercuria*. The many species they dissected from Malta revealed only slight differences as to their genital organs whereas there is a large variability of the shells, so in their opinion only one species of each genus occurs in Malta. In contrast, BOETERS (in BECKMANN 1987: 7–9) found two distinct *Mercuria* spp. on Malta.

LETOURNEUX & BOURGUIGNAT (1887) stated that most of the *Pseudamnicola* spp. were widely distributed in Algeria. If this is the distribution pattern, it is in fact distinct from those in other Mediterranean countries. *Pseudamnicola* has a circum-Mediterranean distribution, while the known species diversity increases from East to West. In those countries where this genus is well investigated (Tunisia: BOETERS (1976), Spain: BOETERS (1988), Balearics: BECKMANN (2007)) the species richness is, nevertheless, much lower than in Algeria, and in contrast to Algeria the species are more confined to smaller regions concerning their distribution.

This paper is intended to elucidate (i) the species richness in the genera *Pseudamnicola* and *Mercuria*, (ii) the distribution patterns of these Hydrobiidae in Algeria, and (iii) to describe the new species: *Pseudamnicola boucheti* n. sp., *P. chabii* n. sp., *P. ghamizii* n. sp., *P. algeriensis* n. sp., *P. gerhardfalkneri* n. sp., *P. calamensis* n. sp., *P. fneti* n. sp., *P. linae* n. sp., *P. rouagi* n. sp., *Mercuria bourguignati* n. sp., and *M. gauthieri* n. sp.

#### Material and methods

The snails were collected by the second author with a sieve from a number of springs in the regions of Guelma and Souk Ahras (northeastern Algeria). The samples were put into 75 % ethanol. The dissections and measurements of the genital organs and shells were carried out using a stereo microscope (Zeiss); the photographs were made with a digital camera system (Leica R8).

To clarify the status of the *Pseudamnicola* species described so far, we borrowed the syntypes of the Muséum d'Histoire Naturelle, Geneva (MHNG, MHNG = collection Bourguignat), the Muséum National d'Histoire Naturelle (MNHN), Paris, and the Natural History Museum Goeteborg. To study the species richness and the distribution of *Pseudamnicola* spp. and *Mercuria* spp. we examined in addition more than 120 lots from the Muséum National d'Histoire Naturelle, Paris, and numerous lots from the Muséum d'Histoire Naturelle, Geneva.

In doubtful cases, the genus group *Pseudamnicola*/*Mercuria* can only be determined by the morphology of the penis. To make it possible to study the penis morphology of dried materials from old samples, too, we put some snails for five minutes into hot water with a drop of detergent to re-hydrate the dried tissue. This method works, if the specimens formerly dried rapidly and without any decomposition.

To be sure that the species from Algeria are distinct from those that have been described from Tunisia, we borrowed the type material, which looked similar to some of our species that have already been studied by BOETERS (1976). We compared the syntypes of the following species with the material under discussion: *Amnicola bythiniopsis* (MHNG 5274), *A. barattei* (MHNG 5272), *A. saharica* (MHNG 5370), and *A. sterea* (MHNG 5384).

The starting point of our investigations was to look at the newly collected material from the regions of Guelma and Souk Ahras, with regard to the variability of the shells as well as to the anatomy. Following this approach, we could distinguish four *Pseudamnicola* spp. in the regions of Guelma and Souk Ahras. Based on this concept, we could separate the species of the dried materials:

Every species has at least one constant feature that allows separation from other species,

At one sampling site more than one *Pseudamnicola*/*Mercuria* species can occur.

A constant distinguishing feature shows that speciation has taken place. But this concept only works with samples that comprise a large number of individual specimens in order to account for the considerable variability concerning this species' shells. In addition, only adult shells with an identical number of whorls may be compared, because the shells of younger specimens or juveniles look distinct from the adults' because of an allometric growth. Especially those species of which the juveniles are spherical, while the adults are oval or elongated oval, can be interpreted as being two distinct species or as being one species with a large phenotypic plasticity, if the age of the snails (number of whorls) is not considered. Obviously aberrant shells are excluded from determination, because e.g. very large shells could be the result of an parasitism (SZAROWSKA et al. 2006: 181). In addition zoogeographical aspects should be also taken into consideration (see e.g. *Mercuria pycnocheilia* and *M. gauthieri* n. sp.).

#### Abbreviations of collections used:

BOE	private collection BOETERS
GLÖ	private collection GLÖER.
MHNG	Muséum d'Histoire Naturelle Genève, Switzerland
MNHN	Muséum National d'Histoire Naturelle, Paris, France
SMF	Senckenberg Research Institut, Frankfurt am Main, Germany
ZMH	Zoological Museum Hamburg, Germany

#### Sampling sites

Algeria can be subdivided from north to south into: the Tellian Atlas (or the Tell), in the northern section bordering the Mediterranean Sea, the Hauts Plateaux,

the Saharan Atlas with the Aurès Massif, and the Sahara Desert with the Sahara depression in the region of Touggourt (Touggourt depression).

Northern Algeria, the Tellian Atlas, which includes the Djurdjura Massif, lies within the temperate zone, and its climate is similar to that of other Mediterranean countries. The Hauts Plateaux has a semi-arid climate, whose basin profile explains the presence of many salt marshes

and dry or shallow lakes (sebkhas or chotts). South of the Saharan Atlas, extends a huge desert area of the Algerian Sahara with an extremely arid climate as well as an irregular and unevenly distributed rainfall.

The sampling sites of the old materials could be found on old maps (PELET 1902), and in addition the paper of LETOURNEUX (1870) was very helpful, because he described many sampling sites very precisely.

## Results

Determination of taxa that belong to the genus *Pseudamnicola* and *Mercuria* is not easy because they are not equipped with a wealth of distinguishing features. Nevertheless it was possible to distinguish many species of the genus groups under discussion. As some lots of the museum collections consisted of only a few specimens, or as, in other cases, no suitable features for determination could be found, not all species could be identified by us. Many lots contained two species, in most cases one of *Pseudamnicola* and one of *Mercuria*.

To identify formerly described species, it was not possible to work with topotypes, because in some regions up to five species occur, and the sampling sites have not in every case been definitely described in former times.

Dissection of the females of the recently found *Pseudamnicola* species showed us that the bursa copulatrix is not folded as in *Corrosiella* (see BOETERS 1970), so that these species belong to the genus *Pseudamnicola*.

The *Pseudamnicola/Mercuria* spp. of Tunisia, mentioned by BOETERS (1976), could not be found in Algeria, except *P. meluzzi* and *Mercuria globulina*, that occur in Algeria, too.

Only a few syntypes and holotypes of the species under discussion could be found (Figs 2–5). In most cases we had to determine the species by making use of the original descriptions, and by those provided by BOURGUIGNAT (1862, 1864) and LETOURNEUX (1870), which are suitable for species' identification.

However, some species could not be found or identified by us, because the description was vague or these species did not occur in the examined samples. These species are listed below:

*Pseudamnicola similis* (DRAPARNAUD 1805) (as *Cyclostoma*, DRAPARNAUD 1805: 34, pl. 1, Fig. 15). The identity of *Cyclostoma similis* has been clarified by BOETERS & FALKNER (2000). This species belongs to the genus *Mercuria* and is distributed in the Mediterranean regions of France. Thus we believe that this species does not occur in Algeria and, considering BOURGUIGNAT's description (1864: 237), we could not find any species similar to this, either. In addition BOETERS & FALKNER (2000)

stated that *Pseudamnicola confusa* FRAUENFELD 1863, is a junior synonym of *Mercuria similis*. *Pseudamnicola confusa* has been mentioned by BOETERS (1976) to occur in Tunisia.

*Pseudamnicola seminium* (MORELET 1857) (as *Paludina*, MORELET 1857: 376): The type locality is „... les eaux thermales, aux alentours de Constantine“. In BOURGUIGNAT's collection in Geneva and Paris three lots could be found with the label „*Pseudamnicola seminium*“ but it was in all cases a *Maresia* sp. Possibly *P. seminium* is an endemic species that lives only in hot springs at the type locality. Syntypes could not be found.

*Pseudamnicola rouvieriana* (LETOURNEUX 1870) [as *Amnicola*, LETOURNEUX 1870: 316]: The type locality is “Hammam Bou-Merzouk” (Ouled Rahmoun), but in this hot spring we could only find *Pseudamnicola constantinae* and *Pseudamnicola chabii* n. sp. Maybe *P. rouvieriana* is an aberrant form of the latter species, though the original description is very distinct from the two species that we found there. Syntypes could not be found.

*Pseudamnicola pomariensis* (LETOURNEUX 1870) [*Amnicola*, LETOURNEUX 1870: 317]: The type locality is “Sefsef [=Es Safsaf] près de Tlemcen” and we had no lots from this sampling site.

*Pseudamnicola costulata* WESTERLUND 1886. WESTERLUND (1886: 82) found this species together with *P. subripta* in Marounania [= Marouania (Oued El Aneb)] near Annaba. This species could not be found in WESTERLUND's collection.

*Pseudamnicola conovula* (FRAUENFELD 1863) [as *Amnicola*, FRAUENFELD 1863: 1026] has been mentioned by VAN DAMME (1984) and other authors for Algeria, but the type locality of this species is the island Pag, Croatia (FALKNER & BOETERS 2003), thus we do not believe that this species occurs in Algeria, and no species could be found of which the shell shape corresponds to the shells of *P. conovula*.

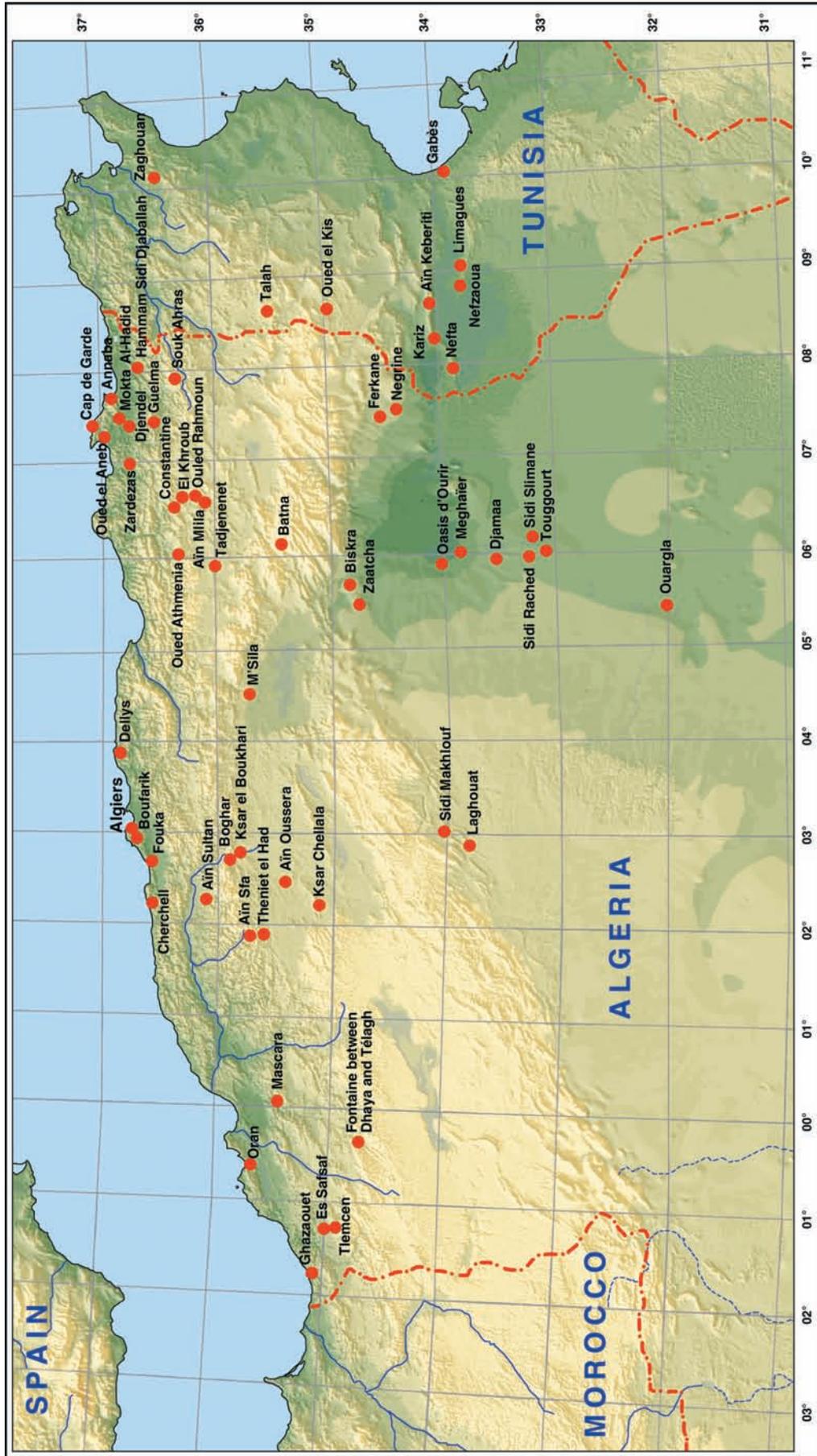


Fig. 1. The sampling sites of the studied specimens.

Table 1. Sampling sites of Algeria and taxa found.

Sampling site	Region	Taxa
Aïn Bendaoud (Ouled Driss)	Souk Ahras	<i>P. rouagi</i> n. sp.
Aïn Feïd-El-Bagrat (Medjez Sfa)	Guelma	<i>P. fineti</i> n. sp.
Aïn H'djar (Medjez Sfa)	Guelma	<i>P. lineae</i> n. sp.
Aïn Kef Kourrath (Medjez Sfa)	Guelma	<i>Pseudamnicola</i> sp.
Aïn M'Daourouch	Souk Ahras	<i>P. numidica</i>
Aïn M'lila	Oum El-Bouaghi	<i>P. boucheti</i> n. sp.
Aïn Oussera	Djelfa	<i>P. dupotetiana</i>
Aïn Sfa (entre Toukria et Sebaïn aioun)	Tissemsilt	<i>P. dupotetiana</i>
Aïn Sultan	Aïn Defla	<i>P. gerhardfalkneri</i> n. sp.
Aïn Zaaroura (Medjez Sfa)	Guelma	<i>P. calamensis</i> n. sp.
Algiers	Algiers	<i>P. dupotetiana</i> , <i>P. boucheti</i> n. sp., <i>P. ghamizii</i> n. sp., <i>M. bourguignati</i> n. sp., <i>M. saharica</i> , <i>M. globulina</i>
Bahr de Tiguedidine près de Djamaa	El Oued	<i>M. pycnocheilia</i>
Boghar	Médéa	<i>P. dupotetiana</i>
Bône [= Annaba]	Annaba	<i>P. letourneuxiana</i> , <i>P. luteola</i> , <i>P. meluzzi</i>
Boufarik	Blida	<i>M. globulina</i> , <i>M. bourguignati</i> n. sp., <i>P. boucheti</i> n. sp., <i>P. luteola</i> , <i>P. dupotetiana</i>
Boughari [=Ksar El Boukhari]	Médéa	<i>M. bourguignati</i> n. sp.
Bougia [= Bejaïa]	Bejaïa	<i>P. dupotetiana</i>
Cap de Garde	Annaba	<i>P. ghamizii</i> n. sp.
Champ de manoeuvre	Algiers	<i>P. dupotetiana</i> , <i>P. ghamizii</i> n. sp.
Cherchell (fontaine près de la mer)	Tipaza	<i>P. dupotetiana</i>
Constantine	Constantine	<i>P. meluzzi</i> , <i>P. numidica</i> , <i>P. boucheti</i> n. sp.
Dellys	Boumerdès	<i>M. bourguignati</i> n. sp.
El Khroub	Constantine	<i>P. numidica</i>
Ferkane	Tébessa	<i>M. pycnocheilia</i>
Fontaine chaude	Batna	<i>P. boucheti</i> n. sp., <i>P. chabii</i> n. sp.
Fontaine chaude du ruisseau des Zaatcha	Biskra	<i>M. saharica</i>
Fontaine entre Daya et Télag	Sidi Bel Abbès	<i>P. algeriensis</i> n. sp.
Fouka près de Kolea	Tipaza	<i>M. bourguignati</i> n. sp.
Hammam Sidi Djaballah (Cheffia)	El Tarf	<i>P. letourneuxiana</i>
Hôpital du Dey	Algiers	<i>M. bourguignati</i> n. sp.
Ksar Chellala	Tiaret	<i>P. dupotetiana</i>
Laghouat	Laghouat	<i>P. luteola</i>
M'Sila	M'Sila	<i>P. numidica</i>
Mefrouch	Tlemcen	<i>P. dupotetiana</i>
Mokta Al-Hadid	Annaba	<i>M. bourguignati</i> n. sp.
Mokta El Oued	entre Djelfa et Boghar	<i>M. saharica</i>
Negrine	Tébessa	<i>M. pycnocheilia</i>
Nemours [=Ghazaouet]	Tlemcen	<i>M. gauthieri</i> n. sp.
Oasis d'Ourir	entre Biskra et Touggourt	<i>M. pycnocheilia</i>
Oran	Oran	<i>P. luteola</i>
Ouargla	Ouargla	<i>M. pycnocheilia</i>
Oued Athmenia	Mila	<i>P. ghamizii</i> n. sp.
Oued El Aneb	Annaba	<i>P. boucheti</i> n. sp.
Puits artésien de Sidi Rached (Oued Rir)	Touggourt (Ouargla)	<i>M. saharica</i>
Puits artésiens de Meghaïer	El Oued	<i>M. sharica</i>
Puits artésiens de Sidi Slimane (Oued Rir)	Touggourt (Ouargla)	<i>M. saharica</i>
Ruisseau de la fontaine chaude	Biskra	<i>M. saharica</i>
Saint Donat [=Tadjenanet]	Mila	<i>P. boucheti</i> n. sp.

Sampling site	Region	Taxa
Sidi M'Cid (thermal spring)	Constantine	<i>P. meluzzi</i>
Sidi Makhoulouf	Laghouat	<i>M. saharica</i>
Source du Boumerzoug (Ouled Rahmoun)	Constantine	<i>P. chabii</i> n. sp., <i>P. constantinae</i>
Source face à l'Institut Pasteur	Algiers	<i>P. ghamizii</i> n. sp.
Theniet El-Had	Tissemsilt	<i>P. luteola</i>
Tlemcen	Tlemcen	<i>P. dupotetiana</i> , <i>P. algeriensis</i> n. sp.
Zardezas	Skikda	<i>P. kuteola</i> , <i>M. globulina</i>



Figs 2–5. Syntypes of *Pseudamnicola* spp. from Algeria from MHNG. — 2: *B. dertorum* (vicinity of Bône, synonym of *P. letourneuxiana*). 3: *B. pynolena* (Mascara, synonym of *P. dupotetiana*). 4: *B. perforata* (vicinity of Oran, synonym of *P. dupotetiana*). 5: *P. letourneuxiana* (Djendell).

*Pseudamnicola orientalis* (FRAUENFELD 1863) [as *Amnicola*, FRAUENFELD 1863: 1027] could not be studied by us because the Natural History Museum Vienna does not lend out type materials. In Vienna exist 9 syntypes and in addition a lot with 2 syntypes separated of the original sample. The measurements, carried out by the curator ANITA ESCHNER, are: shell height 1.7 mm, shell width 1.25 mm. This species could not be found in the material studied by us.

#### Identification key to the genera

1. Fresh shells whitish, especially the aperture and umbilicus, opaque, umbilicus closed to slit-like, penis with a lobe-like appendix ..... *Mercuria*
- 1'. Shells not whitish, umbilicus opened, simple penis without an appendix ..... *Pseudamnicola*

#### Genus *Pseudamnicola* PAULUCCI 1878

Type species: *Bythinia lucensis* ISSEL 1866.

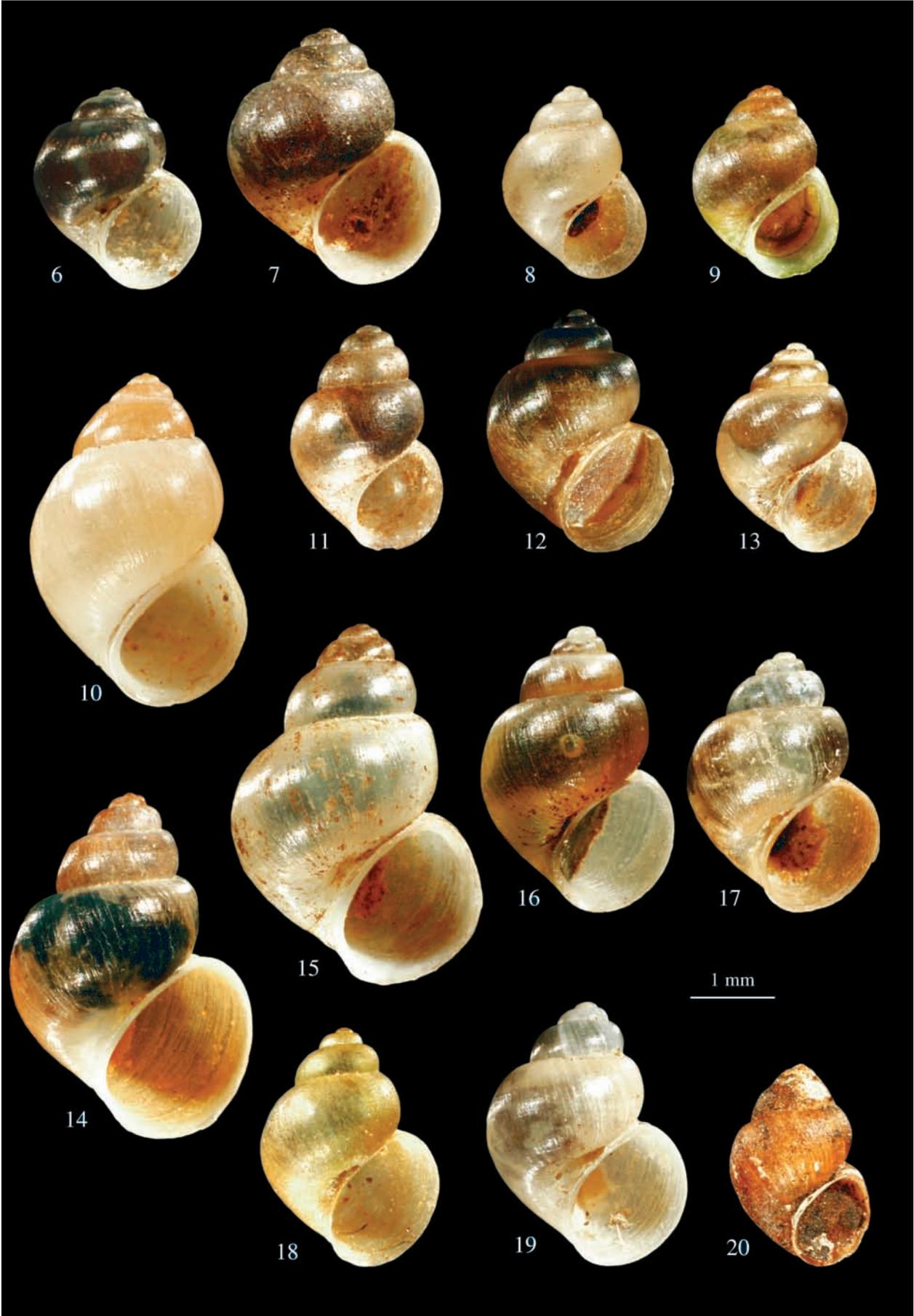
In *Pseudamnicola* species, the renal oviduct is pigmented in black and bears a bursa as well as a receptaculum (rs1). The oviduct enters with one to three spiral loops into the kidney, before the pallial oviduct loops to the wall of the stomach.

#### Identification key

In some species the juveniles look like the adults, in other cases the juveniles are of a more spherical shape than the adults. This key is made to identify adult specimens with four whorls and more.

1. Shell spherical, shell height 2–3 mm ..... 2
- 1'. Shell not spherical ..... 3
2. Shell light horn-coloured, glossy, 2.1–2.9 mm ..... *P. dupotetiana*
- 2'. Shell dark-horn-coloured, surface lustreless, finely striated, 2.9–3.2 mm ..... *P. numidica*
3. Aperture triangular rounded, suture weak, umbilicus closed ..... 4

Figs 6–20. *Pseudamnicola* spp. of Algeria. 6: *P. dupotetiana* (Algiers, champ de manoeuvre). 7: *P. numidica* (Constantine). 8: *P. meluzzi* (Constantine). 9: *P. chabii* n. sp. (Batna, Fontaine chaude, holotype). 10: *P. constantinae* (Ouled Rahmoun). 11: *P. gerhardfalkneri* n. sp. (Aïn Sultan, holotype). 12: *P. calamensis* n. sp. (Aïn Zaaroura, paratype). 13: *P. lineae* n. sp. (Aïn H'Djar, holotype). 14: *P. algeriensis* n. sp. (Tlemcen, holotype). 15: *P. luteola* (Theniet El-Had). 16: *P. rouagi* n. sp. (Aïn Bendaoud, holotype). 17: *P. fineti* n. sp. (Aïn Feïd-El-Bagrât, holotype). 18: *P. boucheti* n. sp. (Batna, Fontaine chaude, holotype). 19: *P. ghamizii* n. sp. (Algiers, champ de manoeuvre, holotype). 20: *P. letourneuxiana* (Annaba).



- 3'. Aperture oval, suture clear to deep ..... 6  
 4. Shell small, 2.1–2.6 mm ..... 5  
 4'. Shell larger, 3.4–4.1 mm ..... *P. constantinae*  
 5. Shell opaque, silky, light horn-coloured ..... *P. meluzzi*  
 5'. Shell thick walled, silky ..... *P. chabii* n. sp.  
 6. Shell elongate oval, height smaller than 3 mm ..... 7  
 6'. Shell not elongated oval or height larger than 3 mm 8  
 7. Suture clear, whorls convex ..... *P. gerhardfalkneri* n. sp.  
 7'. Suture flat, whorls slightly convex . *P. letourneuxiana*  
 8. Shell elongated oval, height larger than 4 mm ..... 9  
 8'. Shell oval to elongated oval, height smaller than  
 4 mm ..... 10  
 9. Whorls stepped, shell height 4.0–4.3 mm  
 ..... *P. algeriensis* n. sp.  
 9'. Whorls rounded, shell height 4.5–5.0 mm .. *P. luteola*  
 10. Surface silky ..... *P. boucheti* n. sp.  
 10'. Surface glossy ..... 11  
 11. Shell light horn-coloured, 3.9–4.3 mm, shell height:  
 width = 0.68 ..... *P. ghamizii* n. sp.  
 11'. Shell dark horn-coloured, height 2.7–4.0 mm..... 12  
 12. Shell small, height smaller than 2.7 mm, oviduct  
 loop 1 small and 1 large loop ..... *P. linæ* n. sp.  
 12'. Shell larger than 2.7 mm, oviduct loop with 1 small  
 or three small loops ..... 13  
 13. Shell dark horn-coloured, 2.7–3.0 mm, oviduct loop  
 with three small loops ..... *P. calamensis* n. sp.  
 13'. Oviduct loop with less than three loops ..... 14  
 14. Oviduct loop with one small loop ..... *P. fineti*. n. sp.  
 14'. Oviduct loop consists only of one large loop, tapered  
 at the proximal part ..... *P. rouagi* n. sp.

***Pseudamnicola dupotetiana* (FORBES 1838)**

Fig. 6

- 1838 *Paludina Dupotetiana* FORBES, Annals of Natural History, 2<sup>nd</sup> series: 254, pl. 12, Fig. 3, loc. typ.: “In muddy rivulets near the sea at Algiers and Bougia [= Bejaïa]”.  
 1862 *Bythinia pycnolena* BOURGUIGNAT, Les Spicilèges Malacologiques: 120.  
 1862 *Bythinia perforata* BOURGUIGNAT, Les Spicilèges Malacologiques: 118.  
 1870 *Amnicola valvatidea* LETOURNEUX, Annales de Malacologie, 1 [1870–1884]: 319.  
 1887 *Amnicola sterea* LETOURNEUX et BOURGUIGNAT, Pro-drome de la Malacologie terrestre et fluviatile de La Tunisie: 146.  
 1997 *Pseudamnicola dupotetiana*, – GHAMIZI & al., Haliotis, 26: 36 (Neotype designation for *Paludina Dupotetiana* FORBES 1838).

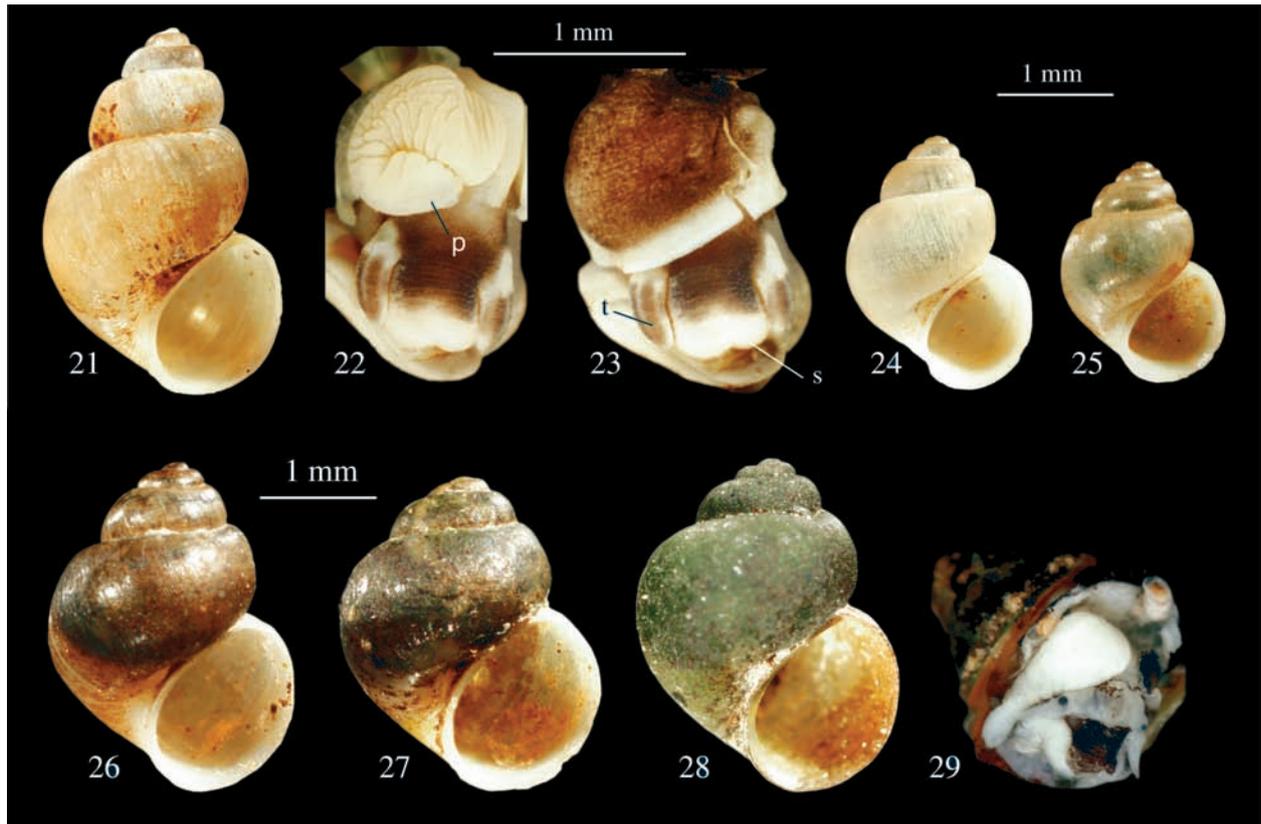
Material examined: MNHN: Algiers (4 samples: 2 ex., 7 ex., 10 ex., champ de manoeuvre 9 ex.); Cherchell

(fontaine près de la mer, 8 ex.); Tlemcen (2 samples: 13 ex., 14 ex.); Boufarik (3 samples: 2 ex., 8 ex., 9 ex.); Mefrouch près de Tlemcen (2 ex.); Tlemcen (numerous; SMF 334670/50); Ksar Chellala (numerous; SMF 334669/42); Boghar, 2 ex.; Aïn Oussera, 6 ex.; two unknown sampling sites (12 ex., 17 ex.). — MHNG: MHNG 5270 (3 ex., labelled as *Amnicola barattei* LETOURNEUX & BOURGUIGNAT) Aïn Kebiriti, entre le Chott Fedjedj et le Djebel Cherb, Tunisie. specimens from coll. BOURGUIGNAT in MHNG, with original label; MHNG 5281 (numerous, labelled as *Amnicola doumeti* LETOURNEUX & BOURGUIGNAT) Tala, Tunisie specimens from coll. BOURGUIGNAT with original label; MHNG 5306 (7 ex., labelled as *Amnicola globulina* LETOURNEUX & BOURGUIGNAT) temple au Zaghouan, Tunisie specimens from coll. BOURGUIGNAT with original label; MHNG 5308 (numerous, labelled as *Amnicola globulina* LETOURNEUX & BOURGUIGNAT) Tala, Tunisie, specimens from coll. BOURGUIGNAT with original label; MHNG 5383 (5 ex., labelled as *Amnicola sterea* BOURGUIGNAT) Aïn Sfa entre Toukria et Sebain Aïoun [ca. 7 km east of Tissemsilt]), specimens from coll. BOURGUIGNAT with original label; MHNG 5384 (numerous, labelled as *Amnicola sterea* BOURGUIGNAT) Limagues (Nefzaouia), Tunisie, specimens from coll. BOURGUIGNAT with original label; MHNG 5385 (1 ex., labelled as *Amnicola sterea* BOURGUIGNAT) Limagues (Nefzaouia), Tunisie, with orig. label; MHNG 5387 holotype of *Amnicola valvatidea* LETOURNEUX 1870 (1 ex., labelled as *Amnicola valvatidea*, “d’Aïnser-Aoumeur, sur la route de Sétif à Takitount”). Until further notice, this juvenile specimen is here confined as a synonym to *Pseudamnicola dupotetiana*.

**Description:** Shell spherical, horn-coloured, surface glossy, apex blunt, 4–5 whorls with a clear suture, umbilicus slit-like, spire small to medium sized, spire height 0.2 of shell height, aperture oval and slightly angled, peristome sharp, shell height 2.1–2.5 mm, shell width 1.8–2.1 mm.

**Distribution:** Central and western Tell and central Hauts Plateaux. Surprisingly, this species could not be found in the eastern part of Algeria.

**Remark:** Because of the misinterpretation of *P. dupotetiana* by BOURGUIGNAT (see discussion), he described *Bithynia pycnolena* in 1862, which is in our opinion conspecific with *P. dupotetiana*. On the tube of the holotype of *B. pycnolena* a label written by BOURGUIGNAT is found, and the sampling site corresponds to the locus typicus. BOURGUIGNAT (1862) measured a shell height of 2.5 mm and a width of 2 mm, our measurements of this single shell (Fig. 3): shell height 2.1 mm, width 1.8 mm. The original description of *B. pycnolena* corresponds well with this shell. Concerning *Bythinia perforata* BOURGUIGNAT 1862, BOURGUIGNAT mentioned a shell height of 3 mm and a shell width of 2.5 mm. We measured a shell height of the photographed specimen (Fig. 4) of 2.3 mm and a width of 1.9 mm, the other one had a shell height of 2.1 mm and a width of 2.0 mm. Both shells looked uniform. This species could not be found in the collection of MNHN, only the syntypes of *B. perforata* exist in BOURGUIGNAT’s collection in Geneva. In our opinion, this species is an aberrant form of *P. dupotetiana* with a larger umbilicus. A specimen of MHNG 5385 labelled



Figs 21–25. *Pseudamnicola luteola*. 21–23: Specimen (Zardezas), 22: Penis, 23: Mantle, 24–25: Shells (Theniet El-Had). - p = penis, s = snout, t = tentacle. — Figs 26–29. *Pseudamnicola numidica*. 26–27: Constantine, 28–29: Aïn M'Daourouch (a fountain in Souk Ahras region, Bouzid leg.).

as *Amnicola sterea* BOURGUIGNAT 1868 was isolated and labelled as "syntype" by BOETERS. Because this species could be identified by us as *P. dupotetiana*, *P. sterea* is a younger synonym of *P. dupotetiana*.

***Pseudamnicola luteola* (KÜSTER 1852)**

Figs 15, 21–25

1852 *Paludina luteola* KÜSTER, In: MARTINI & CHEMNITZ: Systematisches Conchylien-Cabinet, (Ed. 2), 1.21: 44, pl. 9, Figs 8–9, loc. typ.: "in der Provinz Algier".

1886 *Pseudamnicola subriecta* WESTERLUND, Fauna der in der paläarktischen Region lebenden Binnenconchylien. 6: 82), loc. typ.: "Algerien in Marouania [= Marouania] bei Bona".

**Material examined:** The syntypes of *Paludina luteola* could not be found in KÜSTER's collection in Senckenberg (R. JANSSEN in litt.). Thus we could identify this species only by utilising the original description, and in addition we considered the drawing by KOBELT (1892: Orig. Icon. 826). — MNHN: Theniet El-Had (2 samples: numerous; 17 ex., SMF 334674/36); Boufarik (59 ex.); Laghouat (2 samples: 8 ex., 5 ex.); Zardezas (numerous); Oran (7 ex.); Annaba (1 ex., coll. Westerlund); unknown site (2 samples: 22 ex., numerous).

**Description:** Shell elongated oval, horn-coloured, surface finely striated, glossy, apex blunt, 5 whorls

rounded with a clear suture, umbilicus slit-like to closed, spire height 0.3 of shell height, aperture oval, slightly oblique, peristome sharp but flanged. The last two whorls of the adults (!) reach about 7/8 of the shell height. Shell height 4.5–5 mm, shell width 2.5–3.1 mm.

The mantle is brown coloured with a white border (Fig. 23). The penis is broad and obtuse at the distal end (Fig. 22).

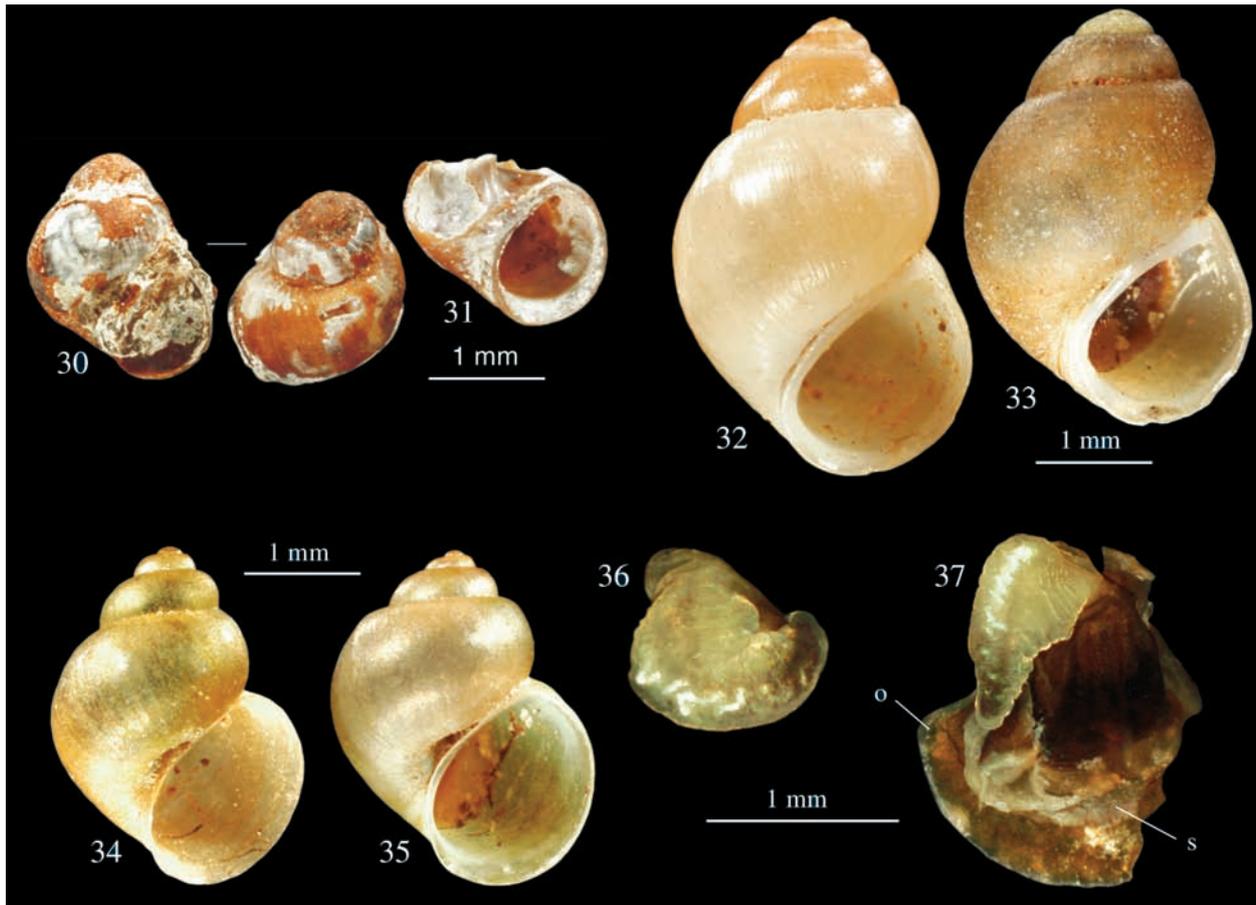
**Distribution:** Eastern, central and western Tellian zone, central Hauts Plateaux and the northern edge of the Sahara.

**Remark:** In WESTERLUND's collection (SMNH Stockholm Type 7480—syntype of *P. subriecta*) we identified the species as being a subadult specimen of *P. luteola*. From Goeteborg we borrowed a sample of *P. subriecta*, which contained one specimen of *P. dupotetiana* and one juvenile of *P. luteola*. As the original description corresponds to juveniles of *P. luteola*, we believe that *P. subriecta* is a younger synonym of *P. luteola*.

***Pseudamnicola numidica* (CLESSIN 1878)**

Figs 7, 26–29

1878 *Amnicola numidica* CLESSIN, Malakozoologische Blätter, 25: 118–119, Pl. 5, Fig. 4 a–b), loc. typ.: "Hab. Algeria (coll. WESTERLUND)".



Figs 30–31. *Pseudamnicola letourneuxiana*. Djendell, syntypes. — Figs 32–33. *Pseudamnicola constantinae*. 32: topotype, 33: Syntype MHNG 5278).— Figs 34–37. *Pseudamnicola boucheti* n. sp. 34–35: paratypes, 36: penis, 37: head with penis.—o = operculum, s = snout.

**Material examined:** The syntypes could not be found in CLESSIN's collection (Natural History Museum Stuttgart, Niederhöfer in litt.), neither in WESTERLUND's collection (VON PROSCHWITZ, Goeteborg, in litt, and SINDEMARK KRONESTEDT, Stockholm, in litt.). But the original description and the drawings of the shells are suitable for determination. — MNHN: Constantine (numerous; SMF 334676/many); M'Sila (20 ex.); El Khroub (numerous); Aïn M'Daourouch [a fountain in Souk Ahras region] Bouzid leg. (numerous).

**Description:** shell spherical to oval, dark horn-coloured, surface lustreless and finely striated, apex obtuse, 4–4.5 slightly convex whorls with a clear suture, umbilicus closed, spire small, aperture oval and not angled with a sharp periostome, shell height 2.9–3.2. mm, shell width 2.2–2.3 mm.

**Penis morphology:** penis triangularly, broad at the proximal part and slim rounded at the distal part (Fig. 29)

**Distribution:** Eastern part of the Algerian Tell.

***Pseudamnicola letourneuxiana* (BOURGUIGNAT 1862)**

Figs 20, 30–31

- 1862 *Bythinia letourneuxiana* BOURGUIGNAT, Les Spicilèges Malacologiques: 121, loc. typ.: "Habite, en Algérie, les sources thermales (42 degrés) de Djendel".
- 1862 *Bythinia desertorum* BOURGUIGNAT, Les Spicilèges Malacologiques: 118.
- 1870 *Amnicola servainiana* LETOURNEUX, Annales de Malacologie, 1 [1870–1884]: 318.

**Material examined:** The syntypes exist in BOURGUIGNAT's collection in Paris (MNHN 22977). The photographed syntype shell (Fig. 30) has a shell height of 2.2 mm and width of 1.7 mm. The second syntype is perforated (Fig. 31) but both looked uniform. — MNHN: La Cheffia [Cheffia near Bône] (2 samples: 6 ex., 17 ex.); Bône (numerous; SMF 334673/27). — The syntypes of *Amnicola servainiana* could be found in BOURGUIGNAT's collection in Geneva: MHNG 10702 (lac des Arbaouam (Senhadja), identified by BOETERS 1970, 2 ex., part of MHNG 5373); MHNG 5371 (3 ex.), Aith Ouaban (Jurjura); MHNG 5372 (numerous), Hammam Sidi Djaballah; MHNG 5373 (numerous), lac des Arbaouam (Senhadja). The lots of *A. servainiana*, mentioned above, have been identified by us as *P. letourneuxiana*.

**Description:** shell conically oval, dark horn-coloured, surface silky, apex obtuse, 4–5 regularly increas-

ing whorls with a clear suture, umbilicus closed, spire 0.3 of shell height, aperture oval, oblique, periostome sharp, shell height 2.2–2.6 mm, shell width 1.4–1.5 mm.

**Distribution:** This species is possibly confined to thermal springs around the region of Annaba.

**Remark:** The syntypes of *P. desertorum* exist in BOURGUIGNAT's collection in Geneva. The type locality is the same as for *P. letourneuxiana*, thus we interpret *P. desertorum* to be an aberrant form of the other.

***Pseudamnicola constantinae* (Letourneux 1870)**

Figs 10, 32–33

1870 *Amnicola constantinae* LETOURNEUX, Annales de Malacologie, 1 [1870–1884]: 314, loc. typ.: “Habite dans des Hammam à 32 degrés, et dans le cours du Bou-Merzouk, près de Constantine”.

**Material examined:** The syntypes exist in BOURGUIGNAT's collection in Geneva: MHNG 5276 (19 ex.), cours du Bou-Merzouk; MHNG 5277 (= var. minor) (numerous), Bou-Merzouk; MHNG 5278 (3 ex.), Hammam à 32 degrés. — MNHN: Sources du Boumerzoug (Ouled Rahmoun) (topotypes) (numerous; SMF 334668/16).

**Description:** shell elongated oval, yellowish horn-coloured, surface silky and finely striated, apex small, 4.5–5 slightly convex whorls with a weak suture, umbilicus closed, spire height 0.25 of shell height, aperture triangular rounded, periostome thick, shell height 3.4–4.1 mm, shell width 2.4–2.6 mm.

**Distribution:** Possibly endemic.

***Pseudamnicola meluzzi* BOETERS 1976**

Fig. 8

1976 *Pseudamnicola meluzzi* BOETERS, Archiv für Molluskenkunde, 107: 94, Figs 2–3 and 12–13, loc. typ.: “in einem Fluß, und zwar Oued Melah unweit der Station Aonana an der Straße zwischen Mateur und Sedjenane”.

**Material examined:** MNHN: Constantine (2 series: 10 ex., numerous); Sidi M'Cid, thermal spring (numerous, SMF 334675/35); Annaba (1 ex. coll. WESTERLUND).

**Description:** shell conically oval, light horn-coloured, thin, opaque, surface silky, apex rounded, 3.5–4 slightly convex whorls with a weak suture, umbilicus closed to slit like, spire height 0.25 of shell height, aperture triangular rounded, periostome sharp, operculum horn-coloured, shell height 2.1–2.6 mm, shell width 1.8–2.0 mm.

**Distribution:** from NE Algeria to NW-Tunisia.

**Remark:** In WESTERLUND's collection we found a juvenile specimen of this species collected in Annaba but determined as *P. substricta*.

***Pseudamnicola boucheti* n. sp.**

Figs 18, 34–37

**Holotype:** Shell 3.0 mm high, 2.4 mm wide, Batna (Fontaine chaude, 25.III.1932), MNHN 21440, Fig. 18. — **Paratypes:** MNHN 21441 (numerous) from type locality; MNHN 21910 (37 ex.), Ain M'lila; MNHN 21915 (St. Donat, 18 ex., Dr F.G. Marill 1953), Tadjenanet; MNHN 21914 (3 ex.), Boufarik; MNHN 21911 (3 ex.), unknown Hammam; Batna (4 samples, Fontaine chaude, 3 x numerous, M. A. Diezede 1932, SMF 334666/54, MNHN 21909, MNHN 21911 24 ex.); MNHN 21912 (numerous), Oued El Aneb; Algiers (2 samples: MNHN 21916 (1 ex.) Dr F.G. Marill 1956, MNHN 21917 (42 ex.) coll. Jousseume); MNHN 21913 (30 ex.), mare route Kairouan à Enfida (Tunisia); MNHN 21918 (3 ex.), Constantine coll. Staadt 1969; unknown sampling site (numerous).

**Etymology:** Named in honour of PHILIPPE BOUCHET, who borrowed us numerous samples from the Muséum National d'Histoire Naturelle, Paris.

**Description:** shell conical oval, light horn-coloured, opaque, surface silky, apex small rounded, 4–4.5 slightly convex whorls with a clear suture, umbilicus slit-like, spire regularly increasing, spire height 0.25 of shell height, aperture oval and not angled, periostome sharp, shell height 2.7–3.0 mm, shell width 2.3–2.4 mm.

**Penis morphology:** penis simple with 17 folds (Figs 36–37).

**Differentiating features:** The conical oval shell is 2.7–3.0 mm high and the surface is silky. Other *Pseudamnicola* spp. which are also conical oval, and of similar size, have a glossy surface.

**Distribution:** Eastern and central parts of the Tell, eastern Hauts Plateaux.

***Pseudamnicola chabii* n. sp.**

Fig. 9

**Holotype:** Shell 2.4 mm high, 1.8 mm wide; Batna (Fontaine chaude), MNHN 21442, Fig. 9. — **Paratypes:** MNHN 21443 (7 ex.) from type locality; MNHN 21896, SMF 334667/many, Source du Boumerzoug (= Ouled Rahmoun, 2 lots, numerous).

**Etymology:** This new species is named in honour of YASSINE CHABI, a dedicated ornithologist in Algeria, who unfortunately passed away so early.

**Description:** shell conical oval, horn-coloured, surface silky, apex small, 4 very slightly rounded whorls, suture flat, umbilicus closed, spire short, aperture triangularly rounded, periostome very thick, shell height 2.3–2.4 mm, shell width 1.8 mm.

**Differentiating features:** The conical shell has a characteristic aperture which is triangularly rounded. It differs from *P. meluzzi* by its thick walled shell and the very thick periostome.

**Associated species:** *Maresia* sp. (numerous in both samples).

**Distribution:** Eastern Hauts Plateaux.

*Pseudamnicola ghamizii* n. sp.

Figs 19, 38–39

**H o l o t y p e :** Shell 3.4 mm high, 2.7 mm wide, Cap de Garde, MNHN 21444, Fig. 19. — **P a r a t y p e s :** MNHN 21445 (25 ex.) SMF 334672/6, Cap de Garde; MNHN 21900 (15 ex.), Oued Athmenia; MNHN 21901 (7 ex.), Alger; MNHN 21902 (6 ex.), Algiers, source face à l'Institut Pasteur, champ de manoeuvre.

**E t y m o l o g y :** Named in honour of our colleague MOHAMED GHAMIZI, who contributed greatly to our knowledge of Moroccan aquatic malacofauna.

**D e s c r i p t i o n :** shell conically oval, light horn-coloured, surface glossy, apex small rounded, 4.5 slightly rounded and regularly increasing whorls, suture clear, umbilicus opened to slit-like, spire conical, aperture oval and not angled, periostome sharp and at the columella straight, shell height 2.7–3.4 mm, shell width 2.4–2.7 mm.

**D i f f e r e n t i a t i n g f e a t u r e s :** The conical oval shell is about 4.0 mm high and the surface is glossy.



Figs 38–39. *Pseudamnicola ghamizii* n. sp., paratypes, 38: champ de manoeuvre, 39: Cap de Garde.

Other *Pseudamnicola* spp. which have also a glossy surface are smaller.

**D i s t r i b u t i o n :** Central and eastern parts of the Tell.



Figs 40–43. The sampling sites of the *Pseudamnicola* spp. from the Guelma region. — 40: Aïn Zaaroura (type locality of *P. calamensis* n. sp.). 41: Aïn Feïd-El-Bagrat (type locality of *P. fineti* n. sp.). 42: Aïn Damous (additional sampling site of *P. fineti* n. sp.). 43: Aïn H'djar (type locality of *P. lineae* n. sp.).

***Pseudamnicola algeriensis* n. sp.**

Fig. 14

**Holotype:** Shell 4.3 mm high, 3.0 mm wide, Tlemcen, Algeria, MNHN 21446, Fig. 14. — **Paratypes:** MNHN 21447 (31 ex.), SMF 334665/10, Tlemcen; MNHN 21898 (9 ex.), “fontaine entre Daya et Télag”.

**Etymology:** Named after the country where the species lives.

**Description:** shell oval, dark horn-coloured, surface silky, apex small, 4–5 slightly rounded and stepped whorls that increase regularly, umbilicus closed, spire height 0.4 of shell height, aperture oval and slightly angled, peristome thick, shell height 3.9–4.3 mm, shell width 2.8–3.3 mm.

**Differentiating features:** The whorls of the shell are stepped and not rounded like in *P. luteola*. In addition the shell is smaller (about 4 mm) than the shell of *P. luteola* (about 5 mm).

**Distribution:** western part of the Tell and western Hauts Plateaux.

***Pseudamnicola gerhardfalkneri* n. sp.**

Fig. 11

**Holotype:** Shell 2.8 mm high, 1.9 mm wide, Aïn Sultan (coll. Denis), MNHN 21448, Fig. 11. — **Paratypes:** MNHN 21449 (numerous), SMF 334671/39, Aïn Sultan; MNHN 21897 (8 ex. coll. H. Fischer), Aïn Sultan.

**Etymology:** Named after GERHARD FALKNER who found the many lots in the collection of the Muséum National d’Histoire Naturelle, Paris, for our studies.

**Description:** shell elongated oval, slim, colour light brown, opaque, surface finely striated, glossy, apex small, 5–5.5 convex whorls with a deep suture, umbilicus slit-like, spire conical, spire height 0.3 of shell height, aperture oval, slightly oblique, peristome sharp, shell height 2.7–2.8 mm, shell width 1.9 mm.

**Differentiating features:** The shell is elongated oval and slim vs. conical or sphaerical.

**Distribution:** This species is restricted to the central part of the Tellian Atlas.

***Pseudamnicola calamensis* n. sp.**

Figs 12, 44–47, 52–54, 60–61

**Holotype:** shell height 2.8 mm, width 2.0 mm, Aïn Zaaroura [at Medjez Sfa, Guelma], 36°25.906'N 07°47.688'E, 237.74 m alt., leg. S. BOUZID, 27.08.2006, ZMH 51388, Figs 12 (type locality), 40. — **Paratypes:** ZMH 51389 (3 ex. in ethanol), SMF 334682/68, GLÖ (18 ex.), BOE 3058 (31 ex.), BOE 3059 (18 ex.) from type locality.

**Habitat:** Natural spring.

**Etymology:** Calama was the name of Guelma during the Roman era.

**Description:** The brownish shell has 4.5–5 convex whorls which increase regularly, the body whorl

dominates and is 3.5 times higher than the spire; apex blunt, suture deep, surface glossy; aperture oval at the top moderately angled, broad at the basis, in adults reflected from the body whorl, peristome continuous; horny operculum transparent colourless, thin; shell height 2.7–3.0 mm, width 2.0–2.1 mm.

**Animal:** mantle black, snout long, slim and crenated; penis long with up to 14 penial folds.

**Anatomy:** Bursa duct slightly curved, receptaculum thumb-shaped.

**Differentiating features:** The species’ shell is similar to *P. lineae* n. sp., *P. fineti* n. sp., and *P. rouagi* n. sp. These species can be distinguished by the renal oviduct: three small loops in *P. calamensis*.

**Distribution:** Only known from the type locality.

**Remarks:** The population contains also infected ♀♀, which develop a pseudopenis.

***Pseudamnicola fineti* n. sp.**

Figs 17, 48–51, 55–56, 62–63

**Holotype:** shell height 3.2 mm, width 2.3 mm, Aïn Feid-El-Bagrat [at Medjez Sfa, Guelma], 36°25.555'N 07°51.386'E, 323.7 m alt., leg. S. BOUZID, 27.08.2006, ZMH 51390, Figs 17 (type locality). — **Paratypes:** ZMH 51391 (5 ex. in ethanol), SMF 334683/43, GLÖ (24 ex.), BOE (xx ex.) from type locality; GLÖ (6 ex.) Aïn Damous [at Medjez Sfa, Guelma], 36°25.350'N 07°51.367'E, 523.34 m alt.

**Habitat:** Natural springs.

**Etymology:** Named after YVES FINET, who borrowed us many material of BOURGUIGNAT’S collection.

**Description:** The horn-coloured shell is elongated oval and has 4.5–5 convex, regularly increasing whorls with a deep suture, the last two whorls are prominent; apex blunt, surface glossy; aperture ovals rounded, peristome continuous, umbilicus closed; horny operculum transparent colourless, shell height 3.5–3.9 mm, width 2.4–2.5 mm.

**Animal:** mantle black with a narrow white border, penis broad at the basis and slim at the distal end, up to 15 penial folds.

**Anatomy:** Bursa duct hard tortuous, receptaculum digitiform, which, however, does not fully reach the loop of the renal oviduct.

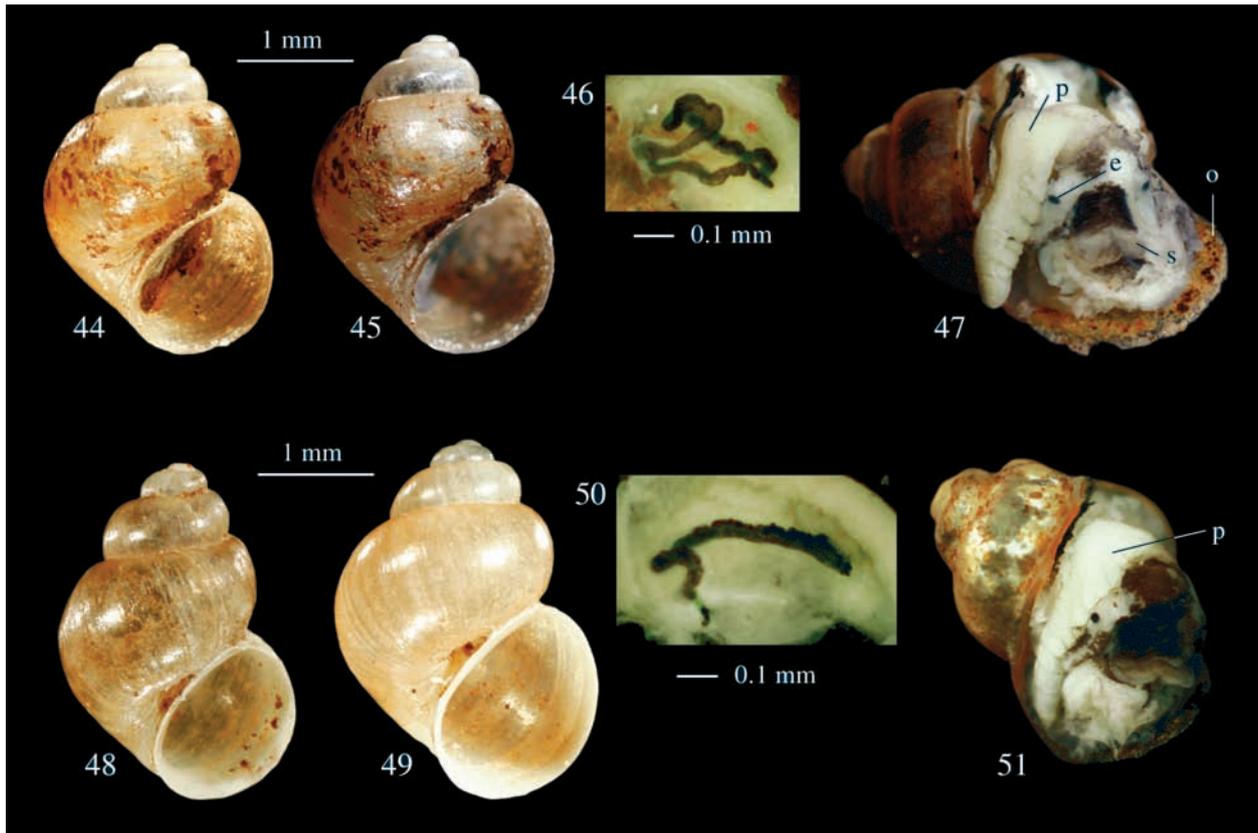
**Differentiating features:** The species’ shell is similar to *P. lineae* n. sp., *P. fineti* n. sp., and *P. rouagi* n. sp. These species can be distinguished by the renal oviduct: one small loop in *P. fineti*.

**Distribution:** Only known from the type locality and from Aïn Damous (at Medjez Sfa, Guelma).

***Pseudamnicola lineae* n. sp.**

Figs 13, 67–70, 57, 64

**Holotype:** shell height 3.3 mm, width 2.2 mm, Aïn H’djar [at Medjez Sfa, Guelma], 36°25.806'N 07°47.708'E, 256.03 m alt., leg. S. BOUZID, 27.08.2006, ZMH 51394, Figs



Figs 44–47. *Pseudamnicola calamensis* n. sp. 44–45: shells (paratypes); 46: renal oviduct; 47: Head with penis.—e = eye, o = operculum, p = penis, s = snout. — Figs 48–51. *Pseudamnicola fineti* n. sp. 48–49: paratypes, 50: renal oviduct, 51: Head with penis (p).

13 (type locality), 43. — Paratypes: ZMH 51395 (5 ex. in ethanol), SMF 334684/142, GLÖ (156 ex), BOE 3062 (32 ex.) from type locality.

**Habitat:** Natural spring.

**Etymology:** Named after LINA BOUZID, first-born daughter of the second author.

**Description:** The brownish shell is conically oval and has 4.25–4.5 slightly convex whorls which increase regularly, the body whorl dominates and is 3.5 times higher than the spire; apex blunt, suture deep, surface glossy; aperture oval at the top moderately angled, peristome continuous and sharp; horny operculum transparent colourless; shell height 3.3–3.5 mm, width 2.2–2.5 mm.

**Animal:** mantle black, snout broad and crenated; penis long with up to 10 penial folds.

**Anatomy:** Bursa duct slightly curved, the straight finger-shaped receptaculum is attached beside the renal oviduct at the bursa.

**Differentiating features:** The species' shell is similar to *P. lineae* n. sp., *P. fineti* n. sp., and *P. rouagi* n. sp. These species can be distinguished by the renal oviduct: one small and one large loop in *P. lineae*.

**Distribution:** Only known from the type locality.

### *Pseudamnicola rouagi* n. sp.

Figs 16, 71–73

**Holotype:** shell height 3.1 mm, width 2.3 mm, Ain Bend-aoud [at Ouled Driss, Souk Ahras], 36°22.373'N 08°04.402'E, 1118 m alt, ZMH 51392, Fig. 16. — Paratypes: ZMH 51393 (5 ex. in ethanol), SMF 334681/5, GLÖ (58 ex.) from type locality.

**Habitat:** Natural fountain.

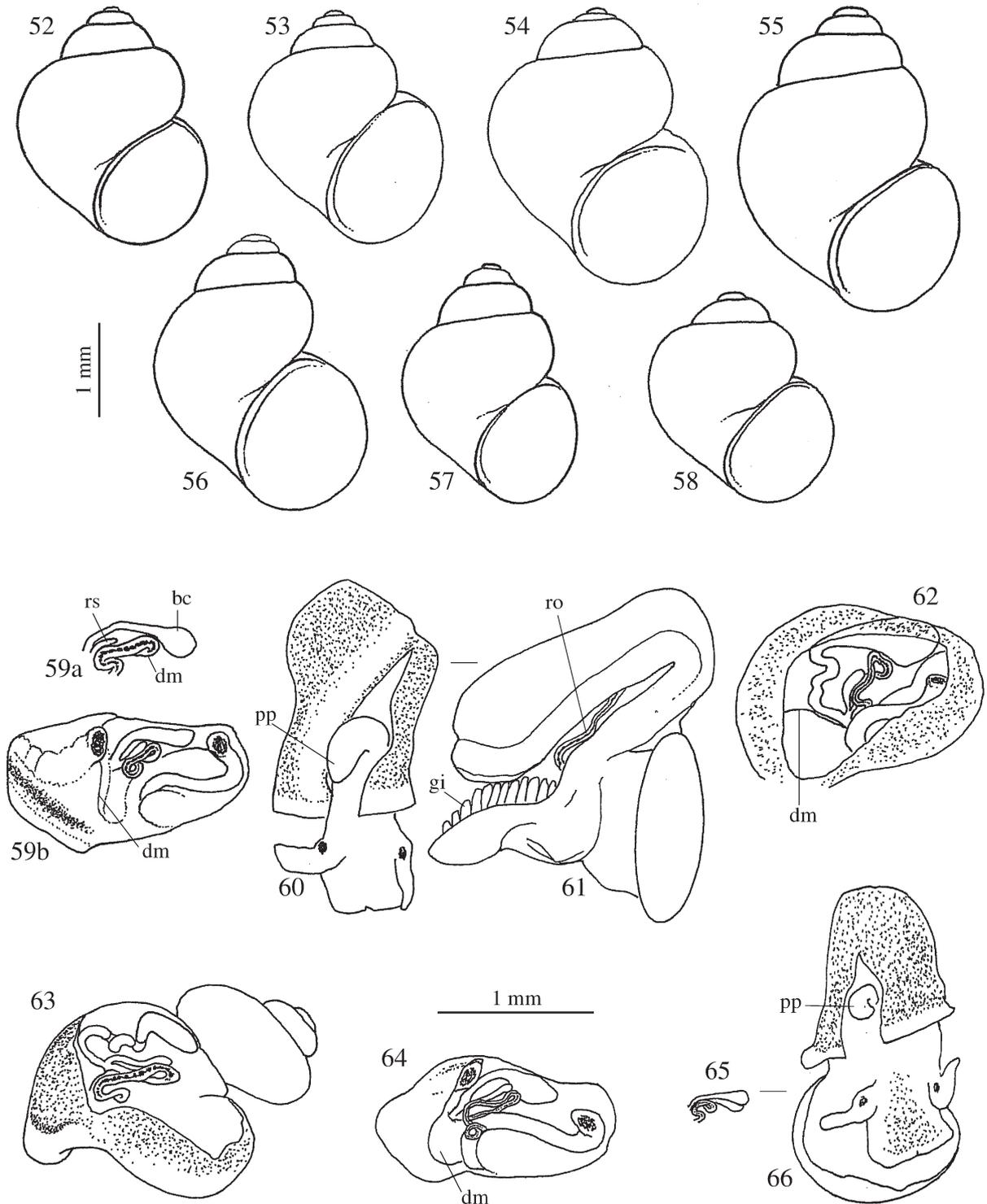
**Etymology:** Named for RACHID ROUAG, promising Algerian herpetologist.

**Description:** The dark horn-coloured shell is conically oval and has 4.5 slightly rounded whorls with a clear to weak suture, the body whorl is 3–4 times higher than the spire; apex blunt, surface glossy and finely striated; aperture oval, peristome continuous and sharp; horny operculum transparent colourless; shell height 2.7–3.1 mm, width 2.2–2.3 mm.

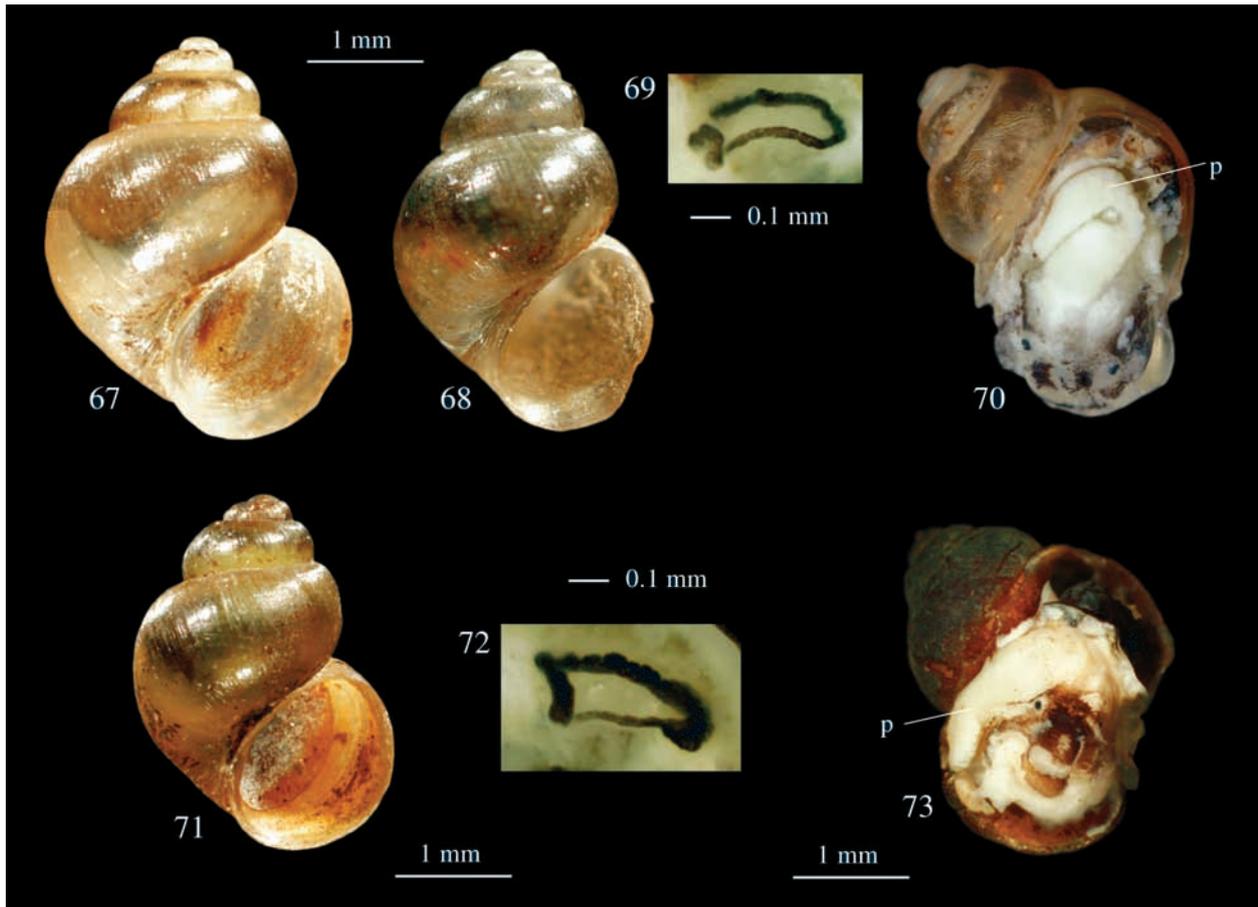
**Animal:** mantle greyish with a white broad border, snout broad and slightly crenated; penis long with a rounded penis tip.

**Anatomy:** Oviduct loop large, at the proximal part tapered.

**Differentiating features:** The species' shell is similar to *P. lineae* n. sp., *P. fineti* n. sp., and *P. rouagi* n. sp.



Figs 52–66. 52–58: Shells of *Pseudamnicola* spp. from the region of Guelma. 52–54: *P. calamensis*; 52: the same ex. as Fig. 58, 53: the same ex. as Fig. 59, 54: the same ex. as Figs 60–61. 55–56: *P. fineti* n. sp. 55: the same ex. as Fig. 62; 56: the same ex. as Fig. 63. 57: *P. linae* n. sp., the same ex. as Fig. 64. 58: *Pseudamnicola* sp., the same ex. as Figs 65–66, see discussion. — 58–66: Anatomy of *Pseudamnicola* spp. from the region of Guelma. 58–59: *P. calamensis*. 60–61: *P. calamensis* infected ♀; 60: pseudopenis; 61: mantle cavity and kidney cut open and gill and renal oviduct uncovered. 62–63: *P. fineti* n. sp.; 62: Aïn Damous; 63: Aïn Feid-El-Bagrat. 64: *P. linae* n. sp. 65–66: *Pseudamnicola* sp. 66: infected ♀ with pseudopenis, see discussion. — Abbreviations: bc = bursa copulatrix, dm = wall of the mantle cavity, gi = gill, pp = pseudopenis, ro = renal oviduct, rs = receptaculum seminis. (Original drawing by H. D. BOETERS). All illustrated specimens are paratypes from type locality.



Figs 67–70. *Pseudamnicola lineae* n. sp. 67-68: paratypes, 69: renal oviduct, 70: Head with penis (p). — Figs 71–73. *Pseudamnicola rouagi* n. sp. 71: shell (paratype), 72: renal oviduct, 73: head with penis (p).

These species can be distinguished by the renal oviduct: one large loop, tapered at the proximal part in *P. rouagi* n. sp.

**Distribution:** Only known from the type locality.

**Genus *Mercuria* BOETERS 1971**

**Type species:** *Cyclostoma simile* Draparnaud 1805.

The shell is whitish, especially in the region of the umbilicus. The penis posses a large and flat triangular appendix.

**Identification key**

- 1. Shell larger than 4 mm, elongated conical ..... 3
- 1'. Shell oval to spherical, smaller than 4 mm ..... 2
- 2. Shell spherical, short spire 0.2–0.3 of shell height, shell height 2.4–3.0 mm ..... *M. globulina*
- 2'. Shell oval, shell height up to 3 mm ..... *M. bourguignati* n. sp.
- 3. Shell whitish, solid, 6–6.5 whorls, aperture slightly angled, aperture height: shell height about 0.6 ..... *M. pycnocheilia*

- 3'. Shell solid, yellowish to whitish, opaque, aperture rounded ..... 4
- 4. Shell large, > 5 mm, aperture height: shell height about 0.5 ..... *M. saharica*
- 4'. Shell smaller, < 5 mm, aperture height: shell height about 0.4 ..... *M. gauthieri* n. sp.

***Mercuria pycnocheilia* (BOURGUIGNAT 1862)**

Figs 74, 79–82

1862 *Bythinia pycnocheilia* BOURGUIGNAT, Les Spicilèges Malacologiques: 117, loc. typ.: „Espèce commune à Temascin [= Temacin], près de Tuggort [= Touggourt]“.

**Material examined:** The syntypes could be found in BOURGUIGNAT’s collection in Geneva: MHNG 5351 (40 ex.), Temascin, près de Tuggort. — MNHN: Ouargla (43 ex.); Ferkane (34 ex.); Oasis d’Ourir entre Biskra et Touggourt (numerous; SMF 334680/23); Bahr de Tiguedidine près de Djamaa (22 ex.); Negrine (18 ex.).

**Description:** Shell solid and conical, colour whitish opaque, surface smooth and glossy, Apex: small and acute, 6–6.5 slightly rounded whorls with a deep suture,



Figs 74–78. *Mercuria* spp. from Algeria. — 74: *Mercuria pycnocheilia*, Temascin, près de Tuggort, syntype. 75: *Mercuria gauthieri* n. sp., Nemours, holotype. 76: *Mercuria saharica*, Sidi Rached. 77: *Mercuria globulina*, Boufarik. 78: *Mercuria bourguignati* n. sp., Boghari, holotype.

whorls increase with constant rates, umbilicus small but opened and deep, spire 0.3 of shell height, aperture oval and angled, not cut by the body whorl, periostome thickened, shell height 3.8–4.9 mm, shell width 2.8–3.5 mm

**Distribution:** Sahara depression and adjacent areas.

**Remark:** The shell shape is a little similar to that of *M. gauthieri* n. sp., but the spires are distinct: slim in *M. pycnocheilia* and broad in *M. gauthieri* n. sp. In addition both species live in distinct zoogeographical regions of Algeria.

***Mercuria globulina* (LETOURNEUX & BOURGUIGNAT 1887)**

Figs 77, 83–84

1887 *Amnicola globulina* LETOURNEUX & BOURGUIGNAT, Prodrome de la Malacologie terrestre et fluviatile de La Tunisie: 147, loc. typ.: „Tala, El-Kis, près de Feriana, ainsi que dans le bassin du temple du Djebel, Zaghuan.“

**Material examined:** syntypes MHNG 5307 (numerous specimens from coll. Bourguignat in MHNG, with original

label) El Kis, près de Feriana, Tunisie. — MNHN: Boufarik (4 samples: 26 ex., 3 x numerous; SMF 334679/many); Algiers (numerous); Zardezas (35 ex.); 2 unknown sampling sites (2 x numerous).

**Description:** Shell conically oval with a prominent body whorl, colour whitish opaque, surface smooth and glossy, apex small, 4.5–5 whorls rapidly increasing with a deep suture, umbilicus open but small, spire height 0.2–0.3 of shell height, aperture oval rounded, periostome thick, shell height 2.5–3.0 mm, shell width 2.3–2.5 mm.

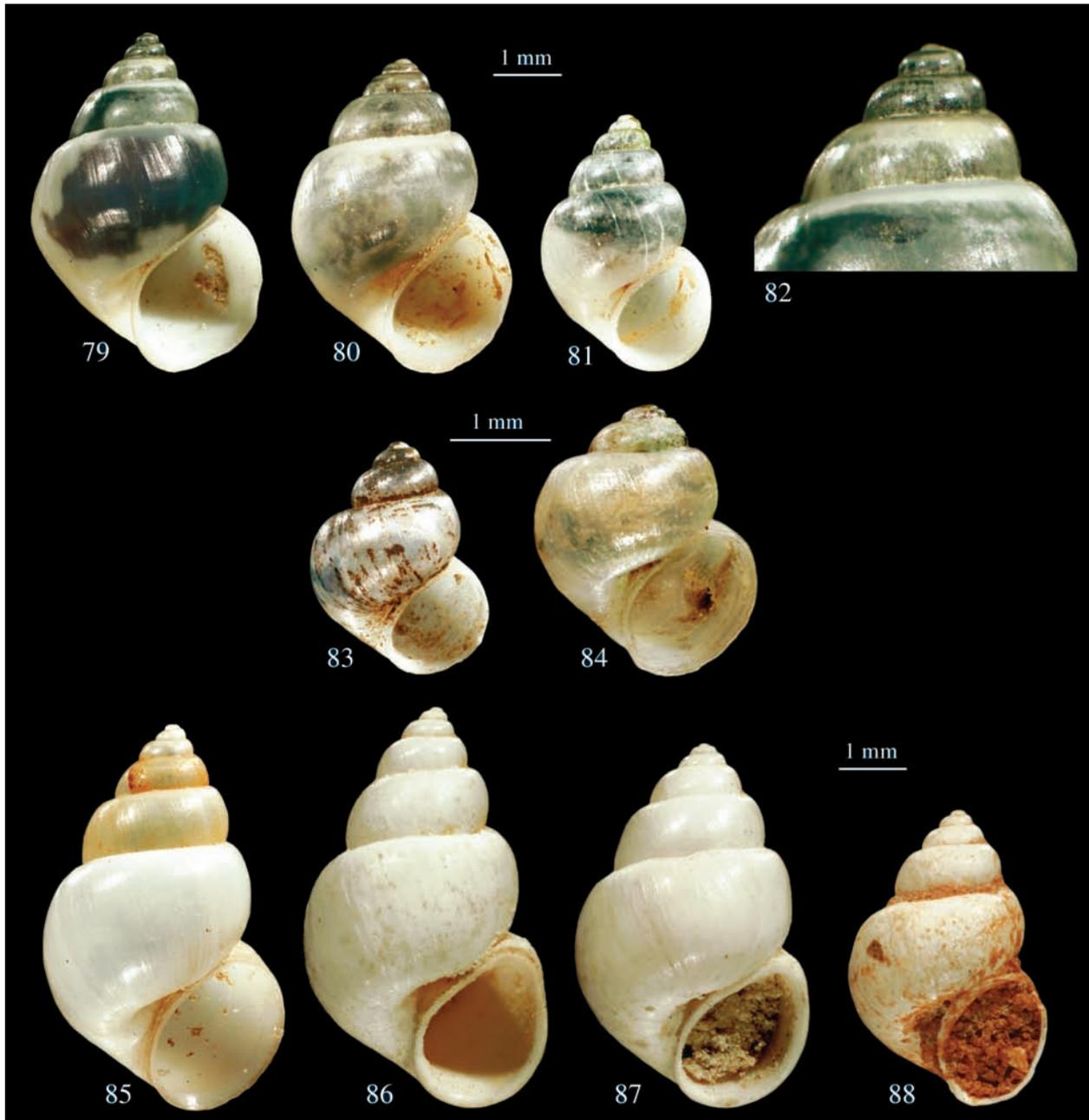
**Distribution:** Central and eastern parts of the Tell.

***Mercuria saharica* (BOURGUIGNAT 1887)**

Figs 76, 85–88

1887 *Amnicola saharica* BOURGUIGNAT, In: LETOURNEUX & BOURGUIGNAT, Prodrome de la Malacologie terrestre et fluviatile de La Tunisie: 144, loc. typ.: “Sidi Sliman; etc.”.

1887 *Amnicola subscalaris* LETOURNEUX & BOURGUIGNAT, Prodrome de la Malacologie terrestre et fluviatile de



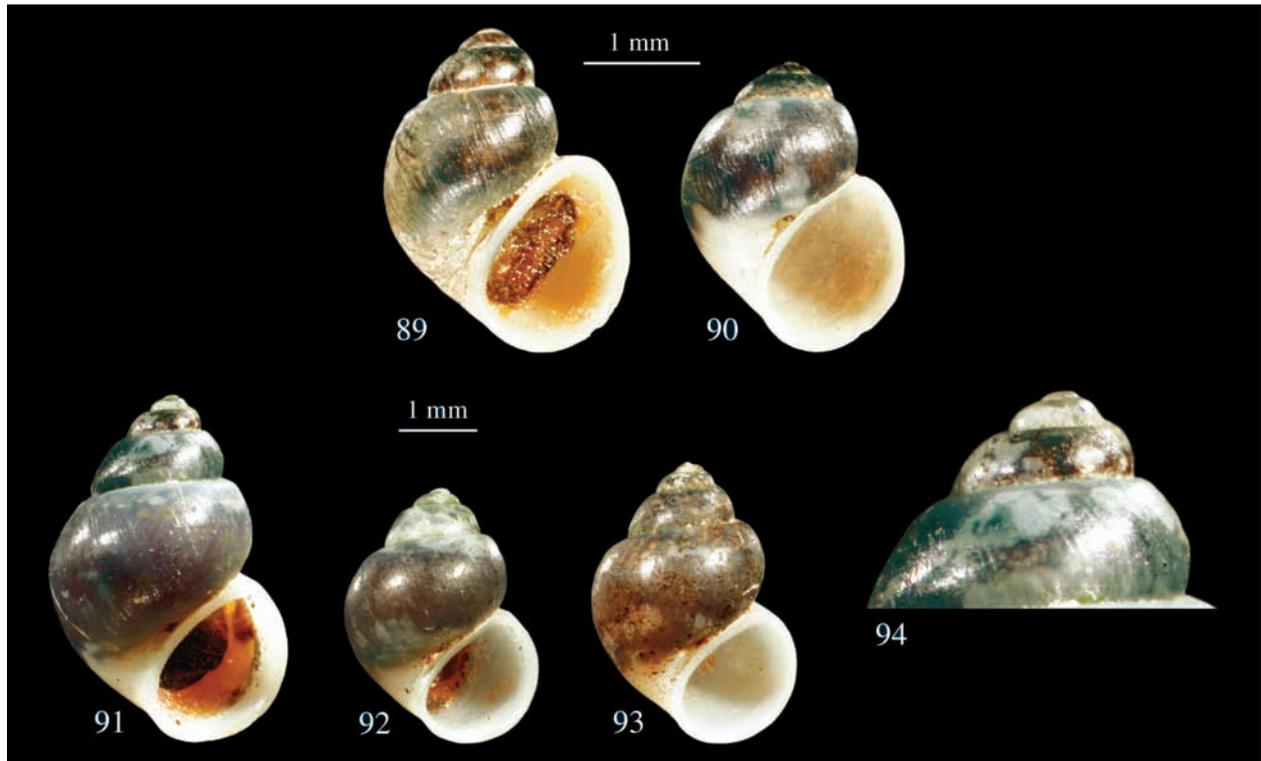
Figs 79–82. *Mercuria pycnocheilia*. 79–81: shells of Ouargla, 82: spire of 79. — Figs 83–84. *Mercuria globulina*. 83: Boufarik (aberrant shell); 84: syntype (MHNG 5307). — Figs 85–88. 1-2: *Mercuria saharica*. 85: Sidi Slimane (syntype MHNG 5370); 86: mare km 139 route Kairouan à Enfida; 87: Oued Gabès (MHNG 5275); 88: Sidi Makhlof.

La Tunisie: 144, loc. typ.: “Algérie, à Mokta-el-Oued, entre Djelfa et Boghar; Tunisie, Oued Gabès à Gabès”.

1887 *Amnicola bythinopsis* LETOURNEUX & BOURGUIGNAT, Prodrôme de la Malacologie terrestre et fluviale de La Tunisie: 144, loc. typ.: “dans les eaux des environs de Gabès”.

**Material examined:** syntypes *saharica*: MHNG 5365 (numerous) Ruisseau de la fontaine chaude de Biskra, Algérie, with original label; MHNG 5366 (numerous) Puits artésien de M’Zaiez (= Meghaïer), entre Biskra et Tuggurt, Algérie, with original label; MHNG 5367 (3 ex.) Fontaine chaude

du ruisseau des Zaatcha, dans le Zab occidental, Algérie, with original label; MHNG 5368 (7 ex.) Oued Gabès à Gabès, Tunisie, with original label; MHNG 5369 (numerous) puits artésien de Sidi-Rached (Oued Priz [= Oued Rir]), with original label, MHNG 5370 (numerous, with original label), puits artésiens de Sidi Sliman (Oued Rir = Sidi Rached). — The following samples are labelled as *A. saharica* (see remark): MHNG 5455 (2 ex.) environs de Palerme, Sicile, specimens from coll. BOURGUIGNAT in MHNG, with original label. [= *Mercuria* sp.]; MHNG 5456 (2 ex.) fleuve Oreto, près de Palerme, Sicile specimens from coll. BOURGUIGNAT with original label [= *Mercuria* sp.]. — syntype *subscalaris*: MHNG 5386 (1 ex.) Oued Gabès



Figs 89–90. *Mercuria bourguignati* n. sp. 89–90: shells, paratypes. — Figs 91–94. *Mercuria gauthieri* n. sp. 91: holotype; 92–93: shells of paratypes, Nemours; 94: spire of 91.

à Gabès, Tunisie, with original label [the Algerian specimens are not present in MHNG]. — syntypes *bythinopsis*: MHNG 5275 (2 ex.) Oued Gabès. — MHNG 5274 (1 ex.) Mokta El Oued, entre Djelfa et Boughar [this lot is named *bythinopsis*, however, this is the “type” locality of *subscalaris* and very probably represents the missing lot; this is probably an original confusion by BOURGUIGNAT himself]. — all following lots from MNHN: Sidi Makhlouf (numerous); mare route Kairouan à Enfida (Tunisia) (8 ex.); unknown puits artesiens (16 ex.); Algiers (numerous).

**Description:** shell elongated conical, surface finely striated and glossy, apex acute, 5.5–6 whorls slightly rounded and rapidly increasing with a deep suture, whitish opaque, umbilicus closed to slit-like, aperture height about 0.4–0.45 of shell height, aperture oval rounded, periostome thick, shell height 5.5–6.2 mm, shell width = 3.0–3.6 mm.

**Distribution:** Sahara depression and adjacent areas, central Hauts Plateaux and coastal regions of Algeria and Tunisia.

**Remark:** GAUTHIER (1928: 66) mentioned this species from “l’Oued Gabès, à Ras-el-Oued... dans l’Oued Béchar”, too. Next to the locality in Algeria (originally considered as “type locality”), LETOURNEUX & BOURGUIGNAT (1887: 144) mentioned *A. subscalaris* also from Tunisia “Oued Gabès, à Gabès”; in parallel, they described *A. bythinopsis* from the same area in Tunisia. The only difference between the shells of both species is in the

shape of the aperture. Because aberrant apertures in *Mercuria* spp. are not unusual (see *Mercuria bourguignati* n. sp., Figs 16.5 and 20.1), we believe that both species are conspecific. LETOURNEUX & BOURGUIGNAT (1887: 145) mentioned *M. saharica* species also from l’Oreto near Palermo (Sicily). GIUSTI & PEZZOLI (1980) did not list this species from Italy, but the shells of BOURGUIGNAT’S collection (MHNG 5455 and MHNG 5456), both samples collected near Palermo, are indeed very similar to *M. saharica*.

#### *Mercuria bourguignati* n. sp.

Figs 78, 89–90

**Holotype:** shell height 2.9 mm, width 2.0 mm, Ksar el Boukhari, MNHN 21450, Fig. 78. — **Paratypes:** MNHN 21451 (2 lots, numerous), SMF 334677/55, Ksar El Boukhari (= Boghari); MNHN 21907 (38 ex.), Fouka près de Kolea; MNHN 21905 (3 samples: 19 ex., 2 x numerous); MNHN 21903 (18 ex.), Boufarik, Algiers (Hôpital du Dey); MNHN 21904 (numerous) Mokta Al-Hadid (coll. Jousseume), MNHN 21906 (numerous), Dellys; MNHN 21908 (3 ex.), unknown sampling site.

**Etymology:** Named after JULES-RENÉ BOURGUIGNAT in appreciation of his work on the continental mollusc fauna of Algeria.

**Description:** shell elongated oval, colour whitish opaque, the juveniles are spherical, surface finely striated and glossy, apex blunt, whorls slightly rounded with a flat to clear suture, umbilicus opened but small, spire

height 0.3 of shell height, aperture oval, peristome sharp and flanged at the columella, shell height 2.9 mm, shell width 2.0 mm.

**Differentiating features:** Shell elongated oval and not spherical like *M. globulina*. The shell is smaller (about 3 mm) than the other *Mercuria* spp. (about 4–6 mm).

**Distribution:** Eastern and central Tell and central Hauts Plateaux.

***Mercuria gauthieri* n. sp.**

Figs 75, 91–94

**Holotype:** shell height 4.6 mm, width 3.2 mm, près de Nemours [= Ghazaouet], MNHN 21452, Fig. 91. — **Paratypes:** MNHN 21453 (numerous), SMF 334678/37 from the type locality; MNHN 21899 (40 ex.), Nemours.

**Ethymology:** Named, in memoriam, for HENRI GAUTHIER, in recognition of his extensive work on the continental aquatic fauna of Algeria and Tunisia.

**Description:** shell solid and conical, colour whitish opaque, surface smooth and glossy, apex rounded, 4.5–5 slightly rounded whorls with a clear suture, whorls regularly increasing, umbilicus small but opened, spire 0.2–0.3 of shell height, aperture oval and angled, not cut by the body whorl, peristome thickened, shell height 3.5–4.7 mm, shell width 2.5–3.1 mm.

**Differentiating features:** The shell shape is a little similar to that of *M. pycnocheilia*, but the spires are distinct: slim in *M. pycnocheilia* and broad in *M. gauthieri* n. sp. In addition both species live in distinct zoogeographical regions of Algeria.

**Distribution:** This species is apparently confined to the westernmost part of the Algerian coast.

## Discussion

It is not possible to decide only by means of contemplating whether the shells of a particular taxon represents a species or a subspecies, but as most of the taxa that we found were not restricted in their distribution, we can exclude geographical races. For this reason we consider all these taxa found by us as being taxa of species rank.

However, identifying the oldest name for a given species may cause some problems, because in former times many species of the genus under discussion have been described as *Ammicola*, *Hydrobia*, *Paludinella*, and *Bithynia*, and only a few of the old names have already been identified until now.

BOURGUIGNAT (1864: 245) misinterpreted the species description of *Pseudamnicola dupotetiana* (FORBES 1839) and recognised a high degree of variability concerning the shell size (3–5 mm). The drawing he provided (his pl. 14, Fig. 31) has nothing in common with the original drawing by FORBES (1839) (Fig. 95). All other authors up to now, e.g. WESTERLUND (1886: 79), PALLARY (1898: 133), and GHAMIZI et al. (1997) followed him. GHAMIZI et al. (1997) designated a neotype for *P. dupotetiana*, but used this name also in a wide sense concerning the shell shape (their Figs 5–7, p. 43) and penis morphology (their Figs 20–28, p. 45). The neotype corresponds to the original description as well as to our species definition, but the additionally illustrated specimens (their Figs 5–7, p. 43) are, in our opinion, distinct from *P. dupotetiana*.

The misidentification of *Pseudamnicola dupotetiana* by BOURGUIGNAT (1862, 1864) and other malacologists possibly happened because *Mercuria globulina* inhabits the same region, which has a similar shell shape if compared to *P. dupotetiana*, but differs by a higher degree of variability, and until the description of the genus *Mercuria*,

both species could not be distinguished. In addition, juveniles of many *Pseudamnicola* spp. are similar to *P. dupotetiana*, because their shells are more spherical than the shells of the adults. This means, if two *Pseudamnicola/Mercuria* spp. occur in sympatric conditions, parallel existence of differing species does not become obvious at the first glance without counting the number of whorls.

BOETERS (1988) already stated that in representatives of *Pseudamnicola*, the duct of the bursa, i.e. the pedunculus, can be curved or even be tortuous. Thus, BOETERS (1988) differentiated for example *P. gasulli* BOETERS, 1981 (BOETERS 1988: 204 figs 78–80) by means of its curved duct from *P. spirata* (PALADILHE 1869) (loc. cit.: 204 figs 81–84) with its tortuous duct. Both species originate from the Iberian peninsula. Further, for *P. meluzzi* BOETERS, 1976 (BOETERS 1976: 96 Fig. 3) he described the duct to be curved, yet for *P. conovula* (FRAUENFELD 1863) (loc. cit.: 96 Fig. 6 and figs 5 and 7, resp.), both from Tunisia. However, according to our present understanding it cannot be excluded that the material as identified by BOETERS (1976) as *P. conovula* might have comprised more than one single species; as regards a revised interpretation of *P. conovula* see for example FALKNER & BOETERS (2003: 23). It may be argued, of course, that the torsion of the oviduct is due to the extreme retreat of the animal during preservation in ethanol. However, even under this assumption the fact remains that one way of killing will cause a torsion of the oviduct while another will not. In addition a tortuous duct resulted by fixation cannot be a constant character for a species, as we found it in our samples.

The three species from the Guelma region (*P. calamensis* n. sp., *P. fineti* n. sp., and *P. liniae* n. sp.) differ

## PALUDINA.

38. *Paludina acuta*, Drap. In rivulets near Algiers, rare.

39. *Paludina Dupotetiana*, nov. sp. Pl. XII. fig. 3.

*P. testa minima ovato-conoidea, ventricosa perforata, fusca; anfractibus quinis teretibus: apertura ovato-rotunda; spira obtusa.*

Long.  $\frac{1}{10}$ ; lat.  $\frac{1}{12}$ .

Animal black. The shell is generally encrusted with mud; the operculum is corneous and striated. In muddy rivulets near the sea at Algiers and Bougia...



Fig. 95. Faksimile of the original description of *Paludina dupotetiana* FORBES 1839, and Fig. 3 of plate 12.

only slightly in their shell shape, their penis morphology, their bursa duct, and their renal oviduct. But the differences in the renal oviduct are constant, so these species can be interpreted as being distinct. Many species described here reveal more differences in their shell shape than those from Guelma region.

One species of *Pseudamnicola* (sampling site: Ain Kef Kourrath, at Medjez Sfa, Guelma, 36°26.395'N 07°51.996'E, 384.05 m alt., Figs 58, 65–66) could not be identified because all specimens were infected, and all females beared a pseudopenis. We do not know if the Oviduct loop, which differed from that of the other species in this region, has become aberrant by the parasites, but the shell sizes seems not to be influenced, as suggested by SZAROWSKA et al. (2006).

Some of the species mentioned in this paper are widely distributed in Algeria, while others, especially those that live in thermal springs, are obviously restricted in their distribution range. In other countries such as Spain for example (see BOETERS 1988), the distribution areas of *Pseudamnicola* spp. are smaller. Additionally, species richness of *Pseudamnicola* spp. and *Mercuria* spp. in Algeria is much larger. Because the number of species listed in a check list depends not only on the actual diversity, but also on the thoroughness of investigation and on the taxonomical expertise. In our case, the great

number of samples studied by us may also have contributed to the species diversity reported here. It should be stressed that Algeria, especially Eastern Algeria, is a hot spot of *Pseudamnicola* speciation.

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