



DESCRIPTION OF A NEW SUBSPECIES OF *PSEUDAMNICOLA* PAULUCCI, 1878 (CAENOGASTROPODA: TRUNCATELLOIDEA: HYDROBIIDAE)

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ABSTRACT: A new subspecies of *Pseudamnicola* (*P.*) *moussonii* is described for the *Pseudamnicola* populations inhabiting the Maltese Islands.

KEY WORDS: *Pseudamnicola*, Maltese Islands, new subspecies

INTRODUCTION

BOETERS (in BECKMANN 1987) discovered a species of *Pseudamnicola* from Gozo, one of the Maltese Islands, and misinterpreted it as *P. melitensis* (Paladilhe, 1869). GIUSTI et al. (1995) identified this species from Malta and Gozo as *P. moussonii* (Calcara, 1841). Moreover, they proved that *Amnicola melitensis* Paladilhe, 1869 belonged to *Mercuria* Boeters, 1971.

In view of the fact that the type locality of *P. moussonii* is situated in Sicily, it seemed reasonable to compare the *Pseudamnicola* from the Maltese Islands not only with *P. moussonii*, but also with all other Sicilian species of *Pseudamnicola*.

According to BODON et al. (1995: 25), in addition to *P. moussonii*, also *P. conovula* (Frauenfeld, 1863) inhabits Sicily. Meanwhile FALKNER & BOETERS (2003: pl. 7, figs 12a–b and 8, respectively) designated lectotypes of both *Paludina moussonii* Calcara, 1841 and *Amnicola conovula* Frauenfeld, 1863 to stabilise their identity. As a result of the designation of the lectotype for *A. conovula*, the island Pag became its type locality. Thus, for the Italian Adriatic area, instead of *P. conovula* sensu BODON et al. (1995), another species name might apply. FALKNER & BOETERS (2003) referred to *P. orsinii* (Küster, 1852)

with “Ascoli[-Piceno] im Kirchenstaat [corr.: Lago Delfico. Abbruzzos]” as the type locality and designated the lectotype also for this species. DELICADO et al. (2015: 408, fig. 2, “Bal”, “Msc”, “Sig” and “Tra” vs. “Fiu”), apart from *P. moussonii*, mentioned *P. orsinii* also from Sicily. Recently, GLÖER & BECKMANN (2007) described *P. sciaccaensis* as the fourth species of *Pseudamnicola* inhabiting Sicily.

The following updated description of the species of *Pseudamnicola* inhabiting the Maltese Islands gives a comparison not only with *P. moussonii*, but also with *P. conovula*, *P. sciaccaensis* and *P. orsinii*. Finally, also *Amnicola cocchii* Benoit, 1882 is taken into consideration, since its type locality is also situated on Sicily: “un piccolo laghetto presso Mazzara” (BENOIT 1882: 165).

Finally, the *Pseudamnicola* sp. inhabiting the Maltese Islands, misinterpreted by BOETERS (in BECKMANN 1987) and occasionally co-occurring with *M. melitensis*, is described as a new subspecies of *P. moussonii*, assuming that the Sicilian populations represent the nominotypical subspecies *P. m. moussonii*.



MATERIAL AND METHODS

The snails were collected with a sieve and preserved in 75% ethanol. Specimens of the new subspecies were found on Gozo, one of the Maltese Islands (Fig. 1). Dissections and measurements of the shells (Figs 2–14) as well as of the male (Figs 15–19) and female (Figs 20–25) genital organs were carried out

using a stereo microscope, the photographs were taken with a Leica digital camera system. In addition we used literature sources and materials listed in the text.

Abbreviations: BOE – BOETERS Collection (München); SMNS – Staatliches Museum für Naturkunde Stuttgart.

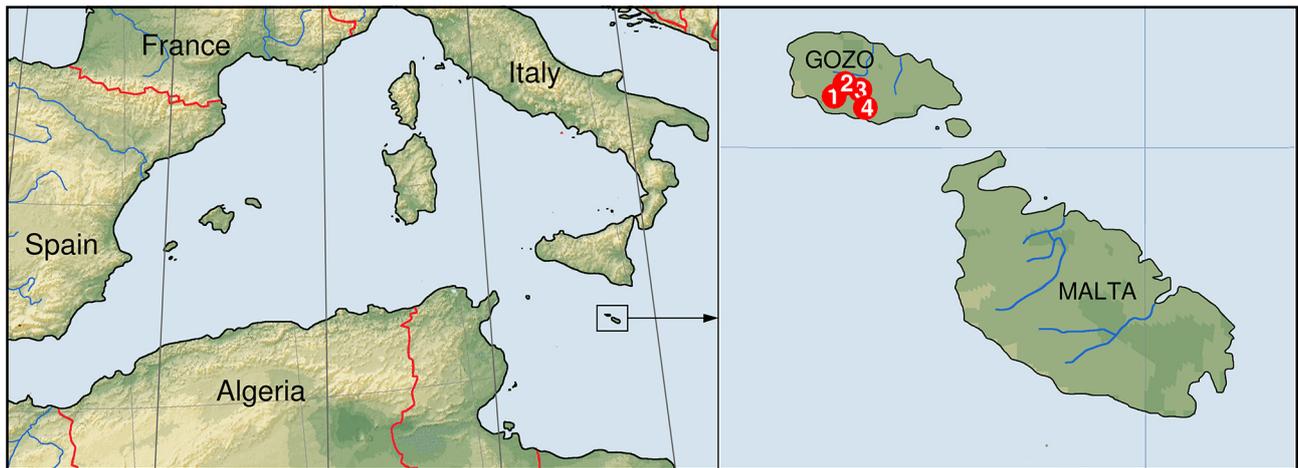


Fig. 1. Localities of *Pseudamnicola m. magozensis* n. subsp.: 1 – Xlendi Valley; 2 – Sara Valley; 3 – Lunzjata Valley; 4 – Fontana

SYSTEMATIC PART

Family: Hydrobiidae Stimpson, 1865

Genus: *Pseudamnicola* Paulucci, 1878

Type species: *Bythinia lucensis* Issel, 1878

***Pseudamnicola moussonii moussonii* (Calcara, 1841)**

Paludina moussonii CALCARA 1841: 9.

Paludina mussoni [sic] – BENOIT 1882: pl. 7, fig. 20 [see: 1882].

Paludina mussoni [sic] – BENOIT 1882: 204 [Sep.: 164].

Pseudamnicola moussoni [sic] – GIUSTI 1976: 105, 106, figs 1G–M, N–U; 108, figs 2I–Q.

Type locality (CALCARA 1841): Piana degli Albanesi at Lake Dingoli (GIUSTI et al. 1995: 141; type locality destroyed) [vicinanze della Piana dei Greci e propriamente in quella parte che lago di Ddingoli viene appellata].

Identity: FALKNER & BOETERS (2003: 26, pl. 7, figs 12–13) designated a lectotype and a paralectotype. A coloured photograph of the lectotype was given by GLÖER & BECKMANN (2007: 123, fig. 2.1). The lectotype height is 1.75 mm, the diameter 1.45 mm (see: FALKNER & BOETERS 2003; twice larger values incorrectly given by GLÖER & BECKMANN 2007).

The following description is based on the two above types and two samples from Calatafimi (Trapani, Sicily) (GIUSTI 1976: 106, figs 1N–O and T–U).

Shell (Figs 2, 3): Whitish opaque. For measurements see Table 1.

Male: Penis (Fig. 16) simple and corrugated on its concave side.

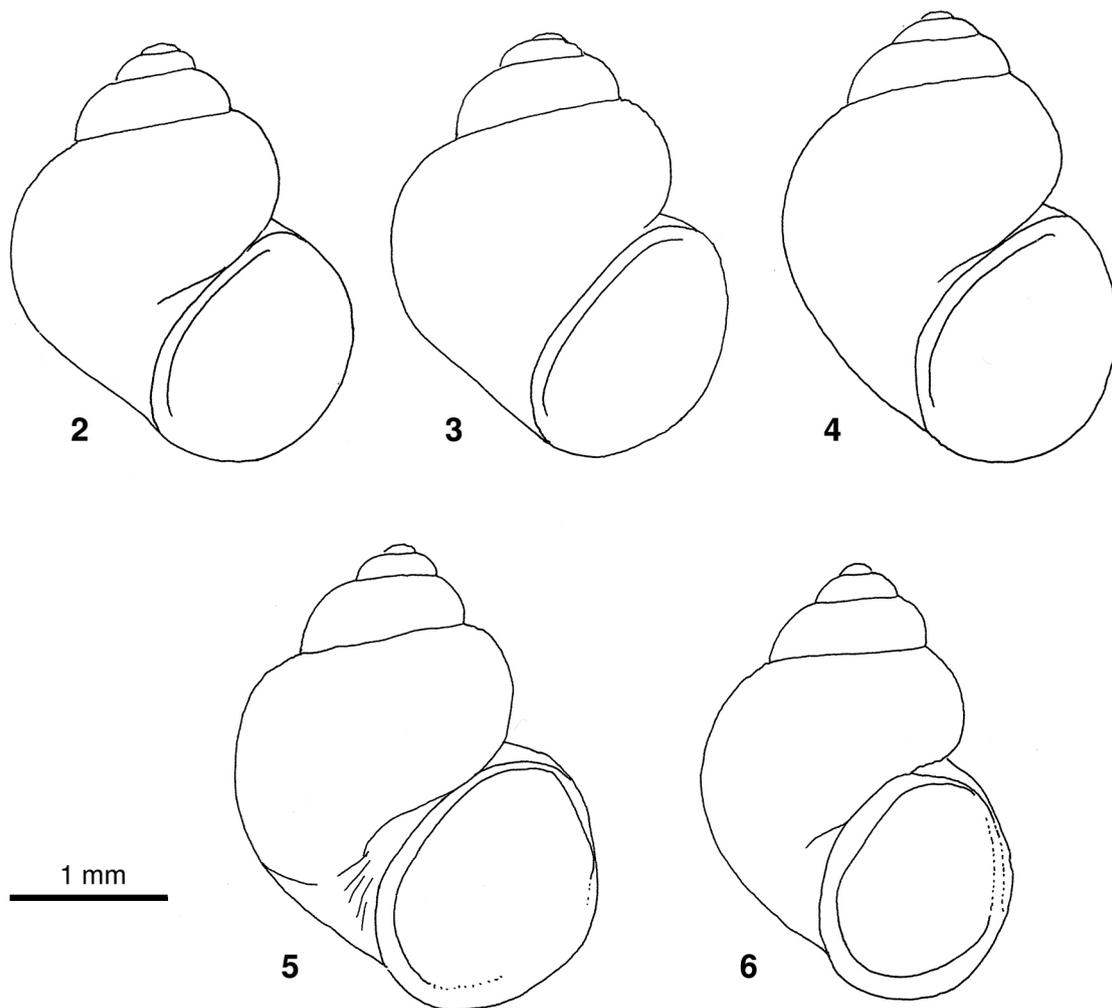
Female genitalia (Fig. 21): Proximal section of renal oviduct black pigmented, distal section unpigmented. Receptaculum (RS1) oval with a negligible duct. Large bursa like a bent, slightly folded sac, on its convex side entered by the bursal duct. Both ducts originate adjacent to each other. The bursal duct broadens gradually to its junction with the bursa.

Habitat and distribution: Presumably on Sicily in springs and brooks. According to GIUSTI (1976: 106–

Table 1. *Pseudamnicola moussonii moussonii* – shell measurements [mm]

	height (h)	diameter (d)	h : d
paralectotype	1.65	1.32	1.25
lectotype	1.75	1.45	1.21
GIUSTI 1976: 106, fig. 1N	2.78	2.04 ¹⁾	1.36
GIUSTI 1976: 106, fig. 1O	2.57	1.78 ¹⁾	1.44

¹⁾The values for figs 1N–O (see GIUSTI 1976: 106, fig. 1) are not calculated with the use of 2 mm scale, but according to fig. 1G measuring 3.25 mm.



Figs 2–6. Shells of *Pseudamnicola*: 2, 3 – *Pseudamnicola m. moussonii*, Italy, Sicily, Trapani, Calatafimi (after GIUSTI 1976: 106, fig. 1N–O); 4–6 – *Pseudamnicola conovula*, Croatia, Pag Island, Zubovivi (outlines of photographs by SZAROWSKA et al. 2006: 183, figs 22–24)

107) possibly widespread in Southern France, Spain and north-western Africa, a view which is shared by GIRARDI et al. (2009: 135), but doubted by FALKNER & BOETERS (2003: 26).

Remarks: (1) It should be borne in mind that according to BODON (in GIUSTI et al. 1995: 142) Sicilian specimens vary considerably in the length of seminal receptacle and in the length and shape of bursa copulatrix duct. This may have led GIUSTI et al. (1995) to assigned also *Pseudamnicola* populations with characters deviating from those listed above for Sicily, especially populations from the mainland of Italy (GIUSTI & PEZZOLI 1980) and from the Maltese Islands, to *P. moussonii*. It is consistent with the fact that GIUSTI et al. (1995: 142) speak of doubts thrown “on the validity of other classical species confirmed on the basis of anatomical study. This is the case of *Pseudamnicola conovula* (Frauenfeld, 1863; type locality: Insel Pag, Croatia), an alleged Transadriatic species ...”. SZAROWSKA et al. (2006: 187), dealing with *P. conovula* on morphological and genetic basis,

seem to confirm this view in expressing their “scepticism considering [at least] shell-based taxonomy in *Pseudamnicola*”.

(2) *Paludina moussonii* was described as having corneous-brown shell tending to yellowish [di color corneo tendente al biondetto] (CALCARA 1841). However, the shell of the lectotype is opaque white (cf. GLÖER & BECKMANN 2007: 123, fig. 2.2). Furthermore, its height is distinctly smaller than that of the shells figured by GIUSTI (1976: 106, fig. 1N–O). Thus, the identification of the taxon in question needs clarification. It should, however, be added that shells of *P. m. magozensis* n. subsp. from the Xlendi Valley on Gozo and of, for example, *P. cf. conovula* from Minareto on Sicily (BOE 0519), are opaque white and resemble shells of *Mercuria*.

(3) Recently DELICADO et al. (2015: 408, for “Tra, MSc, Bal, Sig”) published DNA data for *P. moussonii* from Sicily, but without any morphological characters.

Pseudamnicola (Pseudamnicola) m. magozensis
n. subsp.

Pseudamnicola melitensis – BOETERS in BECKMANN
1987: 7, 8, figs 1–2 and pl. 1, figs 3–5.

Pseudamnicola moussonii – GIUSTI et al. 1995: 131, figs
64–67; 138, 139, figs 80–85.

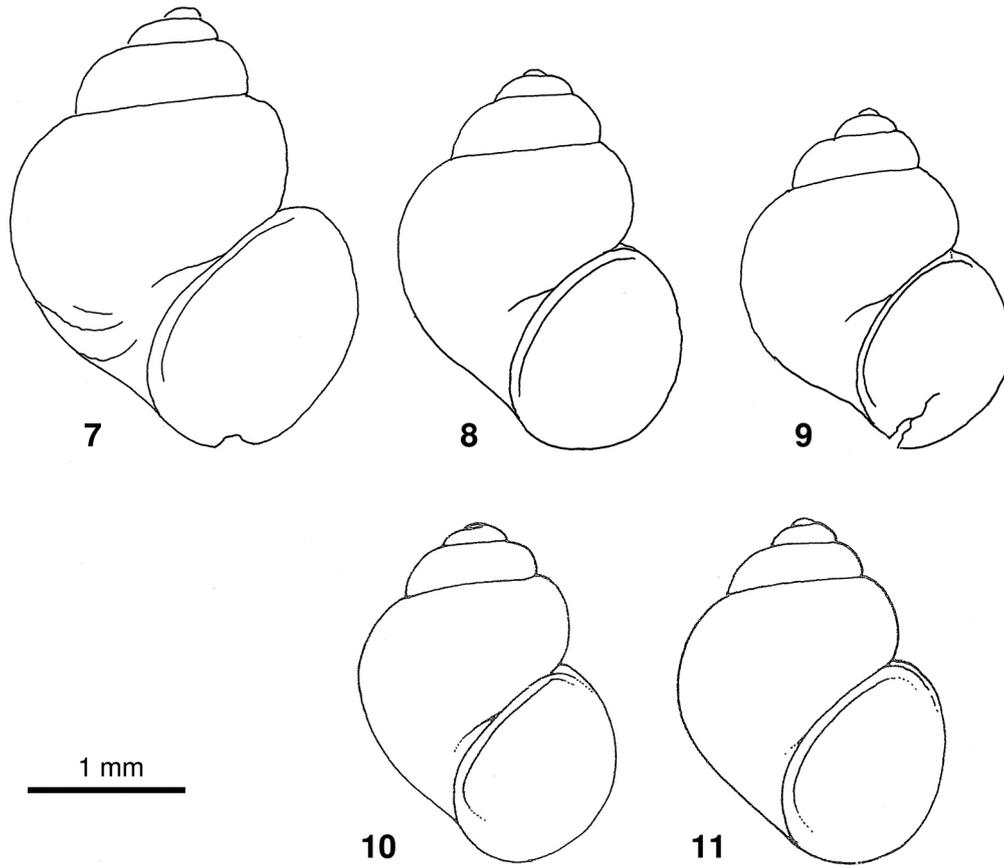
Examined material: Gozo, (i) Xlendi Valley, small
brook; K.-H. BECKMANN leg., 16.11.1986; SMNS-ZI

0 098 090/shell (holotype), SMNS-ZI 0 098 091/
shells (paratypes), BOE 1362/animals (paratypes);
(ii) Lunzjata Valley, P. SUBAI leg., 01.03.1988; BOE
3022/shells (paratypes).

Holotype: SMNS-ZI 0 098 090

Paratypes: SMNS-ZI 0 098 091/shells, BOE 1362/
animals, BOE 3022/shells

Type locality: Gozo, Xlendi Valley, small brook



Figs 7–11. Shells of *Pseudamnicola*: 7–9 – *Pseudamnicola* cf. *conovula*, Italy, Sicily, 7 km S of Syracuse and 50 m from coast, brook at Minareto (BOE 0519); 10, 11 – *Pseudamnicola m. magozensis* n. subsp., Maltese Islands, Gozo, Xlendi Valley (after BOETERS in BECKMANN 1987: 8, figs 1–2)



Figs 12–14. Shells of *Pseudamnicola m. magozensis* n. subsp. Maltese Islands, Gozo: 12 – Xlendi Valley (SMNS-ZI 0 098 090/holotype); 13, 14 – Lunzjata Valley (BOE 3022/ paratypes)



Etymology: The name is a composite derived from the two Maltese Islands Malta and Gozo.

Shell (Figs 10–14): Dextral, very small to small (compare Figs 10, 12 and 13, 14), conical-ovoid, frequently short and tumid, opaque whitish (BOE 1362), opaque yellow or brownish-yellow, sometimes encrusted, frequently eroded; external surface smooth, with thin growth lines; spire formed by 3.5–4 convex whorls; body whorl 0.75–0.80 of shell height; suture deep; umbilicus narrow; aperture oval, not acutely angled above; peristome continuous, generally not thickened (rarely thickened), slightly reflected at lower and external margins, upper peristomal margin angled and flared (except for BOE 1362 after GIUSTI et al. 1995: 140).

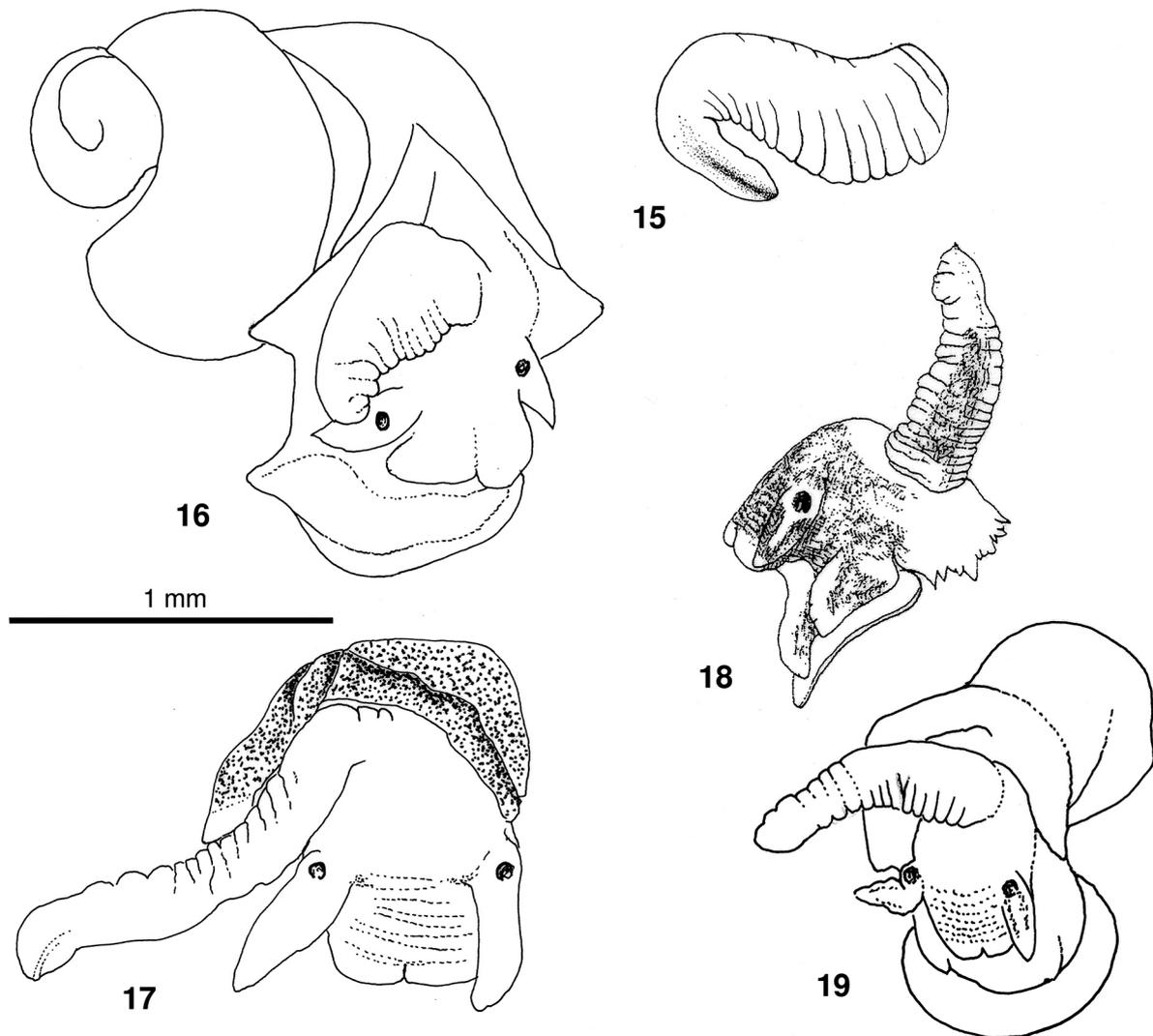
Measurements. Height 2.5–2.8 mm, diameter 1.7–2.2 mm (GIUSTI et al. 1995: 140).

Operculum: Corneous.

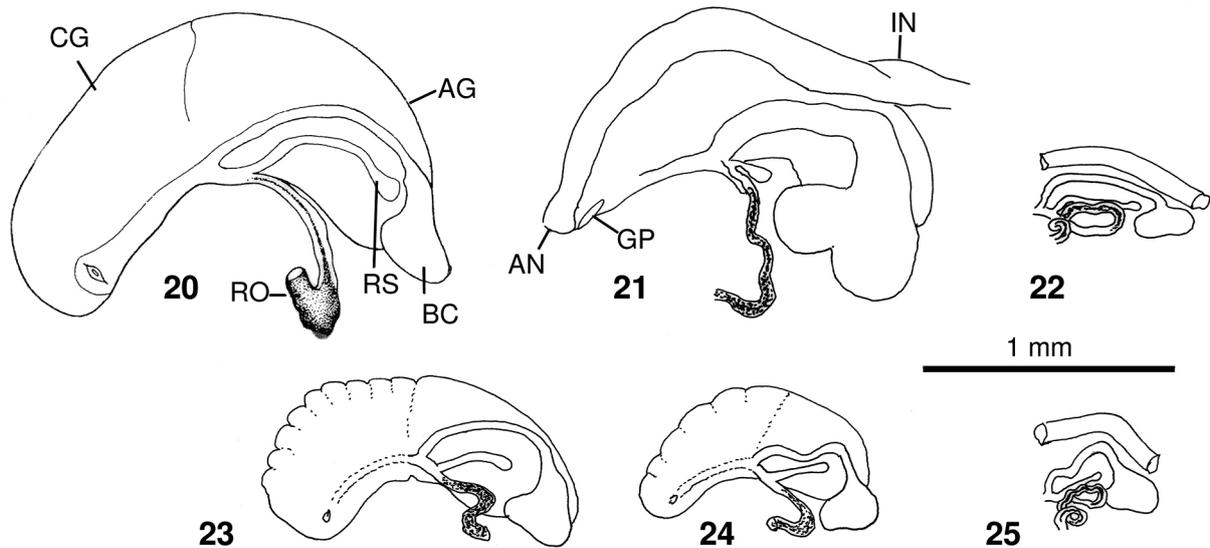
Animal: Body well black pigmented; tentacles black with large white area encircling eyes and continuing as a line toward tentacle tip (after GIUSTI et al 1995: 140). Gill with about 29 lamellae (GIUSTI et al. 1995: 139 fig. 85).

Penis (Figs 18, 19): Elongated, flattened cylindrical with few accordion-like folds and a black pigmented area accompanying the penial duct in the core of the penis; penis tip blunt; vas deferens opening at a papilla of the penis tip.

Female genitalia (Figs 23–25): Below the branching off of the gonopericardial duct the curved first section of the renal oviduct is black pigmented, followed by a straight unpigmented second section; seminal receptacle elongated, sometimes reaching the bottom of bursa, duct of the receptacle arising from the



Figs 15–19. Penes of *Pseudamnicola*: 15 – *Pseudamnicola conovula*, Croatia (after RADOMAN 1972: 198, fig. 4C); 16 – *Pseudamnicola m. moussonii*, Italy, Sicily, Trapani, Calatafimi (after GIUSTI 1976: 106, fig. 1U); 17 – *Pseudamnicola* cf. *conovula*, Italy, Sicily, 7 km S of Syracuse and 50 m from coast, brook at Minareto (BOE 0519); 18, 19 – *Pseudamnicola m. magozensis* n. subsp. Maltese Islands, Gozo: 18 – Wied tal-Lunzjata (after GIUSTI et al. 1995: 139, fig. 81); 19 – Xlendi Valley (BOE 1362)



Figs 20–25. Female genitalia of *Pseudamnicola*: 20 – *Pseudamnicola conovula*, Croatia (after RADOMAN 1972: 198, fig. 4B); 21 – *Pseudamnicola m. moussonii*, Italy, Sicily, Trapani, Calatafimi (after GIUSTI 1976: 106, fig. 1T); 22 – *Pseudamnicola* cf. *conovula*, Italy, Sicily, 7 km S of Syracuse and 50 m from coast, brook at Minareto (BOE 0519); 23–25 – *Pseudamnicola m. magozensis* n. subsp. Maltese Islands, Gozo: 23, 24 – Sara Valley (after GIUSTI et al. 1995: 139, figs 82–83); 25 – Xlendi Valley (BOE 1362). Abbreviations: AG – albumen gland, AN – anus, BC – bursa copulatrix, CG – capsule gland, IN – intestine, GP – gonoporus, RO – renal oviduct, RS – receptaculum seminis

renal oviduct shortly in front of the bursal duct; bursal duct slender, straight or wavy; bursa copulatrix triangular.

Differential diagnosis: (1) Versus *P. m. moussonii*. The males of *P. m. magozensis* n. subsp. differ from those of *P. m. moussonii* in their penis with a comparatively smaller base and a drop-like thickened apex (BOETERS in BECKMANN 1987: 8, fig. 1, GIUSTI et al. 1995: 139, fig. 81). The female genitalia of *P. m. moussonii* are provided with a small receptaculum with a negligible duct and a bursa with a very long duct (GIUSTI 1976: 106, fig. 1T). The female genitalia of *P. m. magozensis* n. subsp. differ in that the duct of the receptaculum has about half the length of the bursal duct. These characters were reported by GIUSTI et al. (1995: 139, figs 82–83) for a population from the Sara Valley on Gozo and confirmed for a population from the Xlendi Valley on Gozo (BOETERS in BECKMANN 1987: 8, fig. 2).

It is important that GIUSTI et al. (1995: 139, figs 84–85) illustrated also two female genitalia of a population from Fontana on Gozo. However, the characters figured for this locality do not correspond to those reported for the Sara and for the Xlendi Valley populations, or to each other. The female genitalia from Fontana are characterised by a bursa twice the size of that in the populations from the Sara and the Xlendi Valley. Furthermore, in fig. 84 the length of the bursal duct is half that found in the populations from the Sara and the Xlendi Valley, and in fig. 85 the receptaculum plus duct is short and the bursa is not embedded in the albumen gland. It remains an open question whether the inconsistent characters report-

ed for the two females of the population of Fontana are representative.

(2) Versus *P. conovula* (Figs 4–6: shells, 15: penis, 20: female genitalia). The females of this species are characterised by a duct of receptaculum which is about as long as the bursal duct (RADOMAN 1972: 198, figs 4A–B, 1978: 49, fig. 7, 1983: 36, fig. 11) and not half as long as the bursal duct in *P. m. magozensis* n. subsp.

GIUSTI et al. (1995) and BODON et al. (1995) raised doubts regarding the species status of *P. conovula* versus *P. moussonii*. However, it should be remembered that the distance between their type localities is about 750 km. Furthermore, on Sicily the differences between *P. moussonii* and the species identified as *P. cf. conovula* (Figs 7–9: shells, 17: penis, 22: female genitalia; BOE 0519) are so great that the two taxa can be easily distinguished.

It is not the aim of this publication to deal with *Amnicola conovula* Frauenfeld, 1863 as the type species of *Adrioinsulana* Radoman, 1978 (see also: SZAROWSKA et al. 2006), or to clarify whether also males of *P. conovula* offer a distinctive character, since the photographs of the penis of topotypes by SZAROWSKA et al. (2006: 186, figs 46–48) look differently from RADOMAN's figure (1972: 198, fig. 4C, 1983: 36, fig. 11).

(3) Versus *P. sciaccaensis*. This species can be distinguished based on its elongated conical shell with a considerable height of 5.2–5.8 mm and diameter of 3.1–3.5 mm. Whereas *P. m. magozensis* n. subsp. belongs to *Pseudamnicola* s. str., it is assumed that *P. sciaccaensis* rather belongs to *Corrosella* Boeters, 1970



(see: GLÖER & BECKMANN 2007: 122), recently elevated to the generic rank by DELICADO et al. (2015).

(4) Versus *P. orsinii*. The shells of the types figured by FALKNER & BOETERS (2003: pl. 7, figs 1–2) measure 3.8–5.2 mm, whereas those of *P. m. magozensis* n. subsp. measure only 2.5–2.8 mm.

(5) Versus ?*Pseudamnicola cocchii*. GIUSTI & PEZZOLI (1980: 25) treat *P. cocchii* as a synonym of *P. moussonii*. According to its original description, with the height

of 4 mm and the diameter of 3 mm, the shell of *P. cocchii* is distinctly larger than that of *P. m. magozensis* n. subsp. with the height of 2.5–2.8 mm and the diameter of 1.7–2.2 mm.

Habitat: In springs and brooks, often sympatric with *Mercuria melitensis* (GLÖER et al. 2015).

Distribution (Fig. 1): Maltese Islands, i.e. Malta and Gozo.

DISCUSSION

The placement of *P. m. magozensis* n. subsp. as a subspecies within *P. moussonii* is based on the fact that GIUSTI et al. (1995) regard this species as the only one inhabiting the Maltese islands. However, the new subspecies resembles *P. cf. conovula* from Minareto on Sicily rather than *P. (P.) moussonii* as described also from Sicily by GIUSTI (1976). Thus, in our opinion all species of *Pseudamnicola* and also of *Mercuria* inhabiting Sicily need revision.

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