

THE ENDEMIC OXYCHILUS SPECIES OF MARETTIMO (AEGADIAN ISLANDS, ITALY): *O. DENATALE* (PFEIFFER, 1856) (PULMONATA, ZONITIDAE)

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Abstract The oxychiline zonitid *Helix denatale* belongs to the genus *Oxychilus* and is readily distinguished from all other species by its unique combination of shell and anatomy characters (shell discoidal, with many tightly coiled whorls and granulate microsculpture; long vaginal gland; very long epiphallus, very short flagellum, slender penis, extraordinarily thick penial sheath).

Some of these characters are shared with other oxychiline zonitid species: a polygyrate shell with species usually assigned to *Oxychilus* (*Hyalocornea*); granulate shell microsculpture with *O. oppressus* (Shuttleworth, 1878), *O. diductus* (Westerlund, 1886) and some species of *Pseudopolita*; slender penis and an extraordinarily thick penial sheath with *Oxychilus majori* (Paulucci, 1886), but it is not yet possible to state whether they may constitute synapomorphies and support phylogenetic relationships. Consequently, discussion of relationships of *O. denatale* is postponed to when more data is available, at least on the other Sicilian species.

Key words *Oxychilus denatale*, taxonomy, systematics, distribution, Marettimo, Aegadian Islands.

INTRODUCTION

Oxychilus denatale (Pfeiffer, 1856), endemic to Marettimo (Aegadian Archipelago), is one of the most interesting endemic non-marine mollusc species of the Sicilian island complex. It belongs to a group named "ossichili poligirati" by past Italian authors (Sacchi, 1957; Riedel, 1973) because of its depressed shell with many tightly coiled whorls. The shell recalls that of *Oxychilus uziellii* (Issel, 1872), a species from Tuscany and Emilia Romagna (central Italy) in such an evident way that some early authors (e.g. De Stefani, 1879) considered them the same species.

Major contributions to its systematics were made by Monterosato (1892) and Riedel (1973). Monterosato (1892) established the monotypic genus-group taxon *Hyalofusca* for it and Riedel (1973) resurrected it as a valid subgenus of *Oxychilus* with Maghrebian affinities (possibly with *Allogenes* Gude, 1911), representing one of two evolutionary lines that he recognized among the Sicilian *Oxychilus*. The other line, represented by *Hyalocornea* Monterosato, 1892 (type species: *Helix canini* Benoit, 1843), includes many species, is presumed to have relationships with *Oxychilus* (s.str.) and to form an "Entwicklungslinie" running east-west: from the less polygyrate and supposedly most primitive species, *Oxychilus alicurensis*

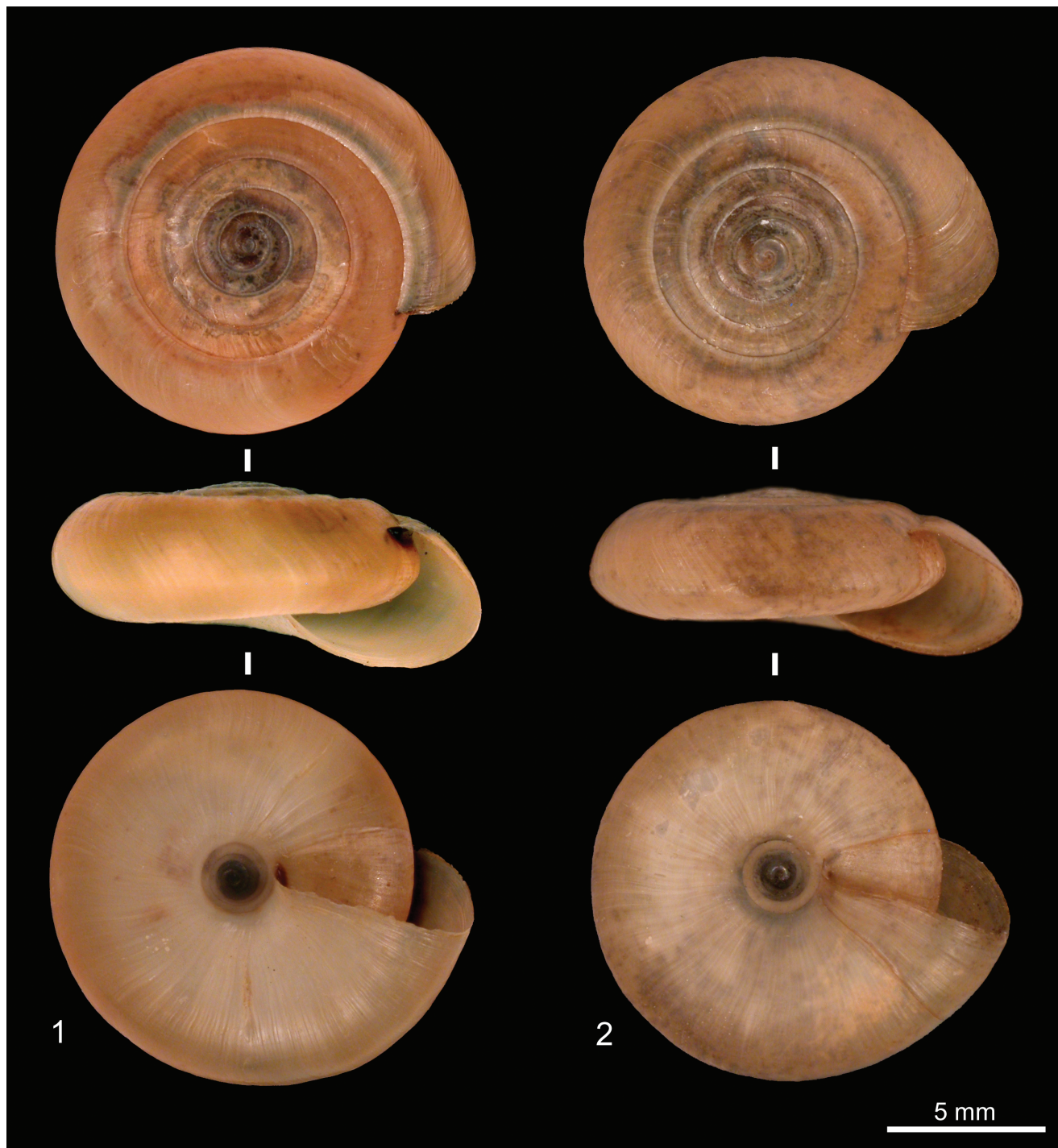
(Benoit, 1857), from the Aeolian island of Alicudi, through *Oxychilus nortoni* (Calcara, 1843) from the island of Ustica and *Oxychilus egadiensis* Riedel, 1973, from the Aegadian islands of Favignana and Levanzo, to the distinctly polygyrate *Oxychilus canini* (Benoit, 1843) from western Sicily.

The aim of this paper, which is our second contribution to the revision of *Oxychilus* species living in Sicily and the surrounding islands (Manganelli *et al.*, 2002), is to redescribe *O. denatale* in detail and to discuss its relationships in the light of the new data on the systematics of the oxychiline zonitids. Another paper, in preparation, will consider the species formerly assigned to *Hyalocornea*.

MATERIAL AND METHODS

Shells were photographed under the light microscope (Wild M5A) and scanning electron microscope (SEM Philips). All dimensions (NW number of whorls, SD shell diameter, SH shell height, UD umbilicus diameter) were measured using a micrometer.

Live specimens were drowned in water, then fixed and preserved in 75% ethanol buffered with NaHCO₃. The bodies were isolated after crushing the shells and dissected under the light microscope (Wild M5A) using fine pointed watchmaker's tweezers. Anatomical details were drawn using a Wild camera lucida. Some



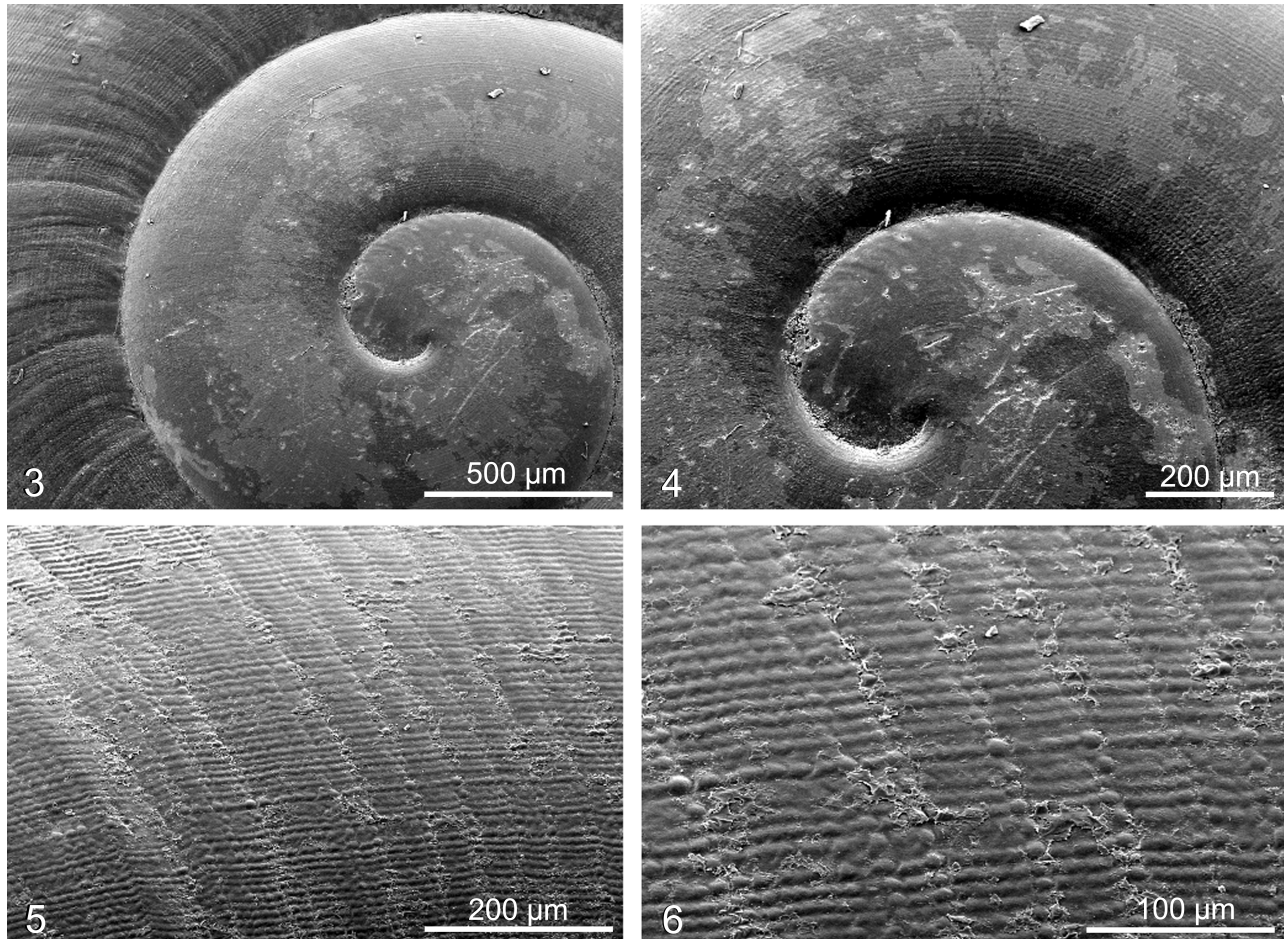
Figs 1-2 Two shells of *Oxychilus denatale* (Pfeiffer, 1856) from Marettimo Paese, near church, 5 m asl, 33STC4206, S. Cianfanelli & E. Talenti leg. 04.06.1997.

parts of the genital organs (e.g. duct of bursa copulatrix, distal vagina, epiphallus, flagellum, proximal portion of penis, distal penis and penial sheath) were measured by micrometer.

The material examined is listed as follows: locality, UTM reference, collector(s), date, number of specimens (sp spirit preserved specimen/s, sh shell/s) and collection where they are kept.

Locality names and UTM references are according to sheet 256 IV NO "Isola Marèttimo" of the 1:25,000 scale map of Italy (Series M 891).

Key to museum and collection acronyms: FGC F. Giusti collection, Dipartimento di Biologia Ambientale, University of Siena, Italy, MZUF Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola", Italy,



Figs 3-6 Detail of shell microsculpture of specimens of *Oxychilus denatale* (Pfeiffer, 1856) between Marettimo Paese and Monte Falcone, 10-686 m asl, 33STC4106, 33STC4107, 33STC4206, S. Cianfanelli & E. Talenti leg. 05.06.1997.

SCC S. Cianfanelli collection, Firenze, Italy.

Key to acronyms used in Figs 7-11: BC bursa copulatrix, BW body wall, DBC duct of bursa copulatrix, DP distal portion of penis, E epiphallus, F flagellum, MP medial portion of penis, POS prostatic portion of ovispermiduct, PP proximal portion of penis, PR penial retractor, PS penial sheath, UOS uterine portion of ovispermiduct, V vagina, VD vas deferens, VG vaginal gland.

Oxychilus denatale (Pfeiffer, 1856)

Primary reference *Helix De Natale* Pfeiffer, 1856: 182-183, Pl. 2, figs 4-6.

Type series unknown.

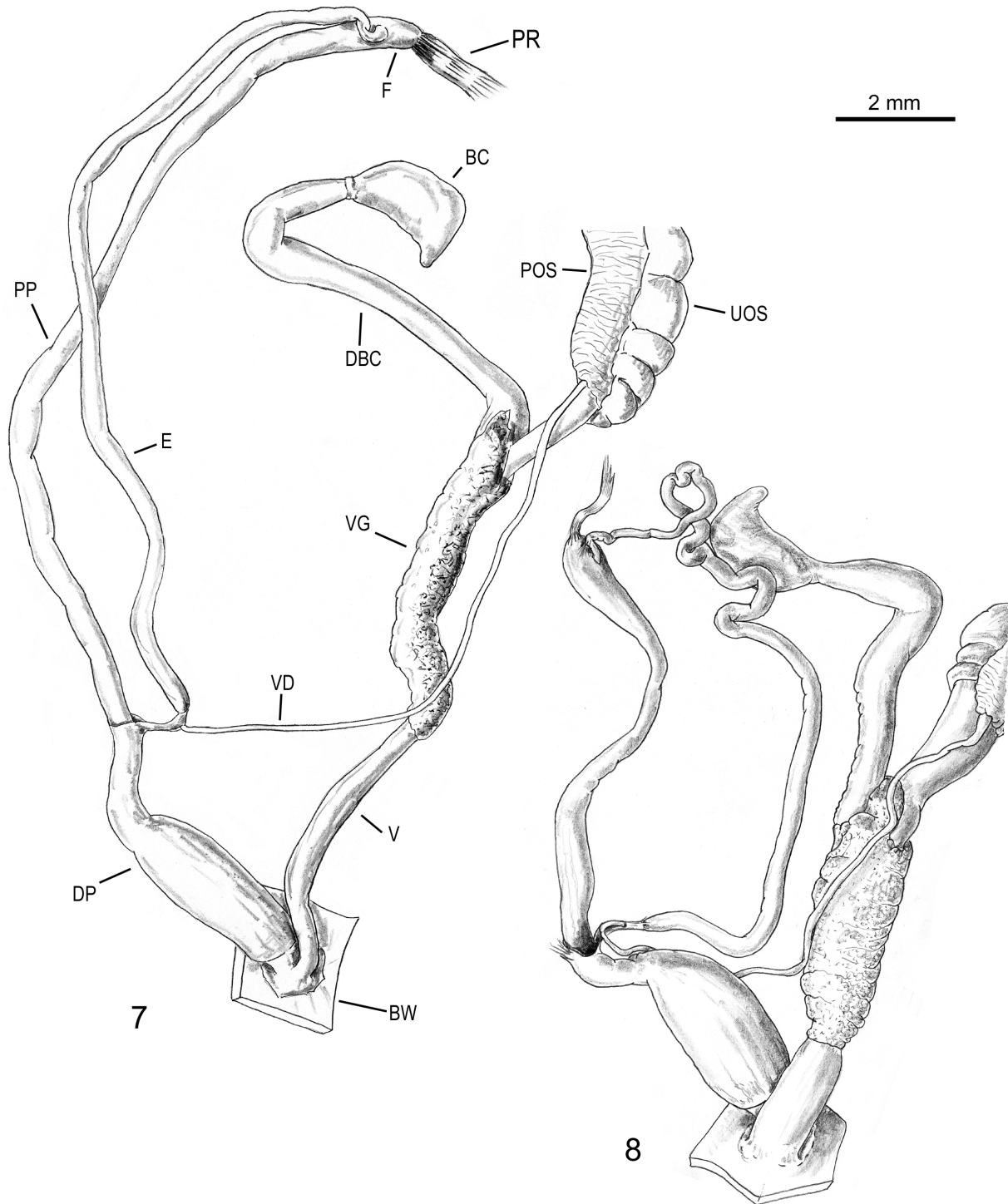
Type locality Marettimo Island. This species was first collected by Domenico Reina on Marettimo (Benoit, 1857). It was communicated by the naturalist Luigi Benoit to his correspondents, including

Louis Pfeiffer who published the first valid description reporting distribution as "Habitat in Sicilia".

Identification A medium-sized species of *Oxychilus*, endemic to Marettimo (one of the Aegadian Islands) characterized by shell opaque-sericeous, discoidal, with many tightly coiled whorls, last whorl more or less angled at periphery and flared near aperture, granulate microsculpture and male distal genitalia with penial sheath extraordinarily thickened.

Description Body slate-blue in colour; neck and upper part of sides with variably wide areas having pits and glandular phylacites; foot slender, of aulacopod type; sole longitudinally tripartite; sigmurethrous kidney; jaw of oxygnathous type.

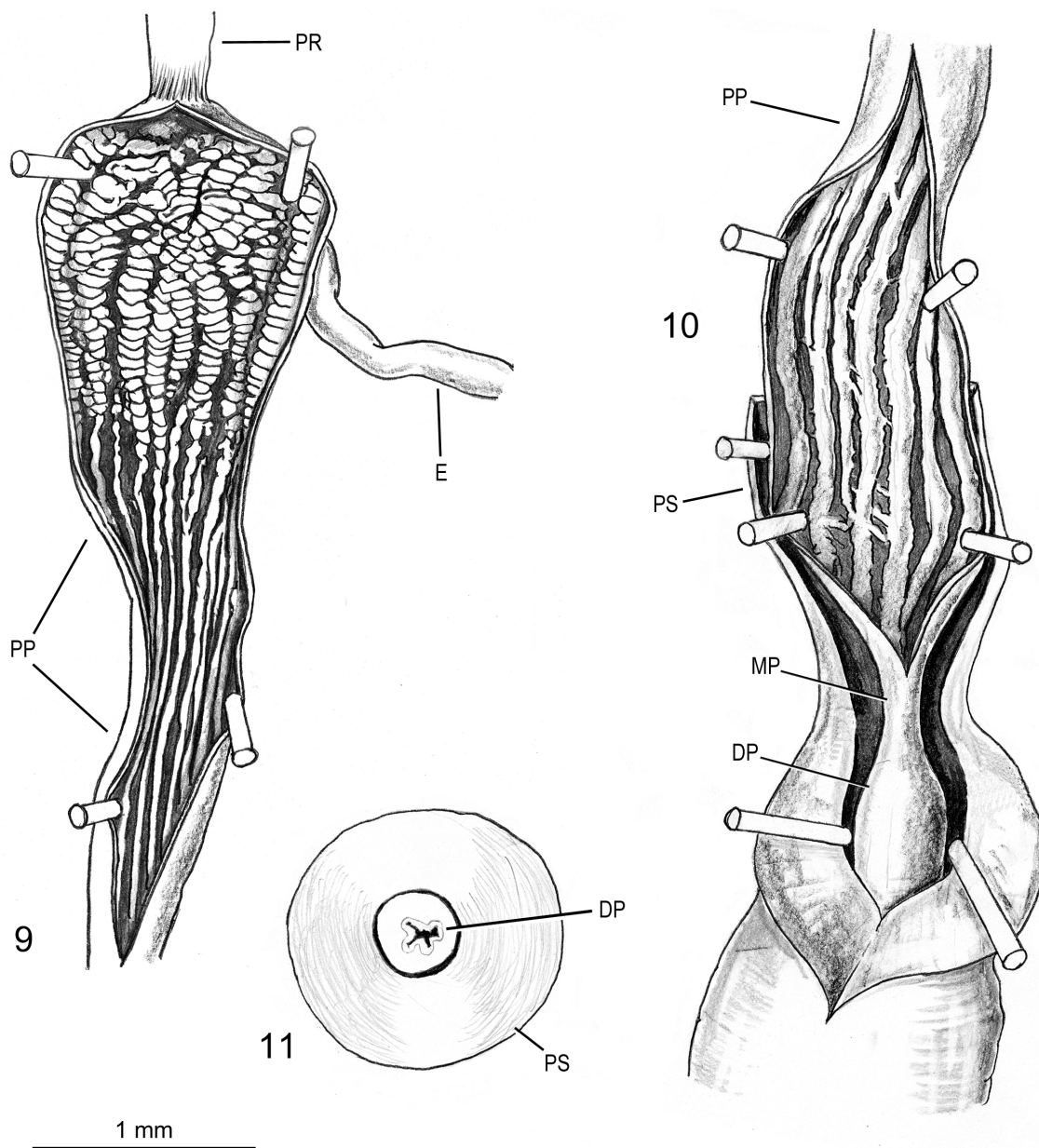
Shell (Figs 1-6) dextral, medium-sized, depressed, discoidal but rather square, thin and fragile, opaque-sericeous, yellowish to pale brownish-yellow in colour when fresh, paler and



Figs 7-8 Distal genitalia of specimens of *Oxychilus denatale* (Pfeiffer, 1856) from Sorgente Canalazzo, 33STC4207, S. Riggio leg. 21.10.1967. Note that genitalia illustrated in Fig. 7 belong to an incompletely mature specimen.

opalescent below, consisting of many ($5 \frac{5}{8}$ to $6 \frac{5}{8}$) tightly coiled whorls, slowly and regularly increasing in size; spire from slightly raised, to flat or slightly concave with first whorls raised at centre; first whorls transparent and glossy; last whorl opaque, compressed, more or less evidently

angled at periphery, its final part (near aperture) slightly descending and more or less flared, its surface with marked, irregularly spaced, transverse growth lines, more evident immediately before aperture; surface of initial protoconch with very thin spiral furrows delimiting very fine,



Figs 9-11 Internal ornamentation of flagellum and proximal penis (Fig. 9), medial penis (Fig. 10) and a section of distal penis (Fig. 11) in a specimen of *Oxychilus denatale* (Pfeiffer, 1856) from Sorgente Canalazzo, 33STC4207, S. Riggio leg. 21.10.1967

small wavy cords (surface resembling ploughed land), covered by thin, usually wrinkled periostracal layer; furrows and cords continue on surface of subsequent whorls giving sericeous appearance, often finely granulate (crossing of spiral and transverse furrows divides surface into tiny squares, each bearing a globular relief or granulum); sutures deep (subsutural part of whorls raised and convex to give shouldered appearance); umbilicus wide, about $1/5 - 1/6$ of maximum shell diameter; aperture oval to

rhomboidal, oblique; peristome interrupted, simple, not thickened nor reflected. Dimensions (20 shells measured): shell diameter: 13.1 ± 0.8 mm (11.5 - 14.2), shell height: 5.3 ± 0.3 mm (4.5 - 6.0), umbilicus diameter: 2.5 ± 0.2 mm (2.0 - 2.9), number of whorls: $6 \frac{1}{4} \pm \frac{1}{3}$ ($5 \frac{5}{8} - 6 \frac{5}{8}$).

Genitalia (Figs 7-11). General scheme of genitalia as in *Oxychilus* (s.str.) sensu Giusti & Manganelli (1999). Only distal genitalia are described here from one sexually mature adult specimen (Figs 8-11); another specimen, not fully mature, had

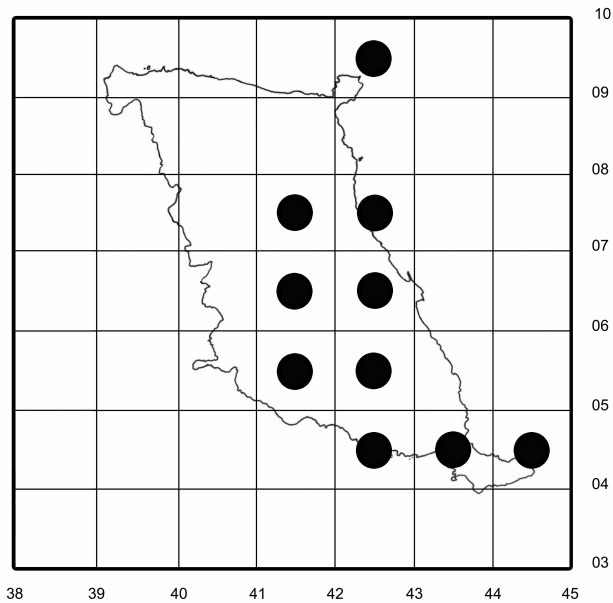


Fig. 12 The distribution of *Oxychilus denatale* (Pfeiffer, 1856) on UTM map (1 x 1 km squares) of Marettimo.

distal genitalia similar to those in the adult one, but more slender and elongated (Fig. 7).

Female distal genitalia include free oviduct, bursa copulatrix and its duct, and vagina. Proximal vagina rather long, completely enveloped by evident though not swollen muff of spongy glandular tissue forming vaginal gland; duct of bursa copulatrix cylindrical and rather long (5.4 mm); bursa copulatrix oval; distal vagina (from end of vaginal gland to genital atrium) relatively wide and short (1.9 mm).

Male distal genitalia include vas deferens, epiphallus and penial complex (flagellum and penis). Epiphallus extraordinarily long (16.3 mm) and slender, not initially flared (where vas deferens ends), its twisted, slender final portion (before entering penis) attached to external wall of proximal penis by thin stripes of tissue. Flagellum very short (0.6 mm), wide and not pointed at apex where penial retractor muscle joins. Penis divided into proximal and distal parts by narrow region located rather distally. Proximal penis (8.8 mm) longer (PP/DP: 3.3) than distal (2.6 mm), initially rather wide, then progressively slenderer, then slightly wider again before entering penial sheath, where it becomes progressively slenderer constituting narrow medial region (minimum caliber: 0.2 mm). Narrow region without 'bottle-neck' structure (i.e. very thin tube, straight or occasionally slightly bent, enveloped in thin, transparent

sheath, connecting proximal and distal penis; Giusti & Manganelli, 1997). Distal penis slender, cylindrical, entirely enveloped by penial sheath. Penial sheath rather long (4.4 mm), initially thin and traversed on one side by vas deferens, then progressively thicker to extraordinary calibre at half its length, then progressively reducing before fusing with distal penis wall. Very short, thin-walled tube connects distal penis (level with where penis sheath originates) to genital atrium.

Internal walls of initial part of proximal penis with papillae encircling epiphallus opening and then disposing in approximately 8-9 rows; papillae very numerous, their number, shape (polygonal, pyramidal or conical) and size varying in different rows; internal walls of medial part of proximal penis with 9-10 very fine continuous pleats originating from rows of papillae; internal walls of final part of proximal penis with 6-7 rather large pleats, some continuous with those in medial part of proximal penis; internal walls of distal penis with a few large pleats with jagged sides, some of which being continuous with those present in final part of proximal penis.

Material examined Marettimo Island, no locality, 1868 (1 sh, M. Paulucci collection, MZUF 770), De Stefanis leg. 1870 and 1877 (5 sh, M. Paulucci collection, MZUF 769), L. Benoit leg. 1897 (3 sh, G. Caramagna collection, MZUF 19146), 09.1966 (4 sh, FGC 17771), 30.09.1966 (4 sh, FGC 17907), G.B. Osella leg. 23.10.1967 (3 sp, FGC 17778), S. Riggio leg. 24.10.1967 (1 sp, FGC 17777), G.B. Osella leg. 22.03.1969 (1 sp, FGC 17775), G.B. Osella leg. 26.03.1969 (1 sh and 1 sp, FGC 17768), G.B. Osella leg. 27.03.1969 (1 sp, FGC 17774), G.B. Osella leg. 28.03.1969 (1 sp, FGC 17773), A. Riedel leg. 11.05.1970 (3 sh and 2 sp, FGC 16266). Between Posaturo and Vallone Zanica, 200 m asl, 33STC4105, 33STC4204, 33STC4304, S. Cianfanelli & E. Talenti leg. 06.06.1997 (12 sh, MZUF 19152). Northwestern side of Punta Ansini, 430 m asl, 33STC4106, V. Fiorentino leg. 08.11.2001 (3 sh, FGC 18790). Between Case Romane and Punta Ansini, 350 m asl, 33STC4106, S. Cianfanelli leg. 11.11.2001 (8 sh, MZUF 21943). Between Marettimo Paese and Monte Falcone, 10-686 m asl, 33STC4106, 33STC4107, 33STC4206, S. Cianfanelli & E. Talenti leg. 05.06.1997 (41 sh and 1 sp, MZUF 19150). Between Case Romane and Punta Campana, 400 m asl, 33STC4106, S. Cianfanelli leg. 10.11.2001 (27 sh and 2 sp, MZUF 21904). Monte Falcone,

33STC4107, F. Giusti leg. 03.04.1982 (1 sh, FGC 17769), V. Fiorentino leg. 06.11.2001 (3 sh, FGC 18757; 2 sh and 2 sp, FGC 18760), S. Cianfanelli leg. 10.11.2001 (2 sh and 1 sp, MZUF 21940). Eastern side of Monte Falcone, 33STC4107, V. Fiorentino leg. 06.11.2001 (1 sh, FGC 18815). Pizzo Falcone, 580 m asl, 33STC4107, S. Cianfanelli leg. 10.11.2001 (77 sh and 1 sp, MZUF 21942). Between Canalazzo and Punta Campana, 33STC4107, S. Cianfanelli leg. 09.11.2001 (1 sp, MZUF 21945). Between Semaforo and Punta Ansini, 33STC4205, S. Cianfanelli leg. 11.11.2001 (1 sp, MZUF 21946). Above Marettimo Paese, 33STC4206, F. Giusti leg. 03.04.1982 (1 sh and 3 sp, FGC 17444). Above Case Romane, 33STC4206, F. Giusti leg. 03.04.1982 (3 sh, FGC 17772). Case Romane, 33STC4206, S. Cianfanelli & E. Talenti leg. 05.06.1997 (3 sh, MZUF 19151). Marettimo Paese, near church, 5 m asl, 33STC4206, S. Cianfanelli & E. Talenti leg. 04.06.1997 (25 sh and 1 sp, MZUF 19147). Between Case Romane and Punta Ansini, 33STC4206, V. Fiorentino leg. 08.11.2001 (3 sh, FGC 18798). Sorgente Canalazzo, 33STC4207, S. Riggio leg. 21.10.1967 (2 sp, FGC 17445). Passo del Bue, 33STC4207, S. Cianfanelli & E. Talenti leg. 04.06.1997 (2 sh and 2 sp, MZUF 19149). Between Valle Bucerrie and Valle Ficarella, 33STC4207, S. Cianfanelli leg. 12.11.2001 (1 sh, MZUF 21941). Punta Troia, 33STC4209, G.B. Osella leg. 28.03.1969 (1 sp, FGC 17776). Carcaredda, 33STC4304, S. Cianfanelli leg. 11.11.2001 (2 sh, MZUF 21994). Punta Basano, 33STC4404, V. Fiorentino leg. 07.11.2001 (5 sh, FGC 18900). Sorgente Pegna, 33STC4404, V. Fiorentino leg. 06.11.2001 (1 sh, FGC 18907).

Etymology This species was discovered by the naturalist Luigi Benoit from Messina and communicated with the name *Helix De Natale* to his correspondents, including Louis Pfeiffer who published the first valid description. Benoit probably named the species after his fellow citizen Giuseppe De Natale, author of some papers on marine crustaceans.

Taxonomy and systematics The oxychiline zonitid *Helix denatale* belongs to the genus *Oxychilus*, which includes the species of *Oxychilus* s.l. characterized by: penis with flagellum; penial retractor inserted at apex of flagellum; internal ornamentation of penis consisting of pleats and rows of papillae; epiphallus long, usually longer than

proximal penis; internal wall of epiphallus with slender longitudinal pleats; mucous gland mainly vaginal; long mesocone of central tooth (see Giusti & Manganelli, 1999, as *Oxychilus* (s.str.))

Among the *Oxychilus* species, it is readily distinguished from all others by its unique combination of shell and anatomy characters (shell opaque-sericeous discoidal, with many tightly coiled whorls, last whorl flared near aperture, granulate microsculpture; female distal genitalia with long vaginal gland; male distal genitalia with very long epiphallus, very short flagellum, slender penis, extraordinarily thick penial sheath, internal ornamentation of proximal penis consisting of rows of evident papillae in first third and narrow pleats in last two thirds).

Some of these characters are shared with other oxychiline zonitid species: a polygyrate shell with species usually assigned to *Oxychilus* (*Hyalocornea*), namely *O. alicurensis* (Benoit, 1857) (Alicudi, Aeolian Islands), *O. canini* (Benoit, 1843) (West Sicily), *O. egadiensis* Riedel, 1973 (Favignana and Levanzo, Aegadian Islands), *O. lagrecai* Giusti, 1973 (Filicudi, Aeolian Islands), *O. nortoni* (Calcara, 1843) (Ustica Island) (Giusti, 1973; Riedel, 1973, 1980, 1998); a granulate shell microsculpture with *O. oppressus* (Shuttleworth, 1878) (Sardinia), *O. diductus* (Westerlund, 1886) (Lampedusa, Pelagian Islands), and some species of *Pseudopolita* (North Africa) (Riedel, 1975, 1980, 1998); a slender penis and an extraordinarily thick penial sheath with *Oxychilus majori* (Paulucci, 1886) (Giannutri Island, Tuscan Archipelago; Monte Argentario and Promontorio di Ansedonia, Tuscany) (Manganelli *et al.*, 1999).

At present, it is impossible to state whether these shared characters may constitute synapomorphies and support phylogenetic relationships. Consequently, discussion of the relationships of *O. denatale* (and the status of *Hyalofusca*) is postponed to when more data is available, at least on the other Sicilian species.

Geographical distribution *Oxychilus denatale* has a reduced distribution, limited to Marettimo Island.

Status and Conservation Although *Oxychilus denatale* is a common species, its narrow distribution is a clear factor of risk. It must therefore be considered a "Lower risk (near threatened)" [LR, nt] species.

ACKNOWLEDGEMENTS

We thank Antonella Daviddi and Elisabetta Lori for technical assistance, Helen Ampt for revising the English, and V. Fiorentino (Siena, Italy), G.B. Osella (L'Aquila, Italy), A. Riedel (Warsaw, Poland), S. Riggio (Palermo, Italy) and E. Talenti (Firenze, Italy) for field collection or gift of material; A. Eschner and H. Sattman (Wien, Austria) for information about the date of publication of Pfeiffer (1856); Riccardo Giannuzzi Savelli (Palermo, Italy) for information about G. De Natale.

Research financed by University of Siena (research project "I molluschi non marini della fauna italiana: filogenesi, sistematica, faunistica, zoogeografia, conservazione") and Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola" (Italy).

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