

Oxychilus mortilleti (Pfeiffer, 1859): a redescription (Pulmonata, Zonitidae)

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The taxonomic and nomenclatural status of *Oxychilus mortilleti* (Pfeiffer, 1859) is revised. *O. mortilleti* is a medium-sized *Oxychilus* species which can only be distinguished from similar shelled, sympatric species [*O. cellarius* (Müller, 1774), *O. draparnaudi* (Beck, 1837), and *O. adamii* (Westerlund, 1886)], on the basis of the following anatomical characters: penis divided into proximal and distal parts by constriction (1), proximal penis about three times as long as distal penis (2), terminal, constricted part ('bottle-neck') of proximal penis long, slender, straight (occasionally slightly bent) (3), penis sheath covering almost entire distal penis (4). At present, *O. mortilleti* is only known from southern central Europe (Austria, Czech Republic and the Alps). In the Alps, confirmed records exist only for Ticino (Switzerland), Piedmont, Lombardy and Venetum (Italy).

Key words: Gastropoda, Pulmonata, Zonitidae, *Oxychilus mortilleti*, redescription, taxonomy, nomenclature, Italy.

INTRODUCTION

Ten species of *Oxychilus* are reported from the Alps: *O. adamii* (Westerlund, 1886), *O. alliaris* (Miller, 1822), *Oxychilus cellarius* (Müller, 1774), *O. clarus* (Held, 1838), *O. depressus* (Sterki, 1880), *O. draparnaudi* (Beck, 1837), *O. glaber* (Rossmässler, 1835), *O. helveticus* (Blum, 1881), *O. mortilleti* (Pfeiffer, 1859), and *O. polygyra* (Pollonera, 1885) (Riedel, 1980; Kerney et al., 1979, 1983; Falkner, 1990; Manganelli et al., 1995).

Some of these species are well known because they have been redescribed recently: *O. cellarius* and *O. draparnaudi* by Giusti & Manganelli (1997), *O. clarus* by Giusti et al. (1985) and Manganelli & Giusti (1993), and *O. glaber* by Manganelli et al. (1990). Relatively little is known about the other species which have never been subject to detailed anatomical study and which are identified in terms of features of poor diagnostic value. We plan to write a series of notes to redescribe them. In this paper we redescribe *Oxychilus mortilleti* (Pfeiffer, 1859), the first *Oxychilus* species described from mainland Italy.

MATERIAL AND METHODS

Whole shells were photographed under the light microscope (Wild M5A). All dimensions (NW number of whorls, SD shell diameter, SH shell height, UD umbilicus diameter) are micrometer readings.

Living 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 thin pointed watchmaker's tweezers. Anatomical details were drawn using a Wild camera lucida. Some parts (e.g. duct of the bursa copulatrix, distal vagina, flagellum, proximal portion of the penis, 'bottle-neck', distal penis and penial sheath) were measured by micrometer.

Radulae were manually extracted from the buccal bulbs, washed in pure 75% ethanol, mounted on copper blocks with electron conductive glue, sputter-coated with gold and photographed using a Philips 505 SEM.

The material examined is listed as follows: locality, municipality and province names in parentheses (only the province name in case available maps do not give the municipalities), UTM reference (only for Italian and Swiss localities), number of specimens in parentheses (ps spirit preserved specimen/s, ss shell/s). Italian and Swiss locality names and UTM references are according to the official 1:100,000 scale map of Italy (series M 691).

Unless otherwise indicated, all material examined is kept in the Giusti Collection (Dipartimento di Biologia Evolutiva, Via Mattioli 4, I-53100 Siena, Italy).

Oxychilus (s.str.) *mortilleti* (Pfeiffer, 1859)

Helix Villae Pfeiffer, 1857: 183, pl. 2 figs. 1-3, non Deshayes, 1850. Type material: the neotype (fig. 2) is in the Museo Zoologico 'La Specola' Università di Firenze, Italy, MZUF no. 13146. Type locality: 'Habitat in Lombardia'. Following the designation of a neotype, the type locality is restricted to Val Seriana, Abbazia (municipality of Albino, province of Bergamo, Italy, UTM reference 32T NR 6565).

H[elix]. *Mortilleti* Pfeiffer, 1859: 101. New name for *Helix villae* Pfeiffer, 1857, non Deshayes, 1850.

Zonites cellarius var. *eugyrus* Stabile, 1859: 141, 175. Type material: the lectotype (fig. 4) is in the Stabile collection no. 631, Museo Cantonale di Storia Naturale in Lugano, Switzerland, no. MOST042. Type locality: 'territorio di Lugano'.

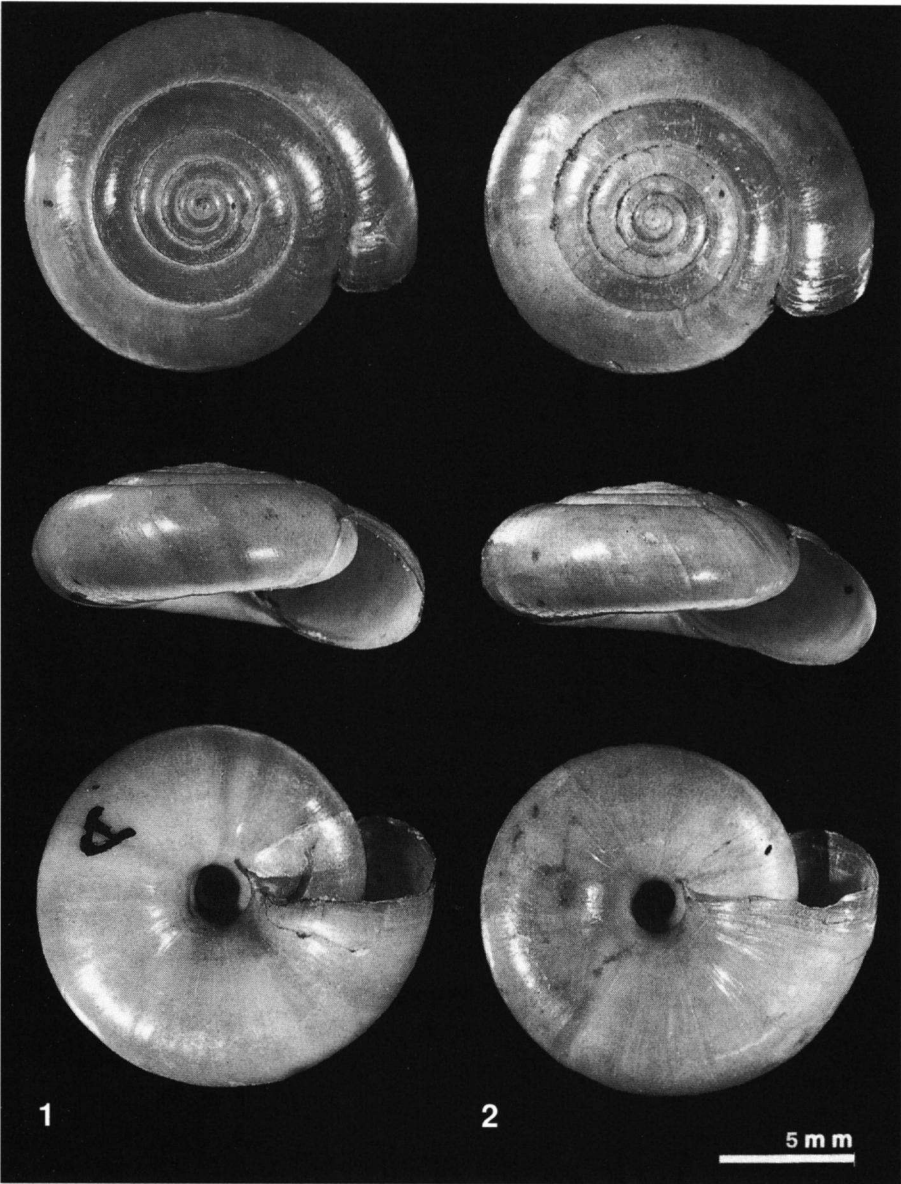
IDENTIFICATION

A medium-sized species of *Oxychilus* with shell discoidal, tectiform, glossy, yellowish to pale brownish-yellow, with about six regularly growing whorls. It can only be identified from similarly shelled, sympatric species (*O. cellarius*, *O. draparnaudi* and *O. adamii*) by anatomical study based on the following characters: penis divided into proximal and distal parts by constriction (1), proximal penis about three times as long as distal penis (PP/DP: 2.8 ± 0.6) (2), terminal, constricted part ('bottle-neck') of proximal penis long, slender, straight (occasionally slightly bent) (3), penis sheath covering almost entire distal penis (4).

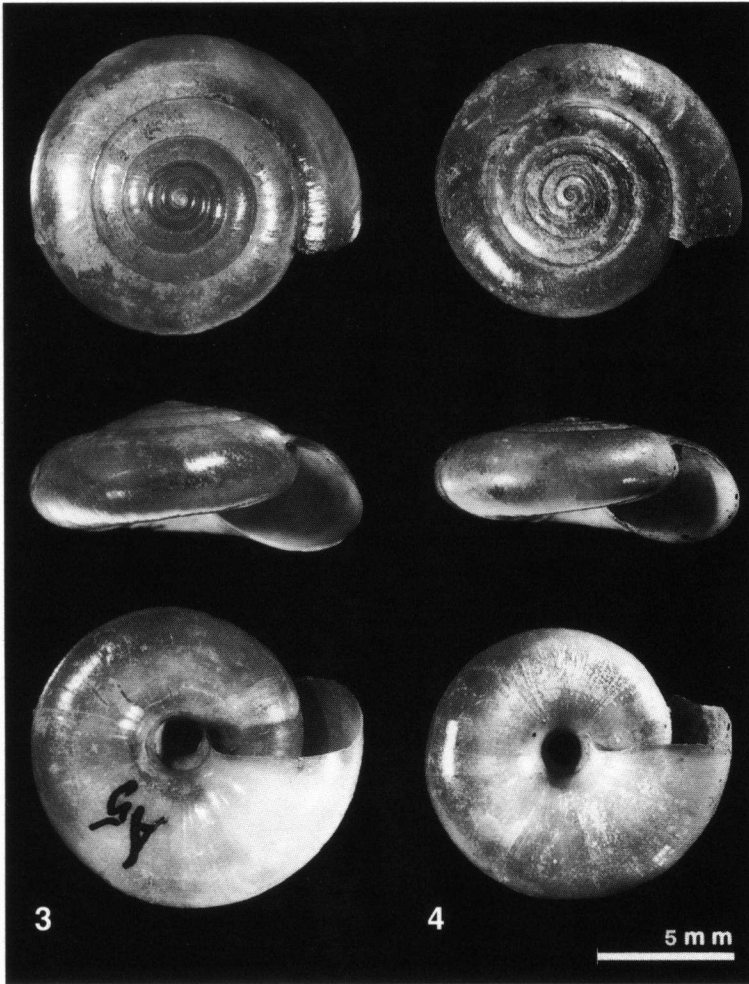
DESCRIPTION

Body slate-blue in colour; neck and upper part of sides with variably wide areas with conspicuous pits (with phylacites); foot slender, of aulacopod type, pale slate-grey, sole longitudinally tripartite; sigmoid kidney; jaw of oxygnathous type.

Shell (figs. 1-4) dextral, medium-sized, discoidal, usually tectiform, occasionally flat above, thin, subtransparent, glossy, yellowish to pale brownish-yellow in colour when fresh; surface smooth or with thin, irregularly spaced growth lines; spire with $5 \frac{1}{3}$ - $6 \frac{4}{7}$ whorls, rather slowly and regularly increasing in size, last whorl not dilated



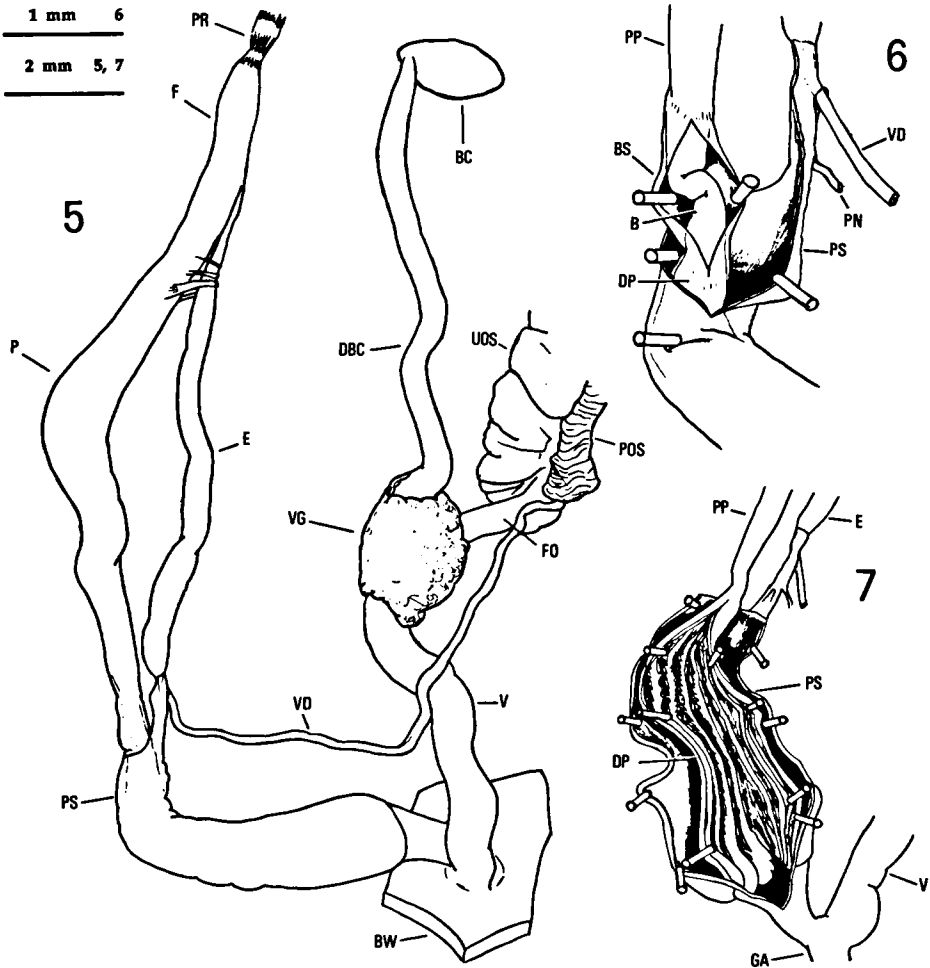
Figs. 1-2. Shells of *Oxychilus mortilleti* from Val Seriana, Abbazia (Albino, Bergamo, Italy) 32TNR6565, G. Comotti leg. 28.XI.82. The shell in fig. 2 is here designated as the neotype of *Helix villae* Pfeiffer, 1857 (Museo Zoologico 'La Specola', Università di Firenze, Italy, no. 13146).



Figs. 3-4. Shells of *Oxychilus mortilleti* from Val Seriana, Cave Martinelli near Piazzo (Nembro, Bergamo, Italy), 32TNR6067, G. Comotti leg. 2.V.82 (fig. 3) and Lugano (Switzerland), (fig. 4). The latter is the lectotype of *Zonites cellarius* var. *eugyrus* Stabile, 1859 (Stabile collection no. 631, Museo Cantonale di Storia Naturale in Lugano, Switzerland, no. MOST042).

near aperture, its last quarter descending to some extent; sutures shallow; umbilicus open, about $1/6 - 1/7$ of maximum shell diameter; aperture oval, oblique; peristome interrupted, simple, not thickened nor reflected, its superior vertex starting at or slightly above periphery of last whorl.

Dimensions (56 shells measured). Number of whorls: $5 \frac{3}{4} \pm 2/7$ ($5 \frac{1}{3} - 6 \frac{4}{7}$), shell diameter: 12.1 ± 0.93 mm (10.6-14.7), umbilicus diameter: 2.0 ± 0.19 mm (1.6-2.4), height: 5.1 ± 0.53 mm (4.1-6.7).

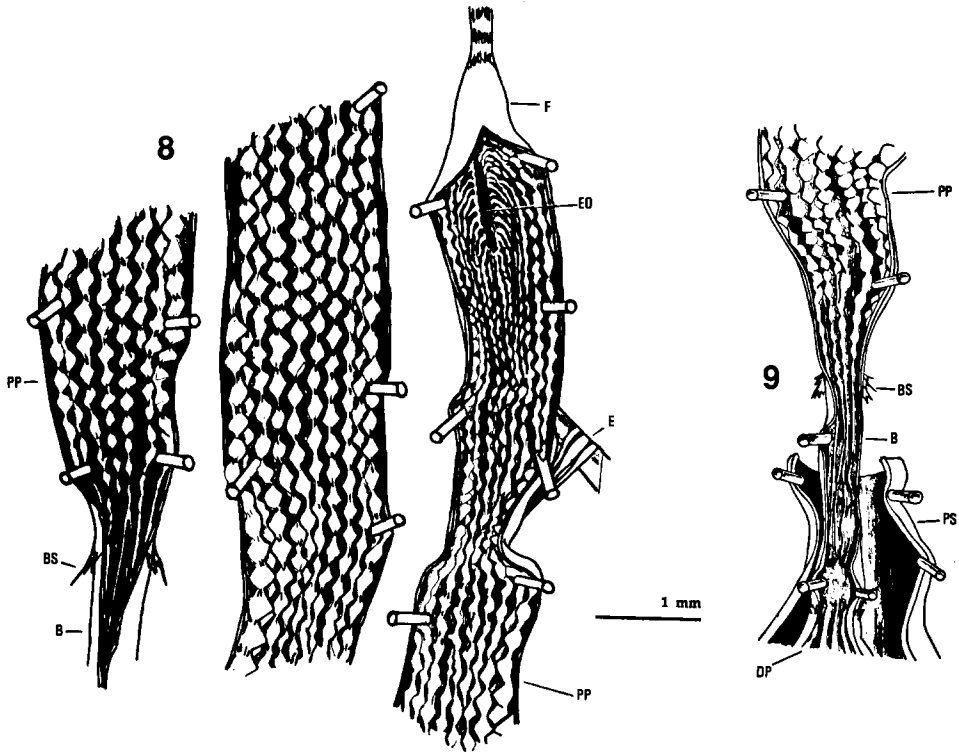


Figs. 5-7. Distal genitalia (fig. 5), detail of 'bottle neck' (fig. 6) and internal ornamentation of distal penis (fig. 7) in specimens of *Oxychilus mortilleti* from Val Seriana, Cave Martinelli near Pizzo (Nembro, Bergamo), 32NR56, G. Comotti, leg. 2.V.82. Key to the acronyms used in Figs. 5-16: B 'bottle-neck', BC bursa copulatrix, BS 'bottle-neck' sheath, BW body wall, DBC duct of bursa copulatrix, DP distal portion of penis, E epiphallus, EO epiphallus opening, F flagellum, FO free oviduct, GA genital perium, P penis, PN penial nerve, 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.

Genitalia (figs. 5-17, table 1; see also Wagner, 1915: 459, pl. 12 fig. 92; Hudec, 1962: fig. 9; Bishop, 1976: fig. 8.).

General scheme of genitalia as in *Oxychilus* (s.str.), we limit ourselves to a description of the distal genitalia.

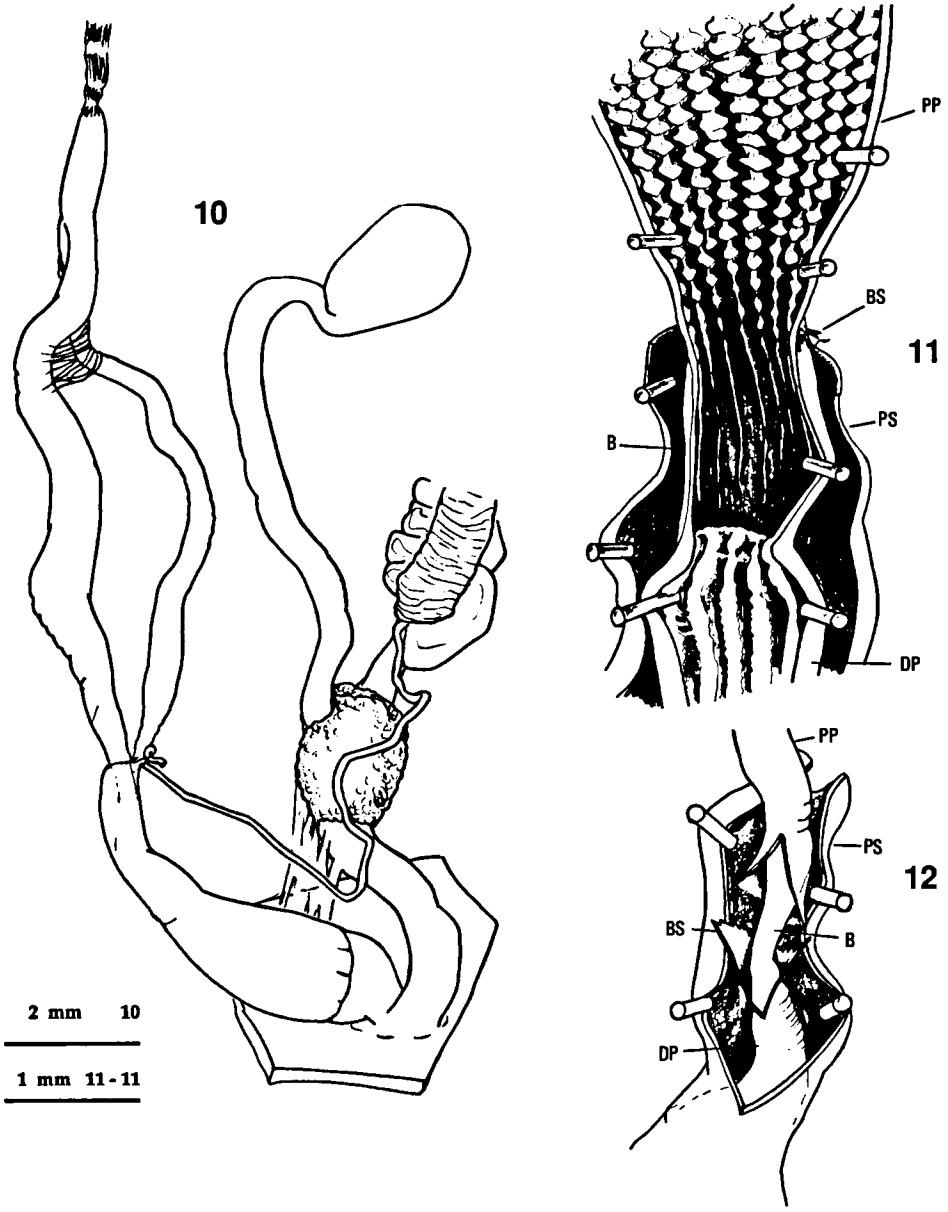
Female distal genitalia include free oviduct, bursa copulatrix and its duct and vagina.



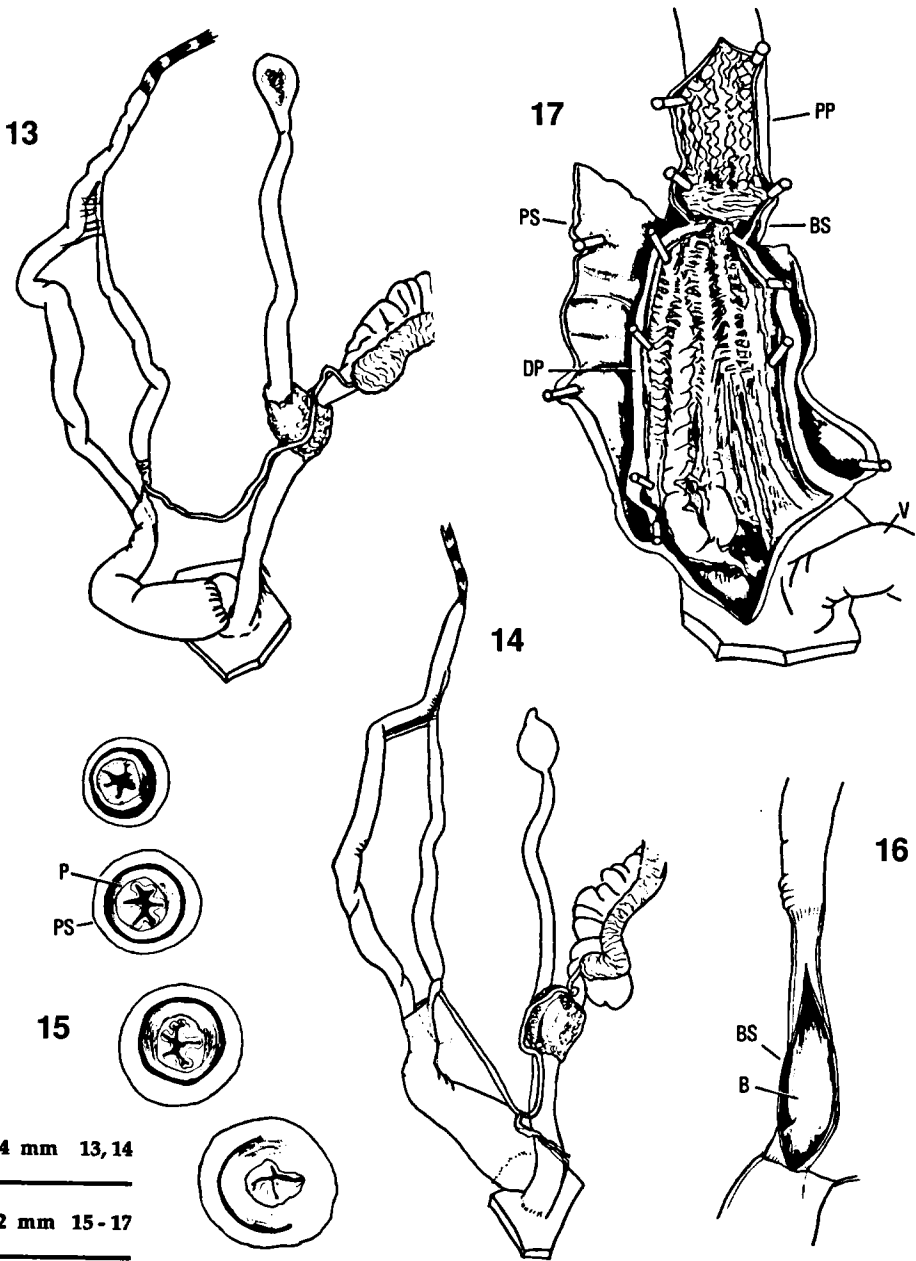
Figs. 8-9. Internal ornamentation of flagellum and proximal penis (fig. 8) and of 'bottle-neck' (fig. 9) in specimens of *Oxychilus mortilleti* from Val Seriana, Cave Martinelli near Piazze (Nembro, Bergamo), 32NR56, G. Comotti, leg. 2.V.82.

Proximal vagina fully enveloped by well developed layer of spongy glandular tissue forming vaginal gland; from this spongy tissue a rather long (7.0 ± 1.3 mm) duct of bursa copulatrix arises, initially flared then progressively narrowing before entering oval or pyriform bursa copulatrix; distal vagina (from end of vaginal gland to genital atrium) rather wide, variably long (4.1 ± 0.8 mm).

Male distal genitalia include vas deferens, epiphallus and penial complex (flagellum and penis). Epiphallus rather long (9.9 ± 1.8 mm), initially wide (where vas deferens ends) then narrowing, its slender final portion (before entering penis) attached to external wall of proximal penis by thin strips of tissue. Flagellum short (2.6 ± 0.8 mm), with penial retractor muscle ending at its apex. Penis divided into distal and proximal portions by evident constriction. Proximal penis (11.6 ± 2.3 mm) much longer (PP/DP: 2.8 ± 0.6) than distal (4.2 ± 0.8 mm), initially slender, slightly wider at about half its length, then progressively reducing in calibre to form a 'bottle-neck'; 'bottle-neck' (1.5 ± 0.8 mm), enveloped by very thin, transparent sheath, straight or occasionally slightly bent, gradually narrowing (0.27 ± 0.01 mm), then gradually widening before continuing into distal penis. Distal penis, beginning where 'bottle-neck' ends (beginning



Figs. 10-12. Distal genitalia (fig. 10), 'bottle-neck' (fig. 11) and internal ornamentation of 'bottle-neck' region (fig. 12) in specimens of *Oxychilus mortilleti* from Val Serina, Abbazia (Albino, Bergamo) 32TNR66, G. Comotti leg. 28.XI.82.



Figs. 13-17. Distal genitalia (fig. 13-14), four sections of distal penis (fig. 15), 'bottle-neck' (fig. 16) and internal ornamentation of 'bottle-neck' and distal penis (fig. 17) in specimens of *Oxychilus mortilleti* from Lago di Lugano, Melano (Canton Ticino), 32TMR98, F. Giusti et al. leg. 3.IX.89 (fig. 13) and from Val Serina, Abbazia (Albino, Bergamo) 32TNR66, G. Comotti leg. 28.XI.82 (figs. 14-17).

marked internally by annular pad when 'bottle-neck' short and wide and by beginning of distal penis pleats when 'bottle-neck' slender and thin) (figs. 9, 11, 17) and ending close to genital atrium; distal penis enveloped by muscular sheath; penial sheath (4.8 ± 0.8 mm) occasionally slightly shorter than distal penis, usually slightly longer, projected on one side to envelop proximal apex of epiphallus (and consequently traversed by vas deferens); maximum width of distal penis plus penial sheath (level where the penial sheath originates): 1.7 ± 0.5 mm (distal penis thickness constant whereas sheath thickness progressively reducing from close to genital atrium where it originates, to near 'bottle-neck' where it ends). Very short, thin walled tube connects distal penis (level with where penis sheath originates) to genital atrium.

Internal wall of flagellum and proximal penis with approximately 9-13 rows of papillae (exact number difficult to establish because some branch just before central, wider portion of proximal penis, and merge near 'bottle-neck'); papillae very numerous and small, their number and size varying in different rows (smaller in flagellum, near opening of epiphallus into proximal penis and soon before 'bottle-neck'); papillae variable in shape and outline (polygonal, pyramidal or conical), distinct but with the bases connected by thin, raised, root-like crests; small, elongated, closely spaced, wavy papillae bordering rim of epiphallus opening into proximal penis. Wall of distal penis thick, with 5-7 continuous internal pleats (exact number of pleats not easy to establish because some repeatedly branch), some (2-3) larger, more raised and with jagged sides; distally these larger pleats wider and become raised, sometimes fused to form knobs.

Radula (Wagner, 1915: 459, pl. 12 fig. 93; Bishop, 1976: 288). Each row with 29-31 teeth; central tooth with robust basal plate from which tricuspid crown arises, crown with long, slender, pointed mesocone and two small, pointed ectocones; lateral teeth (two on each side) with tricuspid crown formed by long, robust mesocone, small endocone (2/3 way up mesocone side) and small ectocone (about half-way up mesocone side); lateromarginal teeth, one on each side, with inwardly curved crown having only mesocone and very small endocone; marginal teeth monocuspid, thorn-like, progressively reducing in size.

Type material

No original syntypes found. Pfeiffer's material was acquired by H. Dohrn and H. Cuming. Dohrn's collection in Stettin Museum was destroyed during the Second World War (Zilch, 1967; Dance, 1986). Cuming's collection in the Natural History Museum (London, UK) does not contain any type material of *Helix villae* (fide P. Mordan, personal communication 14.XI.1996).

Since *Oxychilus mortilleti* (Pfeiffer, 1859) (introduced as a new name for *Helix villae* Pfeiffer, 1857, non Deshayes, 1850) has been misidentified frequently (see Taxonomy), and a restricted type locality is needed for further research to define its relationship to the closely allied *Oxychilus draparnaudi* (Beck, 1837), we believe that the 'exceptional circumstances' (ICZN, 1985: Art. 75 b) for selection of a neotype are fulfilled.

The best candidate for a neotype of *Helix villae* would be a shell studied by Wagner (1915) because only since this paper was the species identified consistently (see Taxonomy). The specimens anatomically studied by Wagner (1915) were collected at 'Salo am Gardasee'. Although we found some shells collected at 'Salo am Gardasee' at the Naturhistorisches Museum Wien (no. 19137) there was no evidence that they were studied by Wagner (1915). The shell figured by Wagner (1915, pl. 12 figs. 86-88) cannot be designated as neotype because it comes from 'Mönchsberg bei Salzburg' outside the type locality s.l. (Lombardy).

We, therefore, selected a neotype from among the material studied by us, a shell from Val Seriana, Abbazia (municipality of Albino, province of Bergamo, Italy, UTM reference 32T NR 6565). The neotype (fig. 2) is kept in the malacological collection of the Museo Zoologico 'La Specola', Università di Firenze (MZUF no. 13146).

Type locality

Lombardy, Italy. Following designation of a neotype for *Helix villae*, the type locality of *Oxychilus mortilleti* is restricted to Val Seriana, Abbazia (municipality of Albino, province of Bergamo, Italy, UTM reference 32T NR 6565).

Material examined

ITALY. 32TMR48) Fornero (Valstrona, Novara), 32TMR4884 (2 ps, University Museum of Zoology, Cambridge UK). 32TMR56) Invorio Inferiore (Invorio, Novara), 32TMR5868 (2 ps, University Museum of Zoology, Cambridge UK). 32TMR69) Cicogna (Novara), 32TMR6093 (3 ps, University Museum of Zoology, Cambridge UK). 32TMR78) Lago Maggiore, Caldè (Varese), 32TMR78 (10 ss, 5 ps). 32TMR79) Lago Maggiore, between Luino and Porto Valtravaglia (Varese), 32TMR79 (12 ss, 4 ps). 32TMS52) Rivasco (Novara), 32TMS5329 (4 ps, University Museum of Zoology, Cambridge, UK). 32TNR59) Val Brembana (Bergamo), 32TNR59 (6 ss, 10 ps). Val Brembrana, Bus del Magro no 1057 Lo/BG (Olmo al Brembo, Bergamo), 32TNR5091 (3 ps). 32TNR66) Val Seriana, Abbazia (Albino, Bergamo), 32TNR6565 (5 ss, one of which designated as neotype of *Helix villae*, 13 ps). Val Seriana, Cave Martinelli near Piazza, 450 m (Nembro, Bergamo), 32TNR6067 (1 ss, 19 ps). 32TNR68) Oltre il Colle (Oltre il Colle, Bergamo), 32TNR6082 (4 ps). Rifugio Grem, 1300 m (Gorno, Bergamo), 32TNR638 (3 ss, 2 ps). Rifugio Grem 1300-1400 m (Gorno, Bergamo), 32TNR6383 (2 ss, 2 ps). 32TPR64) Vajo di Squaranto (Verona), 32TPR64 (1 ps). 32TPR73) Soave (Soave, Verona), 32TPR73 (3 ps). 32TQR03) Monti Berici, Grotta del Fico nel Broion, no. 155 V/VI (Longare, Vicenza), 32TQR0238 (6 ps). Monti Berici, Grotta della Guerra, no. 127 V/VI (Longare, Vicenza), 32TQR0137 (6 ss, 8 ps). 32TPR96) Grotta della Lora, no. 169 V/VI (Sarcedo, Vicenza), 32TPR9666 (1 ps). 32TPS01) Edolo (Edolo, Sondrio), 32TPS01 (8 ss, 1 ps). 33TTM90) Lago Morto (Vittorio Veneto, Treviso), 33TTM90 (1 ps).

SWITZERLAND. 32TMR98) Lago di Lugano, Brusino Arsizio (Canton Ticino), 32TMR98 (33 ss, 4 ps). Lago di Lugano, Lavena (Canton Ticino), 32TMR98 (8 ss, 9 ps). Lago di Lugano, Melano (Canton Ticino), 32TMR98 (8 ss, 8 ps). Lago di Lugano, Vico Morcote (Canton Ticino) 32TMR98 (2 ss, 5 ps). 32TMR99) Lago di Lugano, Brè (Canton Ticino), 32TMR99 (3 ss, 1 ps). Lago di Lugano, Paradiso (Canton Ticino), 32TMR99 (9 ss, 2 ps).

AUSTRIA. Salzburg (3 ps, ex Muzeum i Instytut Zoologii, Warsaw, Poland).

CZECH REPUBLIC. Kopeč near Neratovice, Velkovesky Vrch (2 ps, ex Muzeum i Instytut Zoologii, Warsaw, Poland).

Nomenclature

In the appendix to his long paper on the molluscs of eastern Piedmont, Strobel (1853: 110) reported the contents of a letter from the Villa brothers in which they stated that 'rinvenirsi ad ambo le rive di questo lago [Lago Maggiore], nonché nelle isole Borromeo, una *Helix*, che Mortillet chiama *H. Villa*, distinguendola dalle altre del gruppo delle lucenti (*H. cellaria*) nel modo seguente: Le caractère essentiel de l'*H. Villa* est d'être complètement plane supérieurement et d'avoir les tours de spire qui se recouvrent

presque entièrement, on peut presque dire qu'ils montent les uns sur les autres, ce qui rétrécit beaucoup ceux qui forment la spire et donne un grande développement proportionnel au dernier'.

Shortly after this, Pfeiffer (1857) described a new species from 'Lombardia' naming it *Helix Villae* and attributing it to Mortillet, but without any reference to the short description published by Strobel (1853). Less than two years later, Pfeiffer (1859) renamed this species *Helix Mortilleti* adding a synonymy including three names: *Helix Villa* Mortillet in Strobel, 1853, *Helix Villae* Pfeiffer, 1857, and the manuscript name '*Helix Mortilleti* Stabile, in litt. 1 Mai 1857'. He gave no explanation of this, but he presumably realized the primary homonymy between his *Helix villae* and the oldest *Helix villae* Deshayes, 1850, and renamed his species *Helix mortilleti*.

The identity of *Helix villa* Mortillet in Strobel, 1853, is uncertain (syntypes are unknown). This nominal species has always been regarded as an older synonym of *Helix villae* Pfeiffer, 1857, and a junior homonym of Deshayes' *Helix villae*. However, this is based on two incorrect assumptions: *Helix villa* Mortillet in Strobel, 1853, and *Helix villae* Pfeiffer, 1857, are two different nominal species (their descriptions and type localities are different) and no primary homonymy exists between them (Mortillet's name is a junior homonym of Deshayes's name only in as much as the spelling is emended). At least four different *Oxychilus* species live between eastern Piedmont and Lombardy: *O. draparnaudi* (Beck, 1837), *O. glaber* (Rossmässler, 1835), *O. mortilleti* (Pfeiffer, 1859), and *O. adamii* (Westerlund, 1886). The short description of Mortillet reported in Strobel (1853: 100) ('le caractère essentiel de l'*H. Villa* est d'être complètement plane supérieurement et d'avoir les tours de spire qui se recouvrent presque entièrement') and a subsequent statement by Mortillet (1862: 12-13) ('les premiers échantillons que j'ai reçus des frères Villa étaient très grands et très aplatis, les tours de spire se recouvraient successivement ...'), strongly suggests that *Helix villa* is not based on shells of *O. mortilleti* but on material of *O. adamii*. The latter, in fact, has a flatter and larger shell than *O. mortilleti* (Giusti & Manganelli, in preparation).

Since primary homonymy exists between *Helix villae* Deshayes, 1850, and *Helix villae* Pfeiffer, 1857, Pfeiffer's name of 1857 should have been replaced (ICZN, 1985: Art. 52) by *Helix mortilleti* Pfeiffer, 1859, the latter introduced as a new name for *Helix villae* Pfeiffer, 1857. However, authors continued to use Pfeiffer's name of 1857 for this species until the 1950s. Forcart (1957) is the first modern author to use Pfeiffer's name of 1859.

Two other names have been introduced for northern Italian *Oxychilus* species: an older one and one published at the same time as *Helix mortilleti*. They are *Helix* (*Helicella*) *draparnaldi* [sic] var. *italica* Beck, 1837 (p. 6; referenced to figure 22* of plate 1 of Rossmässler, 1835; type locality: 'Italien', see Rossmässler, 1835: 71) and *Zonites cellarius* var. *eugyrus* Stabile, 1859 (pp. 141, 175; type locality: 'territorio di Lugano'). Both were established as names of variety: *italica* has never been cited as a valid name of a taxon of the species group (it is also ignored by Sherborn, 1927), whereas *eugyrus* was used as the name of a species by Nevill (1880) and Locard (1894). *Helix* (*Helicella*) *draparnaldi* [sic] var. *italica* therefore retains the status of infrasubspecific name and as such is excluded from the zoological nomenclature (ICZN, 1985: Art. 1), and *Zonites cellarius* var. *eugyrus* is a valid name. In what remains of Stabile's collection at the Museo Cantonale di Storia Naturale in Lugano (Switzerland), there is only one specimen of *Zonites cellarius* from Lugano (fig. 4). It agrees well with the shells of *Oxychilus mortilleti* which is very common around the Lake of Lugano (see material examined). We therefore designated this specimen as the lectotype of *Zonites cellarius* var. *eugyrus* Stabile, 1859, which becomes a subjective synonym of *Helix mortilleti* Pfeiffer, 1859.

Helix mortilleti and *Zonites cellarius* var. *eugyrus* were published in the same year. Pfeiffer's paper was completed in November, 1858, and Stabile's was read at a meeting of the Società Geologica on March 20th, 1859; however, their exact dates of publication are unknown. Consequently, in both cases the date of publication is that of the last day of the year (ICZN, 1985: 21c(i)) and the principle of first revisor must be applied (ICZN, 1985: Art. 24). As no-one has yet acted as first revisor, determining the relative precedence of these names, we now establish that *Zonites cellarius* var. *eugyrus* is a junior synonym of *Helix mortilleti*. This action is in agreement with the Recommendation 24A (ICZN, 1985) which suggests selecting the name that best serves the stability and universality of the nomenclature.

Taxonomy

O. mortilleti belongs to *Oxychilus* (s.str.) and is conchologically very similar to *O. cellarius* and *O. draparnaudi*, particularly to the former by virtue of the not dilated last whorl. The possibility of distinguishing *O. mortilleti* from *O. cellarius* and *O. draparnaudi* on a conchological basis has not been verified and is postponed to the moment when more shells from sympatric specimens, determined after anatomical study, are available. Preliminary comparison between north Italian *O. mortilleti* and *O. draparnaudi* (only a few shells available) demonstrated that sympatric specimens of these two species are easily distinguished by the fact that for a given shell diameter, *O. draparnaudi* has fewer whorls (fig. 18) (the localities of the material of *O. draparnaudi* examined are listed in Appendix 1).

Anatomically *O. mortilleti* is very similar to *O. draparnaudi* with which it shares two characters which are diagnostic with respect to *O. cellarius*. They are: penis clearly divided into proximal and distal portions by an elongated, constricted portion or 'bottle-neck' (1) (in *O. cellarius*: little or no sign of constriction and hence no evident distinction of penis into proximal and distal portions; see Giusti & Manganelli, 1997: figs. 3, 5, 7, 9, 11, 13) and internal proximal penis wall with a variable number (6-13) of rows of small, very numerous, polygonal or pyramidal papillae which are always distinctly defined; the base of each papilla is nevertheless connected to the base of the preceding and following ones by thin, raised, root-like crests; the papillae never fused to form wavy pleats (2) (in *O. cellarius*: the internal proximal penis has a variable number (6-8) of rows of papillae; the papillae are few and very large, particularly on the proximal penis wall opposite to that on which the epiphallus opens into the penis; they are usually fused to one another in the same row by raised, root-like crests, sometimes forming wavy pleats; see Giusti & Manganelli, 1997: figs. 4, 6, 8, 10, 12, 14).

O. mortilleti is readily distinguished from *O. draparnaudi* by the following characters: proximal penis about three times as long as the distal penis (PP/DP: 2.8 ± 0.6) (in *O. draparnaudi* proximal penis slightly shorter than distal penis: PP/DP: 0.80 ± 0.20) (1); long, usually straight (only occasionally slightly bent) 'bottle-neck', larger in diameter than in *O. draparnaudi* (in *O. mortilleti*: BD: 0.27 ± 0.10 ; in *O. draparnaudi*, BD: 0.10 ± 0.03) (2); penial sheath longer (PS: 4.8 ± 0.2 ; DP/PS: 0.90 ± 0.18) and enveloping almost entire distal penis (ending level with or very close to 'bottle-neck'); in *O. draparnaudi* shorter and covering only last portion of distal penis (PS: 2.4 ± 0.7 ; DP/PS: 2.59 ± 1.12) (3) (tables 1-2; for *O. draparnaudi* see figs. 19-23 and Giusti & Manganelli, 1997: figs. 15-30).

Among the Alpine species, *O. mortilleti* is also conchologically very similar to young shells of *O. adamii* as both species have tightly coiled whorls. However, adult shells of *O. adamii* are flatter and larger (SD: 16.1 ± 1.0 mm; range: 14.1-17.5 mm; n: 25) than

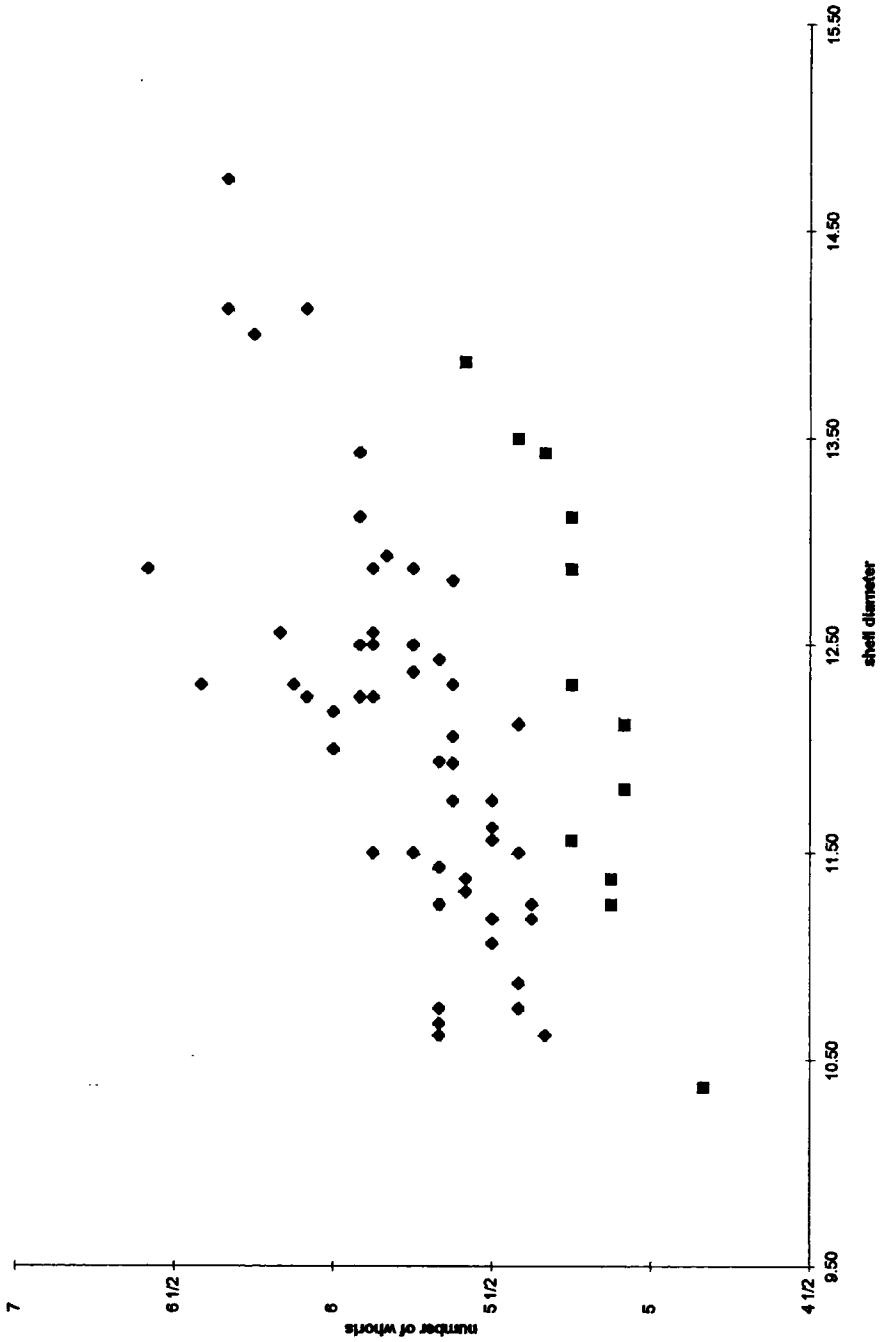


Fig. 18. Comparison of two shell parameters (whorl number and maximum shell diameter) between north Italian *Oxychilus mortilleti* (rhombs) and *O. draparnaudi* (squares). The localities of material of *O. draparnaudi* examined are listed in the Appendix I.

those of *O. mortilleti* (SD: 12.1 ± 0.93 mm, n: 56). *O. adamii* is anatomically very different from *O. mortilleti* (unpublished data by Forcart and Riedel, see Riedel, 1980: 99; Kerney et al., 1983; personal unpublished data) and does not belong to *Oxychilus* (s.str.) (Manganelli et al., 1995). The nomenclatural and taxonomic status of *O. adamii* is being revised and will be the subject of a future paper by us.

As shell characters do not always permit certain distinction with respect to some other species co-existing with *Oxychilus mortilleti*, e.g. *O. cellarius*, *O. draparnaudi* (fig. 18) and young specimens of *O. adamii*, it is impossible to ascertain with certainty what species was actually described by Pfeiffer from the description and figures of *Helix villae*. This uncertainty is also the reason why the interpretation of this nominal species was not consistent in the older literature. It is evident from examination of material in historical collections that earlier authors were unable to distinguish the shell of *O. mortilleti* from those of *O. cellarius* - *O. draparnaudi* and *O. adamii*. On the basis of the shell, authors such as Mortillet (1862), Stabile (1864) and Pini (1876) did not think that *Helix villae* was distinct from Müller's *Helix cellaria* and consequently regarded it as a variety of the latter. As *O. cellarius* seems to be absent from Italy (Bishop, 1976; Manganelli et al., 1995), some of the old north Italian reports may actually have been based on misidentification of *O. draparnaudi* and *O. adamii*.

Wagner (1915) applied Pfeiffer's name to a medium-sized, discoidal-shelled *Oxychilus*, of which he described the anatomy, examining specimens collected at Salò (province of Brescia, Lombardy). They turned out to be characterized by a long, slender penial complex (especially the flagellum) and a long duct of the bursa copulatrix (Wagner, 1915: 459, pl. 12 figs. 92-93). All subsequent authors followed Wagner in regarding these anatomical features as distinguishing the species from the other *Oxychilus* (s.str.) species (Hudec, 1962: 9; Bishop, 1976: fig. 8; Kerney & Cameron, 1979: 124; Kerney et al., 1983: 171). Thorough anatomical study of many populations of *Oxychilus* (s.str.) species has demonstrated that the diagnostic features of Wagner are only such in part. *O. mortilleti* does actually have a very long, slender penial complex and bursa copulatrix duct, but these characters are insufficient to distinguish it from some populations of *O. draparnaudi*.

Our survey confirms that the penial complex as a whole (flagellum plus proximal and distal penis), the flagellum and the bursa copulatrix complex are longer and more slender in average, than in *O. draparnaudi* (tables 1-2) as stated by Wagner (1915), but there exist populations of *O. draparnaudi* in which these organs reach dimensions similar to those of *O. mortilleti*. This is true of some Italian populations from the Apuan Alps (Tuscany) and the Ligurian Apennines, assigned to *O. cf. mortilleti* by Giusti & Mazzini (1971: 263-264) and Boato et al. (1985: 299) due to the very long penial complex (especially the flagellum) and bursa copulatrix complex. However, they have none of the characters distinctive of *O. mortilleti*: the proximal penis is about the same length as the distal one, the 'bottle-neck' is very thin and the penial sheath is very short (figs. 19-22; table 2).

Geographical distribution

At present the species seems to have a limited distribution in southern central Europe. In the Alps, it is only documented with certainty from some Italian regions (Piedmont, Lombardy, Venetum) (Wagner, 1915; Bishop, 1976, 1980; Manganelli et al., 1995), and from Ticino Canton in Switzerland (see material examined). Outside the Alps the species is currently only confirmed from Austria and the Czech Republic (Hudec, 1962; see also material examined). The presence of the species in southern Germany, and in

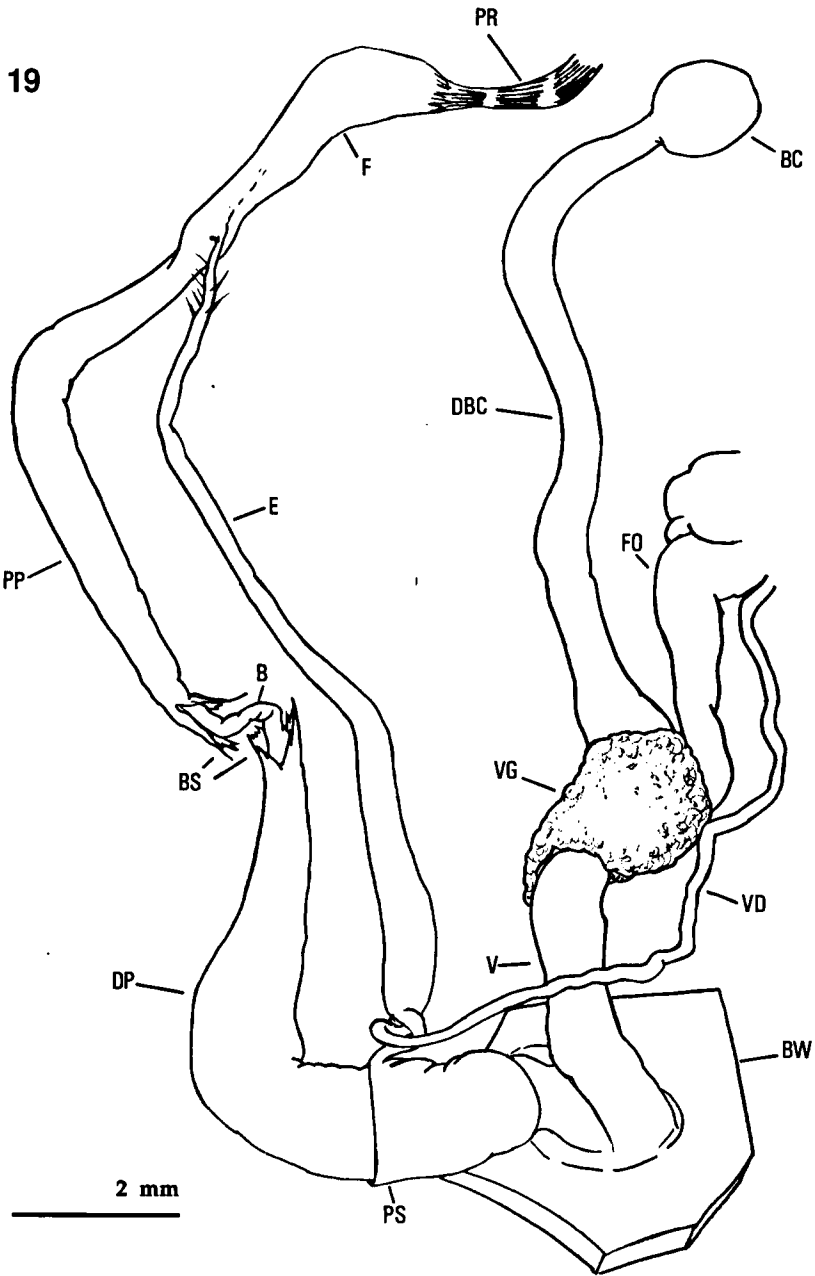
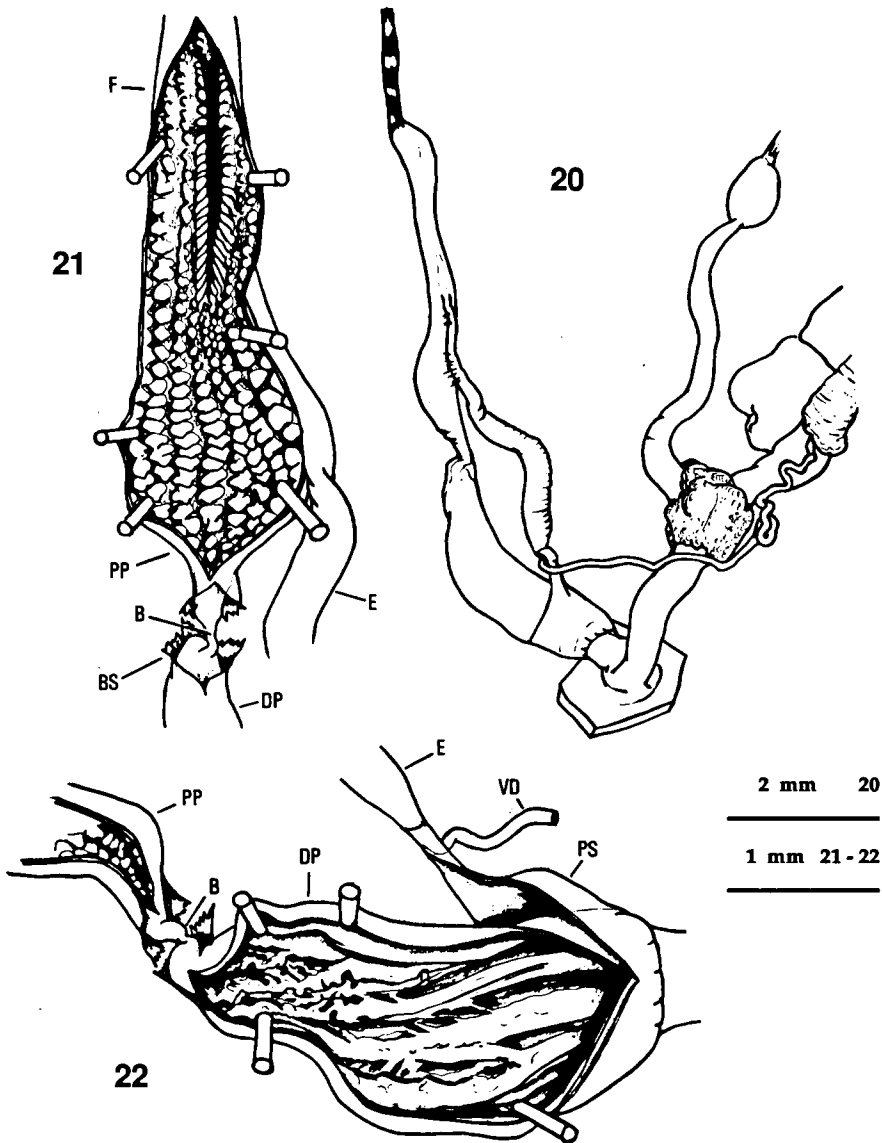


Fig. 19. Distal genitalia of a specimen of *Oxychilus cf. draparnaudi* from Alpi Apuane, Buca della Bastiola (Fosdinovo, Massa Carrara), 32TNP8487, B. Lanza leg. 24.V.70. This specimen agrees with those determined as *O. cf. mortilleti* by Giusti & Mazzini (1971).



Figs. 20-22. Distal genitalia (fig. 20) and internal ornamentation of flagellum and proximal penis (fig. 21) and of 'bottle-neck' and distal penis (fig. 22) in specimens of *Oxychilus* cf. *draparnaudi* from Alpi Apuane, Monte Pisanino, Valle Orto di Donna (Minucciano, Lucca), 32TNP9687, F. Giusti leg. 22.VII.70. These specimens were determined as *O. cf. mortilleti* by Giusti & Mazzini (1971).

Table 1. - Dimensions (and ratios) of some parts of the distal genitalia in specimens of *Oxychilus mortilleti*. For the localities, see Material examined. PC penial complex, F flagellum, PP proximal penis, DP distal penis, BL 'bottle-neck' diameter, BD 'bottle-neck' diameter, F/PC flagellum/penial complex, F+PP/DP flagellum + proximal penis/distal penis, PP/DP proximal penis/distal penis, DP/PS distal penis/penial sheath, DBC duct of bursa copulatrix, DV distal vagina. For identification of the parts measured see the anatomical description.

Locality	PC	F	PP	DP	BL	BD	PS	F/PC	F+PP/DP	PP/DP	DP/PS	DBC	DV
Cave Martinelli	20.6	3.4	13.4	3.8	1.9	0.18	4.8	0.17	4.42	3.5	0.79	6.2	5.0
Cave Martinelli	19.1	3.7	11.1	4.3	1.7	0.20	3.5	0.19	3.44	2.6	1.23	4.8	3.9
Cave Martinelli	17.9	2.1	10.9	4.9	0.9	0.28	5.4	0.12	2.65	2.2	0.91	8.2	4.9
Cave Martinelli	22.3	4.6	13.8	3.9	2.8	0.18	4.5	0.21	4.72	3.5	0.87	7.0	4.3
Abbazia	15.5	1.8	10.1	3.6	1.7	0.18	5.3	0.12	3.30	2.8	0.68	7.8	3.1
Abbazia	20.1	2.6	13.5	4.0	0.3	0.43	4.9	0.13	4.03	3.4	0.82	8.4	4.9
Abbazia	20.2	2.0	13.3	4.9	2.3	0.31	5.6	0.10	3.12	2.7	0.88	7.1	4.7
Abbazia	14.5	2.1	8.3	4.1	0.3	0.53	5.3	0.14	2.54	2.0	0.77	7.2	4.6
Val Brembana	16.4	2.1	10.5	3.8	0.2	0.17	3.6	0.13	3.33	2.8	1.06	5.2	3.0
Soave	17.3	2.1	10.8	4.4	2.8	0.28	4.0	0.12	2.93	2.5	1.10	6.4	3.6
Soave	19.2	2.1	13.3	3.8	2.1	0.37	5.1	0.11	4.05	3.5	0.75	7.3	3.2
Grotta della Guerra	15.1	2.3	10.3	2.5	2.1	0.15	5.1	0.15	5.04	4.1	0.49	5.4	3.4
Grotta della Guerra	11.1	1.5	6.3	3.3	1.3	0.18	3.9	0.14	2.36	1.9	0.85	5.3	2.6
Rifugio Grem	15.8	2.0	9.8	4.0	1.6	0.25	3.6	0.13	2.95	2.5	1.11	7.0	3.4
Monte Generoso	20.4	3.2	11.6	5.6	1.3	0.25	6.1	0.17	2.64	2.1	0.92	9.1	5.5
Monte Generoso	22.1	2.6	13.9	5.6	1.1	0.34	5.2	0.12	2.95	2.3	1.08	9.0	4.6
Monte Generoso	25.0	3.9	16.0	5.1	1.1	0.31	5.1	0.17	3.50	3.1	1.00	8.1	4.6
Mean and standard error	18.4 ± 3.3	2.6 ± 0.8	11.6 ± 2.3	4.2 ± 0.8	1.5 ± 0.8	0.27 ± 0.10	4.8 ± 0.8	0.14 ± 0.03	3.41 ± 0.77	2.8 ± 0.6	0.90 ± 0.18	7.0 ± 1.3	4.1 ± 0.8

Table 2. - Dimensions (and ratios) of some parts of the distal genitalia in specimens of *Oxybitis draparnaudii* (above) and *Oxybitis cf. draparnaudii* (below). For the localities, see Appendix 2. Acronyms as in table 1.

Locality	PC	F	PP	DP	BD	PS	F/PC	F+PP/PD	PP/DP	DP/PS	DBC	DV
Pont du Gard	12.3	1.3	4.1	6.9	0.09	3.4	0.11	0.78	0.59	2.03	7.1	4.4
Saint-Paul-de-Ferrouillet	11.4	1.2	5.1	5.1	0.13	2.7	0.11	1.26	1.00	1.89	5.1	3.8
Vásanád,	11.9	1.1	5.4	5.4	0.12	1.9	0.09	1.20	1.00	2.84	3.6	2.3
Vásanád,	9.7	1.2	3.9	4.6	0.13	2.6	0.12	1.11	0.85	1.77	3.4	2.9
Haarlem	11.9	1.3	5.3	5.3	0.13	2.9	0.11	1.25	1.00	1.83	4.1	3.5
Haarlem	10.4	1.6	3.8	5.0	0.15	3.4	0.15	1.08	0.76	1.47	4.3	3.4
Szozsacín	11.0	1.4	3.6	6.0	0.09	2.4	0.10	0.83	0.60	2.50	4.8	4.1
Basel	11.1	1.1	4.8	5.2	0.06	2.1	0.10	1.13	0.92	2.47	4.1	3.2
Basel	8.4	1.2	2.1	5.1	0.06	3.0	0.14	0.65	0.41	1.70	4.2	3.0
Isola Bella	9.5	1.1	2.5	5.9	0.08	3.2	0.12	0.61	0.42	1.84	3.8	2.9
Zumaglia	9.6	0.9	3.1	5.6	0.08	3.3	0.09	0.71	0.56	1.60	4.1	3.6
Zumaglia	9.8	1.5	3.4	4.9	0.12	3.1	0.15	1.00	0.74	1.58	3.5	3.7
Il Conicchio	16.4	2.5	5.8	8.1	0.06	2.4	0.15	1.02	0.72	3.38	4.8	5.3
Il Conicchio	12.5	1.8	4.3	6.4	0.08	2.9	0.14	0.95	0.67	2.21	3.7	4.0
Mean and standard error	11.1 ± 1.9	1.4 ± 0.4	4.1 ± 1.1	5.7 ± 0.9	0.10 ± 0.03	2.8 ± 0.5	0.12 ± 0.02	0.97 ± 0.22	0.73 ± 0.20	2.08 ± 0.53	4.3 ± 0.9	3.6 ± 0.7
Sant'Anna ^o	11.8	2.8	4.6	4.4	0.13	2.4	0.24	1.68	1.00	1.83	4.9	1.6
Sant'Anna ^o	11.5	2.9	4.5	4.1	0.14	2.2	0.25	1.80	1.12	1.86	5.5	2.7
Grotta dei Versi ^o	12.9	3.1	4.8	4.6	0.14	0.9	0.24	1.71	1.04	5.11	4.6	2.4
Foce di Cardeto ^{oo}	12.4	3.0	3.7	5.7	0.14	1.6	0.24	1.18	0.65	3.56	5.0	1.8
Foce di Cardeto ^{oo}	11.5	2.3	4.0	5.2	0.20	2.0	0.20	1.21	0.77	2.60	4.9	2.9
Valle Ortondonna ^{oo}	10.3	2.8	3.6	3.9	0.10	1.0	0.27	1.64	0.92	3.90	5.1	2.3
Tana della Bastiola ^{oo}	20.6	4.2	8.4	8.0	0.06	2.2	0.20	1.56	1.05	3.64	9.3	4.9
Tana della Bastiola ^{oo}	17.4	2.9	6.7	7.8	0.08	1.4	0.17	1.23	0.86	5.57	7.9	3.9
Mean and standard error	13.6 ± 3.3	3.0 ± 0.5	5.0 ± 1.6	5.5 ± 1.5	1.7 ± 0.5	0.23 ± 0.03	1.50 ± 0.24	0.93 ± 0.15	3.51 ± 1.29	5.9 ± 1.6	2.8 ± 1.0	
Mean and standard error	12.0 ± 2.8	2.4 ± 0.8	4.4 ± 1.4	5.6 ± 1.2	0.10 ± 0.03	2.4 ± 0.7	0.16 ± 0.6	1.16 ± 0.34	0.80 ± 0.20	2.59 ± 1.12	4.9 ± 1.4	3.3 ± 0.9

^o) *O. cf. monticola* sensu Boato et al. (1985)^{oo}) *O. cf. monticola* sensu Giusti & Mazzini (1971)

other Swiss and Austrian localities is probable but needs to be confirmed by anatomical study.

Old and recent reports from the Tyrrhenian area (western Liguria: Boato et al., 1985; Tuscany: Gentiluomo, 1868; Bonelli, 1873; Giusti & Mazzini, 1971; Sicily: Rossmässler, 1858; Westerlund, 1876, 1886; Benoit, 1882; Corsica (Caziot, 1903; Germain, 1930; Holyoak, 1983; Real & Real Testud, 1988) are undoubtedly based on misidentification. Reports of *O. mortilleti* from Tuscany by Bonelli (1873) are misidentifications of *O. uziellii* (Issel, 1873) (Manganelli & Giusti, 1985), those from western Liguria and Apuan Alps (Giusti & Mazzini, 1971; Boato et al., 1985) of *O. cf. draparnaudi* (see Taxonomy) and, finally, some of those from Sicily (Rossmässler, 1858) of *O. egadiensis* (Riedel, 1973) (Riedel, 1973).

Status and Conservation

Not globally threatened. In some places it is a common species.

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APPENDIX 1

Material of *Oxychilus draparnaudi* examined for fig. 18.

ITALY: 32TMR29) Zumaglia, 600 m (Zumaglia, Biella), 32TMR2849. 32TMR68) Lago Maggiore: Isola Bella (Stresa, Novara), 32TMR6382. 32TPR26) Gargnano sul Garda (Gargnano sul Garda, Brescia), 32TPR26. 32TPR54) Grotta di Novare (Negrar, Verona), 32TPR54, G. Caoduro. 32TQQ19) Rovigo (Rovigo, Rovigo), 32TQQ19.

APPENDIX 2

Material of *Oxychilus draparnaudi* examined for table 2.

FRANCE: Pont du Gard (Gard) (Giusti & Manganelli, 1997: figs. 15-17). Saint-Paul-de-Fenouillet (Aube, France) (Riedel, 1970: fig. 15). SWEDEN: Västanå, Eskjö (Jönköpings Län) (Giusti & Manganelli, 1997: figs. 27-29). THE NETHERLANDS: Haarlem (Noord-Holland) (Giusti & Manganelli, 1997: fig. 26). POLAND: Szczecin (Giusti & Manganelli, 1997: figs. 30-31). SWITZERLAND: Basel (Basel) (Giusti & Manganelli, 1997: figs. 22-23). ITALY: 32TMR29) Zumaglia, q 600 m (Zumaglia, Biella), 32TMR2849. 32TMR68) Lago Maggiore: Isola Bella (Stresa, Novara), 32TMR6382. 32TPR26) Isola Bella (Stresa, Novara, Italy), 32TMR6382. 32TMP38) Grotta dei Versi, no. 91 Li (Loano, Savona), 32TMP3989 32TMP49) Sant'Anna (Tovo San Giacomo, Savona), 32TMP4191. 32TPN90) Il Conicchio, Capalbio (Grosseto, Italy), 32TPN9804. 32TNP88) Alpi Apuane: Buca della Bastiola (Fosdinovo, Massa Carrara), 32TNP8487. 32TNP98) Alpi Apuane: Monte Pisanino, Foce di Cardeto (Minucciano, Lucca), 32TNP9686. Alpi Apuane: Monte Pisanino, Orto di Donna (Minucciano, Lucca), 32TNP9687.