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Notulae Malacologicae, XXXIX.

Second contribution to the revision of the *Oxychilus*-species living in the Italian Apennine regions: *Hyalina carotii* PAULUCCI 1878, *Hyalina fragrans* PAULUCCI 1878 and *Helix ercica* BENOIT 1859

(Pulmonata: Zonitidae).[1])

By

GIUSEPPE MANGANELLI, LUCIO CASTAGNOLO & FOLCO GIUSTI.

With 11 figures.

Abstract: The Authors report the finding of living specimens of two problematic Zonitidae of Calabria (southern Italy): *Hyalina carotii* PAULUCCI 1878 and *Hyalina fragrans* PAULUCCI 1878. Anatomical study has allowed the Authors to state that the two taxa belong to a unique species of the genus *Oxychilus* (subgenus *Schistophallus*). Notes on systematics, geographical distribution and ecology of *O. (Schistophallus) carotii* have been added. Research on another Zonitidae living in Calabria and in Sicily, *O. (Morlina) glaber ercicus* (BENOIT), concludes the paper.

Introduction.

The systematic position of three interesting species of the genus *Oxychilus* — *Helix ercica* BENOIT 1859, *Hyalina carotii* PAULUCCI 1878, *Hyalina fragrans* PAULUCCI 1878 — living in southern Italy was recently revised by FORCART (1965: 102-103) and RIEDEL (1969b: 95-96; 1972: 197-200; 1980: 106, 108).

The inclusion of *H. ercica* in the subgenus *Morlina* WAGNER 1914 has been proved thanks to the study of the genital duct anatomy (FORCART 1965: 103; RIEDEL 1969b: 96, Fig. 1), but in the case of *H. carotii* and *H. fragrans* the

[1]) First contribution to the revision of the *Oxychilus*-species living in the Italian Apennine regions: *Zonites uziellii* ISSEL (Pulmonata: Zonitidae). — Arch. Moll. **115:** 311-323. Research supported by a CNR ("Gruppo di Biologia Naturalistica"), MPI 40% and MPI 60% grants.

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identification of the subgeneric taxon on the basis of conchological examination only, remained doubtful. According to FORCART (1965) *H. carotii* and *H. fragrans* should have been placed in the subgenus *Morlina* but according to RIEDEL (1972, 1980) they should have been included in the subgenus *Schistophallus* WAGNER 1914.

The aim of the present research is to establish the systematic position of the two above mentioned species after anatomical examination, to ascertain what the Calabrian populations referred to *O. (Morlina) glaber ercicus* really are and to elucidate their relationships to typical populations from Sicily (Caronie Mountains) and to populations of southern Europe and the Alps belonging to the typical subspecies *O. (Morlina) glaber glaber.*

Systematic review.

Oxychilus (Schistophallus) carotii (PAULUCCI).

Hyalina (Mesomphix) Carotii PAULUCCI 1878; Materiaux Faune malac. Italie: 2 [nomen nudum], 26-27. Locus Typicus: Calabria, slopes of Mt. Pegoraro near Mongiana (Catanzaro).
Hyalina (Mesomphix) fragrans PAULUCCI 1878; Materiaux Faune malac. Italie: 2 [nomen nudum], 27. Locus typicus: Calabria, Melia (Reggio Calabria).
Hyalinia (Retinella) Carotii, — PAULUCCI 1879; Fauna malac. Calabria: 52-53, Pl. 1 fig. 4.
Hyalinia (Retinella) fragrans, — PAULUCCI 1879; Fauna malac. Calabria: 53-54. Pl. 1 fig. 5.
Hyalinia (Aegopsina) Carotii, — KOBELT in ROSSMÄSSLER 1882; Icon. Land-Süssw.-Moll., (N.F.), **1:** 7-8, Pl. 2 fig. 17.
Hyalinia (Aegopsina) fragrans, — KOBELT in ROSSMÄSSLER 1882; Icon. Land-Süssw.-Moll., (N.F.), **1:** 8, Pl. 2 fig. 18.
Hyalinia (Aegopina) fragrans, — WESTERLUND 1886; Fauna, **1:** 74.
Hyalinia (Aegopina) carotii, — WESTERLUND 1886; Fauna, **1:** 74-75.
Oxychilus (*Morlina* ?) *carotii,* — FORCART 1965; Verh. naturf. Ges. Basel., **76:** 103.
Oxychilus (*Morlina* ?) *fragrans,* — FORCART 1965; Verh. naturf. Ges. Basel, **76:** 103.
Oxychilus (s. str.) *carotii,* — ALZONA 1971; Atti Soc. it. Sci. nat. Museo civ. St. nat. Milano, **111:** 126.
Oxychilus (s. str.) *fragrans,* — ALZONA 1971; Atti Soc. it. Sci. nat. Museo civ. St. nat. Milano, **111:** 126.
Oxychilus (Schistophallus) carotii, — RIEDEL 1972; Ann. zool. Warszawa, **29:** 197-198, Fig. 8; Pl. 2 figs. 18-20.
Oxychilus (Schistophallus) fragrans, — RIEDEL 1972; Ann. zool. Warszawa, **29:** 198-200, Fig. 9; Pl. 2 figs. 21-23.
Oxychilus (Schistophallus) carotii, — RIEDEL 1980; Genera Zonitidarum: 106.
Oxychilus (Schistophallus) fragrans, — RIEDEL 1980; Genera Zonitidarum: 106.

Description: The animal has remarkable dimensions. When moving, its length from head to the posterior tip of the foot reaches 4-5 cm. Almost all of the external surface of the body and sole is lemon-yellow in colour. Only the posterior extremity of the body (dorsally and ventrally) and the anterior portion from snout to palleal margin, tentacles included, are bluish-grey.

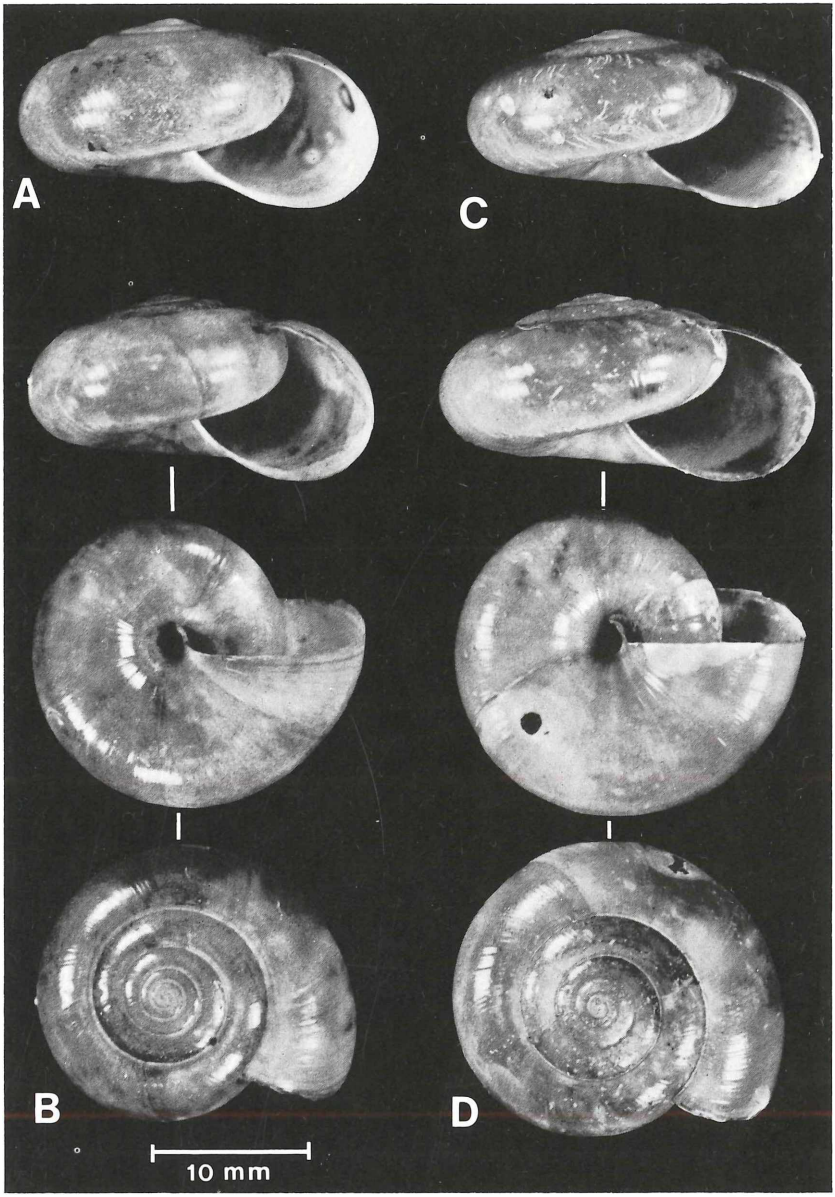


Fig. 1. *O. (Schistophallus) carotii* (Paulucci). Lectotypus (A) and one of the paralectotypi (B) from the slopes of Mt. Pegoraro near Mongiana (Calabria), C. Caroti leg. 1877 [MZUF 823-824]. C-D) two shells collected by us in the type locality [IZPAN, GCUS].

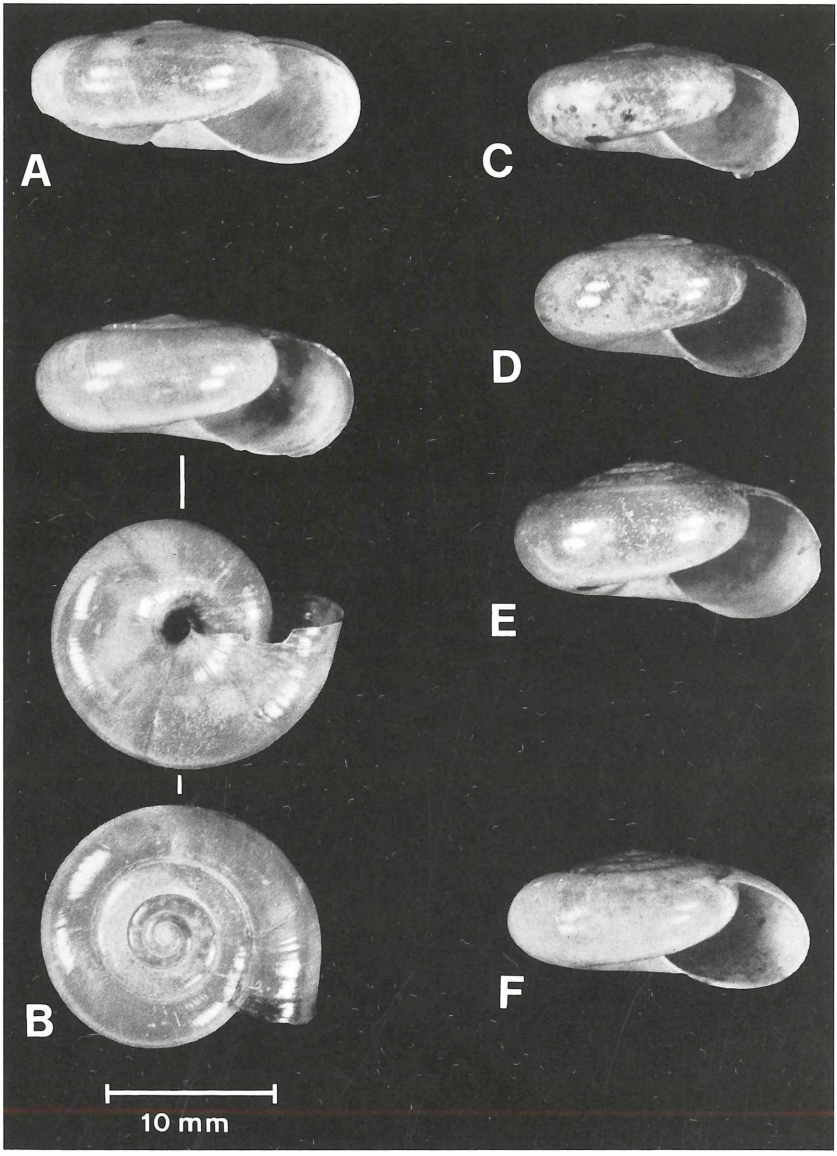
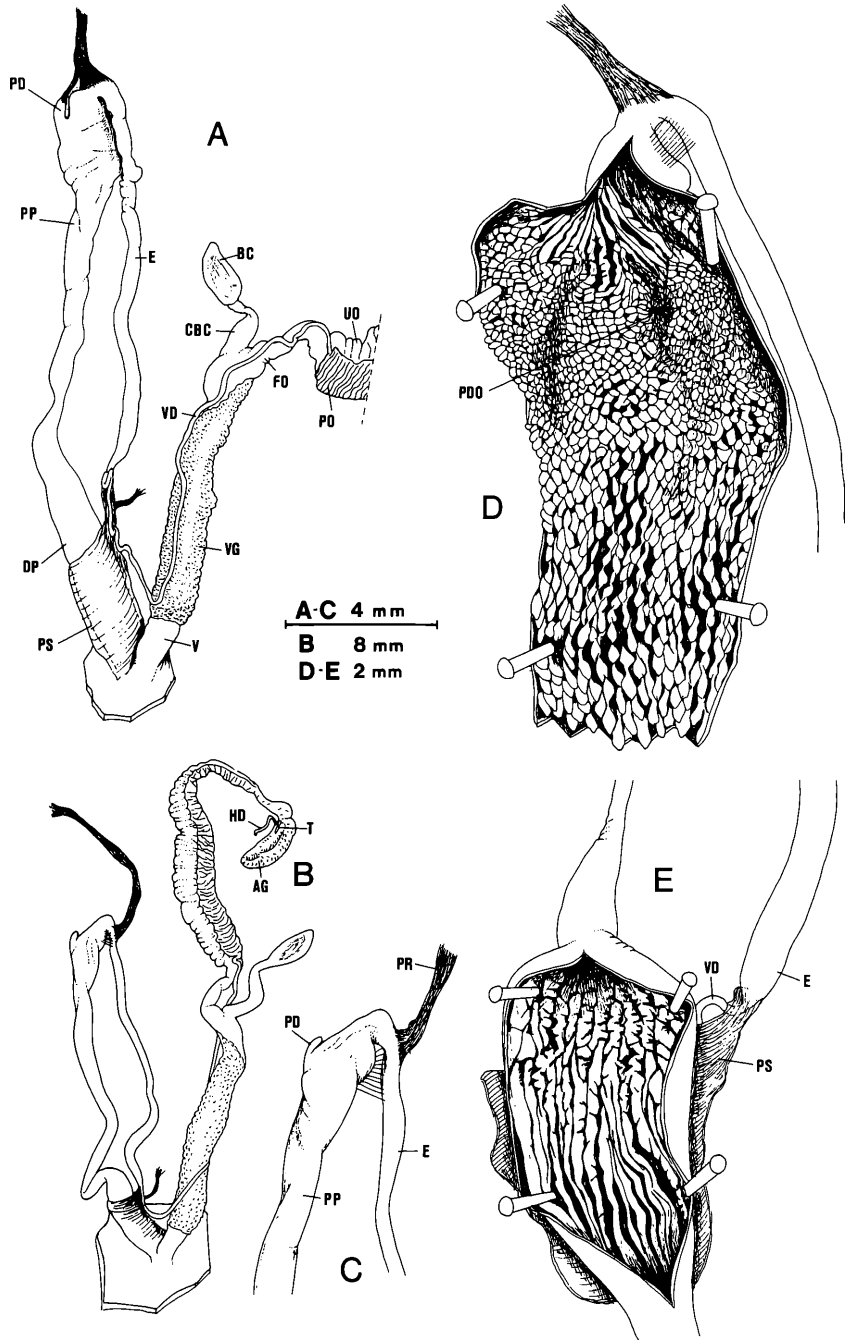


Fig. 2. A-E) *O. (Schistophallus) carotii* (Paulucci); F) *O. (Schistophallus) oscari* (Kimakowicz). — A) Holotypus of *Hyalina fragrans* Paulucci, collected along the road from Scilla to Melia (Calabria), C. Caroti leg., 1877 [MZUF 821]. B-D) Three shells from Melia (Calabria) [GCUS]. E) A young shell of *carotii* from the slopes of Mt. Pegoraro (Calabria) [GCUS]. F) a shell of *oscari* from Durchbruch des Baches Bogata (7·5 km SE of Hoghiz, Muntii Persani, Rumania), A. Riedel leg. [GCUS].

The shell (Fig. 1A-D, Fig. 2A-E) is large, very thin and fragile, globular or more or less flattened, formed by 5-5¾ whorls gradually and regularly increasing in breadth; last whorl widened, sometimes downturned. Umbilicus very small: 1/12-1/10 of the maximum diameter. Mouth oval, more or less widened in height; peristome simple, not thickened nor reflexed. Shell glossy, pale brownish yellow, opaque smooth or with poorly visible growth lines. At high magnification the whorl surface reveals microsculpture of thin spiral grooves.

Dimensions: shell max. diam. = 20-26 mm; shell max. height = 9-13·4 mm; mouth max. diam. = 10·6-13·7 mm; mouth max. height = 8·5-11 mm.

The genital duct (Figs. 3, 4A) shows an hermaphrodite gonad placed amongst the lobes of the digestive gland. A canal, the first hermaphrodite duct arises from the gonad. This duct is full of sperm and thus functions as a seminal vesicle. It ends in the talon (fertilization chamber + seminal-receptacle complex). The talon lies on the inner side of the basal portion of a large albumen gland which is followed by the second hermaphrodite duct (ovispermiduct) formed by a multilobate uterine portion and a prostatic portion. A uterine canal (free oviduct) connects the uterine portion of the ovispermiduct to the vagina. A vaginal gland develops around the vagina walls, extending almost to the genital atrium. Only the initial portion of the proximal vagina is free from the vaginal gland, thus the site where the free oviduct ends and the bursa copulatrix duct begins is perfectly visible. The bursa copulatrix is rather small and is oblong in shape: the total length of the bursa plus its canal varies from 3·5 to 6·8 mm. A slender canal, the vas deferens, arises at the distal end of the ovispermiduct prostatic portion. The vas deferens, 17·1-17·3 mm long, ends in the epiphallus. The zone of passage from vas deferens and epiphallus is wrapped by a thin guaina of tissue connected to the guaina which envelops the distal portion of the penis. The epiphallus is slender and rather long (10·7-14 mm) and ends laterally at the base of the proximal portion of the penis. Thus there is no penial flagellum proper. The penial retractor branches in two before joining the base of the proximal penis. One branch becomes progressively thinner and terminates in the genital atrium area and particularly on the surface of the penial nerve, dividing into a series of small branches. The other branch usually splits into two near the penis base, the larger branch ending on the walls of the last portion of the epiphallus and base of the penis. The smaller branch ends at the tip of a small (0·6-0·8 mm) sac-like penial diverticulum resembling a penial flagellum. This type of penial diverticulum has been homologized to the flagellum of the other *Oxychilus* subgenera by Riedel (1966, 1972, 1980). In one case no muscle ends at the tip of the penial diverticulum: the penial retractor is not divided into smaller branches and ends on the walls of the last portion of the epiphallus. The proximal portion of the penis is wide at its base and tapers toward the distal portion. Its total length varies from 8·1 to 13·7 mm. The distal portion of the penis is 6·5-7·3 mm long and has thick muscular walls enveloped by a thin external guaina of tissue, and ends in the genital atrium along side the vagina. The walls of the proximal portion of the penis are covered internally by many rows of drop-like papillae. Near the epiphallus opening, these papillae fuse to form a series of very small short pleats, similar to those inside the flagellum of the *Oxychilus* (s. str.) species. However the penial diverticulum walls have small drop-like papillae. The walls of the distal portion of the penis have many thin pleats on their internal surface. The genital pore opens on the right, far from the base of the longer right tentacle.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The radula (Fig. 5) was examined in one of the adult specimens collected on the slopes of Mt. Pegoraro. It has many rows of 37 teeth, distributed according the formula:

$$\frac{13}{1}+\frac{1}{2}+\frac{4}{3}+\frac{C}{3}+\frac{4}{3}+\frac{1}{2}+\frac{13}{1}$$

The central tooth of each row consists of a very elongated plate, constituting the base for a small body with three points: a short mesocone and two small ectocones. The first lateral teeth, 4 in number on each side of the central tooth, have an enlarged body with a long sharp mesocone, an arched endocone and a small sharp ectocone. The latero-marginal teeth, one in number on each side have a reduced basal plate and only the mesocone and the endocone. The marginal teeth, 13 on each side, become progressively smaller towards the lateral margins of the radula, and have only a sharp arched point corresponding to the mesocone. The extreme marginal teeth are reduced in size and sometimes devoid of point.

Jaw (Fig. 4B) large of oxygnathous type, arched and with a central denticle.

Material examined: Lectotypus and 5 paralectotypi of *H. carotii* PAULUCCI 1878, Slopes of Mt. Pegoraro near Mongiana (Catanzaro, Calabria), CAROTI leg. 1877 [PAULUCCI Coll., MZUF[1]) 823-824 and DI MARIA DI MONTEROSATO Coll., MCZR]. 11 sps. from the slopes of Mt. Pegoraro near Mongiana (Catanzaro, Calabria), 17.9. 1984, 13.10. 1986 [GCUS, IZPAN, SMF]. Holotypus of *H. fragrans* PAULUCCI 1878, along the road from Scilla to Melia (Reggio Calabria, Calabria), CAROTI leg., 1877 [PAULUCCI Coll., MZUF 821]. 13 sps. from near Melia (Reggio Calabria, Calabria), 12-13.10. 1986 [GCUS, IZPAN, SMF]. 2 sps. from Sorbo di Calabria (Catanzaro, Calabria), 14.10. 1986 [GCUS].

[1]) Abbreviations: GCUS: GIUSTI Coll. Dipart. Biol. Evol. Univ. di Siena (Italy); IZPAN: Inst. Zoologii, Polska Akademia Nauk, Warszawa (Poland); MCZR: Museo civico di Zoologia di Roma (Italy); MZUF: Museo di Zoologia dell'Università di Firenze (Italy); SMF: Senckenberg-Museum Frankfurt (West Germany).

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Fig. 3. *O. (Schistophallus) carotii* (PAULUCCI). Genital duct (A-C) and inner structure of the penis (D-E) in specimens collected on the slopes of the Mt. Pegoraro, near Mongiana (Calabria). A-B) Two genital ducts. C) An enlargement of the distal epiphallus-proximal penis region of the genital duct in B: note the absence of the lesser branch of the penial rectractor which usually ends on the tip of the penial diverticulum. D) The inner structure of the proximal portion of the penis. E) The inner structure of the distal portion of the penis.

Explanation of the symbols used in Figs. 3-4 and Figs. 8-10; **AG** albumen gland, **BC** bursa copulatrix (gametolytic gland), **BPR** branch of the penial retractor ending in the area of the distal portion of the penis, **BW** body wall, **CBC** duct of the bursa copulatrix, **DP** distal portion of the penis, **E** epiphallus, **EO** epiphallus opening, **F** flagellum, **FO** free oviduct, **GP** genital pore, **HD** hermaphrodite duct, **P** penis, **PD** penial diverticulum, **PDO** opening of the penial diverticulum, **PO** prostatic portion of the ovispermiduct, **PP** proximal portion of the penis, **PR** penial retractor, **PS** penial sheath, **T** talon, **TLS** tongue-like structure, **V** vagina, **VD** vas deferens, **VG** vaginal gland, **VO** vaginal opening, **UO** uterine portion of the ovispermiduct.

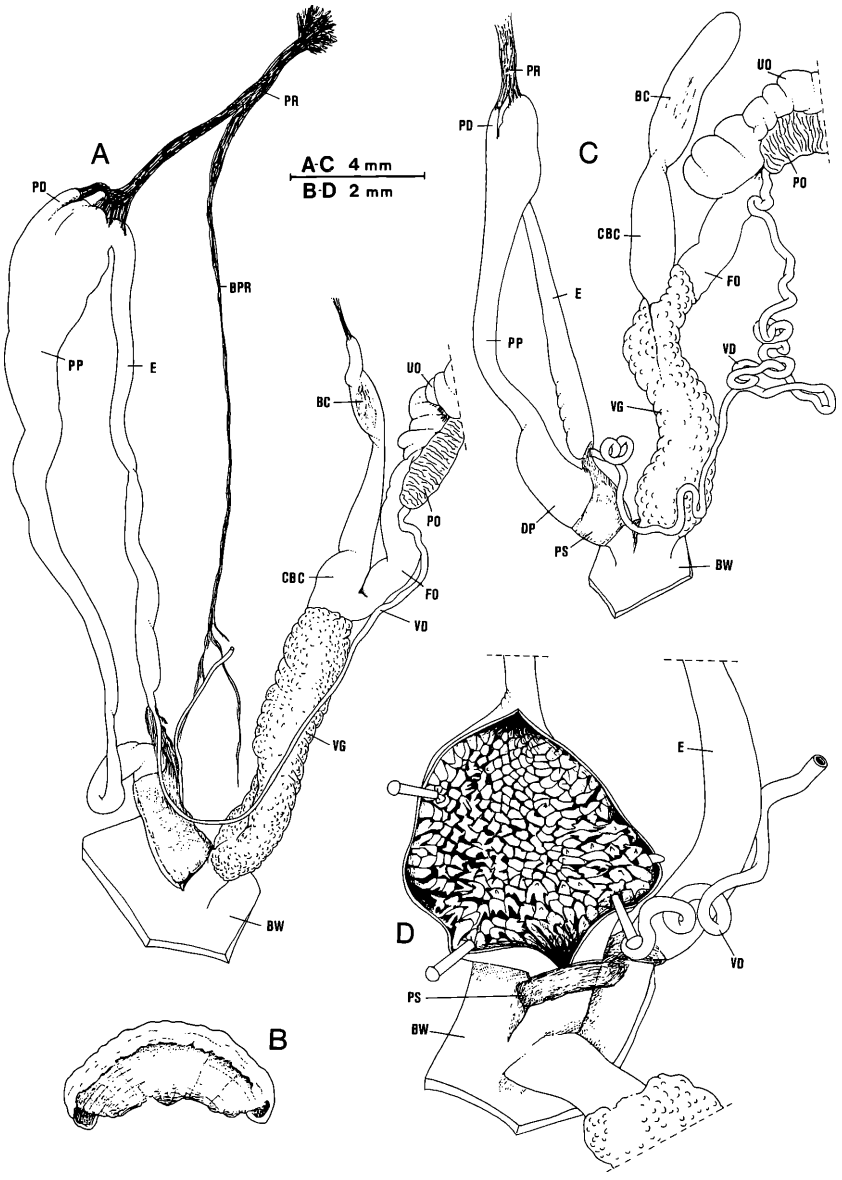


Fig. 4. A-B) *O. (Schistophallus) carotii* (PAULUCCI); C-D) *O. (Schistophallus) oscari* (KIMAKOWICZ). — A) A genital duct of a topotypical specimen of *Hyalina fragrans* from Melia (Calabria). B) Jaw of a specimen of *carotii* from the slopes of Mt. Pegoraro. C-D) A genital duct (C) and the inner structure of the distal penis (D) in a specimen of *oscari* from Codlea near Brasov, Berg Magura (Rumania), A. RIEDEL leg.: note the very long and slender vas deferens and the small "thorns" at the tip of many of the largest penial papillae. — For explanation of the symbols see Fig. 3.

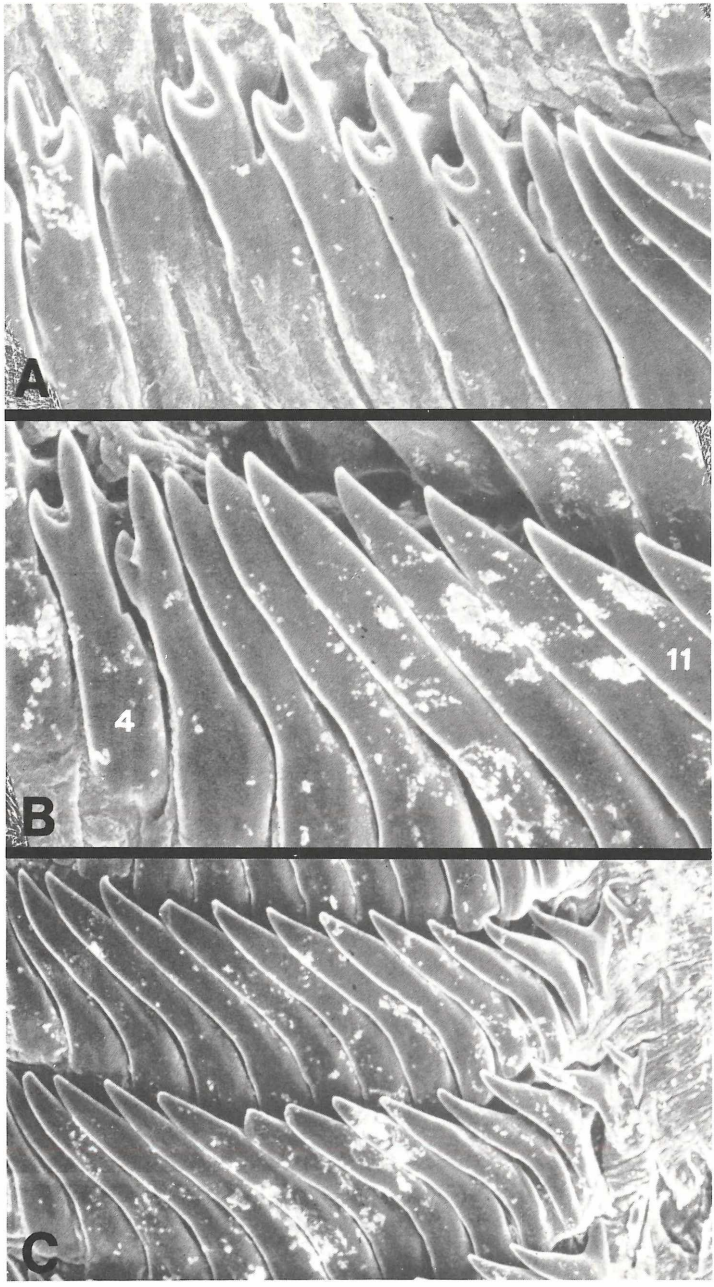


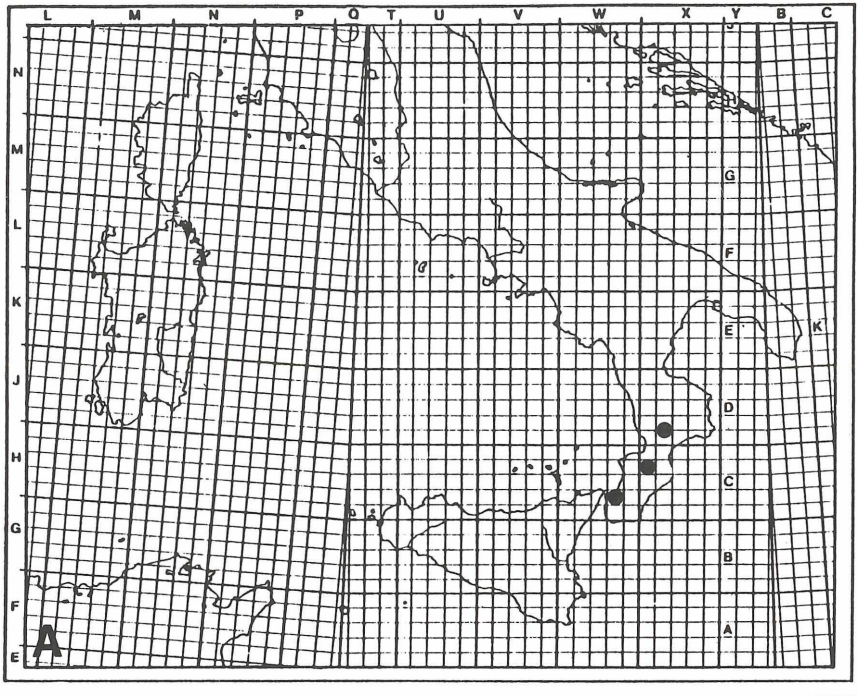
Fig. 5. *O. (Schistophallus) carotii* (PAULUCCI). A radula in a specimen collected on the slopes of Mt. Pegoraro (Calabria). A) The central tooth, the lateral and lateromarginal teeth and the first marginal teeth are visible. B) Portion of the radula from 4th to 11th teeth. C) the extreme marginal teeth.

Taxonomical Notes: As is evident from the list of synonyms, we considered *Hyalina fragrans* PAULUCCI (1878: 27) as a junior synonym of *Hyalina carotii* PAULUCCI (1878: 26-27). The conchological study performed on many topotypical specimens collected in the woods along the road from Scilla to Melia (Reggio Calabria) revealed a substantial concordance with *carotii*. The single specimen (the holotypus of *H. fragrans*) studied by PAULUCCI (Fig. 2A) was traced to the PAULUCCI Coll. (MZUF 821) and although its shell is not so depressed as it appears from PAULUCCI's (1879: Pl. 1 fig. 5) drawings, it is more flattened than those of *carotii* specimens from the type locality (Mt. Pegoraro, near Mongiana). Some of the shells collected by us in the woods near Melia, are clearly similar to the *H. fragrans* holotypus (Fig. 2B) while others are intermediate between these (Fig. 2C) and other specimens (Fig. 2D) which perfectly correspond to typical *carotii*. These conchological findings have been confirmed by anatomical research. No difference at all exists between the genital duct structure of specimens corresponding to both PAULUCCI's species. Anatomical research has also fully confirmed the inclusion of *Hyalina carotii* (now comprising *H. fragrans*) in the subgenus *Schistophallus* as suggested by RIEDEL (1972) after study of the shell and radula. This is not of secondary importance because *O. carotii* is the second *Schistophallus* species by date of description. Of the eleven species of *Schistophallus* which are known anatomically, the closest appears to be *O. (S.) samius* (MARTENS 1889) at least according to the general scheme of its genital duct. This species lives in southern Greece, the Aegean islands and Turkey and seems to be characterized (see RIEDEL 1983: figs. 19-20) by a less enlarged base of the proximal portion of the penis and by a longer diverticulum. It is still difficult to say whether these characters are constant and of sufficient importance to imply a differentiation as a self standing species. Our impression is that there is a strong relationship perhaps conspecificity (the belonging to the same morphospecies) between *carotii* and the younger *samius*. *O. (S.) oscari* (KIMAKOWICZ 1883) (Figs. 2F, 4C-D) from the Rumanian Carpathian Mountains, the type species of subgenus *Schistophallus*, also appears conchologically and anatomically very similar to *carotii*. The spirit specimen kindly provided by Dr. A. RIEDEL of Warsaw has a genital duct perfectly corresponding to that of similar specimens reported by RIEDEL (1972, 1983). It differs from *carotii* by virtue of: a longer and more circumvoluted vas deferens (= 33 mm); the inner surface of the walls of the distal portion of the penis which appears to be almost entirely covered with papillae which fuse to form pleats immediately before reaching the genital atrium, some of these papillae appear to have a sharply pointed tip ending in a small thorn; rare papillae with thorns which also seem to be present on the inner surface of the walls of the proximal portion of the penis; the body which has a more diffuse blue-greyish pigmentation and a sole with a central whitish portion and lateral bluish portions.

▶

Fig. 6A. *O. (Schistophallus) carotii* (PAULUCCI). Distribution on UTM map plotted on 20 × 20 kilometre squares.

6B. *O. (Morlina) glaber ercicus* (BENOIT). Distribution on UTM map plotted on 20 × 20 kilometre squares, on the basis of personal data and reports in literature (BENOIT 1859, ADAMI 1873, PAULUCCI 1879, WESTERLUND 1889, DEGNER 1927, RIEDEL 1969).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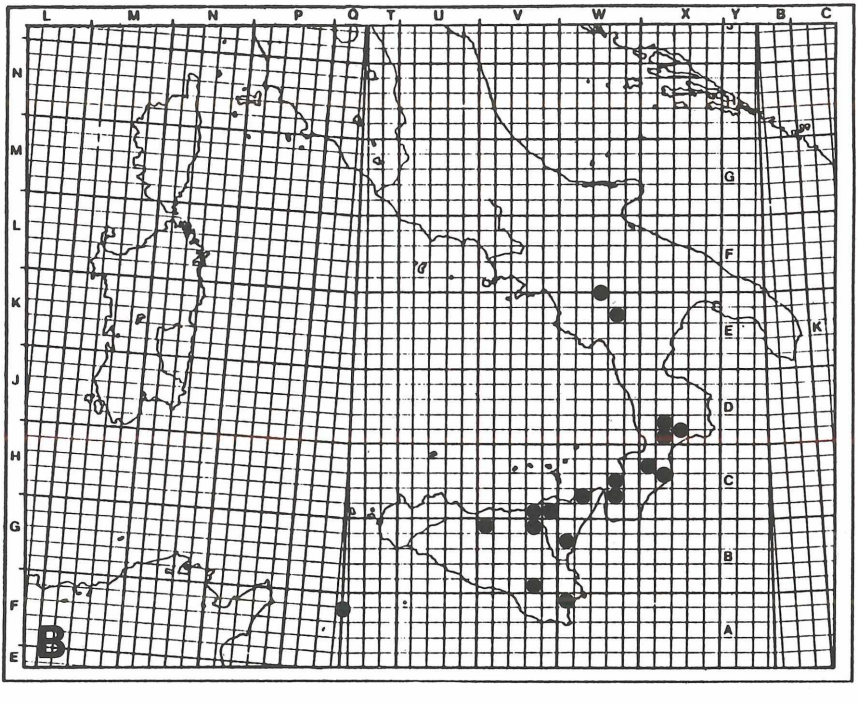
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O. (S.) duboisi (MOUSSON 1863) from W-Transkaukasia, *O. (S.) elegans* (O. BOETTGER 1881) from Talysh Mts. and N-Iran, *O. (S.) horsti* (O. BOETTGER 1892) from W-Kaukasus and W-Ciskaukasia, *O. (S.) moussoni* (KOBELT 1878) from Bulgaria and European Turkey, and *O. (S.) sucinacius* (O. BOETTGER 1883) from Kaukasus and Transkaukasia (see RIEDEL 1959, 1966, 1972) are very similar in the general shape of the genital duct but different in the small details of the vaginal complex and penis.

O. (S.) hyrcanus RIEDEL 1981 from N-Iran, *O. (S.) imperator* RIEDEL 1966 from W-Transkaukasia, *O. (S.) minoicus* RIEDEL 1968 from Crete and *O. (S.) suaneticus* (O. BOETTGER 1883) from Kaukasus (see RIEDEL 1966, 1968, 1981) are more differentiated by virtue of peculiar penis structure or the different extension of the vaginal gland or the position of the bursa copulatrix duct in the vagina.

Unfortunately spirit specimens of these species are very rare and a more detailed comparison of the inner sculpture of penial walls, in particular, was impossible.

Zoogeographical Notes: Subgenus *Schistophallus* occurs over a wide area comprising not only Southern Italy (Calabria) but also the south of the Balkan Peninsula (Greece, Bulgaria and Rumania), many islands of the Aegean Sea including Crete, Turkey, the Black Sea coasts, Crimea, Caucasus and Transcaucasia and north Iran (RIEDEL 1980, 1983).

It thus appears to be a palaeoaegeic taxon with trans-ionic diffusion (LA GRECA 1962).

Its prevalence in the southern Aegeis (RIEDEL 1969a, 1979) suggests that it originated here (somewhere in the Caucasus – Asia Minor according to RIEDEL 1969a) and then spread along the Black Sea coasts to Europe and the Greek islands. This process may have been facilitated by the drying out of the trans-aegean trench and the Mediterranean during the Messinian (Upper Miocene), events which also caused the fusion of South and North Aegeis (see RIEDEL 1969a, 1979). It is possible that in this period some *Schistophallus* of the *samius* group of forms reached also southern Italy, later spreading as far as the woods of Calabrian Apennines and here undergoing a process of differentiation which gave rise to *O. (S.) carotii.* As many elements of Southern Italian fauna are of analogous distribution, this explanation appears feasible, although the ancestors of *carotii* might have reached Italy by passive transport by man in historical times (but this hypothesis seems to us very improbable).

Ecological Notes: Almost all the live specimens found came from woody areas. Typical *carotii* specimens from the slopes of Mt. Pegoraro near Mongiana, were found under a thick layer of litter or in heaps of stones in mixed (*Fagus* and *Abies*) woods. Specimens corresponding to *Hyalina fragrans* were found in subterranean cavities of dry walls in *Castanea* woods.

In the new locality, Sorbo di Calabria, in which we found fresh shell materials the wood consisted mainly of *Quercus.*

Two smaller shells (Fig. 7A-B) possibly belonging to a *Schistophallus* species were found on the slopes of Mt. Consolino, a small calcareous mountain in eastern Calabria, almost completely lacking arboreal covering. If our diagnosis proves right, they will constitute a population of *carotii* adapted to dry places and probably living in subterranean microcavities.

Young specimens were kept in our laboratory until adulthood. We were thus able to verify that they are carnivorous and feed on any kind of small helicids (*Hygromia*, *Cernuella*, etc.).

Oxychilus (Morlina) glaber ercicus (BENOIT).

Helix ercica BENOIT 1859; Ill. Test. Sicilia: 157 [nomen novum pro *Helix glaberrima* BENOIT 1859, homonym with *Helix glaberrima* PFEIFFER 1854, Proc. zool. Soc. London, 1854: 52; published as a synonym of *H. glaberrima* and available according to the Art. 11e of ICZN (1985)].

Helix glaberrima BENOIT 1859; Ill. Test. Sicilia: 157. Locus typicus: Monti delle Caronie, Sicilia.

Helix ercica, — PFEIFFER 1868; Mon. Helic. viv., **5:** 472.

Hyalinia glaberrima, — KOBELT 1871; Cat. Binnenconch.: 5 [non PFEIFFER 1854].

? *Hyalina glabra*, — ADAMI 1873; Atti Soc. veneto-trent. Sci. nat., **2:** 27 [non ROSSMÄSSLER 1835].

Helix glaberrima, — BENOIT 1875; Bull. Soc. malac. it., **1:** 139 [non PFEIFFER 1854].

Hyalinia ercica, — WESTERLUND 1876; Fauna europ. Moll. extram., **1:** 20.

Hyalina (Hyalina) ercica, — PAULUCCI 1878; Mat. Faune malac. Italie: 2.

Hyalinia ercica, — PAULUCCI 1879; Fauna malac. Calabria: 45-47, Pl. 1 fig. 3.

Helix glaberrima, — BENOIT 1882; Nuov. Catal. conch. terr. fluv. Sicilia: 70.

Hyalinia (Polita) nitidissima var. *eucharis* WESTERLUND 1886; Fauna, **1:** 52. Locus typicus: "Italien b. Balvano" [cfr. RIEDEL 1969b: 96].

Hyalinia (Polita) glaberrima, — WESTERLUND 1886; Fauna, **1:** 52.

Polita glabra, — DEGNER 1927; Mitt. zool. Inst. Mus. Hamburg, **43:** 52 [non ROSSMÄSSLER 1835].

Oxychilus (Morlina) glaber ercicus, — FORCART 1965; Verh. naturf. Ges. Basel, **76:** 102-103.

Oxychilus (Morlina) glaber ercicus, — RIEDEL 1969b; Ann. zool. Warszawa, **27:** 95-96, fig. 1-2, map. 1.

Oxychilus (Morlina) glaberrimus, — ALZONA 1971; Atti Soc. it. Sci. nat. Museo civ. St. nat. Milano, **111:** 129.

Oxychilus (Morlina) glaber ercicus, — RIEDEL 1980; Genera Zonitidarum: 10B.

Description: Adult specimens in motion measure 15-20 mm ca. from the snout to the posterior tip of the foot. Most of the body surface, sole included, is light yellow in colour; the upper portion of snout, tentacles, neck up to the margin of the mantle and the posterior part of body are cobalt-blue of varying intensity. The sole is tripartite and uniformly pale in colour.

The shells personally collected by us and those from Vizzini, (Catania, Sicily) and Mt Tiriolo (Catanzaro, Calabria) in the DI MARIA DI MONTEROSATO Collection exactly correspond to those described in the literature (PAULUCCI 1879: Pl. 1 fig. 3).

The shell (Fig. 7C-F) is small, thin, translucent, glossy, brownish-yellow above, yellowish-white below; spire formed by 5-5½ convex, regularly enlarging whorls; the last is somewhat angled at the periphery; mouth ample, oval in shape with a thin and non-reflected peristome; umbilicus very small, 1/12-1/13 of the maximum shell diameter, deep.

Dimensions: shell max. diam. = 12-13 mm; shell max. height = 5·5-7·7; mouth max. diam. = 5·4-7·2 mm; mouth max. height = 4·4-5·5 mm.

The genital duct of the Calabrian (Figs. 8D-F, 9A-E) and Sicilian specimens (Figs. 8A-C) appears to be constituted by an hermaphrodite gonad placed amongst

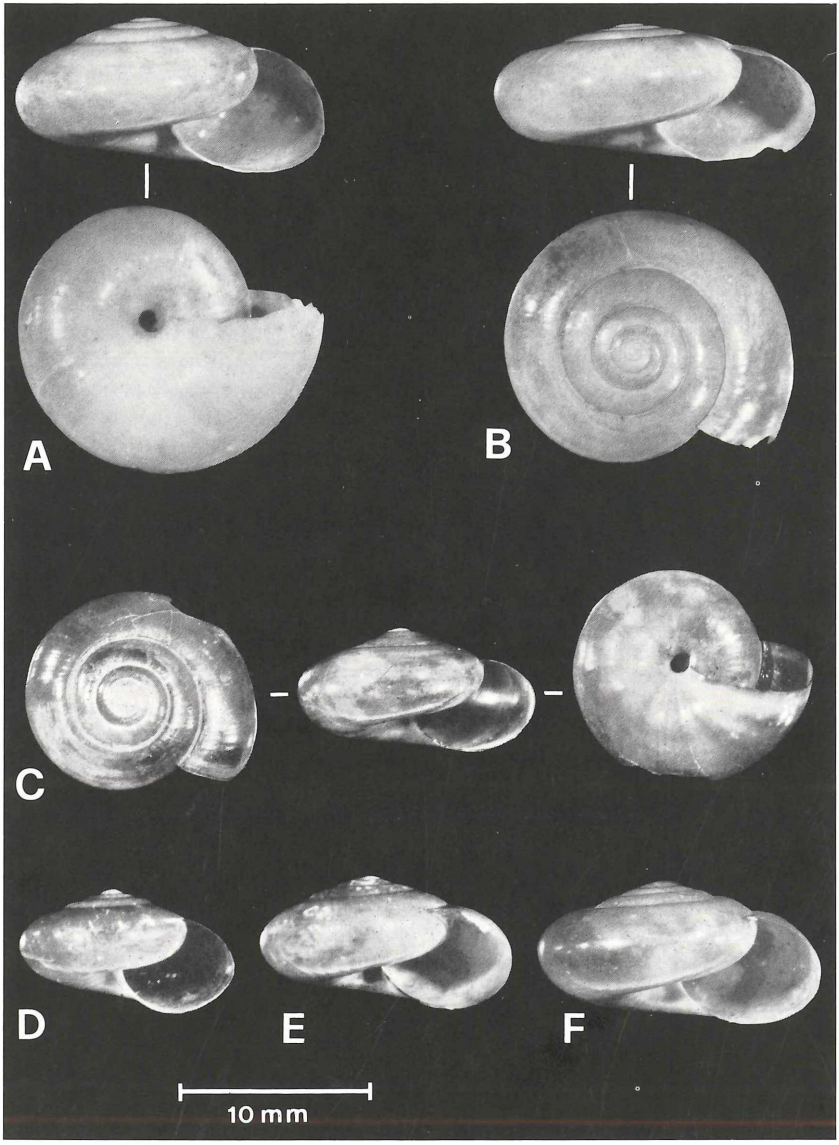


Fig. 7. A-B) *Oxychilus* sp.; C-F) *O. (Morlina) glaber ercicus* (Benoit). — A-B) These shells were collected on Mt. Consolino (Calabria) and appear possibly to correspond to a small sized population of *carotii* [GCUS]. C-E) some shells of *glaber ercicus* from Sicilian localities: C) Vizzini (Ragusa) [GCUS], D) Island of Pantelleria, near loc. Cufarì [GCUS], E) Santa Venerina, near Monacella di sotto (Catania) [GCUS]. F) A shell from Mt. Tiriolo (Calabria) [MCZR].

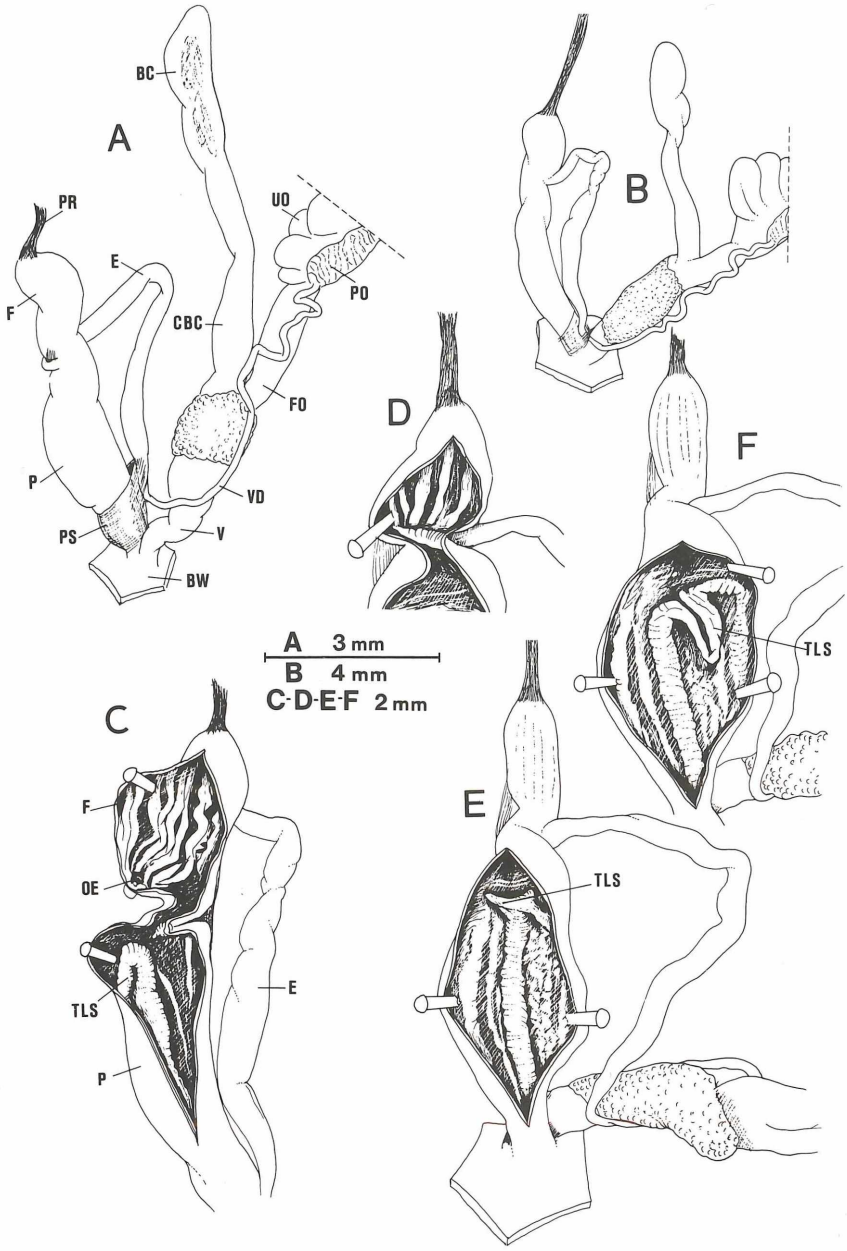


Fig. 8. *O. (Morlina) glaber ercicus* (Benoit). Genital duct (A-B) and inner structure of the flagellum and the penis (C-F) in specimens from the Island of Pantelleria (A), Noto Antica (near Cava del Carosello, Siracusa) (B-C), Grotta di Tremisi (Melia, Calabria) (D-F). — For explanation of the symbols see Fig. 3.

the lobes of the digestive gland. A first hermaphrodite duct originates in the gonad, usually full of sperm and thus functioning as a seminal vesicle. The first hermaphrodite duct ends in a talon (fecundation chamber + seminal receptacle complex) on the inner side of the basal portion of a bean-shaped albumen gland. The second hermaphrodite duct (ovispermiduct) follows on from the albumen gland and consists of a well developed and multilobate uterine portion and a prostatic portion. A short uterine canal (free oviduct) joins the uterine portion of the ovispermiduct to the vagina. The vagina walls are encircled at half the length of the vagina by the glandular sheath of the vaginal gland. The glandular sheath does not extend as far as the base of the vagina where the uterine canal ends and the bursa copulatrix duct begins. The bursa copulatrix duct is of varying length and width and ends in the bursa copulatrix (gametolytic gland) which has an elongated, sac-like or pear-like appearance. The bursa copulatrix is usually as long as its duct. A thin vas deferens arises at the distal end of the prostatic portion of the ovispermiduct and flanks the vagina to end in the epiphallus. The point of passage between vas deferens and epiphallus is ensheathed by a portion of the short guaina which envelops, the distal portion of the penis. The epiphallus is long and slender and forms a loop to end in the proximal portion of the penis. In so doing it allows the portion of the penis which is usually called the flagellum to be distinguished; the penial retractor muscle is inserted at the tip of the flagellum. The proximal portion of the penis is not easily distinguishable from the distal part. Sometimes a slight narrowing seems to divide the two. The distal portion of the penis ends in the genital atrium along side the vagina. Internally, the walls of the flagellum and the proximal portion of the penis show a series of pleats, sometimes branched, which run laterally to the point of entry of the epiphallus into the penis. To the narrowing apparently dividing the short penis proximal portion from the longer penis distal portion corresponds internally a sort of incomplete ring in which end the numerous pleats of the inner surface of the penis proximal and distal portions. The penis distal portion is internally characterized by two wide idented crests, one larger than the other, which begin near the penis atrium and run toward the ring dividing the penis proximal and distal portions. Where the two crests join there is a sort of tongue-like structure, which is usually pointed and bent upon itself. When the penis is everted this tongue-like structure corresponds to the pointed apex which overhangs the penial opening.

The radula (Fig. 11C-D, G-H), studied in two Calabrian specimens collected in the Melia Cave (Aspromonte, Calabria), appears to correspond perfectly with that of northern Italian specimens of *O. (M.) glaber glaber* (Fig. 11A-B, E-F). It consists of many rows of 29 teeth according to the formula:

$$\frac{23}{1}+\frac{1}{2}+\frac{4}{3}+\frac{C}{3}+\frac{4}{3}+\frac{1}{2}+\frac{23}{1}$$

The central tooth has a short basal plate and a small body bearing three cusps: a short and sharp mesocone and two small ectocones. The first lateral teeth have a rather short body provided with a sharp mesocone, a short robust endocone and a short wide ectocone. The latter is situated on the external side of the tooth below the endocone, near the base of the tooth body. The lateral-marginal teeth have a slender arched body capped by a mesocone on the inner side of which the vestiges of an endocone may be discerned. The marginal teeth, progressively smaller as we move toward the radula margin, are arched and slender and end in a single sharp point.

Material examined: Sicily: San Polo, near Vizzini (Catania), 3 sps. [ex Paulucci Coll., GCUS]. Vizzini (Catania), 3 sps. [ex Di Maria di Monterosato Coll., GCUS]. Madonie Mountains, Piano, 1200 m, B. Battaglia & G. Gardini leg. 7.10. 1979, 3 sps.

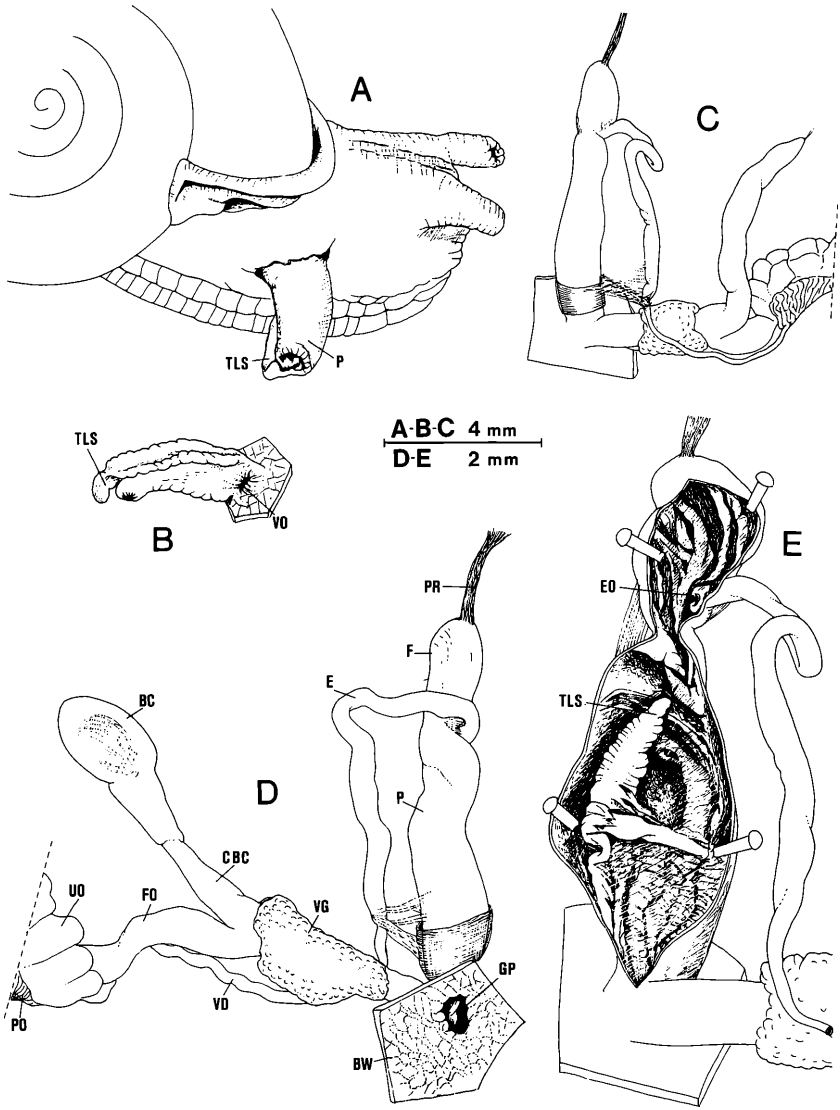


Fig. 9. *O. (Morlina) glaber ercicus* (Benoit) from Grotta di Tremisi (Melia, Calabria). A) The anterior portion of the body; note the everted penis and the right side of the mantle edge. B) An isolated everted penis. C-D) Two genital ducts. E) The penis and the flagellum have been opened to show their inner structure. — For explanation of the symbols see Fig. 3.

[GCUS]. Nebrodi Mountains, Mt. Soro, 15.-19. 9. 1981, 6 sps. [GCUS]. Noto Antica (Siracusa), R. GRASSO leg. 5. 3. 1985, 1 sp. [GCUS]. Santa Lucia del Mela, Vallone Mandrazza (Messina), R. GRASSO leg. 7. 12. 1986, n. sps. [GCUS]. Near Monacella di Sotto (Santa Venerina, Catania), R. GRASSO leg. 11. 12. 1983, 8. 10. 1986, n. sps. [GCUS, SMF]. Island of Pantelleria, near Cufari, D. CARUSO leg. 7. 12. 1986, 1 sp. [GCUS].

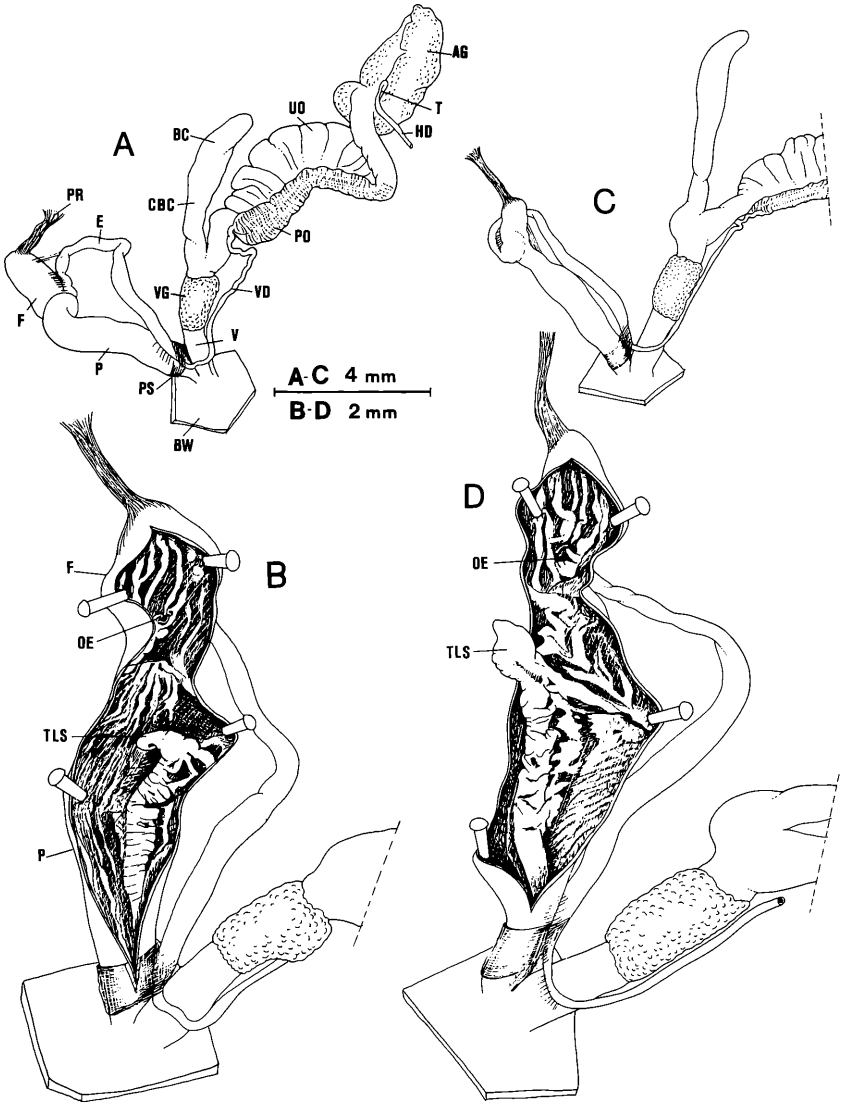


Fig. 10. *O. (Morlina) glaber glaber* (ROSSMÄSSLER) from Novalese, Val di Susa (Turin, Italy). A, C) Two genital ducts. B, D) The penis and the flagellum have been opened to show their inner structure. — For explanation of the symbols see Fig. 3.

Calabria: Mt. Tiriolo (Catanzaro), 2 sps. [Di Maria di Monterosato Coll., MCZR]. Near Melia (Reggio Calabria), 16.9. 1984, 12.10. 1986, n. sps. [GCUS, SMF]. Certosa di Serra San Bruno (Catanzaro), 17.9. 1984, 1 sp. [GCUS]. Mt. Consolino (Reggio Calabria), 17.9. 1984, 1 sp. [GCUS].

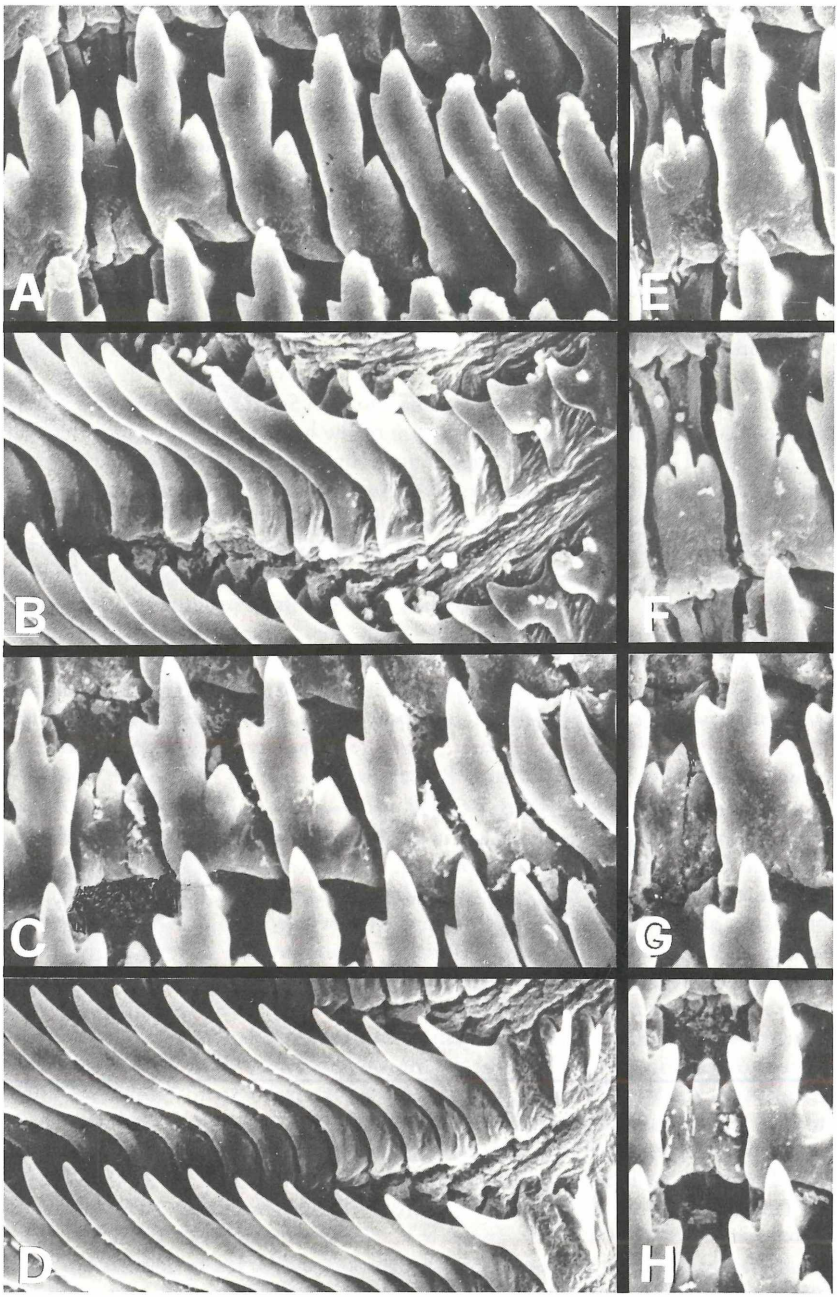
Basilicata: Tramutola near Risorgenza dell'Aquila, V. Sbordoni leg. 9.4. 1970, 1 sp. [GCUS]. Tramutola, Risorgenza dell'Aquila, V. Vomero leg. 21.11. 1970, 1 sp. [GCUS].

Taxonomical Notes: The Calabrian and Sicilian specimens belonging to *O. (M.) glaber ercicus* (Benoit) studied are not easily distinguished from those belonging to the nominotypical subspecies, *glaber glaber* (Rossmässler) from northern Italy.

The shell shape and dimensions of the Calabrian and Sicilian specimens (Fig. 7C-F) frequently coincide with those of specimens collected from Piedmont or other alpine sites. The same is true of genital duct anatomy not only in its general outline but also in the sculpture of the inner walls of the penial complex (see Fig. 8-9 and Fig. 10).

The only feature which seems peculiar to the Southern Italian and Sicilian specimens consists in the paler pigmentation of the body and in the almost entirely pale foot-sole. However this character is not proper of *glaber ercicus,* it is also one of the peculiarities of *glaber striarius* (Westerlund 1881), a subspecies known in eastern Europe from Poland to Romania and Bulgaria (Riedel 1969b). For the moment we have decided not to change the systematic status of the present taxon. However, in order to establish in a more precise way the single levels of morphological diversification, it is absolutely necessary to reexamine the entire group of *glaber* subspecies (*glaber glaber* Rossmässler 1835, loc. typ.: France, Mountains of Bugey, near Colombier; *glaber nitidissimus* Mousson 1859, loc. typ.: Greece, Epirus; *glaber ercicus* Benoit 1859, loc. typ.: Island of Sicily, Caronie Mountains; *glaber striarius* Westerlund 1881, loc. typ. restr.: Rumania, Michelsberg near Hermannstadt (= Sibiu); *glaber harlei* Fagot 1884, loc. typ.: Spain, San Gar Cave, in the Mountains of Montserrat near Barcelona).

Zoogeographical Notes: *O. (M.) glaber* appears to be completely absent in the Apennines from western Liguria to Basilicata (Riedel 1969b). Suddenly it appears in Basilicata and in central southern Calabria and extends to Sicily, particularly the eastern sector. There is an immediate explanation of this strange distribution. The Calabro-Peloritan Massif (at present corresponding to Aspromonte and the Sila in Calabria and to the Peloritani Mountains in eastern Sicily) was a microplate of Alpidic origin. This microplate fused to the Sardo-Corsican complex which migrated away from the southern flank of the Palaeoeuropean Continent, during the Oligocene or Lower Miocene, until Sardinia and Corsica attained their present position (in the Tortonian or the Messinian). Then, in the Tortonian or post-Tortonian the Calabro-Peloritan Massif detached from the Sardo-Corsican complex and migrated towards the south-east. The Tyrrhenian Basin gradually opened and the Calabro-Peloritan Massif was pushed toward its present position (Alvarez 1972; Radicati di Brozolo & Giglia 1973; Alvarez et al. 1974; Giusti 1976, 1977; Mantovani et al. 1981, 1982; Giusti & Castagnolo 1983; Giusti & Manganelli 1984). One can argue that *glaber* was present in the southern European Alpidic Chain since Oligocene times, before the above drifting phenomenon began and that it survived on the moving microplates until they reached their present location in central-southern Calabria and eastern Sicily. The differentiation


A
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into the peculiar form, *glaber ercicus,* could have happened during this same period or later on in the Sicilian or in the Calabrian sectors. In the latter case, the diffusion from one to the other locality might have happened during one of the Quaternary ages thanks to the lowering of the sea level (a similar case has been discussed by MANGANELLI & GIUSTI 1989). Any other explanation seems to us less possible. If *O. glaber* was pushed all along the Apennines to extreme southern Italy during one of the Quaternary glaciations, how can the total absence of the species from the entire central and northern Apennine chain be explained? It also seems unrealistic to advance an hypothesis analogous to that proposed for *O. (S.) carotii,* i. e. that it came from the southern Balkan peninsula. Its distribution (see RIEDEL 1969b: map 1) and its ecology seem to suggest that it is certainly not of palaeoaegeic origin but, rather, of central European origin, diffused southwards in more recent times (Pleistocene ?).

At this point prudence also suggests the possibility of passive transport by man, as suggested by the presence of a population in the Island of Pantelleria (Sicilian Channel). Nevertheless it is difficult to prefer such a simplistic explanation when present distribution data are clearly compatible with an historic explanation based on proved geological evidence.

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Fig. 11. The radula of *O. (Morlina) glaber glaber* (ROSSMÄSSLER) in specimens from Novalese, Val di Susa (Turin, Italy) (A-B, E-F) and of *O. (Morlina) glaber ercicus* (BENOIT) in specimens from Grotta di Tremisi (Melia, Calabria) (C-D, G-H). A, C) the central tooth and the lateral, lateromarginal and first marginal teeth. B, D) The extreme marginal teeth. E-H) The central and the first lateral teeth.

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