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First contribution to the revision of the *Oxychilus*-species living in the Italian Apennine regions: *Zonites uziellii* Issel

(Pulmonata: Zonitidae).*)

By

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With 6 figures.

Abstract: The authors have initiated a revision of the genus *Oxychilus* in the Apennine regions of Italy with the study of one of its oldest species: *"Zonites" uziellii* Issel 1872.

Introduction.

One of the most interesting but least known groups of the Apennine region malacofauna is found in the genus *Oxychilus*. In the past, authors have described numerous species as being new, on the sole basis of the shell morphology. For various reasons (inadequate and insufficient descriptions, loss of original materials, splitting tendency of many authors) they are easily misinterpreted.

Recent anatomical studies have demonstrated a remarkable variability in the shell dimensions and form within single populations of the same species, due perhaps to environmental and/or evolutive factors (Giusti 1973, 1976). In reference to the Apuan Alps malacofauna, Giusti & Mazzini (1970) indicated the disordered state of the systematics of this genus as well as the disagreement between their conclusions and those of Forcart (1967). However, in view of the impossibility of reaching valid conclusions in the absence of documentation, they delayed the problem for future solution.

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The discovery of part of the original specimens of *"Zonites" uziellii* ISSEL in the PAULUCCI Collection in Florence[1] and the finding of living specimens in the provinces of Siena and Grosseto now offer a perfect opportunity to re-examining the subject. *"Zonites" uziellii* ISSEL is, infact, the oldest name available for the Tuscan *Oxychilus*. A definition of the species therefore constitutes the necessary pre-requisite for any further studies of the many taxa of this region described and cited in the past.

ALZONA (1971) until 1961 listed the following *Oxychilus* for continental Tuscany: *blauneri* (SHUTTLEWORTH), *blauneri cloacarum* (WESTERLUND), *cellarius* (MÜLLER), *draparnaudi* (BECK), *guidonii* (DE STEFANI), *hydatinus* (ROSSMÄSSLER), *isselianus* (PAULUCCI), *libysonis* (PAULUCCI), *majori* (WESTERLUND), *meridionalis* (PAULUCCI), *silvicola* (WESTERLUND), *scotophilus* (DE STEFANI), *scotophilus dilatatus* (WESTERLUND), *scotophilus nothus* (WESTERLUND), *uziellii* (ISSEL). From this list only *O. (Morlina) glaber* (ROSSMÄSSLER) has been removed, being limitated to prealpine and alpine northern Italy and probably cited by error. The more recent entries include: *lanzai* FORCART, *obscuratus* (VILLA & VILLA), *porroi* (PAULUCCI) (FORCART 1967, 1968); *forcartianus* GIUSTI, *tongiorgii* GIUSTI 1969a); *alliarius* (MILLER) (GIUSTI 1969b); *mortilleti* (PFEIFFER) (GIUSTI & MAZZINI 1970).

Historical notes.

"Zonites" uziellii was described by ISSEL in 1872 on the basis of three specimens gathered by UZIELLI on Gombo Beach near San Rossore (Pisa). BONELLI (1873) reported it under the name of *Hyalina villae* (non DE MORTILLET in STROBEL 1853) in province of Siena: in Southern Chianti (in the debris of the Arbia stream) and in the Sienese Montagnola. DE STEFANI (1875), although unsure of its validity reported it in Garfagnana, near Barga and Pieve Fosciana. PAULUCCI (1878, 1879), after searching in vain in these last localities and suspicious of DE STEFANI's uncertainty, gave only a dubious acknowledgement of the presence in Garfagnana while was able to clearly identify the presence of the species near San Gimignano (Siena). Slightly miffed, DE STEFANI(1879, 1883) insisted on the correctness of his determinations and pointed out that his specimens resembled *"Helix" denatalei* PFEIFFER 1856, endemic in the Marettimo Island (Sicily). DE STEFANI (1879) also includes *"Hyalina" regnolii* in the *"Zonites" uziellii* group of forms, the former being reported by him in post-Pliocene deposits at Mount Pisano (Pisa). Unfortunately the loss of materials impedes any verification. WESTERLUND (1886), after first having treated *"Helix" denatalei* as a separate species (:47), later on referred to Sicilian specimens of this species cited by ROSSMÄSSLER (1859) as *"Zonites" uziellii* (:58). At the time, the combination of these species seemed justified as the forms of their shell are very similar. Examination of the structures of the soft parts, however, removes any doubt as they are decidedly different (cfr. RIEDEL 1973).

Many years later, FORCART (1967) in re-adressing the controversy, considers ISSEL's species as a younger synonym of *"Helix" obscurata* VILLA & VILLA 1841.

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[1] Our thanks to Prof. BETTINO LANZA, Director of the Zoology Museum of the University of Florence.

This conclusion was subsequently refuted by GIUSTI & MAZZINI (1970), because the name *"Helix" obscurata* should be reserved solely for a species of *Oxychilus* found in Corsica, as established by the first revisor PAULUCCI (1882). Moreover, the species that FORCART (1967) designated as *O. (Ortizius) obscuratus* not only differs conchologically from the true *"Zonites" uziellii* ISSEL, but also anatomically resembles topotypical specimens of a species often reported in Tuscany and called *"Hyalina" meridionalis* PAULUCCI (1881). The latter, apparently displaying great variability in its shell form and dimensions, should be carefully reviewed. We can presume, however, that its affinity with *"Zonites" uziellii,* that seems evident in some populations, will be refuted.

Oxychilus (? Ortizius) uziellii (ISSEL).

Zonites uziellii ISSEL 1872; Atti Soc. it. Sci. nat. Milano, **15**: 60.
Hyalina villae, — BONELLI 1873; Atti Soc. it. Soc. nat. Milano, **15**: 403 [non DE MORTILLET in STROBEL 1853].
? *Zonites uzielli* [sic!], — DE STEFANI 1875; Bull. Soc. malac. it., **1**: 42.
Helix uziellii, — PFEIFFER 1876; Monographia Heliceorum viventium, **7**: 183.
Hyalina (s. str.) *uziellii,* — PAULUCCI 1878; Mat. faune malac. Italie: 2.
Hyalina uziellii, — DE STEFANI 1879; Bull. Soc. malac. it., **5**: 67. [? partim].
Hyalinia (s. str.) *uziellii,* — DE STEFANI 1883; Bull. Soc. malac. it., **9**: 36 [? partim].
Hyalinia (Polita) uziellii, — WESTERLUND 1886; Fauna, **1**: 58 [partim].
Oxychilus (Ortizius) obscuratus, — FORCART 1967; Arch. Moll., **96** (3/6): 115 [partim, non VILLA & VILLA 1841].
Oxychilus (Ortizius) obscuratus, — FORCART 1968; Ann. Mus. civ. St. nat. Genova, **77**: 87 [partim, non VILLA & VILLA 1841].
Oxychilus (s. str.) cfr. *uziellii,* — GIUSTI & MAZZINI 1970; Lav. Soc. it. Biogeogr., (N. S.) **1**: 259 [? partim].
Oxychilus (s. str.) *uziellii,* — ALZONA 1971; Atti Soc. it. Sci. nat. Mus. Civ. St. nat. Milano, **111**: 127 [? partim].
Oxychilus (s. str.) *uziellii,* — RIEDEL 1980. Genera Zonitidarum: 99.

Description: The animal's back and tentacles are slate-coloured, its sides light grey; the foot is tripartite, the sides of the sole and the caudal apex are slate-coloured, the central stripe colourless.

The fragile shell (Fig. 3A-B, D-F; 4A-D) is of average size, subdiscoid, and depressed, superiorly convex and tectiform, although sometimes flat; inferiorly flat at the sides, funnel-shaped at the centre. The umbilicus (circa ¼-⅕ of maximum diameter) is wide and deep so that it is possible to see the entire unwinding of the spire. The spire is composed of 5½-6¼ whorls, growing slowly and regularly, separated by evident sutures. The last whorl, undilated, descending, has a sort of carena at the base. The opening is narrow, slightly oblique and subtriangular. The peristome is simple, unreflected, with a wavy outline. The fresh shell is fairly shiny, horn-yellow, with many evident radial stripes.

The structure of the genital apparatus follows the typical *Oxychilus* scheme (Fig. 1A-D, 2A-C). The hermaphrodite gonad is connected by a first hermaphrodite duct, initially narrow and twining, to the "talon" (= fertilization chamber and seminal receptacles), followed by an albumen gland and a second hermaphrodite duct (= ovispermiduct). The latter has a well-developed uterine part that is

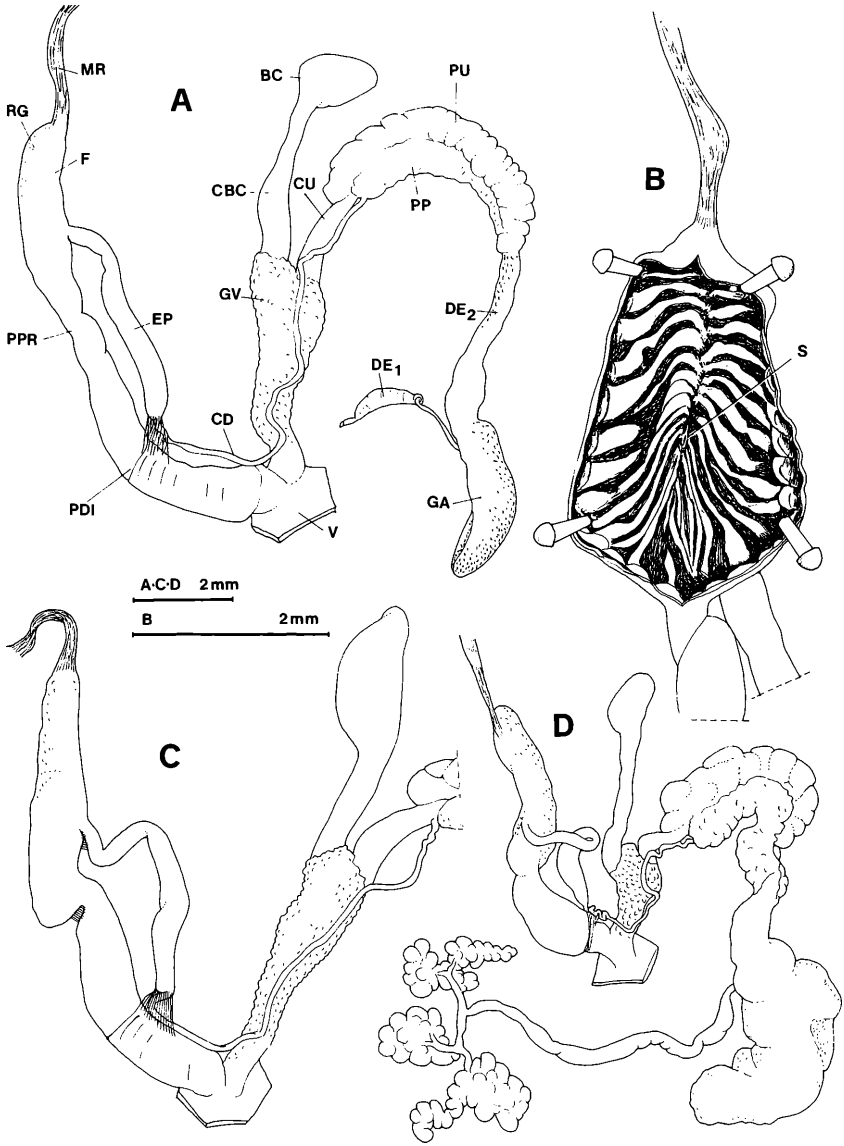


Fig. 1. *Oxychilus* (? *Ortizius*) *uziellii* (Issel). Genital ducts and inner structure of the penis. A-B) Gerfalco (GR); C) San Giusto in Salcio (Gaiole in Chianti, SI); D) Le Fonti (San Gimignano, SI). — BC bursa copulatrix (= gametolytic gland), CBC duct of the bursa copulatrix, CD vas deferens, CU uterine duct (= free ovispermiduct), DE_1 first hermaphrodite duct, DE_2 second hermaphrodite duct (= ovispermiduct), EP epiphallus, F flagellum, GA albumen gland, GV vaginal gland, MR penial retractor, PDI distal portion of the penis, PP prostatic portion of the ovispermiduct, PPR proximal portion of the penis, PU uterine portion of the ovispermiduct, RG glandular covering, S epiphallus opening, V body wall.

thickened and multilobate and a shorter prostatic section. A fairly long uterine duct (= free oviduct) originates from the uterine part and leads to the vagina. A vaginal gland envelops the base of the bursa copulatrix canal and most of the length of the vagina. At the base of the vaginal gland, beside the uterine duct, a wide canal leads to an ample bursa copulatrix (= gametolytic gland). The internal surface of the bursa's duct is traversed by thin longitudinal folds, and that of the vagina by sparse papillae. A thin vas deferens, attached to the sheath of the distal part of the penis by means of connective tissue extensions, originates from the prostatic section of the ovispermiduct and finishes as a well-developed epiphallus. The epiphallus empties into the base of the proximal portion of the penis, individualizing a conspicuous flagellum. The retractor muscle of the penis is inserted in the apex of the latter. The proximal portion of the penis is rather short, but its actual length is not easily defined as there is no clear zone of demarcation that distinguishes it from the distal portion. Part of the external flagellar surface is covered by a not very evident spongy glandular tissue. The internal surface of the flagellum and of the proximal part of the penis is traversed by two pleat systems. One, horizontal and/or slightly inclined, encircles the distal opening of the epiphallus and a kind of double longitudinal cordon which originates from the opposite part. The other, constituted by thinner pleats, has a perpendicular course with respect to the opening of the epiphallus and terminates at the beginning of the distal part of the penis. The inner walls of the latter appear smooth in young specimens whilst appear corrugated, particularly in close proximity to the atrium, in fully developed specimens.

The radula (Fig. 5A-C) is constituted by numerous lines of teeth distributed according to the following formula:

12-13M	1LM	2L	C	2L	1LM	12-13M
1	2	3	3	3	2	1

The central tooth of each file is formed by a wide plate providing the base for a thin, pointed mesocone, flanked by two short ectocones. On each side of the central tooth there are two lateral tricuspid teeth, a lateral bicuspid tooth and a series of marginal monocuspid teeth in descending order of size.

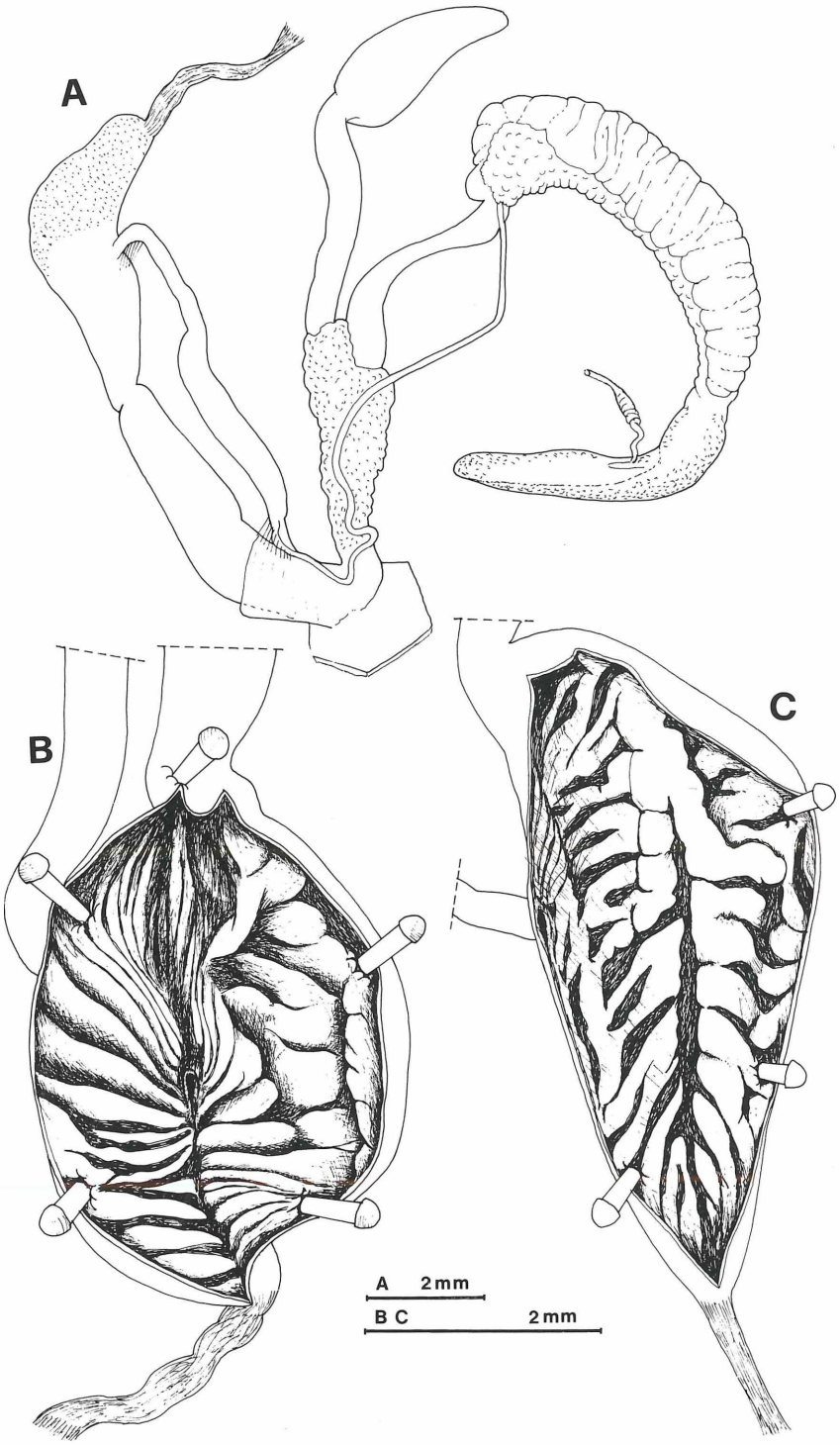
Shell dimensions: height = 4·5-6·0 mm; maximum diameter = 9·6-12·5 mm; aperture diameter = 4·4-5·4 mm; aperture height = 3·4-4·4 mm; umbilicus diameter = 2·0-2·9 mm.

Dimensions of the genital apparatus: uterine duct = 1·1-4·0 mm; bursa copulatrix + its ducts = 3·5-7·5 mm; vagina 1·9-3·75 mm; flagellum = 2·4-3·2 mm; distal part + proximal part of penis = 3·1-7·5 mm.

Typical materials: In the PAULUCCI Collection in Florence there is a container with two of the three original specimens (ZMF 0689). These were probably restituited by ISSEL to UZIELLI who later gave them to PAULUCCI who distinguished them as "Typo", as indicated by the original label, reproduced in Fig. 3C.

Lectotypus (Fig. 3A): chosen from the two syntypi. The remaining syntypus consequently has the status of Paralectotypus (Fig. 3B).

Locus typicus: The original specimens were gathered from the debris scattered along the coast opposite Gombo near Pisa. As noted by PAULUCCI (1878) this locality is effectively the landing point for material flowing from numerous streams or rivers that terminate in that zone. Gombo therefore does not exactly have the proper requisite of a locus typicus, and personal research excludes decisively at the present, that *O.* (*?Ortizius*) *uziellii* colonizes the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A 2mm
B C 2mm

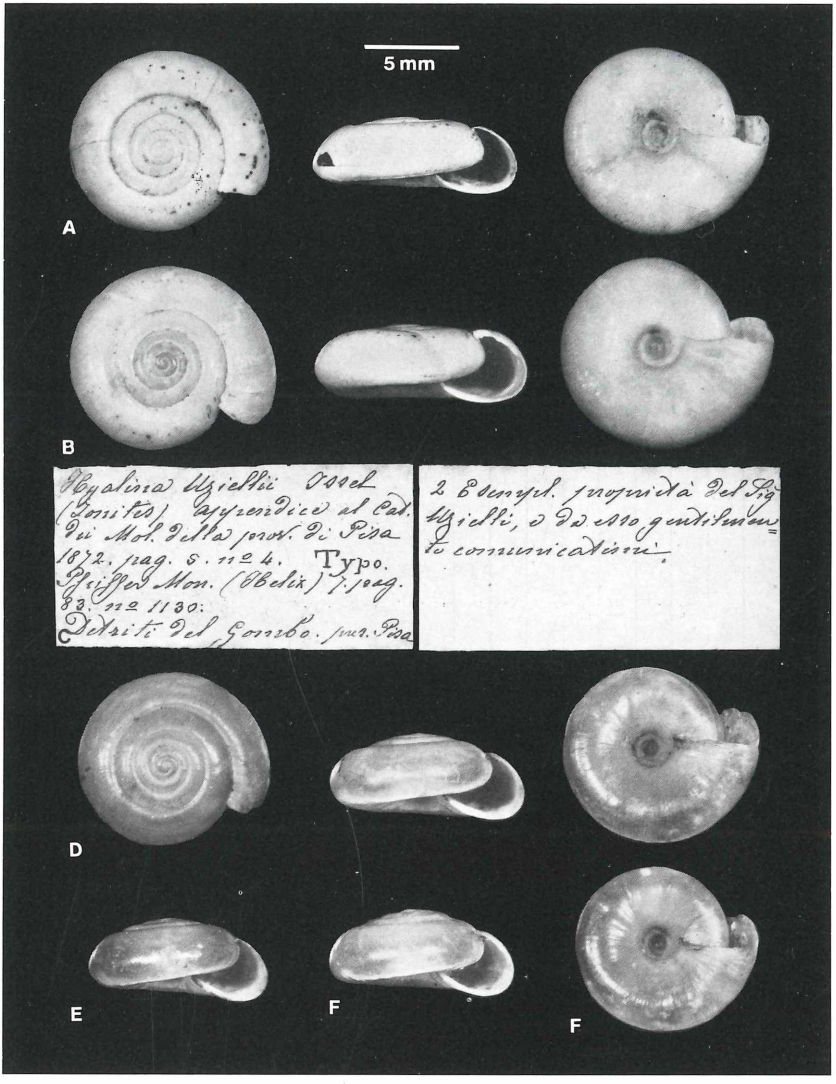


Fig. 3. *Oxychilus* (? *Ortizius*) *uziellii* (Issel). Specimens of Paulucci Collection. A) Lectotypus, Gombo debris near Pisa, Uzielli leg., ZMF 0689; B) Paralectotypus, Gombo debris near Pisa, Uzielli leg., ZMF 0689; C) original label of the syntypes: "*Hyalina Uziellii* Issel (*Zonites*)-Appendix to the Catalogue of the Mollusca collected in the Pisa province, 1872, pag. 5, n° 4, Typo. Pfeiffer Mon. (*Helix*) 7 pag. 83. n° 1130. Gombo debris near Pisa. 2 specimens belonging to Mr. Uzielli and gently presented to me." D-F) three specimens gathered near "Le Fonti" (San Gimignano, SI) Paulucci leg., ZMF 0692.

◀ Fig. 2. *Oxychilus* (? *Ortizius*) *uziellii* (Issel). Genital duct and inner structure of the proximal portion of the penis and of the flagellum seen from the side opposite to that where epiphallus ends (B) and viceversa (C). A-C) San Giusto in Salcio (Gaiole in Chianti, SI). Symbols as in Fig. 1.

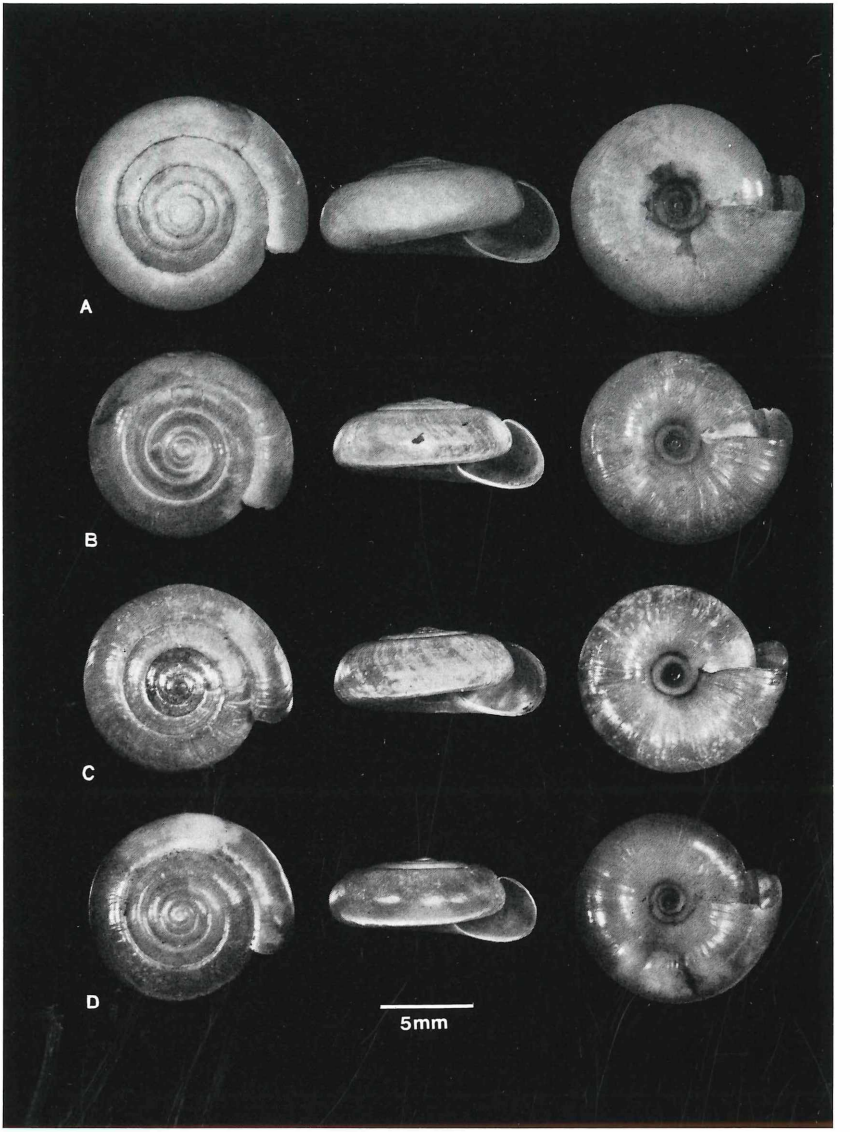
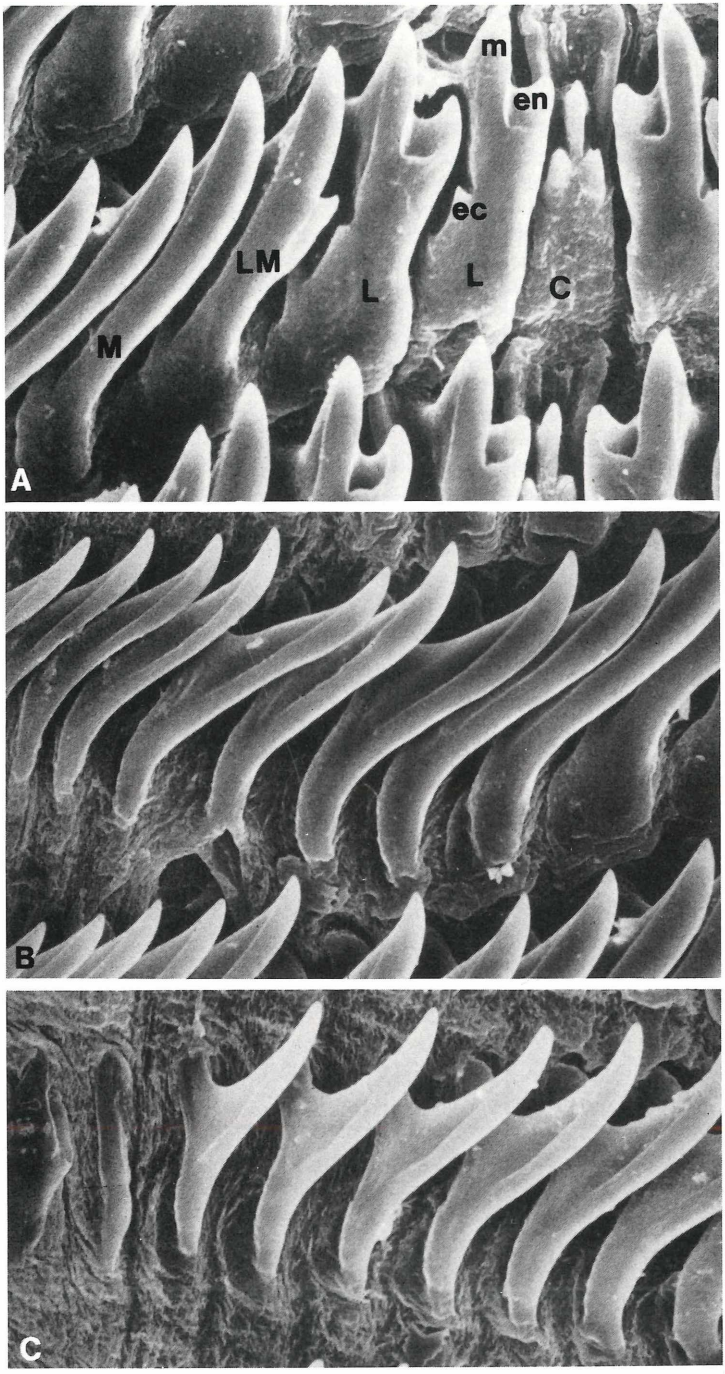


Fig. 4. *Oxychilus* (? *Ortizius*) *uziellii* (Issel). A) Sienese Montagnola, Montarrenti (Sovicille, SI); B-C) Gerfalco (GR); D) San Giusto in Salcio (Gaiole in Chianti, SI).

Fig. 5. *Oxychilus* (? *Ortizius*) *uziellii* (Issel). Radular structure in a specimen from San Giusto in Salcio (Gaiole in Chianti, SI). A) central portion of the radula: C central tooth, L lateral tooth, LM lateromarginal tooth, M marginal tooth; ec ectocone, en endocone; m mesocone. B) a group of latero-marginal teeth; C) extreme marginal teeth. ▶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Gombo woods. It therefore seems preferable to identify the locus typicus as the entire province of Pisa.

Material examined: 1) "Arbia stream" debris (SI), BONELLI leg. autumn 1872, 6 sp., BONELLI (1873) det. *Hyalina villae,* Zool. Mus. of the Fisiocritici Academy, Siena. 2) Gombo debris (PI), PAULUCCI leg. 19/11/1877, 4 sp., ZMF (Zoology Museum of Florence) 0693. 3) Le Fonti (San Gimignano, SI), PAULUCCI leg., 10 sp., ZMF 0692. 4) Le Fonti (San Gimignano, SI), PAULUCCI leg., 15 sp., DE MARIA DI MONTEROSATO Coll., Rome. 5) Colle Val d'Elsa (SI), PAULUCCI leg., 2 sp., DE MARIA DI MONTEROSATO Coll., Rome. 6) Buca Istrice, Montemaggio (Monteriggioni, SI), LANZA leg. 21/2/1954, 1 sp., ZMF 388, FORCART (1968) det. *O. (Ortizius) obscuratus.* 7) Grotta del Chiostraccio (Sovicille, SI), 29/7/1966, 1 sp. 8) Val di Farma, Solaia (Monticiano, SI), 27/12/1981, 6 sp. 9) Val di Arbia, San Sano (Gaiole in Chianti, SI), 1/3/1982, 11 sp. 10) Sienese Montagnola, Montarrenti (Sovicille, SI), 14/3/1982, 5 sp. 11) Val d'Arbia, Pianella (SI), 4/1982, 2 sp. 12) Sienese Montagnola, Montarrenti (Sovicille, SI), 9/3/1983, 12 sp. 13) Val d'Arbia, San Giusto in Salcio (Gaiole in Chianti, SI), 30/4/1983. 14) Gerfalco (GR), 17/5/1983, 3 sp. 15) Le Fonti (San Gimignano, SI), 28/12/1983, 4 sp. — The material gathered personally is kept in the GIUSTI Collection at the Zoology Institute of the University of Siena.

Habitat: The populations found with living specimens seem to prefer cool and damp places with trees, and close to streams.

Distribution: According to the literature, and our studies this species is limited to central eastern Tuscany (Fig. 6).

Observations.

The form and the dimensions of the shell indicate a resemblance between *O. (? Ortizius) uziellii* (ISSEL) and one species that is not geographical neighbour *O. (Hyalofusca) denatalei* (PFEIFFER). *O. denatalei* is found on Marettimo Island (Sicily), and is distinguished from the Tuscan species by both its shell (a smaller umbilicus, tubular in form and not funnel-shaped) and its penial complex which is narrower, the flagellum almost absent, the internal surface of the proximal portion of the penis which displays some rows of low papillae, poligonal in shape (cfr. RIEDEL 1973). Obviously the similarity in shell form of these two species is strictly coincidental. It is undoubtedly due to a convergence phenomenon.

O. uziellii is a well-characterized species with respect to any other noted in Tuscany and in the entire Apennine region of Italy. The internal structure of the penis renders it easily distinguishable from the species ascribed to the subgenus *Oxychilus* (s. str.) or to the subgenus *Ortizius.* The internal surface of the proximal portion of the penis displays folds similar to those of *Ortizius,* although their distribution and dimensions are completely different.

Contrary to the case in other *Ortizius* (GIUSTI 1973), the portion of the proximal tract of the penis which is more developed in *uziellii,* is that receiving the opening of the epiphallus and in continuity with the flagellum. As a consequence its folds are very well-developed while in the others they are not, often being hardly noticeable. Instead the second portion of the proximal tract of the penis has clearly regressed. As a consequence the longitudinal folds, normally well-developed in the other *Ortizius,* are here very short and extremely thin. The anatomical peculiarity just described renders difficult the placement of *uziellii* in the subgenus *Ortizius.* This explains in part the question mark we place before the subgenus name. The question mark serves also to underline our perplexity as to the real systematic value of

subgenus *Ortizius* FORCART 1957. *Ortizius* is distinguishable from *Oxychilus* (s. str.) only because the internal pleats of the proximal tract of the penis are not subdivided into papillae, but remain whole and are shaped like crests (GIUSTI 1973, RIEDEL 1980). If the internal structure of the penis has adaptive value, the subdivision of the folds into papillae could be interpreted as an evolutive advancement of the *Oxychilus* (s. str.) not found in the *Ortizius*, expected to guarantee a more efficient adhesion between penis and vagina. There does not, however, exist a clear

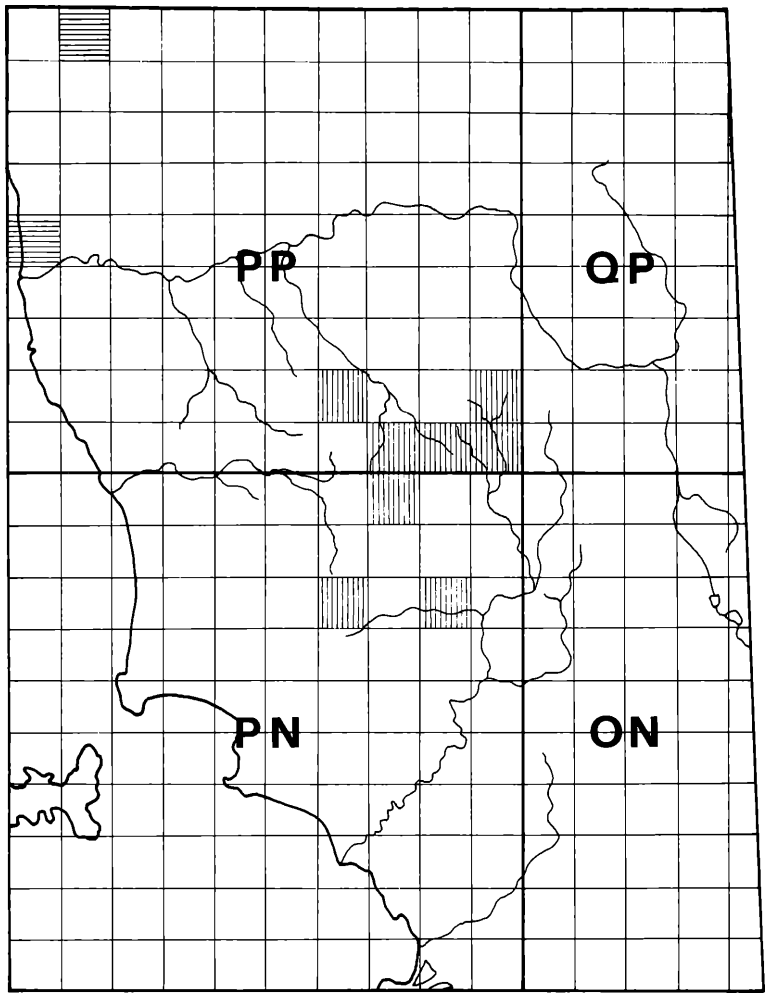

Fig. 6. Distribution of *O.* (? *Ortizius*) *uziellii* (ISSEL) in Tuscany and UTM notations of 10 × 10 km squares. Vertical lines correspond to actual presences of the species; horizontal lines to uncorfirmed data from literature.

demarcation between the two different organizations. In fact, many species display rows of papillae that continue into uninterrupted pleats (*O. pilula* WESTERLUND) or papillae fused to give wavy pleats of irregular contour. The latter is a phenomenon evident also in some populations of the two more typical *Oxychilus* (s. str.): *O. cellarius* (MÜLLER) and *O. draparnaudi* (BECK) (GIUSTI 1973, 1976). In absence of other distinguishing characters other than the internal structure of penis, a distinction of *Ortizius* from *Oxychilus* (s. str.) seems to be without solid basis and not feasible. At any rate we delay in recognizing a synonimization until the future development of anatomical studies has provided more comprehensive data.

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