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A NEW HYGROMIIDAE FROM THE ITALIAN APENNINES AND NOTES
ON THE GENUS *CERNUELLA* AND RELATED TAXA (PULMONATA:
HELICOIDEA) **

Summary

In the present paper the authors describe a new species of the Hygromiidae recently discovered living at high altitudes on certain mountains in the central and southern Apennines. After a discussion on how to weigh the anatomical characters for establishing systematic ranking, the authors describe a new genus for the new species.

The comparative analysis which follows the description gives occasion to revise the systematics of some taxa of the genus group which could be considered close to the new genus by virtue of the genital duct anatomy: *Cernuella* [*C.* (s. str.), *C. (Xerocincta)*]; *Xerosecta* [*X.* (s. str.), *X. (Polloneriella)*] and *Microxeromagna*. The status of the problematic genus group taxa: *Xerofalsa*, *Xeroplana*, *Xeroamanda* and *Xeromunda* is discussed.

Riassunto

La necessità di fornire un'esauriente discussione alla descrizione di una nuova specie della famiglia Hygromiidae, recentemente scoperta alle alte quote di alcuni complessi montuosi dell'Appennino centro-meridionale, ha condotto gli autori ad intraprendere l'esame critico della sistematica del genere *Cernuella* e di alcuni taxa ad esso comunemente associati. Dopo aver esposto la logica seguita nella valutazione dei caratteri anatomici, ai fini di costruire lo schema classificativo che è stato proposto, gli autori forniscono la sintetica ridescrizione dei seguenti taxa: *Cernuella* [*C.* (s. str.), *C. (Xerocincta)*], *Xerosecta* [*X.* (s. str.), *X. (Polloneriella)*] e *Microxeromagna*. Una breve analisi critica della storia di alcuni altri taxa: *Xerofalsa*, *Xeroplana*, *Xeroamanda* e *Xeromunda*, dei quali non è stato possibile lo studio anatomico per l'assenza di materiali in alcool, conclude il lavoro.

Il nuovo genere è caratterizzato in particolare dai seguenti caratteri. La vagina prossimale è breve. Il complesso dei sacchi del dardo di aspetto peculiare, è disposto asimmetricamente rispetto alla vagina; i due sacchi del dardo, fusi lato a lato, formano un insieme che appare come adagiato a cavallo della vagina. Tale disposizione impedisce di intravedere una chiara omologia tra questi due stilofori e lo stiloforo interno e quello esterno delle Hygromiinae. Inoltre, la concavità dello stiloforo privo di dardo non è rivolta verso la vagina, ma verso l'altro stiloforo. Il

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dardo è piccolo, un pò arcuato, ovale in sezione trasversa. La sua punta è semplice o presenta due brevi alette. Le aperture degli stilofores nella vagina sono racchiuse da una struttura cilindrica munita, in corrispondenza della base distale di un breve «fucile del dardo». Le ghiandole digitiformi sono presenti. Il pene è snello ed è munito di una papilla peniale con spesse pareti e priva di frenuli. Il retrattore del tentacolo destro non passa tra pene e vagina. Il nervo peniale prende apparentemente origine dal ganglio pedale destro.

Il genere *Cernuella* SCHÜTLER, 1838 è principalmente distinto dai seguenti caratteri. La vagina prossimale è ridotta. Il complesso dei sacchi del dardo è formato da due stilofores, talvolta di simili dimensioni, talvolta l'interno un pò più piccolo dell'esterno, fusi l'uno all'altro per quasi tutta la loro lunghezza, e che aderiscono ad un lato della vagina, senza formare un complesso peduncolato. Le cavità interne degli stilofores sono piccole e si aprono lontano l'una dall'altra, in un solco situato sul fianco di una struttura conica che si protende all'interno della vagina. All'apice, la parete della struttura conica non è fessurata e forma così una sorta di «fucile del dardo». Lo stiloforo esterno contiene un dardo arcuato con l'apice a mò di punta di freccia. Presso la base la sezione del dardo è circolare, all'apice è a forma di croce con due braccia più lunghe. La parete interna della vagina è percorsa da pliche; due di queste si fondono al disotto della struttura conica, formando attorno ad essa una sorta di anello. Le ghiandole digitiformi sono presenti. Il pene è snello ed è munito di una papilla più o meno lunga. Quest'ultima, in sezione trasversa, ha una spessa parete contenente piccole lacune. La base della papilla peniale è talvolta collegata alla parete del pene da tre piccoli frenuli. Il retrattore del tentacolo destro non passa tra pene e vagina. Il nervo peniale si origina dal ganglio pedale destro.

Il sottogenere *Cernuella* (s. str.) presenta una papilla peniale con la base collegata alla parete peniale da tre esili frenuli.

Il sottogenere *Cernuella* (*Xerocincta*) DI MARIA di MONTEROSATO, 1892 presenta una papilla peniale priva di frenuli.

Il genere *Xerosecta* DI MARIA di MONTEROSATO, 1892 è distinto principalmente dai seguenti caratteri. La vagina prossimale non è ridotta. Il complesso dei sacchi del dardo è formato da due stilofores di uguali dimensioni o, talvolta, da uno stiloforo interno più piccolo dell'esterno, fusi lato a lato solo per circa la metà della loro lunghezza, collegati ad un lato della vagina mediante una sorta di peduncolo. La cavità dello stiloforo interno è ampia e si apre nella vagina accanto a quella dello stiloforo esterno. Quest'ultimo contiene un dardo arcuato, ovale in sezione trasversa, talvolta percorso da due alette per la maggior parte della sua lunghezza. L'apertura degli stilofores nella vagina è bordata a destra e a sinistra da due grandi pliche vaginali. «Il fucile del dardo» è assente. Le ghiandole digitiformi sono presenti. Il pene è largo ed è munito di una papilla peniale senza frenuli che, in sezione trasversa, appare formata da una guaina esterna e da un canale centrale separati da uno spazio vuoto. In un caso la guaina centrale è semplice, in altri ha un aspetto irregolare che imita una sorta di «corpo cavernoso». Il retrattore del tentacolo destro non passa tra pene e vagina. Il nervo peniale apparentemente si diparte dal ganglio cerebrale destro.

Il sottogenere *Xerosecta* (s. str.) presenta una papilla peniale con una guaina esterna di aspetto irregolare, che imita un «corpo cavernoso».

Il sottogenere *Xerosecta* (*Polloneriella*) ALZONA & ALZONA BISACCHI, 1940 presenta una papilla peniale con una guaina esterna semplice.

Il genere *Microxeromagna* ORTIZ DE ZARATE LOPEZ, 1946 è principalmente distinto dai seguenti caratteri. La vagina prossimale non è ridotta. Il complesso dei sacchi del dardo è formato da due stilofores, l'interno più piccolo dell'esterno, fusi lato a lato per più della metà della loro lunghezza e peduncolati. La cavità dello stiloforo interno è ampia e si apre, assieme a quella dello stiloforo esterno, in un'ampia apertura nella vagina. Questa apertura è bordata da due grosse pliche. Il «fucile del dardo» è assente. Lo stiloforo esterno contiene un dardo quasi diritto percorso da due alette per quasi tutta la sua lunghezza. Il dardo in sezione trasversa, ha una forma rombica. Le ghiandole digitiformi sono presenti. Il pene è largo ed è munito di una corta papilla peniale di peculiare aspetto, formata, cioè, da una parete semplice e sottile accartocciata su sé stessa e fessurata su un lato. Il retrattore del tentacolo destro non passa tra pene e vagina. Il nervo peniale apparentemente prende origine dal ganglio cerebrale destro.

Introduction

During recent faunistic expeditions into certain areas of the southern Apennines (Mt. Sirino, Mt. Pollino) we had the occasion to find a small «*Helicella*» with a shell recalling that of some species of the genera *Candidula*, *Trochoidea* and *Cernuella*. Anatomical examination of the genital duct later performed in our laboratory verified the presence of two stylophores forming a dart-sac complex on one side of the vagina. Any relationships with the genus *Cernuella* was promptly denied by the peculiar inner structure of the dart-sac complex and vagina.

The inclusion of the new species in a genus of its own thus appeared inevitable. For diagnostic comparison we consequently felt obliged to re-examine some taxa of the genus group, analogously referable to the subfamily Hygromiinae sensu SCHILEYKO (1978) (see GIUSTI & MANGANELLI, 1987a) which have two stylophores fused side by side to form a dart-sac complex on one side of the vagina.

A recent revision of some of these genera (GIUSTI & MANGANELLI, 1987a) has reduced our task, and we needed only to address ourselves to a group of taxa usually considered to show a more or less evident affinity with genus *Cernuella*, some of which considered in the past to be subgenera of *Cernuella*. This research has also served the purpose of continuing to collect data toward a better understanding of the pattern of anatomical variability of the structures forming the genital duct of the Hygromiidae and of contributing to the efforts to test and complete the classificatory scheme of this family.

Character Weighting

The diagnosis of the new genus and the new systematic scheme of *Cernuella* and related taxa (genera or subgenera) which we are going to utilize arises from the discovery of additional anatomical characters (1) and from a different, at present obviously subjective, way of weighting the anatomical characters of the genital duct. A very simple preliminary phenetic approach to the problem will be tried. A cladistic approach would be inappropriate because of the small number of structures having suitable characters for genus classification and also the present scarcity of data on how the various characters may be considered for inferring phylogenetical relationships. SOLEM (1974) in his paper on characters weighting in land snail classification says that the concept of «progress»: «change in ecological relationships over time, leading to "success" measured by group survival, diversification in ways of living and/or persistence in a taxonomic sense» is implicit in his attempt to understand the patterns of land snail evolution (and hence higher systematic categories).

According to this philosophy there is a first level of evolutionary change involving a shift in adaptive zones (i.e. movement from water to land, etc.). The second more common level involves processes of diversi-

1) About the use of the term «character» or «character state» see GHISELIN (1984) and RODRIGUES (1986).

fication (i.e. changes from terrestrial to arboreal life, herbivore to carnivore, etc.). Finally the lowest level of evolutionary change involves sympatric species interaction (i.e. competitive exclusion, character displacement, niche specialisation, etc.).

From the above, it follows that any kind of character has to be thought of in terms of functional significance to the snail, particularly in comparison with potentially related species. This can be analysed by answering a series of questions: could this behavioural/genetic/biochemical/anatomical/shell/radular variation be the result of selection caused by local species interactions? Does it permit a shift in life style compared to similar species? Then other questions to be answered are: is the character common throughout a group, present in a few or unique to one species? Do the species all have very similar «life styles» or is one species «different» in its ecological role? Is the different type simply an «odd ball» or does it pre-*sage* a «new way» of living? (SOLEM, 1974: 49).

This philosophy implies that one must try to understand the importance of characters in terms of «progress» or their direct or indirect correlation with changes which have rendered the species more competitive. So, if an evolutive premium corresponds to a character or a series of characters these can be considered for grouping taxa in higher categories with the hope of identifying a natural classification.

In the lower ranks of systematics of our Gastropods we find that most characters are stable within single groups so that relatively few remain for use in systematics above species level (genus and family groups). In many Pulmonates, particularly in the Helicoidea, only the characters of the genital duct have proved useful for constructing a genus-family classification, as the general body anatomy and radula do not change and the shell characters are so subject to convergence to be useful only at the species level.

This praxis is clearly at variance with that of SOLEM! In fact how can the difference (if there is one) in terms of «progress» be decided between a genital duct with or without stylophores (=dart-sacs) if snails can normally copulate in either case? Or what is the difference between presence or absence of penial papilla, a short or long penial flagellum, simple or ramified digitiform glands, etc.? A difference exists, but who can say what it means? Are the anatomical characters an indirect sign of other obscure evolutionary events or are they «odd balls» i.e. simple variations of the same theme with no precise evolutive value?

The only way to try to answer such questions is to look at what happens in many different species of a supposedly monophyletic group. Taking as example the family Hygromiidae (*sensu* SCHILEYKO) we note that the vaginal tract of the genital duct can appear with many different variants (SCHILEYKO, 1978b; GIUSTI & MANGANELLI, 1987a), e.g. vagina with four stylophores fused two by two to form two dart-sac complexes on opposite sides of the vagina; two stylophores on opposite sides of the vagina; two stylophores fused to form a complex on the same side; one stylophore; no stylophores. Accepting SCHILEYKO's assumption that the presence of four stylophores is the primitive state, we observe that the number of stylophores tends to decrease, but as we have underlined elsewhere (GIUSTI &

MANGANELLI, 1987a) many different paths are possible between different states (i.e. those of one stylophore or no stylophores) and the tendency does not appear to be related to life style. *Hygromia* in fact has a vaginal tract which is externally and internally very similar to that of *Cernuella* (the dart and the position of the right ommatophore retractor are different). *Hygromia* contains species living in moist habitats, and *Cernuella*, species living in semi-arid habitats. The shells are different: thin, transparent or semitransparent and fragile in *Hygromia*, thick, opaque and robust in *Cernuella*. The shell structure evidently depends on ecology, not genital duct anatomy! The genital tract characters can therefore be said to indicate the close affinity of the two genera because they have been inherited from a common ancestor.

This is not the only example. There are apparently closely related groups of species living in similar habitats, with shells having similar characters, but very different vaginal tracts (*Trichia*, *Hygromia*, *Ganula*, *Monachoides* etc.; *Cernuella*, *Xerosecta*, *Candidula* etc.). Here again we cannot invoke competitive exclusion (the genital duct works independently of habitat and interspecific competition), character displacement or niche specialisation etc. One can more logically argue that species of different origin have adapted to the same kind of habitat (acquiring similar shells!). In the light of the famous «Darwin principle» (MAYR, 1969) one can legitimately affirm that characters of no evident or low adaptive value are important in showing underlying genetic similarity. They can provide clues to possible relationships and at least help to establish a lower level of systematic ranking. Instead of merely considering the number of stylophores or their disposition in the vagina, as has been done in the past, there are many other minute characters associated with vagina and dart-sacs (plus penial characters) which will help define a taxon by revealing whether an organ is similar to another by simple convergence or by homology. In so doing subgenera and genera will become more clearly distinguishable.

For eventual subfamilies the problems are clearly more complicated (see GIUSTI & MANGANELLI, 1987a). The number of stylophores utilised for this purpose by SCHILEYKO (1972b, 1972c, 1978a, 1978b; in GIUSTI & MANGANELLI, 1987a: fig. 17) seems insufficient to assess the succession of the evolutionary steps. Although it is logical to suppose, as SCHILEYKO did, that from a primitive situation of two couples of stylophores on opposite sides of the vagina many derived situations originated by a process of reduction by oligomerisation, there is nothing to exclude the inverse process of pluralisation or other equally logical steps not linking all the different derived situations. Because SCHILEYKO's scheme of subfamilies closely adheres to other traditionally followed schemes and because it can be recognised as a logical and useful guideline, we thought (GIUSTI & MANGANELLI, 1987a) and still think it better not to entirely reject this scheme until more evidence is collected to test its validity. According to our method of weighting morphological characters (we stress that these characters are only of relative value in defining biological species: GIUSTI et al., 1986; GIUSTI & MANGANELLI, 1987b) we consider a species (or rather a morphospecies!) to be different from another supposedly belonging to the same group when it shows minor variations in the form and dimensions of the shell and in

genital duct characters.

While a single morphological character (shell shape: width of the umbilicus, number of whorls, form of spire etc.; genital duct: length of a particular portion such as the vagina, penis, penial flagellum, penial papilla, etc.) can be utilised to distinguish groups of specimens in a self-standing species when they live in sympatry with other specimens having a different character and when no intermediate phenotypes are present, things are obviously more complicated when two or more allopatric populations are concerned.

In this case the constancy of a character (preferably anatomical) or complexes of characters must be considered discriminant. For example in the genus *Xerosecta*, subgenus *Xerosecta* (s. str.), we consider *X. explanata* different from the closely related *X. cespitum* because its shell is consistently smaller, flattened, keeled and because its genital duct has a shorter penial flagellum, a shorter ductus of the bursa copulatrix and fewer branches in the digitiform glands. Moreover in the case of *Hygromia cinctella* and *H. limbata* the two species are easily distinguished not only by dart sac structure and dart shape (characters which led SCHILEYKO 1972a and GIUSTI & MANGANELLI 1987a to consider them to belong to different subgenera) but also because *H. cinctella* has a smaller and clearly keeled shell and a genital duct with a shorter penial complex, penial papilla and vagina. As intimated in the example of the two *Hygromia*, subgeneric differentiation can be assumed when a few characters (possibly correlated; see FARRIS, 1969; WHEELER, 1986) suggest that two species are not immediately derived from one another or at least not in the recent past. In other words, even if the two species have a substantially common anatomical organisation, they must differ in at least a few qualitative characters which can be interpreted as a sign of long independence.

Another case is that of *Cernuella* (s. str.) and of *Cernuella* (*Xerocincta*), the first distinguished substantially by a penial papilla with three small basally located «frenula» which are completely absent in the second. The length of the proximal vagina which is considered by CLERX & GITTENBERGER (1977) to be a distinctive character (shorter in *Cernuella* (s. str.), longer in *Xerocincta*) depends on the species.

In the case of *Xerosecta* (s. str.) and *Xerosecta* (*Polloneriella*), ignoring shell characters which are peculiar to each single species, the first contains two species (*X. explanata*, *X. cespitum*) having a peculiar penial papilla with a lateral canal partially enveloped by an interrupted external guaina and a vagina, on one side of which two small stylophores are fused to form a complex with a very slender stalk. The second contains a species [*X. (Polloneriella) contermina*] which has a penial papilla formed by a central canal and by a continuous external envelope with two basal openings and a vagina which has on one side, two small stylophores fused to form a complex inserted between two swellings.

Clearly such data are not always easy to interpret and consequently the solution is sometimes a matter of choice. From these examples it will be evident why we have doubts (GIUSTI & MANGANELLI, 1987a) about considering *Zenobiella* a genus distinct from *Hygromia* (and not a junior synonym as suggested by SCHILEYKO, 1970) and also about considering

these two distinct from the older genus *Cernuella*. The *Cernuella-Hygromia-Zenobiella* example is clearly a difficult borderline case. In fact their vaginal complex is almost identical. Our decision comes from consideration of the numerous characters (transverse section of the dart, vaginal pleats, penial papilla, penial flagellum etc.) which distinguish *Zenobiella* from *Cernuella* and these from both *H. (s. str.) cinctella* and *H. (Riedelia) limbata* and which seem to suggest a degree of differentiation higher than subgenus (2). Differentiation at the rank of genus can be postulated whenever a species shows a complex of characters which consists not of a simple variation of the same basic scheme but which forms a new one.

This is the case with some genera recently revised by us (GIUSTI & MANGANELLI, 1987a). The schemes of the vagina (dart-sac complex, dart, pleats of the inner walls of the vagina) of *Hygromia*, *Ganula*, *Ichnusotricha* and *Pyrenaearia* are so different from each other that they can be considered to constitute peculiar, not directly related schemes. If the presence of two stylophores fused to form a complex on one side of the vagina can be considered to include the four genera in the same higher taxon (subfamily-family) the structure of the entire vaginal complex can be interpreted as the basis for differentiation not lower than genus.

Another example is that of *Cernuella* and *Xerosecta* (the latter considered by CLERX & GITTENBERGER, 1977 to be a subgenus of the former). Ignoring the shell, we know that both genera have two stylophores, the internal one reduced, the external one with a dart, but while the former has the internal stylophore opening independently of the external one, in the latter it ends in the final portion of the external stylophore. In *Cernuella* the dart-sac complex is larger and internally there is a sort of tube-like expansion, constituting a type of gun for the dart, which is completely missing in *Xerosecta*. The internal reduced stylophore in *Cernuella* has a small cavity while in *Xerosecta* the cavity is always wide.

From the examples described above it will be clear that the set of characters utilised for genus distinction in the Hygromiidae is mainly that of the vaginal complex. What happens when these characters do not exist because of total regression of the dart-sac apparatus? How can we apply the above if no new scheme is detectable? An uncritical approach would suggest that many genera from different Palaearctic areas: *Cyrnotheba*, *Ashfordia*, *Monacha* (*Szentgalya*), *Ciliella*, *Metafruticicola*, *Caucasocressa*, *Cretigena*, «*Circassina circassica*» *simpla* (sensu SCHILEYKO, 1972a), belong to the same genus! As demonstrated elsewhere (GIUSTI & MANGANELLI, 1987a) many different paths can be followed to reach the same result (i.e. in this case no stylophores). At this point we can only resort to our faculty of choice, obviously after having analysed all the other possible characters (shell, penial complex, etc.) which are usually considered to lend themselves to the systematic study of the species and subgenera.

As mentioned at the beginning of this chapter, we realise that this way of interpreting characters is as subjective as any proposed before. Nevertheless we submit these proposals and invite our colleagues to examine

- 2) As for the position of the right ommatophore retractor independent of the penis and vagina in *Cernuella*, passing between the two in *Hygromia* and *Zenobiella* see GIUSTI & MANGANELLI (1987a).

their validity.

To conclude we consider it worthwhile adding that we also examined the structure of the mantle collar and the site of origin of the penial nerve. These two characters have been given a certain value in defining the affinities between different genus groups (DEGNER, 1927; ORTIZ DE ZARATE LOPEZ, 1950; GITTENBERGER & SUBAI, 1985). Unfortunately the mantle collar proved to have a constant general structure even if characterized by minor peculiarities in the single species. On the contrary our data on the apparent site of origin of the penial nerve, seem to confirm the literature on subject.

In *Cernuella* (s. str.) and *Cernuella* (*Xerocincta*) the penial nerve parts from the right pedal ganglion while in *Xerosecta* (s. str.), *Xerosecta* (*Pol-loneriella*), and *Microxeromagna* it apparently parts from the right cerebral ganglion. Unfortunately little informations are at present available on this character in the Hygromiidae literature so that it is impossible to conclude anything about its significance or to try to use it for generic or suprageneric systematics.

CERNUELLOPSIS n. gen.

Description:

Shell small, globose-conical, sometimes depressed to some extent above, with a conic-convex spire of $5\frac{1}{2}$ -6 slightly convex whorls with moderately deep sutures, sometimes slightly angled at the periphery. Umbilicus wide and deep. Mouth oval, with a white internal rib. Shell opaque, white, often with brown spiral bands and blotches, and with fine and rather regular transverse ribbing.

Genital duct characterized by a short proximal vagina, two stylophores lying side by side, giving rise to a proportionately well developed dart-sac complex which enters the first portion of the distal vagina. The dart-sac complex is disposed asymmetrically with respect to the vagina. The longitudinal axis of the proximal vagina is not parallel to those of the two stylophores and the «inner» stylophore doesn't lie side by side with the proximal vagina. The latter meets the dart-sac complex on one side and ends obliquely almost in-between the «inner» and «outer» stylophores. This disposition is quite new so that there cannot be said to be homology between these two stylophores and the inner and outer stylophores of the Hygromiinae. Moreover the concavity of the empty dart cavity of the «inner» stylophore does not face the proximal vagina, but the «outer» stylophore.

The cavity of the «outer» stylophore contains a small dart of oval-roundish transverse section almost straight or very slightly curved, with an arrow head tip wingless or sometimes showing only two very short lateral wings. It is not possible to see the openings of the two stylophores in the vagina by dissecting the vagina walls. In fact they end in the cavity of a peculiar cylindrical structure with an open base (the end facing the proximal portion of the vagina) and an apex (the end facing the genital

atrium) this last extending into a short conical tube functioning as a «dart gun». A pleat extends from the inner walls of the proximal vagina to the dart-sac area. Here it branches giving rise on one side to a pleat which penetrates into the cavity of the above described cylindrical structure and on the other side to a tongue-like structure which develops to laterally embrace the said cylindrical structure. The distal vagina is usually long or very long. Digitiform glands are present. Bursa copulatrix duct slender and longer than the vagina, its initial portion is not flared. Bursa copulatrix (= gametolytic gland) shoe-shaped. Penis and epiphallus of almost equal length. Flagellum short. Penis has an internal papilla. Right ommatophore retractor muscle independent of penis and vagina. Penial nerve apparently inserted in a bundle of nerves originating in the right pedal ganglion.

Derivatio nominis:

The name *Cernuellopsis* is suggested by the apparent conchological and anatomical similarity of the new taxon with genus *Cernuella*.

Comments

No problem exists in distinguishing the new genus from well known western Palaearctic genera of the Hygromiinae that have two stylophores fused to form a dart-sac complex on one side of the vagina, such as *Hygromia*, *Lozekia*, *Pyrenaearia*, *Zenobiella*, *Ganula*, & *Ichnusotricha*. These show differently structured dart-sac complexes, vagina and shell structure and the right ommatophore retractor passes between the penis and vagina (SCHILEYKO, 1972a; VARGA, 1979; GIUSTI & MANGANELLI, 1987a). Some problems still exist in distinguishing the new genus from other taxa of the genus group, the structure of vagina and dart-sac complex of which are still little known e.g. *Cernuella* and its allies: *Xerocincta* *Xeromagna*, *Poltoneriella*, *Microxeromagna* & *Xerosecta*. All these taxa have the right ommatophore retractor independent of penis and vagina just like the new genus and in most cases, being xerophilous, a shell with similar characters.

Our anatomical studies and the redescrptions which follow in this paper demonstrate that the peculiar structure of the dart-sac complex and vagina of the new genus clearly avoid any confusion with the above taxa. For the same reason no confusion seems possible with the other genera living in eastern Europe and Asia, anatomically revised by SCHILEYKO (1970, 1978b). Things appear rather complicate as for the subfamilial status of *Cernuellopsis* n. gen. The above described structure of the dart-sac complex appears peculiar enough to support the hypothesis of a non-homology of the two stylophores seen in *Cernuellopsis* and the inner and outer stylophore of the Hygromiinae (sensu SCHILEYKO). An eventual conclusion on the argument is clearly premature and has to be anticipated by a more careful anatomical study on many other genera and by a verification of SCHILEYKO's subfamilial subdivision of the Hygromiidae. A doubtful inclusion amongst the Hygromiinae can, nevertheless, represent an acceptable interlocutory solution.

Type species:

Cernuellopsis ghisottii n. sp.

Description:

SHELL (Pl. 1: figs. A-G; Pl. 2: figs. A-B) small in size, globose-conical sometimes depressed above and rounded below. Spire conical with $5\frac{1}{2}$ -6 slightly convex whorls; sutures moderately deep, last whorl not widened, sometimes slightly angled at the periphery. Deep, open umbilicus, circa $\frac{1}{5}$ of the maximum diameter of the shell. Mouth oval with the peristome more or less thickened and not reflexed, with a white internal rib. Shell opaque, white, often with brown spiral bands and blotches. Protoconch pinkish or brown in colour; teleoconch with fine and rather regular transverse ribbing.

DIMENSIONS: shell max. diam.: 7.5-10 mm; shell height: 4.5-6.3 mm mouth max. diam.: 3.5-4.6 mm; mouth height: 3.2-4.2 mm.

GENITAL DUCT (Figs. 1-2) with a multilobate gonad from which the first hermaphrodite duct arises. This duct is long and slender and opens into the talon (= fecundation chamber + seminal-receptacle complex). The talon lies on the inner side of the albumen gland near the beginning of the second hermaphrodite duct (= ovispermiduct). The latter consists of a female portion (= uterine) on one side which is multilobate and well developed and continues into the uterine canal (= free oviduct). On the other side it consists of a male portion (prostatic) at the apex of which a long, slender, vas deferens arises. A long and fairly slender canal of the bursa copulatrix arises from the proximal vagina just where the free-oviduct ends. Its base is not flared. Bursa copulatrix (= gametolytic gland) shoe-shaped.

The proximal vagina terminates on the internal face of the dart-sac complex, approximately between the inner and outer stylophore. Almost half way along its length, a group of digitiform glands consisting of 4 tufts, each composed of 2-3 branches, arises from the proximal vagina wall. The plane which cuts the proximal vagina in two specular portions does not

Fig. 1 - *Cernuellopsis ghisottii* n. sp. The genital duct and some of its parts in specimens collected on Mt. Pollino (near Passo del Colle del Dragone, Calabria) (A,E-G), on Mt. Sirino (loc. Monte del Papa, Basilicata) (B) and in the Simbruini Mountains (Mt. Autore, Latium) (C-D). A-C: the genital duct (gonad excluded). Note the peculiar relationships between the proximal vagina and the dart-sac complex. D: a dart. E: penial papilla with its transverse section (F) half way along its length. G: a wingless dart. Explanations of the symbols used in Figs. 1-13: **AG** albumen gland, **BC** bursa copulatrix (= gametolytic gland), **BW** body wall, **CBC** duct of the bursa copulatrix, **DFG** digitiform glands, **DG** «dart gun», **DSC** dart-sac complex, **DSO** opening of the dart sac complex, **DV** distal vagina, **E** epiphallus, **ESO** external dart-sac opening, **FL** flagellum, **FO** free oviduct, **FR** frenulum, **GA** genital atrium, **HD** hermaphrodite duct, **IDS** inner dart-sac, **ISO** inner dart-sac opening, **ODS** outer dart-sac, **P** penis, **PO** prostatic portion of the ovispermiduct, **PP** penial papilla (= glans), **PR** penial retractor muscle, **PV** proximal vagina, **PW** penial wall, **T** talon, **TLS** tongue-like structure, **UO** uterine portion of the ovispermiduct, **V** vagina, **VD** vas deferens, **VCS** vaginal cylindrical structure in which the stylophores open, **VP** vaginal plica.

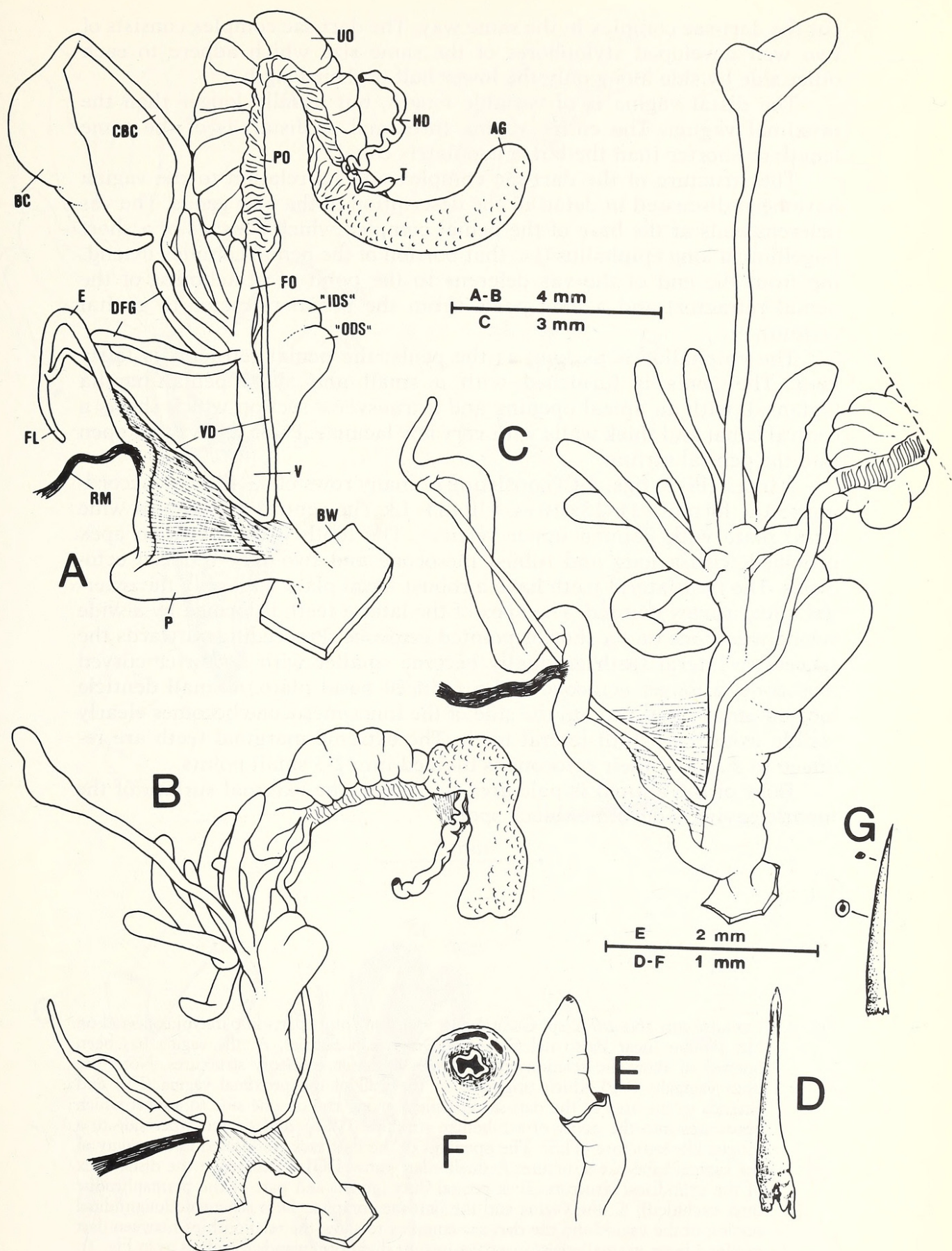


Fig. 1

cut the dart-sac complex in the same way. The dart-sac complex consists of two well developed stylophores of the same size which adhere to each other side by side along only the lower half of their length.

The distal vagina is of variable length, but usually longer than the proximal vagina. The entire vagina (proximal + distal) is of the same length or shorter than the bursa copulatrix canal.

The structure of the dart-sac complex and its relation to the vagina have been discussed in detail in the description of the new genus. The vas deferens ends at the base of the penial complex which consists of a short flagellum, a long epiphallus (i.e. that portion of the penial complex extending from the end of the vas deferens to the point of attachment of the penial retractor) and a long penis (from the penial retractor to genital atrium).

The epiphallus is as long as the penis; the penial retractor is fairly long. The penis is furnished with a small and short penial papilla («glans»), with an apical opening and a transverse section which shows a central canal and thick walls with very few lacunae. Penis and vagina open into the genital atrium.

RADULA (Pl. 3: figs. A-C) consisting of many rows of 43-47 teeth according to the formula $11-13+10+C+10+11-13$. The central tooth has a wide basal plate with pointed upper vertices. The tooth body shows an apex provided with a long and robust mesocone and two very reduced ectocones. The first lateral teeth have a robust basal plate with only the external upper vertex pointed. The apex of the lateral teeth is formed by a wide strong mesocone and a shorter pointed ectocone. Proceeding outwards the successive lateral teeth gradually become smaller with a shorter curved mesocone, a longer ectocone and a reduced basal plate. A small denticle located almost half way up the side of the inner mesocone becomes clearly visible from the 8-10th lateral teeth. The extreme marginal teeth are reduced in size and their ectocone is divided into 2-3 small points.

Body of the animal is pale grey in colour. The external surface of the mantle cavity is devoid of black spots.

Fig. 2 - *Cernuellopsis ghisottii* n. sp. Genital duct and some of its parts in paratypes collected on Mt. Pollino (near Passo del Colle del Dragone, Calabria). A: the vagina has been opened to show the relationships between its inner accessory structures. Note: the plica vaginalis (VP) which originates in the wall of the proximal vagina (PV) and extends to the area of the dart-sac complex, giving rise on one side to a pleat which penetrates into the cavity of a tube-like structure (VCS), and on the other side to a tongue-like structure (TLS). The openings of the dart sacs are located in the cavity of the vaginal tube-like structure. A small «dart gun» (DG) is situated at the distal apex of the cylindrical structure. B: a genital duct (gonad and part of the hermaphrodite duct excluded). C: the vagina and the dart-sac complex. D: a schematic longitudinal section of the vagina and the dart-sac complex to show the relationships between dart sacs and inner vaginal accessory structures. E: digitiform glands (Symbols as in Fig. 1).

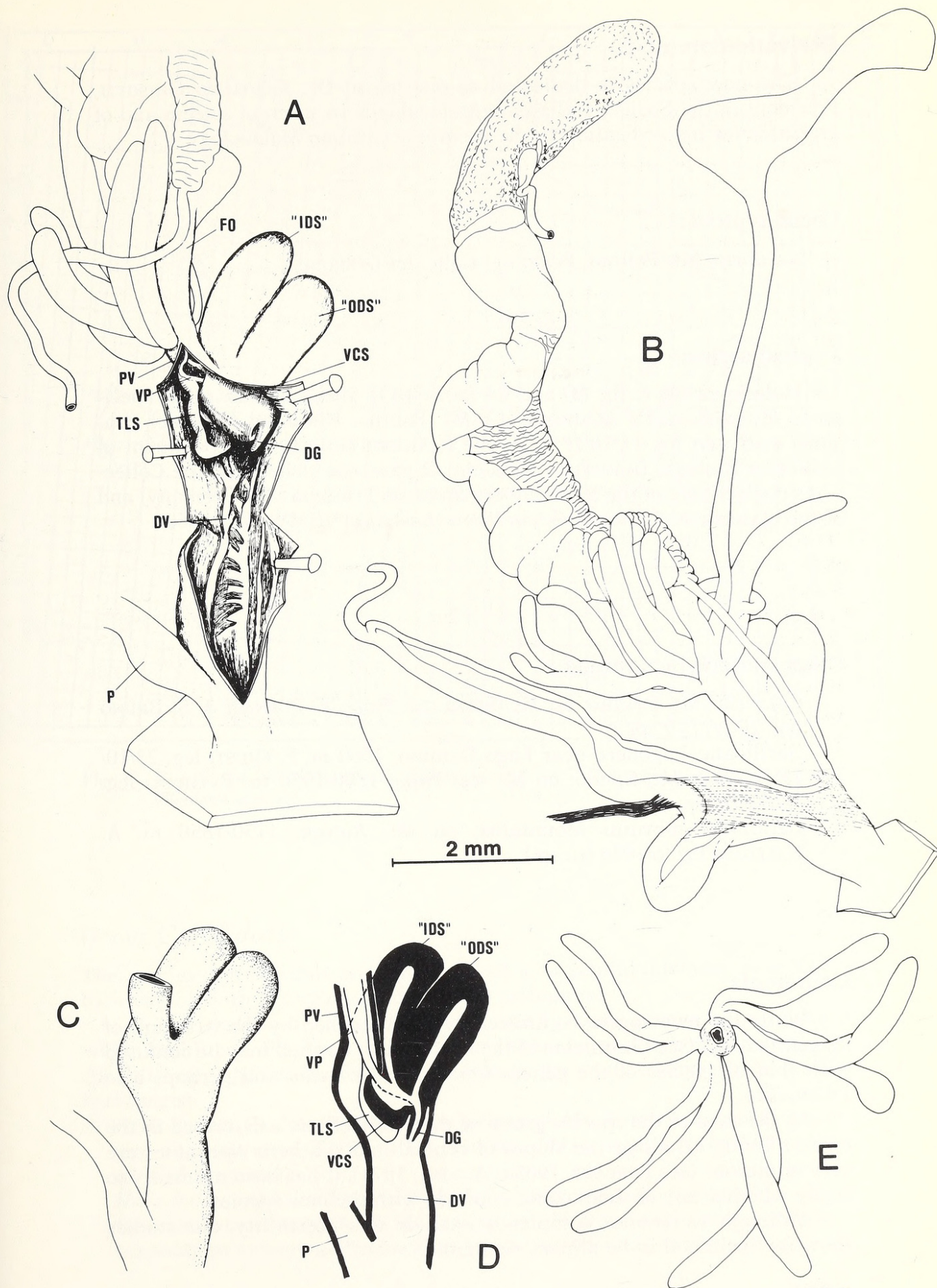


Fig. 2

Derivatio nominis:

The new species is dedicated to our friend Dr. FERNANDO GHISOTTI, President of the Società Italiana di Malacologia, in token of esteem and of gratitude for his dedication to the progress of Italian Malacology.

Locus typicus:

Calabria, Mt. Pollino, Passo del Colle del Dragone.

Typical series:

Holotypus (Pl 1: fig. B) and 24 Paratypi (8 shells and 16 spirit specimens -8 entire and 8 anatomized-), Mt. Pollino, Passo del Colle del Dragone, F. GIUSTI leg 13/10/1977, in the F. GIUSTI collection (Department of Evolutive Biology, University of Siena). 2 paratypes (shells) in the Collections respectively of the Senckenberg Museum Frankfurt (W-Germany) and of the Naturhistorisches Museum Wien (Austria) (NHMW no. 84360).

Other material examined:

Calabria: Mt. Pollino, on Mt. Serra del Prete, F. FURNARI & S. BRUNO leg. 20/9/77 (9 sps.).

Basilicata: Lagonero near Lago Remmo, 1500 m, F. GIUSTI leg. 23/10/71 (2 sps.); Mt. Sirino, on Mt. del Papa, 1800-1950 m, F. GIUSTI leg. 1/7/71 (n. sps.).

Latium: Simbruini Mountains, on Mt. Autore, 1750-1850 m, A. HALLGASS leg. 6/1986 (n. sp.).

Comments

While the new species is noticeably distinguished by the structure of its genital duct (see Comments of the new genus), its shell may be confused with that of species of the genera *Candidula*, *Cernuella* and perhaps also *Trochoidea*.

As the taxa of the species group of the «*Helicellinae*» described in the past as living all along the slopes of central and southern Apennines are very numerous (see FORCART, 1965a; ALZONA, 1971), it has been necessary to verify whether any of them could coincide with the new species.

Although we cannot completely exclude this possibility, our studies show its likelihood to be almost negligible.

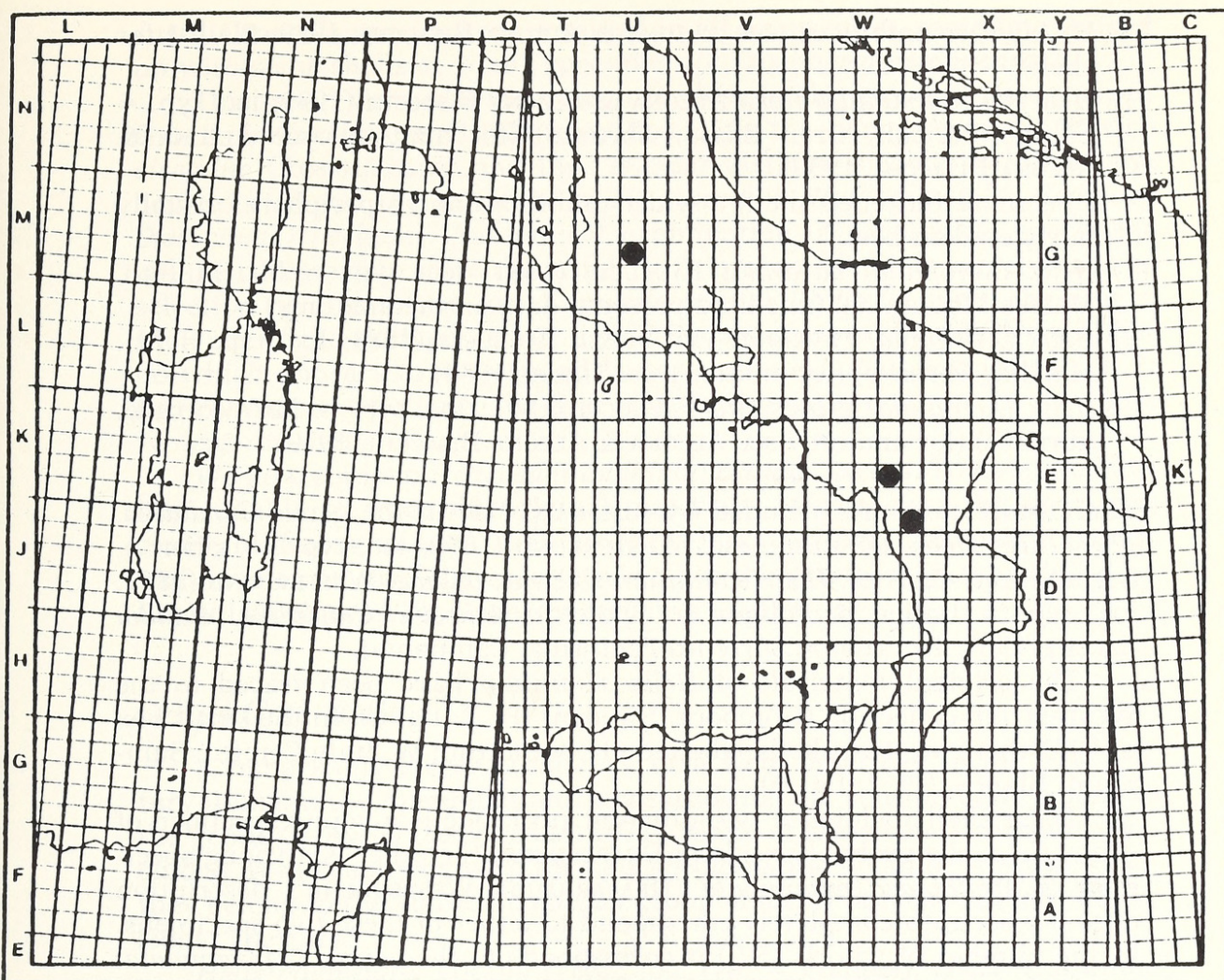


Fig. 3 - Distribution of *Cernuellopsis ghisottii* n. sp. on UTM map, plotted on 20 x 20 kilometre squares.

Genus *Candidula*

The species of this genus are distinguished by a genital duct characterized by a vagina with a single well developed stylophore.

A) The shell is distinguished by a usually more convex spire and a wider umbilicus. For both these characters we have clearly distinguished the following species and varieties thanks to the study of topotypical shell specimens:

- 1) *Helix spadai* CALCARA (1845; locus typicus = Mt. Vettore, Ascoli Piceno) (for anatomy see: HESSE, 1934; GIUSTI, 1971), with its regularly described synonyms:

Helix bathyomphalus PFEIFFER (1848; loc. typ. = Ascoli province)

Helix destituta PFEIFFER (1853; loc. typ. = Mt. Sivo, near Ascoli) and its manuscript synonym *Helix ocellus* VILLA (see STABILE, 1859).

B) A wider umbilicus (see ALZONA & ALZONA BISACCHI, 1939, Plate 1 for shell):

- 1) *Helicella (Candidula) fiorii* ALZONA & ALZONA BISACCHI (1939; loc. typ. = Campo Pericoli, Gran Sasso, Abruzzo) (for anatomy see ALZONA & ALZONA BISACCHI, 1939).

C) A more flattened shell, a wider umbilicus and a peripheral, usually fairly evident keel:

- 1) *Helix (Xerophila) cavannai* PAULUCCI (1881; loc. typ. = Mt. Miletto, Matese Mountains) (unedited personal data on the anatomy).
- 2) *Helix (Xerophila) cavannai* var. *scissa* PAULUCCI (1881; loc. typ. = Mt. Maiella, Abruzzo) (for anatomy see HESSE, 1934).
- 3) *Helix (Xerophila) grovesiana* PAULUCCI (1881; loc. typ. = Mt. Morrone, Abruzzo) (for anatomy see ALZONA & ALZONA BISACCHI, 1939).

Three more taxa are included by ALZONA (1971) in the genus *Candidula*. These are: *Helix samnitum* sic! WESTERLUND (1889; loc. typ. = Italien b. Samnium u. Cerrito), *Helix samnitum* sic! var. *pugnax* WESTERLUND (1889; loc. typ. = Italien b. Foligno u. Spoleto), *Helicella (Candidula) claudia* SACCHI (1959; loc. typ. = Sorrento Peninsula, Campania).

The original materials of *Helix samnitum* have been traced to the WESTERLUND collection (Göteborg, Sweden) (Pl. 2: fig. C). In the small box n. 1073 there are two shells labelled «*H. samnitum* W. Italy Ceretto, Samnium, Blanc». (Pl. 2: fig. D).

These shells belong to two different taxa: one is a young specimen of genus *Cernuella* probably *neglecta* DRAPARNAUD; the other is a young specimen of *Trochoidea pyramidata* (DRAPARNAUD). WESTERLUND's description does not seem to completely correspond to either of these two specimens. In the number of whorls ($5\frac{1}{2}$) it corresponds to the young *T. pyramidata*, but for general characters (bands and dimensions: diam. = 9 mm; h. = 6 mm) it corresponds to the young *Cernuella*. We were astonished by this incredible fact and while we can hardly suppose an exchange of materials, we cannot help recognizing that the young *Cernuella* was closer to the original description and we therefore selected it as the lectotype.

H. samnitum WESTERLUND thus comes to be an almost sure junior synonym of *Cernuella (Xerocincta) neglecta* (DRAPARNAUD). Although we have materials of this species from Sannio, it seems better to verify this assumption by examining the Cerrito topotypical specimens.

There are seven tubes of shells in the box in the WESTERLUND Collection in Göteborg (NMG, n. 1074) which is supposed to contain the original material of *H. samnitum* var. *pugnax*.

Three tubes, labelled as «*H. samnitum* var. *pugnax*» contain shells collected near Foligno (Umbria), Spoleto (Umbria) and Caserta Vecchia (Naples, Campania).

One tube has two labels, one with the name «*H. variepicta* var. *fasciata* Monterosato», the other with the name *H. samnitum* var. *pugnax*». This suggests that WESTERLUND considered the first form to be a synonym of the second.

The remaining three tubes are labelled «*H. (Xerolena) variepicta*» and contain shells from Palermo and other Sicilian sites. Shells belonging to a

small *Cernuella* species are contained in all seven tubes, sometimes mixed up with some shells of young specimens of *Trochoidea pyramidata*.

This small *Cernuella* is apparently close to the group of forms which GIUSTI & CASTAGNOLO (1982) identified with the name *Cernuella* (s. str.) *cisalpina* (ROSSMÄSSLER) and thus is clearly distinguishable both from the new species and the lectotype of *H. samnitum* WESTERLUND [= *Cernuella* (*Xerocincta*) *neglecta*]. Anatomical examination of topotypical specimens will be necessary to solve the problem. At present we limit ourselves to the selection of a lectotype for «*Cernuella pugnax* (WESTERLUND)» choosing a shell out of the syntypes (Pl. 2, figs. E-F) contained in the tube from Foligno which appears to correspond better to the original description (Pl. 2: fig. F). We elect Foligno, the first site cited by WESTERLUND, as the locus typicus restrictus.

We now come to *Helicella* (*Candidula*) *claudia* SACCHI. To date, we have been unable to trace the original materials. Nevertheless this species is clearly different in both shell structure and anatomy. Its generic status will have to be carefully ascertained since the genital duct reproduced by SACCHI suggests a *Trochoidea* (s. str.) or a *Candidula*.

Genus *Cernuella*

A remarkably larger number of taxa were described in the past century living in the Apennines and were traditionally considered to belong to the genus *Cernuella* (see ALZONA, 1971). Many of these can be promptly excluded from synonymy with the new species while it can be suggested that they belong to the «large *Cernuella*» group of forms because of their dimensions. They are:

Helix pompeiana LOCARD (1882; loc. typ. = Pompei); *Helix hydruntina* KOBELT (1884; loc. typ. = Terra d'Otranto); *Helix variata* PINI (1885; loc. typ. = southern Italy and Sicily); *Helix virgata* var. *tumida* WESTERLUND (1889; loc. typ. = Apulien); *H. virgata* var. *inflata* WESTERLUND (1889; loc. typ. = southern Italy); *H. virgata* var. *turgida* BLANC & WESTERLUND (in WESTERLUND 1889; loc. typ. = southern Italy); *Xerophila* (*Xerolauta*) *peninsularis* KOBELT (1907; loc. typ. = Campagna Felice) and its «forms»: *neptunensis* KOBELT (1907; loc. typ. = Nettuno), *virginea* KOBELT (1907; loc. typ. = Montevergine), *alburni* KOBELT (1907; loc. typ. = Mt. Postiglione), *laurensis* KOBELT (1907; loc. typ. = Lauria), *sybaritica* KOBELT (1907; loc. typ. = from Mormanno to Morano), *moranensis* KOBELT (1907; loc. typ. = Morano), *messapiensis* KOBELT (1907; loc. typ. = Terra d'Otranto), *saprensis* KOBELT (1907; loc. typ. = Sapri) (3).

Other species are closer to the new species because of their reduced dimensions. It is consequently very hard to come to conclusions about them, particularly when the descriptions are not sufficiently diagnostic

- 3) *Helix salentina* LOCARD (1885) has been omitted because the materials on which the description is based came from Lyon (France). LOCARD (1885: 76) wrote also that, according to BOURGUIGNAT *H. salentina* had to be considered as a southern «form» diffused in Italy, Sicily, Greece and Algeria. Its presence in France was explained with a passive transport phenomenon.

and the typical materials not traceable or lost. According to ALZONA (1971) they may be included in the «small *Cernuella*» group of forms. Their locus typicus makes it seem likely, though not certain, they are different. The new species, in fact, appears to live only at high altitudes.

They are:

Helix (Xeroampulla) subprofuga var. *maxima* BELLINI (1915; loc. typ. = Paludi al Vasto, near Naples). *Helix (Xeroampulla) subprofuga* var. *hoemastoma* (sic!) BELLINI (1915; loc. typ. = Capri, ruins of Forte Vigliena; Paludi al Vasto). *Helix (Xeroampulla) subprofuga* var. *turriculata* BELLINI (1915; loc. typ. = Capri, on the calcareous rocks near the Scala d'Anacapri).

According to FAGOT (1884) and ALZONA (1971) *Helix aprutiana* FAGOT (1884; loc. typ. = Mt. Maiella and Caramanico, Abruzzo) also belongs to the same group. We are in doubt about this species, as its description is not sufficiently clear and suggests the possibility of a relationship with the genus *Candidula*.

Finally we prefer to include *Helix casertana* BOURGUIGNAT (in LETOURNEUX & BOURGUIGNAT, 1887; loc. typ. = Caserta) among the «small *Cernuella*» rather than the «large *Cernuella*» as suggested by ALZONA (1971). Its dimensions suggest that it might correspond to materials in the GIUSTI collection, recently collected in the same area.

Genus *Trochoidea*

A few more taxa still remain to be considered. These, *H. pyramidata* var. *nova* PAULUCCI (1879; loc. typ. = Mt. Ghoni = Mt. Leone, Vibo Valentia; see FORCART, 1965) and *H. tarentina* PFEIFFER (= *H. pyramidata* var. *costulata* ROSSMÄSSLER 1848; loc. typ. = near Taranto) have been traced to the PAULUCCI collection.

This and the anatomical study of topotypical specimens allowed us to verify that they belong to the genus *Trochoidea* as previously suggested by FORCART (1965a).

The new species appears to be limited to high altitudes in the Apennines. To our first findings on Mt. Pollino and Mt. Sirino (southern Apennines) a new one has been recently added by Dr. A. HALLGASS in June 1986 on Mt. Autore (Simbruini Mountains, Latium). This has obliged us to revise our first conclusions about the origin of the new species. It seems certainly not a recent southern Italian endemism, but rather it can be considered as a relict of uncertain origin, possibly central European, pushed south by the quaternary glaciations, exactly as can be postulated for the genus *Candidula*. Its apparently sporadic presence in peripheral high altitude habitats seems to suggest that it has been present in the Apennines for longer than *Candidula*, possibly from the beginning of the glaciations. The successive arrival of the genus *Candidula* (during the last glaciations?) might have caused a concurrence phenomenon and its exclusion from most of the high altitude habitats, particularly in the central Apennines.

As a matter of fact the new species has never been found to coexist with any *Candidula* species. On Mt. Pollino both may be found but in clearly distant areas of the same high altitude grasslands.

THE GENUS *CERNUELLA* AND THE ASSOCIATED TAXA OF THE GENUS GROUP

Premise

The systematic ranking of the genus *Cernuella* and the taxa usually associated with it, appears unsound in the light of recent data on the genital duct structure of the Hygromiinae. Too often researchers have included in this genus any taxa having two stylophores forming a dart-sac complex on one side of the vagina without verifying whether the structure of this apparatus was really always the same in all its details or whether it was only apparently similar due to convergence or persistence of the characters defining its basic outline. We have tried to obviate this problem by carefully analyzing the minute structure of the dart-sac complex and of other portions of the genital duct (penial complex, digitiform glands, etc.) in search of characters which could facilitate the diagnosis of the species and of the taxa of the genus group.

Unfortunately the lack of reliable data on the nature of some type species and the lack of spirit materials of others, has prevented a complete solution of the problem, and obliged us to limit the analysis of some of the taxa to their historical aspects.

Genus *Cernuella* SCHLUTER, 1838

Type species: *Helix variabilis* DRAPARNAUD 1801 (= *Cochlea virgata* DA COSTA, 1778); subsequent designation: GUDE & WOODWARD, 1921: 182 («no type having, therefore, been fixed we select *Helix variabilis* DRAP. = *virgata* DA C., as the type»).

Description:

Medium-large or small sized shell, with 5-7 whorls increasing more or less gradually and regularly; globular, flattened or conical above, opaque, white to ginger, commonly with brown spiral bands or blotches; external surface without hairs; some degree of transverse ribbing, sometimes almost smooth. Umbilicus variable in diameter from very small to wide. Mouth roundish or oval; peristome not reflected with an internal white or brown rib.

The genital duct is characterized by the following series of characters: more or less reduced proximal vagina; two stylophores disposed side by side to form a dart-sac complex adhering to one side of the vagina. The complex is externally enveloped for most of its length by a continuous tissue layer; only the very vertices of the sacs are separated from one another. The outer stylophore is of the same size or larger than the inner one. The two small cavities of the stylophores open independently one above the other into a groove running along a conical structure which extends into the vagina; the conical structure has a long slit which parts from its base

and extends past the opening of the inner stylophore cavity to end almost in coincidence with the opening of the outer stylophore. The conical structure near its tip thus forms a sort of «dart gun». Vaginal pleats in variable number run along the inner surface of the vaginal walls in correspondence with the conical structure; two of these pleats originating at about half the length of the conical structure in the neighbourhood of the slit, fuse below the conical structure giving rise to a sort of ring. The outer stylophore contains an arched dart which has a circular section near its base; the tip has the form of an arrow head with a transverse section in form of a cross with the two opposing arms longer than the other two. Digitiform glands present. The bursa copulatrix duct is much longer than the vagina, and has a flared initial portion. Epiphallus longer than penis (which we take to be the portion of the penial complex from penial retractor to genital atrium); the penis is slender and enters the vagina level with the apex of the conical structure of the dart-sac complex; the penial opening into genital atrium is bordered by a sort of ring-shaped sphincter, usually contracted. The penial papilla (= glans) is of variable length, with an apical opening; in transverse section near the tip or at half its length it shows only a central canal, sometimes surrounded by a ring of small lacunae. Wider lacunae are present in basal sections and in some species are seen to communicate with the penial cavity through small openings; in some species small muscles (= «frenula») connect the base of the penial papilla to the penial walls. The penial flagellum is short, very much shorter than the epiphallus. The penial nerve starts from the right pedal ganglion. The right ommatophore retractor is independent of penis and vagina.

Subgenus *Cernuella* (s. str.)

Description:

Genital duct characterized by a penial papilla with three small muscles («frenula») which connect its base to the penial walls.

Material examined:

«Small sized *Cernuella*» [= *Cernuella virgata* DA COSTA (partim?) in the sense of English Authors = *Cernuella subprofuga* or *jonica* in the sense of

Fig. 4 - «Small sized *Cernuella*» [*Cernuella virgata* (DA COSTA) in the sense of English Authors; *C. cfr. subprofuga* (STABILE) or *jonica* (MOUSSON) in the sense of continental Authors; *C. cfr. cisalpina* (ROSSMÄSSLER) in the sense of GIUSTI & CASTAGNOLO, 1982].

The genital duct and its various parts in specimens collected near Dunstanborough Castle (Northumberland, England) (A-F) and near Salse di Mirano (Modena, Italy) (G). A-B: penial papilla and its transverse section; note two of the three basal frenula. C: digitiform glands; note the join of the digitiform glands situated between the vagina (V) and the inner dart sac (IDS). D,G: portions of genital ducts. E: the vagina and the genital atrium have been opened to show the inner vaginal accessory structures. F: dart and its section at the tip. (Symbols as in Fig. 1)

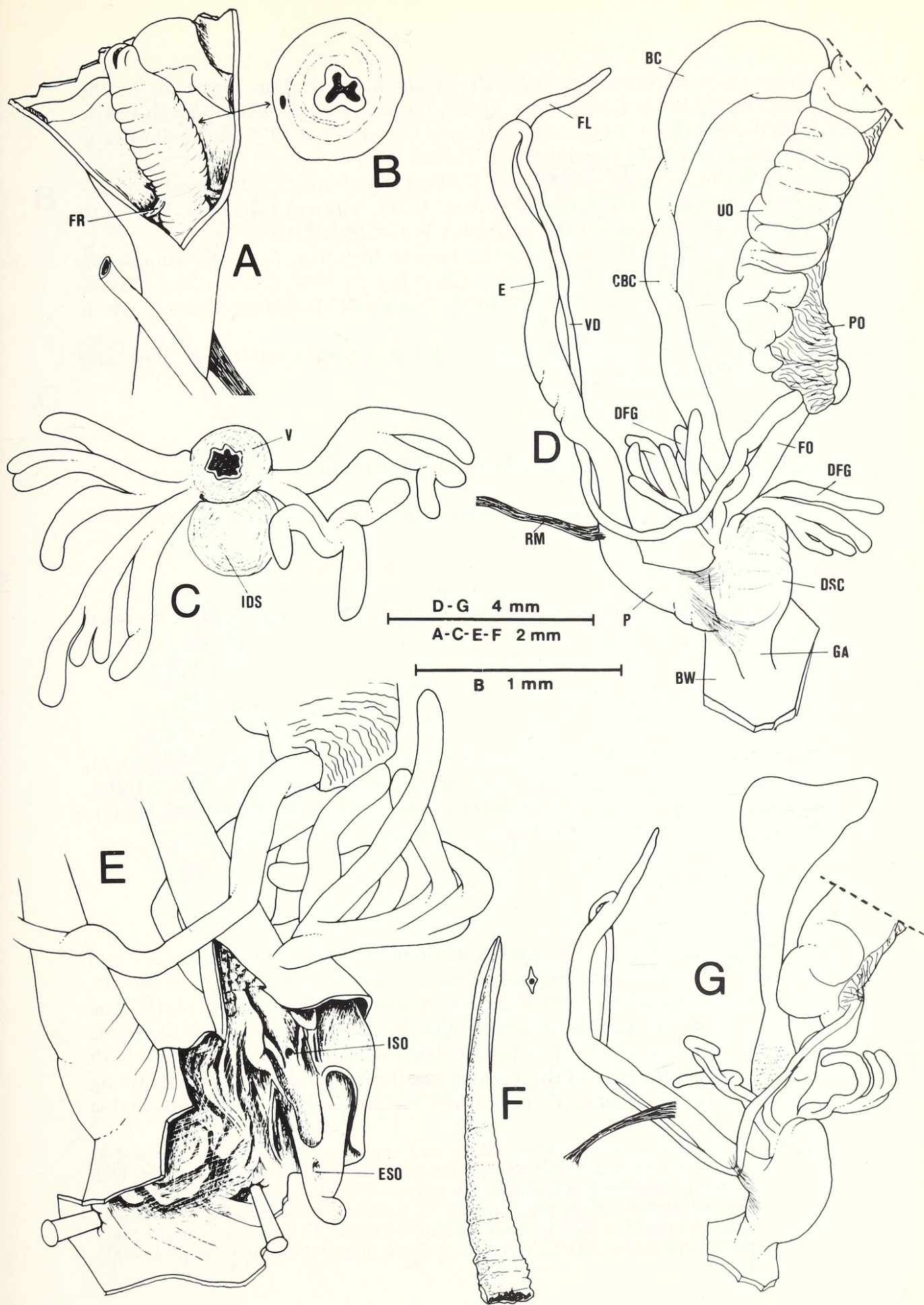


Fig. 4

continental Authors; *Cernuella* cfr. *cisalpina* for Italian materials in the sense of GIUSTI & CASTAGNOLO, 1982]: on sea cliffs, Dunstanborough Castle (Northumberland, England), A. NORRIS leg. et det. 9/1979; Salse di Mirano (Modena, Italy), P. TONGIORGI leg. 15/3/85 (Fig. 4).

«Medium sized *Cernuella*» (= *C. virgata* Auctores; *C.* cfr. *virgata* for Italian materials in the sense of GIUSTI, 1976): Viacaya (Spain), C.E. PRIETO leg. 4/12/82; Montaperti (Siena, Italy), F. GIUSTI leg. 10/11/74.

«Large sized *Cernuella*» (= *C. virgata* Auctores; *C.* cfr. *virgata* sensu GIUSTI, 1976): Grassé (France), C. ALZONA leg. 11/1937; Castrovillari (Catanzaro, Italy), F. GIUSTI leg. 15/10/77; Sulmona (L'Aquila, Italy) C. & J. ALZONA, leg. 10/1937 (Fig. 5).

Cernuella cfr. *caruanae* (KOBELT): Wied is Sewda (Malta), P. SCHEMBRI leg. 11/10/80 (Fig. 6).

Subgenus *Xerocincta* DI MARIA di MONTEROSATO, 1892

Type species: *Helix neglecta* DRAPARNAUD 1805 (typus by monotypy).

Description:

Genital duct characterized by a long penial papilla with no basal frenula.

Material examined:

Cernuella (Xerocincta) neglecta (DRAPARNAUD): Villacoublay (France), M. TESTUD leg. 9/1974; Angoulême (France), M. BODON leg. 6/9/85; Siena (Italy), N. BACCETTI leg. 12/10/72; Ovindoli (L'Aquila, Italy), A. NORRIS leg. 6/1981; Passignano sul Lago (Perugia, Italy), F. GIUSTI leg. 23/2/69 (Fig. 7).

Comments

As is evident from the above descriptions, the shell characters and most of the genital duct characters vary so much as to be useless for distinguishing *Cernuella* into two groups of species. This is particularly true after our study of specimens from Malta, known at present with the name *Cernuella caruanae* (Kobelt), which shows a shell and a penial papilla with frenula similar to those of the various small-medium-large *Cernuella* living in Europe (= *C. virgata*; *C. subprofuga-jonica-cisalpina* Auctores), and a

Fig. 5 - «Large sized *Cernuella*» [*Cernuella* (s. str.) *virgata* Auctores]. Genital duct and its parts in specimens collected near Castrovillari (Calabria, Italy). A: the penis has been opened to show the penial papilla (PP) and two of its three basal frenula (FR). B: two different sections of the penial papilla. C: a section of the proximal penis. D: the vagina is opened to show its inner accessory structures. E: digitiform glands. F: distal portion of a genital duct. G: two darts and some different sections. (Symbols as in Fig. 1)

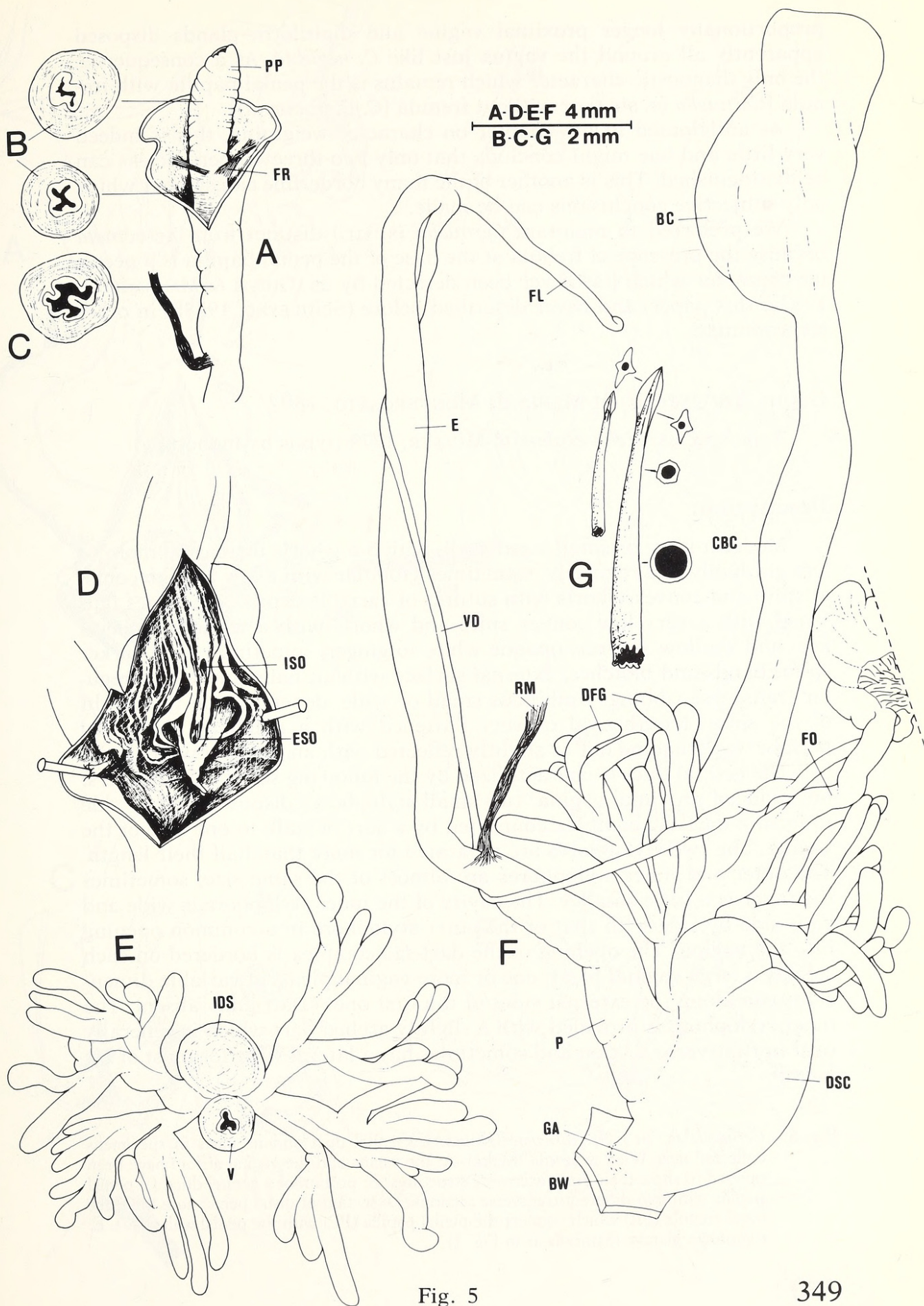


Fig. 5

proportionally longer proximal vagina and digitiform glands disposed apparently all around the vagina just like *C. neglecta*. As a consequence, the only diagnostic character which remains is the penial papilla with frenula [*Cernuella* (s. str.)] or without frenula [*C. (Xerocincta)*].

As anticipated in the chapter on character weighting, this is indeed very little and one might conclude that only two-three «superspecies» can be distinguished! This is another of the many borderline cases about which only subjective conclusions can be made.

We preferred to maintain *Cernuella* (s. str.) distinct from *Xerocincta* because the presence of frenula at the base of the penial papilla is a peculiar character which has never been detected by us (GIUSTI & MANGANELLI, 1987a; this paper) and never described before (SCHILEYKO, 1978b) in other Hygromiinae.

Genus *Xerosecta* DI MARIA di MONTEROSATO, 1892

Type species: *Helix explanata* MÜLLER, 1774 (typus by monotypy).

Description:

Medium-large or small sized shell, with 5-6 whorls increasing more or less gradually and regularly, sometimes globular with a low or high conical spire and convex whorls with sutures of variable depth, sometimes flattened with a very low convex spire and whorls with a white peripheral keel and shallow sutures, opaque white to ginger, sometimes with darker spiral bands and blotches; external surface without hairs and with irregular transverse ribbing. Umbilicus small or wide, depending on the height of the spire. Mouth oval or very flattened with a notch at the keeled periphery; peristome not or slightly reflected with an internal whitish rib.

The genital duct is characterized by the following series of characters: not reduced proximal vagina; two small stylophores disposed side by side to form a dart-sac complex connected by a sort of stalk to one side of the vagina. The two stylophores are separated for more than half their length. The outer and inner stylophores are almost of the same size; sometimes the inner is a little smaller. The cavity of the inner stylophore is wide and ends side by side with that of the outer stylophore in a common opening into the vagina. The opening of the dart-sac complex is bordered on each side by a large vaginal pleat; one or more vaginal pleats of variable dimensions run along the external sides of the first one. «Dart gun» absent. The outer stylophore is provided with a slightly arched dart which is generally oval in transverse section and sometimes has a lateral wing for most of his length.

Fig. 6 - *Cernuella* (s. str.) cfr. *caruanae* (KOBELT). Genital duct and its parts in specimens collected near Wied is Sewda (Malta). A: the vagina and the genital atrium have been opened to show their inner accessory structures. B: portion of a genital duct. C: penial papilla with two different transverse sections. D: section of distal penis; note the three basal frenula (FR) which connect the penial papilla (PP) with the penial wall (PW). E: digitiform glands. (Symbols as in Fig. 1)

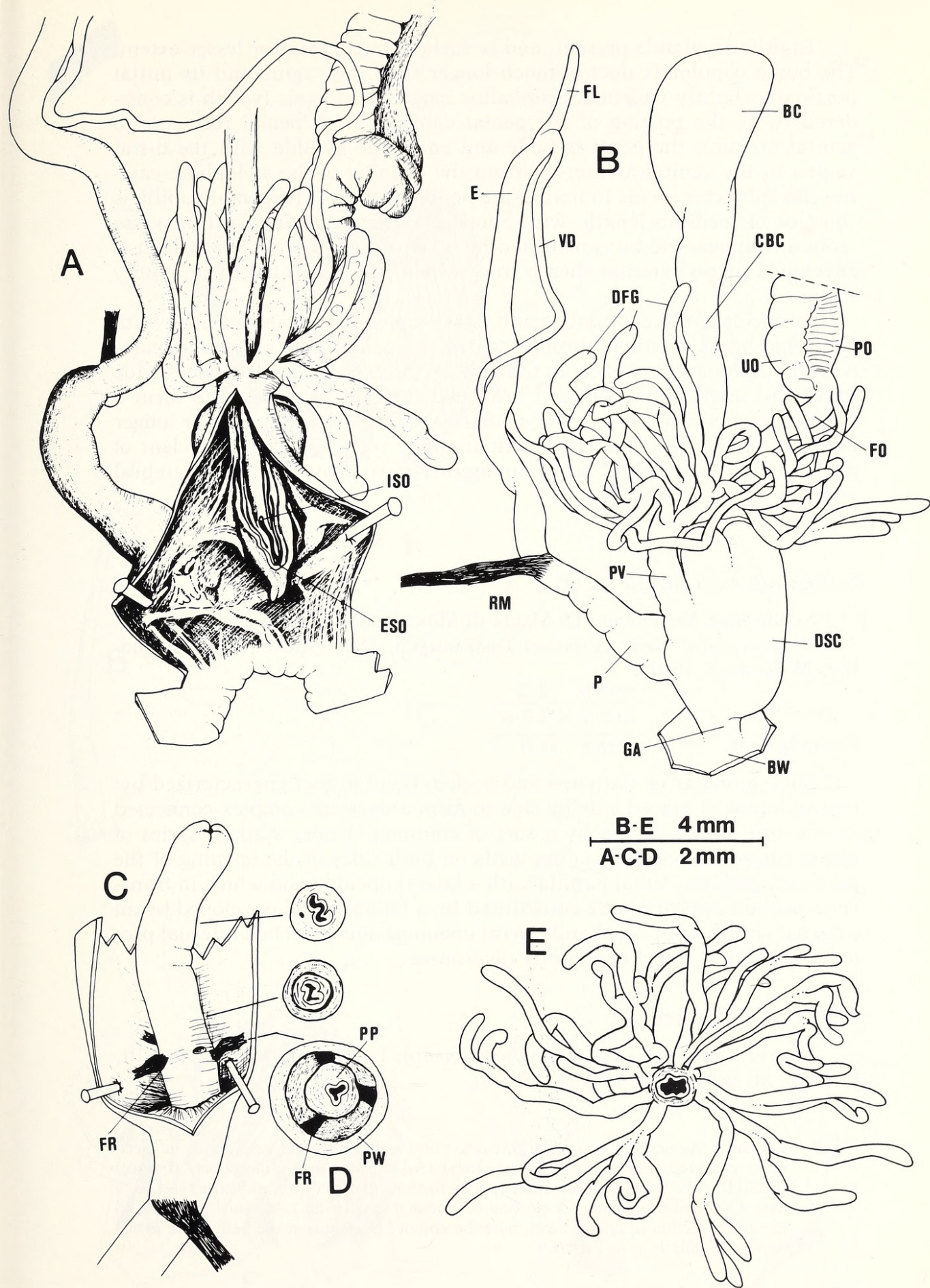


Fig. 6

Digitiform glands present, and branched to a greater or lesser extent. The bursa copulatrix duct is much longer than the vagina and its initial portion is slightly widened. Epiphallus longer than penis (which is considered to be the portion of the penial complex from penial retractor to genital atrium); the penis is wide and ends side by side with the distal vagina in the genital atrium far from the opening of the stylophore cavities; no sphincter seems to border the penial opening. The penial papilla is short or of medium length, with apical or lateral opening; in transverse section it appears to be constituted by a central or lateral canal which is enveloped by an external sheath from which it is separated by an empty space.

In one case the external sheath is a simple continuous envelope with two wide basal openings through which the penial cavity communicates with the endopapillar space; in other cases the external sheath shows wide basal and lateral openings and branched internal projections to form a sort of «corpus cavernosus». The penial flagellum is long, shorter or longer than the epiphallus. The right ommatophore retractor is independent of penis and vagina. Penial nerve apparently parts from the right cerebral ganglion.

Subgenus *Xerosecta* (s. str.)

Synonyms: *Xeromagna* DI MARIA di MONTEROSATO (1892: 24)

Type species: *Helix cespitum* DRAPARNAUD, 1805 (subsequent designation by KOBELT, 1892).

Description:

Shell globular or flattened and keeled. Genital duct characterized by: two stylophores placed side by side to form a dart-sac complex connected to one side of the vagina by a sort of common slender stalk; a series of pleats runs all along the vagina walls on both sides of the opening of the dart-sac complex. Penial papilla with a lateral opening and which in transverse section appears to be constituted by a lateral canal enveloped by an external sheath with basal and lateral openings and branched internal projections to form a sort of «corpus cavernosus».

Material examined:

Xerosecta (s. str.) *explanata* (DRAPARNAUD): La Grande Motte (Herault, France), M. BODON leg. 3/12/84) (Fig. 8).

Fig. 7 - *Cerņuella* (*Xerocincta*) *neglecta* (DRAPARNAUD). Genital duct and its portions in specimens collected near Siena (Tuscany, Italy) (A-D,F) and near Villecoublay (France) (E,G-H). A,E: the vagina has been opened to show its inner accessory structures. B: a dart. C: digitiform glands. D: portion of a genital duct. F-H: two penial papillae and the apical section of one of them; note the absence of frenula at the base of the penial papilla. (Symbols as in Fig. 1)

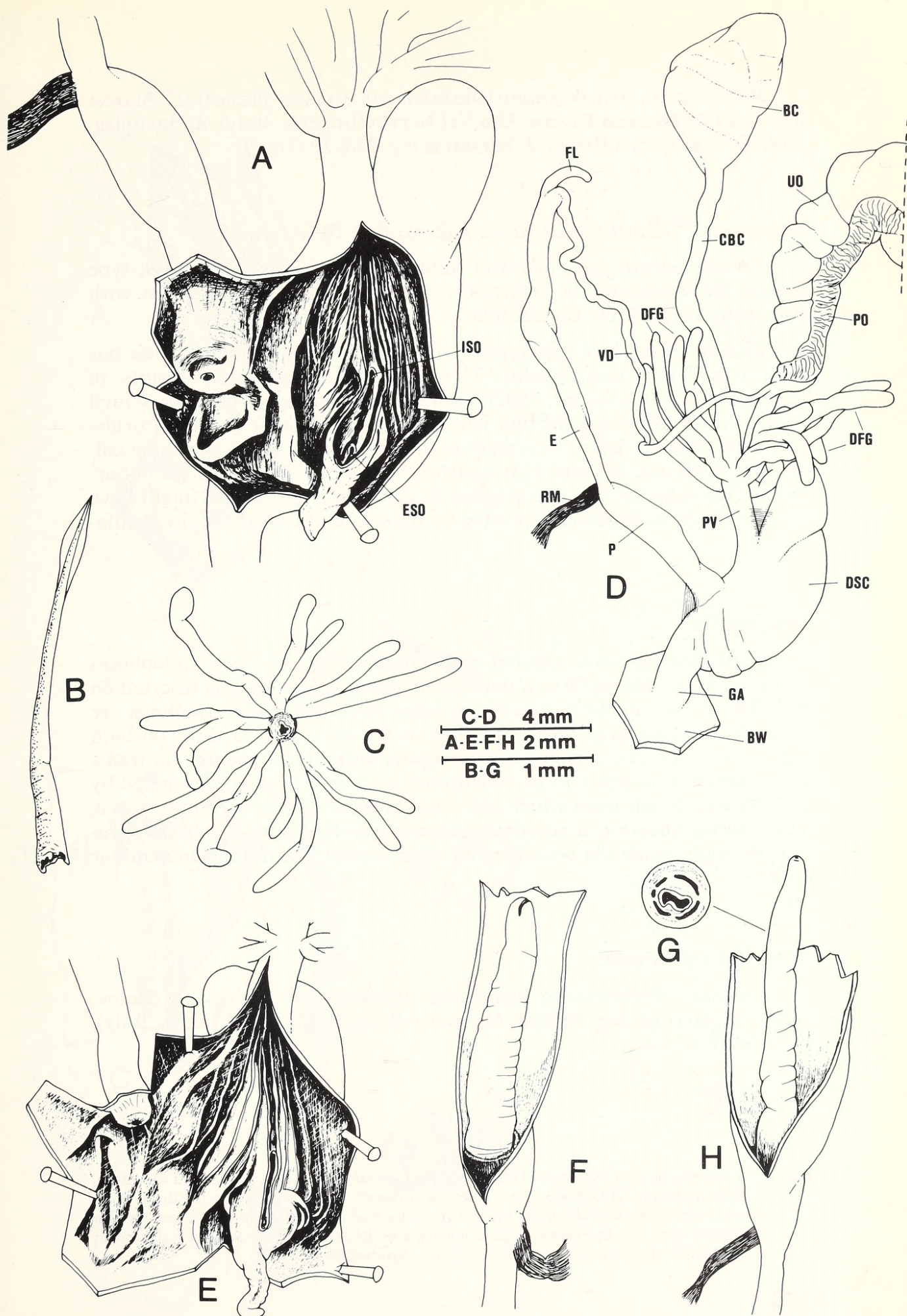


Fig. 7

Xerosecta (s. str.) *cespitum* (DRAPARNAUD): Grassé (France), C. ALZONA leg. 11/1937; Fontana Povera, Alta Val Nervia (Imperia, Italy), A. BOATO leg. 25/6/78; near Genoa (Italy), J. NIENHUIS leg. 23/8/70 (Fig. 9).

Subgenus *Polloneriella* ALZONA & ALZONA BISACCHI, 1940

Nomen novum pro *Polloneria* ALZONA & ALZONA BISACCHI, 1939, type species *Helix contermina* PFEIFFER, original designation, homonym with *Polloneria* SACCO, 1886, Clausiliidae.

Recent research of topotypical specimens in the Bonifacio area has been completely unsuccessful. This confirms the negative results of CAZIOT's efforts (see CAZIOT, 1902). Bonifacio specimens are not represented in the SHUTTLEWORTH collection which at present is kept in the Naturhistorisches Museum Bern. Nevertheless, other materials from the same collection (NMB nrs. 424 and 425) confirm the presence of the species in Sardinia. This suggests that the original *H. contermina* specimens might have been shells from Sardinia deposited by the sea on the shores of the Bonifacio area.

Description:

Shell globose-conic. Genital duct characterized by: two stylophores placed side by side to form a dart-sac complex whose stalk is inserted on one side of the vagina between two large swellings. These swellings are produced by two large pleats running on the inner vagina walls on both sides of the dart-sac opening. Penial papilla with apical opening, in transverse section it appears to be constituted by a central canal enveloped by an external sheath from which the canal is separated by an empty space. The external sheath is a simple continuous envelope with two basal openings through which the penial cavity communicates with the endopapillar space.

Material examined:

Xerosecta (*Polloneriella*) *contermina* (PFEIFFER): Castelfusano (Rome, Italy), A. HALLGASS leg. 28/9/86; Montalto di Castro Marina (Viterbo, Italy), 24/11/86 (Fig. 10).

Fig. 8 - *Xerosecta* (s. str.) *explanata* (DRAPARNAUD). Genital duct and its portions in specimens collected near La Grande Motte (Herault, France). A: the vagina and the distal penis are opened to show the inner vaginal structure and the penial papilla. B: portion of a genital duct. C: the penial papilla and two of its transverse sections. D: digitiform glands. E: the dart and two of its sections. (Symbols as in Fig. 1)

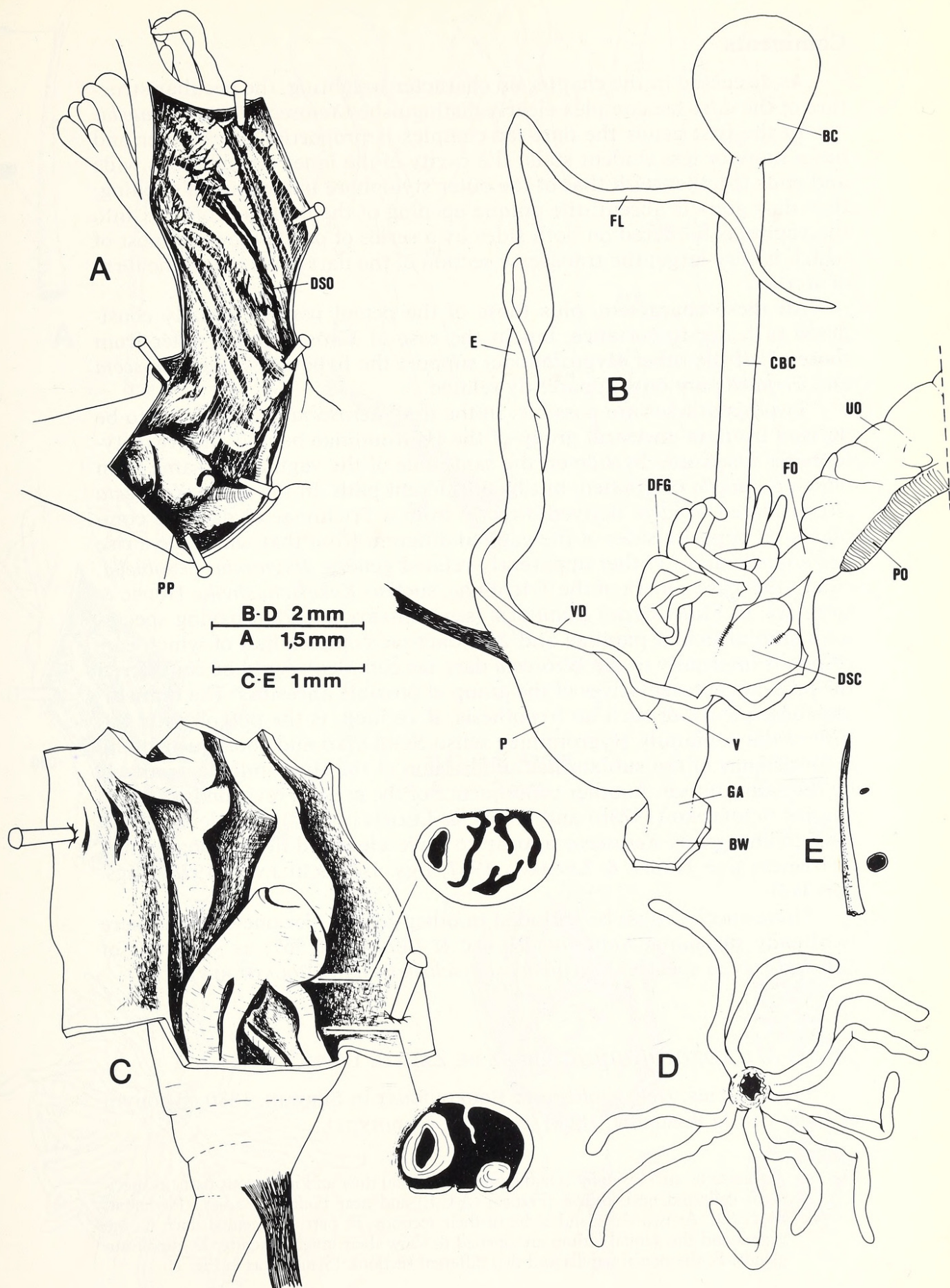


Fig. 8

Comments

As discussed in the chapter on character weighting, the peculiar structure of the dart-sac complex clearly distinguishes *Xerosecta* from *Cernuella*.

In the first genus the dart-sac complex is proportionally smaller and has a more or less evident stalk; the cavity of the inner stylophore is wide and ends together with that of the outer stylophore in a common opening; the «dart gun» is absent; the unique opening of the dart-sac complex into the vagina is bordered on both sides by a series of pleats the innermost of which is very large; the transverse section of the dart tip is not in the form of a cross.

All these characters, plus those of the penial papilla (usually considered of lesser importance, but in the case of *Xerosecta* they differ from those of all the other Hygromiinae) support the hypothesis that *Xerosecta* and *Cernuella* are only apparently related.

Two hypotheses are possible. In the first, *Xerosecta* is considered to be derived from an ancestral group of the Hygromiinae having only two stylophores fused side by side on the same side of the vagina, the same from which *Cernuella* originated, but by a different path. In the other, *Xerosecta* is considered to have derived directly from a Trichiinae (2 dart-sac complexes on opposite sides of the vagina) different from that which gave rise to *Cernuella* and to other apparently related genera: *Hygromia*, *Zenobiella*, etc. In this case genera of the Trichiinae, such as *Kakotschashvilia* HUDEC & LEZHAWA, or *Caucasigena* LINDHOLM (see SCHILEYKO, 1978b) having species with similar penial papillae and 2+2 dart-sac complex half of which corresponds internally to the *Xerosecta* dart-sac complex), could be considered the present representatives of the group of possible ancestors. The immediate consequence of such an hypothesis, if verified, is the polyphyletic nature of the subfamily Hygromiinae sensu SCHILEYKO and consequently the inconsistency of the subfamilial subdivision of the Hygromiidae proposed by the same author. Another consequence of the present revision is that the species SCHILEYKO (1978b) and HUDEC & LEZHAWA (1967) considered to belong to the genus *Xerosecta* appear to have clearly different anatomical characters (see HUDEC & LEZHAWA 1967, figs. 1-2; SCHILEYKO, 1978b, figs. 306-313).

These species must be included in other genera. For one of these there is already the name *Kalitinaia* HUDEC & LEZHAWA (1967; as subgenus of *Xerosecta*; type species: *Helix (Jacosta) schelkovnikovi* BOGATSHEV).

Genus *Microxeromagna* ORTIZ DE ZARATE LOPEZ, 1950

Type species: *Helix stolismena* BOURGUIGNAT in SERVAIN, 1880, synonym of *Helix vestita* RAMBOUR, 1868) (typus by monotypy).

Fig. 9 - *Xerosecta* (s. str.) *cespitum* (DRAPARNAUD). Genital duct and its various parts in specimens collected near Grassé (France) (A-C,E) and near Fontana Povera, (Piedmont, Italy) (D). A: two darts and some of their sections. B: part of a genital duct. C: the vagina and the genital atrium are opened to show their inner structure. D: digitiform glands. E: the penial papilla and two different sections. (Symbols as in Fig. 1)

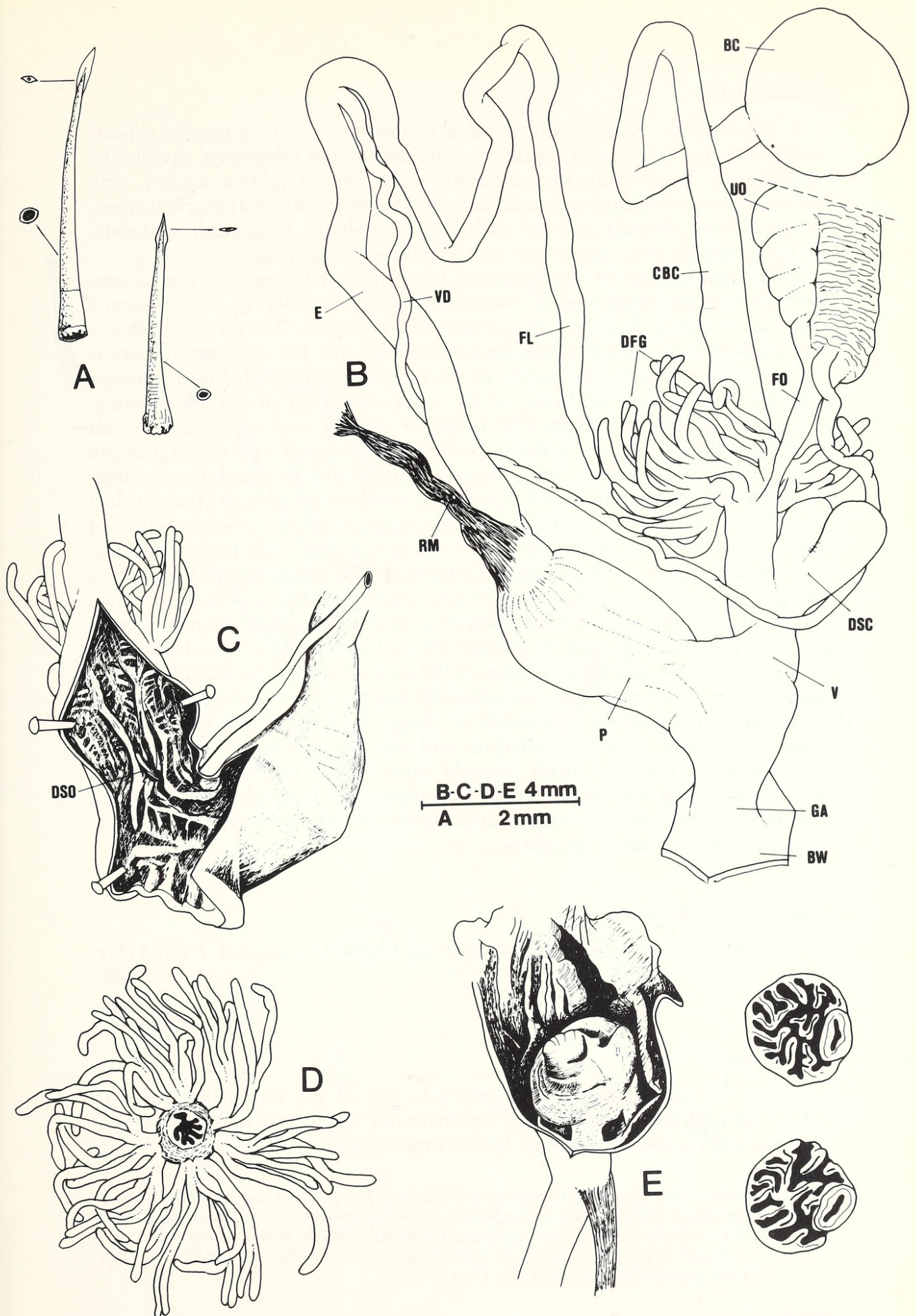


Fig. 9

Description:

Small shell with a conical spire formed by 4 1/3 –5 convex whorls increasing gradually and regularly, rounded at the periphery, divided by moderately deep sutures; opaque brown in colour, above flecked with white, below with darker bands. External surface with well marked transverse ribbing, densely covered with very short hairs. Umbilicus moderately wide. Mouth oval; peristome neither thickened nor reflexed.

The genital duct is characterized by the following series of characters: not reduced proximal vagina; two stylophores fused side by side to form a dart-sac complex disposed on one side of the vagina. The two stylophores are separated for less than one half of their length. The outer stylophore is larger than the inner. The cavity of the inner stylophore is wide and opens into the vagina with the cavity of the outer stylophore in a single opening. Two large pleats, not fused anteriorly, lie side by side and border to left and right the groove where the dart-sac complex opens into the vagina. No additional pleat is visible on the vagina walls in the dart-sac complex area. «Dart gun» absent. The outer stylophore contains an almost straight dart which shows only two lateral wings (one opposed to the other) for most of its length; dart transverse section at various points (half length and tip) resembles a more or less flattened rhombus. The bursa copulatrix duct is not flared at its beginning and is much longer than the vagina. Epiphallus longer than penis (which is considered to be the portion of the penial complex from penial retractor to genital atrium); the penis is broad and ends side by side with the distal vagina in the genital atrium far from the opening of the dart-sac complex; no sphincter seems to border the penial opening. The penial papilla is peculiar in shape: it is short and formed by a thin, simple wall which is rolled up and one side interrupted by a slit; in transverse section the wall reveals very small lacunae. The penial flagellum is long, almost as long as the epiphallus. The right ommatophore retractor is independent of penis and vagina. Penial nerve apparently parts from the right cerebral ganglion.

Material examined:

Microxeromagna vestita (RAMBOUR): near Olmeto (Corsica), 1/12/83 (Fig. 11).

Comments

That of *Microxeromagna* is evidently one of the borderline cases to which we referred in the chapter on character weighting. Many of its anatomical characters suggest it to be more closely related to the genus

Fig. 10 - *Xerosecta* (*Polloneriella*) *contermina* (PFEIFFER). Genital duct and its various parts in specimens collected near Montalto di Castro Marina (Latium). A: portion of a genital duct with the vagina opened to show its inner structure. B: part of a genital duct. C: a dart and its section at the tip. D: penial papilla with two different sections. E: digitiform glands. (Symbols as in Fig. 1)

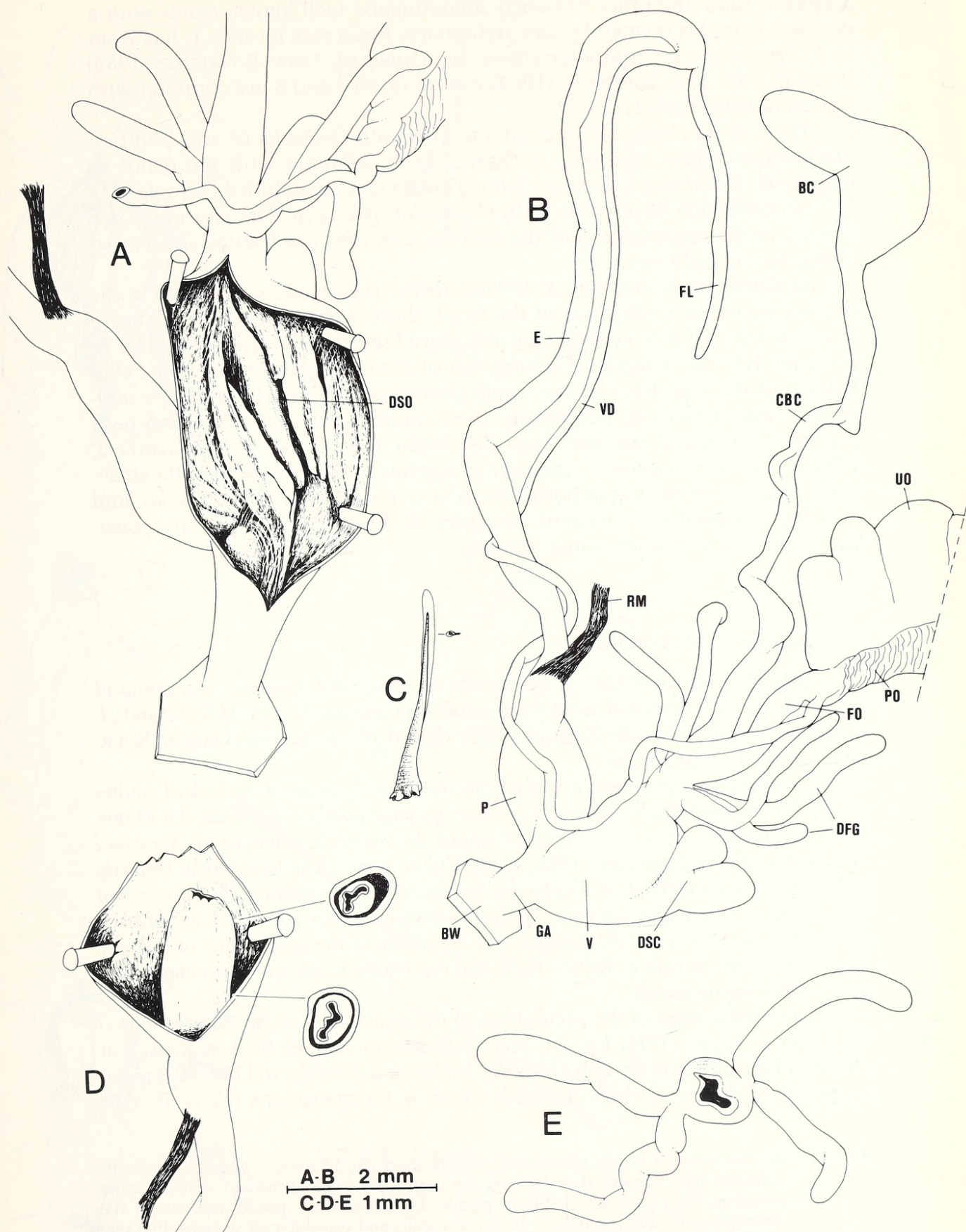


Fig. 10

Xerosecta than any other presently anatomically well known genus with a dart-sac complex formed by two stylophores fused side by side. It has 9 out of 13 characters (= character states; see GHISELIN, 1984; RODRIGUES, 1986) listed in Tab. 1, in common with *Xerosecta* (s. str.) and 8 are common with *Xerosecta* (*Polloneriella*).

There is no character in common with both *Cernuella* (s. str.) and *Cernuella* (*Xerocincta*), and only 3 characters in common with the genus in which «*H. lacosteana*» MORELET from Tunisia can be included (*Xeroplana*?).

No confusion is possible with *Cernuellopsis* n. gen. The enormous difference in the organization of the dart-sac complex has limited the shared characters to only two.

As *Xerosecta* (s. str.) and *X. (Polloneriella)* (the second considered in the present paper as a subgenus of the first), share 9 characters (out of the 13 listed in Tab. 1), it is evident that the more logical conclusion would be to consider *Microxeromagna* as a subgenus of *Xerosecta*. Nevertheless the evaluation of the «quality» of the single characters differentiating *Microxeromagna* from *Xerosecta*, not simply their number, suggests the same path previously utilized for the case *Zenobiella* (see GIUSTI & MANGANELLI, 1987a). *Microxeromagna* is set apart as a genus and its penial papilla structure, different from that of both *Xerosecta* (s. str.) and *X. (Polloneriella)*, and to a lesser extent the different structure of the dart and shell, are considered the main distinguishing features.

The problem of *Xerofalsa*

In 1892 (: 21) DI MARIA di MONTEROSATO described *Xerofalsa* as a group of species living in Tunisia and listed three constituent species: *H. idia*, *H. enica* and *H. zougitana*. In the same year KOBELT (1892) elected *H. idia* LETOURNEUX & BOURGUIGNAT as the type species.

For a long period of time it was left unconsidered because of the lack of studies on N. African land snails. Although «senior» by page number, *Xerofalsa* (DI MARIA di MONTEROSATO, 1892: 21) was listed among the probable synonyms of *Xeroplexa* (DI MARIA di MONTEROSATO, 1892: 23) by ZILCH (1960). The latter taxon formerly believed to be a subgenus of *Trochoidea* has recently been anatomically revised and discovered to be a junior synonym of *Candidula* (GITTEMBERGER, 1985). It has been impossible to revise *Xerofalsa* because only an outline of the genital duct of the type species is known (KTARI & REZIG, 1976) and our efforts to get spirit specimens have always been unsuccessful.

Nevertheless some of the peculiarities of the genital duct of *H. idia* reproduced by KTARI & REZIG (1976, Fig. 24) seem sufficient to support the hypothesis that *Xerofalsa* has nothing to do with *Cernuella*. In this case *Xerofalsa* will become a genus proper of N. Africa to which *Alteniella* CLERX & GITTEMBERGER (1977: 53; type

Fig. 11 - *Microxeromagna vestita* (RAMBOUR). Genital duct and its various parts in specimens collected near Olmeto (Corsica). A: the vagina has been opened to show its inner structure. B: a dart. C: digitiform glands. D: genital duct (gonad and part of the hermaphrodite duct excluded). E: penial papilla and two different sections. F: a section of the proximal penis. (Symbols as in Fig. 1)

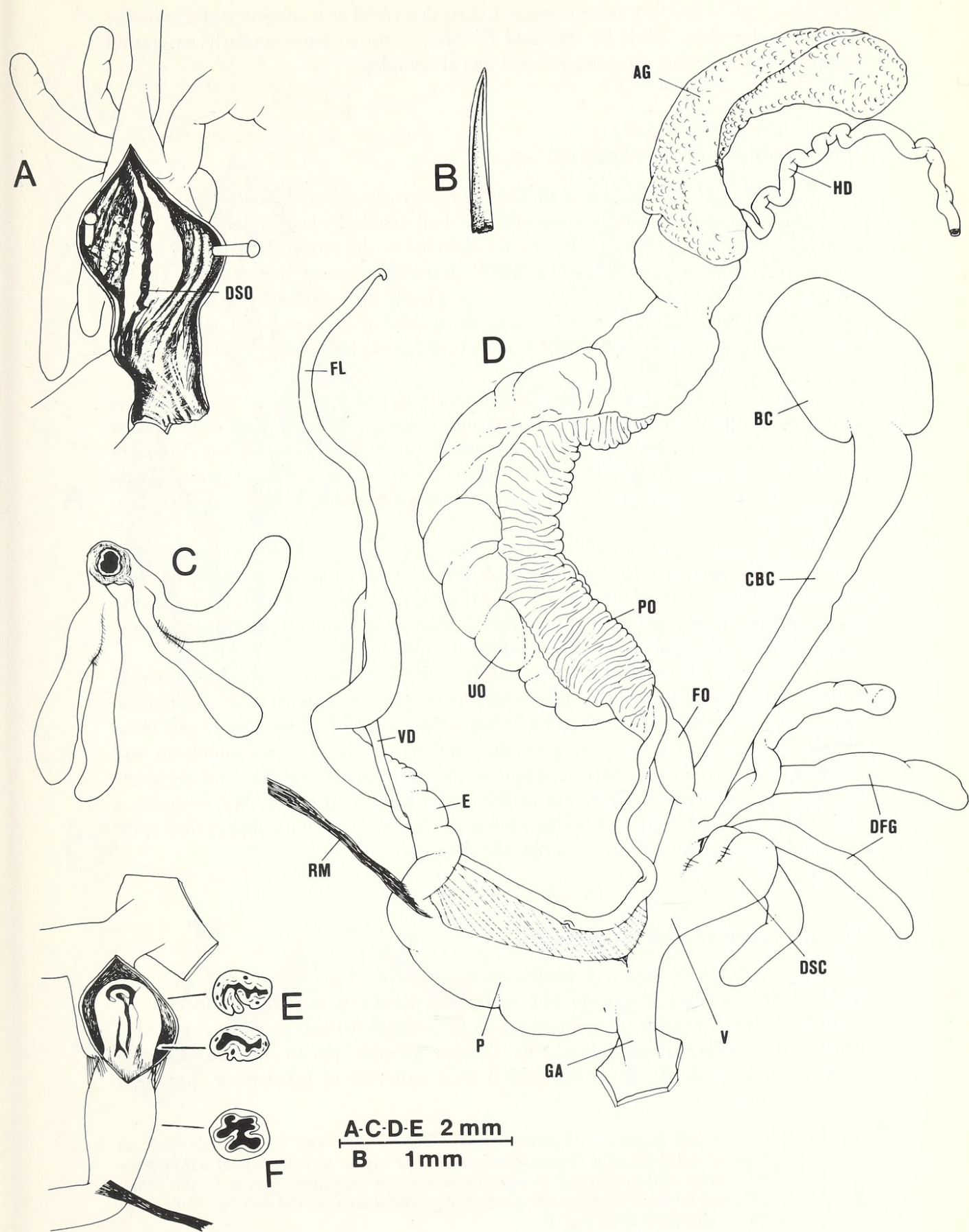


Fig. 11

species: *C. zilchi* BRANDT from Cyrene, Lybia; described as a subgenus of *Cernuella*) appear to be close. Both *H. idia* and *C. zilchi* seem to have similarly structured digitiform glands, dart-sac complex and penial complex.

The problem of *Xeroplana*

In 1892 (: 21-22) DI MARIA di MONTEROSATO described *Xeroplana* as a group of Tunisian species showing a nummuliform shell, markedly keeled, faded in colour, widely umbilicated. Two were the species included in the group: *H. doumeti* and *H. depressula*. In the same year KOBELT (1892) elected *H. doumeti* BOURGUIGNAT as the type species. The taxon *Xeroplana*, was subsequently disregarded by KOBELT (1904: 206) when he included *H. doumeti* among the species of *Xeroamanda*. Later on *Xeroplana* was considered to be a junior synonym of *Jacosta* by HESSE (1934: 20) and of *Leucochroa* (ZILCH, 1960).

FORCART (1965b) was the first to demonstrate that both these last two names had been wrongly interpreted in the past and, consequently, that they could not be used for the taxon including the «nummuliform Helicellinae» of the Western-Mediterranean area. In fact FORCART utilized for the type species of genus *Jacosta* sensu HESSE — *H. explanata* — the generic name *Xerosecta* DI MARIA di MONTEROSATO (1892: 21).

At this point one could conclude that *Xeroplana* is a junior synonym of *Xerosecta*. The present anatomical study of *Xerosecta* and of adult specimens of *Helix lacosteana* MORELET from Sbeitla (Tunisia) (Fig. 12) a «species» usually considered to belong to the *H. doumeti* group of forms (*H. doumeti* is known from a close locality: Djebel Edmar near Gabes, Tunisia) exclude this possibility.

H. lacosteana belongs to a taxon which is clearly different from both *Cernuella* and *Xerosecta* (see Tab. 1). The almost total correspondence between the anatomical characters of *H. doumeti* reported by HESSE (1934: 21, Pl. 5: figs. 35 a-f) and those of our *H. lacosteana* specimens, prevents confusion with other nummuliform and keeled species of Tunisia, considered here to belong to genus *Xerofalsa* and decisively supports the eventual confirmation of *Xeroplana* as a good genus. We postpone a categorical conclusion and the redescription of *Xeroplana* to when topotypical spirit specimens of *H. doumeti* can be personally dissected.

The problem of *Xeroamanda*

In 1892 (: 22) DI MARIA DI MONTEROSATO described *Xeroamanda* as a group of species living in Algeria, Tunisia and Sicily, and listed two constituent species: *H. amanda* and *H. usticensis*. In the same year *H. amanda* ROSSMÄSSLER (loc. typ.: bei Panormus = Palermo) was elected by KOBELT as type species. Unfortunately no information is available about the genital duct structure of topotypical specimens

Fig. 12 - (?) *Xeroplana lacosteana* (BOURGUIGNAT). Genital duct and its different parts in specimens collected near Sbeitla (Tunisia). A: the vagina and the genital atrium have been opened to show vaginal accessory structures. B: digitiform glands. C: the penial papilla and its medial section. D: portion of a genital duct. E: the dart and some of its sections. (Symbols as in Fig. 1)

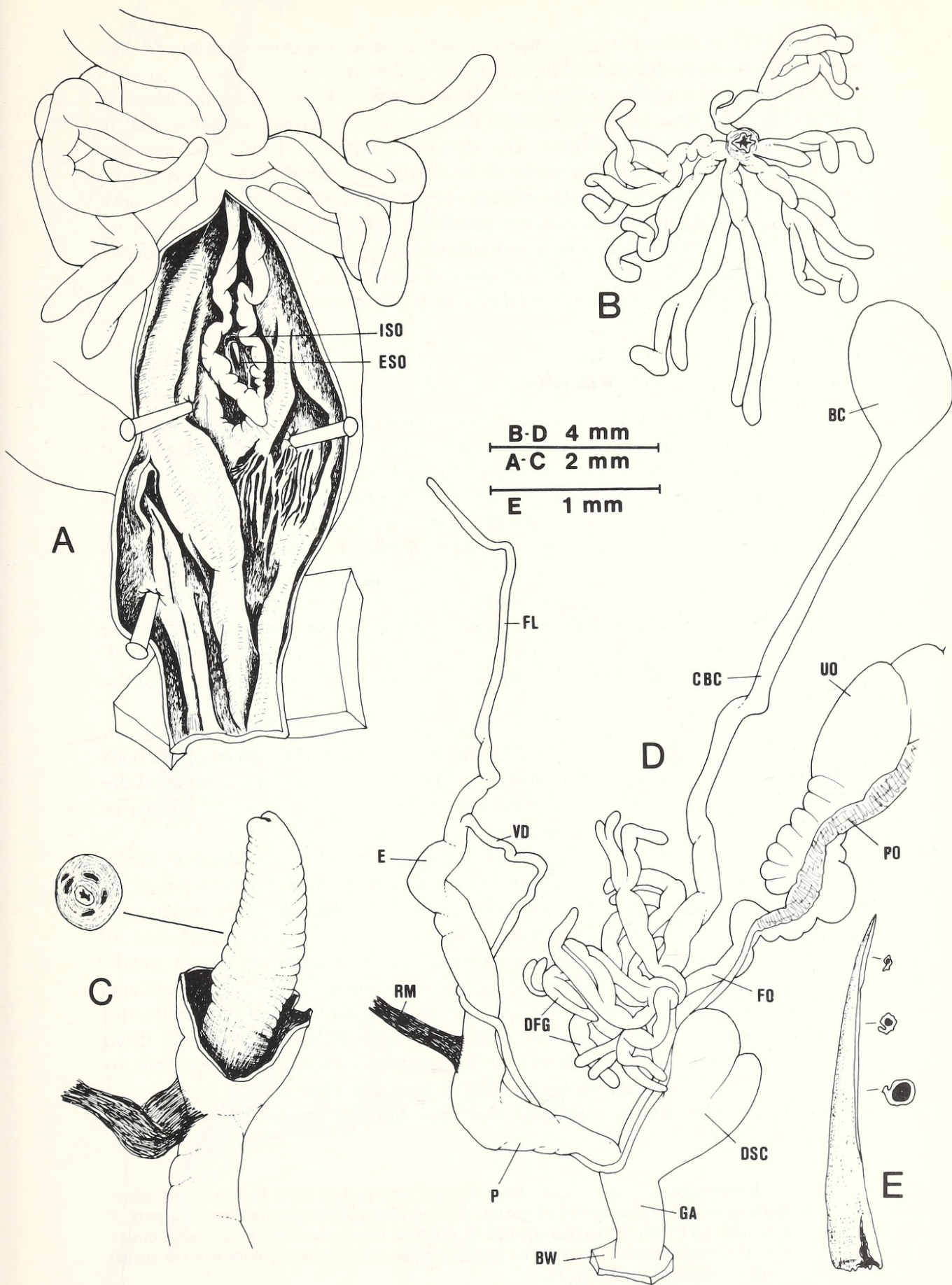


Fig. 12

(SACCHI, 1955, examined only presumed conspecific materials from Algeria) and consequently it is impossible to establish the value of the taxon.

The study of a young specimen of «*H. usticensis*» CALCARA from the island of Ustica (Fig. 13) seems to reveal a genital duct structure externally similar to that of *Cernuella*, but internally different. The dart-sac complex is formed by two stylophores fused side by side but seems to be devoid of a «dart-gun». If this is confirmed after the study of adult *H. amanda* specimens, *Xeroamanda* could be considered a separate taxon. No confusion is possible with *Xeroplexa* DI MARIA di MONTEROSATO (1892) in which ZILCH (1960) included as a synonym the older *Xeroamanda*. *Xeroplexa*, formerly considered a subgenus of *Trochoidea*, has recently been discovered to be a junior synonym of *Candidula* (see GITTENBERGER, 1985).

The problem of *Xeromunda*

In 1892 (: 25) DI MARIA di MONTEROSATO described *Xeromunda* as a group of species living in Greece and Syria (= Syra, an island of the Greek Archipelago!) and listed in it only two species: *H. turbinata* and *H. candiota*.

In the same year *H. turbinata* DE CRISTOFORI & JAN was elected by KOBELT as the type species. But the true *H. turbinata* De Cristofori & Jan (1832, Conchyliæ: 4, nomen nudum, Sicilia; Mantissa: 2, description) was described by its Authors as living in Sicily! We can obviously claim that *H. turbinata* sensu DI MARIA di MONTEROSATO, being a species of Greece and the Greek Archipelago, was not the same species of DE CRISTOFORI & JAN from Sicily. If this is true we cannot accept as type species of the taxon of the genus group *Xeromunda*, the species selected by KOBELT!

The only way to try to solve the problem is to carefully analyze the history of the name *H. turbinata* in literature.

After DE CRISTOFORI & JAN (1832), this name was used by PFEIFFER (1846, in MARTINI & CHEMNITZ, 2nd Ed.: 254-255, Pl. 37: figs. 17-18) for a species from both Sicily and the Greek islands of Syra and Crete. This because PFEIFFER considered the Crete materials received by FRIVALDSKY with the handwritten name *H. candiota* as conspecific with the Sicilian *H. turbinata*.

PFEIFFER (1848: 155) redescribed *H. turbinata*, and stated: «habitat in Sicilia (JAN)? In insula Syra (SPRATT, FORBES)». It therefore seems that PFEIFFER mixed up under the same name «*H. turbinata*» two different, but conchologically similar species, one from Sicily (the true *H. turbinata*) and one from the Greek Archipelago. It is probable that the whole problem has its roots in this confusion created by PFEIFFER. PFEIFFER was evidently dubious about the real conspecificity of the Greek and Sicilian materials, as indicated by the question mark he added after «Sicilia (JAN)». Many malacologists, who subsequently utilized the name *H. turbinata*, did not delve into the matter and, on the authority of PFEIFFER, considered themselves free to utilize the name *H. turbinata* for both materials from Greece and Sicily.

KOBELT (1877: 106-107) realized that two different species were mixed up

Fig. 13 - (?) *Xeroamanda usticensis* (CALCARA). Genital duct and its parts in two young specimens collected on the Island of Ustica. A-B: portions of two genital ducts. C: part of a genital duct with the vagina opened to show its inner structure. D: penial complex with the penis opened to show the penial papilla; note the two sections of the penial papilla. (Symbols as in Fig. 1)

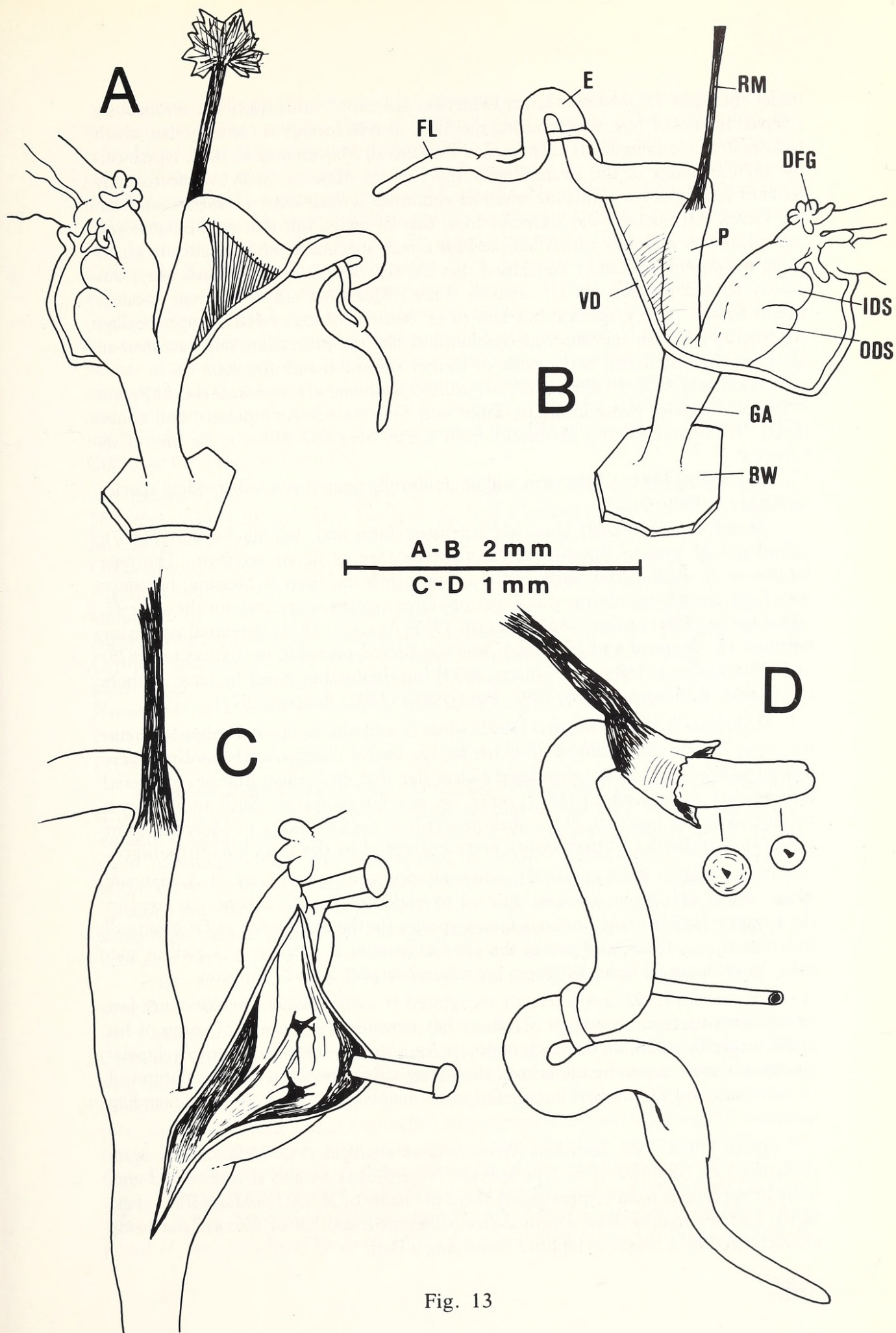


Fig. 13

under the name *H. turbinata* sensu PFEIFFER. He wrote: «this species is erroneously referred to that of JAN, which having the Sicily as type locality is certainly that which follows in this catalogue» (i.e. *H. aradasi* PIRAJNO di MANDRALISCA, 1842, type locality: on the banks of the swamps near the Faro of Messina, Sicily). Unfortunately KOBELT left room for confusion when he continued writing that «*H. turbinata*» from the Greek Archipelago was different from that of Sicily, but that as the name «*H. turbinata*» was also very widely adopted for Greek specimens, he felt better to go on using it. Moreover KOBELT concluded that his «*H. turbinata*» (the Greek one!) was closely related not only to *H. candiota* (FRIV.) MOUSSON (1854: 10, type locality: Creta) another Greek species, but also to *H. berlieri* MORELET (1857, type locality: Algeria) an Algerian species. This opinion, just like the preceeding one based on an apparent shell-similarity, is the cause of further confusion and mistakes!

WESTERLUND & BLANC (1879: 64) utilized the name «*H. turbinata* (JAN?) PFEIFFER» for a species living in Crete, Tinos and Syra (Greek Archipelago) and considered *H. candiota* (FRIV.) MOUSSON from Crete, Syra and Milos to be one of its varieties.

H. candiota (FRIV.) MOUSSON will be doubtfully treated as a self-standing species by KOBELT (1879: 7).

BENOIT (1882: 41-42) cited «*H. turbinata* JAN» and, imitating KOBELT (1877), considered *H. aradasi* PIRAJNO di MANDRALISCA as its junior synonym. The type locality of *H. aradasi* (the banks of the swamps near the Faro of Messina) has since then been considered by many as a sort of «locus typicus restrictus» for the same *H. turbinata* (see POLLONERA, 1892; SACCHI, 1955; ALZONA, 1971). Eventual synonymy between *H. turbinata* and *H. aradasi* was considered probable by PAULUCCI (1879) and WESTERLUND (1889) (see GIUSTI, 1973) but doubted or reject by most Authors (DI MARIA di MONTEROSATO, 1892; POLLONERA, 1892; ALZONA 1971).

DI MARIA di MONTEROSATO (1892) when describing his taxon *Xeromunda* omitted Sicily among the localities in which its species (*H. turbinata*, *H. candiota*) were known to live. This can be considered a clear sign that the Sicilian Author considered *H. turbinata* in the KOBELT (1877) sense, i.e. as a Greek species. Such an opinion is confirmed by the fact that all the shell materials in the DI MARIA di MONTEROSATO collection named «*H. turbinata*» were collected in the Greek Archipelago.

Unfortunately KOBELT (1892), when electing the type species of *Xeromunda* wrote simply «*H. turbinata*» and omitted to underline that this name was used in the KOBELT (1877) sense, i.e. for a Greek species (in the same sense as DI MARIA di MONTEROSATO, 1892), and not in the DE CRISTOFORI & JAN sense (a Sicilian species). In so doing he again left room for misunderstanding and confusion.

POLLONERA (1892: 3-4) correctly recognized *H. turbinata* DE CRISTOFORI & JAN as a Sicilian species. He wrote: «KOBELT has repeated the mistake of many of his predecessors by using the name *H. turbinata* for a species from the Greek Archipelago». In the same paper, he underlined the strong affinity between the descriptions of *H. turbinata* and *H. aradasi*, but preferred to maintain the latter as a self-standing species.

HESSE (1934: 7-8) described *Xeromunda* as a subgenus of *Helicella* and again recognized *H. turbinata* as its type species. Nevertheless he also described the anatomy of specimens from Cyprus giving them the name of *H. (X.) candiota* (Pl. 1: figs: 9a-d). HESSE's figures show a genital duct different from that of *Cernuella* in being characterized by a single stylophore containing a dart.

SACCHI (1955: 11-12) described the anatomy of supposed *H. turbinata turbinata* in specimens living near the Faro of Messina (= *H. aradasi*). The genital duct he reproduced (Fig. 6) (vagina with two stylophores fused side by side), corresponded very well to that of a *Cernuella* (s. str.) and suggested to SACCHI that *Xeromunda* might correspond to a group of species of *Cernuella*. He evidently did not realize that *H. turbinata* sensu DI MARIA di MONTEROSATO was not that of DE CRISTOFORI & JAN. In the same paper SACCHI cites *H. durieui* PFEIFFER (1848, Locus typicus: La Calle = El Kalla, Algeria) as a subspecies of *H. turbinata*. The anatomy of materials supposed to correspond to *H. durieui* from Bizerte (Tunisia) reproduced by Sacchi (Fig. 5), corresponded very well to those of the supposed typical *H. turbinata* from Messina, and seemed to confirm the group of species considered to belong to *Xeromunda* as a junior synonym of *Cernuella*, thanks to their globose-conical shell. It is interesting that SACCHI noticed the evident anatomical difference between his Sicilian and Tunisian materials and those of *H. candiota* studied by HESSE. It seems most unlikely that he misinterpreted the structure of the dart-sac complex as suggested by CLERX & GITTENBERGER (1977).

BRANDT (1959: 85-88) analyzed the problem of *H. turbinata* clearly recognizing *H. turbinata* DE CRISTOFORI & JAN from Sicily as a species different from *H. candiota* MOUSSON (= *H. turbinata* sensu PFEIFFER 1846 partim and 1848 partim) living in the Greek Archipelago, this last considered by him as a subspecies of *H. durieui* from Algeria. Unfortunately BRANDT's anatomical research and drawings were not accurate enough to be of help in recognizing the real nature of his North-African materials. After having affirmed their genital duct corresponded to that of *H. candiota* from Cyprus and Syra studied by HESSE, BRANDT was not able to distinguish them from the *Cernuella* species. Consequently, BRANDT was led to consider *Xeromunda* as a junior synonym of *Cernuella* (s. str.). Finally, BRANDT (1959: 85), even if completely lacking anatomical data admits *Cernuella durieui candiota* to be present in Puglia and in Sicily mixed up with «typical *C. turbinata*».

From this follows that PAGET (1962: 182-184) utilized the name *Cernuella* (s. str.) *durieui candiota* for globose-conical specimens collected by MARCUZZI near Taranto (Puglia, Italy). He evidently noticed a strong conchological similarity between Taranto specimens and those studied by BRANDT from North Africa. Our exam of the above mentioned shell materials [NHW, no number: 4 tubes with shells from Chiatona and La Praia (Taranto); NHW ex coll. KLEMM, no. 46252: 1 tube with shells from Chiatona] confirms PAGET's determination and confirms the presence, at least near Taranto, of a species of the «*durieu-candiota*» group.

FORCART (1965a: 130) cited PAGET's data for Puglia, but did not discuss the problem of «*Cernuella turbinata*».

CLERX & GITTENBERGER (1977: 52-53, figs. 110-112) studied materials from Cyrenaika and, on the basis of the genital duct apparently showing strong affinity with those studied by HESSE (1934), gave them the name *Xeromunda durieui candiota* (MOUSSON). In so doing, they rightly recognized that it was impossible to include their specimens in the genus *Cernuella*! Unfortunately CLERX & GITTENBERGER did not investigate the argument in great depth. From what they report it is evident that they did not realize that *H. turbinata* sensu DI MARIA di MONTEROSATO (1892) and sensu KOBELT (1892) was a Greek species and not the Sicilian *H. turbinata* DE CRISTOFORI & JAN. Moreover they consider SACCHI's (1955) anatomical drawings of supposed *H. turbinata* from Sicily (from the type locality of *H. aradasi* PIRAJNO di MAN-

DRALISCA) and those of Tunisia of supposed *H. durieui*, badly drawn and wrongly interpreted. CLERX & GITTENBERGER did not realize that, instead, to think to bad drawings and to a wrong interpretation, it was easier to think to the possibility that both SACCHI's species were not those corresponding to the names and could be true *Cernuella* (s. str.) specimens!

In conclusion we think we have demonstrated convincingly that many Authors of the past confused two different species, one from Sicily and one from Greece, the Greek Archipelago and Crete under the name, *H. turbinata* JAN or DE CRISTOFORI & JAN.

We can have no idea about the real nature of *H. turbinata* DE CRISTOFORI & JAN as the collection of these malacologists was destroyed during the last World War and no original materials have been traced in historical collections including the one of DI MARIA di MONTEROSATO.

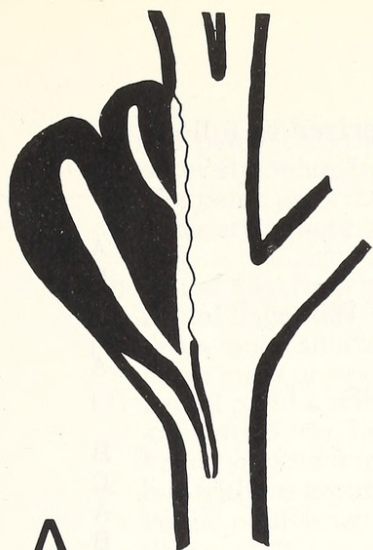
In the Collection GIUSTI we have many specimens from Sicily corresponding to the original description («*Helix*, testa conicoglobosa, subperforata, albida, alt. 5''' (= about 10mm) lat. 6''' (= about 12mm), apertura lunari-rotundata diam. 3''' (= about 6mm), peristomate simplici, marginato). They all belong to the «large *Cernuella* group of forms (see GIUSTI 1973, 1980), usually defined as that of *C. virgata* (DA COSTA). We are inclined to think that this group is conspecific with the original *H. turbinata* DE CRISTOFORI & JAN.

H. aradasi PIRAJNO di MANDRALISCA, according to the lectotype recently selected by GIANNUZZI SAVELLI & al. (1986), seems to belong to the «small *Cernuella*» group of forms, usually defined as *C. cisalpina* (ROSSMÄSSLER) or as *C. subprofuga* (STABILE) and thus cannot be synonymized with *H. turbinata*. Consequently the banks of the swamps near the Faro of Messina (Sicily) can be considered only as the type locality of *H. aradasi* not also of *H. turbinata*! A locus typicus restrictus has to be selected for the latter species, when eventually surely recognized.

Specimens from Taranto having the same shell characters as those called *Cernuella durieui candiota* by BRANDT, PAGET and FORCART are still unknown anatomically and poorly known are still the «*Cernuella candiota*» from the Greek Archipelago and Crete. Nevertheless their shells correspond very well and consequently the above mentioned species group can be, at least provisionally, confirmed in the list of the Italian malacofauna.

H. turbinata sensu DI MARIA di MONTEROSATO (1892) and KOBELT (1892) (non DE CRISTOFORI & JAN 1832) is a Greek species! It is extremely likely that it is a form of *H. candiota* MOUSSON, and should be named accordingly! Consequently we wish to propose *H. candiota* MOUSSON as the type species of *Xeromunda* DI MARIA di MONTEROSATO, 1829 and, according to the Art. 70 of the ICZN (1985), we are going to apply for to the International Commission on Zoological Nomenclature.

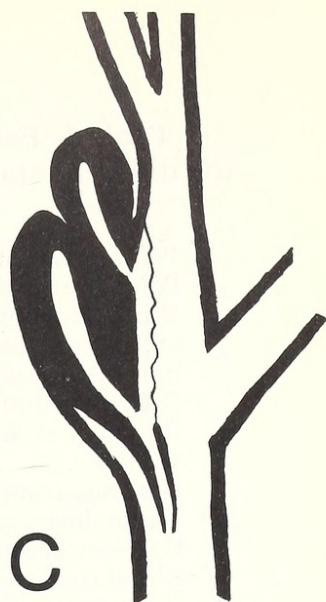
Fig. 14 - Schematic longitudinal section of the vaginal complexes in: A, «large sized *Cernuella* (s. str.)»; B, «small sized *Cernuella* (s. str.)»; C, *Cernuella (Xerocincta) neglecta* (DRAPARNAUD); D, (?) *Xeroplana lacosteana* BOURGUIGNAT; E, *Xerosecta* (s. str.) *explanata* (DRAPARNAUD); F, *Xerosecta* (s. str.) *cespitum* (DRAPARNAUD); G, *Xerosecta (Pol-loneriella) contermina* (PFEIFFER); H, *Microxeromagma vestita* (RAMBOUR); L, *Cernuellopsis ghisottii* n. sp.



A



B



C



D



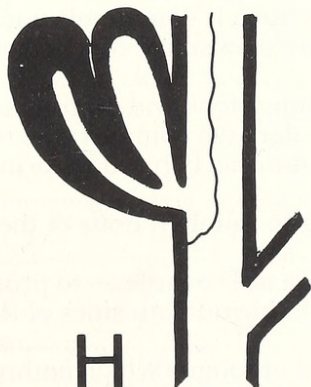
E



F



G



H



L

Table 1. Each genus or subgenus has been characterized as follows by the different status of 13 characters:

1) Penial nerve apparently from cerebral ganglion	A
Penial nerve apparently from pedal ganglion	B
2) Dart-sac complex symmetrical with the vagina (i.e. a plane can cut the vagina and the dart-sac complex into two specular halves) and pedunculated	A
Dart-sac complex symmetrical but not pedunculated because the inner stylophore adheres for most of its length to the vagina	B
Dart-sac complex asymmetrical with the vagina	C
3) Large dart-sac complex	A
Dart-sac complex of medium dimensions	B
Small dart-sac complex	C
4) Wide inner stylophore internal cavity	A
Small, straight or curved inner stylophore internal cavity, when curved its concavity faces the vagina	B
Small, curved inner stylophore internal cavity, its concavity facing the outer stylophore	C
5) Openings of the two stylophores into the vagina distinct and distant from one another	A
Openings of the stylophores into vagina distinct but close one to another	B
The two stylophores end in a common opening into the vagina	C
Openings of the two stylophores distinct and close one to the other, via the cavity of a peculiar cylindrical structure	D
6) Dart tip of arrow-head form with 4 wings (disposed in a cross), two (the opposite ones) more widened than the others	A
Dart with only 2 lateral wings which run for most of its length (lying in the same plane)	B
Dart with only one straight wing for most of its length; the dart section is oval	C
Dart with only one wrinkled wing for most of its length; the dart section is rhombic	D
Dart with arrow head tip wingless or with only two very short lateral, more or less expanded wings	E
7) The furrow into which the stylophores open is bordered on each side by a large pleat; these pleats are fused anteriorly to give origin to a well developed «dart gun»	A
The furrow into which the stylophores open is bordered on each side by a large pleat; these pleats are fused anteriorly to give origin to a poorly developed «dart gun»	B
The furrow into which the stylophores open is bordered by a large pleat on each side; these pleats are not fused anteriorly, «dart gun» absent	C
The site where the stylophores open is completely enclosed by a peculiar vaginal structure having a small «dart gun» at its distal end	D
8) Accessory pleats of variable dimensions and number in the vagina walls in the area of the dart sac complex; the two which lie close to the «dart gun» are anteriorly fused to form a belt under the «dart gun»	A
Small accessory pleats varying in number, none of them fused anteriorly	B
Only two accessory pleats; these are so large as to produce two external swellings which are visible on both sides of the stalk of the dart sac complex	C
A large pleat gives rise to a sort of tongue which embraces a cylindrical structure inside which the stylophores end	D

- 9) The penis joins the distal vagina level with the opening of the outer stylophore (and the «dart gun») A
The penis joins the distal vagina away from the opening of the outer stylophore (and distally with respect to the «dart gun» tip) B
- 10) Penial flagellum short or very short A
Penial flagellum long or very long B
- 11) Penis much shorter than the epiphallus A
Penis more or less as long as the epiphallus B
- 12) Penial papilla with wide compact walls for most of its length and with 3 basal «frenula» A
Penial papilla with wide compact walls for most of its length but without basal «frenula» B
Penial papilla with a double wall; an empty space separates the outer and inner layers; sperm canal centrally located C
Penial papilla with a double wall; an empty space separates the two layers; the external layer gives rise to apical «corpora cavernosa»; sperm canal laterally located D
Very simple penial papilla formed by a thin wrinkled wall having a lateral slit for most of its length E
- 13) Shell variable in shape, thickened, with no hairs A
Shell globular, thin, with hairs B

	1	2	3	4	5	6	7	8	9	10	11	12	13
<i>Cernuella</i> (s. str.)	B	B	A	A	A	A	A	A	A	A	A	A	A
<i>C. (Xerocincta)</i>	B	B	A	A	A	A	A	A	A	A	A	B	A
<i>Xerosecta</i> (s. str.)	A	A	C	B	C	E	C	B	B	B	A	D	A
<i>X. (Polloneriella)</i>	A	A	C	B	C	C	C	C	B	B	A	C	A
<i>Microxeromagna</i>	A	A	C	B	C	B	C	B	B	B	B	E	B
<i>Cernuellopsis</i>	B	C	B	C	D	E	D	D	B	A	B	B	A
? <i>Xeroplana</i>	B	B	B	A	B	D	B	A	B	B	B	B	A

Table 2. Number of characters (see Tab. 1) by which the taxa of the genus-group listed in Tab. 1 differ from each other.

	<i>Cernuella</i> (s. str.)	<i>C. (Xerocincta)</i>	<i>Xerosecta</i> (s. str.)	<i>X. (Polloneriella)</i>	<i>Microxeromagna</i>	<i>Cernuellopsis</i>	? <i>Xeroplana</i>
<i>Cernuella</i> (s. str.)	0	1	11	11	13	10	8
<i>C. (Xerocincta)</i>	1	0	11	11	13	9	7
<i>Xerosecta</i> (s. str.)	11	11	0	3	4	12	10
<i>X. (Polloneriella)</i>	11	11	3	0	5	13	10
<i>Microxeromagna</i>	13	13	4	5	0	13	10
<i>Cernuellopsis</i>	10	9	12	13	13	0	8
? <i>Xeroplana</i>	8	7	10	10	10	8	0

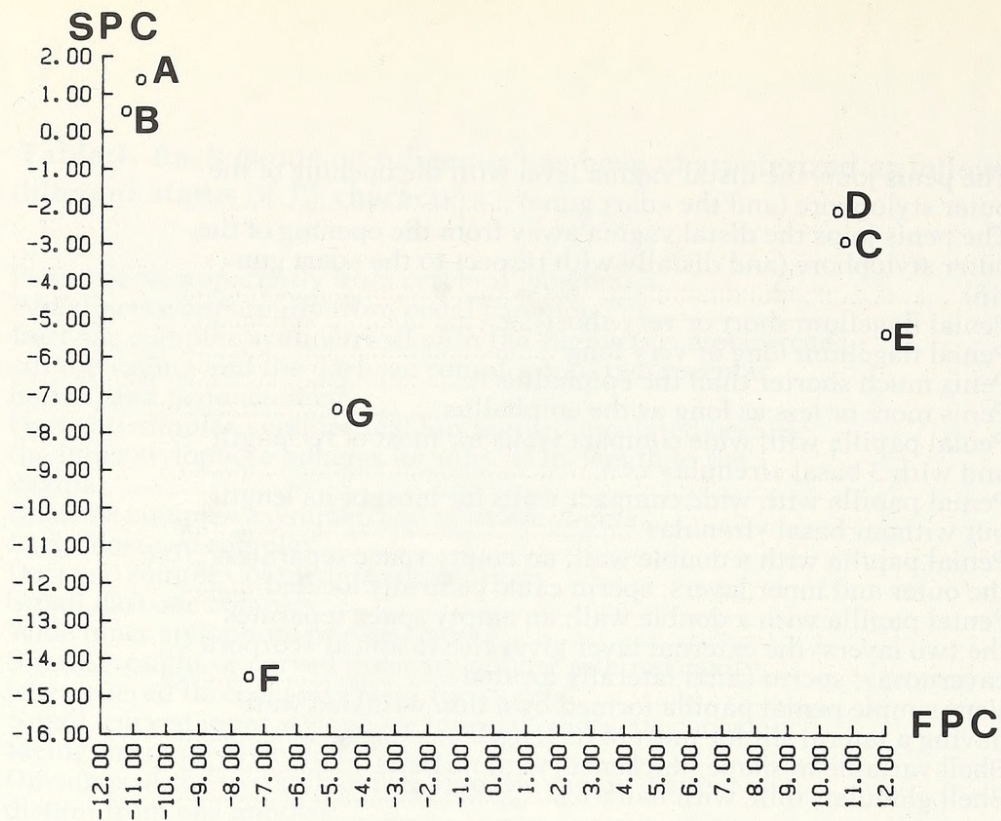


Fig. 15 - Multivariate analysis of the principal coordinates based on the eigenvectors associated with the maximum and minimum eigenvector of the taxa differences matrix (Tab. 2) (for the method see BLACKITH & REYMENT, 1971).
 Explanations of symbols used in the Figs. 15-16: **A** *Cernuella* (s. str.), **B** *C. (Xerocincta)*, **C** *Xerosecta* (s. str.), **D** *X. (Polloneriella)*, **E** *Microxeromagna*, **F** *Cernuellopsis*, **FPC** first principle component, **G** ? *Xeroplana*, **SPC** second principle component.

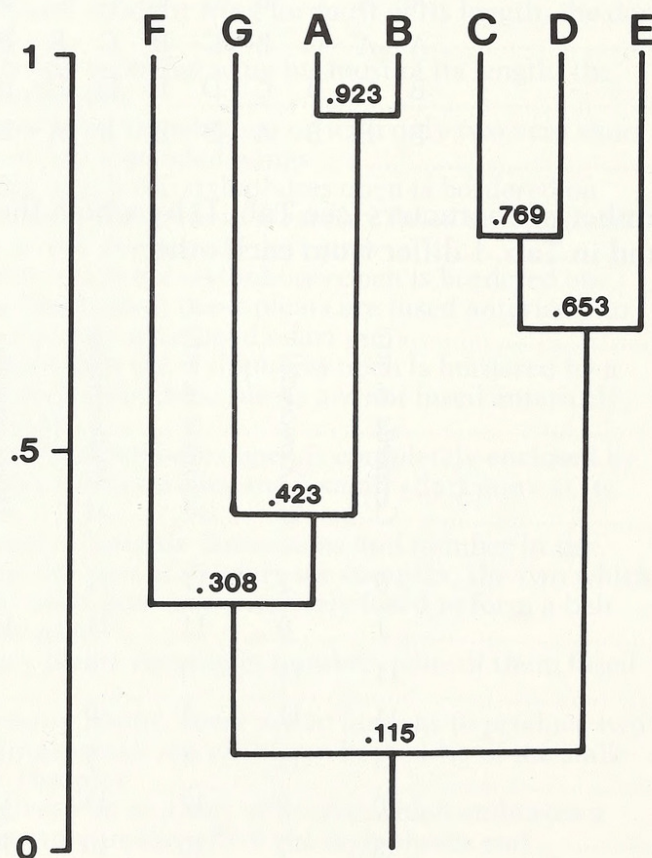


Fig. 16 - UPGMA cluster based on similarity coefficients calculated by applying SORESENSEN's index to the matrix in Tab. 2.
 Symbols as in Fig. 15.

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Addendum

While this paper was in press, Dr. A. HALLGASS has discovered a new population of *Cernuellopsis ghisottii* from Latium (on Mt. Semprevisa, 1560 m, Lepini Mountains, 16.7.87).

Anatomical research on adult specimens of *Helicella (Candidula) claudia* SACCHI, collected by Dr. A. HALLGASS from Sorrentina Peninsula (Mt. Faito, 700, 10.7.87) confirmed this species to belong to genus *Candidula*.

REFERENCES

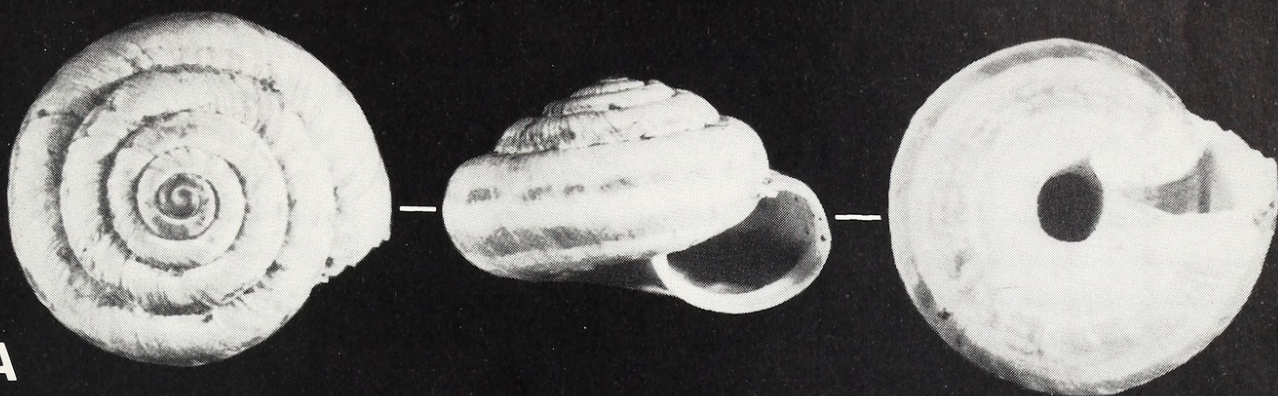
- ALZONA, C. (1971). Malacofauna Italica. Catalogo e bibliografia dei molluschi viventi, terrestri e d'acqua dolce. - *Atti Soc. it. Sci. nat. Museo civ. St. nat. Milano*, **111**: 1-433.
- ALZONA, C. & ALZONA BISACCHI, J. (1939). Malacofauna Italica, **1** (2): 93-127.
- BLACKITH, R.E. & REYMENT, R.A. (1971). Multivariate morphometrics. London, pags.
- BELLINI, R. (1915). I Molluschi extramarini dei dintorni di Napoli. - *Boll. Soc. Natur. Napoli*, **27**: 149-194.
- BENOIT, L. (1882). Nuovo Catalogo delle Conchiglie terrestri e fluviatili della Sicilia o Continuazione alla Illustrazione sistematica critica iconografica dei Testacei extramarini della Sicilia Ulteriore e delle Isole circostanti. - Messina, 176 pags.
- BRANDT, R.A. (1959). Die Helicellinae der Cyrenaika. - *Arch. Moll.*, **88**: 81-150.
- CALCARA, P. (1845). Cenno sui molluschi viventi e fossili della Sicilia. - Palermo, 63 pags.
- CAZIOT, E. (1902). Étude sur la Faune des Mollusques vivants terrestres et fluviatiles de l'île de Corse. - *Bull. Soc. Sci. hist. nat. Corse*: 1-354.
- CLERX, J.P.M. & GITTENBERGER, E. (1977). Eniger über *Cernuella* (Pulmonata, Helicidae). - *Zool. Meded.*, **52**: 27-56.
- DE CRISTOFORI, G. & JAN, G. (1832). Catalogus in IV sectiones divisus rerum naturalium in Museo exstantium Josephi De Cristofori et Georgii Jan plurium Acad. scient. et Societ. nat. cur sodalium complectens adumbrationem *oryctognosiae et geognosiae* atque prodromus *Faunae et Florae Italiae superioris*. Sectio IIa: Conchyliologia. Pars Ia. Conspectus methodicus Molluscorum. Fasc. Ius. Testacea terrestria et fluviatilia. (With: Conchylia terrestria et fluviatilia in collectione nostra exstantia cum aliis ea deficientibus commutanda atque argento aequiparanda, 8 pags.; Mantissa in secundam partem catalogi Testaceorum exstantium in collectione quam possident De Cristofori et Jan, exhibens Characteres essentielles specierum Molluscorum terrestrium et fluviatilium ab eis enunciatarum in prima parte ejusdem Catalogi, 4 pags.). - Parma, 22 pags.
- DEGNER, E. (1927). Zur Molluskenfauna Unteritaliens. - *Mitt. Zool. Staatsinst. Zool. Museum Hamburg*, **43**: 39-124.
- DI MARIA di MONTEROSATO, T. (1892). Molluschi terrestri delle isole adiacenti alla Sicilia. - *Atti r. Accad. Sci. Lett. Arti*, (III), **2**: 1-34.
- FAGOT, P. (1884). Étude sur les Hélices xérophiliennes des groupes *Cisalpiniana* et *Spadana*. - *Bull. Soc. malac. France*, **1**: 107-131.
- FARRIS, J.S. (1969). A successive approssimations approach to character weighting. - *Syst. Zool.*, **18**: 374-385.
- FORCART, L. (1965a). Rezente Land- und Süßwassermollusken der süditalienischen Landschaften Apulien, Basilicata und Calabrien. - *Verh. naturf. Ges. Basel*, **76**: 59-184.
- FORCART, L. (1965b). *Leucochroa* BECK, 1837. Eine nomenklaturische Studie. - *Arch. Moll.*, **94**: 255-257.
- GIANNUZZI SAVELLI, R., SPARACIO, I. & OLIVA, N. (1986). I tipi di molluschi terrestri della Collezione Pirajno del Museo Mandralisca di Cefalù. - *Lavori S.I.M.*, **22**: 195-208.
- GHISELIN, M.T. (1984). «Definition», «Character», and other equivocal terms. - *Syst. Zool.*, **33**: 104-110.
- GITTENBERGER, E. (1985). The taxonomic status of *Xeroplexa* Monterosato, 1892 (Pulmonata: Helicidae: Helicellinae), a surprise. - *Iberus*, **5**: 59-62.
- GITTENBERGER, E. & SUBAI, P. (1986). Zur näheren Kenntnis von *Cernuella* (*Xerosecta*) *graja* WESTERLUND, einer griechischen gekielten Art der Helicellinae (Pulmonata: Helicidae). - *Arch. Moll.*, **116**: 67-72.
- GIUSTI, F. (1971). Notulae Malacologicae, XVI. I molluschi terrestri e di acqua dolce viventi sul massiccio dei Monti Reatini (Appennino centrale). - *Lav. Soc. it. Biogeogr.*, (N.S.), **2**: 423-576.
- GIUSTI, F. (1973). Notulae Malacologicae, XVIII. I molluschi terrestri e salmastri delle Isole Eolie. - *Lav. Soc. it. Biogeogr.*, (N.S.), **3**: 113-306.
- GIUSTI, F. (1976). Notulae Malacologicae, XXIII. I Molluschi terrestri, salmastri e d'acqua dolce dell'Elba, Giannutri e scogli minori dell'Arcipelago Toscano. Conclusioni generali sul popolamento malacologico dell'Arcipelago Toscano e descrizione di una nuova specie. (Studi sulla Riserva naturale dell'Isola di Montecristo, IV). - *Lav. Soc. it. Biogeogr.*, (N.S.), **5**: 99-355.
- GIUSTI, F. (1980). On the exact state of *Helix lineata* OLIVI 1792 (Pulmonata: Helicidae) - *Arch. Moll.*, **110**: 191-197.

- GIUSTI, F. & CASTAGNOLO, L. (1982). I molluschi terrestri delle dune italiane: brevi cenni di ecologia, elenco delle specie e chiavi per il loro riconoscimento. - Consiglio Nazionale delle Ricerche, Pubblicazione AQ/1/174. *Quaderni sulla «Struttura delle Zoocenosi terrestri»*, **3**. Ambienti mediterranei, **1**. Le coste sabbiose: 51-102.
- GIUSTI, F., GRAPPELLI, C., MANGANELLI, G., FONDI, R. & BULLINI, L. (1986). An attempt of natural classification of the genus *Medora* in Italy and Yugoslavia, on the basis of conchological, anatomical and allozymic characters (Pulmonata: Clausiliidae). - *Lavori S.I.M.*, **22**: 259-362.
- GIUSTI, F. & MANGANELLI, G. (1987a). Notulae Malacologicae, XXXVI. On some Hygromiidae (Gastropoda: Helicoidea) living in Sardinia and in Corsica. (Studies on the Sardinian and Corsican Malacofauna, VI). - *Boll. Malac.*, **23**: 123-206.
- GIUSTI, F. & MANGANELLI, G. (1987b). The problem of the species in Malacology after clear evidence of the limits of morphological systematics. - *Proc. IX Congr. Unitas Malacologica*, in press.
- HESSE, P. (1934). Zur Anatomie und Systematik palaearktischer Stylommatophoren. - *Zoologica*, **85**: 1-59.
- HUDEC, V. & LEZHAVA, G.I. (1967). *Kalitinaia* n. subgen. des Genus *Xerosecta* MONTEROSATO, 1892 (Helicidae, Helicellinae). - *Arch. Moll.*, **96**: 131-137.
- KOBELT, W. (1877-1907). In ROSSMÄSSLER, E.A.: Iconographie der Land- und Süßwasser-Mollusken, mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten, (I), **5**: 1-129 (1877), **6**: 1-160 (1879); (N.F.), **1**: 1-72 (1884), **11**: I-XII + 1-342 (1904), **13**: 1-68 (1907).
- KOBELT, W. (1892). Literaturbericht. - *Nachr. dtsch. malak. Ges.*, **9**: 149-152.
- KTARI, M.H. & REZIG, M. (1976). La faune malacologique de la Tunisie septentrionale - *Bull. Soc. Sci. nat. Tunisie*, **11**: 31-74.
- LETOURNEUX, A. & BOURGUIGNAT, J.R. (1887). Exploration scientifique de la Tunisie. Prodrôme de la Malacologie terrestre et fluviatile de la Tunisie. - Paris, 166 pags.
- LOCARD, A. (1882). Prodrôme de la Malacologie française. Catalogue général des Mollusques vivants de France. - Paris, 462 pags.
- LOCARD, A. (1885). Matériaux pour servir à l'histoire de la Malacologie française. Descriptions de quelques Hélices xérophiliennes nouvelles. - *Bull. Soc. malac. France*, **2**: 51-92.
- MAYR, E. (1969). Principles of systematic zoology. New York, XI+428 pags.
- MORELET, A. (1857). Appendice à la conchyliologie de l'Algérie. - *J. Conch.*, Paris, **7**: 39-42.
- MOUSSON, A. (1854). Coquilles terrestres et fluviatiles, recueillies par M. le Prof. Bellardi dans un voyage en Orient. - *Mitt. naturf. Ges. Zürich*, **3**: 362-402.
- PAGET, O. (1962). Beschreibung einer Molluskenausbeute aus Apulien (Süditalien) (Mit einer systematischen Zusammenstellung der bisher bekannten süditalienischen Gastropoden). - *Mem. Biogeogr. Adriat.*, **4**: 171-200.
- PAULUCCI, M. (1879). Escursione scientifica nella Calabria, 1877-78. Fauna malacologica. Specie terrestri e fluviatili. Firenze, XIX+223 pags.
- PAULUCCI, M. (1881). Contribuzione alla fauna malacologica italiana. Specie raccolte dal Dr. Cavanna negli anni 1878, 1879, 1880 con elenco delle conchiglie abruzzesi e descrizione di due nuove *Succinea*. - *Bull. Soc. malac. It.*, **7**: 69-180.
- PFEIFFER, L. (1846). Die Schnirkelschnecken (Gattung *Helix*). In MARTINI, F.H.W. & CHEMNITZ, J.H.: Systematisches Conchylien-Cabinet. Nürnberg.
- PFEIFFER, L. (1848-1853). Monographia Heliceorum viventium sistens descriptiones systematicas et criticas omnium huius familiae generum et specierum hodie cognitarum. - **1**: I-XXXII + 1-484 (1848), **3**: I-VIII + 1-711 (1853).
- PINI, N. (1885). Due nuove forme di *Helix* italiane del gruppo della *variabilis* DRAP. - *Atti Soc. It. Sci. nat.*, **28**: 165-168.
- PIRAJNO DI MANDRALISCA, E. (1842). Nota di talune specie di Molluschi terrestri e fluviatili di Sicilia. - *Giorn. Sci. Lett. Arti Sicilia*, **230**, 10 pags.
- POLLONERA, C. (1892). Note su alcuni gruppi di specie del genere *Xerophila*. - *Bull. Mus. Zool. Anat. comp. r. Univ. Torino*, **7** (128), 18 pags.
- ORTIZ DE ZARATE LOPEZ, A. (1950). Observaciones anatomicas y position sistematica de varios helicidos españoles. - *Bol. r. Soc. Esp. Hist. nat.*, **43**: 21-85.
- RODRIGUES, P.D. (1986). On the term character. - *Syst. Zool.*, **35**: 140-141.
- ROSSMÄSSLER, E.A. (1842). Iconographie der Land- und süßwasser-Mollusken mit vorzüglicher Berücksichtigung der europäischen noch nicht abgebildeten Arten, (I), **2** (5): I-IV + 1-15.

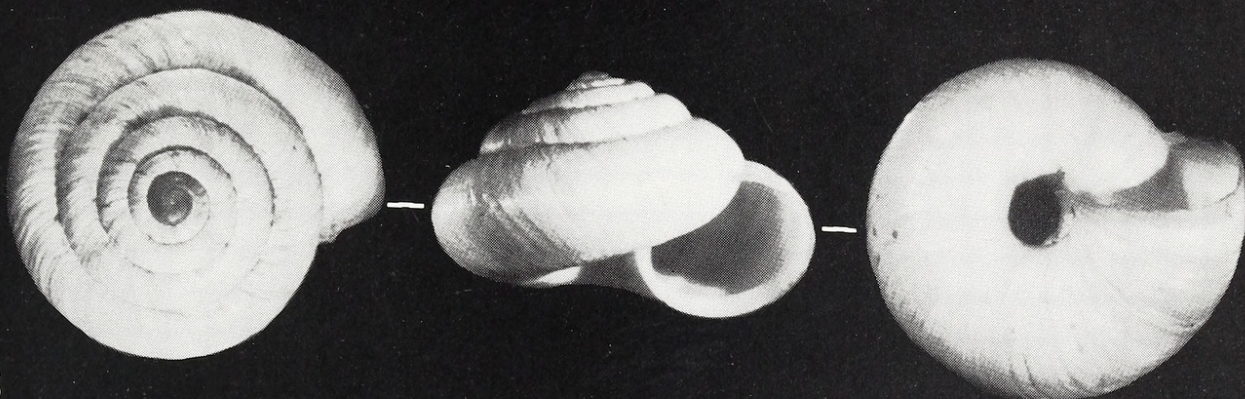
- SACCHI, C. (1954). Contributo alla conoscenza faunistica della Campania. Ricerche malacologiche sulla regione sorrentina. I. Note sistematiche su alcune Elicelline. - *Annuario Ist. Mus. Zool. Univ. Napoli*, **6**, 14 pags.
- SACCHI, C. (1955). Sulla sistematica di alcune Elicelline (Stylomm. Helicidae) della fauna italiana. - *Annuario Ist. Mus. Zool. Univ. Napoli*, **7**, 16 pags.
- SCHILEYKO, A.A. (1970). Volume, systematics and philogeny of the group *Perforatella*, *Zenobiel-la*, *Chilanodon* (Pulmonata, Helicidae). - *Zool. Zh.*, **49**: 1306-1321 (in Russian).
- SCHILEYKO, A.A. (1972a). Taxonomical and geographical structure of the tribus Hygromiini SCHILEYKO (Pulmonata: Helicidae). - *Zool. Zh.*, **51**: 1129-1141 (in Russian).
- SCHILEYKO, A.A. (1972b). Some aspects of study of recent non-marine gastropod mollusks. - *Results of Sciences. Zoology of Invertebrates*, **1**: 1-188 (in Russian).
- SCHILEYKO, A.A. (1972c). Subfamilia Metafruticicolinae SCHILEYKO, 1972 as a phyletic line. - *Nauch. Dokl. Vys. Shk. Biol. Nauki*, **12**: 12-29 (in Russian).
- SCHILEYKO, A.A. (1978a). On the systematics of *Trichia* s. lat. (Pulmonata: Helicoidea: Hygromiidae). - *Malacologia*, **17**: 1-56.
- SCHILEYKO, A.A. (1978b). Molluscs. Land molluscs of the superfamily Helicoidea. - *Fauna SSSR*, (N.S.), **17**: 1-348 (in Russian).
- SOLEM, A. (1974). Character weighting in land snail classification. - *Bull. Amer. malac. Un.*, **47**: 47-50.
- STABILE, G. (1859). Description de quelques coquilles nouvelles ou peu connues. - *Rev. Mag. Zool. (II)*, **11**: 419-432.
- WESTERLUND, C.A. (1889). Fauna der in der palaarktischen Region lebenden Binnenconchylien, **2**: 1-473 + 1-30.
- WESTERLUND, C.A. & BLANC, H. (1879). Aperçu sur la faune malacologique de la Grèce inclus l'Épire et la Thessalie. Coquilles extramarines. Naples, 161 pags.
- WHEELER, Q.D., (1984). Character weighting and cladistic analysis. - *Syst. Zool.*, **35**: 102-109.
- ZILCH, A. (1960). Euthyneura. In WENZ, W.: Gastropoda. - *Handb. Palaeozool.*, **6** (2, 4th part): 601-835 + I-XII.

EXPLANATIONS OF THE PLATES

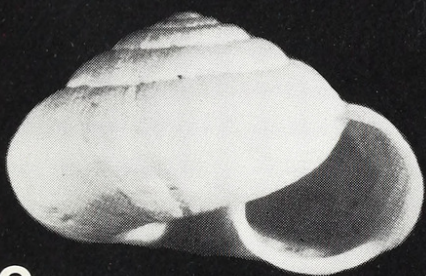
- Plate 1** - *Cernuellopsis ghisottii* n. sp. from Mt. Sirino (loc. Monte del Papa, Basilicata) (A), and Mt. Pollino (near Passo del Colle del Dragone, Calabria) (B-G). B: Holotypus. C-G: some paratypes.
- Plate 2** - A-B: *Cernuellopsis ghisottii* n. sp. from the Simbruini Mountains (Mt. Autore, Latium), A. HALLGASS leg. 6.1986. C: Lectotypus of *Helix samnitum* WESTERLUND and its original label (D). E-F: Lectotypus (F) and one of the paralectotypi (E) of *Helix samnitum* var. *pugnax* WESTERLUND and their original label (G).
- Plate 3** - *Cernuellopsis ghisottii* n. sp. Radula of a specimen collected on Mt. Pollino (near Passo del Colle del Dragone, Calabria). A: central tooth and first lateral teeth. B: 8th - 13rd lateral teeth. C: extreme marginal teeth (x 1000).



A



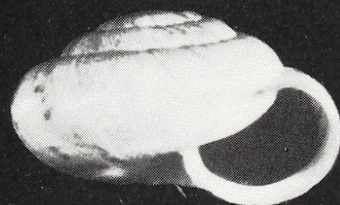
B



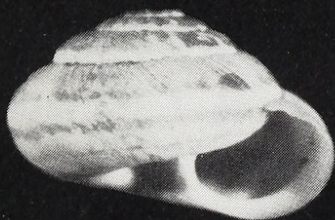
C



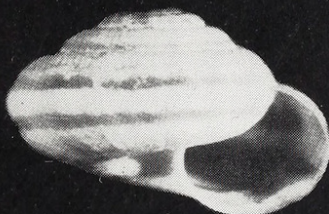
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E

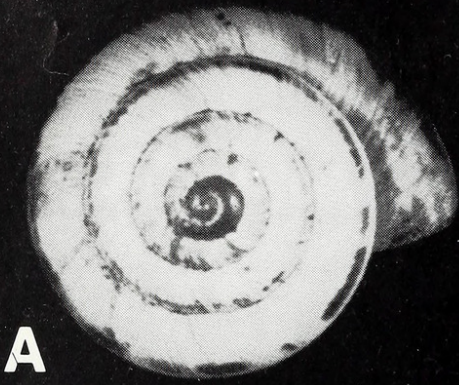


F

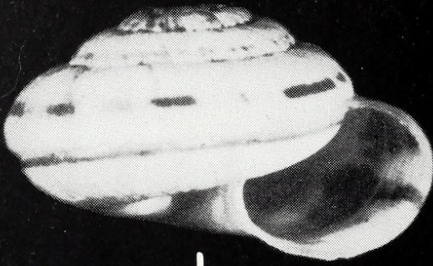


G

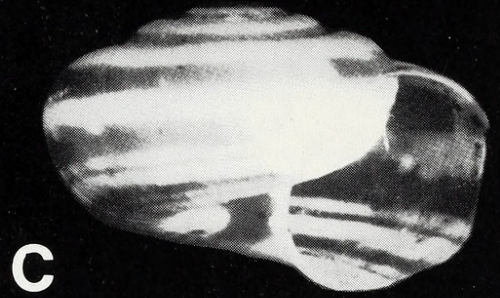
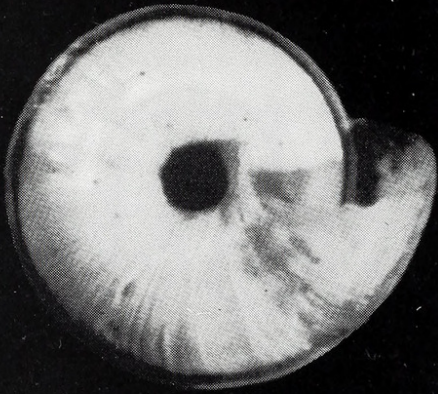
5 mm



A



B

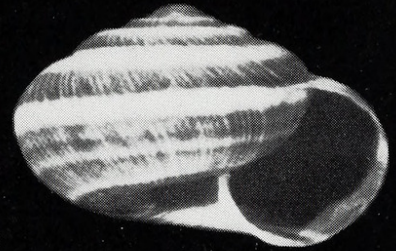


C

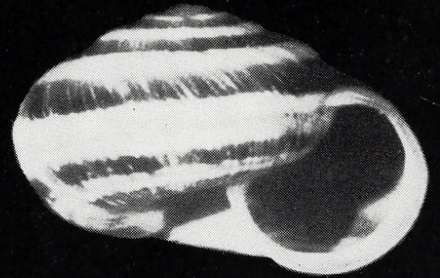
D

H. samnitum W.
Ital., Benito,
Samnium, Blanc.

E



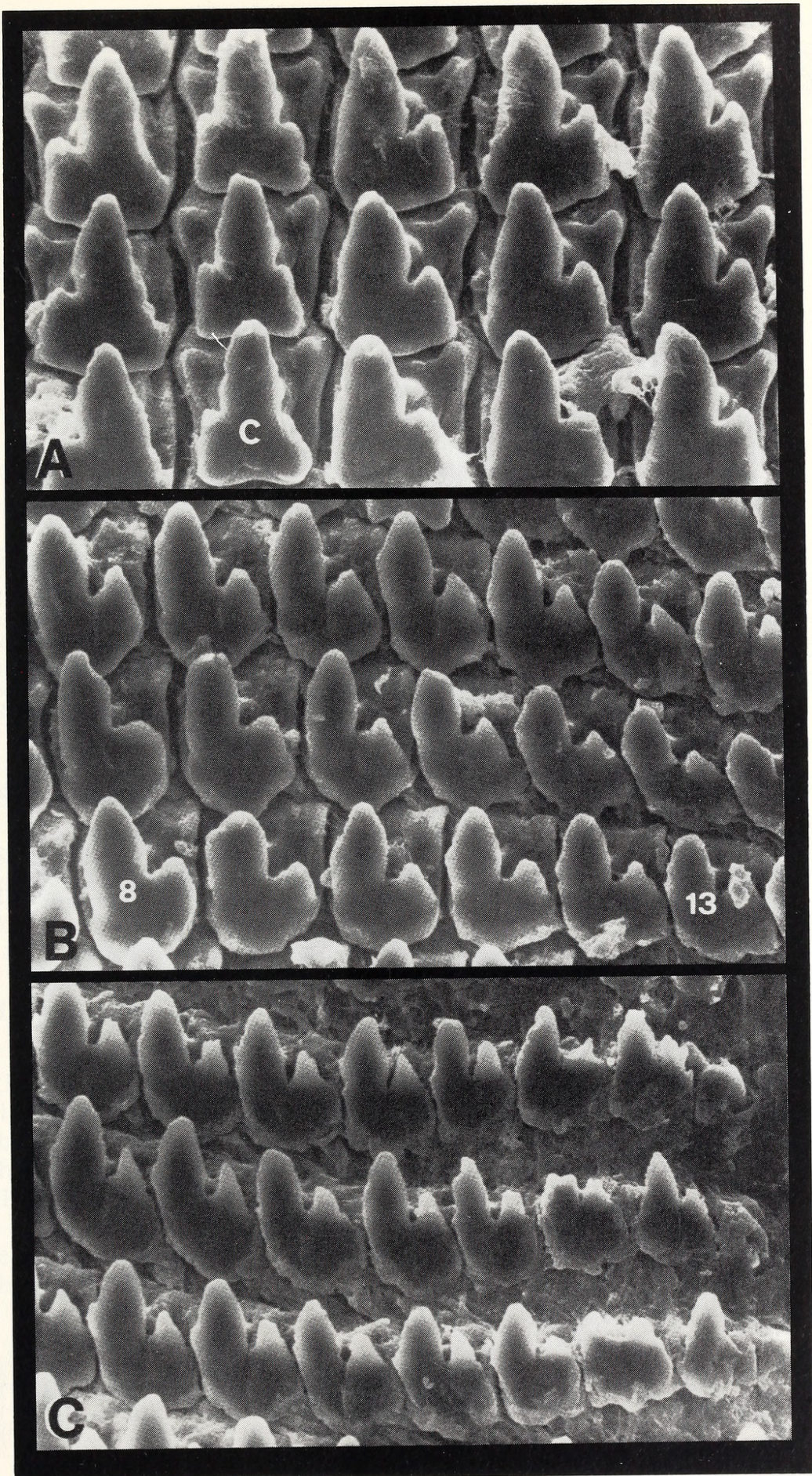
F



G

H. samnitum
var. *pugna* W.
Ital., Foligno.
Blanc.

5 mm





Manganelli, G and Giusti, Folco. 1987. "A NEW HYGROMIIDAE FROM THE ITALIAN APENNINES AND NOTES ON THE GENUS CERNUELLA AND RELATED TAXA PULMONATA HELICOIDEA." *Bollettino malacologico* 23, 327–380.

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