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On a new slug from the Northern Apennines

(Pulmonata: Arionidae).[1])

By

ALBERTA BOATO, MARCO BODON, & FOLCO GIUSTI,
Genova Siena.

With 5 figures.

Introduction.

Arion hortensis is recorded by ALZONA (1971) as widespread in Italy. However, field researches carried out in Liguria (Northern Italy) in the last few years have shown that the species of the *hortensis* complex fail in this area, whereas *A. intermedius* (NORMAND) is, on the other hand, widely spread, though not so frequent.

Another slug, recently collected in Eastern Liguria and Apuane Alps, resembles in its external appearance *A. hortensis*, the external diagnostic features being only the foot-fringe spotting and the position of the genital aperture with respect to the respiratory orifice.

On the other hand, on the basis of anatomical characters, it appears to belong to a new taxon, as hereafter described.

Arion franciscoloi n. sp.

Fig. 1-5.

Description:

External features: The body is rather lengthened, almost cylindrical, not keeled; usually slate gray, sometimes fading to yellowish or greenish. A single darker longitudinal band is present on each side, becoming paler at the lower edge and with a white trimming at the top margin. The external surface of the body shows elongated tubercles, which are surrounded by a thin reticulation and finely dotted. The mantle is oval, rounded at both ends, slightly granulose and extended for about one-third of the body length. The coloured bands on the mantle are somewhat closely arranged, and not in line with the body bands. The head and tentacles are bluish-gray, whilst the foot-fringe is yellowish gray, with small blackish spots. The sole is pale yellow. The respiratory orifice opens in the first half of the mantle, on the right side, and has a pale

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border. The genital aperture is located in between the right upper tentacle and the slit of the respiratory orifice. The caudal mucous gland is clearly evident, the foot-fringe becoming paler behind. The mucus is colourless.

The shell is normally reduced to discrete granules of various dimensions; sometimes a central nucleus is present.

Lenght of adult specimens in alcohol, about 2·5-3 cm.

Internal features: Reproductive system. The ovotestis lies between the lobes of the liver, variably situated (dorso-laterally or ventrally) in the central part of the visceral mass, and is partly exposed. The hermaphrodite duct is rather long. Its folded terminal part gives origin to the claw, before entering the elongated albumen gland. This one varies in size depending on the maturity of the animal. The long sperm-oviduct is repeatedly folded. The free-oviduct is rather long, slender proximally and dilated distally before entering the upper atrium. Its proximal slender part is about as long as one-fourth of the whole free-oviduct, and shows a slightly swelled bend. The genital retractors arise from the body wall, and are connected to both the duct and the body of the gametolytic gland (= copulatory bursa = spermatheca, sensu auctores plurimi). Some of these muscles are also inserted on the bending of the free-oviduct. The distal part of the free oviduct becomes greatly enlarged, extending with a rather constant diameter until it ends in the upper atrium; another retractor muscle connects it to the body wall. This dilated part of the free-oviduct contains a conspicuous, U-bent fold, prominent in the upper atrium and representing the "ligula" (Fig. 3 E, F: l). The two ends of the fold join posteriorly, without giving rise to any remarkable structure. The vas deferens[2]) has thin walls; its inside surface, initially smooth, shows four to six longitudinal folds that narrow slightly before the vas deferens enters the epiphallus (Fig. 3F). The epiphallus consists of a wide, roundish basal portion, connected to the upper atrium, and of a conical diverticulum which is more or less curved (Fig. 3A: d). Internally the basal portion of the epiphallus shows a large rounded papilla, and terminates with an annular swelling placed at the entrance into the upper atrium. The inside wall of the epiphallic diverticulum is thick, and shows light folds reaching the papilla (Fig. 3E, F). The vas deferens enters the epiphallic diverticulum laterally, close to its basal portion; internally, it runs inside a fold, to reach the apex of the diverticulum, where the real opening of the vas deferens into the epiphallus is located. The epiphallus enters the upper atrium between the duct of the gametolytic gland and the free oviduct, its opening being in front of the genital aperture. The genital retractor system is composed of several different groups of muscles connecting the distal genital ducts to the body walls. Three to four stems connect the duct of the gametolytic gland directly to the body wall (Fig. 3A: md). A single retractor is inserted on the body wall, arising from the end portion of the free-oviduct (Fig. 3A: mo). The duct and the body of the gametolytic gland are connected with the bent portion of the free-oviduct, and then to the body wall, by a group of 6-7 muscles which at times are fused to one another (Fig. 3A: mgo). The main stem arising from the gametolytic gland sometimes is split to form a separate stem directly connected to the body wall. The lower atrium, with a soft glandular covering, is also connected to the

[2]) We call "vas deferens" the whole duct that, leaving the sperm-oviduct and becoming separate, reaches its end at the apex of the epiphallic diverticulum. As a matter of fact, the inside wall of this duct, being slightly folded, is similar to that of the vas deferens of other *Arion* species; in these species the epiphallus contains small papillae arranged in rows.

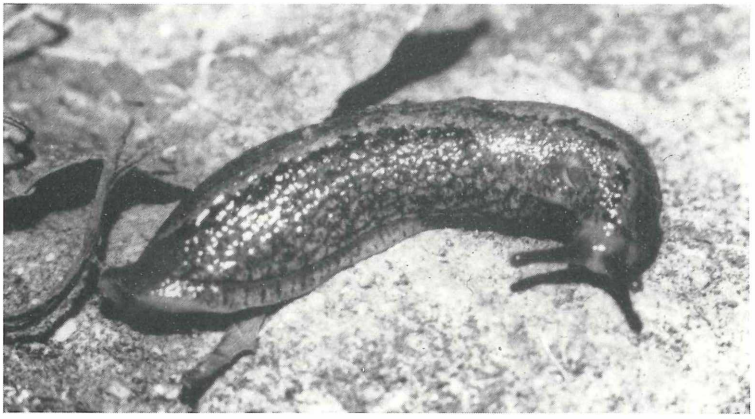

Fig. 1. An adult specimen of *Arion franciscoloi* n. sp. from the neighbourhoods of Rapallo (GE), x 3.

body wall by small muscles. The upper and lower parts of the atrium are separated by a narrow neck. The spermatophore is in shape of a twisted chitinous tube, with a hook-shaped posterior end and smooth walls lacking of denticulations (Fig. 3G).

Alimentary system: The jaw is odontognate, crossed by about twentyfive ribs (Fig. 2E, Fig. 5F). The radula has 83-87 teeth on each row. The basal plate of the central tooth is rather large, being dilated and rounded at its top margin. The central tooth has a well developed and sharpened mesocone, and short, pointed ectocones (Fig. 5A). The lateral teeth, with a long, pointed mesocone and a small ectocone are rather constant in structure, decreasing in dimensions toward the ends of the radula; they have no endocone (Fig. 5A-D). The 1-2 small outermost teeth of each row are devoid of ectocones and endocones (Fig. 5E). The alimentary system, with one anterior and two posterior loops, is slightly twisted. There is no real gastric caecum, but the stomach has a lobated outgrowth (Fig. 2C, arrow).

Holotype: Pietre Strette, Monte di Portofino, 400 m (Camogli, Genova, GE), A. Boato leg. 24. 1. 82; in coll. Giusti, Istituto di Zoologia (University of Siena).

Paratypes: Bavari, M. Riega (Genova, GE), 2 spec., S. Zoia leg. 23. 12. 76; Pietre Strette, M. Portofino, 400 m (Camogli, GE), 12 spec., M. Franciscolo leg. 5. 6. 80; Ruta di Camogli, 260 m (Camogli, GE), 4 spec., A. Boato leg. 11. 4. 82; at the entrance of Tanna de Strie, 105 m (Rapallo, GE), 1 spec., M. Bodon leg. 9. 1. 82; S. Margherita, 200 m (Sesta Godano, La Spezia, SP), 1 spec., P. Barenghi leg. 8. 5. 82; Mangia, 150 m (Sesta Godano, SP), 1 spec., M. Bodon leg. 7. 11. 81; Madonna di Roverano, 260 m (Carrodano, SP), 1 spec., A. Boato leg. 18. 3. 82; Casale, 160 m (Pignone, SP), 1 spec., A. Boato leg. 18. 3. 82; Coregna Valley, 140 m (La Spezia, SP), 2 spec., M. Bodon leg. 27. 3. 82; M. Altissimo, Alpi Apuane, 1000-1200 m (Lucca, LU), 1 spec., F. Giusti leg. 26. 9. 69. — In coll. Giusti, Istituto di Zoologia, University of Siena; Istituto di Zoologia, University of Genoa; Museo Civico di Storia Naturale "G. Doria", Genoa; SMF 256213/3.

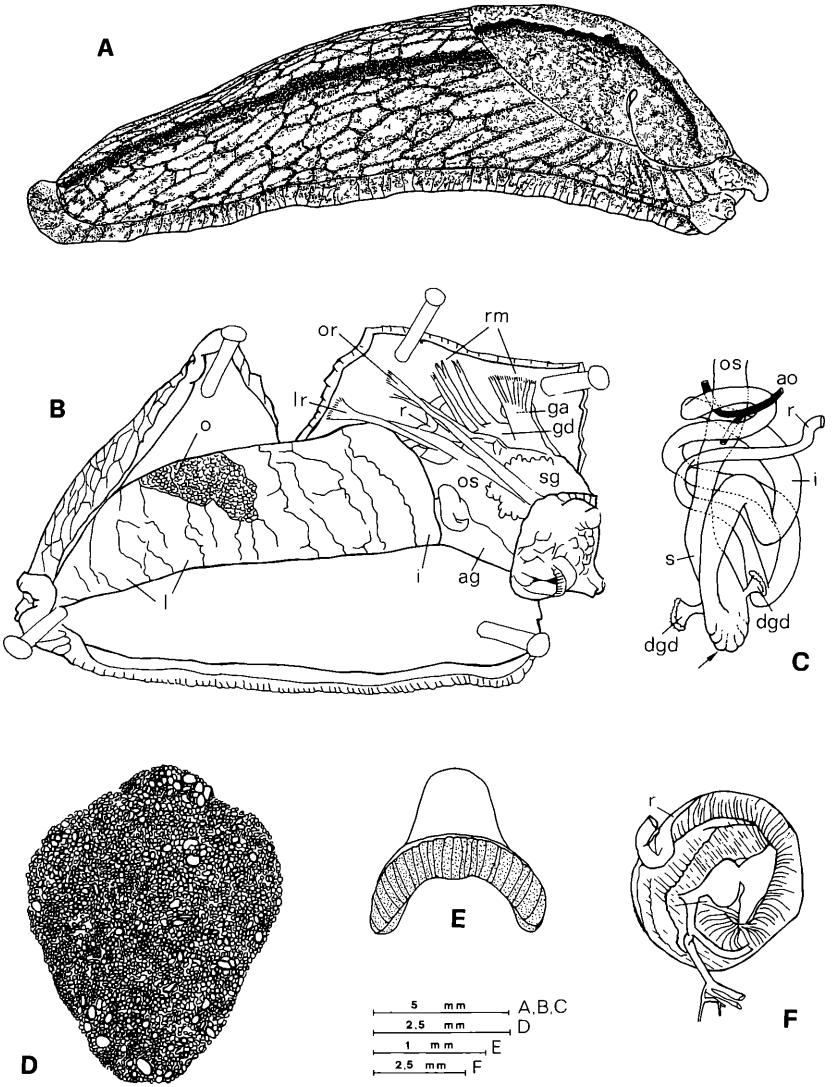

Fig. 2. *Arion franciscoloi* n. sp., paratypes from different localities. A) external appearance, B) internal organs in situ, C) alimentary system, D) "shell", E) jaw, F) pallial region in ventral view, showing pericardium, auricule and ventricle. — ao aorta, ag albumen gland, dgd digestive gland diverticules, ga genital atrium, gd gametolytic gland duct, i intestine, l liver, lr lower tentacle retractor, o ovotestis, or ocular retractors, os oesophagus, r rectum, rm retractor muscles of the gametolytic gland duct, s stomach, sg salivary gland.

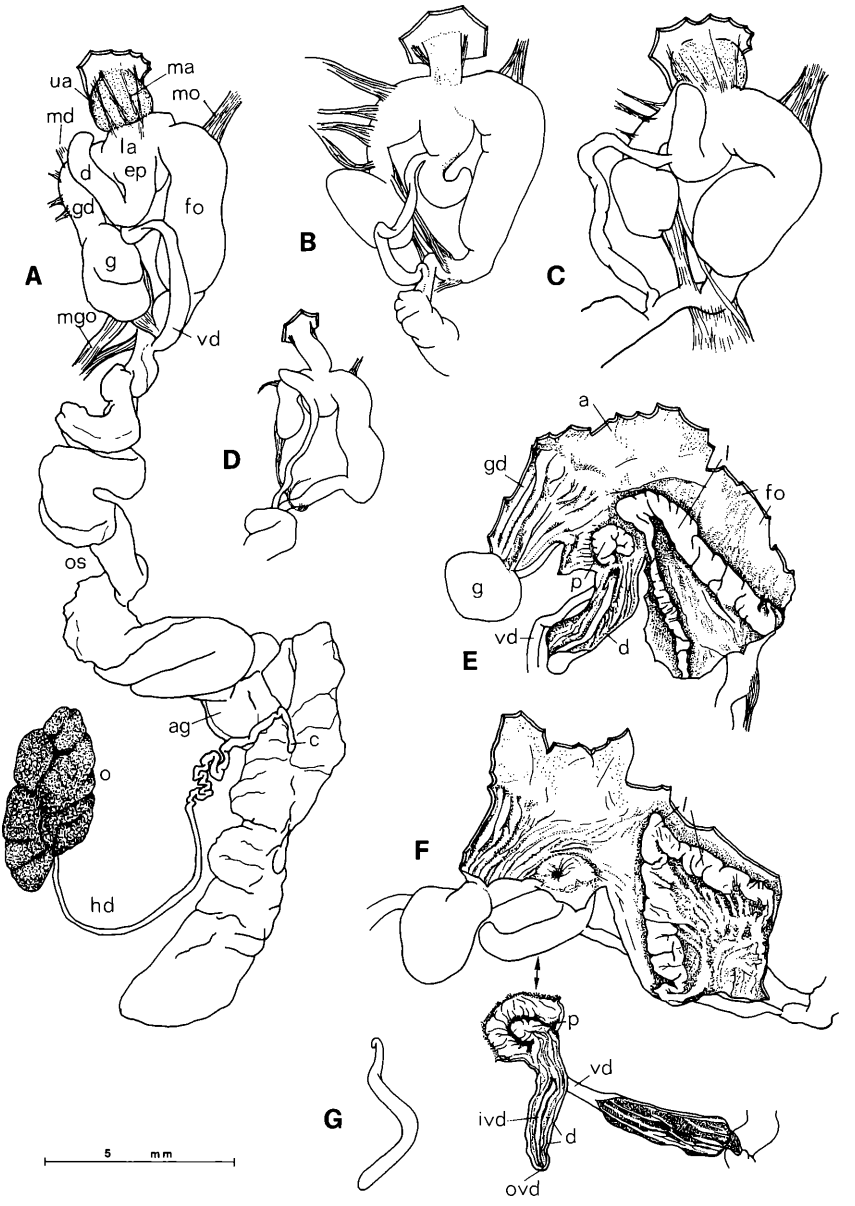

Fig. 3. *Arion franciscoloi* n. sp. A) reproductive system, B, C) distal genital ducts of adult specimens and D) of a young individual, E, F) internal structure of distal genital ducts, G) spermatophore. — a atrium, ag albumen gland, c claw, d epiphallic diverticulum, ep epiphallus, fo free-oviduct, g gametolytic gland, gd gametolytic gland duct, hd hermaphrodite duct, ivd internal tract of the vas deferens, l ligula, la lower atrium, ma retractor muscles of upper and lower atria, md retractor muscles of the gametolytic gland duct, mgo retractor muscles of both the oviduct and the gametolytic gland, mo retractor muscles of free-oviduct, o ovotestis, os ovispermiduct, ovd opening of the vas deferens, p epiphallic papilla, ua upper atrium, vd vas deferens.

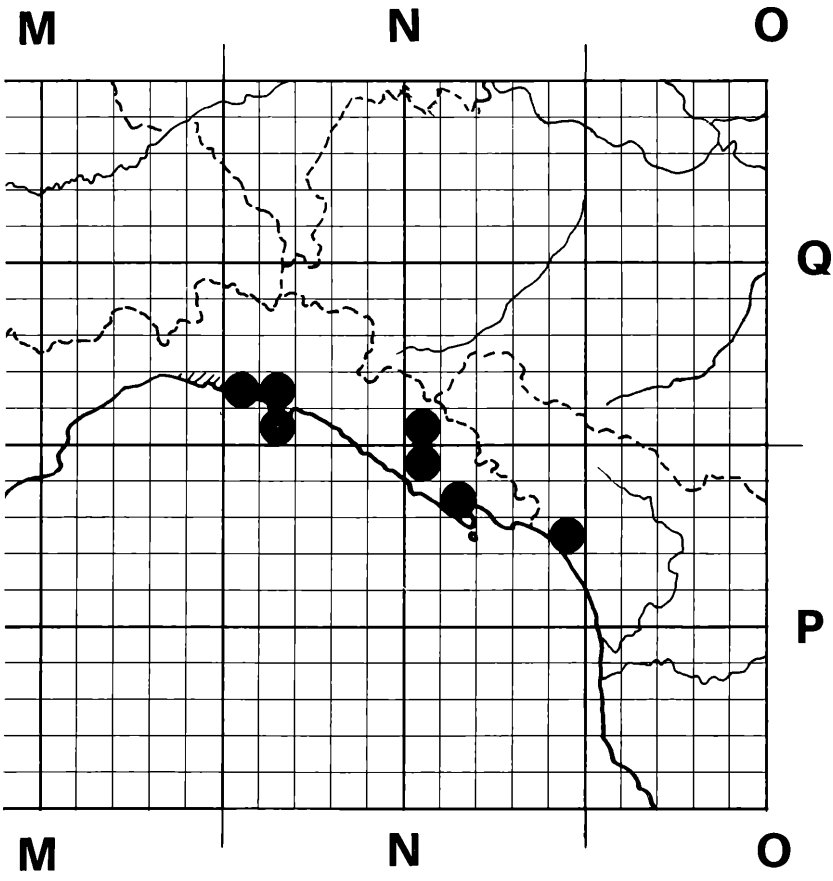

Fig. 4. Distribution of *Arion franciscoloi* n. sp. in Northern Apennines (Italy) and UTM notation of 10 x 10 km squares.

Distribution: *A. franciscoloi* is recorded from several places of the Ligurian Apennines. A few samples come also from Apuane Alps. It appears to be, at present, a species endemic for the Northern Apennines.

Habitat: *A. franciscoloi* inhabits lower-montane woodlands such as xerophilous deciduous-oak woods or chestnut groves. As other Arionidae, *A. franciscoloi* seems not to depend on the $CaCO_3$ content of the soil, occuring in both acid and calcareous loci.

Derivatio nominis: dedicated to our friend Prof. MARIO FRANCISCOLO, entomologist.

Discussion.

The diagnostic characters distinguishing *Arion franciscoloi* n. sp. from the other *Arion* species are:

– the high number of genital retractor muscles, particularly those connecting the duct of the gametolytic gland to the body wall.

– the distal portion of the male duct, with clearly distinguishable "vas deferens" and "epiphallus"

– the so -called epiphallus, shaped to recall a sort of copulatory organ (the enlarged base of the epiphallus, in fact, with its thick walls and the large, rounded papilla, could be interpreted as an anchoring structure).

– the vas deferens, running distally inside the epiphallic diverticulum, its opening being placed just at the apex of the diverticulum itself. This one could be responsible of spermatophore production.

In addition, other diagnostic features might be taken into account, as follows:

– the spermatophore, completely lacking of denticulations. This character, once supposed to be present in the *Kobeltia* group only, (GERMAIN 1930, RIEDEL & WIKTOR 1974), was not confirmed by DAVIES (1977).

– the internal structure of the epiphallus, containing longitudinal folds only. In other species, the epiphallus shows folds and papillae internally (*Arion* [*Carinarion*] *sylvaticus*), or only papillae, arranged in rows (*Arion* [*Mesarion*] *subfuscus, A.* [*Microarion*] *intermedius*, A. [*Kobeltia*] *hortensis* and *A.* [*A.*] *lusitanicus.*).

Slugs belonging to genus *Arion* FÉRUSSAC 1819 were divided by HESSE (1926) in the subgenera *Arion* s. s., *Mesarion, Carinarion, Kobeltia* and *Microarion*, both on the basis of external appearance and of some features of the reproductive system. These last features were mainly focused on the relative dimensions, the reproductive system in the group remaining rather unchanged in structure and arrangement.

A separate genus, named *Ariunculus* LESSONA 1881[3]) was distinguished from *Arion* by the genital aperture placed anteriorly to the respiratory orifice. In this new genus LESSONA placed three new species, all from Piedmont (*Ariunculus mortilleti, A. speziai* [emend. for *speziae*], and *cameranoi* [emend. for *camerani*]), having in common, besides the location of the genital aperture, the duct of the gametolytic gland, the epiphallus and the oviduct which open independently into the upper atrium, the former of these openings being closer to the genital aperture. Some time later a fourth species, described from Sardinia, *Ariunculus isseli* (LESSONA & POLLONERA 1882), was also placed in this genus, because the duct of the gametolytic gland, the epiphallus and the oviduct enter the upper atrium separately.[4])

The new species recalls, in its external appearance, the four species of "*Ariunculus*", the genital aperture being anterior to the respiratory orifice. Nevertheless, from the anatomical point of view, the reproductive organs are more similar to those of the genus *Arion.* In fact, the oviduct, the epiphallus and the duct of the gametolytic gland open in the upper atrium near to one another.

As far as the internal structure of distal genitalia is concerned, *A. franciscoloi*, since it has a ligula, could be compared (though not confused) with species which are in-

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[3]) The value of this genus is still uncertain. ZILCH & JAECKEL (1962) and BISHOP (1976) consider it as a valid genus, whilst ALZONA (1971) considered it as a subgenus of *Arion*. WIKTOR (in litt.) suggests it to be an artificial taxon.

[4]) Later on POLLONERA (1890) observed that in the case of *isseli* the whole arrangement of the distal genitalia was different from that of the other species of *Ariunculus*, thus creating the new subgenus *Ichnusarion.*

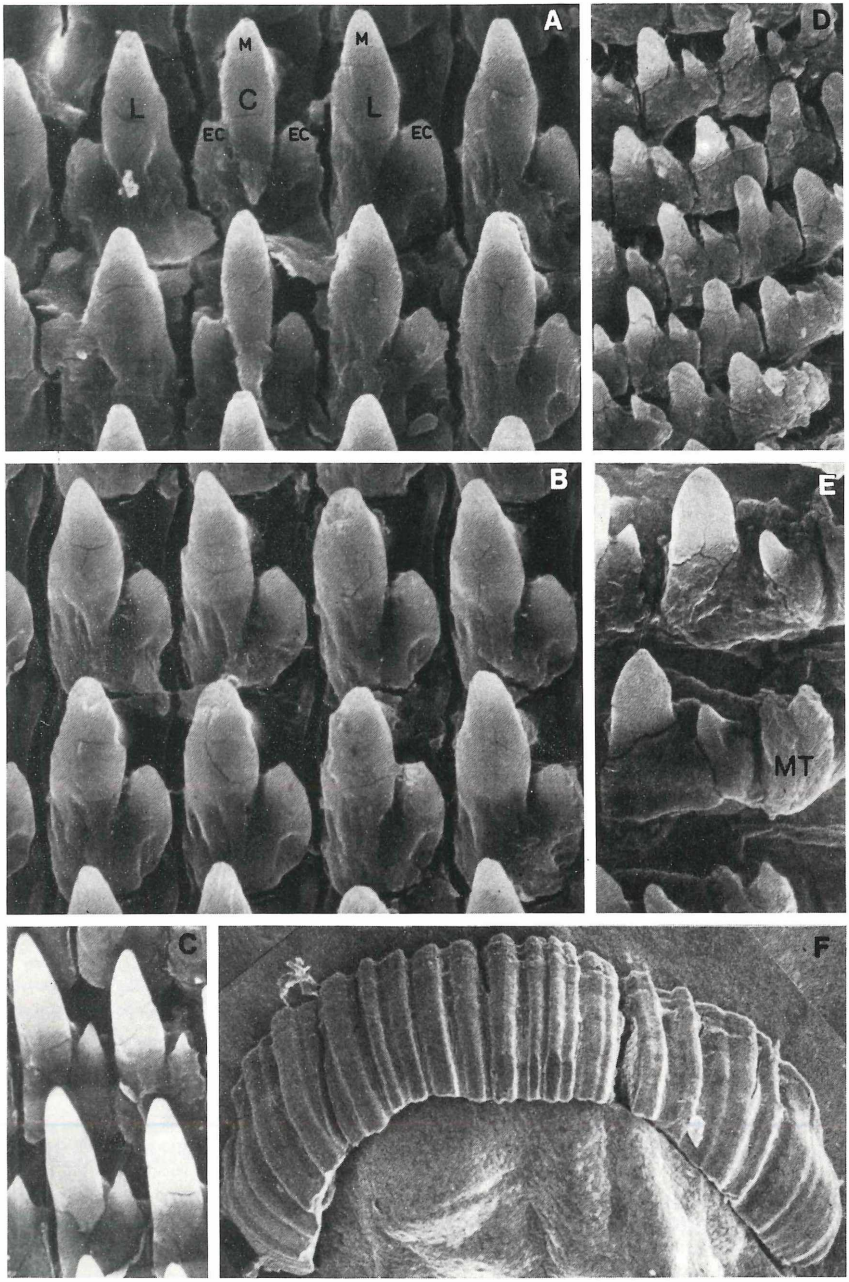

Fig. 5. Radula and jaw of *Arion franciscoloi* n. sp. A) central tooth (C) and first lateral teeth (L), M mesocone, EC ectocones, x 1000; B) 5°-8° lateral teeth, x 1000; C) 23°-24° lateral teeth, x 1000; D) 37°-40° latero-marginal teeth (MT), x 2000; F) jaw, x 80.

cluded at present in the subgenera *Arion*. s.s., *Mesarion* and *Kobeltia*. The structure of the ligula, which is prominent as a solid mass in the upper atrium, recalls that of *A. lusitanicus*. This is at variance with the *Mesarion* group, where the two folds representing this structure are always separated in the distal part of the oviduct. In *Kobeltia* the two folds seem to be distinct in their whole length (QUICK 1960: 140, fig. 4 C).

Insofar as the taxonomic rank to be given to *A. franciscoloi* we must say that the new species is distinguished from the other ones of *Arion* to the extant that one might consider it as belonging, at least, to a new subgenus, Nevertheless, the subdivision of *Arion* into subgenera is still rather uncertain and based upon too undefined anatomical features[5]). In lack of a taxonomic revision of the group, to be based upon a more cautious evaluation of these features, we prefer to place *franciscoloi* simply in the genus *Arion* s. l.

Summary: *Arion franciscoloi* n. sp. is described from Eastern Liguria and Apuane Alps. Although the structure of the male genital ducts and the genital retractor system are certainly peculiar, the authors include *franciscoloi* into *Arion* s. l., without assigning it any subgenerical status in lack of an analytical revision of the taxonomical value of the anatomical features.

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[5]) Several authors have recently given relevance to the internal structure of the reproductive system as a diagnostic character. In particular, DAVIES (1977) uses this criterion within the genus *Arion*. In this case, the most distinctive anatomical features seem to be the conformation of the ligula and the characteristic structures associated to the termination of both the epiphallus and the duct of the gametolytic gland.

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The authors: ALBERTA BOATO, MARCO BODON, Istituto di Zoologia, Università di Genova, Via Balbi 5, I-16126 Genova, Italia. — Prof. Dr. FOLCO GIUSTI, Istituto di Zoologia, Università di Siena, Via Mattioli 4, I-53100 Siena, Italia.