# SPIRORBINAE (SERPULIDAE: POLYCHAETA) FROM SOUTH-EASTERN AUSTRALIA.

## A NEW GENUS, FOUR NEW SUBGENERA AND SEVEN NEW SPECIES

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CONTENTS



SYNOPSIS

*Metalaeospira*, represented by one new species, has its embryos adhering to the body, but lacks any attachment stalk. *Protolaeospira* (inc. *Marsipospira*) is represented by two new species. The incubatory stalk characteristic of this genus is also found in the dextral form *Protolaeospira falklandica* (Pixell) (which is made the type of a new subgenus) and in *Helicosiphon*. A somewhat similar but funnel-like stalk is found in *Romanchella*, which is represented here by a new species. Southern *Romanchella* spp. have the collar folds fused dorsally, and a new subgenus is proposed for northern *Romanchella* spp. which have unfused collars and a more symmetrical distribution of uncini. A new subgenus is proposed for species of *Pileolaria* which lack sickle setae. The new genus represented by a single species, has '4½ segments' in the thoracic region but some affinities with *Pileolaria*. A new species of *Janua* (*Dexiospira*) has a tube with perforated ridges. A new subgenus of *Janua* is erected, with a new species as type, for form close to *Dexiospira* but with unfused collar folds.

## INTRODUCTION

Wisely's (1962) description of two species and Straughan's (1967) record of another seem to have been the only notable contributions to knowledge of Australian Spirorbinae so far published. Other authors who have dealt with these forms (Lamarck, 1818; Mörch, 1863; Bush, 1904) have offered just a few inadequate descriptions, several based on empty tubes, none of which had characters sufficiently distinctive for identification.

The following descriptions are based on material collected by Dr Leighton C. Llewellyn from South Australia (January 1967) and Sydney (July 1967). All the new species were present on the coast of Kangaroo Island, South Australia, namely at Cape du Couedic (S.W. tip), Sou' West River (south coast) and Kingscote (east coast), and two of them were also present off the mainland, at Brighton and Moanna, south of Adelaide. No new species were found at Sydney.

The material was preserved mainly in 5% formaldehyde in sea water (some in 70% alcohol) and examined early in 1970. Due to the length of time in fixative it was not possible to record the colours. The presence or absence of collar fusion (Pillai, 1970) was demonstrated by probing with a mounted eyelash (Knight-Jones, 1972). This and details of the tubes and opercula were distinguished in reflected light. Setae were examined in polyvinyl-lactophenol preparations (Knox, 1951; Gee, 1964; Harris, 1969) in which the clearing was considerably aided by gently warming on a hot plate for at least 48 hours. These preparations were viewed by phase contrast, with quartz-iodine illumination, and drawings were made on squared paper with the help of squared eyepiece graticules. The setae and uncini chosen for illustration were always the largest of their type. Light microscopy was used for all drawings, but in some species the finer details (particularly of the uncini) were confirmed from stereoscan electron-micrographs.

The species were compared with type material from several sources (p. 257). The classification into genera used below is mostly a compromise between the views of Bailey (1969b) and Pillai (1970), with amendments explained previously (Knight-Jones, 1972). It appears that the Spirorbinae of Australia may be remarkably different from those of Europe, in lacking any representative of the genus which Pillai called *Laeospira* Caullery and Mesnil, but which should rather (on priority grounds) be called *Spirorbis* Daudin. The nearest Australian genus would appear to be *Eulaeospira* Pillai. The reason originally given for separating this genus from *Spirorbis sensu stricto* was that its representatives lack sickle setae in the third thoracic fascicles. In fact, however, both the Australian form *Eulaeospira convexis* Wisely and the type species from Ceylon *Eulaeospira orientalis* Pillai were found on examination to be quite different from *Spirorbis* in having a bilaterally asymmetrical distribution of abdominal uncini and embryonic masses fixed to the body of the parent within the faecal groove. *Spirorbis* has the embryos fixed not to the body of the parent but to the wall of the tube (Bailey, 1969b).

## TAXONOMY

The collections included 15 species, 7 of which were new, the rest comprise:—

*Eulaeospira convexis* (Wisely, 1962)
*Pileolaria* (*Pileolaria*) *militaris* (Claparède, 1868)
*Pileolaria* (*Simplicaria*—see p. 245) *pseudomilitaris* (Thiriot-Quiévreux, 1965)
*Janua* (*Janua*) *pagenstecheri* (Quatrefages, 1865)
*Janua* (*Dexiospira*) *pseudocorrugata* (Bush, 1904—see p. 256)

*Janua* (*Dexiospira*) *formosa* (Bush, 1904) (Knight-Jones, 1972)
*Janua* (*Dexiospira*) *lamellosa* (Lamarck, 1818) (Wisely, 1962)
*Janua* (*Dexiospira*) *steueri* (Sterzinger, 1909)(Knight-Jones, 1972)

The recent references quoted above give descriptions of most of these forms. The others have been described recently by Bailey (1969a) and Zibrowius (1968). As shore ecologists may still find some difficulty in identifying these taxa, even after consulting the literature cited, it is hoped to complete, without much delay, an illustrated key to the fifteen species found, with notes on the ecology and distribution (Knight-Jones, Knight-Jones & Llewellyn, 1973). The two species described by Wisely have not yet been found outside Australia, but the distribution of the remaining six seems to be almost world-wide in warm-temperate and tropical seas.

Descriptions of the new species follow, starting with the genus that seems to be taxonomically nearest to *Eulaeospira*, judging from the way in which the embryos are attached to the parent's body (p. 236).

## Genus *METALAEOSPIRA* Pillai, 1970 (amended)

Sinistral coiling; three rows of thoracic tori on the concave side; embryos incubated in the faecal groove, but without a specialised thoracic attachment stalk; collar setae with simple blades; thoracic uncini slender and with a blunt anterior peg; thoracic and abdominal uncini much more numerous on the concave side (Fig. 7b); tori large throughout most of the setigerous region; abdominal setae less than a quarter the length of the collar setae (Fig. 6b), and with vestigial brush-like blades.

TYPE. *Spirorbis pixelli* Harris, 1969 nom. nov. pro *Spirorbis antarcticus* Pixell, 1913.

### *Metalaeospira tenuis* sp. n. (Fig. 1)

*Tube* up to 2·5 mm across, sinistral, porcellaneous, thin-walled and somewhat triangular in cross section, having a smooth median ridge with sloping sides. At the mouth, the tube becomes rounded, often bearing a swollen ring where growth was presumably interrupted. Occasionally two such rings are present, indicating a period of renewed growth. The mouth may ascend slightly, but usually all the whorls (three to five) lie flat against the substratum and increase regularly in size and height so that the central region forms a shallow dish-like depression (Fig. 1a).

*Operculum* borne on a remarkably long stiff stalk, usually resembling in outline that of *Conopomatus acuiconus* Pillai, 1960. The distal calcification is in the form of a white, finely-granular thin-walled truncated cone, which is shallower in young specimens (Fig. 1c & d). In mounted specimens (polyvinyl-lactophenol) the cone is often dislodged, showing that the ampulla below has a fine membranous upper surface bearing a few small, scattered denticles (Fig. 1e).

*Thorax.* Collar margins not fused dorsally. Collar setae resembling those of the second and third fascicles in bearing slender simple blades with smooth margins

(Figs 1f & g), but smaller, particularly on the concave side. Capillary setae also present in the first fascicles and sickle setae (Fig. 1h) in the third. Three rows of tori on the concave side. Uncini slender, with a rounded anterior peg followed by four longitudinal rows of teeth and fewer rows of larger teeth posteriorly (Fig. 1j).

*Abdomen.* The asetigerous region is very long, but its proportionate length is not so great, because the whole abdomen is remarkably attenuated, particularly in older specimens (Fig. 1m). Setae (up to five per fascicle) are brush-like with blunt teeth. Many of the posterior fascicles include hooked capillary setae (Fig. 1l). Uncini with about eight longitudinal rows of very fine teeth and a broad, blunt anterior peg (Fig. 1k).

*Setation* (Figs 6b & 7b).

*Incubation.* Up to thirteen embryos in a single row, closely adhering to the faecal groove of the abdomen, mainly along the asetigerous region and occasionally well into the thoracic region. Careful examination showed that the embryo chains were attached to the body by delicate transparent strands. The attachment was generally near the first abdominal uncinus, but it involved different parts of the embryo chain, depending on the position of the latter relative to the body (Figs 1m, n, o & p). Only one specimen seemed to show a thoracic attachment and this was merely by a somewhat elastic thread. The faecal groove and particularly its spiral course is not obvious, because of the extreme attenuation of the animal. The comparatively large spawned eggs are associated with an indentation along the body, however, which may be due to retraction and compression of the animal on addition of fixative, but is nevertheless in the normal position of a faecal groove. One specimen seemed to have two separate large eggs lying in the more posterior part of the groove (Fig. 1p).

*Location.* Brighton. Collected by L. C. Llewellyn, January 1967. Very abundant (including type specimen) on a red alga, *Jeanerettia pedicellata*, presumed to have been washed up from sublittoral reefs, and some on a marine angiosperm *Amphibolis* (= *Cymodocea*) *antarctica.* Also found at Moanna on *Sargassum linearifolum;* Sou' West River and Cape du Couedic on *Amphibolis antarctica.*

Holotype. British Museum (Nat. Hist.) Reg. No. ZB 1971:8a.

Paratypes. British Museum (Nat. Hist.) Reg. No. ZB 1971:9. Australian Museum Reg. No. W4473.

Remarks. This genus has been represented previously only by the type *M. pixelli* (Harris, 1969), a species with which *M. tenuis* has strong affinities, particularly in setation and the distinctive form of the tube. It differs mainly in opercular detail. Pixell says of her species "Small circular perforations occur in the calcareous plate and through these project small membranous projections which are generally thorn-shaped'. There are 'membranous thorns' similar in form but much fewer in number below and within the conical 'plate' of *M. tenuis* (Fig. 1e), but examination of numerous specimens showed the cone to be entire, without perforations and distal projections. Furthermore *M. pixelli* has an opercular talon, but *M. tenuis* has none.

The method of incubation of *M. pixelli* has not so far been described, but material of this species was available from South Georgia (identified by Harris, 1969, and kindly provided by the British Museum (Natural History)). Examination revealed

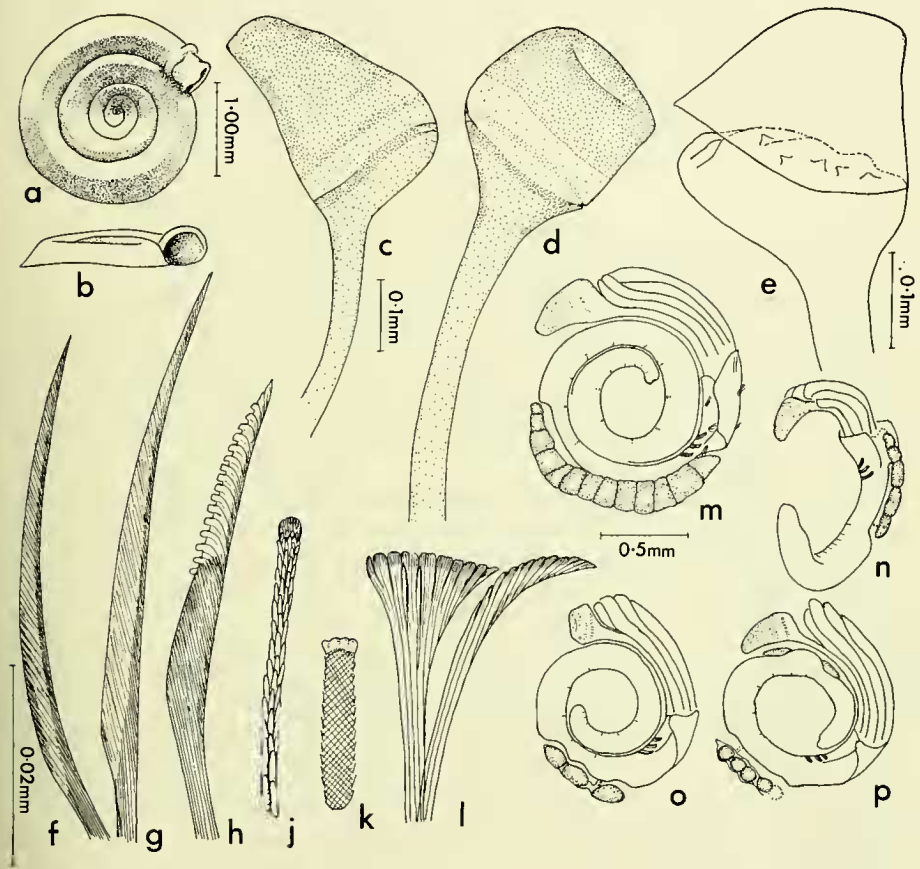



FIG. 1. *Metalaeospira tenuis* sp. n. a) tube from above; b) tube, side view; c) operculum side view; d) operculum of a younger individual, dorsal view; e) operculum showing membranous denticles on the upper surface of the ampulla, within the cone; f) collar seta; g) seta representative of most in the second and third fascicles; h) sickle seta from the 3rd fascicle; j) thoracic uncinus; k) abdominal uncinus, cross hatched to represent teeth almost beyond resolution by light microscope; l) abdominal seta with associated hooked capillary seta; m) whole mature animal dorsal view showing the position of a fully developed egg string; n), o) and p) showing smaller egg strings and tenuous attachments to the faecal grooves.

*Scales*: b) as a); d) as c); g), h), j), k) and l) as f); n), o) and p) as m).

an egg string tightly compressed against the faecal groove, with the anterior end approximately level with the first abdominal torus. The method of attachment of the egg mass could not be discerned but it seems likely that direct attachment to the body surface, as described above, is the method characteristic of *Metalaeospira*. In that respect this genus differs from *Romanchella* and *Marsipospira* but resembles *Eulaeospira*, to judge from observations on *Eulaeospira orientalis* (Pillai, 1960) and *E. convexis* (Wisely, 1962), (Knight-Jones, Knight-Jones & Llewellyn, 1973). Further resemblances to *Eulaeospira* include the asymmetrical distribution of abdominal uncini and the presence of hooked capillary setae on several abdominal segments. The opercular stalk also resembles that of *Eulaeospira orientalis*, but not that of *E. convexis*.

## Genus ***PROTOLAEOSPIRA*** Pixell, 1912 (redefined)
## (inc. *Marsipospira* Bailey, 1969b; *Pixellia* Pillai, 1970)

Coiling usually sinistral (see below); three rows of tori on the concave side of the thorax; other traces of a fourth thoracic segment may or may not be present; embryos incubated in the faecal groove and attached to a stalk which arises dorsally from the floor of the groove, in the thoracic region and towards the left side; collar setae with separate fins and blades which are usually cross-striated; sickle setae present in the third fascicle; thoracic and abdominal uncini much more numerous on the concave side (Fig. 7c & d, p. 250); thoracic uncini usually very long and slender, with a blunt, bilobed anterior peg; abdominal setae less than a quarter the length of the collar setae (Fig. 6c & d, p. 248); and with vestigial brush-like blades; opercular talon massive and usually bearing lateral projections; single white larval attachment gland may be present.

Bailey (1969b), in a valuable taxonomic review, first united these forms into a single subgenus, with *Marsipospira striata* (Quiévreux, 1963) as the type, but they must include *Spirorbis* (*Protolaeospira*) *ambilateralis* Pixell, 1912. This was originally separated into a monotypic subgenus, because it has all four parapodial rudiments appropriate to a fourth thoracic segment, thus differing from *Paralaeospira* in which the fourth segment is usually represented by a single torus (the neuropodium of the concave side). Pixell described her species as having a thoracic brood stalk but did not regard this character as helping to distinguish it from *Paralaeospira* because she described a similar stalk in *Spirorbis* (*Paralaeospira*) *racemosus*. The latter was made the type of a new genus *Pixellia* by Pillai (1970), but as Zibrowius (1968) showed there is probably no important difference between a complete or incomplete fourth thoracic segment and indeed the number of rudiments developed varies with the size of the specimen (Caullery and Mesnil, 1897; Crisp, Bailey, Knight-Jones, 1967; Bailey, 1969a). *Pixellia* and *Protolaeospira* must therefore be reunited and the rules of priority unfortunately necessitate use of the name *Protolaeospira*, in spite of the risk of confusion which redefinition entails.

It is also unfortunate that the name seems inappropriate. The stalk is unlikely to be primitive and not all these forms are sinistral. The direction of coiling in the diagnosis above must be qualified as being *usually* sinistral, because of the characters

of what has hitherto been called *Spirorbis* (*Paradexiospira*) *falklandicus* Pixell, 1913. Schizosyntypes of this species from the British Museum (Nat. Hist.) clearly showed the egg mass to have a thoracic attachment stalk like that typical of *Protolaeospira*. This species is thus quite different from the type species of *Paradexiospira*, i.e. *P. vitrea* (Fabricius, 1780), of which numerous live specimens from Cornwall, U.K. were examined (kindly provided by Mr Hedley Brown.) In *P. vitrea* the egg mass is attached to the tube and not to the animal. Clearly the subantarctic species cannot remain in the genus *Paradexiospira*. It has recently been shown that the direction of coiling is not very useful in distinguishing between genera in Spirorbinae (Knight-Jones, 1972). It is quite a useful character, however, at subgeneric level, so it seems best to institute herewith a new subgenus ***Dextralia,*** within the genus *Protolaeospira*, with *P.*(*D.*) *falklandica* as the type species.

Before reaching the above decision on priority it was of course necessary to check the method of incubation in the type of *Paralaeospira* (i.e. *P. aggregata* Caullery and Mesnil, 1897, kindly loaned by the Museum National d'Histoire Naturelle, Paris). In this form the egg mass lies in the faecal groove, but no thoracic attachment stalk is present. *Spirorbis* (*Paralaeospira*) *lebruni* (Caullery and Mesnil, 1897) has the specialized attachment stalk, however, so must now be placed in *Protolaeospira* (see page 240).

Type. *Spirorbis* (*Protolaeospira*) *ambilateralis* Pixell, 1912.

### *Protolaeospira (Protolaeospira) triflabellis* sp. n. (Fig. 2)

Tube sinistral, large (up to 4 mm across), ornamented by high, round, smooth transverse ridges which converge into a longitudinal ridge on the innermost edge of the single visible whorl. The walls are thick and hard, but in no way translucent (Fig. 2a).

*Opercular* plate concave, densely calcified and very oblique, with a massive calcified talon bearing three irregularly fluted projections which appear fan-like in dorsal view. The terminal 'fan' is thick in profile and fluted on both sides (Fig. 2b & c).

*Thorax*. Collar margins unfused dorsally. Three pairs of tori. Three fascicles of setae on the concave side and four fascicles on the convex, forming what some authors have described as '$3\frac{3}{4}$ segments'. Collar setae with fins, and cross-striations, which are confined to about a third of the width of the blades (Fig. 2d). Setae of the second, third and fourth fascicles have simple slender blades, with smooth margins (Fig. 2f). Also present in the third and fourth fascicles are sickle setae with the distal portions unusually small and bearing remarkably fine recurved teeth (Fig. 2g). Capillary setae (Fig. 2e) are present in all the fascicles. Uncini unusually numerous, elongated, each with a single longitudinal row of large teeth along most of its length, but with finer more numerous teeth adjoining the blunt, gouge-like anterior peg (Fig. 2k).

*Abdomen* with a long asetigerous region, followed by up to thirty-four rows of tori on the concave side. Uncini with about ten longitudinal rows of teeth and a blunt fluted anterior peg (Fig. 2l). Very small setae, up to four per fascicle and

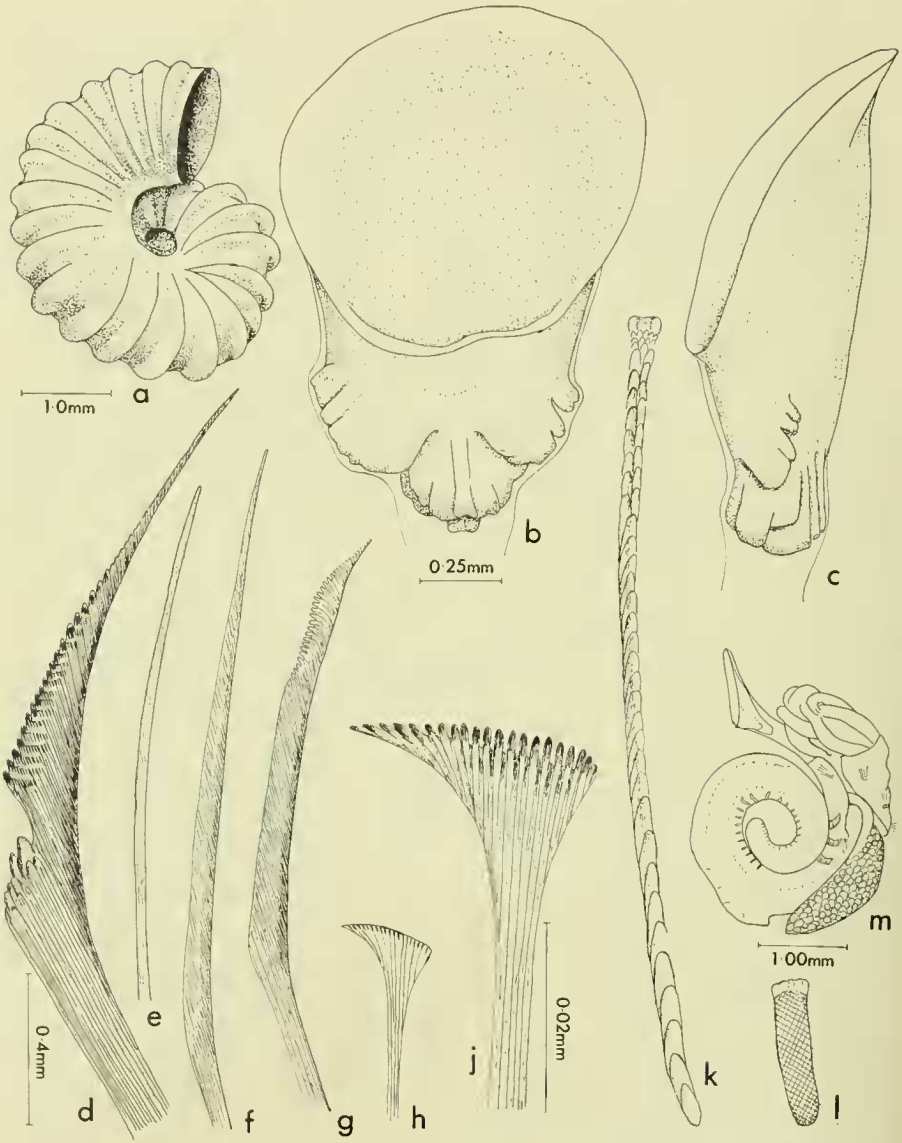



FIG. 2. *Protolaeospira* (*P.*) *triflabellis* sp. n. a) tube; b) operculum, dorsal view; c) operculum side view; d) collar seta; e) capillary seta as in the first and third fascicles; f) simple seta, as in the second, third and fourth fascicles; g) sickle seta, as in the third and fourth fascicles; h) abdominal seta; j) abdominal seta shown to a larger scale; k) thoracic uncinus; l) abdominal uncinus (cross-hatching denotes teeth almost beyond resolution by the light microscope); m) whole animal viewed dorsally showing the egg mass and position of attachment stalk.
Scales: c) as b); e), f), g) and h), as d); k) and l) as j).

somewhat brush-like in appearance, with the short blade bordered by dense, well separated ovate teeth (Fig. 2j).

*Setation* (Figs 6d & 7d).

*Incubation.* About two hundred embryos lying in the faecal groove in an elongated mass which is attached to a thoracic stalk. The latter arises dorsally from the floor of the faecal groove on the concave side, just anterior to the first thoracic torus (Fig. 2m).

Locations. Cape du Couedic. Collected by L. C. Llewellyn January 1967. Occur sublittorally on kelp holdfasts (*Ecklonia radiata*) and on stones and shells in shaded places in the littoral zone (5 specimens). A few of these empty but highly characteristic tubes were also found at Moanna.

Holotype. British Museum (Nat. Hist.) Reg. No. ZB 1971:10, 10a & 10b.

Paratypes. British Museum (Nat. Hist.) Reg. No. ZB 1971: 11. Australian Museum Reg. No. W4474.

Remarks. This species resembles *Protolaeospira striata* and *P. racemosa* in having a tube with remarkably prominent transverse folds, but differs from them in having no spur ornamenting the ventral side of the talon. Its talon somewhat resembles that of a species from the Galapagos Islands, *P. translucens* (Bailey & Harris, 1968), but that has a translucent tube with indistinct transverse ridges, uncini with three to four longitudinal rows of teeth, and sickle setae of different proportions. Examination of *P. striata* showed that its attachment stalk also arises from the left side of the dorsal groove, just anterior to the first thoracic torus, and not in *close* association with the branchial crown, as was indicated by Pixell (1912) and Quiévreux (1963). It seems unlikely therefore to be a modified branchial tentacle, as Bailey (1969b) suggested. The full complement of branchiae may be said to be present without it, for the peduncle of the operculum in all these species arises in the normal (for Spirorbinae) position of second on the left, the most dorsal tentacle being of the usual pinnate form. Hartman (1953), however, noted the position of a similar thoracic stalk in her description of *Helicosiphon biscoeensis* Gravier, 1907. 'The egg sack is attached to a thick stalk that arises from the dorsal side of the body between the first and second setigerous segment'. Examination of this species from the South Orkneys (Knight-Jones, Knight-Jones & Bregazzi, 1973) confirmed that the method of brood attachment in *Helicosiphon* is similar to that in *Protolaeospira*. It also resembles that found in *Romanchella sensu stricto* (p. 243), but further studies of this are desirable.

### ***Protolaeospira (Protolaeospira) canina*** sp. n. (Fig. 3)

*Tube* sinistral, bearing two longitudinal ridges (of which the inner may be the most prominent), with slight transverse grooves between them (Fig. 3a & b). A wide striated flange slopes down from the outer ridge and projects somewhat in front of the mouth, which may or may not ascend.

*Opercular plate* slightly concave with a massive talon; in side view this is somewhat like a dog's tooth, but a dorsal view shows faint bulges on each side (one higher than the other) and an indistinct median longitudinal ridge (Fig. 3c & d).

*Thorax.* Collar margins unfused dorsally. A fourth 'segment' represented by only a third torus on the concave side. Uncini long and slender, each with a single longitudinal row of teeth for most of its length and finer more numerous teeth behind the anterior peg, which is like a gouge (Fig. 3k). Collar setae with a fin and an indistinctly cross-striated blade (Fig. 3e & f). Capillary setae are also present. Setae of the second and third fascicles are simple with smooth margins (Fig. 3g) and there are also sickle setae (Fig. 3h) in the third fascicles.

*Abdomen.* About seventeen abdominal 'segments' closely spaced, except that the first is equidistant between the third thoracic torus and the second abdominal torus, resulting in what could be called a relatively short asetigerous region (see legend Fig. 7). Uncini with about nine rows of longitudinal teeth, which seem to occlude the anterior peg (Fig. 3). Setae small, up to six per fascicle and somewhat brush-like (Fig. 3j).

*Setation* (Figs 6c & 7c).

*Incubation.* The egg mass (up to 17 embryos) lying in the faecal groove and attached anteriorly by a stalk-like process, which arises from the floor of the groove level with the first thoracic torus on the concave side.

Location. Cape du Couedic. Collected by L. C. Llewellyn January 1967. Twenty-seven specimens on stones in midlittoral pools.

Holotype. British Museum (Nat. Hist.) Reg. No. ZB 1971: 12.

Paratypes. British Museum (Nat. Hist.) Reg. No. ZB 1971: 13. Australian Museum Reg. No. W4475.

Remarks. This species is closely related to *P. lebruni*, material of which, collected from the Falkland Isles and recently described by Harris (1969), was kindly loaned by the British Museum (Nat. Hist.). Further specimens from New Zealand were kindly made available by Dr Peter Vine. Study of these showed the embryo mass to be held in position by a thoracic groove attachment stalk as in the above and preceding species. The opercular plate of *P. lebruni* varies from being slightly convex to prominently conical, perhaps with increasing age, but it is always adorned with brown concentric rings peripherally and apically. The talon too shows great variability in the size and angle of its lateral protuberances, though a ventral cavity and dorsal longitudinal ridge are usually present.

The range of variation includes that described by Harris (1969) as a separate species, *Spirorbis auricularis*. Paratypes of this from the British Museum (Nat. Hist.) were examined and found to be the same as *P. lebruni*, having the same setation and characteristic brown rings. The talon in *P. canina* is more massive and much simpler in outline, whilst the distal plate is concave and lacks brown rings, irrespective of the size of the animal. The anterior uncini are less numerous, the first, second and third thoracic tori on the concave side containing approximately 50, 70, and 60, compared with 80, 110 and 100 uncini, whilst the first abdominal torus

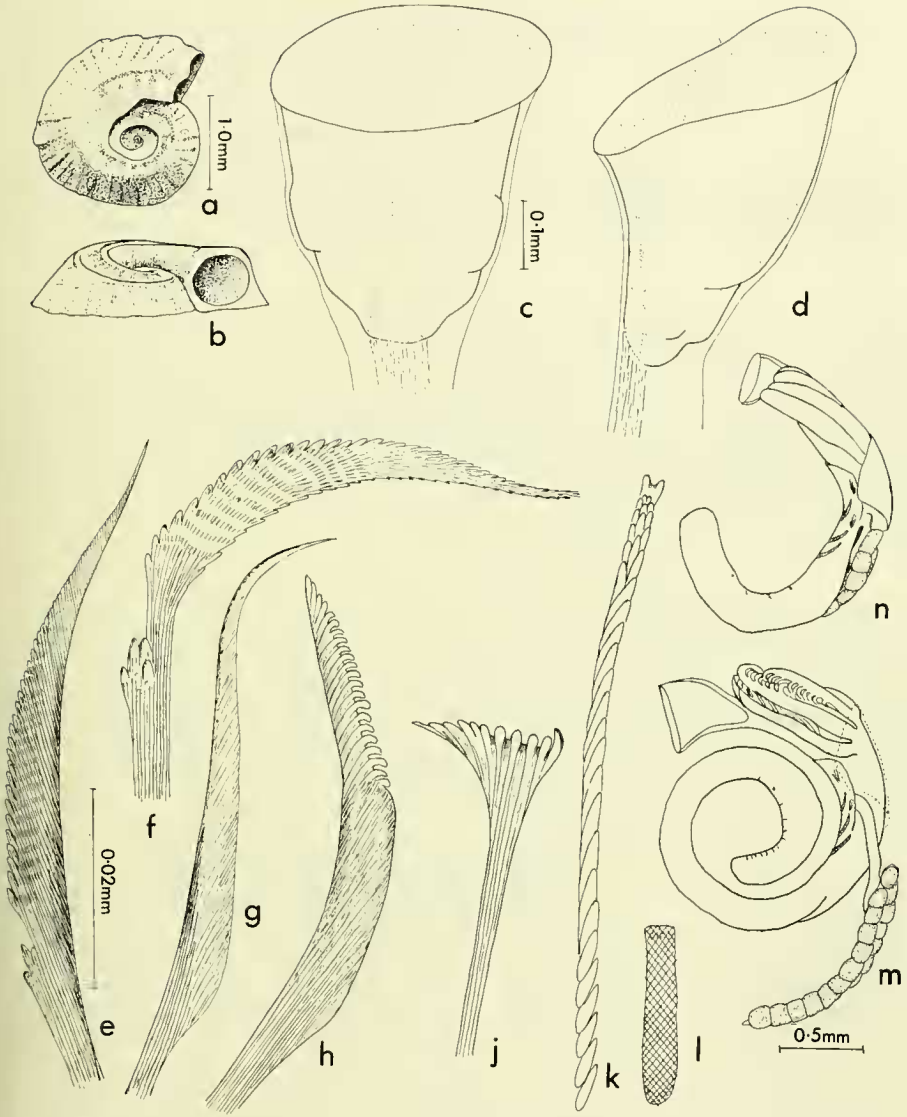



FIG. 3. *Protolaeospira* (*P.*) *canina* sp. n. a) tube from above; b) tube, side view; c) operculum, dorsal view; d) operculum, side view; e) collar seta, viewing side of 'blade'; f) collar seta, viewing front of 'blade'; g) simple seta as in second and third fascicles; h) sickle seta as in third fascicles; j) abdominal seta; k) thoracic uncinus; l) abdominal uncinus (cross-hatching denotes teeth almost beyond resolution by light microscope); m) whole animal viewed from the dorsal side showing the egg mass and the position of the attachment stalk; n) another specimen showing the egg mass lying in its natural position, following the spiral course of the faecal groove.
Scales: b) as a); d) as c); f), g), h), j), k), l) as e); n) as m).

contains 40, compared with the remarkably large number of 110. The ridges of the tube are more distinct than in *P. lebruni* from the Falkland Islands, but less prominent than in those from New Zealand. Both *P. canina* and *P. lebruni* (including the form *auricularis*) have collar setae with indistinct cross-striations.

The constancy of the characters of *P. canina* (particularly its operculum) suggests that this is more than a variety of *P. lebruni* and that specific status is justifiable. Both these forms are different from other species of *Protolaeospira* in that the first abdominal torus is the largest (cf Figs 7c & 7d), whilst the attachment stalk seems to arise in a slightly more posterior position.

### Genus ***ROMANCHELLA*** Caullery and Mesnil, 1897 (amended)

Sinistral coiling; incubation in the faecal groove; simple collar setae; only two pairs of thoracic tori; sickle setae present in the third fascicles; abdominal setae less than a quarter the size of the collar setae (Fig. 6a, p. 248), usually paired and strongly geniculate, with small tapered blades, but one of a pair is often a hooked capillary seta; thoracic uncini with a blunt gouge-shaped anterior peg; white larval attachment glands probably not present.

### Subgenus ***ROMANCHELLA*** Caullery and Mesnil, 1897

Margins of the collar fused to form a tunnel over the mid-dorsal thoracic groove; incubation in an egg mass attached anteriorly by a stalk arising in the thoracic groove and level with the tori; collar setae few compared with those of the other thoracic fascicles (Fig. 7a, p. 250), and small on the concave side (Fig. 6a, p. 248); uncini numerous on the concave side of the abdomen and sparse on the convex side, with the largest tori near the anterior end of the setigerous region (Fig. 7a, p. 250).

Type. *Spirorbis* (*Romanchella*) *perrieri* Caullery and Mesnil, 1897.

It seems best to adopt the narrow definition of this group outlined above, in order to exclude from it certain northern-hemisphere forms which fall within the definition of the genus. Of these I have studied mostly *Romanchella evoluta* (Bush, 1904) from the Smithsonian Institution and hereby designate it as the type of a new subgenus ***Bushiella,*** with the characters of the genus *Romanchella* and with separate dorsal collar margins; collar setae comparatively numerous and well developed; thoracic uncini long and narrow and bearing no more than two rows of longitudinal teeth; no marked bilateral asymmetry in the distribution of abdominal tori; and the largest tori about half way along the setigerous region. The poor preservation of the type material did not allow proper study of the method by which the egg masses were held in the faecal groove. A lectotype has been selected for the Smithsonian Institution. In the closely related form *Romanchella* (*Bushiella*) *media* (Pixell, 1912) also from the Smithsonian, there is a flap of skin from one side of the faecal groove, extending from the thorax to approximately the sixth abdominal 'segment' and partially covering the egg mass. *Romanchella coronata* (Zachs, 1933), kindly

supplied from the National Museum, Tokyo, and *Romanchella asperata* (Bush, 1904), from the Smithsonian Institution, also seem to be closely related to these and have unfused collar folds.

### *Romanchella (Romanchella) quadricostalis* sp. n. (Fig. 4)

*Tube* sinistral, thick-walled, porcellaneous, with four to five high smooth longitudinal ridges, three of which form prominent teeth at the mouth. The upper whorl is often irregularly evolute, whilst the lower is tightly coiled and very firmly attached to the algal filament which forms the substratum.

*Opercular* plate slightly concave, oblique and bearing towards the dorsal edge a shallow broad talon with a central cleft forming shallow bilobed 'lips' terminally. Sometimes the outer surface of the plate shows incipient delamination and occasionally two lobed plates may be seen, one above the other (Fig. 4e).

*Thorax.* Collar margins fused dorsally (Fig. 4p). Collar setae simple and finely serrate, with those on the concave side smaller than the others. Setae of the second and third fascicles are similar, but larger and with smooth margins. Capillary setae are also present in the first fascicle and sickle setae in the third (Fig. 4k). Two pairs of tori, each uncinus broad and with unusually numerous minute teeth in about twelve to fifteen longitudinal rows, which almost cover a wide, blunt anterior peg (Fig. 4n).

*Abdomen.* Asetigerous region short and followed by about seventeen 'segments'. Uncini numerous on the concave side (sparse on the convex) and similar to those of the thorax, but with about fifteen to twenty longitudinal rows of teeth. Setae often in pairs and strongly geniculate, with sharply tapering blades bearing recurved teeth. Usually the second seta of the last few fascicles of mature specimens is in the form of a hooked capillary (Fig. 4m).

*Incubation* in the faecal groove. The egg mass (up to 25 orange embryos) is attached dorsally by a stalk-like process which arises from the floor of the thoracic groove, between the second and third thoracic 'segments'. The usual spiral course of the faecal groove and its associated egg 'string' can be seen particularly clearly because the body is short and relatively fat (Fig. 4q).

*Setation* (Fig. 6a and Fig. 7a).

Locations. Numerous (including the type specimens) on a red alga *Pterocladia capillacea* in the lower littoral zone at Cape du Couedic and a few attached to the base of various epiphytes on detached algae, presumed to have been cast ashore from the sublittoral reef about 100 m off Sou' West River. Collected by L. C. Llewellyn January 1967.

Holotype. British Museum (Nat. Hist.) Reg. No. ZB 1971: 14 & 14a.

Paratypes. British Museum (Nat. Hist.) Reg. No. ZB 1971: 15. Australian Museum Reg. No. W4476.

Remarks. Dorsal collar fusion, similar setation (including sickles) and an egg-mass attachment process were found in *R.* (*R.*) *perrieri* from New Zealand (identified and made available by P. Vine), *R.* (*R.*) *perrieri* from Falkland Isles and *R.* (*R.*)

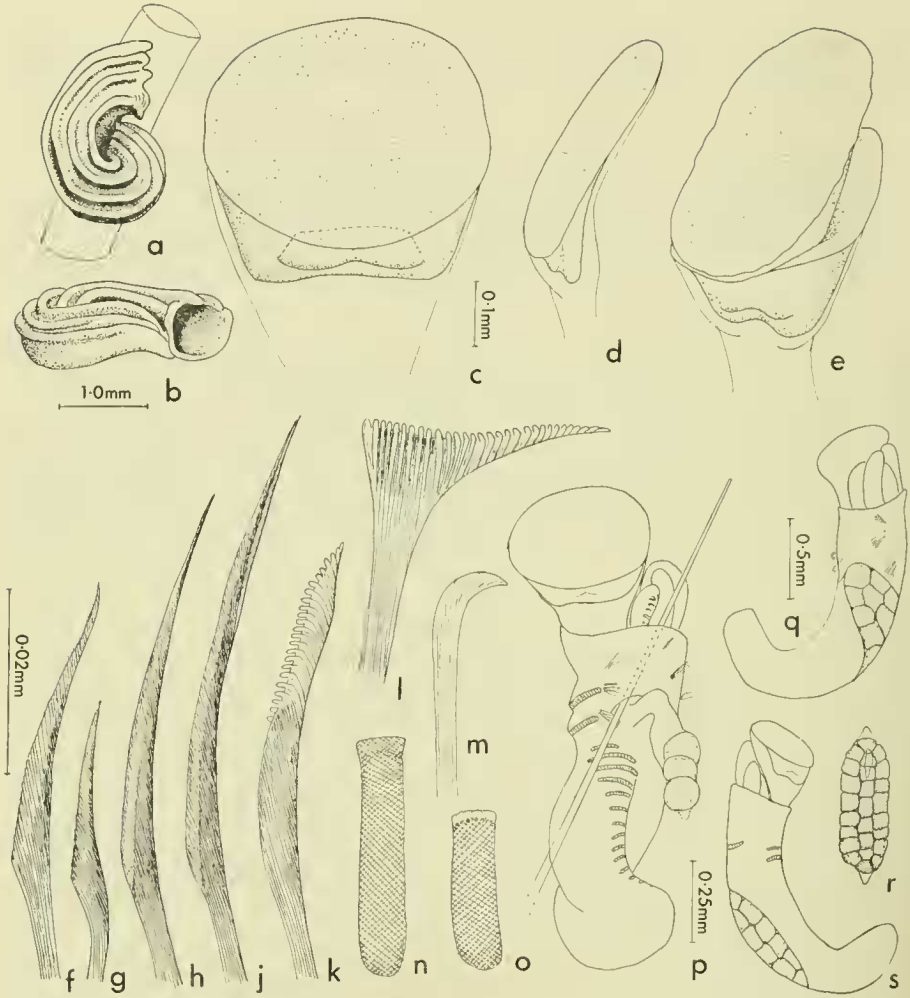



FIG. 4. *Romanchella* (*Romanchella*) *quadricostalis* sp. n. a) tube from above; b) tube, side view; c) operculum, dorsal view; d) operculum, side view; e) operculum showing delamination of an outer plate; f) collar seta from convex side of animal; g) collar seta from concave side; h) simple seta as in second fascicles; j) simple seta as in third fascicles, showing the tip of the blade in edge-on view; k) sickle seta as in third fascicles; l) geniculate abdominal seta; m) hooked capillary abdominal seta; n) thoracic uncinus (cross-hatching denotes teeth almost beyond resolution by light microscope); o) abdominal uncinus; p) whole animal viewed from the dorso-concave side, showing egg mass, position of the attachment stalk and probe inserted to demonstrate the fused collar folds; q) dorsal view of specimen with a fully developed egg mass obscuring the attachment stalk; r) detached egg mass, showing area of attachment near its anterior end; s) ventral view of q) showing the egg mass conforming with the spiral course of the faecal groove.
Scales: b) as a); d) and e) as c); g), h), j), k), l), m), n) and o) as f); r) and s) as q).

*scoresbyi* (Harris) and *R.* (*R.*) *inventis* (Harris) from Tristan Da Cunha (loaned by the British Museum (Natural History)). However, the tubes, opercula and uncini showed that all these were distinct species.

Collar fusion in dextral opercular incubators has been noted by Day (1961) and Pillai (1970) and has since been observed in sinistral forms of *Janua* (Knight-Jones, 1972; Vine, 1972a), but not hitherto in any genus of tube-incubators. Attachment stalks have previously been noted in *Protolaeospira* and *Helicosiphon*, but these arise in a slightly more anterior position and are long and thin, like unbranched tentacles. A transverse section of part of the thoracic region of *R.* (*R.*) *quadricostalis* showed the attachment stalk to be a hollow 'funnel' connecting with the coelomic cavity by a pore through the body wall (Knight-Jones, Knight-Jones & Vine, 1972). In whole animals it appears membranous and is often hidden under a mass of embryos.

The occasional appearance of delamination from the opercular plate recalls the periodic moulting described in other Spirorbinae by Thorp (1961), the function of which is presumably to get rid of epiphytes and epizoites. The opercular plate is usually double in *Romanchella* (*Bushiella*) *media* and it is presumably through more prolonged retention of such delaminations that the multiple operculum of *R.* (*R.*) *perrieri* is built up.

## Genus ***PILEOLARIA*** Claparède, 1868 (amended)

Sinistral coiling; only two pairs of thoracic tori; incubation in the operculum; each collar seta with a fin, separated from a blade which is usually coarsely serrated and cross-striated; sickle setae may or may not be present; thoracic uncini very slender, with one to three rows of teeth and a blunt anterior peg; abdominal setae obliquely geniculate (with tapering blades) and usually about half the size of the collar setae; abdominal uncini fairly symmetrical in bilateral distribution; the largest abdominal tori lie in the posterior half of the setigerous region; larvae have single, white, mid-dorsal attachment glands.

Type. *Pileolaria militaris* Claparède.

This is a large and rather diverse genus. Vine (1972a) advocates grouping *Pileolaria koehleri* (Caullery & Mesnil, 1897) and related forms with multiple opercular plates and a divided first abdominal torus, into a separate subgenus. Another convenient criterion for dividing the group is the presence or absence of sickle setae. Pillai (1970) indeed regards this as a criterion for separating genera. Most species of *Pileolaria* have sickle setae, including the type species *P. militaris* (Claparède, 1868) and the others mentioned above. A few lack them and for these a new subgenus ***Simplicaria*** is here proposed, with *Pileolaria* (*Simplicaria*) *pseudomilitaris* (Thiriot-Quiévreux, 1965) as the type. According to some authors, *P. moerchi* (Levinsen, 1883) and *P. berkleyana* (Rioja, 1942) also lack sickles, but other authors disagree and it will be necessary to study material from type localities to elucidate this problem. *P.* (*S.*) *pseudomilitaris* and *P. militaris* are both common off Australia and redescriptions from Australian material will be given in a separate paper (Knight-Jones, Knight-Jones & Llewellyn, 1973).

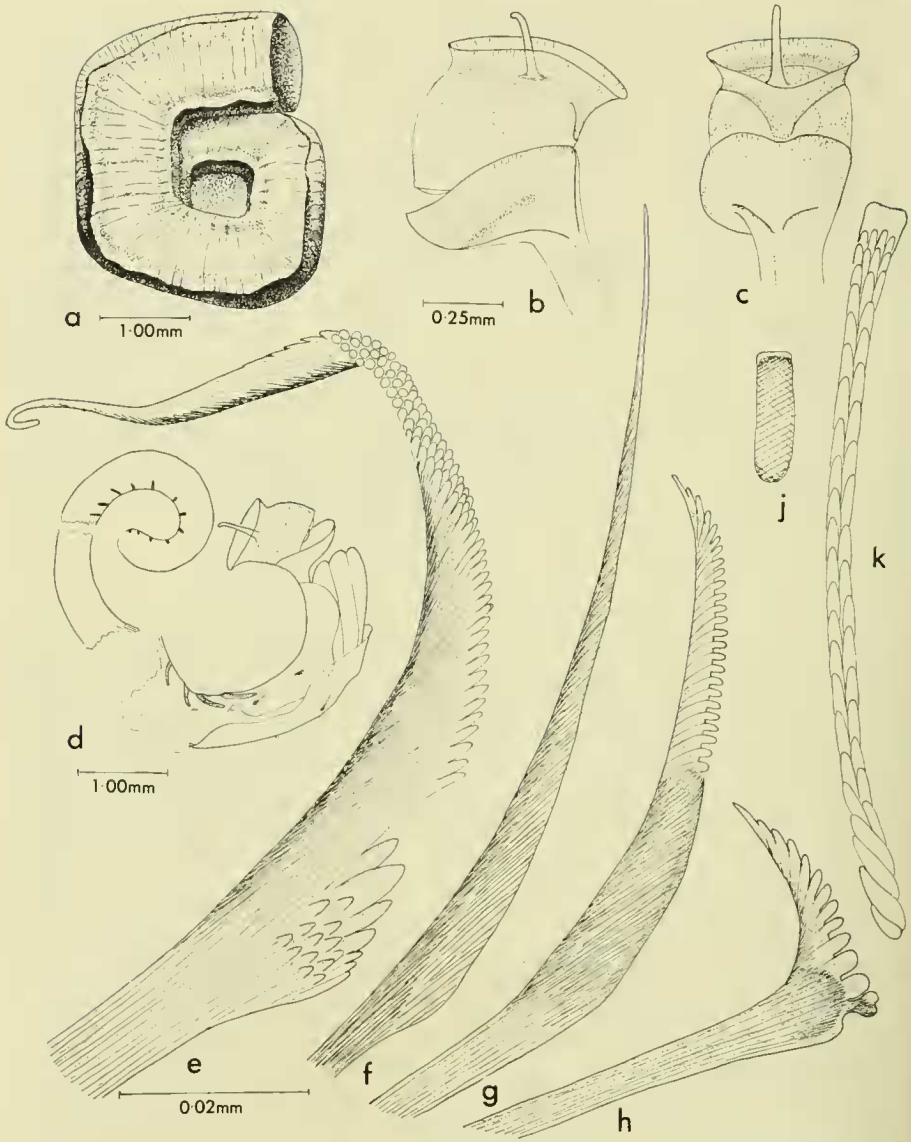



FIG. 5. *Amplaria spiculosa* sp. n. a) tube; b) operculum from side; c) operculum, dorsal view; d) whole animal, showing unfused dorsal collar margin; e) collar seta; f) seta of second or third fascicles; g) sickle seta, as in third fascicles; h) abdominal seta; j) abdominal uncinus (cross-hatching denotes teeth almost beyond resolution by light microscope); k) thoracic uncinus.
Scales: c) as b); f), g), h), j), and k) as e).

## Genus *AMPLARIA* gen. n.

Sinistral coiling; four thoracic tori and four fascicles of setae on the concave side, and three tori and five fascicles on the convex; incubation in the operculum; fin and blade collar setae without cross-striations; sickle setae present in the third and fourth fascicles; thoracic uncini slender and with a blunt anterior peg; abdominal setae geniculate, with a prominent indentation at the 'heel', less than a quarter the size of the collar setae (Fig. 6e) and with short tapering blades; abdominal uncini somewhat asymmetrical in bilateral distribution, with the largest tori about halfway along the setigerous region of the abdomen (Fig. 7e).

The name is derived from the latin *amplus*, referring to the large number of thoracic segments, with a termination to signify the apparent affinities with *Pileolaria* (see below).

TYPE. *Amplaria spiculosa* sp. n.

### *Amplaria spiculosa* sp. n. (Fig. 5)

*Tube* sinistral, thick-walled, with two blunt and widely spaced ridges making the cross-section somewhat square (Fig. 5a).

*Opercular plate* rather flat, but depressed dorsally to form a sharp 'V'. It bears peripherally a high transparent collar, the distal edge of which is yellow or horny in appearance. From the centre of the plate arises a strong, slender hooked spine which is also yellow (Fig. 5b, c). The walls of the incubatory chamber below the plate are lightly calcified, with faint longitudinal granulations. The base of the chamber is within a cup-like secondary opercular plate. A scarcely visible, flexible 'rod' extends from this plate into the opercular stalk.

*Thorax.* The collar is unfused dorsally and extensive distally, partially covering the tentacles (Fig. 5d). There are four rows of tori and four fascicles of setae on the concave side and three tori and five fascicles on the convex. The collar setae have fins and blades, which are not cross-striated (Fig. 5e). Capillary setae were not observed. The second fascicles contain slender simple setae, which are similar to setae in the third, fourth, and fifth fascicles. Sickle setae (Fig. 5g) are also present in the third, fourth and perhaps the fifth fascicles. Uncini slender, with two longitudinal rows of teeth along most of the length and with a blunt, somewhat gouge-shaped anterior peg (Fig. 5k).

*Abdomen.* A long asetigerous region followed by twelve pairs of tori. Uncini small and with about 10 longitudinal rows of teeth (Fig. 5j). The setae are distinctive in having a deep indentation and a bulbous 'spine' at the distal end of the shaft and a short tapering geniculate blade with large marginal teeth (Fig. 5h).

*Setation* somewhat asymmetrical (Figs 6e & 7e).

LOCATION. Kingscote on stones intertidally, associated with *Pileolaria* (*Simplicaria*) *pseudomilitaris* and *Janua* (*Janua*) *pagenstecheri*. Collected by L. C. Llewellyn January 1967.

HOLOTYPE. British Museum (Nat. Hist.) Reg. No. ZB 1971: 16 & 16a.

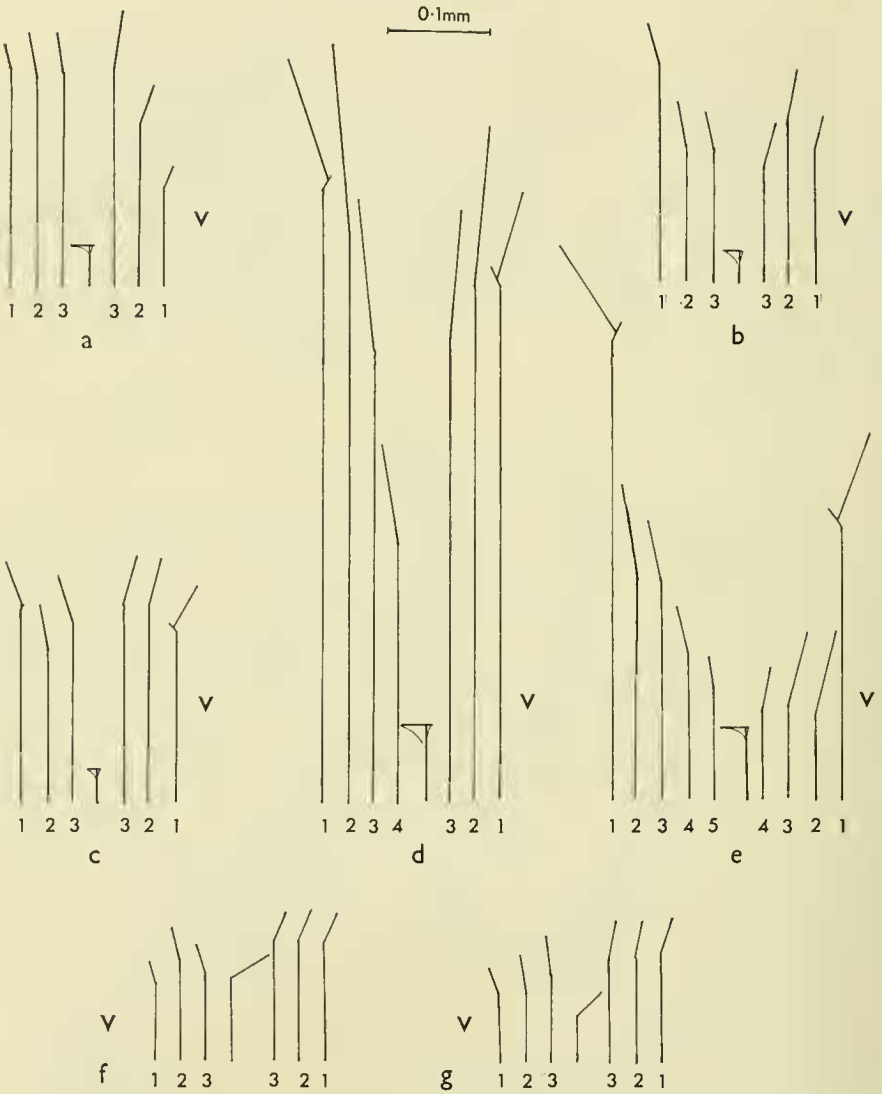



FIG. 6. Diagrams showing sizes of seta and their blades in a) *Romanchella* (*Romanchella*) *quadricostalis*; b) *Metalaeospira tenuis*; c) *Protolaeospira canina*; d) *Protolaeospira triflabellis*; e) *Amplaria spiculosa*; f) *Janua* (*Pillaiospira*) *trifurcata*; g) *Janua* (*Dexiospira*) *fenestrata*.

'V' denotes the concave side. 1, 2, 3 (4 and 5) mark the thoracic fascicles and the middle seta represents the largest abdominal seta. The length of the blade and the angle at which it comes off from the shaft is indicated for each seta. All are to the same scale.

Remarks. *Amplaria spiculosa* is almost unique among Spirorbinae in having a thorax with what some authors might call '$4\frac{1}{2}$ segments', the only other form sharing this character being a Red Sea species found recently by Dr Peter Vine (1972a). His species, however, differs from *A. spiculosa* in having dextral coiling, small thoracic uncini with multi-pronged anterior pegs, no sickle setae and simple collar setae, the blades of which are not much larger than those of the abdominal setae. Such characters suggest some affinities with *Janua* (see below), whereas *Amplaria* would appear to have affinities with *Pileolaria*, to judge from its large fin-and-blade collar setae, narrow elongated thoracic uncini and the posterior position of the largest abdominal tori (Fig. 7e). It differs from *Pileolaria* in having rudiments of two extra thoracic 'segments', a more asymmetrical distribution of abdominal uncini, a different type of abdominal setae and an operculum quite different in structure, though somewhat reminiscent of the *Pileolaria koehleri* 'group'.

Although only one specimen was found, it was felt that this species could not be an abnormal mutant of any *Pileolaria* and thus the erection of a new genus was inevitable. Moreover Dr Peter Vine has since found the same species off the Poor Knights Island, not far from Auckland, New Zealand.

## Genus ***JANUA*** Saint-Joseph, 1894 (amended)

Mostly with dextral coiling; only two pairs of thoracic tori; incubation in an opercular brood chamber, below which a secondary plate (rudiment of next opercular plate) is formed soon after spawning; collar setae without toothed fin; abdominal setae with elongated blades as big as or bigger than those of the collar setae (Fig. 6f & g) and often accompanied by secondary setae, with rudimentary shafts (Vine, 1972a—see also Fig. 9q); thoracic uncini with anterior pegs narrow and more or less pointed in surface view; largest abdominal tori lie in the anterior half of the setigerous region (Fig. 7f & g); larvae have paired white attachment glands in the thoracic region.

### Subgenus ***JANUA*** Saint-Joseph, 1894

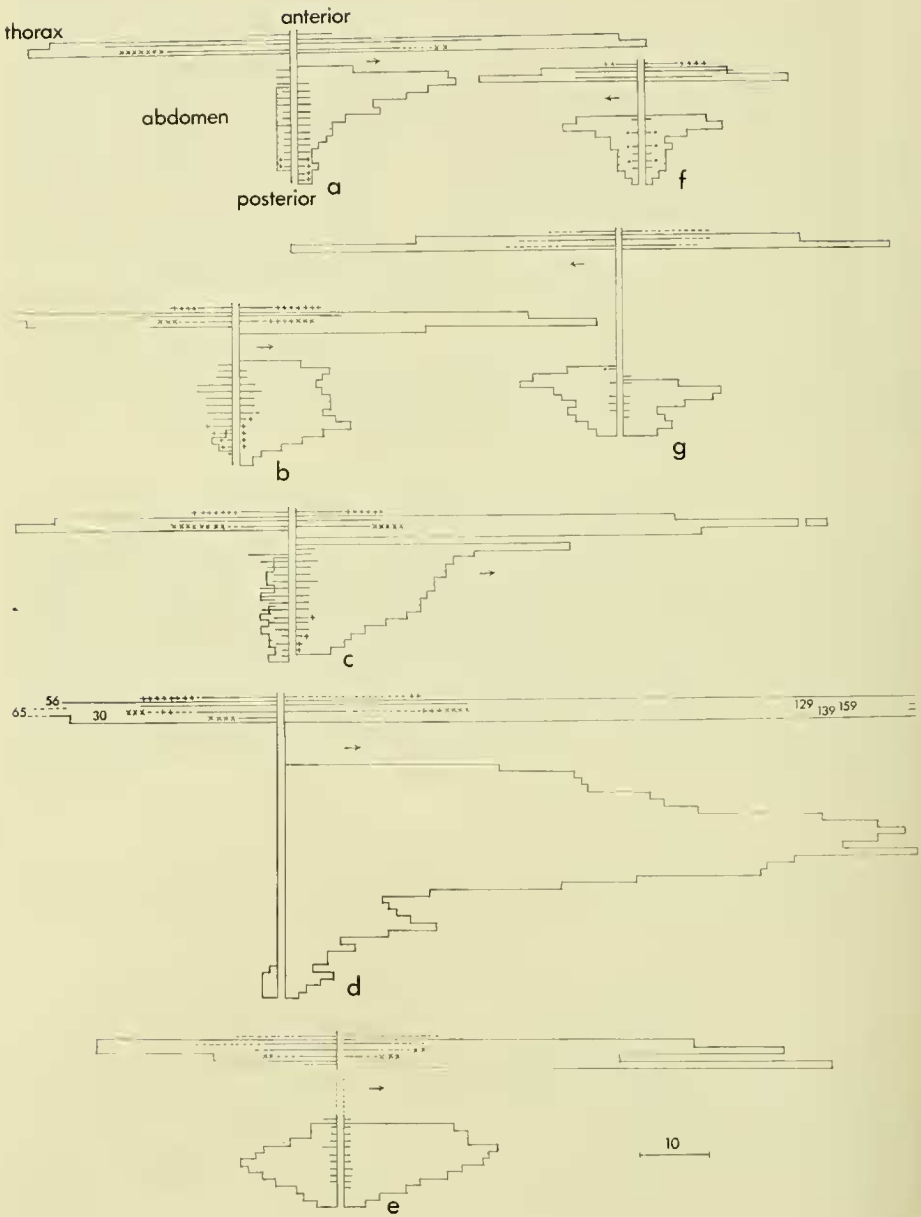
Dextral coiling; sickle setae present in the third thoracic fascicles; thoracic collar not fused dorsally.

Type. *Spirorbis pagenstecheri* Quatrefages, 1865.

### Subgenus ***DEXIOSPIRA*** Caullery and Mesnil, 1897 (amended) (syn. *Neodexiospira* Pillai, 1970, see p. 253)

Coiling usually dextral; sickle setae absent; collar margins fused to form a tunnel over the mid-dorsal thoracic groove.

Type. *Spirorbis pseudocorrugatus* Bush, 1904 (=*Spirorbis corrugatus*: Caullery and Mesnil, 1897, *non* Montagu, 1803—see p. 256).


thorax
anterior
abdomen
posterior
a
f
b
g
c
65
56
30
129
139
159
d
e
10

### *Janua (Dexiospira) fenestrata* sp. n. (Fig. 8)

*Tube* may coil in one plane or the last whorl may ascend. Three very prominent equidistant longitudinal ridges, the outer of which projects as far as or beyond the area of attachment to the substratum. Between the ridges are deep transverse furrows, which in many specimens extend to form holes (tunnels) through the two outer ridges, giving a 'lacy' appearance from above (Fig. 8a, b & c).

*Opercular plate* with a central calcified disc surrounded by an upturned, brown rather membranous rim. A peg-like talon bilobed terminally, extends proximally from the dorsal edge of the plate (Fig. 8d & e). Mature opercula lose their talons and develop lightly calcified walls through which the embryos can be seen. A secondary plate develops below the embryos (Fig. 8f).

*Thorax.* Collar setae on the convex side have simple blades with coarsely serrated margins and indistinct, widely spaced cross-striations (Fig. 8g). Collar setae on the concave side (Fig. 8h) are like those of the second and third fascicles (Fig. 8j) with almost smooth margins. Capillary setae are also present in the first fascicle. Uncini have about five longitudinal rows of teeth, and a pointed anterior peg (Fig. 8l).

*Abdomen.* Asetigerous region is remarkably long (Fig. 7g) and followed by about ten pairs of tori. Setae have elongated, obliquely geniculate blades with recurved teeth (Fig. 8k). Secondary setae are occasionally present. Uncini have numerous (possibly ten) rows of minute teeth and a broad flared anterior peg (Fig. 8m).

*Incubation.* About six to eight embryos in the opercular chamber.

*Setal distribution* (Figs 6g & 7g) fairly symmetrical.

Location. Cape du Couedic. Collected by L. C. Llewellyn January 1967. Fourteen specimens mainly on rock and stones in the midlittoral zone. One also found on a holdfast of *Ecklonia radiata.*

Holotype. British Museum (Nat. Hist.) Reg. No. ZB 1971: 17 & 17a.

Paratypes. British Museum (Nat. Hist.) Reg. No. ZB 1971: 18. Australian Museum Reg. No. W4477.

Fig. 7. Distribution of setae in: a. *Romanchella quadricostalis*; b. *Metalaeospira tenuis*; c. *Protolaeospira canina*; d. *Protolaeospira triflabellis*; e. *Amplaria spiculosa*; f. *Janua (Pillaiospira) trifurcata*; g. *Janua (Dexiospira) fenestrata.* Each diagram represents a worm straightened out and viewed from the ventral side (so that the concave side, indicated by an arrow, appears to the observer's right if the species is sinistral). The histograms represent the number of uncini per segment and the continuous lines (———) within the histograms the number of simple setae or collar setae. Each plus sign (+) represents a capillary seta in the thorax or a hooked capillary seta in the abdomen. A cross (X) represents a sickle seta and a dot( . ) a secondary abdominal seta. Indeterminate setae are represented by short dashes (– – –). The length of the asetigerous region relative to the length of the nearest abdominal segment is represented by the gap between the histograms for thoracic and abdominal segments. In c) the anterior abdominal segment is unusually long, thus the asetigerous region appears relatively short. Each diagram relates to a single typical individual except for d), which is a composite diagram from two individuals, neither of which alone was suitable for determining the distribution of abdominal setae.

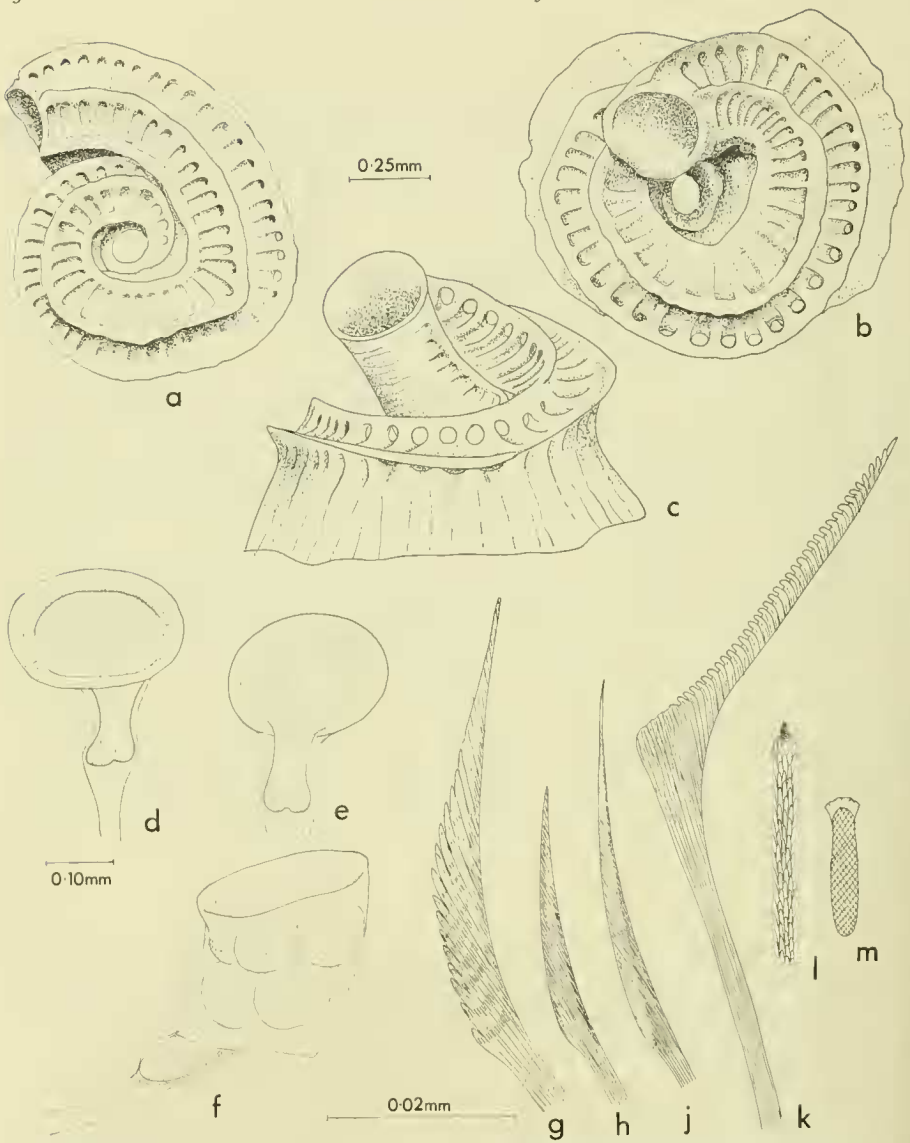



FIG. 8. *Janua* (*Dexiospira*) *fenestrata* sp. n. a) tube with only three perforations; b) tube with numerous perforations; c) side view of b); d) juvenile operculum, dorsal view; e) same operculum viewed ventrally and from below; f) mature operculum with embryos and secondary plate; g) collar seta from convex side of animal; h) collar seta from concave side, which is like the setae from the second fascicles; j) seta from third fascicles; k) abdominal seta; l) thoracic uncinus; m) abdominal uncinus (cross-hatching denotes teeth almost beyond resolution by light microscope).

Scales: b) and c) as a); e) and f) as d); h), j), k), l) and m) as g).

Remarks. The perforations of the tube recall the name *Spirorbis foraminosus* Moore & Bush, 1904, type material of which was kindly loaned by the Smithsonian Institution. Examination of a tube remnant showed that this species probably lacks prominent ridges (and associated perforations) and has a brood chamber and setae quite different from those of *J.* (*D.*) *fenestrata* (see p. 256).

Ridge perforations occur in *Spirorbis alveolatus* Zachs, 1933, but to judge from the original description the tube of that species is semi-transparent and incubation probably takes place within it. The name *alveolatus* has more recently been given to *Janua* (*Dexiospira*) *nipponica* (Okuda, 1934) by Imajima and Hartman (1964), but in fact Zach's description, although scarcely adequate, appears to belong to a species quite different from the Japanese form (see p. 256), which is itself quite different from *J.* (*D.*) *fenestrata.*

Bush (1904) inadequately described an empty tube from Port Phillip Australia, which may possibly have resembled that of *J.* (*D.*) *fenestrata*, although there is no mention of intercostal furrows (or perforations). She gave to it the name of *Spirorbis tridentatus*, however, which is a junior homonym for a common European species of *Spirorbis sensu stricto.*

The lectotype of *J.* (*D.*) *ceylonica* (Pillai, 1960), kindly made available by the British Museum (Natural History), differs from that of *J.* (*D.*) *fenestrata* in having unequally spaced low ridges and vestigial intercostal depressions which are not perforate. No other material was available and there has been no description of a juvenile form of operculum nor of setal distribution in this species. Further studies of *J.* (*D.*) *ceylonica* are necessary to establish whether it is a senior synonym for the present form.

The only adequately described forms to which *J.* (*D.*) *fenestrata* may be closely related are two new species from the Red Sea and Hawaii collected and studied by Peter Vine (1972a and 1972b). These resemble *J.* (*D.*) *fenestrata* in having simple talons, a brood chamber with lightly calcified walls, similar setae and a remarkably long asetigerous region. They differ in that the talons are spear-like, not bilobed, the rims of the opercular plates are narrow and more laterally placed and the tubes less deeply sculptured, without perforations. Both species have collars fused dorsally. It is uncertain whether those of *J.* (*D.*) *fenestrata* are fused, because the specimens had become very hardened. It seems likely that the material had been allowed to dry out, for the displacement of the secondary plate (Fig. 6f) seems likely to have resulted from dehydration. Because of this uncertainty, inclusion in this subgenus (rather than in the one that follows) is tentative and suggested only because of the close resemblance to the two species of *Dexiospira* mentioned above, coupled with the fact that this group contains most of the world's dextral opercular incubators, including most of such forms from Australia.

## Subgenus ***PILLAIOSPIRA*** subgen. n.

Lacking sickle setae and collar folds not fused dorsally.

Pillai (1970) separated *Neodexiospira* from *Dexiospira* since he was led to believe, from examination of material misidentified by Fauvel (1914) that the type species

of *Dexiospira* has unfused collar folds. In this he was mistaken (see Knight-Jones, 1972), but discovery of the species below has confirmed that there is at least one species which is closely related to *Dexiospira*, but nevertheless has collar folds unfused. It is proposed to institute a new subgenus for this named after Dr G. Pillai, who first proposed a taxonomic division on this basis.

TYPE. *Janua trifurcata* sp. n.

### *Janua (Pillaiospira) trifurcata* sp. n. (Fig. 9)

*Tube* dextral, round in cross section and bearing three longitudinal ridges, with 'chevron' sculpturing between (Fig. 9a & b). Most of the tubes were somewhat decalcified, so it is not certain whether this distinctive intercostal pattern is present in fresh material.

*Opercular plate* in juvenile specimens is convex, with the dorsal edge asymmetrically folded to form a latero-dorsal peak (always towards the right) and a deep 'U' shaped peripheral depression dorsally, with which a flattened peg talon is associated (Fig. 9c & d). The first incubatory chamber is formed by the development of finely granular calcified walls from the periphery of the plate (Fig. 9e & f). A secondary plate develops below the embryos and forms the distal part of the next brood chamber. This second stage chamber has an undulating thick rim surrounding a flat distal plate and no talon (Fig. 9g & h). There is no marked bilateral asymmetry as in the earlier forms. The wall of an empty chamber in reflected light shows rather widely spaced longitudinal markings (Fig. 9h). When damaged the chamber tends to break in the position of these lineations (Fig. 9j).

*Thorax* with the dorsal margins of the collar unfused. Collar setae on the convex side have simple, finely serrate blades (Fig. 9k). Those on the concave side (Fig. 9l) resemble those of the second and third fascicles (Fig. 9m) in being simple with almost smooth margins. Capillary setae are also present in the first fascicles. Two pairs of tori. Uncini with four longitudinal rows of teeth and a strongly trifurcate anterior peg (Fig. 9o).

*Abdomen* with about ten pairs of tori and uncini with about ten longitudinal rows of teeth, some of which obscure the anterior peg (Fig. 9p). Setae large and obliquely geniculate (Fig. 9n). Secondary setae (Fig. 9q) occasionally present.

*Setation* (Figs 6f & 7f) as in most *Janua*.

*Incubation* about six to eight embryos in the opercular chamber.

LOCATIONS. Twenty-nine specimens from Brighton (including types) and nine from Sou' West River on a small red alga, *Hypnea* (possibly *muciformis*) presumed to have been cast ashore from the sublittoral zone. Collected by L. C. Llewellyn January 1967.

HOLOTYPE. British Museum (Nat. Hist.) Reg. No. ZB 1971: 19 & 19a.

PARATYPES. British Museum (Nat. Hist.) Reg. No. ZB 1971: 20. Australian Museum Reg. No. W4478.

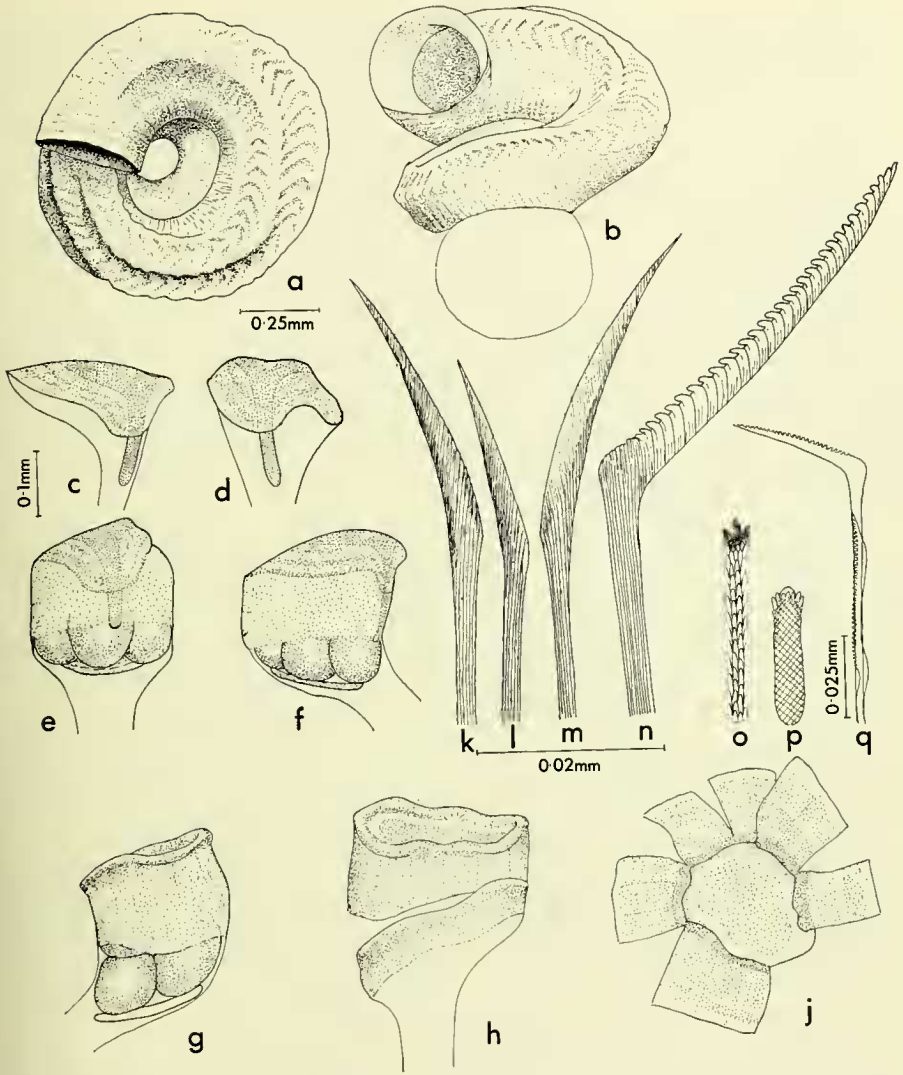



FIG. 9. *Janua* (*Pillaiospira*) *trifurcata* sp. n. a) tube viewed from above; b) tube, side view (attached to an algal filament seen in cross-section); c) juvenile operculum, side view; d) as c, but viewed dorsally; e) first stage mature operculum with embryos dorsal view; f) as e, but side view; g) second stage mature operculum with embryos; h) second stage mature operculum showing dehiscence (presumably after release of embryos) and the developing brood chamber below; j) a smashed brood chamber, showing tendency to break into sections resembling staves of a barrel; k) collar seta from convex side; l) collar seta from concave side; m) seta representative of second and third fascicles; n) abdominal seta; o) thoracic uncinus; p) abdominal uncinus (cross-hatching denotes teeth so small as to be almost beyond resolution by light microscope); q) secondary seta lying alongside shaft of an abdominal seta.

Scales: b) as a); d), e), f), g), h) and j) as c); l), m), n), o) and p) as k).

Remarks. This species is very unusual amongst its close relatives, in having a marked difference between the shape of the distal plate in the first and second stage brood chambers, and somewhat unusual in having well defined three-pronged anterior pegs to the thoracic uncini. The only other forms described as having such anterior pegs are *Janua nipponica* (Okuda, 1934) and those from South Africa reported by Day (1961) as *Spirorbis foraminosus*. Japanese material thought to be the former species, but labelled *Spirorbis alveolatus* (see. p. 253) was kindly supplied by Dr M. Imajima of the National Science Museum, Tokyo. The material agreed well with Okuda's description but also contained young forms (not previously described) with a rather flat distal plate and a broad, faintly bifid talon reminiscent of that in *J.* (*D.*) *pseudocorrugata* (Bush) and thus unlike that of *J.* (*P.*) *trifurcata*. The first stage incubatory chamber resembles that of most *Janua* (but not that of *J.* (*P.*) *trifurcata*) in being bilaterally symmetrical and flat distally, with a distinct fine rim. Later incubatory chambers (with no talon) differ from *J.* (*P.*) *trifurcata* only in that the rim is thinner and without undulations, whilst the calcified walls have very closely spaced lineations. The only other notable difference is that the collar folds in *Janua nipponica* were found to be fused. The setae and uncini of both species are very similar.

Professor Day kindly made available a specimen labelled *Spirorbis foraminosus* from Inhaca Island, Mozambique. Its operculum was similar to the juvenile operculum of *J.* (*D.*) *nipponica* and its other characters described by Day (he mentioned that the collar is continuous dorsally) agree well with *J.* (*D.*) *nipponica*.

The type material from Japanese waters of *Spirorbis foraminosus* Moore & Bush (see p. 253) proved to have uncini with a single anterior peg; faintly cross-striated collar setae; abdominal setae having rather broad (though elongated) blades with very fine recurved teeth and a remarkably slender opercular brood chamber with an unusually large flared rim, to which the elongated tentacles reach. It is thus a *Janua*, but very different from *J.* (*P.*) *trifurcata*. The talon figured by Bush could not be seen owing to decalcification in preservative.

The unusual and characteristic pattern of fracture seen in broken opercula of *J.* (*P.*) *trifurcata* (Fig. 9j) recalls the description by Langerhans (1880) of a dextral species from Madeira, with simple cylindrical brood chambers, the walls of which were easily smashed into pieces, like the staves of a barrel. He regarded it as possibly related to *Spirorbis corrugatus* (Montagu, 1803). Caullery and Mesnil (1897) also misapplied this name to a dextral species from France, which they thought agreed well with the description of Langerhans, but Bush (1904) pointed out that Montagu's name referred to a sinistral species. In fact Montagu's species was inadequately described, but the grouping of species in his account clearly shows that Bush was right, in spite of what Fauvel (1914) has written to the contrary. Caullery and Mesnil's dextral species, which should now be called *Janua* (*Dexiospira*) *pseudocorrugata* (Bush), was collected abundantly from France, Portugal and the Mediterranean and found to have collar folds fused dorsally (Knight-Jones, 1972). It has lightly calcified brood-chamber walls, bearing closely spaced granular lineations, which are indeed arranged longitudinally (as are the staves of a barrel) but do not form lines of fracture. These brood chambers in fact shatter irregularly.

The virtually unnamed description from Madeira does not agree with this but could agree with *J.* (*P.*) *trifurcata*. Langerhans noticed that the collar had an entire margin, slit open dorsally, as in the subgenus *Pillaiospira* here defined.

## SUMMARY

The collections, mostly from near Adelaide, included eight previously known species (one *Eulaeospira*, two *Pileolaria* and five *Janua*) and seven new species. The latter represent four existing genera, all of which are redefined. Four new subgenera are also described.

(1) *Metalaeospira tenuis* **sp. n.** is close to the type of the genus, but has a smooth operculum.

(2) *Protolaeospira* (including *Marsipospira* and *Pixellia*) is elevated to generic rank. The incubatory stalk characteristic of *Protolaeospira* is found too in the dextral form *P. falklandica* (which is made the type of *P.* (*Dextralia*) **subgen. n.**) and in *Helicosiphon*.

(3) *Protolaeospira* (*P.*) *triflabellis* **sp. n.** has $3\frac{3}{4}$ thoracic setigers and a tube with transverse ridges. *Protolaeospira* (*P.*) *canina* **sp. n.** is close to *P. lebruni* (=*auricularis*).

(4) *Romanchella* (*R.*) *quadricostalis* **sp. n.** also has an incubatory stalk, similarly located but shorter and funnel-like.

In *R.* (*Romanchella*) the collar folds are fused dorsally and *R.* (*Bushiella*) **subgen. n.** is proposed for northern *Romanchella* spp. which have unfused collars and a more symmetrical distribution of uncini.

*Pileolaria* (*Simplicaria*) **subgen. n.** lacks sickle setae.

(5) *Amplaria spiculosa* **gen. et sp. n.** has $4\frac{1}{2}$ thoracic setigers, but affinities with *Pileolaria*.

(6) *Janua* (*Dexiospira*) *fenestrata* **sp. n.** has a tube with perforated ridges.

(7) *Janua* (*Pillaiospira*) *trifurcata* **subgen. et sp. n.** (subgenus type by monotypy). The subgenus contains forms close to *J.* (*Dexiospira*) but with unfused collar folds.

Species (1) and (4) above were particularly numerous and found only on algae. All these southern hemisphere tube-incubators differ from the opercular incubators (and from *Spirorbis*) in having the abdominal uncini distributed asymmetrically.

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