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Pages 243-248 Figs. 1–18

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Two Spirorbid Tubeworms (Serpulidae, Polychaeta) from Eastern Australia

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(Figs. 1-18) Manuscript received 20. 2. 62

INTRODUCTION

This paper describes the systematic features of two species of *Spirorbis* the larvae of which have been used in experimental anti-fouling investigations at the C.S.I.R.O. Marine Laboratory. Dew's (1959) revision of the Australian Serpulidae did not include the genus *Spirorbis*, but she noted that it was well represented and listed the references to the five species previously described from the area.

MATERIAL AND METHODS

All material was collected from the *Posidonia* sp. beds which extend from the C.S.I.R.O. Marine Laboratory's jetty across the entrance to Gunnamatta Bay in Port Hacking, Sydney. Since the *Posidonia* sp. was not observed in flower, its specific identity could not be established.

Dissections of the tubeworms were made on fresh material immersed in the polyvinyl lactophenol mountant recommended for polychaete setae preparations by Knox (1951).

SYSTEMATICS

Genus **Spirorbis** Daudin 1800

Body asymmetrical, less than five thoracic segments; operculum usually with a terminal calcareous plate; tube calcareous, coiled in either a sinistral or dextral spiral; incubation of the eggs either in the tube or the operculum.

Spirorbis convexis, sp. nov.

Tube.—In solitary individuals the tube forms a flat, sinistral spiral (fig. 1), but in crowded populations the tube whorls may twist irregularly or coil on one another to form a tall spiral. The upper surface of the tube is white and shiny, and does not bear longitudinal ridges; its surface is smooth except for slight transverse growth striae. The diameter of 25 specimens each containing well developed larvae averaged 1·35 mm. (range 0·81—1·88 mm.).

Setation.—The setae of the dorsal and ventral bundles of the first thoracic segment are similar. Each of these bundles contains five main setae with well-developed blades, notches and fins (fig. 2.). The blade of each seta has fine serrations and there are 3-4 coarse teeth on the fin. The outline of the seta opposite the notch is unusual in that it is distinctly convex; it is to this feature that the proposed specific name refers. Each bundle has three fine capillary setae. The dorsal and ventral bundles of the second segment each have 7-8 setae bearing simple blades (fig. 3) which vary a little in size and amount of curvature. A few capillary setae are present. The bundles of the third segment are similar to those of the second, but the shape of the setae is slightly different (cf. figs. 3, 4).

Branchiae, operculum and incubation.—The six non-pigmented branchiae each bear 14-20 filaments; the terminal filaments are blunt (fig. 5). The operculum, which is transparent, arises from the right side of the animal and consists of a smooth, approximately cylindrical pedicel terminating in a flattish, rounded plate. The distal face of the plate may be convex, concave or

flat (figs. 6, 7), and it has a central calcified area. The eggs, which are reddish-brown and retain this colour throughout development, are incubated within the tube. When there are less than eight eggs, they are arranged linearly, but when larger numbers are present the eggs are arranged in a double row along most of the length of the egg mass (fig. 8).

Breeding season.—During 1960 and 1961 very large numbers of larvae were obtained from adults collected during October, November and December in Gunnamatta Bay.

Larvae.—The average number of larvae present in the 25 specimens referred to earlier was 15 and the range 4-28. There are four features of possible systematic value: (1) a reddish-brown coloration, deeper in the central areas of the thoracic and abdominal segments, and across the prototroch (fig. 9); (2) a lack of frontal eyespots; (3) a characteristic angle of 30-45° between the caudal setae; (4) an apparent lack of " attachment " or " shell " glands. Hoglund (1951) noted that in *S. spirillum* (Fabricus, 1780) " shell " glands were also absent. The length of *S. convexis* larvae varies between 310 and 330 μ. When they are fully developed they swim out of the adult tube at intervals of 10-15 seconds and are photopositive; their larval reactions have not been investigated in detail, but exploratory behaviour reminiscent of that recorded for *S. borealis* Daudin (Wisely, 1960) has been observed on several occasions.

Metamorphosis.—The appearance of a young adult 24 hours after attachment at *c.* 20°C. is shown in figure 10. At this stage rudimentary branchiae and an operculum have differentiated; despite the apparent absence of " attachment " or " shell " glands, the animal is firmly attached to the substratum. In contrast to the other species described here (*S. lamellosa* Lamarck 1818) the proximal part of the transparent primary attachment tube is straight, cylindrical and smooth-walled; the more distal curved part has a corrugated outline.

Types.—Holotype W.3749 and paratypes W.3750 in the Australian Museum, Sydney. Paratypes in the British Museum (Nat. Hist.).

Type locality.—Gunnamatta Bay in Port Hacking, Sydney, N.S.W. 34°04·5′S., 151°09′E. Abundant on *Posidonia* sp. leaves.

Discussion.—The tube of *S. convexis* differs markedly from those of the other three sinistral species described previously from the Australian area. It does not possess the median rib described by Lamark (1818) and figured by Chenu (1843, plate 1, fig. 3) for *S. incisus* Mörch 1863; nor the three rounded ribs described by Lamarck (1818) and figured by Chenu (1843, plate 1, fig. 4*a*). The terminal portion of the tube does not turn downwards, like a spout, as it does in *S. inversus* Bush 1904.

Spirorbis lamellosa Lamarck 1818

Tube.—The tube (fig. 11) forms a dextral spiral with the aperture in mature specimens often slightly elevated and funnel-shaped. There are usually three rounded ridges running longitudinally along the upper surface of the tube, and sometimes a faint fourth ridge is discernible on the convex side of the tube. The upper surface of the tube is dull, bears prominent curved growth striae, and is yellowish-brown with small white, brown and purple markings. The prominence of the ridges and the colour of the tube are variable, but the curved growth striae are consistently prominent. The aperture has two main indentations in its margin adjacent to the central ridge. The diameter of 25 specimens each containing well-developed larvae averaged 1·65 mm. (range 1·31-1·88 mm.).

Setation.—The dorsal and ventral bundles of each thoracic segment vary more than in the previous species. The dorsal bundle of the first thoracic segment consists of five long setae with coarsely serrated blades, evenly rounded at their bases, and lacking fin-like expansions or notches (fig. 12). The blade size increases progressively from the most anterior to the most posterior in the series. A few fine tapering capillary setae are present. The seven setae of the second thoracic dorsal bundle are not serrated, but are slightly flattened and expanded into simple blades near their distal ends (fig. 13). The third thoracic dorsal bundle is similar. The ventral bundles are smaller and closer together. The four setae of the first bundle are shorter than the remainder and possess simple blades similar to those of the second dorsal bundle. One of the setae is curved. The second bundle is similar but two of the setae are curved. All seven setae of the third bundle are curved.

Branchiae, operculum and incubation.—Each of the seven branchiae bears 16-20 filaments. The terminal filament is attenuated into a fine process. In large specimens this attenuation is longer than any of the other filaments. Red markings are sometimes present on the branchial bases. The developing operculum (fig. 14) is transparent and consists of a short pedicel, chamber and a circular concave plate. Within the chamber, and proximally to the plate, there is an opaque white rod with two lateral arms; from the base of this rod an opaque white ring runs parallel to the periphery of the plate (fig. 15). On the convex side of the chamber there is an opening bordered

distally by a concave border, and laterally by a pair of thin flaps. In mature specimens in which the operculum becomes larger and functions as an incubation chamber (fig. 16), this opening persists as a transverse slit which probably allows sea-water circulation around the developing larvae. When the eggs first appear in this incubation chamber they are green, but later they become brownish. When the larvae are near liberation their conspicuous red eyespots and white thoracic "shell" glands give the operculum a distinctive mottled appearance. During the later stages of incubation the transverse plate which delimites the distal incubation chamber from the proximal cup becomes white. The larvae escape through the slit in the incubation chamber and the latter is then shed and a new incubation chamber differentiated from the basal cup. Occasional specimens are found in which two incubation chambers containing larvae are present; evidently in such cases the second incubation chamber becomes functional before the primary has been shed.

Breeding season.—Similar to *S. convexis.*

Larvae.—The average number of larvae present in the 25 specimens referrred to earlier was 19 and the range 13-31. The larvae are between 340 and 360μ. in length, transparent, and photopositive at liberation. The general anatomical features are shown in fig. 17. Possible systematic features are : (1) two prominent white " shell " glands on the thorax; (2) a dark green coloration centrally in the thoracic and abdominal segments; (3) the almost parallel caudal setae.

Metamorphosis.—When it attaches, the larva adopts a curved position resulting in a markedly curved primary attachment tube (fig. 18). The proximal end of this is frequently ruptured and the walls are smooth. The thoracic " shell " glands do not seem to contribute to the formation of the primary attachment tube. They appear to be unchanged during its formation, but gradually disappear as the secondary calcareous tube is formed. Metamorphosis of this species appeared to be more rapid than that of *S. convexis*; the branchiae, after 24 hours at *c.* 20°C., were further developed (cf. figs. 10, 18).

Specimens examined include W.3751 in the Australian Museum, Sydney, and a batch in the British Museum (Nat. Hist.).

Type locality.—Lamarck (1818) gave this as Australia. The present material was taken from Gunnamatta Bay in Port Hacking, Sydney, where it occurs abundantly on *Posidonia* sp. leaves.

Discussion.—It has been difficult to evaluate the status of this species. According to Bush (1904) *S. tridentatus*, the other dextral species, described from Port Phillip, Australia, differs " from all known forms in having the lower surface of the whorls distinctly smaller than the upper surface, the sides inclined outwards forming a carinated shoulder. " The whorls of the present material are vertical to the substratum. The material seems to fit Lamarck's (1818) description of *S. lamellosa*, i.e. " tube pourvu de trois côtes longitudinales, lamelleuses denticulées striées dans les intervalles, et s'enroulant en un disque subombilique. " Also, fig. 11 of the present paper is almost indentical with Chenu's (1843) plate 1, fig. 4 of the tube of *S. lamellosa* and was prepared before Chenu's figure was seen. Presumably Lamarck, in calling the species *lamellosa*, considered the lamellate appearance of the growth striae to be the most characteristic tube feature. Since this is also true for the present material, it is not proposed at this stage to differentiate the two.

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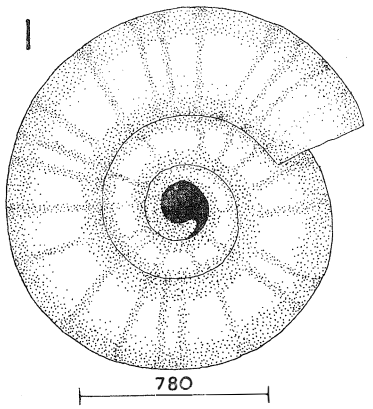
EXPLANATION OF FIGURES

Figs. 1-10.—*Spirorbis convexis*: (1) tube, (2) dorsal seta from first thoracic segment, (3) dorsal seta from second thoracic segment, (4) dorsal seta from third thoracic segment, (5) tip of branchia showing blunt terminal filament, (6-7) side and plan views of operculum with calcified area stippled, (8) egg mass *c.* 1·0 mm. length, (9) larva, (10) young adult 24 hours after attachment. At = apical tuft, b = branchia, c_2–c_3 = setae, *cs* = caudal setae, e = eyespot, f = fin, n = notch, o = operculum, p = prototroch, pt = primary attachment tube, u = uncini. Camera lucida, scale in mμ.

Figs. 11-18.—*Spirorbis lamellosa* Lamarck 1818: (11) tube, (12) dorsal seta from first thoracic segment, (13) dorsal seta from second thoracic segment, (14-15) side and plan views of developing operculum with calcified areas stippled, (16) mature operculum containing eggs, (17) larva, (18) young adult 24 hours after attachment. C = cup, s = slit, sg = thoracic "shell" gland; other abbrevations as in Figs. 1-10. Camera lucida, scale in mμ.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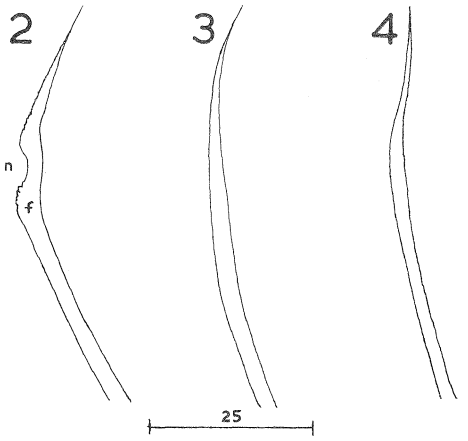
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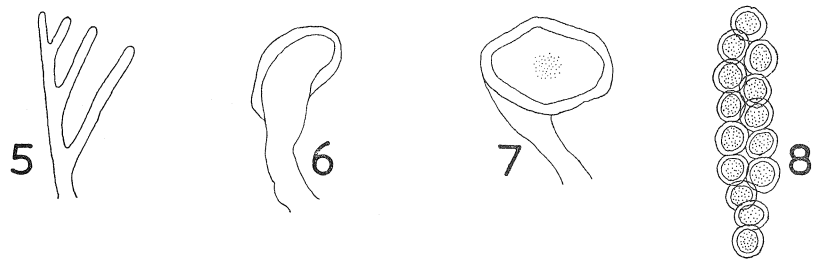
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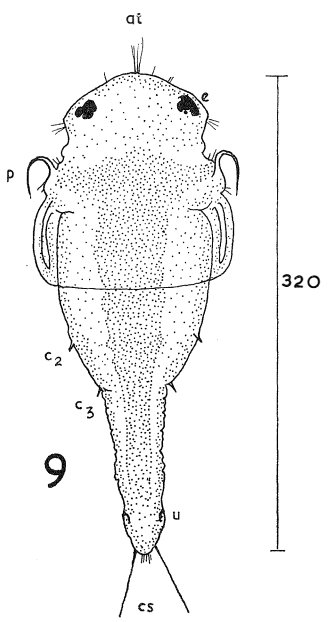
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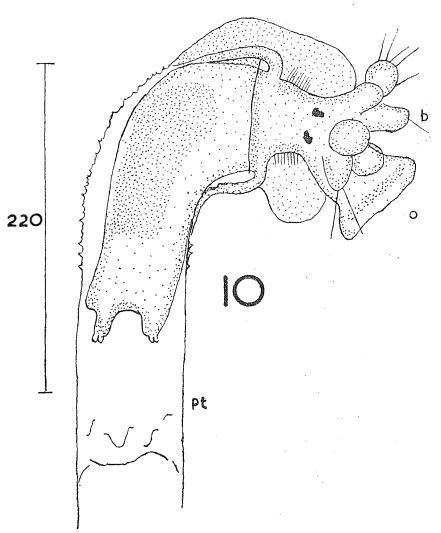
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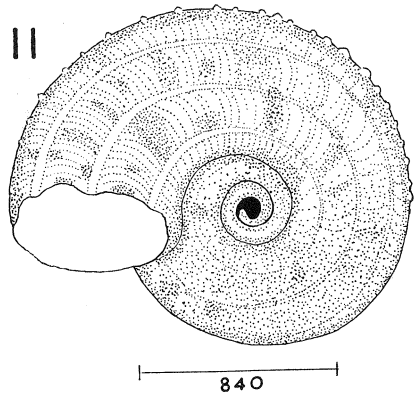

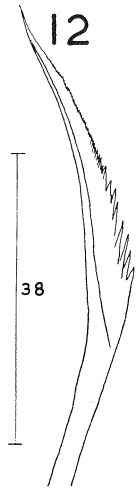

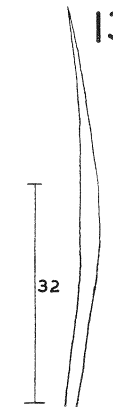

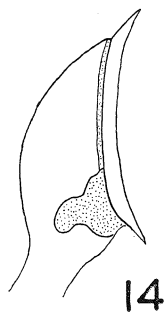

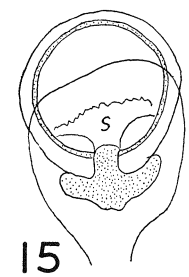

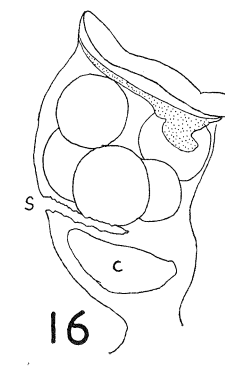

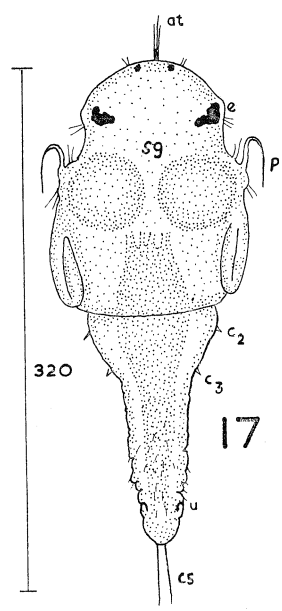

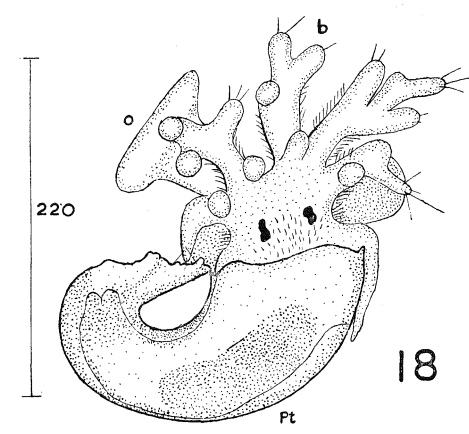

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