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*Serpulidae (Polychaeta) from Australia*

By

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Pages 19-56

Figs. 1-21

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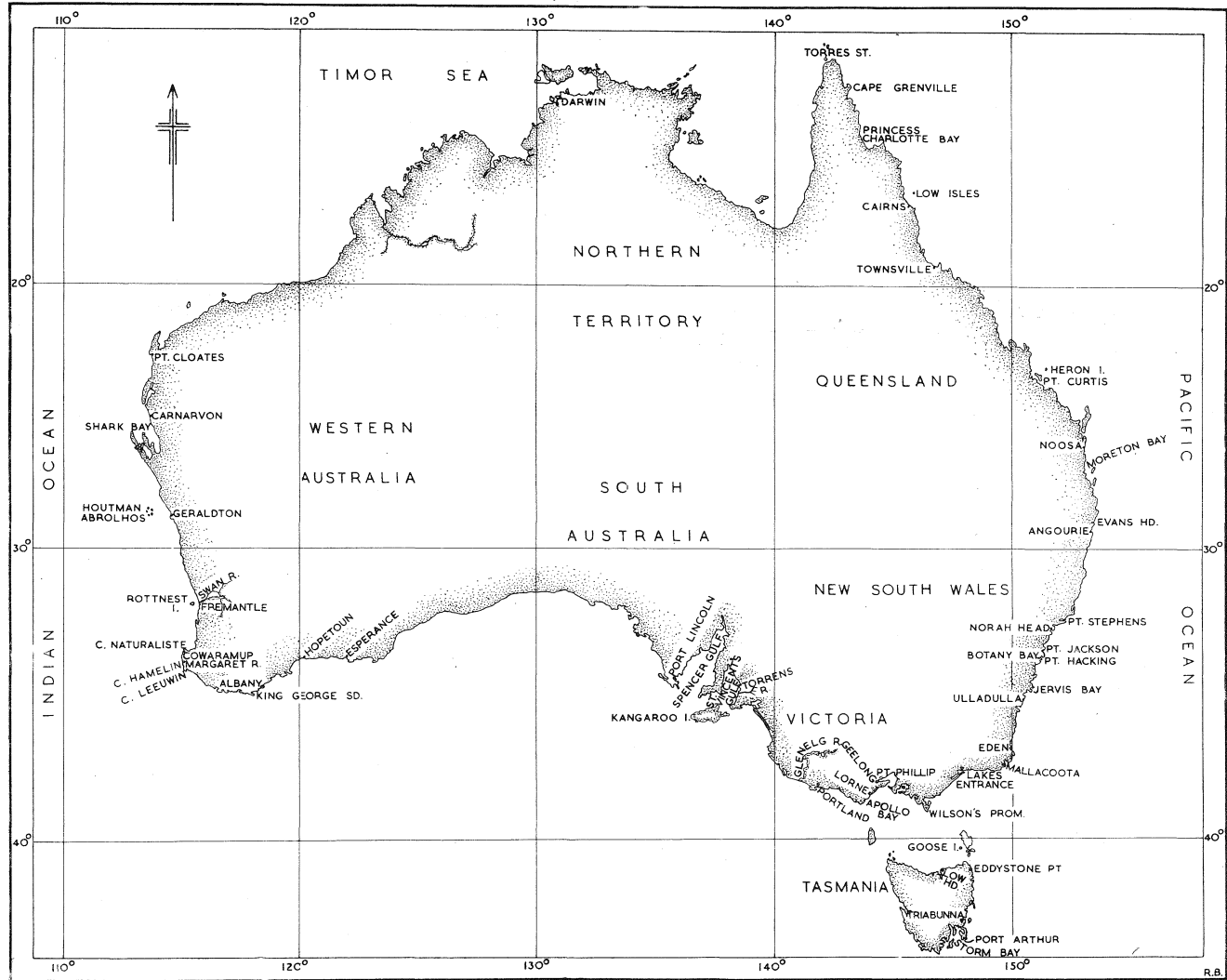


Fig 1: Map of Australia, showing localities mentioned in text.

# SERPULIDAE (POLYCHAETA) FROM AUSTRALIA

By BARBARA DEW

(Figs. 1-21)

Manuscript Received 30.9.58

## INTRODUCTION

This study was part of the marine fouling programme (Allen and Wood, 1950) of the C.S.I.R.O. Marine Laboratory, Cronulla, New South Wales, Australia. This paper reviews most of the known Australian species, except the Spirorbidae, includes a key to the genera, gives full descriptions of the species and adds to the knowledge of Serpulid distribution.

## MATERIALS AND METHODS

The material was collected from panels exposed at marine fouling stations on the coasts of Queensland and New South Wales and at Rabaul, New Britain; from wharf piles and under rocks on the coasts of all States of Australia (Fig. 1), and from the Solomon Islands.

The distribution of each species is given. It indicates the localities from which the material examined in this investigation was collected and also the distribution given by previous authors.

The worm tubes were carefully removed from the substratum and, where possible, fresh material was immediately examined. To preserve specimens, the worms were narcotized with menthol or magnesium chloride, or were allowed to become moribund in stagnant sea water. The extended worms and their tubes were then preserved in 70 per cent. alcohol. The setae and uncini were dissected out and cleaned in Gaiter's Medium (gum Arabic 50g, chloral hydrate 100g, glycerine 40ml, distilled water 100ml).

## TAXONOMY

### *Family Serpulidae*

Body divided into thorax, usually three to seven segments, bearing dorsal capillary setae and ventral uncigerous tori, and the abdomen, bearing ventral capillary setae and dorsal uncigerous tori (Fig. 2); first thoracic segment with collar; thoracic membrane present; branchiae forming a funnel around the mouth and composed of two spiral lobes or semi-circles bearing a number of filaments with two rows of barbules; operculum usually present; tube calcareous and usually attached.

## KEY TO GENERA

- |    |  |           |
|----|--|-----------|
| 1. | Body symmetrical .....   | 2         |
|    | Body asymmetrical, calcareous tube spirally coiled .....                   | SPIRORBIS |
| 2. | (1) Operculum present .....  | 3         |
|    | No operculum, or an operculum on a branchial filament .....                | 13        |
| 3. | (2) Collar setae present .....   | 4         |
|    | No collar setae .....  | 11        |
| 4. | (3) Collar setae with two conical processes at the base of the blade ..... | 5         |
|    | Collar setae without processes .....                                       | 6         |
| 5. | (4) Operculum a simple funnel .....  | SERPULA   |
|    | Operculum a funnel with a crown of spines .....                            | HYDROIDES |
| 6. | (4) Operculum stalk smooth .....   | 7         |
|    | Operculum stalk winged .....   | 8         |

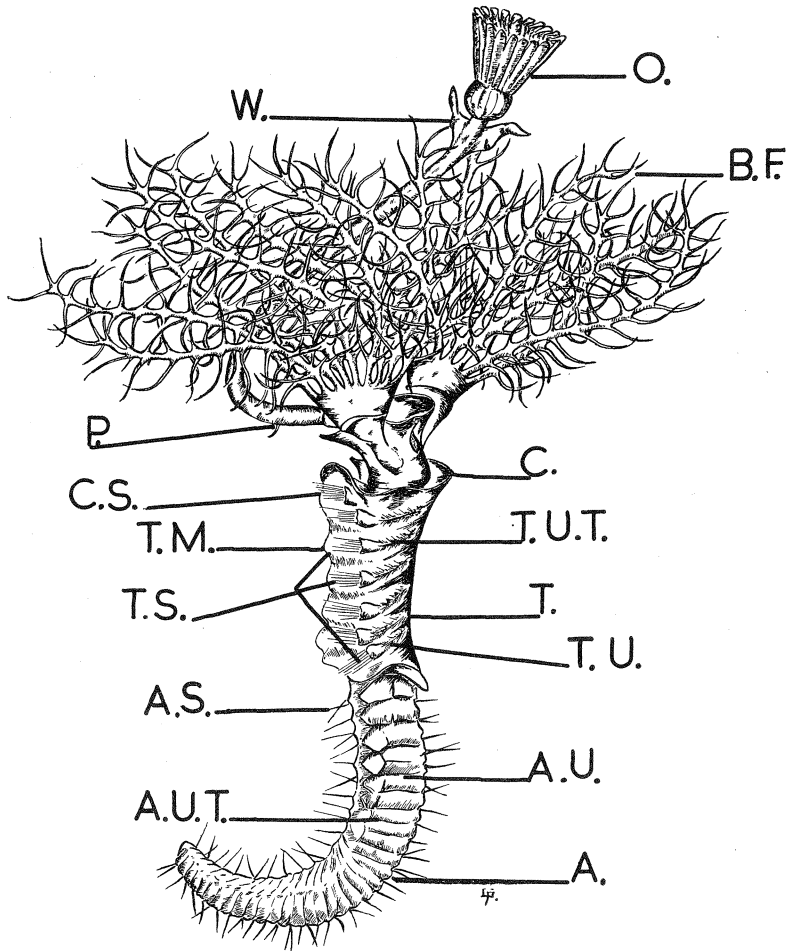
7.	(6)	Operculum vesicular and armed with hooks; collar setae deeply serrated	MERCIERELLA
		Operculum horny, with a conical or cylindrical cap; collar setae not serrated	VERMILIOPSIS
8.	(6)	Collar setae very small and fine	9
		Collar setae bayonet-like	10
9.	(8)	Operculum flattish with movable calcareous spines	GALEOLARIA
		Operculum conical or bearing non-movable processes	POMATOCEROS
10.	(8)	Operculum very variable in shape	POMATOSTEGUS
		Operculum with a calcareous plate and spiny processes	SPIROBANCHUS
11.	(3)	Operculum stalk winged	POMATOLEIOS
		Operculum stalk smooth	12
12.	(11)	Tube attached to substratum	PLACOSTEGUS
		Tube free	DITRUPA
13.	(2)	No operculum	14
		Operculum carried on the end of a branchial filament	15
14.	(13)	Tubes colonial and fine	SALMACINA
		Tubes single and large	PROTULA
15.	(13)	Tubes single and very fine	JOSEHELLA
		Tubes single and large	APOMATUS, f.

f Indicates that no specimens were collected or examined. The writer believes that representatives of these genera will ultimately be found in Australian waters.

### LIST OF DESCRIBED SPECIES

[Specimens have been deposited in the Australian Museum, and the registered numbers of the collection are indicated below. Duplicates have also been sent to the British Museum (Natural History).]

	AUST. MUS. REGISTERED No.
<i>Serpula vermicularis</i> Linnaeus 1767	W.3623
<i>Hydroides norvegica</i> Gunnerus 1768	W.3624
<i>Hydroides novea-pommeraniae</i> Augener 1924	W.3625
<i>Hydroides exaltatus</i> (Marenzeller) 1885	W.3626
<i>Hydroides brachyacantha</i> Rioja 1941	W.3627
<i>Mercierella enigmatica</i> Fauvel 1922	W.3628
<i>Vermiliopsis acanthophora</i> Augener 1914	W.3629
<i>Vermiliopsis globula</i> sp. nov. (Holotype)	W.3630
<i>Galeolaria caespitosa</i> Lamarck 1818	W.3631
<i>Galeolaria hystrix</i> Mörch 1863	W.3632
<i>Pomatoceros terrae-novae</i> Benham 1927	W.3633
<i>Pomatostegus stellatus</i> (Abildgaard) 1789	W.3634
<i>Pomatostegus polytrema</i> (Philippi) 1844	W.3635
<i>Spirobranchus giganteus</i> (Pallas) 1766	W.3636
<i>Ditrupa australis</i> Bretnall 1921	W.3637
<i>Ditrupa laeve</i> (Brazier) 1878	W.3638
<i>Ditrupa amphora</i> sp. nov. (Holotype)	W.3639
<i>Salmacina dysteri</i> (Huxley) 1855	W.3640
<i>Protula palliata</i> (Willely) 1905	W.3641
<i>Josephella marenzelleri</i> Caullery and Mesnil 1896	W.3642



C.E.P.

Fig. 2.—Diagrammatic figure showing the taxonomic characteristics of the family Serpulidae; A, abdomen; A.S., abdominal setae; A.U., abdominal uncini; A.U.T., abdominal uncinigerous tori; B.F., branchial filament; C, collar; C.S., collar setae; O, operculum; P, pedicle; T, thorax; T.M., thoracic membrane; T.S., thoracic setae; T.U., thoracic uncini; T.U.T., thoracic uncinigerous tori; W, wings.

#### Genus *Serpula* Linnaeus, 1758

Collar setae of two types, simple and bayonet-shaped, with two conical processes at base of blade; operculum a simple funnel, with numerous radii; thoracic setae winged, abdominal setae trumpet-shaped; uncini with few teeth, the most anterior stouter.

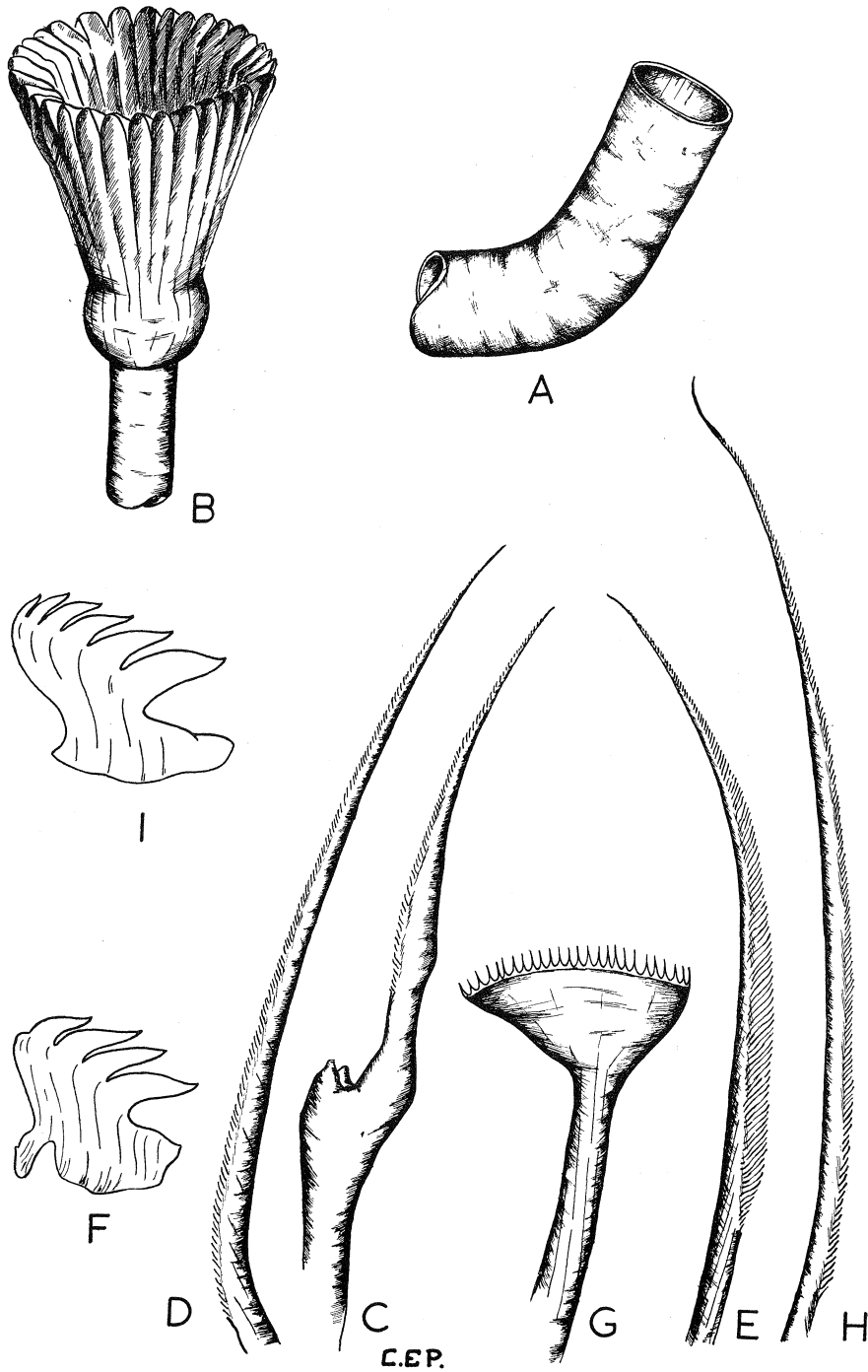
*Serpula vermicularis* Linnaeus, 1767

Fig. 3.—*Serpula vermicularis*: A, tube, x 18; B, operculum, x 30; C, D, collar setae, x 950; E, thoracic setae, x 475; F, thoracic uncinus, x 950; G, H, abdominal setae, x 950; I, abdominal uncinus, x 950.

*Serpula vermicularis* Linnaeus, 1767, p. 126; Augener, 1914, p. 133; McIntosh, 1923, p. 354; Fauvel, 1927, p. 351 (for synonymy).

*Serpula jukesi* Baird, 1865, p. 20.

*Serpula zelandica* Baird, 1865, p. 21.

*Serpula vasifera* Haswell, 1884, p. 668.

*Tube*.—White or yellowish, circular in section, with faint longitudinal ridge (Fig. 3A)

*Branchiae*.—Long, bearing a varying number of pinnae, with a long naked terminal filament, the number of pairs of filaments varying from 16 to 32, depending on age and length of individual; colour variable, usually a deep scarlet at base, becoming orange, tipped with yellow or white, regularly marked with narrow white bands; the simple operculum is carried on a smooth pedicle, which can arise from either branchial tuft; pedicle usually red, darker at base.

*Operculum*.—Funnel-shaped, with a varying number (15-80) of radii; outer edge crenated, degree of crenation (Fig. 3B) varying with age and length of individual specimen; usually whitish, but may be yellowish; rudimentary operculum usually present on opposite side.

*Collar*.—Tri-lobed, ventral lobe large and entire, lateral lobes uniting with thoracic membrane and extending on the ventral side to cover first few abdominal segments; the collar and thoracic membrane usually scarlet; setae a golden yellow; setae of two types—(1) simple and faintly serrated (Fig. 3D), and (2) bayonet-like with two conical processes at base of blade. (Fig. 3C).

*Thorax*.—Seven setigerous segments; the remaining six posterior segments have simple, winged striated setae (Fig. 3E); uncini with four to six teeth, the most anterior one being larger and stouter (Fig. 3F).

*Abdomen*.—Has large number of segments, frequently well over 100; setae trumpet-shaped, fine and short (Fig. 3G), except on posterior end, where there are a number of long simple setae (Fig. 3H); uncini similar to those of thorax, but smaller and with a more flattened base (Fig. 3I); abdominal region pale yellowish, but when preserved in alcohol becomes a dull yellow-brown.

*Material examined* in Queensland (Thursday Island, Townsville, Heron Island); New South Wales (Angowrie, Norah Head, Port Jackson, Port Hacking).

*Distribution*.—Western Australia [Shark Bay, Geraldton, King George Sound, Champion Bay (Augener, 1914)]; Cosmopolitan.

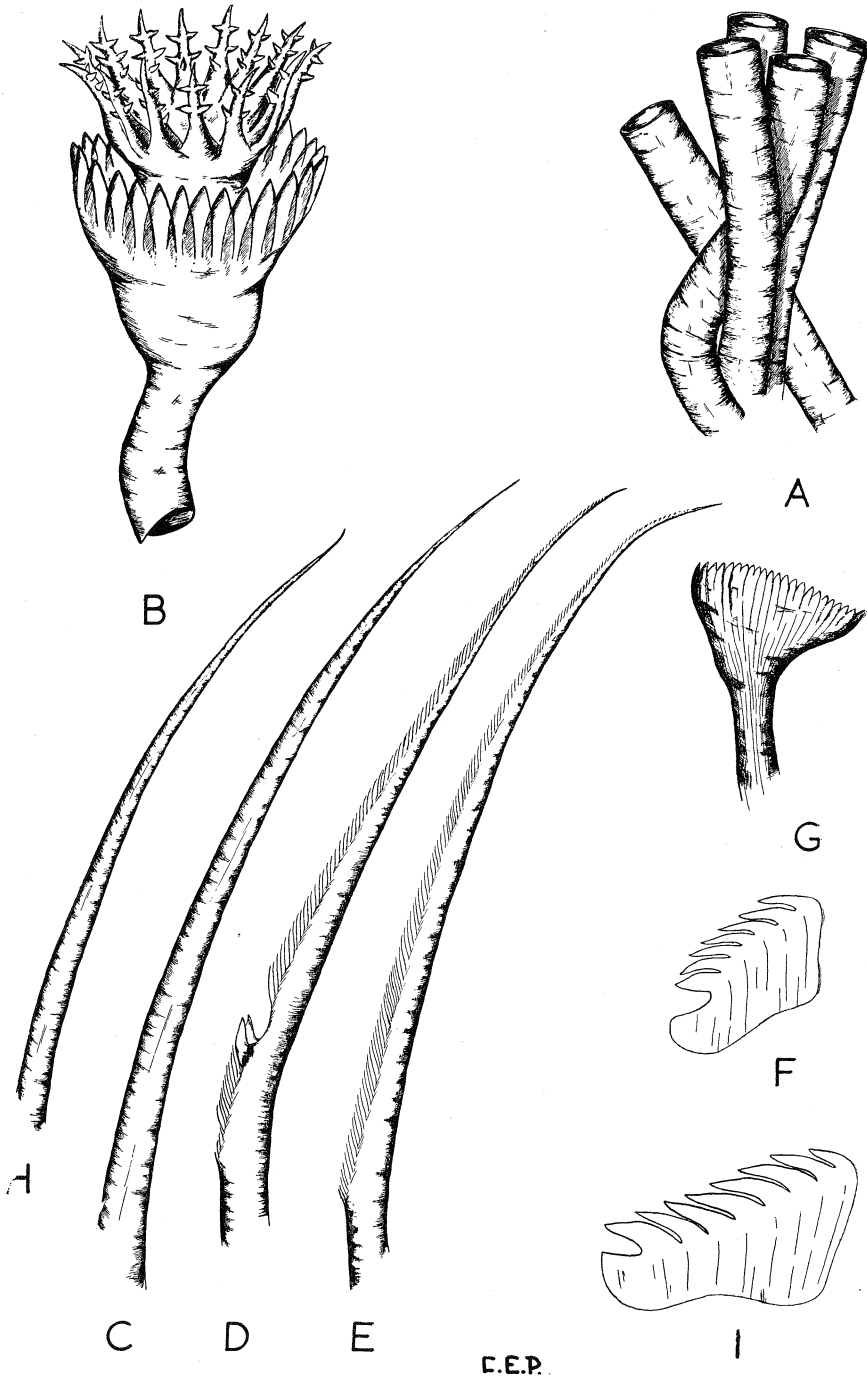
#### Genus *Hydroides* Gunnerus, 1769

Collar setae of two kinds—(1) simple and (2) bayonet-shaped with two conical processes at base of blade; operculum a simple funnel with central crown of spines; thoracic setae winged, abdominal setae trumpet-shaped; uncini with few teeth, the most anterior being stoutest.

#### KEY TO SPECIES OF HYDROIDES

- (1) Superior operculum spines all alike ..... (2)  
     Superior operculum spines unlike ..... (3)
- (2) Superior spines with lateral processes ..... *H. norvegica*  
     Superior spines without lateral processes ..... *H. novae-pommeraniae*
- (3) Similar operculum spines face inwards, no pronounced column .. *H. brachyacantha*  
     Similar operculum spines face outwards, pronounced column ..... *H. exaltatus*



*Hydroides norvegica* Gunnerus, 1768

—*Hydroides norvegica*: A, tube, x 5; B, operculum, x 37; C, D, collar setae, x 475; E, thoracic setae, 475; F, thoracic uncinus, x 950; G, H, abdominal setae, x 950; I, abdominal uncinus, x 950.

*Hydroides norvegica* Gunnerus, 1768; Pixell, 1913, p. 73; Fauvel, 1927, p. 356 (for synonymy).

*Hydroides multispinosa* Marenzeller, 1885, p. 216; Augener, 1914, p. 139, 1927, p. 273.

*Eupomatus elegans* Haswell, 1883, p. 633.

*Tube*.—White, circular in section, usually faintly marked with irregular growth rings; at first adherent to surface, later becoming erect and frequently intertwined. (Fig. 4A).

*Branchiae*.—11-14 pairs, each with a short terminal filament and numerous pinnae, variable in colour, with bands of contrasting colour along the axis; pedicle smooth, arising from either branchial tuft.

*Operculum*.—Complex, consisting of two superimposed cups, the lower somewhat funnel-shaped and having 23-32 crenulations, the superior arising from the centre of the lower and having a crown of sharp-pointed spines, each with sharp lateral processes (Fig. 4B); on the inner surface, along the mid-line, is a row of short projecting teeth; in the centre of the cup is usually a single short, sharp spine; rudimentary operculum normally present on opposite side, its state of development varying considerably.

*Collar*.—Entirely fused with the large colourless thoracic membrane; setae of two kinds—(1) simple (Fig. 4C) and (2) bayonet-like, with two conical processes at base of blade (Fig. 4D).

*Thorax*.—Seven setigerous segments, remaining six segments with simple faintly striated setae (Fig. 4E); uncini with six to seven teeth, the most anterior being stouter than the remainder (Fig. 4F).

*Abdomen*.—Setae trumpet-shaped (Fig. 4G); extreme end of the abdomen has long simple setae (Fig. 4H); uncini similar to those of thorax, but with eight to nine teeth. (Fig. 4I).

*Discussion*.—There is a surprising variation in colour, setae, and opercular structure, even within one clump of tubes. Although one operculum is usual, two are not uncommon Dew (1958). The number of lateral opercular spines also varies from three to five, both with and without further spines set at right angles.

In 1768 Gunnerus proposed a new genus, *Hydroides*, and, as the type of the genus, described *H. norvegica*. Since that date *H. norvegica* has been recorded and described under various names from many parts of the world. In 1885 Marenzeller described a single incomplete specimen and named what he regarded as a new species, *Hydroides multispinosa*, which was collected at low tide at Eno-Sima (Japan). All recent attempts to obtain similar specimens of this species from Japan have proved unsuccessful, but there seems little doubt that it is identical with *H. norvegica*.

In 1883 Haswell described a serpulid from Port Jackson under the name of *Eupomatus elegans*. He found that the species occurred in great numbers on algae in 10-12 fathoms and, rarely, on the underside of rocks.

In 1910 Fauvel claimed that, in this species, the number and shape of the setae and opercular spines varied with the age of the individual. This appears to hold for the material examined in this study. Fauvel (1932) notes that *H. multispinosa*, as described by Marenzeller, is the same as *H. norvegica*; Pixell (1913) and Augener (1927) have also suggested that *H. multispinosa* is synonymous with *H. norvegica*.

This species is one of the most important fouling organisms in Port Jackson and other ports. It occurs on ships, buoys and other floating structures, but rarely elsewhere, except powerhouses' water intake conduits in Port Jackson.

*Material examined* in Queensland (Townsville, Heron Island, Dunwich, Moreton Bay); New South Wales (Port Stephens, Port Jackson, Port Hacking, Jervis Bay, Ulladulla, Eden); Victoria (Geelong); South Australia (Port Lincoln); Western Australia (Fremantle); New Zealand (Auckland); New Britain (Rabaul).

*Distribution*.—Western Australia [Shark Bay (Augener 1914)]; Cosmopolitan.

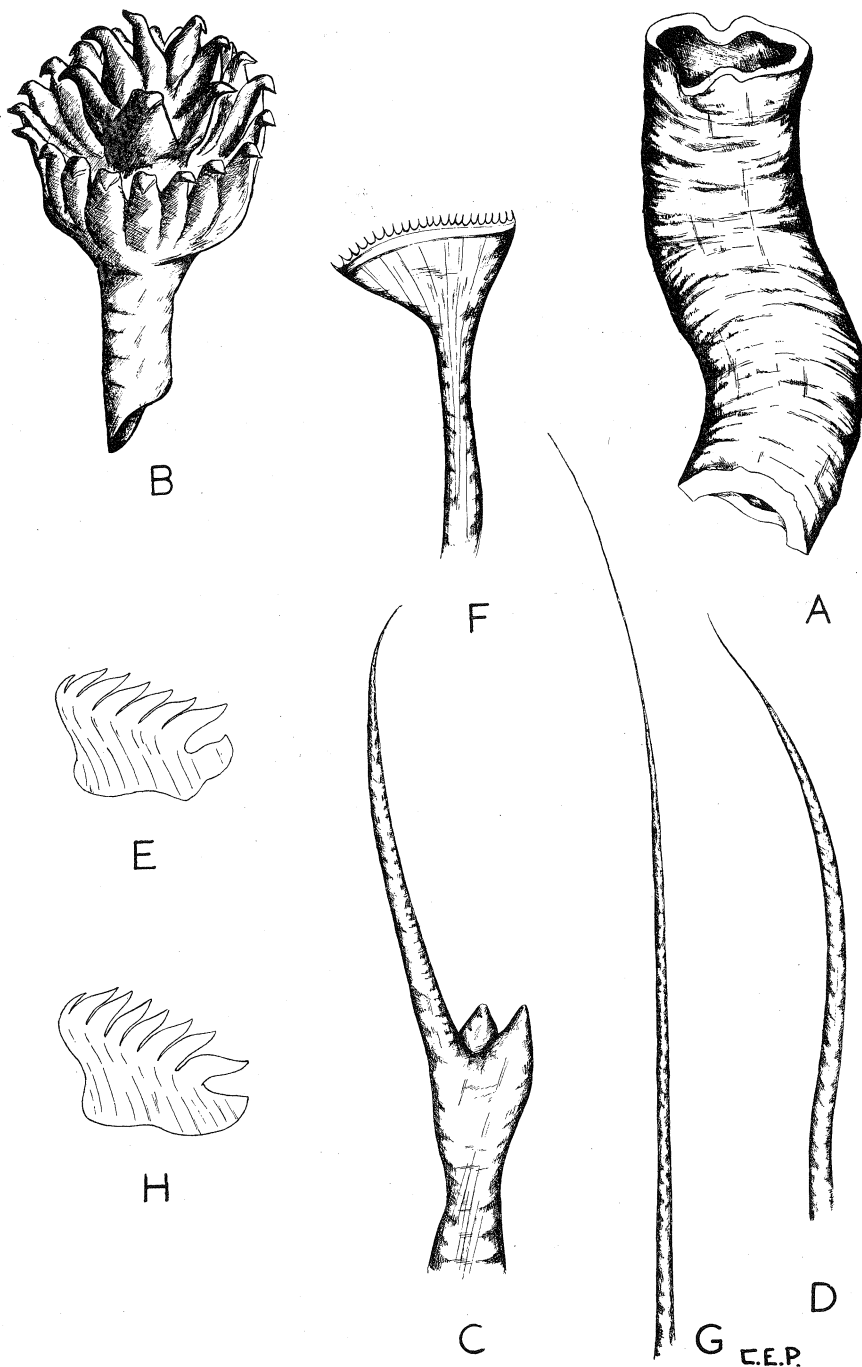
*Hydroides novae-pommeraniae* Augener, 1924

Fig. 5.—*Hydroides novae-pommeraniae*: A, tube, x 13; B, operculum, x 30; C, collar setae, x 475; D, thoracic setae, x 475; E, thoracic uncinus, x 950; F, G, abdominal setae, x 950; H, abdominal uncinus, x 950.

*Hydroides novae-pommeraniae* Augener, 1924, p. 17, Figs. 5, 5A.

*Hydroides (Eupomatus) novae-pommeraniae* Okada, 1937, p. 308.

*Tube*.—White, usually attached to a submerged object along its whole length; circular in section, with irregular growth rings and often with two irregular longitudinal ridges. (Fig. 5A).

*Branchiae*.—Seven to eight filamentous pairs, with a short terminal filament; operculum carried on smooth pedicle, which arises from either branchial tuft.

*Operculum*.—Complex, consisting of two superimposed cups; lower cup with twenty to twenty-three smooth spines, bearing everted tips; upper cup with seven short stout spines arising from a common base; spines of both cups terminating in sharp points (Fig. 5B). A rudimentary operculum is carried on the opposite side. An individual with two fully developed opercula was examined.

*Collar*.—Tri-lobed—one ventral, two lateral; the thoracic membrane extends downwards and covers first few abdominal segments; setae of two kinds—(1) fine capillary and (2) bayonet-like with two conical processes at the base of the blade (Fig. 5C).

*Thorax*.—Seven setigerous segments, remaining six segments with simple capillary setae (Fig. 5D); uncini with seven to eight teeth, the anterior tooth being much larger and blunter (Fig. 5E).

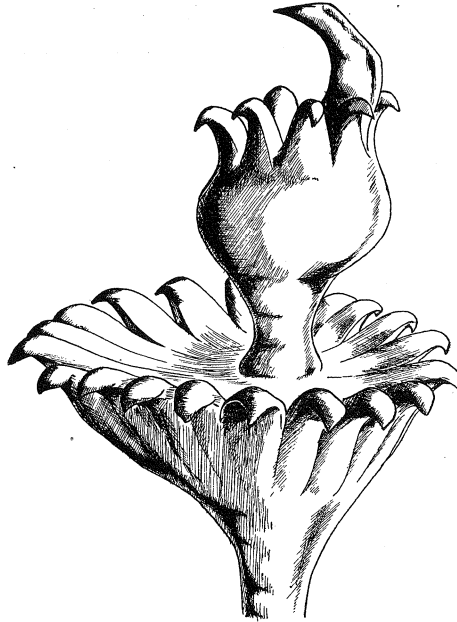
*Abdomen*.—Setae trumpet-shaped, with faint serrations (Fig. 5F); setae on terminal portion of abdomen simple (Fig. 5G); uncini vary slightly from those of thorax, having eight to ten teeth, the most anterior of which is larger (Fig. 5H).

*Discussion*.—This is the first report of this species from the Australian mainland. It occurred frequently on the "fouling" plates exposed at Townsville, Queensland, both mature and immature individuals being collected.

*Material examined* in Queensland (Thursday Island, Townsville).

*Distribution*.—New Guinea, Palau (Kororu) Island.

***Hydroides exaltatus* (Marenzeller), 1885.**



A

C.E.P

Fig. 6.—*Hydroides exaltatus*: A, operculum, x 26.

*Eupomatus exaltatus* Marenzeller, 1885, p. 217; Pixell, 1913, p. 77, Pl. 8, Fig. 4; Willey, 1905, p. 312, Pl. VII, Fig. 182.

*Hydroides (Eupomatus) exaltatus* Augener, 1914, p. 142.

*Tube*.—White, circular in section, with few irregular growth rings, usually three but sometimes only one; longitudinal keel.

*Branchiae*.—13-15 filamentous pairs, with a clear, broken black line on their outer edge; short terminal filament; operculum pedicle smooth, arising from either branchial tuft.

*Operculum*.—Complex, consisting of two parts, the lower having 23-25 crenulations, from the off-centre of which arises a short stout column carrying seven or nine strong hook-like spines. Among these is a much larger dorsal one, bending over the others at almost a right angle (Fig. 6A); all spines lack lateral processes, except small ones on inner surface, close to base; a rudimentary operculum usually carried on opposite side.

*Collar*.—Setae of two kinds: (1) simple capillary and (2) bayonet-like, with two projecting conical processes at base of blade.

*Thorax*.—Seven setigerous segments; remaining six segments have simple winged setae; uncini have six to seven teeth, most anterior being stouter and larger.

*Abdomen*.—Setae trumpet-shaped, with end finely serrated; uncini similar to those of thorax.

*Discussion*.—A number of specimens of this species were collected in the Solomon Islands (Bougainville). They were removed from the shell of the Hammer Oyster (*Malleus vulgaris*), but the bodies, except for the opercula, were dried up.

*Material examined* in Queensland (Townsville) and Solomon Islands (Bougainville).

*Distribution*.—Western Australia (Shark Bay, Augener, 1914); Japan, Zanzibar, Ceylon, Red Sea.

#### ***Hydroides brachyacantha* Rioja, 1941**

*Hydroides brachyacantha* Rioja, 1941, p. 169, Pl. 3, Fig. 2, Pl. IV, Figs. 1-9.

*Tube*.—White, brittle and usually completely attached to substrate; two parallel ridges run the whole length of tube, enclosing a median longitudinal groove; groove and ridges not always conspicuous, sometimes absent (Fig. 7A).

*Branchiae*.—Twelve pairs, each with a long naked terminal filament, joined by a low interbranchial membrane; operculum pedicle smooth, arising from either branchial tuft.

*Operculum*.—Complex, consisting of two parts; lower cup crenated, having general shape of a horse's hoof; superior part arising from off-centre of the lower, normally consisting of nine stout inwardly-pointing spines, largest and stoutest of which curves over remaining eight, forming a cage. (Fig. 7B); remaining spines, except pair flanking large spine, have a blunt, tooth-like projection on shoulder of curve; operculum and pedicle about 4 mm in length; rudimentary operculum often present on opposite side.

*Collar*.—Tri-lobed, two lateral lobes joining single large ventral, then curling over top of thoracic membrane; setae of two kinds—(1) simple capillary (Fig. 7C), (2) large bayonet-like, with two marked protruding teeth at base of blade (Fig. 7D).

*Thorax*.—Seven setigerous segments; remaining six segments with simple, winged setae (Fig. 7E); uncini have five to six teeth, most anterior being much larger and stouter (Fig. 7F).

*Abdomen*.—Setae trumpet-shaped, finely toothed (Fig. 7G); uncini similar to those of the thorax (Fig. 7H).

*Discussion*.—This is the first record of this species from Australia, and the second world locality. The material from Townsville was removed from "fouling" panels, where it was quite plentiful; that from New South Wales occurred as numerous isolated examples on the under side of rocks.

*Material examined* in Queensland (Townsville), New South Wales (Botany Bay, Port Hacking).

*Distribution*.—Mexico.

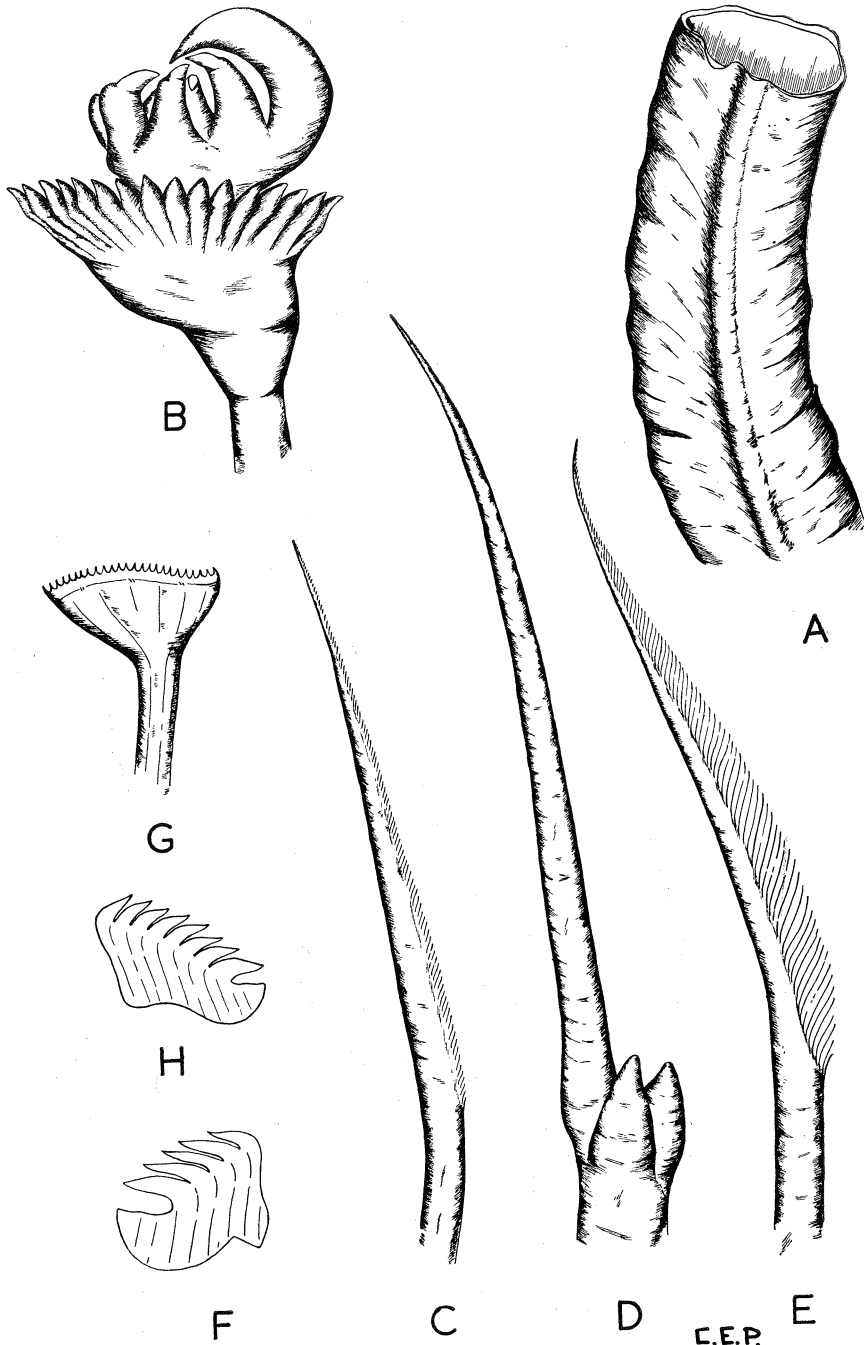


Fig. 7.—*Hydroides brachyacantha*: A, tube, x 13; B, operculum, x 16; C, D, collar setae, x 475; E, thoracic seta, x 475; F, thoracic uncinus, x 950; G, abdominal seta, x 950; H, abdominal uncinus, x 950.

Genus *Mercierella* Fauvel, 1922

Operculum vesicular, armed with chitinous hooks, borne on smooth pedicle; collar setae of two kinds—(1) simple, (2) deeply serrated; thoracic setae capillary, abdominal setae geniculate; uncini with few teeth, the last one being stouter and gouged.

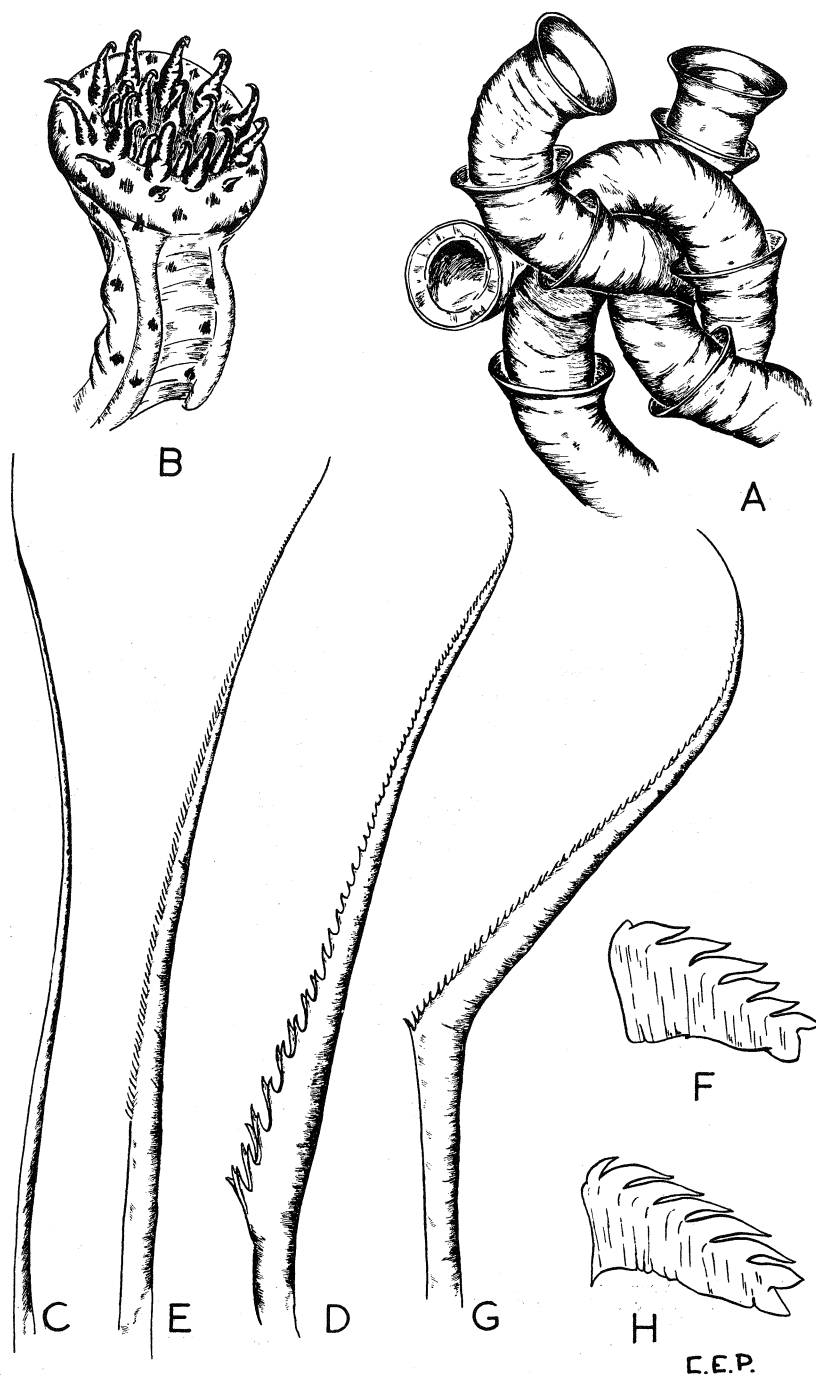
*Mercierella enigmatica* Fauvel, 1922

Fig. 8.—*Mercierella enigmatica*: A, tube, x 7; B, operculum, x 26; C, D, collar setae, x 475; E, thoracic seta, x 475; F, thoracic uncinus, x 950; G, abdominal seta, x 950; H, abdominal uncinus, x 950.

*Mercierella enigmatica* Fauvel, 1922, p. 425; Monro, 1924, p. 155; Fauvel, 1927, p. 359; 1932, p. 249; 1933, p. 185; 1935, p. 515; Monro, 1938, p. 624; Mensil and Fauvel, 1939, p. 37; Tebble, 1953, p. 1.

*Tube*.—White, but becoming yellowish-brown; circular in section; at irregular intervals "collar-like" outgrowths occur, giving a characteristic appearance (Fig. 8A); usually compact, forming dense "coral-like" masses; single tubes rare and tending to lack characteristic "collars".

*Branchiae*.—Usually nine pairs of eyeless filaments; terminal filament very long; interbranchial membrane completely absent; operculum with a smooth pedicle arising from the left branchial tuft; pedicle flattened, somewhat grooved on the dorsal surface, greenish-olive in colour, with a dark patch near base of operculum.

*Operculum*.—Non-calcareous, cone-shaped; somewhat vesicular; top slightly depressed, usually containing two concentric rows of chitinous hooks, outer of which stouter and darker in colour; number of hooks varies greatly, but averages about 20 (Fig. 8B).

*Collar*.—High, entire, and covering the base of the branchiae; setae of two types—(1) simple capillary (Fig. 8C), (2) deeply serrated, with a few rows of teeth set transversely at base and two long rows set longitudinally (Fig. 8D).

*Thorax*.—Thoracic membrane wide and frequently overlapping in the mid-line; dorsally and ventrally it overlaps the first few segments of abdomen; seven setigerous segments; remaining six segments have simple capillary setae (Fig. 8E). Uncini with six to seven teeth, most anterior being stouter and gouged (Fig. 8F).

*Abdomen*.—Setae geniculate and strongly toothed (Fig. 8G); uncini similar to those of thorax, but with seven to nine teeth (Fig. 8H).

*Discussion*.—This species was first noted in Cook's River, Botany Bay, during 1910, when it was observed to have formed dense coral-like masses; unfortunately no material was deposited in the Australian Museum, Sydney, at the time. The first written account is that of Monro (1938) from the Swan River (Western Australia).

The material found at Townsville (Queensland) usually occurred on the test plates exposed during the monsoonal periods of January-March. A few scattered individuals were also found if heavy rain fell during the non-monsoonal period. This was especially true during the very wet year of 1950. The tube structure of the Townsville specimens differs from those found in other parts of Australia as they lack the characteristic "collars", but this may be due simply to the fact that they were completely attached to the test panels and did not grow upright.

The worms grow very rapidly under certain conditions of salinity. Tebble (1953) found that below 25°/00 or at 57°/00, if the temperature exceeded 68°F., was especially favourable to rapid growth. A similar effect has been noted near Tempe, on Cook's River, Sydney.

*Material examined* in Queensland (Townsville, Noosa); New South Wales (Cook's River, George's River, Port Hacking); Victoria (Glenelg River, Newport); South Australia (River Torrens); Western Australia (Swan River, Carnarvon).

*Distribution*.—Europe, especially the Mediterranean countries; South Africa, India, North and South America. See Tebble (1953) for greater detail.

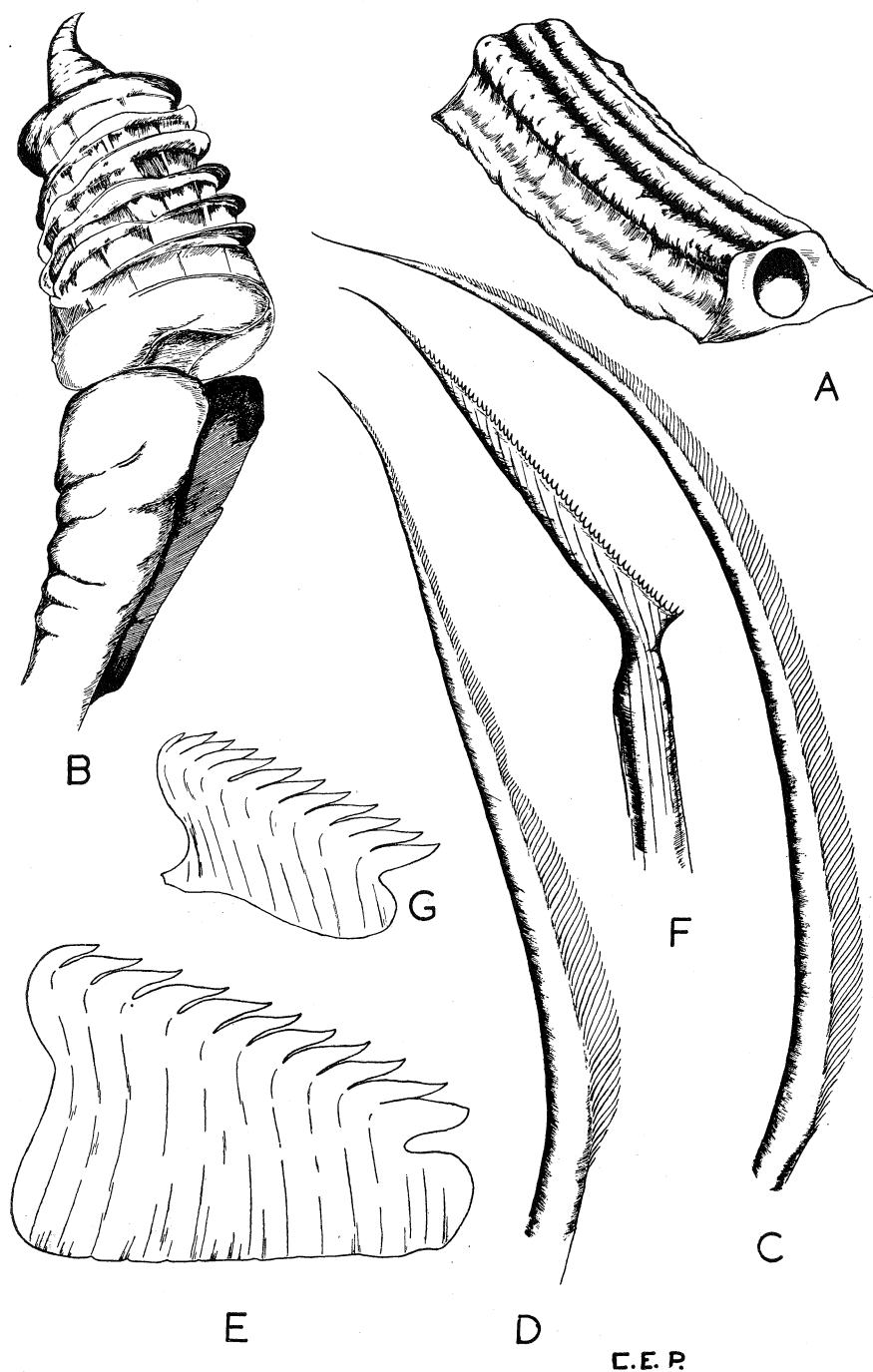
#### Genus *Vermiliopsis* Saint Joseph, 1906

Collar setae simple blades; uncini with fairly numerous teeth, the most anterior larger and blunter than the rest; abdominal setae geniculate; some thoracic setae of *Apomatus* type; operculum with a horny, somewhat cylindrical or conical, cap.

#### KEY TO SPECIES OF GENUS VERMILIOPSIS

1. Operculum elongated, with numerous tiers ..... *V. acanthophora*.
2. Operculum globular, without tiers ..... *V. globula* n.sp.



*Vermiliopsis Acanthophora* Augener, 1914

C. E. P.

Fig. 9.—*Vermiliopsis acanthophora*: A, tube, x 20; B, operculum, x 33; C, collar seta, x 475; D, thoracic seta, x 475; E, thoracic uncinus, x 950; F, abdominal seta, x 950; G, abdominal uncinus, x 1800.

*Vermiliopsis acanthophora* Augener, 1914, p. 155, Pl. 1, Figs. 21-24; Fauvel, 1930, p. 63; Monro, 1937, p. 318.

*Tube*.—Whitish, frequently covered with a coating of yellowish brown alga; wall thick, somewhat trapezoid in section, with distinctly flattened top, and sometimes with a barely detectable ridge along the whole length; distinct thickenings occur transversely at very irregular intervals (Fig. 9A).

*Branchiae*.—Twenty pinnate pairs, with short club-like ends; pedicle whitish, stout and ribbon-like, with broad lateral edges, arising from right branchial tuft.

*Operculum*.—Whitish, soft near base where it joins pedicle, but this changes to brownish colour where it becomes chitinous; conical in shape, with four to six parallel layers of superimposed tiers; tiers unequally developed, especially those closest to base of operculum; only top two fully encircle cone, top one being best developed; top of operculum capped by single strong conical spine, with slightly curved tip (Fig. 9B); rudimentary operculum on left.

*Collar*.—Soft, appearing to be four-lobed, the ventral pair high and undulating; setae simple, winged, and faintly striated, few in number, small and fine (Fig. 9C).

*Thorax*.—Thoracic membrane well developed, covering thorax and first abdominal segment; seven setigerous segments; remaining six segments with stronger, stouter setae (Fig. 9D); uncini with 10-11 teeth, most anterior being noticeably stouter and blunter (Fig. 9E).

*Abdomen*.—Setae geniculate and finely toothed, the teeth reaching almost to end (Fig. 9F); uncini similar to those of thorax, but containing 12-13 teeth, most anterior being similarly stout (Fig. 9G).

*Material examined* in New South Wales (Norah Head, Port Jackson, Port Hacking).

*Distribution*.—Western Australia (Shark Bay, Augener 1914); Gulf of Manaar, Galapagos Islands, Gulf of Omana, Arabian Coast.

### *Vermiliopsis globula* sp. nov.

(Fig. 10)

*Tube*.—White, heavy and solid, with a very marked, irregularly indented dorsal keel. (Fig. 10A).

*Branchiae*.—35 pinnate pairs, with shortish, naked, greenish-brown filaments; pedicle, somewhat triangular, is slightly swollen just before fusing with operculum, and arises from left branchial tuft.

*Operculum*.—Globular, with faintly striated cap, yellowish-ochre in colour; knob-like protrusion to one side of operculum (Fig. 10B).

*Collar*.—Well-developed, tri-lobed, single large ventral lobe distinctly divided from two laterals; centre of ventral lobe frequently folded into two triangular lappets; setae simple striated blades, tapering to a fine point (Fig. 10C).

*Thorax*.—Seven setigerous segments; thoracic membrane joins with that of collar, overlaps near collar but becomes progressively narrower towards posterior end; setae on remaining six segments of two kinds—(1) simple, like those of collar segment (Fig. 10D), and (2) simple winged, faintly striated; uncini with seven teeth, most anterior being stouter and blunter (Fig. 10E).

*Abdomen*.—Setae long, geniculate, finely toothed, terminating in a long fine point (Fig. 10F); few simple capillary setae on most posterior segments (Fig. 10G); uncini similar to those of thorax, with same number of teeth, slightly smaller in size (Fig. 10H).

*Total length*.—32 mm (thorax 4 mm, branchiae 5 mm, abdomen 23 mm).

*Type locality*.—Cronulla, N.S.W. Holotype in Australian Museum (Cat. No. W.3630), paratype in British Museum (Nat. Hist.) London.

*Material examined*.—New South Wales [Norah Head, Port Jackson, Cronulla (Port Hacking)].

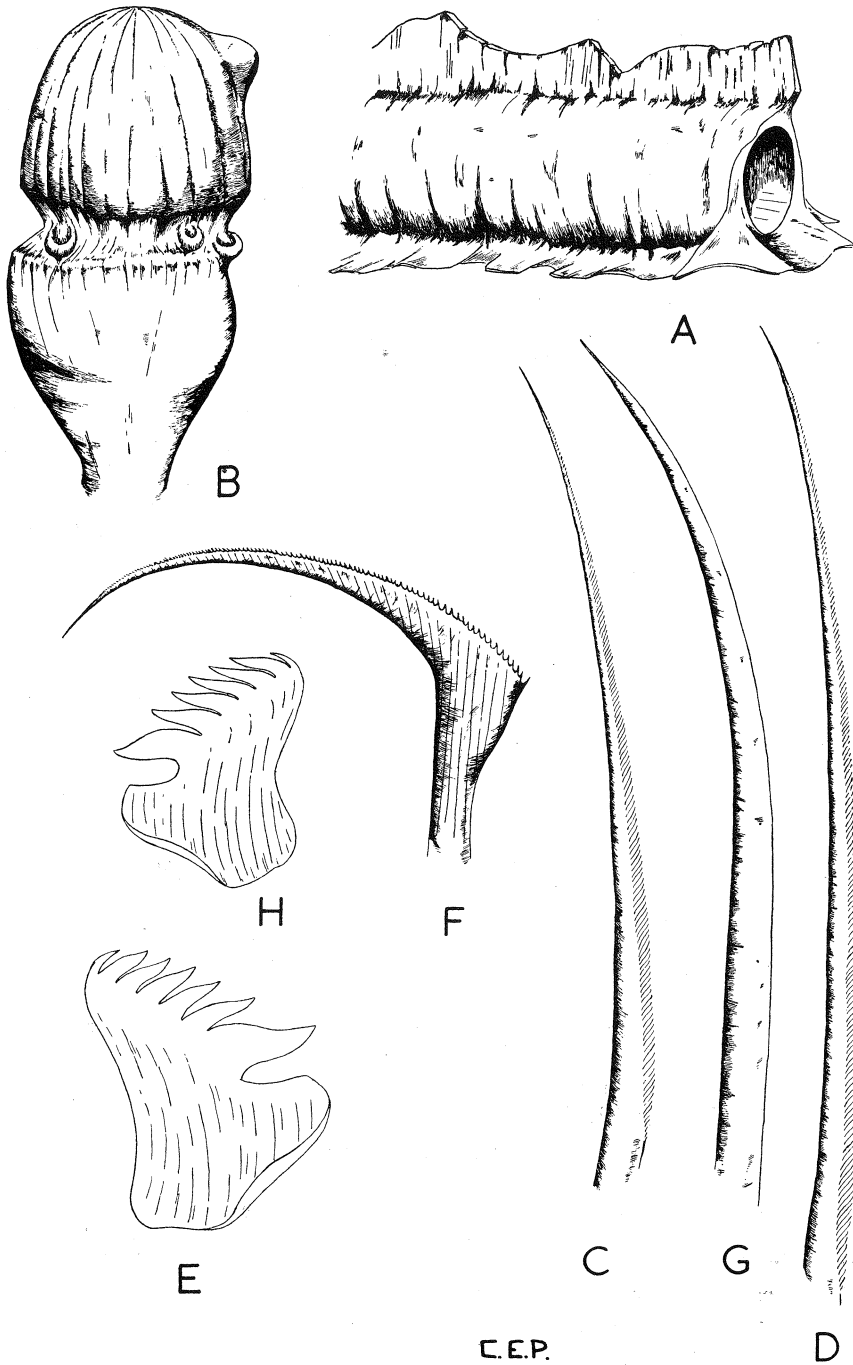


Fig. 10.—*Vermiliopsis globula*: A, tube, x 6; B, operculum, x 15; C, collar seta, x 475; D, thoracic seta, x 475; E, thoracic uncinus, x 950; F, G, abdominal setae, x 950; H, abdominal uncinus, x 950.

*Discussion.*—*Vermiliopsis globula* differs from *V. glandigerus* Gravier 1906 (from the Red Sea), which it most closely resembles and which has been recorded (Monro 1939) off the coast of Tasmania, in both shape and form of the tube and operculum. The tube of *V. globula* has one heavy well-developed ridge, while that of *V. glandigerus* has five longitudinal ridges of varying clarity. The operculum of *V. globula* is globular in shape, with longitudinal striae and a smooth, if somewhat swollen, pedicle. *V. glandigerus*, on the other hand, has concentric rings on both operculum and pedicle.

#### Genus *Galeolaria* Lamarck, 1818

Collar setae very short and fine; operculum consisting of calcareous plates, with movable spines; tube stout and with marked central keel; pedicle winged.

#### KEY TO SPECIES OF GALEOLARIA

1. Operculum with seven to nine movable calcareous spines ..... *G. caespitosa*
2. Operculum with numerous movable calcareous spines ..... *G. histrix*

#### *Galeolaria caespitosa* Lamarck, 1818

(Fig. 11)

*Galeolaria caespitosa* Lamarck, 1818, p. 636; Mörch, 1863, p. 368 (for synonymy); Augener, 1914, p. 145 (for synonymy); Pope, 1948, p. 235.

*Vermilia caespitosa* Haswell, 1884, p. 665 (for synonymy).

*Tube.*—White, cemented for most of length to substrate; usually found in colonies forming dense clumps or mats on rocks between tide levels; heavy and rough, with flattened grooved central keel which projects over the mouth. (Fig. 11A).

*Branchiae.*—23 pairs, joined by a high interbranchial membrane, with prominent white band just below its free edge; short, with a very short terminal filament; colour variable, predominant colour greenish-olive with bands and blotches of black and white; pedicle short, blackish-green and winged.

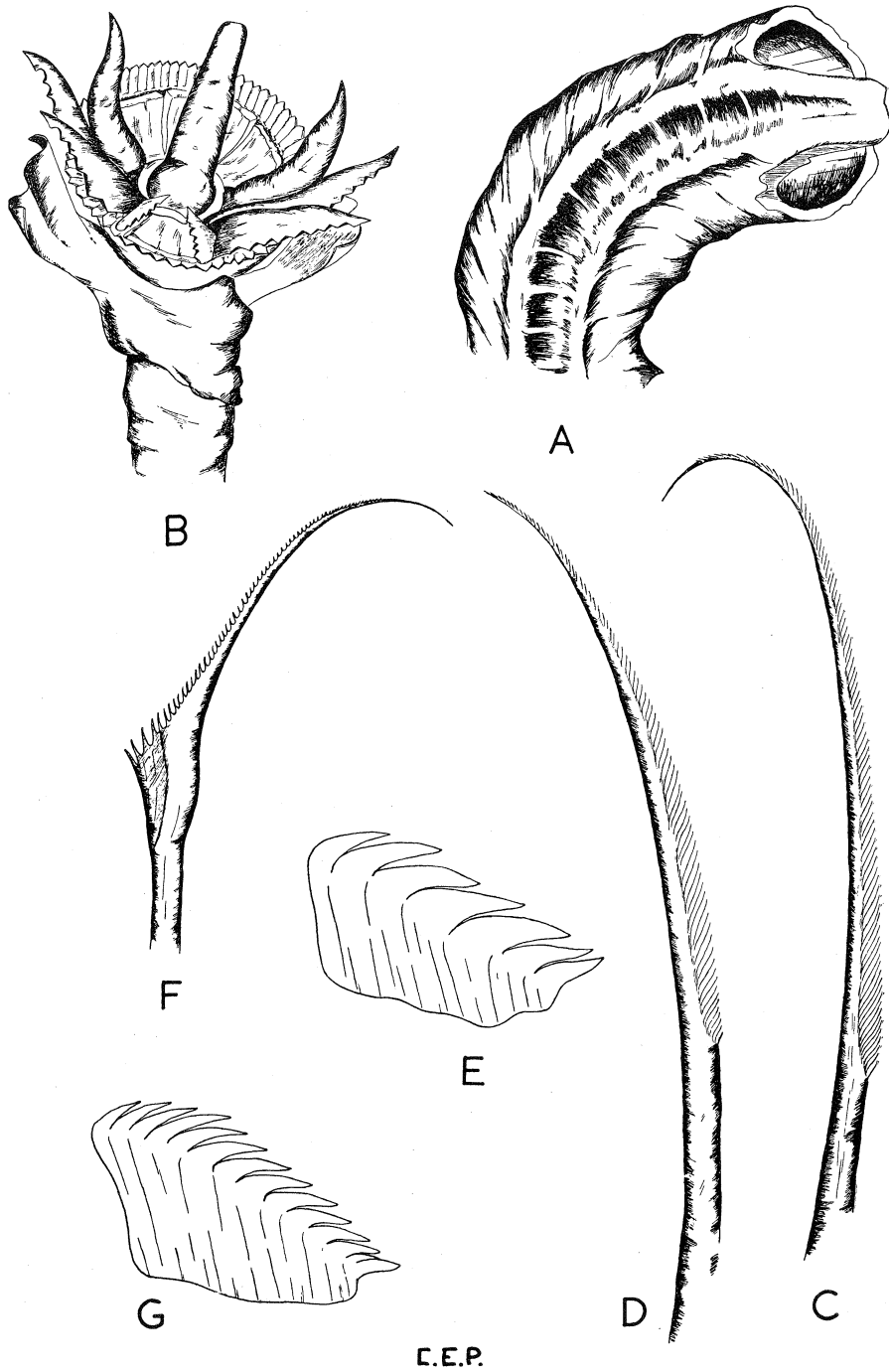
*Operculum.*—Four (occasionally three) calcareous basal plates, surrounded by an outer fringe of small blunt processes; from base of basal plates arise nine (rarely 11) movable calcareous spines, each on its own base and capable of individual movement; the central spine is longest, smooth and tapers to blunt point; remaining four pairs of spines of two types—the outer pair smooth and terminating in a sharp point, the inner series, also pointed, all laterally toothed on one side and somewhat saw-like. The innermost pair shorter than the other spines, the outer pair being the longest (Fig. 11B).

*Collar.*—With a prominent white triangular lobe on upper ventral surface, deeply indented laterally; setae minute, very short and fine, and weakly striated at the edge (Fig. 11C).

*Thorax.*—Seven setigerous segments; the remaining six segments have more setae than the collar, similar but stronger, in bundles of 45 (Fig. 11D); uncini with seven to nine teeth, most anterior being stouter and grooved (Fig. 11E).

*Abdomen.*—Setae geniculate, with fine tapering points, lower edges being finely toothed. Two setae per bundle and two bundles per segment (Fig. 11F). Uncini with 11-15 teeth most anterior one being stouter and gouged (Fig. 11G).

*Discussion.*—This very common Australian species is popularly known as “Sydney Coral” (Pope 1948). It is usually found in a well defined belt or zone known to Australian shore ecologists as the *Galeolaria* Zone (Dakin, Bennett and Pope, 1948, pp. 196 and 211). This zone is mid-littoral, immediately above that of the ascidian *Pyura stolonifera*. The sharp demarcation is very obvious, and the thickness of the belt depends on the slope of the shore. On a vertical surface, such as a wharf pile, the band may be about two feet wide, but on a gentle slope, exposed to surf, it will be much wider, although remaining within the same tidal range. Occasionally, scattered individual tubes may be found outside this zone.



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Fig. 11.—*Galeolaria caespitosa*: A, tube, x 17; B, operculum, x 21; C, collar seta, x 950; D, thoracic seta, x 475; E, thoracic uncinus, x 950; F, abdominal seta, x 950; G, abdominal uncinus, x 950.

*Galeolaria* is rarely found on floating surfaces, but isolated specimens have been obtained from ships in Sydney Harbour, especially those moored in Athol Bight. This species thrives best under conditions of normal salinity, and appears to tolerate only slight variation. It spends half of the day covered by the surge of the waves.

*Galeolaria caespitosa* was named by Lamarck (1818). Later, Quoy and Gaimard (1830) made reference to a siphonophore *Beroide australis*, which Blainville (1834) subsequently called *Galeolaria australis*. Stechow (1921), realising that this was a siphonophore and not a tubeworm, changed its generic name to *Galetta* to avoid confusion with *Galeolaria*.

*Material examined*.—Queensland (Dunwich, Moreton Bay); New South Wales (Evans Head, Port Stephens, Norah Head, Long Reef, Port Jackson, Port Hacking, Wollongong, Shell Harbour, Kiama, Ulladulla, Bateman's Bay, Tollgate Islands, Jervis Bay, Eden); Victoria (Lakes Entrance, Wilson's Promontory, Tidal River, Phillip I., Rickett's Point, Lorne, Apollo Bay, Cape Otway, Portland, Nelsons Bay); South Australia (Port Lincoln, Kangaroo Island); Tasmania (Port Arthur, Low Head, Eddystone Point, Cape Sorell, Goose Island); Western Australia (Esperance, Hopetoun, Albany, Cape Leeuwin, Hamelin, Margaret River, Cowaramup, Cape Naturaliste).

*Distribution*.—This species is endemic and occurs from Dunwich (Moreton Bay, Qld.) south and west to Cape Naturaliste (Western Australia) and also in Tasmania. It is plentiful on the ocean shores and extends into the numerous bays and harbours.

### *Galeolaria hystrix* Mörch, 1863

(Fig. 12)

*Galeolaria hystrix* Mörch, 1863, p. 370; Ehlers 1907, p. 29; Fauvel, 1917, p. 269, Fig. XXIX (for synonymy).

*Galeolaria rosea* Ehlers, 1905, p. 20.

*Eupomatus boltoni* Baird, 1865, p. 12, Fig. 10.

*Vermilia rosea* Haswell, 1884, p. 667, Pl. xxxii, Fig. 2-5.

*Tube*.—Varying in colour from pale pink to deep rose, with two pronounced, irregularly serrated parallel ridges, enclosing a central groove (Fig. 12A).

*Branchiae*.—Short, 17 pairs, marked with bands of brown and red; interbranchial membrane present, joining bases of branchiae; pedicle winged, short, stout and flattened, the wings usually cut up into a number of short tooth-like projections.

*Operculum*.—With a number of small flattened calcareous plates, many of which carry movable calcareous spines; spines of two types—(1) smooth, (2) short, curved, toothed spines; outer circumference consists of row of short, blunt, radiating, calcareous spines; remaining spines arranged in two semi-circles, inner one consisting of long smooth spines with curved apices and outer series consisting of about 21 spines armed with five to six stout broad teeth (Fig. 12B).

*Collar*.—Tri-lobed, the two lateral lobes curling over on themselves while the single large ventral lobe is folded into a number of waves; setae fine and all of one type, blades simple with faint striation (Fig. 12C).

*Thorax*.—Seven setigerous segments; remaining six segments have setae similar to those of collar, except that they are more plentiful and stouter (Fig. 12D); uncini with six to seven teeth, most anterior being stouter and gouged (Fig. 12E).

*Abdomen*.—Setae are geniculate and finely toothed; there are two setae per tuft and two tufts per segment (Fig. 12F); uncini similar to those on thorax, but with six to eight teeth, most anterior being similarly gouged (Fig. 12G).

*Discussion*.—In Australia *G. hystrix*, unlike *G. caespitosa*, usually occurs as scattered individuals under rocks below low tide level, and is often found on the holdfasts of kelp (*Ecklonia radiata*) washed up after storms. *G. hystrix* is larger than *G. caespitosa*.

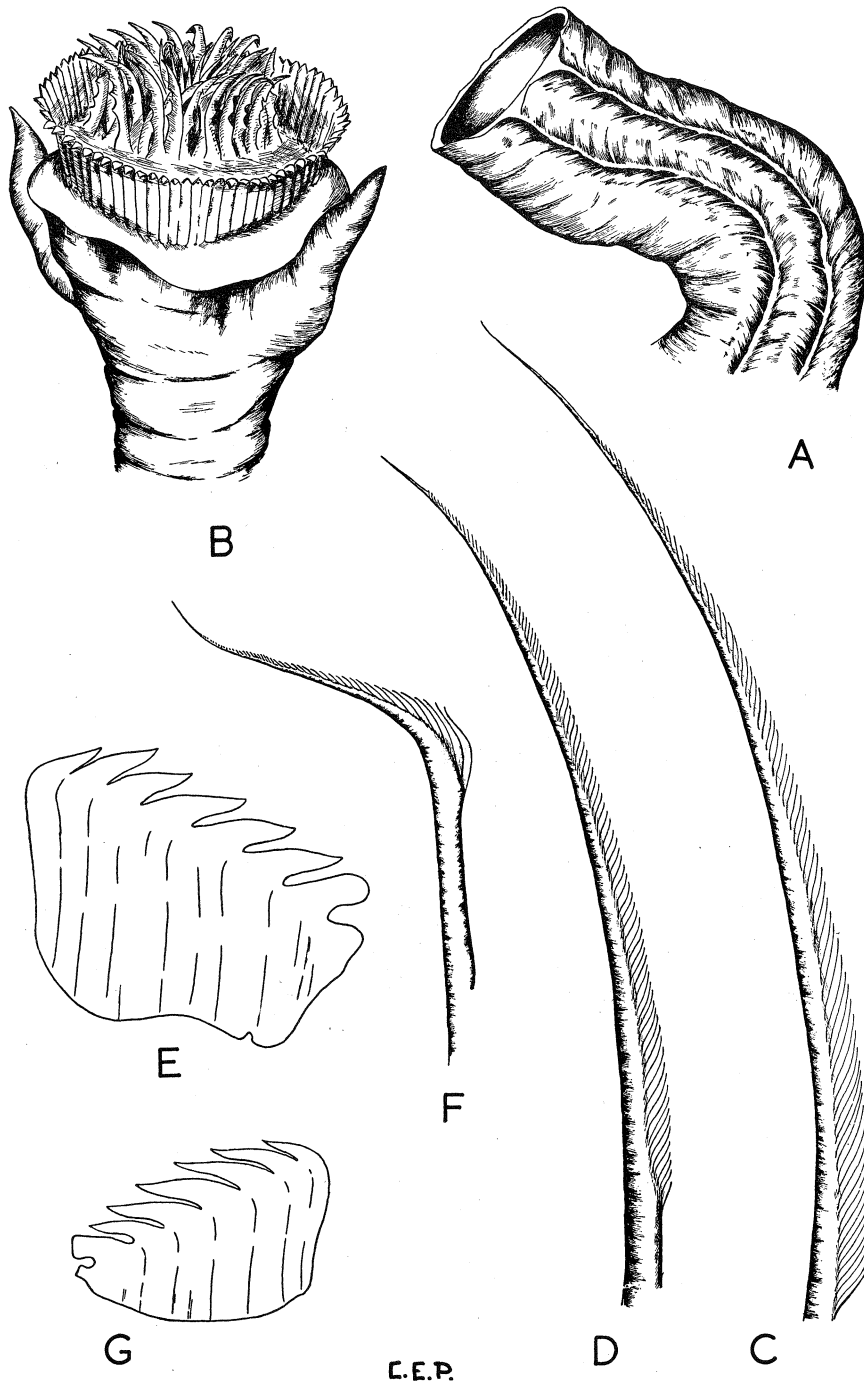


Fig. 12.—*Galeolaria hystrix*: A, tube, x 6; B, operculum, x 16; C, collar seta, x 950; D, thoracic seta, x 950; E, thoracic uncinus, x 950; F, abdominal seta, x 950; G, abdominal uncinus, x 950.

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and an adult may measure up to 16 mm in length with a tube over 30 mm long. In New Zealand both tubes and worms are larger, a tube length of 68 mm being not uncommon and the worm being between 25-30 mm long. The tubes are also found in a different habitat (at Portobello), occurring in large numbers on the upper surfaces of rocks. The indented central keels are more pronounced than the local Sydney forms, and the colour is frequently a deeper rose-pink.

*Material examined*.—New South Wales (Port Jackson, Port Hacking, Jervis Bay); New Zealand (Portobello, Dunedin).

*Distribution*.—South Australia [St. Vincent's Gulf, Spencer Gulf (Fauvel, 1917)].

#### Genus *Pomatoceros* Philippi, 1844

Operculum terminated by a flat calcareous plate, very variable in shape, with or without spines; pedicle has broad lateral wings, faintly serrated on their free edges; collar setae very small, few in number; remaining thoracic setae limbate; abdominal setae compressed and trumpet-shaped, with a long terminal point; uncini have numerous teeth, most anterior teeth being gouged.

#### *Pomatoceros terrae-novae* Benham, 1927

(Fig. 13)

*Pomatoceros terrae-novae* Benham, 1927, p. 151, Pl. V, Figs. 174-180.

*Tube*.—White, with two more-or-less marked violet or lilac stripes running each side of a central keel; circular in section, with no definite shape, following undulations of substrata; the central keel is undulate, occasionally having quite well-defined, tooth-like processes (Fig. 13A).

*Branchiae*.—15 pinnate pairs, with naked terminal filaments; pedicle arising from either side is long, smooth and cylindrical, having a pair of thin, filamentous wings close to base of operculum.

*Operculum*.—Simple, membranous, somewhat like an inverted cone, with a thin, white calcareous plate on upper surface; plate is either flat or has a slightly raised projection (Fig. 13B); rudimentary operculum is present on the opposite side, and takes the place of a damaged or lost one.

*Collar*.—Tri-lobed; lateral lobes short, not extending far up the branchiae; single ventral lobe simple and sometimes with a peak at centre. Setae (usually about 10-12) of one type, winged, slightly curved, with faint, denticulate striations. Setae of two sizes, one set being much stouter than remainder (Fig. 13C).

*Thorax*.—Thoracic membrane joining that of collar, overlapping the first few segments of thorax and sweeping back to a blunt taper at rear; whole membrane short and fragile; seven setigerous segments; remaining six segments with setae similar to those of collar, but stouter and more numerous; last segments with fewer setae (Fig. 13D); uncini with 8-10 teeth, most anterior being stouter and blunter (Fig. 13E).

*Abdomen*.—First few segments devoid of setae; remaining segments with two setae per tuft and two tufts per segment; setae trumpet-like, with long terminal filament (Fig. 13F); uncini are similar to those of thorax (Fig. 13G).

*Discussion*.—This is the first record of this species from Australia. It is recorded in Australia as a fouling organism at Geelong and Port Lincoln. At Wilson's Promontory (Victoria) and Triabunna and Storm Bay (Tasmania) it was collected in the intertidal region, while the specimens from Port Curtis, Queensland, and Lakes Entrance, Victoria, were dredged from 10 and 50 fathoms, respectively.

*Material examined* in Queensland (Port Curtis), Victoria (Mallacoota, Lakes Entrance, Wilson's Promontory, Corio Bay, Geelong); Tasmania (Triabunna, Storm Bay); South Australia (Port Lincoln).

*Distribution*.—South Trinidad.

#### Genus *Pomatostegus* Schmarda, 1861

Operculum very variable in shape; pedicle with broad lateral wings; collar setae of two kinds, (1) simple, (2) bayonet-like, covered with fine, hair-like processes; abdominal setae sickle-shaped, i.e., *Salmacina* setae; uncini with about nine teeth, most anterior ones being larger and gouged out underneath; uncinigerous tori of right and left side almost meeting on ventral side of thorax, leaving only a narrow straight depression along medial line.



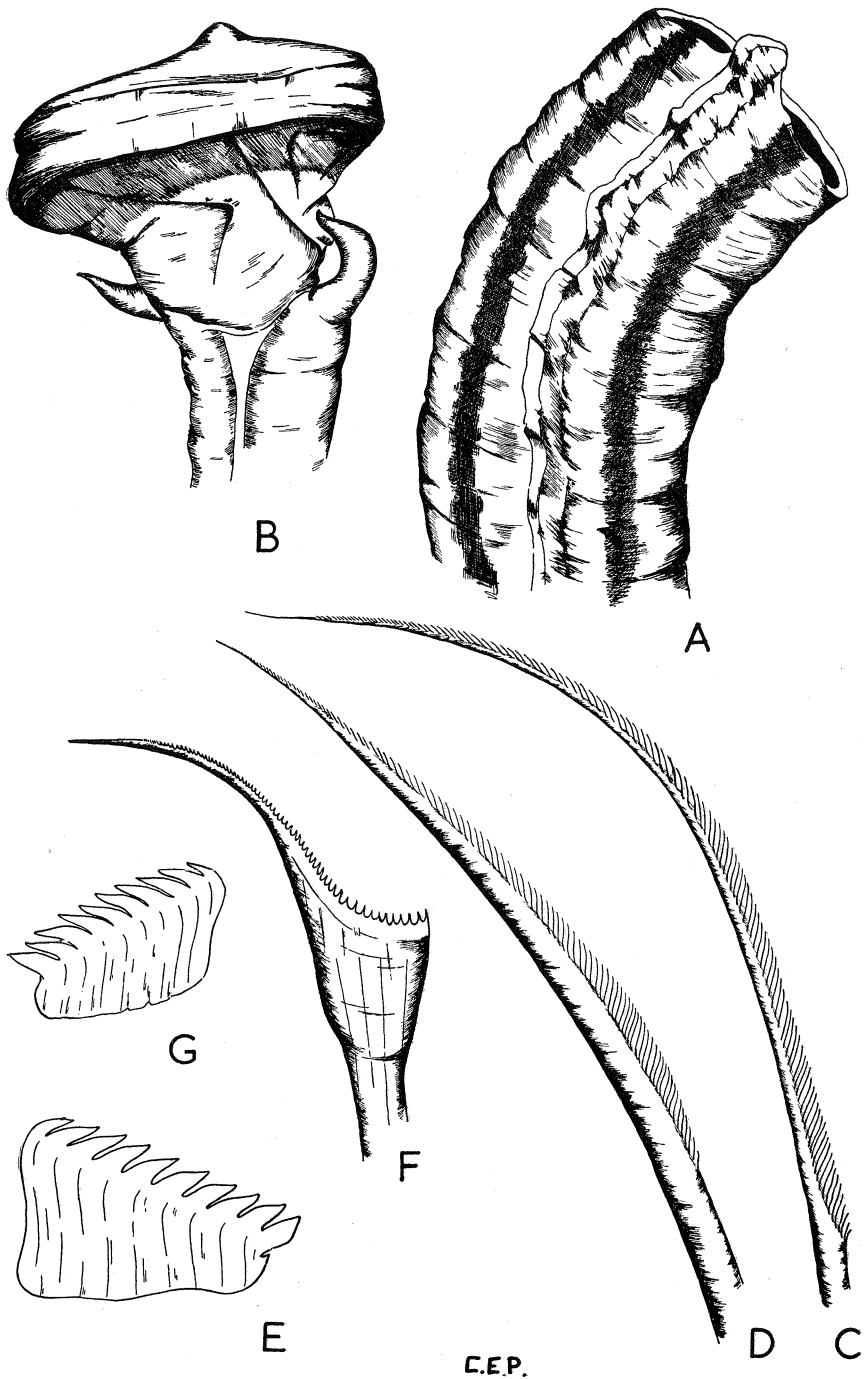


Fig. 13.—*Pomatoceros terrae-novae*: A, tube, x 13; B, operculum, x 30; C, collar seta, x 950; D, thoracic seta, x 950; E, thoracic uncinus, x 950; F, abdominal seta, x 950; G, abdominal uncinus, x 950.

## KEY TO SPECIES OF POMATOSTEGUS

1. Operculum with numerous discs on a central column ..... *P. stellatus*.  
 2. Operculum variable, flat or conical ..... *P. polytrema*.

***Pomatostegus stellatus*** (Abildgaard) 1789

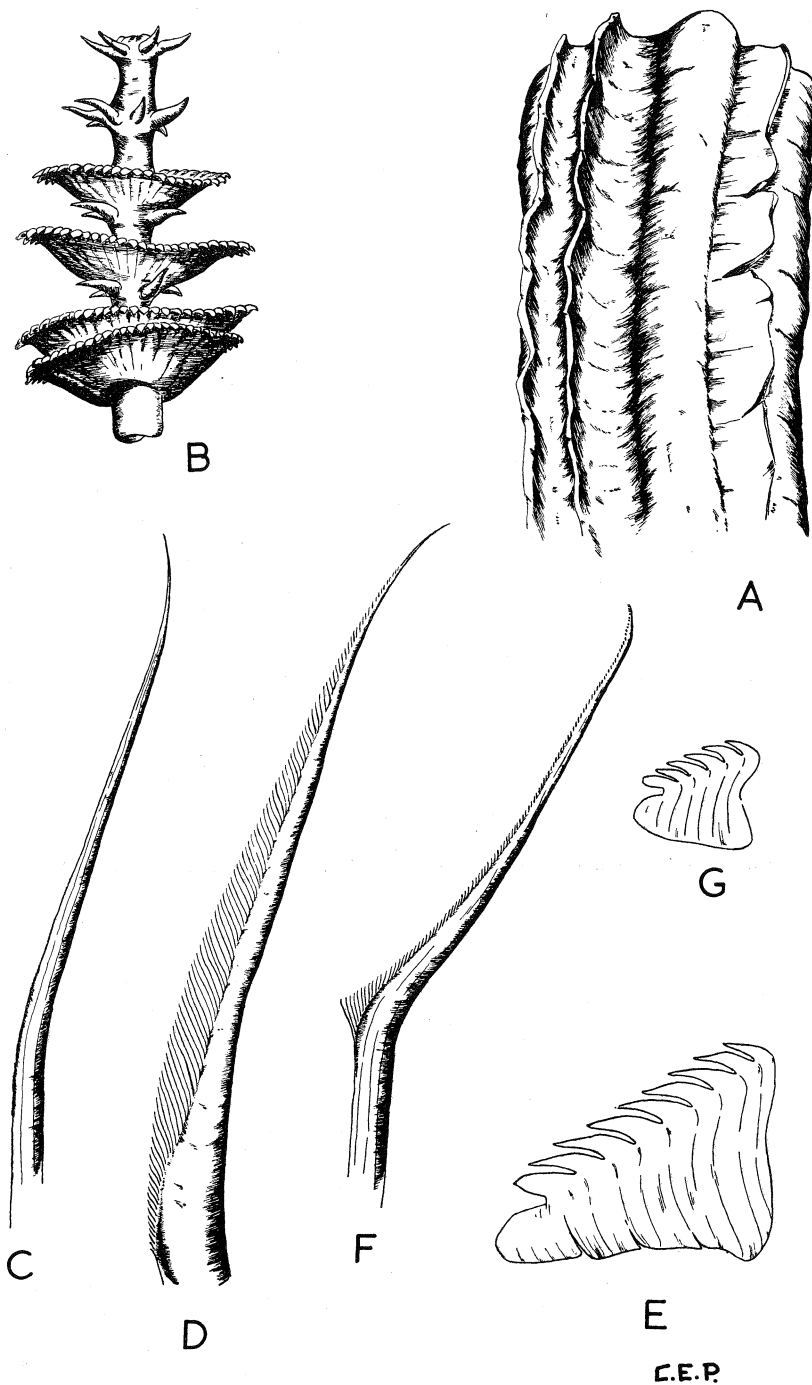


Fig. 14.—*Pomatostegus stellatus*: A, tube, x 13; B, operculum, x 12; C, collar seta, x 950; D, thoracic seta, x 950; E, thoracic uncinus, x 950; F, abdominal seta, x 950; G, abdominal uncinus, x 950.

C.E.P.

*Terebella stellatus* Abildgaard, 1789.

*Pomatostegus stellatus* Pixell, 1913, p. 79; Fauvel, 1932, p. 246 (for synonym); Okuda, 1937, p. 309; Mesnil and Fauvel, 1939, p. 34.

*Pomatostegus actinoceros* Augener, 1914, p. 152.

*Tubes*.—Whitish, thick-walled, with one to three irregular longitudinal ridges and a tooth-like projection over the mouth. (Fig. 14A).

*Branchiae*.—Short, and terminating in a short naked filament, spirally arranged with between 26 and 34 filamentous pairs; pedicle broad and winged, the wings tending to form a continuous band for the whole length of the pedicle.

*Operculum*.—With two to five serrated horny discs, borne on a central column; beneath each disc is a star-like circle of projecting spines; at upper end a circle or circles of spines sometimes take the place of discs (Fig. 14B).

*Collar*.—Entire, well-developed, and appearing to cover and protect branchiae when in tube; collar unites with the thoracic membrane, which overlaps on ventral mid-line; setae of two types—(1) simple and faintly striated, (2) bayonet-like with a finely striated border and with a slight projection towards the base of the blade (Fig. 14C).

*Thorax*.—Seven setigerous segments; remaining six segments with setae of two types—(1) simple serrated (Fig. 14D), (2) sickle-shaped (*Salmacina*) setae; winged setae in majority; *Salmacina* setae usually lose their characteristic shape in preservative; uncini with a single large terminal tooth and from nine to thirteen teeth (Fig. 14E).

*Abdomen*.—Varying number of segments; setae four per segment, are sickle-shaped and faintly serrated (Fig. 14F); uncini similar to those of thorax, but smaller and with fewer teeth (usually about six to eight) (Fig. 14G).

*Discussion*.—The material from Thursday Island, Queensland, was obtained from a "spat catcher" set to catch oyster spat. That from the Solomon Islands was removed from the shell of the hammer oyster *Malleus vulgaris*.

*Material examined* in Queensland (Thursday Island); Solomon Islands (Bougainville).

*Distribution*.—Western Australia (Shark Bay, Augener 1914); Red Sea, India, East Indies, Palau, West Indies, Atlantic Ocean.

### *Pomatostegus polytrema* (Philippi) 1844

(Figs. 15 and 16)

*Vermilia polytrema* Philippi, 1844, p. 194, Pl. VI, Fig. N.

*Pomatostegus polytrema* Saint-Joseph, 1906, p. 252, Pl. V, Fig. 118-119; Fauvel, 1927, p. 369, Fig. 127, 1-u.

*Tube*.—Pinkish to bluish-mauve, especially sides, but interior distinctly bluish; somewhat triangular in shape, and irregularly coiled; a single broad keel runs the whole length of dorsal surface and hangs over opening of tube in a tooth-like projection; two parallel rows of minute holes or pores appear along sides, one row just below keel, the other just above basal attachment (Fig. 16A); the clarity and size of pores varies considerably, as does the clarity of the ridges between them.

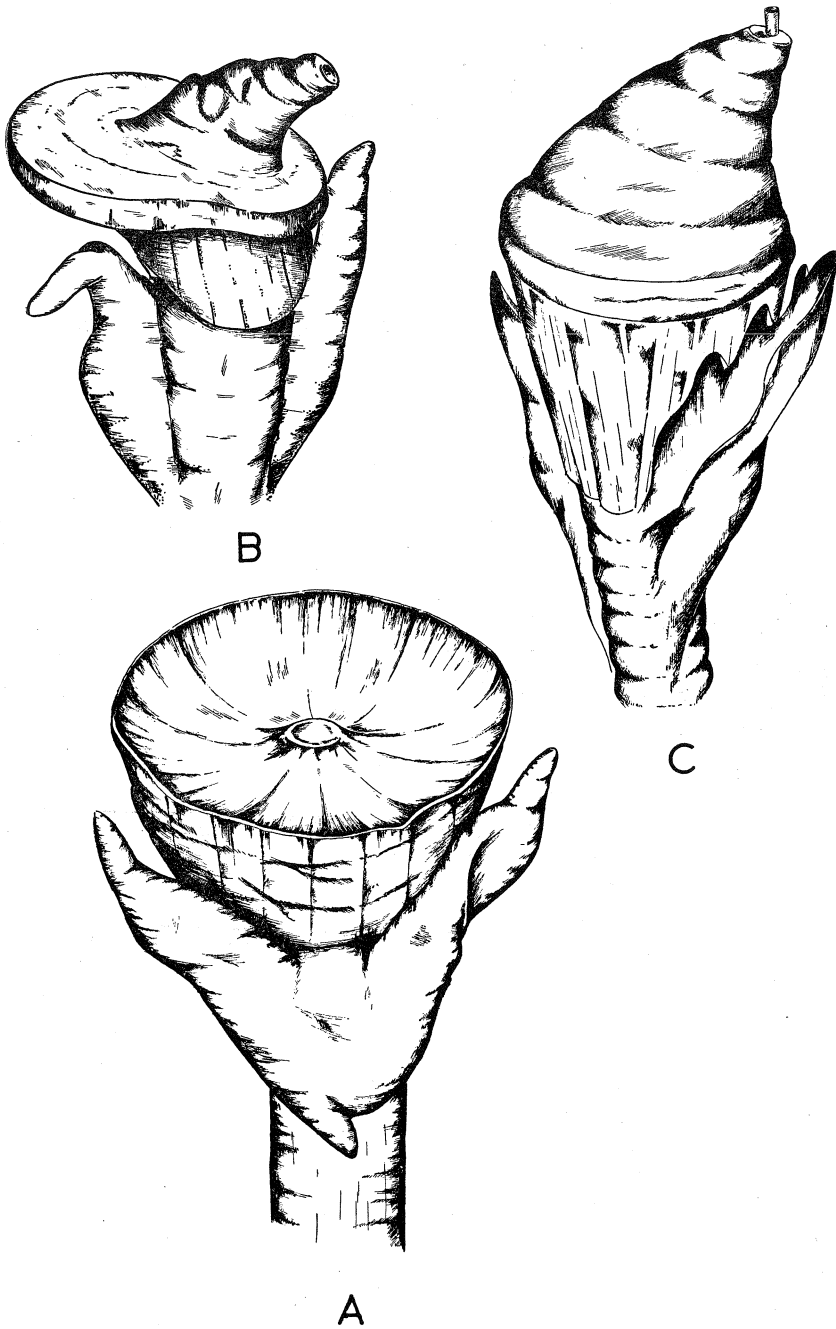
*Branchiae*.—24 pairs, with naked terminal filament; colour variable, but lower half usually yellowish-white and upper a straw colour; upper half is banded with five to six (usually five) dark brown splashes of colour on each side of mid-line; pedicle winged, arising from left branchial tuft; wings may be smooth (Figs. 15 A, B) or cut like a saw (Fig. 15C).

*Operculum*.—A flattish calcareous plate with narrow chitinous border; towards pedicle, on surface of plate, is usually seen a small flattish knob, never developing into spines or projections (Fig. 15A). Figs. 5B and 15C show some of the variations of the operculum.

*Collar*.—Tri-lobed, a large ventral and two small lateral; laterals fold back behind the ventral, giving the appearance of two upright projections; setae simple, usually 17 in number (Fig. 16B).

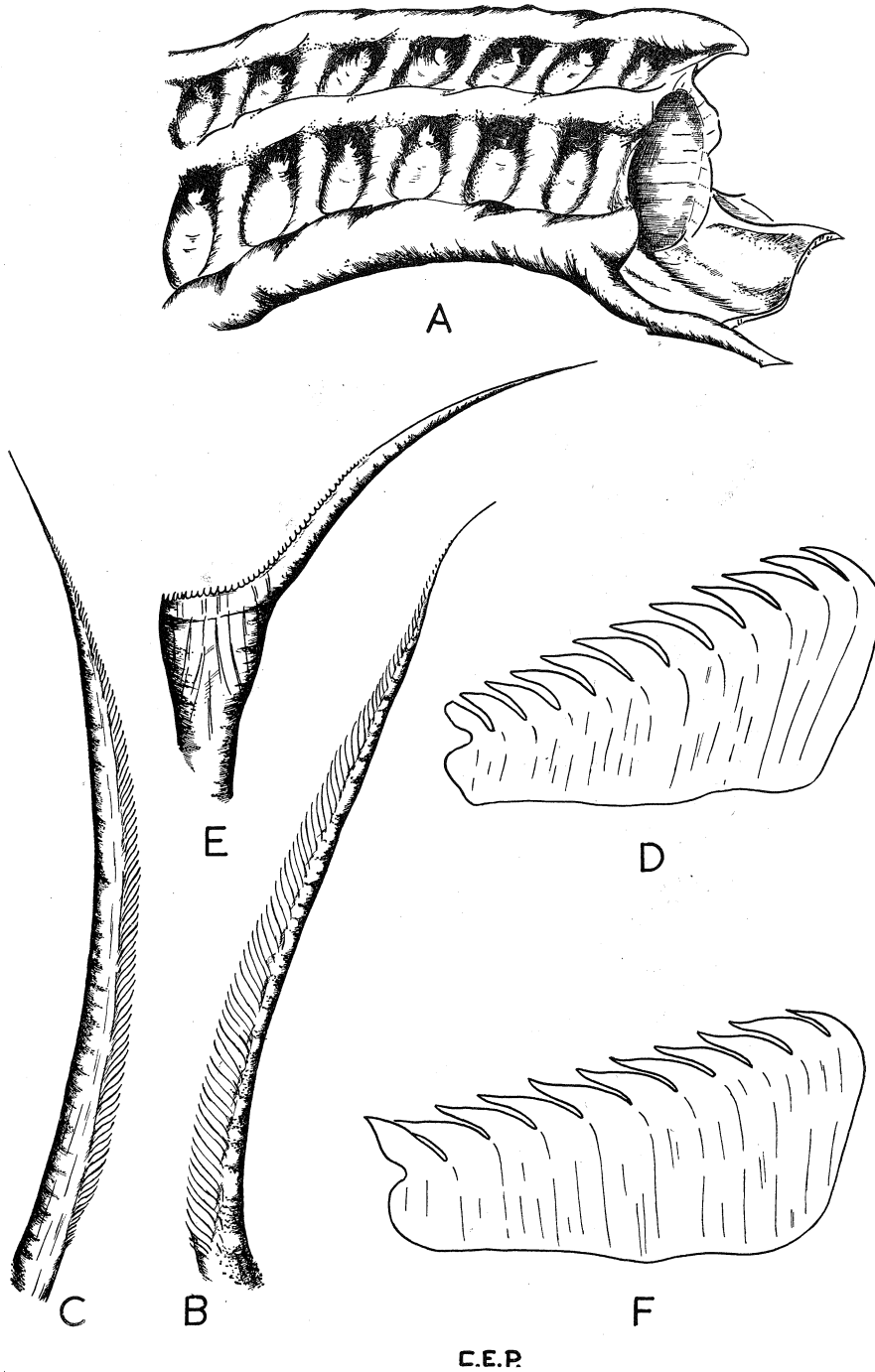
*Thorax*.—Thoracic membrane joining collar membrane and extending ventrally to cover thoracic region; seven setigerous segments; remaining six segments with stout limbate setae (Fig. 16C); uncini with 10-12 teeth, the most anterior somewhat larger and gouged (Fig. 16D).

*Abdomen*.—Setae trumpet-shaped, with a long terminal point (Fig. 16E); uncini similar to those of thorax, but smaller and with nine to 10 teeth (Fig. 16F).



C.E.P.

Fig. 15.—*Pomatostegus polytrema*: A, B, C, various forms of opercula, x 15.



C.E.P.

Fig. 16.—*Pomatostegus polytrema*: A, tube, x 7; B, collar seta, x 475; C, thoracic seta, x 475; D, thoracic uncinus, x 950; E, abdominal seta, x 475; F, abdominal uncinus, x 950.

*Discussion.*—This is the first record of this species from Australia. It has been collected at all times of the year, on stones and other submerged surfaces, both between and below tide levels. Its characteristic tube permits immediate and certain identification.

*Material examined* in New South Wales (Port Jackson; Kurnell, Botany Bay; Port Hacking; Tollgate Islands, Bateman's Bay); Victoria (Wilson's Promontory).

*Distribution.*—Mediterranean area.

#### Genus *Spirobranchus* Blainville, 1817

Operculum with calcareous plate, usually bearing a group of branched spines; pedicle winged; collar setae of two kinds—(1) simple, (2) bayonet-like and covered with fine hair-like processes; abdominal setae trumpet-shaped; uncini with numerous teeth, the most anterior one being larger and gouged out; uncinigerous tori of the two sides widely separated ventrally in front and gradually approaching one another towards the end of the thorax, thus leaving a triangular depression.

#### *Spirobranchus giganteus* (Pallas), 1766

(Fig. 17)

*Serpula gigantea* Pallas, 1766.

*Cymospira gigantea* Blainville, 1817.

*Spirobranchus giganteus* Mörch, 1863; Pixell, 1913, p. 80; Fauvel, 1932, p. 244 (for synonymy); Mesnil and Fauvel, 1939, p. 33.

*Spirobranchus semperi* Augener, 1914, p. 148 (for synonymy).

*Pomatoceros elaphus* Haswell, 1884, p. 663.

*Tube.*—Reddish-pink, with a definite blue-tinge inside; quite characteristic, strong, and somewhat triangular in section, with a marked serrated dorsal ridge and a tooth-like projection over the mouth of the tube (Fig. 17A).

*Branchiae.*—Variable in colour from a deep indigo-blue through burgundy to bright orange; others have a combination of these colours, with irregular coloured stripes; arranged spirally, number of whorls increasing with size and length of worm; specimens from tropical areas (Heron Island) tend to have five or six spirals on each side, while the specimens from the Sydney area have one or one-and-a-half spirals a side; pedicle broad and winged, the wings sometimes showing a fringed edge; pedicle usually bluish-green and arising from left side.

*Operculum.*—Variable, usually with a circular, calcareous basic plate which may be flat, concave or convex; plate carries on its superior surface a group of branched spines, which frequently have numerous short, branched, brittle secondary spines (Fig. 17B).

*Collar.*—Well-developed and brightly coloured; tri-lobed, with two lateral and a single large ventral lobe, usually notched at centre; shape variable, ventral lobe sometimes being badly shrunken, at other times folded back on itself, giving appearance of two triangular lappets; setae of two types—(1) simple (Fig. 17C), (2) bayonet-like, with numerous hair-like processes on its basic portion and a definite projection just above its junction with its main shank (Fig. 17D).

*Thorax.*—Seven setigerous segments; the six remaining segments with simple winged setae (Fig. 17E); uncini large, with up to 25 teeth, of which most anterior is stouter and hollowed out at end, giving it a gouged out appearance (Fig. 17F).

*Abdomen.*—Segments variable in number, with finely toothed geniculate setae (Fig. 17G); uncini similar to those of thorax, but slightly bigger (Fig. 17H).

*Discussion.*—Specimens collected at the Biological Laboratory of the Great Barrier Reef Committee, on Heron Island, had larger uncini and setae than the local Sydney forms. The tubes were nearly always surrounded with living coral, their branchiae making a very noticeable contrast in colour to the usual dull yellowish-green of the coral. Colours were very variable, some being immediately alcohol-soluble, others being much more resistant.

*Material examined* in Queensland (Thursday Island, Heron Island, Moreton Bay); New South Wales (Port Stephens, Norah Head, Port Jackson, Port Hacking).

*Distribution.*—Queensland (Low Isles, Monro 1931b); Western Australia (Shark Bay, Augener 1914); Indo-Pacific area, Persian Gulf, Natal.

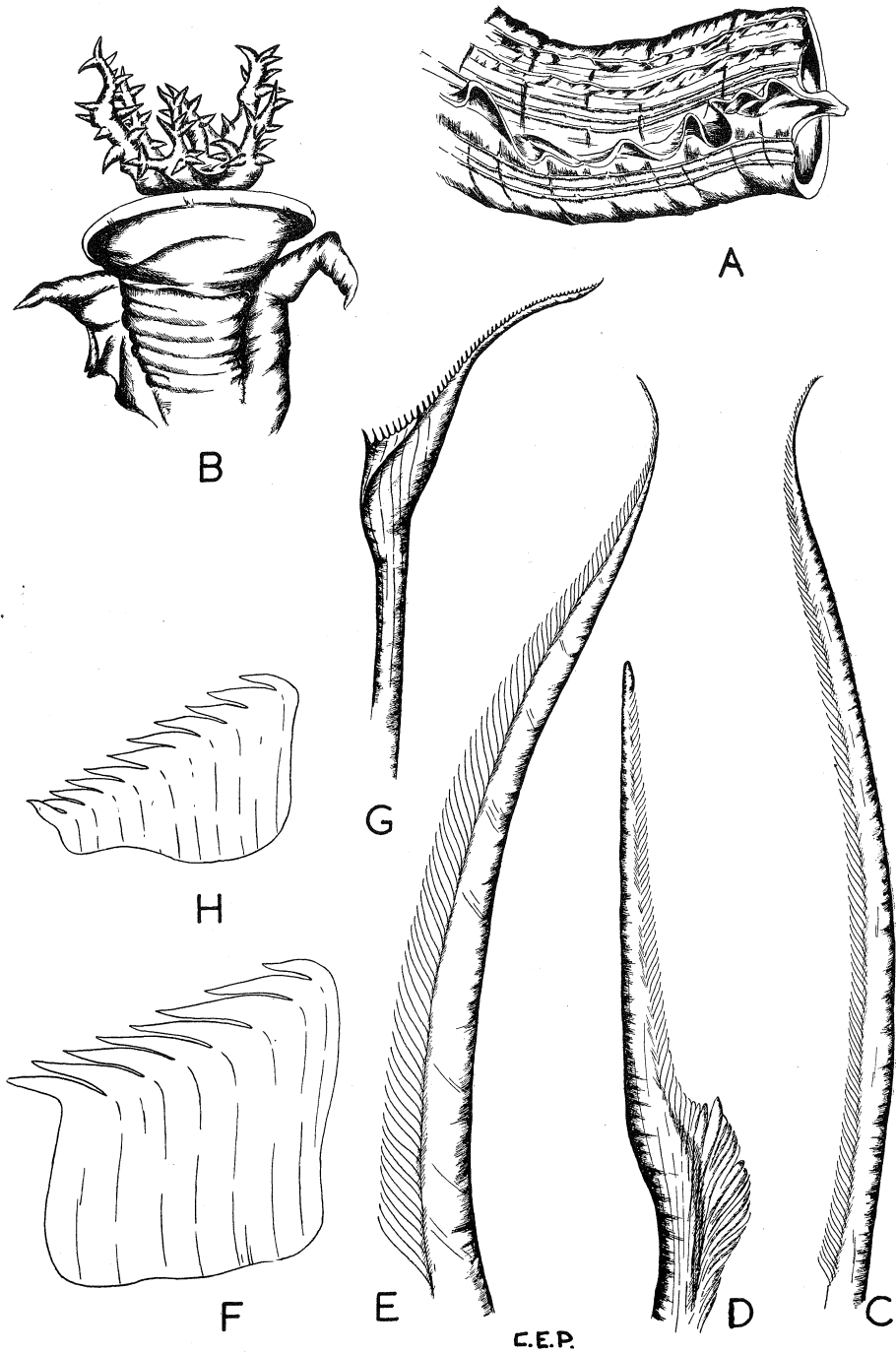


Fig. 17.—*Spirobranchus giganteus*: A, tube, x 8; B, operculum, x 14; C, D, collar setae, x 950; E, thoracic seta, x 950; F, thoracic uncinus, x 950; G, abdominal seta, x 950; H, abdominal uncinus, x 950.

Genus *Pomatoleios* Pixell, 1913

Collar setae and eye spots absent; uncini with fairly numerous teeth, the most anterior being larger and gouged underneath; abdominal setae trumpet-shaped, with one side produced into a long spine; operculum flat, with winged pedicle; tube with a flap over entrance.

*Pomatoleios kraussii* (Baird), 1864

*Placostegus cariniferus* var. *kraussii* Baird, 1864.

*Pomatoleios crosslandi* Pixell, 1913.

*Pomatoleios kraussii* Day, 1955, p. 449.

Material of this genus has not been examined, but it has been recorded from various points on the Queensland coast by Edean, Kenny and Stephenson (1956). It was recorded as *P. crosslandi*, but this species is synonymous with *Pomatoleios kraussii*.

Genus *Ditrupa* Berkeley, 1832

Operculum an inverted cone with a horny plate, usually striated, carried on a smooth pedicle; collar present, collar setae absent; uncini with numerous teeth, the most anterior one being larger, stouter and gouged; thoracic setae of two kinds—(1) simple capillary, (2) winged; abdominal setae simple capillary; tube calcareous, free-living, open at both ends and tusk-shaped, somewhat like the mollusc *Dentalium*.

## KEY TO SPECIES OF DITRUPA

1. Tube tusk-shaped, no shoulder before mouth opening ..... *D. australis*  
    Tube tusk-shaped, pronounced shoulders before mouth opening ..... 2
2. Mouth with pronounced lip, shoulders with curved slope ..... *D. amphora*  
    Mouth without pronounced lip, shoulders with straight slope ..... *D. laeve*

*Ditrupa australis* Bretnall, 1921

(Fig. 18A)

*Ditrupa australis* Bretnall, 1921, p. 156, Fig 2.

*Tube*.—Whitish or grey, circular in section and tapering to a small opening at anterior orifice; outer surface smooth, slightly curved; length variable, typical specimen being 12 mm in length and 1.25 mm in diameter at the mouth, which is the widest part.

*Discussion*.—Specimens of this species have been obtained in dredgings on muddy bottoms at depths of from one to 10 fm. No trace of the worms have been found. In spite of a search, no trace can be found of the type.

*Material examined* in Queensland (Cairns to Endeavour Reef, Burket Reef); New South Wales (Rose Bay, Double Bay, Green Point, all in Port Jackson; Gunnamatta Bay, Port Hacking).

*Ditrupa laeve* (Brazier), 1878

(Figs. 18B and 18C)

*Dentalium laeve* Brazier, 1878, p. 59.

*Cadulus laevis* Hedley, 1900, p. 499, Pl. xxvi, Fig. 8-10.

*Ditrupa brazieri* Bretnall, 1921, p. 156, Fig. 1.

*Tube*.—Whitish, circular in section, tapering to a narrow anterior orifice. The specimen examined was 7 mm in length and 0.75 mm in diameter at the widest part. At a distance of 0.5 mm from the mouth the sides sloped inwards, as in the sides of a cone, to form a mouth only 0.25 mm in diameter. There was no trace of the worm, which has never been found.

*Discussion*.—This species was originally described by Brazier in 1878 as a mollusc, *Dentalium laeve*, but this name had already been given to Schlotheim's *Dentalium laevis* (1820). Further examination by a later worker, Bretnall (1921), proved that Brazier's species was a polychaete belonging to the genus *Ditrupa*. In spite of a careful search by several people, no trace of Brazier's material can be found.

*Material examined*.—Dredged by F.R.V. "Warreen" on 26th November, 1948, at Station 229W/48 (23° 02'S and 113° 33'E), in 53 fm; bottom sand and muddy clay; sample obtained from a cone dredge, stored dry.



***Ditrupa amphora* sp. nov.**

(Fig. 18d)

*Tube*.—Chalky white; outer surface smooth and porcelain-like; circular in section; posterior end shaped very like the top of a Greek amphora, having gently curving sides and a pronounced rim around the lip of the tube, anterior end terminating in a narrow orifice; overall length 8.0 mm, diameter at the widest part 0.75 mm, mouth 0.5 mm in diameter.

*Types*.—Holotype in Australian Museum, Sydney (Cat. W.3639).

*Type locality*.—Dredged by F.R.V. "Warreen" on 18th November, 1948, at Station 218/W (23°25'S and 113°13'E), in 78 fm; bottom coral sand and coral fragments; sample obtained in a cone dredge.

*Discussion*.—This species differs from the other two species of the genus quite considerably, but is closest to *D. laeve* in general shape and colour. The chief difference lies in the shape of the lip of the tube and the slope of the shoulders. The lip of *D. laeve* is sharp and clear while that of *D. amphora* has a pronounced rim. The shoulders of *D. laeve* have a sharp straight slope to the edge of the mouth, but *D. amphora* has a well defined curve, exactly like a Greek amphora. As in the two preceding species, the tubes examined lacked animals.

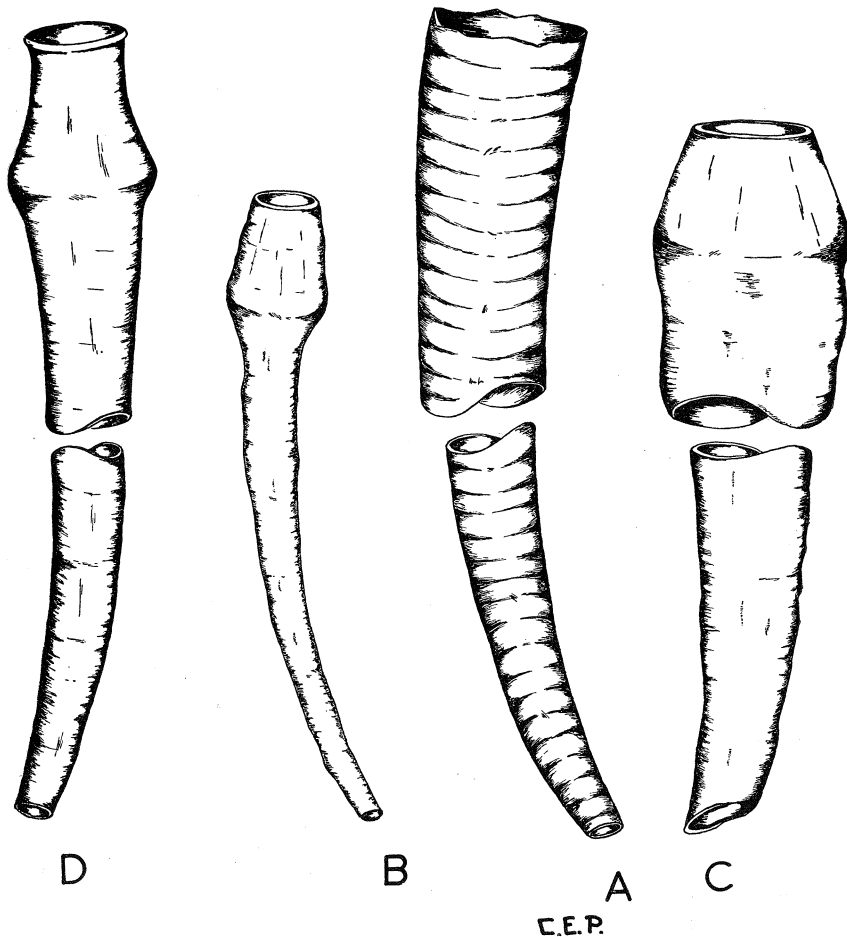
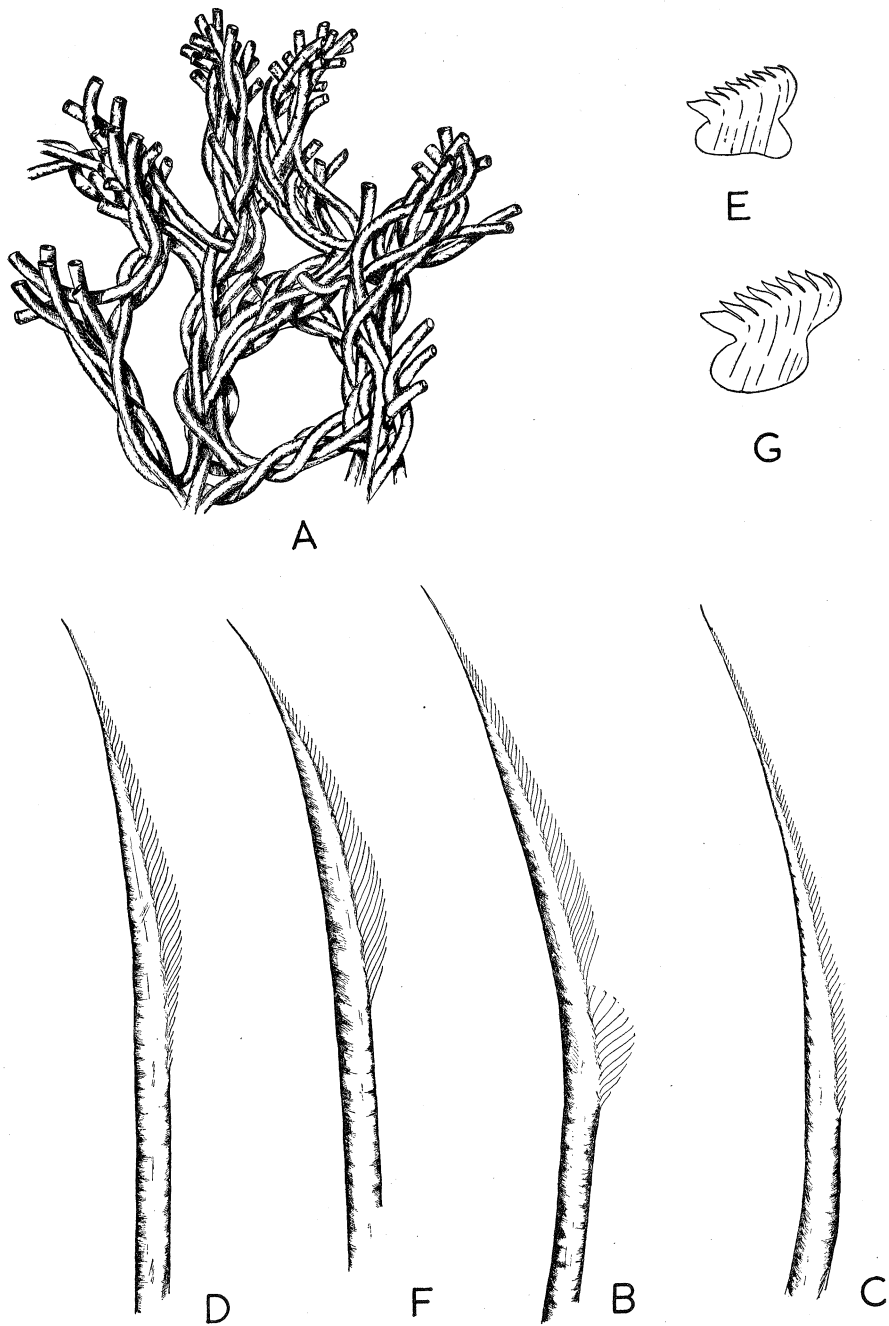


Fig. 18.—*Ditrupa* spp.; A, tube, *D. australis*; B, C, tubes, *D. laeve*; D, tube, *D. amphora*.

Genus *Salmacina* Claparede, 1868

Operculum absent; eight branchial filaments, with spatulate enlargements on their terminal ends; tubes calcareous, colonial and very fine, forming an intricate coral-like mass; uncini with numerous fine teeth, forming several rows when in front view; collar and thoracic membrane well-developed; eye spots present; hermaphrodite.



C.E.P.

Fig. 19.—*Salmacina dysteri*: A, tube, x 5; B, C, collar setae, x 950; D, thoracic seta, x 950; E, thoracic uncinus, x 950; F, abdominal seta, x 950; G, abdominal uncinus, x 950.

**Salmacina dysteri** (Huxley), 1855

(Fig. 19.)

*Protula dysteri* Huxley, 1855, p. 113.*Salmacina dysteri* Augener, 1914, p. 160; Fauvel, 1917, p. 271; Fauvel, 1927, p. 377 (for synonymy); Monro, 1931*b*, p. 31.*Salmacina australis* Haswell, 1884, p. 669; Dakin, Bennett and Pope, 1948, pp. 206 and 208.

*Tubes*.—White and fine, forming an entwining, connected compact mass (Fig. 19A); colonies covering an area of over a square foot have been recorded, and a piece of a large colony, dredged off Lakes Entrance, Victoria, measured 21.5 cm in height; a colony is formed by the budding-off of individuals from the original worm.

*Branchiae*.—Four white or colourless, on each side of a transverse mouth opening, terminal filament being spatulate in shape and having a row of glandular cells around the circumference; the projecting prostomium has two eye spots at the base.

*Collar*.—Has two lateral lobes and a single large ventral one; joins the thoracic membrane, which covers a varying number of thoracic segments; setae of two kinds—(1) simple limbate (Fig. 19C), (2) complex and more numerous (Fig. 19B); these latter are divided into two distinct parts, the upper terminal portion being finely toothed and having a fine tapering point, the lower portion having a pronounced enlargement which is strongly toothed.

*Thorax*.—Segments vary in number from five to nine (usually seven to nine); setae of two kinds—(1) simple limbate setae (Fig. 19D), (2) those which are characteristic of the genus and are known as *Salmacina* setae; uncini small, with teeth in two rows (rarely three) when seen face-on, and small and fine, anterior being much stouter and longer, when seen in profile (Fig. 19C).

*Abdomen*.—Setae geniculate, finely toothed (Fig. 19F); uncini similar to those of thorax, but larger (Fig. 19G); there is an achaetous area between thorax and abdomen; body colour variable from red-orange through pink to white; the average size from 1 mm to 3 mm, the majority being 2 mm.

*Discussion*.—This very common Serpulid has been recorded from many parts of Australia by shore ecologists. It occurs from Thursday Island south, and west to Shark Bay (Western Australia). It is frequently found on ships and fouling test plates, and is of significance as a fouling organism.

*Material examined* in Queensland (Thursday Island, Heron Island, Moreton Bay); New South Wales (Angowrie, Norah Head, Long Reef, Port Jackson, Port Hacking, Wollongong, Jervis Bay, Eden); Victoria (Lakes Entrance, Portland, Apollo Bay, Mallacoota); South Australia (St. Vincent's Gulf, Spencer Gulf); Western Australia (Albany, Fremantle).

*Distribution*.—Queensland [Mair Island, Low Isles, (Monro 1931*b*)]; Victoria [Mallacoota-Portland, (Bennett and Pope 1953)]; Tasmania [off south-west Coast, (Monro 1939)]; Western Australia [Shark Bay, (Augener 1914)]; cosmopolitan.

Genus **Protula** Risso, 1826

Operculum absent; tube large and solitary; collar setae simple blades; thoracic setae simple winged blades and *Apomatus* type; abdominal setae either bayonet-like or sickle-shaped; terminal dorsal gland present.

**Protula palliata** (Willey), 1905

(Fig. 20)

*Protulopsis palliata* Willey, 1905, p. 316, Pl. VII, Figs. 183-185; Benham, 1916, p. 161, Pl. xlviii, Figs. 51-55.*Protula palliata* Fauvel, 1911, p. 433.

*Tube*.—White, circular in section and fairly smooth, with only occasional faint, although sometimes well-marked, growth rings; solitary, fairly brittle, usually encrusted with sponges and bryozoa; growing edge white, easily seen on the under surface of rocks, etc. (Fig. 20A).

*Branchiae*.—Variable in number, usually about 25 pairs, arranged spirally, usually with  $1\frac{1}{4}$  turns; naked terminal filaments yellowish-ochre in colour, with very conspicuous bands of brilliant orange-red; between these bands are irregular whitish-yellow blotches; as these blotches approach the tip they tend to become elongated; interbranchial membrane short, extending for about one fourth of the length of the branchiae (Fig. 20B).

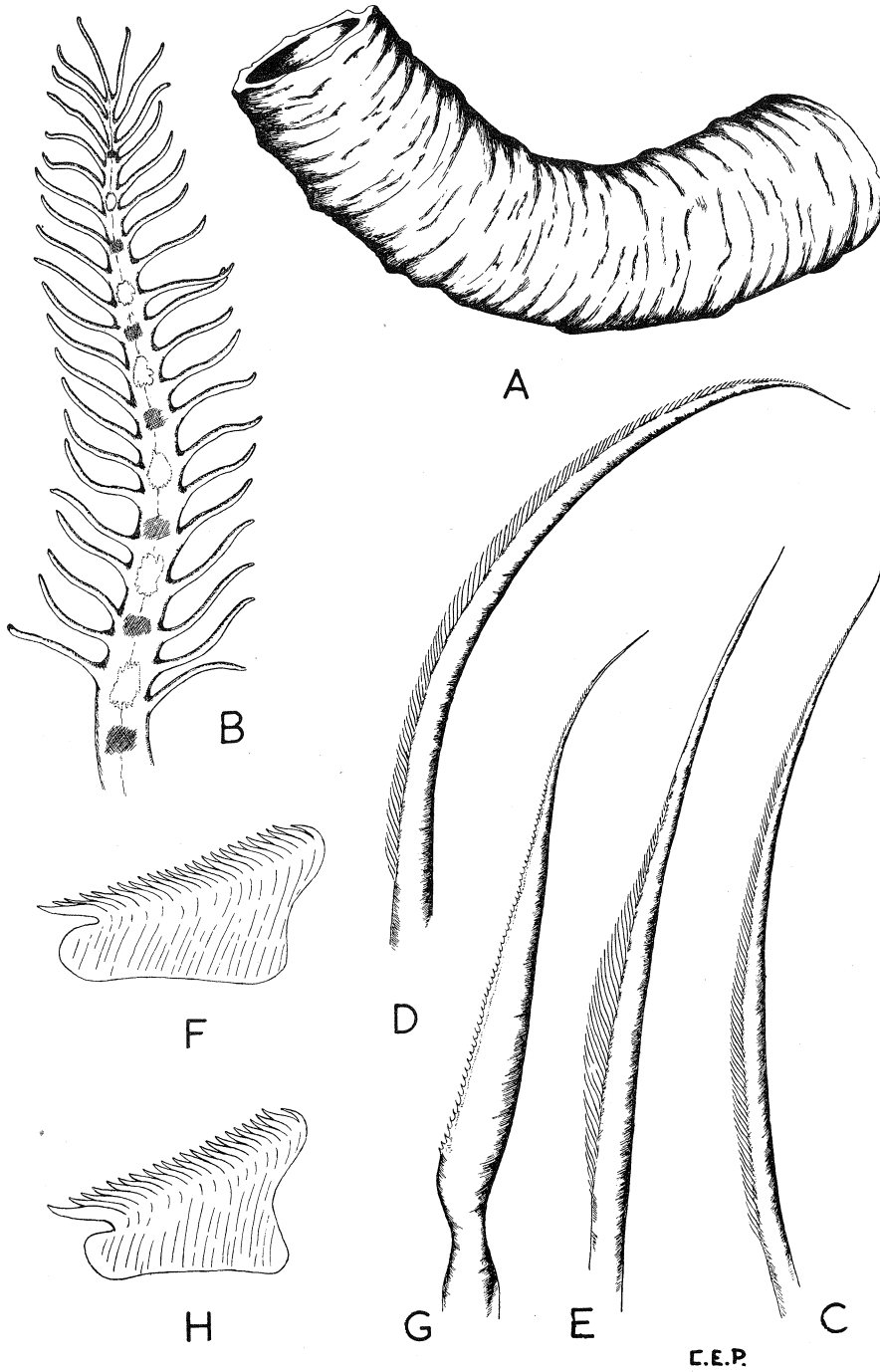


Fig. 20.—*Protula palliata*: A, tube, x 8; B, branchial filament; C, collar setae, x 475; D, E, thoracic setae, x 475; F, thoracic uncinus, x 950; G, abdominal setae, x 950; H, abdominal uncinus, x 950.

*Collar*.—Pale yellow ochre, well-developed, with three lobes of about same size; simple, limbate, capillary setae (Fig. 20C).

*Thorax*.—Thoracic membrane well-developed, forming a continuation of collar; this membrane, similar in colour to the collar, is large and undulating, tending to fold back on itself, especially along the edge; whole thorax well covered and protected; seven setigerous segments; remaining six segments with setae as those of collar (Fig. 20D), but in posterior three tufts there are setae of the *Apomatus* type (Fig. 20E); uncini with 22-25 teeth, the most anterior being elongated and narrow with a bifurcated tip (Fig. 20F).

*Abdomen*.—More than 100 segments; setae sickle-shaped and finely toothed (Fig. 20G); uncini similar to those of thorax, having 19-23 teeth, the most anterior being much longer (Fig. 20H).

*Discussion*.—This Serpulid is very common on the under surface of rocks around Sydney. Its conspicuous colour makes it easily distinguishable from any other species.

*Material examined* in New South Wales (Norah Head, Long Reef, Port Jackson, Port Hacking).

*Distribution*.—Western Australia [Shark Bay, Rottnest Island, (Augener 1914)]; Ceylon, Persian Gulf.

#### Genus *Josephella* Caullery and Mesnil, 1896

Operculum carried on the end of a branchial filament; collar well-developed; thoracic membrane rudimentary; collar setae capillary, limbate; five thoracic segments; uncini has two rows of fine teeth and two long projections arising from the anterior end; there is a long region between thorax and abdomen devoid of setae and uncini; the tube is calcareous and very fine, usually standing erect from its substrate; reproduces by budding.

#### *Josephella marenzelleri* Caullery and Mesnil, 1896

(Fig. 21)

*Josephella marenzelleri* Caullery and Mesnil, 1896, p. 482; Figs. 3-6; Fauvel, 1927, p. 380, Fig. 129 m-t.

*Tube*.—White, very fine and brittle, with faintly raised ridges; usually poorly attached to the substrata, and almost at once begin to grow away from the base at right angles; grow in clumps, each containing an individual worm, which may or may not be in the process of budding; it has not been possible to determine by what means these buds become separate from the parent and so form their own tubes.

*Branchiae*.—Two tufts, each containing three filaments, the pinnæ being fringed with actively moving cilia; one pair of filaments is much shorter than the others; one of the longer filaments, which may be on either side, is modified to carry the operculum, the pinnæ of the filament extending almost to base of operculum.

*Operculum*.—A small bell-like process, crowned with a cap surrounded by a circle of fine, upright spines, united by a fine membrane; the cap within the spines has a number of small upright knobs projecting from its surface (Fig. 21B). One specimen with two opercula, one on each side, has been examined.

*Collar*.—Well-developed, with three indistinct lobes, which are partly folded back on themselves; setae sickle-shaped, very small and fine, usually eight to a tuft (Fig. 21C).

*Thorax*.—Five setigerous segments; remaining four segments with setae of two types—(1) like those of collar (Fig. 21D), (2) sickle-shaped, without the fine striations (Fig. 21E); uncini very small, difficult to find, with a number of very fine teeth with two long, sweeping processes (Figs. 21 F, G); region between thorax and abdomen achaetous.

*Abdomen*.—Simple capillary setae which are narrow and non-limbate (Fig. 21H); uncini similar to those of thorax, but somewhat thicker and shorter (Fig. 21I).

*Discussion*.—This is the first record of this species from Australia, and it is surprising that both should be from aquaria. Although a search has been made, no sign of the worms has been found outside these localities so far. It appears that the fairly still and protected waters of aquaria suit the worms.

*Material examined* in New South Wales [Taronga Zoological Park Aquarium (Port Jackson); C.S.I.R.O. Laboratory aquarium, Cronulla (Port Hacking)].

*Distribution*.—English Channel, Mediterranean Sea.

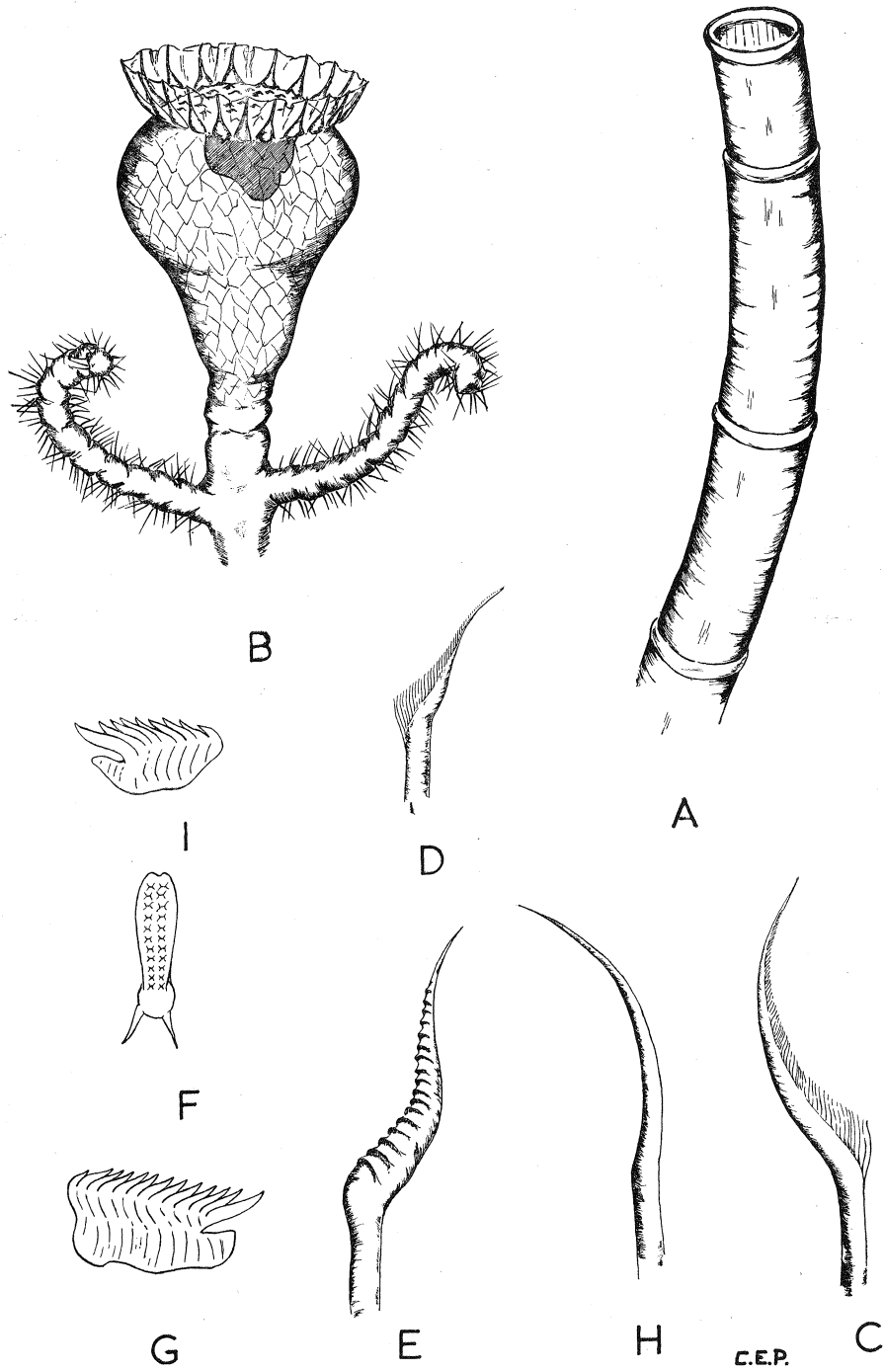


Fig. 21.—*Josephella marenzelleri*: A, tube, x 85; B, operculum, x 350; C, collar setae, x 1800; D, E, thoracic setae, x 1800; F, G, thoracic uncini, x 1800; H, abdominal setae, x 1800; I, abdominal uncini, x 1800.

Genus *Spirorbis* Daudin, 1800

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

*Discussion.*—This genus has a world-wide distribution, and is well represented in Australia. Bush (1904) described the empty tubes of *Spirorbis inversus* and *S. tridentatus* from Port Phillip, Victoria. *S. incisus* Mörch (1863) and *S. lammellosus* Lamarck (1818) have been recorded from King Island, Bass Strait. Lamarck (1818) also described *S. tricos-talis* from King George Sound, Western Australia.

Numerous species have been collected in our fouling studies, mainly on the east coast of Australia. They include at least eight species from Gunnamatta Bay, Cronulla, New South Wales. They are a complex group, and have not been included in this paper because it is hoped to make this genus the subject of a separate contribution.

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