Serpulidae (Annelida) of Lizard Island, Great Barrier Reef, Australia

ELENA K. KUPRIYANOVA1*, YANAN SUN1-2, HARRY A. TEN HOVE3, EUNICE WONG1 & GREG W. ROUSE4

1Australian Museum Research Institute, Australian Museum, 6 College Street, Sydney, NSW, 2010, Australia. Email: elena.kupriyanova@austmus.gov.au
yanan.sun@austmus.gov.au
eunice.wong@austmus.gov.au
2Department of Biological Sciences, Macquarie University, Sydney, NSW, 2109, Australia.
3Naturalis Biodiversity Center, POB 9517, 2300 RA Leiden, the Netherlands. Email: harry.tenhove@naturalis.nl
4Scripps Institution of Oceanography, UCSD, 9500 Gilman Drive, La Jolla CA, 92093-0202, USA. Email: grouse@ucsd.edu
*Corresponding author

Abstract

Serpulidae are obligatory sedentary polychaetes inhabiting calcareous tubes that are most common in subtropical and tropical areas of the world. This paper describes serpulid polychaetes collected from Lizard Island, Great Barrier Reef, Australia in 1983–2013 and deposited in Australian museums and overseas. In total, 17 serpulid genera were recorded, but although the study deals with 44 nominal taxa, the exact number of species remains unclear because a number of genera (i.e., Salmacina, Protula, Serpula, Spirobranchus, and Vermiliopsis) need world-wide revisions. Some species described herein are commonly found in the waters around Lizard Island, but had not previously been formally reported. A new species of Hydroides (H. lirs) and two new species of Semivermilia (S. annehoggettae and S. lylevaili) are described. A taxonomic key to all taxa found at Lizard Island is provided.

Key words: Serpulidae, taxonomy, new records, new species

Introduction

The annelid family Serpulidae sensu lato is large, currently comprising 70 valid genera and over 500 species (ten Hove & Kupriyanova 2009; Rzhavsky et al. 2013). Traditionally the family was divided into the subfamilies Spirorbinae, Serpulinae, and Filograninae (e.g., Rioja 1923; Fauvel 1927). Pillai (1970) elevated the Spirorbinae to family status, but a number of later phylogenetic studies (e.g., ten Hove 1984; Smith 1991; Kupriyanova 2003; Kupriyanova et al. 2006) showed that spirorbins are monophyletic and are nested within the Serpulidae. Moreover, the results of analyses of both molecular (Lehrke et al. 2007; Kupriyanova et al. 2009) and combined morphological and molecular data (Kupriyanova et al. 2006) indicate that neither Serpulinae nor Filograninae is monophyletic and that Spirorbinae is a sister group to a clade containing mostly “filogranins” and some “serpulins”. Therefore, currently the spirorbids are lowered to subfamily rank (Rzhavsky et al. 2013) and the traditional subfamilies Serpulinae and Filograninae have been abandoned pending revision and re-formulation.

Studies of serpulids in Australia are scarce. Haswell (1883, 1885) was the first zoologist who described 11 Australian serpulid species from the British Museum collections. Early studies of Australian serpulids were published by Bush (1905), Augener (1914), Benham (1916), Fauvel (1917, 1922), Johansson (1918), Bretnall (1921), and Monro (1938). Among those, only Bretnall (1921) mentions a serpulid (Ditrupa) from Queensland. Dew (1959) and Straughan (1967a, b) were the first authors dealing exclusively with serpulid polychaetes, together mentioning over 50 taxa from Thursday Island in North Queensland to Cape Jarvis in Southern New South Wales. Between 1979 and 1991 Hartmann-Schröder published 11 papers on polychaetes (including some serpulid records)

Material and methods

The present work is based on the serpulid material collected at Lizard Island by Harry ten Hove in 1983 and 1986, Richard Smith (James Cook University, Australia) in 1984–1986, Elena Kupriyanova and Greg Rouse in 2005, Charlotte Watson and Chris Glasby (both MAGNT, CReefs surveys http://www.aims.gov.au/creefs/field-program.html) in 2008 and 2009, and Yanan Sun, Elena Kupriyanova, and Pat Hutchings (Lizard Island Polychaete Workshop) in 2013. Locality data for material collected in 2013 during the Lizard Island Polychaete Workshop (MI QLD xxxx) are provided in the Appendix of Ribas & Hutchings (2015, Zootaxa 4019) together with maps showing sites.

The specimens are deposited in the following museum collections: AM—Australian Museum, Sydney, Australia, BM(NH)—British Museum (Natural History), nowadays Natural History Museum, London, UK, MAGNT—Museum and Art Gallery of Northern Territory, Darwin, Australia, MBMCAS—Marine Biological Museum of the Chinese Academy of Sciences, Qingdao, China, SAM—South Australian Museum, Adelaide, Australia (some material lacks registration numbers), SMF—Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt, Germany, and ZMA—Zoological Museum of Amsterdam, nowadays incorporated in the Naturalis Biodiversity Center, Leiden, the Netherlands. Other abbreviations used: NSW—New South Wales, NT—Northern Territory, Qld—Queensland, WA—Western Australia.

Live specimens were examined in the laboratory of Lizard Island Research Station (LIRS) and were photographed by G. Rouse in 2005 and by A. Semenov in 2013. Fixed specimens were completely or partially removed from their tubes, stained with methyl blue to increase contrast, and were viewed under a dissecting microscope Leica MZ8. Selected fixed specimens were photographed by Eunice Wong with Spot Flex CCD 15.2 camera fitted on a Leica MZ16 dissection microscope at the AM. Helicon Focus 5.3 Pro software was used to create a sharply focussed photomontage, using the layers of partially focused images captured. Number of specimens listed under each registration number is one unless otherwise specified.

Taxonomic account

Genus Crucigera Benedict, 1887

Type-species. Crucigera websteri Benedict, 1887

Diagnosis. (from ten Hove & Kupriyanova 2009). Tube white or yellowish, opaque, circular to semi-circular in cross-section, with or without longitudinal keels and/or peristomes; tabulae may be present. Granular overlay absent, but outer layer may be shingly hyaline. Operculum soft, funnel shaped, formed of fused radii. Base of funnel with 2–4 finger-like bosses. Peduncle smooth, cylindrical, without wings, separated from operculum by constriction; inserted proximal from first and/or second dorsal radiole on one side. Pseudoperculum present. Arrangement of radioles in two half to complete circles, up to 50 radioles per lobe in larger taxa. Inter-radioral

Remarks. The genus, with five species, was thoroughly revised by ten Hove & Jansen-Jacobs (1984). It is most similar to the nominal genus Serpula, the only difference being the finger-like bosses below the opercular funnel. However, a molecular phylogenetic study by Kupriyanova et al. (2008) demonstrated that both traditional genera Crucigera and Serpula most probably are paraphyletic.

Crucigera tricornis Gravier, 1906
(Fig. 1A, B)


Diagnosis. Operculum a shallow funnel with three large elongated proximal processes; tube with 6–9 longitudinal keels (Fig. 1A, B).

Remarks. According to descriptions and illustrations of Imajima (1977) and Imajima & ten Hove (1984), the tube of this species is white with 7–9 sinuous longitudinal keels, with a row of pits between the keels. However, at least one specimen from Lizard Island (Fig. 1B) had a yellowish tube with straight longitudinal keels and numerous transverse ridges.

Distribution. Red Sea, Japan, Australia; widely distributed in the Indo-West Pacific.
FIGURE 1. A. Crucigera tricornis, live animal, stn. G231, SAM E3587; B. Live animal, stn. G238, AM W.47450; C. Dasynema chrysogyrus, anterior lateral view of fixed specimen (stained with methylene blue), operculum missing, AM W.45087, arrow indicates radiolar stylodes. Photo: A, B—G. Rouse, C—E. Wong. Scale bars: A = 1 mm, B = 1 mm, C = 0.5 mm.
Genus *Dasynema* Saint-Joseph, 1894

**Type-species.** *Serpula chrysogyrus* Grube, 1876


**Remarks.** This poorly known monotypic genus is easily recognizable because of its characteristic feature, outwardly directed stylodes on the radioles, which is unique for serpulids. For a detailed differential diagnosis see Imajima & ten Hove (1984: 55).

*Dasynema chrysogyrus* (Grube, 1876)  
(Fig. 1C)

*Serpula chrysogyrus* Grube, 1876: 73 [Philippines].  
*Serpula chrysogyrus.*—Grube 1878: 276–278, pl. 15, fig. 8 [Philippines]; Andrews 1891: 289 [same]; McIntosh 1926: 412 [same].  
Not *Dasynema chrysogyrus.*—Nishi 1993c: 145–146, figs 1, 2 [Okinawa, Japan; see Remarks].

**Material examined.** AM W.45087, MI QLD 2424; ZMA V.Pol. 4539 (2), stn.18, lagoon near East entrance, sheltered side of reef, near sandy bottom, 2–20 m, coll. H. ten Hove, 3 Mar 1986; ZMA V.Pol. 4540, stn.20, reef front north of South Island, sloping reef outside lagoon & sandy bottom below, 10–17 m, coll. H. ten Hove, P. Hutchings & M. Reid, 5 Mar 1986.

**Diagnosis.** Tubes elaborate with five longitudinal ridges of tubercles; pale dull yellow with white ridges. Radioles with slender external stylodes in a single row; paired eyespots at the base of stylodes. Operculum with light-brown chitinous cap.

**Remarks.** The preserved material of *Dasynema* could be mistaken for species of *Vermiliopsis glandigera/pygidialis*-complex based on tube and opercular characters since stylodes have to be teased carefully away from the radiole to be seen in some specimens. The record of *Dasynema* in Okinawa (Nishi 1993c) is based on a misidentification because the reported specimen lacks stylodes and thus, does not belong to this genus (Nishi pers. comm.), but probably belongs to the *Vermiliopsis glandigera/pygidialis*-complex.

**Distribution.** Philippines: Ponape Island, Eastern Caroline Islands; Okinawa, Japan; Qld, Australia; Marshall Islands. First record for Lizard Island.

Genus *Hydroides* Gunnerus, 1768

**Type-species.** *Hydroides norvegica* Gunnerus, 1768

Remarks. The genus in Australia was recently revised by Sun et al. (2015) to include 26 taxa, 9 of which were found off Lizard Island.

Hydroides albiceps (Grube, 1870) (Fig. 2)

Serpula (Eupomatus) albiceps Grube, 1870: 520–521 [Red Sea].
Hydroides minax (not Grube).—Gibbs 1971: 203 [Solomon Islands].


Diagnosis. Opercular verticil with 6–13 spines, curved outward, with rectangular to clavate tips, without any accessory spinules. Dorsal verticil spine vesicular, consisting of a bulbous median part, and two latero-dorsal more or less triangular (seen from the dorsal side) outpockets; the three parts vary considerably in relative size. Funnel with 14–31 clavate to bottle-shaped chitinized radii, bluntly rounded in juveniles, base of funnel not chitinized. Grooves separating radii extending 1/2 of funnel length (Fig. 2).

Remarks. The species is most similar to Hydroides trivesiculosa Straughan, 1967b. According to Sun et al. 2015, H. albiceps differs from H. trivesiculosa in the size and shape of the dorsal verticil spine. H. trivesiculosa has an exceptionally large vesicular dorsal verticil spine which is more than 5 times longer than the smaller verticil spines. The lateral outpockets of the dorsal verticil spine are straight in H. albiceps, while those of H. trivesiculosa are larger and curved ventrally.

**Hydroides externispina Straughan, 1967b**

(Fig. 3)

*Hydroides externispina* Straughan, 1967b: 31–33, fig. 3 [Heron Island, Qld; material studied].

*Hydroides externispina.—Imajima 1976a: 232 [diagnosis; Japan]; 1976b: 126–127, fig. 3a–k [South-Western Japan; description]; ten Hove & Kupriyanova 2009: 53 [name only]; Sun *et al.* 2015: 32–34, fig 8 [WA, Qld, Australia].

*Hydroides externispinosa* [in error].—Day & Hutchings 1979: 144 [Qld; name in checklist].
FIGURE 3. Hydroides externispina. A. Live animal in tube, AM W.45056; B. Fixed specimen, various views of the same operculum. Photo: A—A. Semenov, B—E. Wong. Scale bars: A = 1 mm, B = 0.1 mm.
Material examined. AM W.45056, MI QLD 2406; AM W.45086, MI QLD 2424; MAGNT W025511, southwest of Palfrey Island, lagoon, 14°41’42"S, 145°26’50"E, coral rubble, 4 m, coll. M. Ekins, 13 Apr 2008; MAGNT W025514, lagoon southwest of Palfrey Island, 14°41’42"S, 145°26’30"E, coral rubble, 4 m, coll. M. Ekins, 15 Apr 2008.

Diagnosis. Opercular verticil with 8–10 spines, ending into sharply pointed tips, curved inwards. Two dorsal verticil spines long and curved inwards, with pair of proximal lateral spinules. Dorsal spines covering other verticil spines, the latter with one curved external spinule on 1/3 of the incurring sharp tip, with a pair of lateral spinules curving outward and a small basal spinule. Funnel with 24–36 pointed chitinized tips, base of funnel not chitinized. Grooves separating radii extending 1/3 of funnel length (Fig. 3).

Remarks. Hydroides externispina is easily recognisable because of its two large, strongly curved inwards dorsal verticil spines as well as dark curved outwards lateral and external spinules. This species can be confused with H. tambilagamensis Pillai, 1961 because of similar dark curved outwards lateral spinules on the verticil spines in both species. H. externispina differs from H. tambilagamensis by the presence of two enlarged curved inwards dorsal verticil spines, whereas in H. tambilagamensis all verticil spines are of the same size. The presence of these two large inwards-curved dorsal verticil spines makes H. externispina similar to H. glasbyi Sun et al., 2015, however, the latter species lacks conspicuous externally curved lateral spinules on smaller verticil spines.

Distribution. Indo-West Pacific: Southwestern Japan, Indonesia, New Caledonia; Qld, WA, Australia.

Hydroides lirs n. sp. (Figs 4, 5)


Diagnosis. Opercular verticil with a basal column and 11–12 spines (Figs 4A, 5A). All verticil spines with pointed tips and one pointed internal spinule each at mid-length. Dorsal verticil spine large hook, strongly curved inward and bearing a pair of lateral spinules distally; other spines similar in size and shape, curved outwards. Central tooth absent. Funnel with 20–30 chitinized radii ending in long pointed tips; radii each bearing a minute internal spinule basally; base of funnel elongated, chitinized. Grooves separating radii extending 1/2 of funnel length.

Description. TUBE: white, width 3.86 mm (4.24 ± 0.92 mm, n = 3, 3.57–4.24 mm), with lumen of 3.14 mm (2.76 ± 0.66 mm, n = 3, 2–3.14 mm). Circular in cross section, without longitudinal ridges.

BRANCHIAE: with 20 radioles on left lobe, 24 radioles on right lobe (21.2 ± 1.3 left radioles, n = 5, 20–23; 22.6 ± 1.95 right radioles, n = 5, 20–25), arranged in semicircles, not connected by inter-radiolar membrane (Fig. 4B). Branchial eyes absent.

PEDUNCLE: smooth, circular in cross section, inserted just below first and second normal radioles; with clear chitinized constriction at the base of the funnel (Fig. 4A). Pseudoperculum present.

OPEPERCULUM: with distal verticil inserted on short stalk into proximal oblique radially symmetrical funnel. Verticil with 11 spines (11.4 ± 0.55, n = 5, 11–12), with pointed tip; one dorsal hook stout, elongated, curved inward, with a pair of subterminal lateral spinules; other verticil spines curved outwards, with one inner spinule at about half of their length (Figs 4A, 5A). Basal spinule absent. Funnel with 34 (50 ± 10.3, n = 5, 34–62) sharp chitinized radii, each radius with one curved basal tooth. Grooves separating radii extending 1/3 to 1/2 of funnel length. Length of operculum 2.33 mm (3.27 ± 0.64 mm, n = 5, 2.33–4 mm), width 1.37 mm (1.93 ± 0.48 mm, n = 5, 1.37–2.67 mm).

COLLAR AND THORACIC MEMBRANES: collar low, continuous with thoracic membranes, forming apron across anterior abdominal chaetigers.

THORAX: with collar chaetiger and 6 uncinigerous chaetigers. Collar chaetae of two types: bayonet with two short conical teeth (Fig. 5B) and limbate. Subsequent chaetae limbate, of two sizes. Uncini along entire thorax saw-shaped with 6–7 teeth (Fig. 5C).
FIGURE 4. Hydroides lirs n. sp. A. Fixed specimen, various views of the same operculum, AM W.41749; B. Live animal in tube, AM W.43967. Photo: A—E. Wong, B—A. Semenov. Scale bars: A = 0.1 mm, B = 1 mm.
FIGURE 5. *Hydroides liris* n. sp., AM W.42366, SEM images. A. Operculum, top view; B. Collar chaetae; C. Uncini of thoracic chaetiger; D. Uncini of anterior abdominal chaetiger; E. Flat trumpet-shaped chaetae of mid-abdominal chaetiger; F. Uncini of mid-abdominal chaetiger. Photo: A–F—Y. Sun & S. Lindsay. Scales: A, B = 0.1 mm, C–F = 0.01 mm.

ABDOMEN: abdominal chaetigers 140 (131 ± 10.3, n = 3, 120–140 mm). Chaetae flat trumpet-shaped (Fig. 5E), uncini saw-shaped anteriorly (Fig. 5D, F), with pointed fang and 4–5 teeth; rasp-shaped with 2–5 rows of teeth and fang and up to 4–5 teeth in profile view posteriorly. Simple capillaries present posteriorly.

SIZE: length 16.7 mm (24.6 ± 8.26 mm, n = 5, 16.7–34.3 mm). Width of thorax 2.57 mm (2.46 ± 0.23 mm, n = 5, 2.14–2.71 mm). Branchiae and operculum accounting for 1/5 of entire length.

COLOUR: verticil spines and tips of funnel radii yellow. Base of branchial crown purple, brown, yellow bands present above the purple base, the middle region of branchial crown with white bands, terminal brown to yellow (Fig. 4B).

ECOLOGY: found from subtidal, 10–20 m, embedded in corals.
**Hydroides longispinosa** Imajima, 1976a

(Fig. 6)

*Hydroides longispinosa* Imajima, 1976a: 240–246, fig. 5 [Ogasawara Islands, Southern Japan].


*Hydroides longispinosa.*—Meng et al. 1994: 46, figs 3, 1–9 [Hainan Island, South China Sea]; Sun & Yang 2000: 119 [South China Sea]; Sun et al. 2015: 46–50, Fig. 14 [Qld, NSW, Australia].


FIGURE 6. Hydroides longispinosa, opercula of fixed specimens, AM W.42327 (bottom right), AM W.42333 (the rest). Photo: E. Wong. Scale bars = 0.1 mm.
with two opercula showed one smooth central spine and one with lateral pinnules. Because the smooth central
Material of Fiege & Sun (1999) included specimens with smooth central spines in the verticil, but one specimen
Fiege & Sun (1999: 118) synonymised
Island, Tonga.

Hydroides minax.

Hydroides monoceros.

Eupomatus minax.

Serpula minax

Distribution. Indo-West Pacific, from Qld, Australia to South Japan and Micronesia, South China, Ponape
Island, Tonga.

Hydroides minax (Grube, 1878)

(Fig. 7)

Serpula minax Grube, 1878: 269–271, pl. 15, fig. 5 [Philippines; original description].

Eupomatus minax.—Willey 1905: 314 [Sri Lanka].

Serpula (Hydroides) monoceros.—Gravier 1906a: 110–111 [Red Sea; description]; 1906b pl. 8 fig. 288 [same]; 1908: 115–117, figs 467–472 [same].


Not Hydroides minax.—Gibbs 1971: 203 [Solomon Islands; see H. albiceps].

Diagnosis. Opercular verticil with 7–11 spines, dorsal one stout, elongated, terminating in three sharply pointed ventrally curving hooks that may be of similar size, but generally one large terminally and two smaller ones laterally; other verticil spines short, curved outwards, with pointed tips. Spinules and central tooth absent. Funnel with 22–26 chitinized radii ending in swollen or sharp tips, base of funnel elongated, chitinized, merging into constriction. Grooves separating radii extending 1/2 of funnel length (Fig. 7).

Remarks. *Hydroides minax* can be easily confused with *H. lirs* n. sp. (see Remarks after description of *H. lirs* n. sp.). In addition to morphological differences, the two species appear to differ ecologically: specimens of *H. minax* were collected from coral rubble or rocks, while those of *H. lirs* n. sp. were found embedded in living corals.


*Hydroides cf. recta* Straughan, 1967
(Fig. 8)

*Hydroides novaepommeraniae* (not Augener, 1925).—Kupriyanova et al. 2008: 428–430 [Lizard Island, Qld; DNA data].

*Hydroides cf. recta*.—Sun et al. 2015: 71–74, fig. 23 [Lizard Island, Qld, Australia].


Diagnosis. Opercular verticil small, with 7–11 straight spines, ending in pointed tips (Fig. 8). AM W.44229 and AM W.45071 with all verticil spines smooth, similar in size and shape, spinules absent. SAM E3599 with one dorsal verticil spine slightly larger than others with subterminal inner spinule, a tiny inner basal spinule present on each spine. Funnel hardly chitinized, with 14–21 radii ending with pointed to swollen tips. Grooves separating radii extending 1/3 of length of wide part of funnel; funnel extending down to constriction for a length equalling 1/2 of that of the peduncle.

Remarks. Although Sun et al. (2015) re-examined a paratype of *H. longistylaris* (MBMCAS MBM40) and the holotype and paratypes of *H. recta*, they could not attribute the specimens from Lizard Island to either of these two nominal taxa. A similar specimen has been recorded from the Solomon Islands under the name *Hydroides (aff.) recta* (BMNH 1970: 829, identifications by H. Zibrowius 1972, H. ten Hove 1986). Because we do not have any additional data on these forms other than the slightly ambiguous data in Sun et al. (2015), we refrain from describing this material as a new species.

Distribution. Lizard Island, Qld, Solomon Islands.

*Hydroides tambalagamensis* Pillai, 1961
(Fig. 9)

*Hydroides tambalagamensis* Pillai, 1961: 36–38, fig. 12 [Tambalagam Lake, Sri Lanka].

*Hydroides tambalagamensis*.—Straughan 1967b: 33, fig. 3g [Heron Island, Qld; diagnosis]; Imajima 1976a: 231–132 [diagnosis, Japan]; Imajima 1976b: 123–126, fig. 2a–j [Tanega-Shima, Japan]; Imajima 1979: 167 [Kii Peninsula, Japan]; Imajima & ten Hove 1984: 49 [Majuro, Marshall Islands, Lizard Island, Qld; synonymy]; ten Hove & Kupriyanova 2009: 54 [name only]; Sun et al. 2012a: 21 [Hong Kong, description]; Sun et al. 2015: 82–85, fig. 27 [WA, NT, Qld, Australia].


290  Zootaxa 4019 (1)  © 2015 Magnolia Press  KUPIRIYANOVA ET AL.
FIGURE 8. *Hydroides cf. recta*, various views of the same operculum, stn.G238, SAM E3599. Photo: E. Wong. Scale bar = 0.1 mm.

Material examined. AM W.38609, North Point, 14°40’S, 145°28’E, 20 m, coll. P. Hutchings, 9 Mar 1986; AM W.45050, MI QLD 2406 (5); AM W.45058, MI QLD 2406; AM W.45064, MI QLD 2413; AM W.45417, MI QLD 2446 (2); AM W.45418, MI QLD 2446; AM W.46430, Hicks Reef Outer Barrier, Fore Reef, 4°28’48”S, 145°29’12”E, coral rubble, 2–18 m, coll. C. Watson & K. Mills, 14 Feb 2009; AM W.46431, Day Reef, Fore Reef, 14°28’18”S, 145°31’48”E, coral rubble, 10 m, coll. M. Blazewicz-Paskowycz, 13 Feb 2009; SAM E3598 (2), stn.G232, between First Beach and Osprey Island, 1 m, coll. G. Rouse & E. Kupriyanova, 26 Oct 2005.

Diagnosis. Verticil with 7–8 sub-equal spines (no larger dorsal spine). Each verticil spine curved outwards and ending in pointed tip, bearing a pair of outwardly curved lateral spinules at about half of its length, an inwardly curved radial spine at the same place or slightly above, and a small basal radial spine. Funnel with 24–39 sharply pointed dark-brown chitinized radii, base of funnel not chitinized. Grooves separating radii extending 1/3 of funnel length (Fig. 9).

Remarks. Pillai (2009) described specimens with H. tambalagamensis-type operculum and a detachable inner tube as Hydroides spiculituba n. sp. However, Sun et al. (2015) synonymized H. spiculituba with H. tambalagamensis based on the identical 18S sequences of specimens with and without inner tubes. Here we follow the synonymy of Sun et al. (2015).

Distribution. Indo-West Pacific.

Hydroides trivesiculosa Straughan, 1967b
(Fig. 10)

Hydroides trivesiculosa Straughan, 1967b: 33–34, fig. 3h–j [Heron Island, Qld; material studied].

Hydroides trivesiculosa.—Sun et al. 2015: 85–87, fig. 28 [WA, NT, Qld, Australia].


Diagnosis. Opercular verticil inserted on a short stalk into proximal funnel. Verticil with 5–8 spines, one very large dorsal spine made of a bulbous median part and two latero-dorsal extensions and 4–7 small outwardly curved spines positioned at the base of dorsal verticil spine, each ending in T-shaped tip, without accessory spinules. Funnel with 18–25 chitinated radii tips, base of funnel slightly chitinized. Grooves separating radii extending 1/3 of funnel length (Fig. 10).
Remarks. *Hydroides trivesiculosa* can usually be distinguished from *H. albiceps* by the exceptionally large size of the dorsal bulbous verticil spine, and the lower number of verticil spines, but there are (few) transitional forms. Additionally, molecular studies are needed to determine whether *H. trivesiculosa* and *H. albiceps* are separate species.

Distribution. Qld, tropical Australia, Tanzania, Red Sea, Seychelles, Indonesia.

---


---

**Hydroides tuberculata** Imajima, 1976

(Fig. 11)

*Hydroides tuberculata*.—Imajima 1978: 53 [Izu Islands, Japan]; 1982: 44 [Palau and Yap Islands, Micronesia]; Imajima & ten Hove 1984: 44–45 [Truk, Ponape Island; Okinawa, experimental fouling; Lizard Island, experimental fouling, Noosa Head, Heron Island; synonymy, extensive discussion]; Bailey-Brock 1985: 210 [Fiji]; Sun et al. 2015: 88–91, Fig. 29 [WA, NT, Qld, Australia].

*Hydroides perezi* not Fauvel, 1918.—Straughan 1967a: 219–220, Fig. 6o [Havannah Island, Qld, see Imajima & ten Hove 1984: 44].


**Diagnosis.** Opercular verticil consists of 5–6 triangular spines curved inward, with a small external knob. Dorsal verticil spine larger than others, with elongated sharp tip, curved inward. Funnel radii with 18–25 chitinized pointed tips, base of funnel half chitinized (Fig. 11). Tube often (but not always) bluish, dark brown or black inside.

**Remarks.** Specimens from Lizard Island (AM W.45474, AM W.45414, and AM W.45419) show more slender verticil spines than specimens from other localities. Lizard Island specimens have dark brown verticil spines and funnel radii tips, a large inward curved hook and sub-triangular ventral verticil spines. The external knob, which

---

was considered to be one of the most important taxonomic characters (Imajima & ten Hove 1984) is not obvious in *AM W.45474, AM W.45414, AM W.45419*. However, our molecular data (Sun *et al.* unpubl.) show that these specimens belong to the same species as other specimens that have typical *Hydroides tuberculata* opercula.


**Distribution.** Indo-West Pacific (Micronesia, Melanesia, Southern Japan; NT, Qld, WA, Australia).

**Genus *Josephella* Caullery & Mesnil, 1896**

**Type species.** *Josephella marenzelleri* Caullery & Mesnil, 1896


**Remarks.** This tiny serpulid is known from numerous circum(sub)tropical, temperate locations around the world. The species was confused with *Rhodopsis* by Straughan (1967a, fig. 5i).

**Josephella marenzelleri** Caullery & Mesnil, 1896

(Fig. 12)

*Josephella marenzelleri* Caullery & Mesnil, 1896: 484–486, figs 4–6 [Cap de la Hague, France; original description].


**Diagnosis.** Tube white, about 0.1 mm in diameter. Operculum delicate membranous cup with a flat distal
surface surmounted by a marginal crown of fine teeth joined by a transparent membrane; borne on normal pinnulated radiole (Fig. 12).

Remarks. This tiny serpulid has been reported from numerous circum(sub)tropical to temperate locations around the world: Australia (Dew 1959), Japan (Uchida 1978, Imajima 1979), Hawaii (Bailey-Brock 1991), Israel (Ben-Eliahu 1976), Italy (Bianchi 1981), Cyprus (Ben-Eliahu & Payiatas 1999), Germany (Hartmann-Schröder 1971), France (Fauvel 1927; Zibrowius 1968), west coast of Africa (Zibrowius 1973), north coast of Tunis (Zibrowius 1979). It remains to be seen if this wide distribution will stand up against the scrutiny of DNA. The species has the same body size as *Rhodopsis pusilla* and was confused with *Rhodopsis* (by Straughan 1967a, fig. 5i).

Distribution. Questionably circum(sub)tropical, temperate.


**Genus Metavernilia** Bush, 1905 *sensu* Zibrowius, 1971

**Type-species.** *Vermilia multicristata* Philippi, 1844

**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube white, opaque, peristomes may be present, as well as several longitudinal keels, sometimes denticulate. Granular overlay generally absent. Operculum with chitinous, non-calcified endplate, sometimes with complex multi-tiered structures, or endplate may be absent. Peduncle flattened, ribbon-like, without distal wings; formed from second dorsal radiole on one side. Constriction may be present. Pseudoperculum may be present. Radioles arranged in semi-circles to short pectinate, up to 18 per lobe. Inter-radiole membrane and stylodes absent. Branchial eyes may be present. Mouth palps absent. Seven thoracic chaetigerous segments. Collar trilobed, tonguelets between ventral and lateral collar lobes absent. Length of

**Metavermilia acanthophora** (Augener, 1914)  
(Fig. 13A, B)

*Vermiliopsis acanthophora* Augener, 1914: 155–158, pl. 1, figs 21–24 [WA, Australia].


Not *Vermiliopsis acanthophora*.—sensu Fauvel 1919: 343 [Gambier Islands]; 1923: 53 [Gambier Islands; = *V. glandigera/pygidialis*-complex]; Monro 1937: 80 [Okinawa, Japan]; Stull 1979: 38 [East off North Island, New Zealand; 26–170 m]; Wu et al. 1987: 80 [Okinawa, Japan]; Kupriyanova et al. 2006: 423–433, fig. 2 [DNA data]; ten Hove & Kupriyanova 2009: 18, fig. 4c, 62–63, fig. 28 [SEM of chaetae].


**Diagnosis.** Distal part of the operculum composed of 4–10 parallel tiers and terminating with a single distal spine or hook (Fig. 13); tube with one or three irregular, rounded longitudinal keels. Thoracic membranes reaching to the end of thorax, but no apron.

**Remarks.** Literature records need to be checked since some are misidentified (some examples from the Indo-Pacific have been given in the synonymy, above). Besides, there are doubts if this essentially temperate/subtropical species can occur in the tropics. There are two major types, one is large animals with opercula having only 2–3 "disks", the top one is wide and nearly flat, with a distinct hook in the centre, probably *M. acanthophora sensu stricto*; another is much smaller, with opercula reminding pine cones, made of many (up to 20) "disks" or flanges, tapering to the top, with more or less developed hook on the top or without the hook altogether, the latter form attributed to *M. nates* here.

**Distribution.** Indo-West Pacific, South Japan to Australia.
Metavermilia multicristata (Philippi, 1844)

Vermilia multicristata Philippi, 1844: 193, pl. 6, fig. K [Southern Italy].


Diagnosis. Opercular ampulla globular, covered with simple chitinous, convex distal cap; tube with 5–7 longitudinal keels and some transverse ridges between, giving the tube a porose appearance.

Remarks. The tube and operculum of the specimen from North Point are indistinguishable from Mediterranean material (ZMA V.Pol. 3130) when compared under the stereomicroscope and very similar to Sun & Yang (2001b: 213, fig. 1L–M). The two specimens from Osprey Island are the same, including tubes, but for the fact that their opercula (similar to that figured by Bianchi 1981: fig. 29e) appear to have a thin veneer or incrustation of calcareous matter in the opercular cap, just as in the operculum on half branchial crown from Granite Head. Notwithstanding the fact that an essentially temperate-subtropical Mediterranean species of deeper waters is unlikely to occur in tropical waters from the Indo-Pacific, for the time being we regard the material to be conspecific.

Distribution. Subtropical to temperate Atlantic, Mediterranean, West Indian Ocean, South China Sea. New record for Australia.

Metavermilia nates Zibrowius, 1971

(Fig. 13C, D)

Vermilia (sic!) nates Zibrowius, 1971: 1380–1381, fig. 4 [Europa Island, Mozambique Channel, Tanzania Coast].


Metavermilia nates.—Imajima 1979: 171–173, fig. 5 [Southern tip of Honshu, Japan]; Imajima & ten Hove 1984: 54 [Ponape Island]; ten Hove & Kupriyanova 2009: 63 [name only].


Diagnosis. Opercular ampulla complex, consisting of basal ampulla, often with mid-dorsal groove, distal part composed of 4–10 parallel tiers with dorsal indent and terminating with flat disk; tube with 5–9 longitudinal teethed keels (Fig. 13).

Remarks. Zibrowius (1971) also mentioned enlarged tips of branchial radioles in M. nates as a specific character.

Distribution. Europa Island, Tanzania; Red Sea; Ponape Island; Honshu, Japan. New record for Australia.

Genus Paraprotis Uchida, 1978

Type-species. Paraprotis dendrova Uchida, 1978
**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube white, opaque, circular in cross-section, without longitudinal keels. Granular overlay not observed. Operculum and pseudoperculum absent (or soft globular operculum may be present on second unmodified radiole in *P. pulchra*). Arrangement of radioles semi-circular or short pectinate, up to 6 per lobe (up to 32 per lobe in *P. pulchra*). Inter-radiolar membrane absent. Branchial eyes (ocellar clusters) present. Styloides absent. Mouth palps absent, but a spiral projection for brood attachment originates from the right side of the mouth. Collar non-lobed, tonguelets absent. Thoracic membranes narrowing at third chaetiger but continuing to 7th thoracic chaetiger, a narrow apron is probably present. Seven thoracic chaetigerous segments. Collar chaetae limbate. *Apomatus* chaetae absent. Thoracic uncini of *Protis* type, saw-shaped with about 10 teeth, anterior fang with pointed tip. Thoracic triangular depression not observed. Anterior abdominal chaetae flat narrow geniculate with a row of sharp teeth along its free margin. Abdominal uncini similar to thoracic ones but rasp-shaped. Achaetous anterior abdominal zone present, short (2–4 segments). Long posterior capillary chaetae present. Posterior glandular pad not observed.

**Remarks.** The genus currently includes two species *P. dendrova* and *P. pulchra* (the latter generic attribution questionable), however, our preliminary molecular data (Kupriyanova et al. unpubl.) indicate that these two species are not closely related, thus, *P. pulchra* should be transferred to another genus.

*Paraprotis dendrova* Uchida, 1978  
(Fig. 14A)

*Paraprotis dendrova* Uchida, 1978: 16–17, plas 3, 4 [Sabiura, Japan].

*Paraprotis dendrova.—Nishi 1992a: 18–19, fig. 3A–D [Okinawa, Japan]; 1996: 309, fig. 4e [Okinawa, Japan]; Nishi & Yamasu 1992a: 85 [Ryukyu Islands, Japan; brooding]; Rouse 2005: 168, 173, 175, fig. 3B [Okinawa, Japan].


**Diagnosis.** Operculum absent. Ocellar clusters (2–3 per radiole) present. A spiral projection for brood attachment originates from the right side of the mouth, carrying up to 50 embryos (Fig. 14A). Collar non-lobed.

**Remarks.** This small (tube about 1 mm wide) cryptic species lacks an operculum and is easily recognizable only when the brooding appendage is present.

**Distribution.** Okinawa, Japan, Qld, Australia. New record for Australia.

*Genus Placostegus* Philippi, 1844

**Type-species.** *Serpula tridentata* Fabricius, 1799

**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube triangular in cross-section, with denticulate keels, transparent or semi-transparent, often only attached to substratum at the base, collar-like rings absent. Granular overlay absent. Operculum inverse conical, with chitinous cup-shaped endplate. Peduncle cylindrical, smooth, without wings, gradually merging into operculum, at most with shallow constriction; inserted at base of radioles on one side between first and second normal radiole and maximally covering base of first three radioles. Pseudoperculum absent. Radioles arranged in semi-circles, up to 24 per lobe; inter-radiolar membrane, branchial eyes, and styloides absent. Mouth palps present. Six thoracic chaetigerous segments. Collar tri- to penta-lobed, collar edge may be almost laciniate; tonguelets between ventral and lateral collar lobes present. Thoracic membranes long, forming ventral apron across anterior abdominal segment. Collar chaetae absent; collar region with girdle of reddish ocelli. *Apomatus* chaetae absent. All uncini sub-rectangular, rasp-shaped with > 20 teeth in profile, and up to 8 small teeth in a row; anterior peg wide, flat, bluntly truncate, almost rectangular. Thoracic triangular depression absent. Abdominal chaetae true trumpet-shaped, with distal hollow triangular blade, abruptly bent. Achaetous anterior abdominal zone present. Long posterior capillary chaetae may be present. Posterior glandular pad absent.

**Remarks.** The genus is poorly known from areas other than the Atlantic/Mediterranean.
FIGURE 14. A. *Paraprotis dendrova*, live animal removed from the tube, with typical brooding appendage bearing developing larvae (arrow), stn. G243, SAM E3591; B. *Placostegus* sp., operculum covered with brown distal plate, stn. G231, SAM E3589; C. Same, live animal in transparent tube, radiolar crown and operculum missing, bright orange belt of thoracic eyes (arrow) is seen through tube, stn. G231, SAM E3589; D. *Pomatostegus actinoceras*, live animal in tube, AM W.44540. Photo: A–C—G. Rouse, D—A. Semenov. Scale bars: A = 0.5 mm, B–D = 1 mm.
**Placostegus sp.**
(Fig. 14B, C)

? *Placostegus tridentatus* not (Fabricius, 1779) Imajima 1978: 67–69, fig. 9 [Izu Islands, Japan]; 1979: 179 [Kii Peninsula, Japan; see Remarks].


**Diagnosis.** Tube transparent, with three longitudinal rows of blunt teeth (Fig. 14C); collar region with a band of reddish ocelli, operculum asymmetrical, with dark brown distal plate (Fig. 14B).

**Remarks.** We have refrained from giving a list of synonyms for this taxon and the reference to Imajima (1978) is tentative only, mainly meant as an illustration of the genus. Unpublished notes of one of us (HtH) mention two types of opercula for material from all around Australia, one with an almost circular endplate (like figured by Imajima 1978 fig. 9a–c for ? *P. tridentatus*), the other with a zygomorphic endplate (cf. Hartman 1969: 763 for *P. californicus*). The operculum of our present specimen does not entirely fit one of these types, especially with regard to the two ventral bumps of the ampulla, not known from any other *Placostegus* spec. *Placostegus* *tridentatus* (Fabricius, 1799) is listed by ten Hove & Kupriyanova (2009) as a widely distributed species found in the Atlantic, Mediterranean, and Indo-West Pacific, including Zanzibar, Amirantes Islands, Indonesia, Western Australia and Japan (ten Hove 1994: 109). However, Imajima (1978: 69) already doubted whether or not his Japanese material was identical with the Atlantic specimens on a number of differences, a doubt also expressed by ten Hove (1994: 109) for his material from the Seychelles. Such a wide distribution is questionable in itself, and both unpublished morphological and molecular data indicate that *Placostegus* from Lizard Island is distinct from *P. tridentatus* from Northern Europe. *Placostegus* spp. from the Indo-Pacific Region, including Lizard Island, most likely belong to several undescribed species.

**Distribution.** Currently unknown.

---

**Genus Pomatostegus Schmarda, 1861**

**Type-species.** *Pomatostegus macrosoma* Schmarda, 1861, junior synonym of *Terebella stellata* Abildgaard, 1789.

**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube white, opaque, semi-circular to roughly triangular in cross-section, with up to 5 longitudinal keels; granular overlay absent. Operculum a very flat ampulla covered with chitinous disk bearing a column with several serrated disks alternating with circlets of spines proximally and closely applied to each disk. Peduncle flatly triangular in cross-section with broad latero-distal wings along its entire length; inserted to the left or right at the basis of the branchial lobe; from the fact that the first and second radiolar separated by the base of the peduncle, it is inferred that it is derived from the second normal radiolar. Constriction absent. Pseudoperculum absent. Arrangement of radioles in (semi-)circles, up to 90 per lobe. Inter-radiolar membrane present. Branchial eyes present. Stylodes absent. Mouth palps absent. Seven thoracic chaetigerous segments. Collar tri- to penta-lobed, well developed with an entire smooth margin. Tonguelets absent. Thoracic membranes short, ending just posterior to the second row of uncini (segment 3). Collar chaetae *Spirobranchus*-type, with basal pilose fin and distal blade, and limbate. *Apomatus* chaetae present. Thoracic uncini saw-shaped, with 9–13 teeth, anterior peg blunt. Thoracic tori meet ventrally in larger specimens; in juveniles the ventral space between thoracic tori narrowing towards last rows that almost fused, leaving a triangular depression. Abdominal chaetae flat narrow geniculate, with long blade. Abdominal uncini smaller than thoracic ones, with about 8 teeth in profile, 3 teeth in a row. Achaetous anterior abdominal zone absent. Long posterior capillary chaetae absent, but posterior chaetae longer. Posterior glandular pad absent.

**Remarks.** For a couple of decades, the genus was thought to be monotypic, with *Pomatostegus stellatus* (Abildgaard, 1789) as single representative, occurring circumtropically. Instigated by P. Valentijn (personal communication from unpublished student's research), ten Hove & Kupriyanova (2009: 78) restricted the nominal taxon *P. stellatus* to the tropical Atlantic Region, and the previously synonymized *P. actinoceras* Mörch, 1863, from the Indo-West Pacific Region and *P. kroyeri* Mörch, 1863, from tropical Pacific America, were elevated to full species again.
Pomatostegus actinoceras Mörch, 1863
(Fig. 14D)

Pomatostegus actinoceras Mörch, 1863: 400, figs 9a–d [Philippines; original description].


Diagnosis. Tube thick, opaque, white, triangular in cross-section; a strong median keel with blunt teeth and two or more lateral rows of well-defined teeth. Peduncle broad with lateral wings terminating in pointed tips. Operculum a column with 2–6 chitinous plates with frilled margins stacked one above the other; diameter of plates decreases upwards (distally). Circlets of 10–12 spines present at the basis of each disk, except for the first chitinous plate (Fig. 14D).

Remarks. There tend to be more of “free” circlets of spines, without accompanying wide plates in the Indo-Pacific *P. actinoceras* as opposed to the Caribbean *P. stellatus*. Figure 14D suggests 3 discs surmounted by 2 or 3 starlets of spines, also compare Rullier 1974 (Cuba) versus Fiege & Sun 1999: 132, fig. 19 (China) and Imajima 1977: 101, fig. 7 (Japan); it seems to be one of the morphological differences between these two species.

Distribution. Indo-West Pacific distribution, including Southern Japan, Micronesia and Australia, China, Sri Lanka.

Genus Protula Risso, 1826

Type-species. *Protula rudolphi* Risso, 1826, junior synonym of *Serpula tubularia* Montagu, 1803.

Diagnosis. (from ten Hove & Kupriyanova 2009). Tube white, opaque, may be up to 2 cm across and 40 cm long, (semi-)circular in cross-section, longitudinal keels and flaring peristomes absent. Operculum and pseudoperculum absent. Radioles arranged in two semicircles to a spire of up to 6 whorls, up to 320 per lobe (*P. superba* Moore, 1909). Inter-radiolar membrane present. Branchial eyes may be present. Stylodes absent. Mouth palps present. Seven thoracic chaetigerous segments. Collar trilobed, tonguelets absent. Thoracic membranes long and wide, with undulating edge, forming ventral apron across anterior abdominal segments. Collar chaetae limbate. *Apomatus* chaetae present. Thoracic and abdominal uncini rasp-shaped with approximately 30 teeth in profile, up to 6 rows of teeth above and continuing onto elongated rounded peg. Thoracic triangular depression absent. Abdominal chaetae sickle-shaped, with finely denticulate blades, may be retro-geniculate in some taxa.achaetous anterior abdominal zone absent. Long posterior capillary chaetae present. Posterior glandular pad present.

Remarks. In their recent review of the taxonomy of serpulid genera, ten Hove & Kupriyanova (2009: 81) called *Protula* the most problematic serpulid taxon. Often authors do not even try to identify specimens to species level as evidenced by over 60 literature records of *Protula* spec. in ten Hove’s literature database. The phylogenetic basis for this genus is ill-defined and based on negative characters, such as lack of an operculum, lack of special collar chaetae and mostly lack of any characteristic ornamentation of the tube (although *Protula diomedeae*...
Gosliner et al. 1996: 119 [Indonesia, Sulawesi; colour photograph]; Humann & Deloach 2010: 70 [Indo-West Pacific; colour photograph].


Diagnosis. Largest Australian species. Conspicuous radioles as evidenced by numerous pictures in field guides (however often mistaken for feather duster worms (Sabella) or for Christmas tree worms (Spirobranchus) and vice versa, and even in a travel guide (Finlay et al. 1998: 80)). Radioles white, reddish or mottled, arranged in two spires of up to 6 whorls, up to 4 cm across and 4.5 cm high (Fig. 15D).

Remarks. The nominal taxon is badly in need of revision. Though usually reported from the tropical region, it was mentioned from cold-temperate areas as the Cape, South Africa and Stewart Island, New Zealand (e.g., Day 1967: 818–820; Augener 1926: 276–277), a very unlikely distributional pattern. Opinion 1461 in the Bulletin of Zoological Nomenclature 44 (3): 219–220 gives as date for Savigny’s paper 1822 (as opposed to the generally circulating 1820).

Distribution. Currently unknown.

Protula spp. (Fig. 15A–C)


Remarks. The specimens collected at Lizard Island belong to an unknown number of most likely undescribed species (see Remarks after the generic diagnosis).

Distribution. Currently unknown.

Genus Pseudovermilia Bush, 1907

Type-species. Spirobranchus occidentalis McIntosh, 1885

Diagnosis. (from ten Hove & Kupriyanova 2009). Tube white (in one species with transverse brown bands), opaque, with longitudinal keel(s), sub-triangular or triangular in cross-section; generally with regular ornamentation of ribs, pits, or teeth. Double or single brooding scoops may be present. Granular overlay absent. Operculum consisting of bulbous ampulla terminated by chitinous endplate or cap, usually with spine(s). Pseudoperculum absent. Peduncle smooth, cylindrical, without wings, clearly separated from ampulla by constriction; inserted just below and between first and second radiole on one side. Arrangement of radioles pectinate, up to 17 per lobe, inter-radiole membrane absent. Branchial eyes not known. Stylodes absent. Filiform mouth palps present. Seven thoracic chaetigerous segments. Collar with unpaired medio-ventral lobe and two latero-dorsal lobes continuous with short thoracic membranes, continuing to second thoracic chaetiger. Tonguelets between ventral and lateral collar lobes absent. Collar chaetae limbate. Apomatus chaetae from second or third chaetiger onward. Thoracic uncini saw-shaped, with 9–17 teeth above gouged peg (seemingly bifurcate). Triangular depression absent. Abdominal chaetae flat narrow geniculate, with rounded teeth on edge. Abdominal uncini rasp-shaped with 9–13 teeth in profile view, up to 6 teeth in a row above gouged peg. Short achaetous anterior abdominal zone may be present. Long posterior capillary chaetae present. Posterior glandular pad may be present.

Remarks. The genus Pseudovermilia is most similar to the genus Semivermilia, the differences being the insertion of the peduncle (inserted just below and between first and second radiole in the former versus inserted as second radiole in the latter); the arrangement of the radioles, long pectiform versus short pectiform; the structure of thoracic uncini (saw-shaped in the former versus saw- to-rasp-shaped in the latter) and the (mostly) regular ornamentation of the tube in Pseudovermilia, missing in Semivermilia. All these characters show clinal variation and it remains to be seen if ten Hove’s (1975) proposed differentiation holds under DNA scrutiny.

Pseudovermilia pacifica Imajima, 1978

(Fig. 16)

Pseudovermilia pacifica Imajima, 1978: 57–59, fig. 4a–n [Ponape Island; original description].
FIGURE 16. *Pseudovermilia pacifica*. A. Specimen in tube, AM W.28343; B. Specimen in tube, AM W.28326; C. Operculum, AM W.28305; D. Operculum, AM W.28326; E. Specimen in tube, AM W.28305. Photo: E. Wong. Scale bars: A = 0.5 mm, B–E = 0.1 mm.


**Diagnosis.** Tube white, triangular in cross-section, with thick, rounded median ridge, two finely toothed lateral ridges and lateral flanges. Peduncle with asymmetrical swelling at the distal end. Operculum with a bell-shaped ampulla and a stack (3–14) of diabolo-like yellow tiers, chitinous in appearance, with distinct margins; with or without a hook at the top (Fig. 16).

**Remarks.** The tubes are very faintly striated transversely, as opposed to the clear ribs figured by Imajima (1978, fig. 4m–o) and visible in the paratype (ZMA V.Pol. 3295).

**Distribution.** Izu Island, Japan, Indo-West Pacific. New record for Australia.

**Genus Rhodopsis Bush, 1905**

**Type-species.** Rhodopsis pusilla Bush, 1905

**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube white, circular in cross-section, thin-walled, not increasing in diameter, distal part sometimes erect, unattached, with peristomes; granular overlay absent. Animals with tube diameter $< 0.2$ mm. Some tubes may have one or more unpaired, inverted brood-chambers associated with peristomial rings. Operculum pear-shaped, laterally compressed, usually with well-developed chitinous plate bearing spines. Opercular plate may be deeply infolded and sunk, angled, within the opercular ampulla, then with halves closely appressed; plate rarely flat and terminal. Rarely operculum a simple ampulla only. Peduncle smooth, cylindrical, without wings, separated from ampulla by constriction; inserted proximal to 1\(^{st}\) radiole on one side. Pseudoperculum absent. Arrangement of radioles short pectinate, only 2–3 radioles per lobe. Inter-radiolar membrane absent. Branchial eyes not observed. Styloides absent. Mouth palps present. Four to six thoracic chaetigerous segments present. Collar (tri-)tetra-lobed. Thoracic membranes short, reaching 1\(^{st}\) thoracic chaetiger. Collar chaetae absent. Apomatus chaetae present from second chaetiger onward. Thoracic and abdominal uncini rasp-shaped, with 6–8 teeth in a row in edge view and about 8 teeth in profile, anterior fang simple pointed. Triangular depression absent. Single capillary chaeta on middle abdominal chaetigers accompanied by single flat narrow geniculate chaeta with blunt teeth. Achaetous anterior abdominal zone long, followed by up to 15 chaetigers. Posterior capillary chaetae present. Posterior glandular pad not observed.

**Rhodopsis pusilla Bush, 1905**

(Fig. 17A)

*Rhodopsis pusillus* Bush, 1905: 289–290 [Bermuda; original description].

*Josephella marenzelleri* not Caullery & Mesnil, 1896 (*partim*).—Straughan 1967a: 42, fig. 5i [Straughan refers to Dew’s (1959) material correctly identified as *J. marenzelleri*, but Straughan’s material from Heron Island clearly is *Rhodopsis*].

*Rhodopsis pusilla*.—Ben-Eliahu & ten Hove 1989: 383–390, figs 1–11 [Bermuda, Netherlands Antilles, Cyprus, Red Sea (Elat), Reunion, Indonesia (Banda Sea), Australia (Lizard and Heron Islands, Qld); detailed redescription]; Bailey-Brock 1991: 201–204 [Hawaii; Nishi 1993a: 12, table 1 [reproductive biology, Okinawa, Japan]; 1993b: 17–19, fig. 1D [tube ultrastructure, Okinawa, Japan]; 1993d: 6–9, fig. 2 [hypothesized origin of brooding characteristics, SEM of tube brooding ovicells and operculum]; 1996: 312, 314, fig. 4a–c [attached to dead coral skeletons, Okinawa Japan]; Nishi & Nishihira

Diagnosis. Tube diameter 0.11–0.17 mm, some tubes may have one or more unpaired, inverted brood-chambers (see ten Hove & Kupriyanova 2009, fig. 2A). Operculum pear-shaped, laterally compressed, usually with chitinous plate bearing spines (Fig. 17A). Opercular plate may be deeply infolded and sunk, angled, within the opercular ampulla, then with halves closely appressed.

Remarks. This little known species, characterized by numerous irregular spines in its chitinous opercular plate, was incompletely described by Bush (1905) from a tiny worm collected on corals off Bermuda. The type material was lost. Ben-Eliahu & ten Hove (1989) designated a neotype and re-described the species in detail.


Genus Salmacina Claparède, 1870

Type-species. Salmacina incrustans Claparède, 1870


Remarks. The nominal genera Filograna Berkeley, 1835 (operculate) and Salmacina (non-operculate), contain a number of small, asexually reproducing taxa, without distinctive morphological characters. Discussions are given by Nogueira & ten Hove (2000: 151–153), ten Hove & Kupriyanova (2009: 42) and most recently a very extensive analysis was given by Ben-Eliahu & ten Hove (2011: 62–71); however, they all conclude that the complex is badly in need of a revision. Moreover, being small, often unnoticed but nevertheless very common in (ship)fouling communities, a distribution heavily influenced by human interference is very likely; such a revision only can be furthered with help of molecular data. One nominal species, Salmacina australis Haswell, 1885, was described from Port Jackson, NSW, Australia, and later mentioned from the temperate-cold southern part of Australia, and New Zealand. From biogeographic and ecological viewpoints, it is unlikely that such a cold-temperate taxon would occur in the tropical Indo-West Pacific region as well. We therefore refrain from attributing a specific name to the material from Lizard Island.

Salmacina spec.
(Fig. 17B, C)

**Diagnosis.** Forming open aggregates consisting of large numbers of tiny (0.2–0.35 mm diameter), whitish tubes, circular in cross-section (Fig. 17C); granular overlay absent. Operculum and pseudoperculum absent. Asexual reproduction common (Fig. 17B).

**FIGURE 17.** A. *Rhodopsis pusilla*, fixed specimen removed from its tube, **AM W.202470**; B. *Salmacina* sp., live asexually reproducing specimens, stn.G237, **AM W.47460**; C. Pseudo-colony of tubes of *Salmacina* sp., **AM W.47347**. Photo: A, C–E. Wong, B–G. Rouse. Scale bars: A–B = 0.1 mm, C = 1 mm.

**Genus** Semivermilia **ten Hove, 1975**

**Type-species.** *Vermiliopsis pomatostegoides* Zibrowius, 1969

**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube triangular to sub-triangular in cross-section, keels present, otherwise variable; without flaring peristomes; granular overlay absent. Operculum inverse conical with chitinous endplate, more often a cap or series of diabolo-like plates; sometimes with terminal spine. Peduncle inserted as second radiole, cylindrical in cross-section; constriction present. Pseudoperculum absent. Radiolar arrangement short pectinately, up to 7 radioles per lobe. Inter-radiolar membrane absent. Branchial eyes may be present. Stylodes absent. Mouth palps present. Five to seven thoracic chaetigerous segments. Collar tri- to penta-lobed, tonguelets absent. Thoracic membranes end at chaetiger 2. Collar chaetae limbate. *Apomatus* chaetae present on posterior thoracic segments. Thoracic uncini saw- to-rasp-shaped; with about 15 teeth in profile view, 1 tooth at the apex of the uncini to 5 teeth in the row above the wide gouged peg (dental formula e.g., P:5:3:2:2:1:1:1:1:1:1:1:1:1:1). Triangular depression absent. Abdominal chaetae flat narrow geniculate, with rounded teeth on edge; abdominal uncini smaller than thoracic ones, entirely rasp-shaped, with about 13 teeth in profile view, up to 8 teeth in a row. Achaetous anterior abdominal zone, if present, very short. Long posterior capillary chaetae absent. Posterior glandular pad may be present.

**Remarks.** See remarks under *Pseudovermilia*. The nominal genus includes 8 species, opercula of which are
characterised by elongated distal chitinous caps made of series of diabolo-like plates (S. elliptica, S. parapomatostega, S. pomatostegoides, and S. uchidai), by simple caps or plates without terminal spine (S. cribrata, S. agglutinata, S. torquata) or with flattened endplate with terminal spine (S. crenata). The tubes of these species are more distinct and often allow specific recognition better than opercula do.

**Semivermilia annehoggettae** n. sp. (Figs 18, 19)

*Semivermilia* spec.—ten Hove & Kupriyanova 2009: 21 fig. 7D [Lizard Island, Qld; SEM of double hollow chambers].


**Description.** TUBE: white, about 0.4 mm wide, with lumen of 0.3 mm; anteriorly with double hollow chambers on top (Fig. 18A–D). If broken, these chambers may appear as three separate thin sharp longitudinal keels. Branched eyes absent.

PEDUNCLE: smooth, circular in cross section, inserted as second radiole; without distal wings, clearly separated from opercular ampulla by constriction (Fig. 18C).

OPERCULUM: simple semi-transparent inverted cone, sometimes inner vesicle visible inside, with flat, also (semi-)transparent endplate or just flat surface (Figs 18B, C; 19A). Pseudoperculum absent.

COLLAR AND THORACIC MEMBRANES: collar trilobed, continuous with short thoracic membranes ending at 2nd thoracic chaetiger.

THORAX: with collar chaetiger and 6 uncinigerous chaetigers (Fig. 19A). Tori positioned along mid-line, triangular depression absent. Collar chaetae limbate, of two sizes (Fig. 19B). Subsequent chaetae limbate, of two sizes, Apomatus chaetae starting at chaetiger 3 (Fig. 19C). Uncini saw-to-rasp shaped, with up to 15 teeth in profile view and up to 4 teeth in the row above the wide gouged peg (dental formula P:5:4:3:3:2:1:2:1:1:1:1:1:1:1:1:1:1) (Fig. 19D).

ABDOMEN: abdominal chaetigers up to 30. Uncini rasp-shaped, with up to 12 teeth in profile view and up to 6 rows of teeth above wide gouged (Fig. 19E). Anterior chaetae and posterior capillary chaetae not observed (see Remarks). Posterior glandular pad absent.

SIZE: length up to 2 mm, width of thorax up to 0.2 mm. Branchiae and operculum accounting for 1/3 of entire length.

COLOUR: white to yellowish (Fig. 18B, C).
**Etymology.** The species is named after Dr. Anne Hoggett, the director of LIRS.

**Remarks.** This small species occurs cryptically, it is reminiscent of *S. pomatostegoides*, but with very different operculum, simple transparent inverted cone lacking any chitinous enforcement. The most distinct character of this species is the tube with one or several consecutive pairs of hollow "pipes" anteriorly. These hollow chambers on top break easily and only rarely remain intact, but the remaining tube, with its flattened chambered sides, is typical enough. The function of these pipes is unclear, they clearly resemble brood chambers found in other small serpulids, but we actually observed lecithotrophic larvae of various stages (Fig. 19G) being brooded inside the tubes proper, not in the chambers. The thoracic uncini are saw-to-rasp shaped, which is typical for *Semivermilia*. Abdominal chaetae were looked for under SEM in three specimens, but not observed, so assumed absent.

**Reproduction.** Lecithotrophic larvae brooded inside the tube. No larvae were found inside paired ovicells.

**Type locality.** Lizard Island, Qld, Australia.

**Distribution.** Qld, Australia.

---

**Semivermilia lylevaili** n. sp.  
(Figs 20, 21)


**Additional material:** AM W.45076, MI QLD 2417 (5); AM W.45077, MI QLD 2417 (2); AM 47631, MI QLD 2386; AM W.47632, MI QLD 2352; AM W.47633, MI QLD 2406.

**Description.** TUBE: white, about 0.4 mm wide, with lumen of 0.3 mm. Circular in cross section, with two not very distinct longitudinal ridges (Fig. 20A), without flaring peristomes; granular overlay absent.

BRANCHIAE: with 5–6 pairs of radioles, arranged short pectinately, not connected by inter-radiolar membrane. Branchial eyes absent (Fig. 20B, C).

PEDUNCLE: smooth, circular in cross section, inserted just below first and second normal radiole; without wings, clearly separated from opercular ampulla by a constriction (Fig. 20B, C).

OPERCULUM: slightly asymmetrical, with simple convex thin brownish endplate, terminal spine absent (Figs 20A–C, 21A). Pseudoperculum absent.

COLLAR AND THORACIC MEMBRANES: collar relatively high, trilobed, continuous with thoracic membranes ending at 2nd thoracic chaetiger (Fig. 21A).

THORAX: with collar chaetiger and 6 uncinigerous chaetigers. Tori positioned along mid-line, triangular depression absent. Collar chaetae limbate of two sizes (Fig. 21B). Subsequent chaetae limbate, of two sizes, with *Apomatus chaetae* starting at chaetiger 3 (Fig. 21C). Uncini saw-to-rasp shaped, with up to 15 teeth in profile view and up to 4 teeth in the row above the wide gouged peg (dental formula depending place in row from P:4:4:2:1:2:1:1:1, 9 in profile view, to P:4:3:2:2:1:1:1:1:1:1:1:1, 14 in side view) (Fig. 21D).

ABDOMEN: abdominal chaetigers up to 30. Uncini rasp-shaped, with 8–10 rows of 7–3 teeth each above wide, slightly crenulated peg (Fig. 21F). Chaetae narrow flat geniculate with rounded teeth (Fig. 21E). Achaetous anterior abdominal zone short. Posterior glandular pad absent. Long posterior capillary chaetae absent (Fig. 21A).

SIZE: length up to 1.6 mm, width of thorax 0.2 mm. Branchiae and operculum accounting for 1/3 of entire length.

COLOUR: orange to yellow (Fig. 20).

**Etymology.** The species is named after Dr Lyle Vail, director of LIRS.

**Remarks.** By its simple operculum, this new species resembles *S. annehoggettae* n. sp., but lacks distinct elongated ovicells typical for the latter species.

**Reproduction.** Lecithotrophic larvae brooded inside the tube.

**Type locality.** Lizard Island, Qld, Australia.

**Distribution.** Qld, Australia.
**FIGURE 21.** *Semivermilia lylevaili* n. sp., SEM images. AM W.47582. A. Lateral view of entire worm; B. Collar chaetae; C. Thoracic chaetae with *Apomatus* chaeta; D. Thoracic uncini; E. Abdominal chaetae; F. Abdominal uncini. Photo: A–F—E. Kupriyanova & S. Lindsay. Scale bars: A = 100 µm, B–C = 10 µm, D–F = 2 µm.

*Semivermilia pomatostegoides* (Zibrowius, 1969)  
(Figs 22A, 23)

*Vermiliopsis pomatostegoides* Zibrowius, 1969: 129–130, figs 4–10 [Tripoli; original description].  
FIGURE 22. A. *Semivermilia pomatostegoides*, close-up of operculum (left) (AM W.28421), animal in tube (top right) (AM W.47635) and empty tube (bottom right) (AM W.28452); B. *Semivermilis uchidai*, specimen stained with methyl green, close-up of operculum (left) (AM W.45052), animal in tube (top right) (AM W.45052) and empty tube (bottom right) (AM W.47635). Photos: E. Wong. Scale bars: A–B = 0.1 mm.

Diagnosis. Tube white and relatively smooth, triangular in cross section, with a well-defined median ridge, two lateral longitudinal ridges, and broad lateral flanges. Operculum consisting of an ampulla bearing 2–6 chitinous tiers, the most distal may be with a short spine. The ampulla shows a slight swelling medio-ventrally at the junction with the peduncle; in fresh material it is red and clearly an eyespot (Vine & Bailey-Brock 1984: 144, fig. 3I). Thoracic uncini saw-to-rasp shaped, dental formula P:5:4:3:3:?:? ??, P:4:2:3:?:? ??. Abdominal uncini rasp shaped, with up to 11 rows of 6–2 teeth (not entirely regularly placed).

Remarks. This taxon was described from material from 130 m depth off Tripoli (Mediterranean) as Vermiliopsis pomatostegoides Zibrowius, 1969, and referred to Semivermilia by ten Hove (1975). It has been recorded commonly from the Mediterranean/Atlantic, but also from diving depths in the Caribbean and Indo-Pacific. Though Zibrowius does not mention the medio-ventral eyespot on the opercular bulb, it was present in material from the Seychelles and from the Netherlands Antilles (Bonaire; both ten Hove, unpubl.). It remains to be seen if all those far distant populations belong to a single species.

Whether or not Semivermilia parapomatostega Wu & Chen, 1981b (p. 248–249, fig. 2) from the Xisha Islands, South China Sea is a synonym should be decided for a direct comparison of material. The “distinctive” characters given by its authors are not distinctive at all: 5 discs in S. parapomatostega already fall within the range given by Zibrowius for S. pomatostegoides (4–6), the difference between a terminal spine and the bulge figured by Zibrowius is minor as well as the width of the columella. The nature of the square blocks figured on the mid-dorsal keel of S. parapomatostega is unclear, a “longitudinal row of subcircular processes” according to Wu & Chen, 1981b has the feeling of an irregularly growth of a median keel.

Reproduction. One specimen (ZMA V.Pol. 4797) shed eggs, embryos and actively swimming 3 chaetiger trochophore larvae, when the tube was accidentally opened.

Distribution. Mediterranean Sea, East and West (sub)tropical Atlantic, Seychelles, Red Sea, ? South China Sea; Qld, Australia. A new record for Australia.

Remarks. The species is so similar in the shape of the operculum to S. uchidai that they are difficult to distinguish. The two species can only be separated by the shape of their tubes, which bear three longitudinal keels in both species, but the lateral keels are high and oblique in S. uchidai, and are shallowly blunt in S. pomatostegoides.

Semivermilia uchidai Imajima & ten Hove, 1986
(Fig. 22B)

Semivermilia uchidai Imajima & ten Hove, 1986: 9–11, fig. 2a–k [Solomon Islands; Lizard Island, Australia; original description].

**Diagnosis.** Tube white, more or less trapezoidal in cross section, with one erect and two oblique longitudinal keels; keels irregularly serrated and ending in tooth over entrance; just above anterior basal attachment area there are two more projecting teeth. Tube at most with narrow lateral flanges. Operculum consisting of an ampulla bearing 3–8 chitinous tiers (narrow diabolos), the most distal may bear a short spine.

**Remarks.** As in 1986, one of us (HtH) compared the present material side by side with 2 paratypes of *Semivermilia uchidai* (ZMA V.Pol. 3563, Solomon Islands, Nggela group, Makambo, 18 Aug 1984, det. Imajima & ten Hove 1986). The sample ZMA V.Pol. 4776, registered under field identification *Pseudovermilia* spec., contained three specimens of *Pseudovermilia pacifica*, 1 specimen of the tube brooding *Semivermilia annehoggettae* n. sp. and one specimen identical in size, shape of operculum and three keeled tube with *S. uchidai*. See also remarks after *S. pomatostegoides*.

**Distribution.** Mediterranean Sea, East and West (sub)tropical Atlantic, Seychelles, Red Sea, ? South China Sea; Qld, Australia.

**Genus Serpula Linnaeus, 1767**

_Type-species._ *Serpula vermicularis* Linnaeus, 1767, designated by Heppell 1963.

**Diagnosis.** (from ten Hove & Kupriyanova 2009). Tube white, pink, orange, or yellowish, opaque; (semi)circular to trapezoidal in cross-section, rarely polygonal; longitudinal keels, peristomes, a hyaline outer layer or granular overlay may be present. Operculum soft to cartilaginous, funnel shaped with crenulated edge (fused radii). Peduncle smooth, cylindrical, without wings; inserted just below and between first and second dorsal radiole on one side. In large specimens the insertion outside the normal radioles, seemingly the first radiole. Radioles arranged in semi-circles, up to 50 per lobe in larger species. Pseudoperculum and inter-radiolar membrane present. Branchial eyes may be present. Mouth palps present. Styloides absent. Seven (rarely 9) thoracic segments. Collar trilobed. Tonguelets absent, though wart-like protuberances may be present at base of cleft between ventral and latero-dorsal collar lobes. Thoracic membranes long, forming ventral apron across anterior abdominal segments. Collar chaetae bayonet-shaped and limbate. *Apomatus* chaetae absent. Uncini saw-shaped, with approximately 5 teeth, anterior fang simple pointed. Thoracic triangular depression present. Abdominal chaetae flat trumpet-shaped with denticulate edge; uncini similar to thoracic ones, smaller, anteriorly saw-shaped but becoming rasp-shaped towards the pygidium, with up to 12 teeth in profile, up to 8 teeth in a row. Achaetous anterior abdominal zone absent. Posterior capillary chaetae present. Posterior glandular pad absent.

**Remarks.** A recent study by Kupriyanova _et al. _(2008) demonstrates that the traditional genus *Serpula* is most probably paraphyletic.

**Serpula vittata Augener, 1914**

(Fig. 24A)

*Serpula vittata* Augener, 1914: 137–139, fig. 17, pl. 1, figs 18–19 [WA, Shark Bay; original description].

*Serpula vittata*—Imajima & ten Hove 1984: 41–42 [WA, Palau Islands; type material studied and synonymy]; Imajima 1987: 79 [Okinawa, Japan]; Parab & Gaikwad 1989: 224 [India]; Nishi 1993b: 18–19, fig. 1e, table 1 [Okinawa, Japan; in living coral]; Kupriyanova _et al._ 2008: 95, fig. 1E [Lizard Island, Qld; DNA data, colour photo]; ten Hove & Kupriyanova 2009: 8, fig. 1C [colour photo].

_Not Serpula vittata._—Straughan 1967a: 30 [Heron Island, Qld; see Imajima & ten Hove 1984: 41]; Nishi & Asakura 1996: 56 [description; Marianas].

*Serpula palauense* Imajima, 1982: 40–42, fig. 2a–m [fide Imajima & ten Hove 1984: 41].

Diagnosis. Tube white with (3–)5 longitudinal ridges, dotted with small deep-brown speckles (to almost orange in fresh material) between those ridges (Imajima 1982: 41, fig. 2m; as *S. palauense*) to complete transverse bands of brown.

Remarks. *Serpula vittata* differs from all other known *Serpula* spp. in its very characteristic tube. Though the operculum has been described with 18–23 radii (Augener 1914: 138, fig. 18 respectively Imajima 1982: 40, fig. 2a), in our material the operculum occasionally is globular only, with 6 longitudinal grooves (probably still developing from the pseudoperculum; Fig. 24A). From the diagnosis of the tube by Straughan (1967a: 30), round and white, her material evidently belongs to a different species. Similarly, Nishi & Asakura (1996) describe the tube as “white, thick walled, with a granular surface, irregularly coiled and lacking longitudinal ridges”.

Distribution. WA, Qld Australia; Palau Islands. First record from Lizard Island.

*Serpula watsoni* Willey, 1905
(Fig. 24B)

*Serpula watsoni* Willey, 1905: 317, pl. 7, fig. 187, pl. 8, fig. 6 [Trincomalee, Sri Lanka].

*Serpula watsoni*.—Straughan 1967a: 207–208, fig. 3b [Havannah Island, Qld]; Imajima 1977: 91–92, fig. 2a–j [Ogasawara Islands, Japan; redescription]; 1987: 78 [Okinawa, Japan]; Mak 1982: 609 [Hong Kong]; Morton & Morton 1983: 348 [Hong Kong]; Imajima & ten Hove 1984: 39, fig. 2 [Truk, Ponape, Majuro; Lizard Island; opercular variation]; 1986: 2 [Solomon Islands]; Parab & Gaikwad 1989: 224–225 [India]; Nishi 1992c: 79–80 [occurrence on living coral; Okinawa, Japan]; Wang & Huang 1993: 7 [Hong Kong; fouling]; Bastida-Zavala 2008: 46–47, fig. 11L–M [Hawaii]; Kupriyanova *et al.* 2008: 429 [Lizard Island, Qld; DNA data].


Diagnosis. Opercular funnel with 33 to 55 radii, very elongated, about as long as peduncle, with deep hollow, and inter-radiolar grooves almost reaching towards the constriction between funnel and peduncle.

Remarks. A taxon with a very similar operculum, but probably a different species, has been found at Long Reef (Sydney) and in the Abrolhos Archipelago (ten Hove unpubl.).


*Serpula spp.* (Fig. 24C, D)


Diagnosis. Tube white, opaque; (semi)circular to trapezoidal in cross-section; longitudinal keels, peristomes, may be present. Operculum funnel shaped with crenulated edge (fused radii). Peduncle smooth, cylindrical, without wings; inserted just below and between first and second dorsal radiole. Radioles arranged in semi-circles. Pseudoperculum and inter-radiolar membrane present. Branchial eyes may be present. Seven thoracic segments. Collar trilobed. Thoracic membranes long, forming ventral apron across anterior abdominal segments. Collar chaetae bayonet-shaped and limbate. *Apomatus* chaetae absent. Uncini saw-shaped, with approximately 5 teeth,
anterior fang simple pointed. Thoracic triangular depression present. Abdominal chaetae flat trumpet-shaped with denticulate edge; uncini similar to thoracic ones, smaller, anteriorly saw-shaped but becoming rasp-shaped towards the pygidium.

Remarks. The diagnosis above is essentially the shortened generic diagnosis that fits a general “Serpula”. A generic revision is badly needed.

Distribution. Currently unknown.

Genus *Spiraserpula* Regenhardt, 1961

Type-species. *Spiraserpula spiraserpula* Regenhardt, 1961

Diagnosis. (from ten Hove & Kupriyanova 2009). Tube variable in colour, from white to orange and mustard, or with pink lateral longitudinal stripes; opaque; circular to trapezoidal in cross-section, rarely with small peristomes. Rounded longitudinal keels may be present; hyaline granular overlay present. Tube with internal longitudinal keels or other structures and/or rows of teeth. Operculum soft, funnel shaped, formed of fused radii, endplate absent. Operculum absent in some species. Peduncle smooth, cylindrical, without wings; it is formed from the second dorsal radiole on one side. Pseudoperculum present. Radioles arranged in semi-circles, up to 8 per lobe. Inter-radial membrane present. Branchial eyes may be present. Stylos absent. Mouth palps absent. Five to ten thoracic chaetigerous segments. Collar trilobed, tonguellets absent. Thoracic membranes ending in mid-thorax. Collar chaetae bayonet-shaped and limbate. Apomatus chaetae absent. Thoracic uncini saw-shaped, with up to 7 teeth above anterior pointed fang. Thoracic triangular depression present. Abdominal chaetae flat trumpet-shaped with denticulate edge. Abdominal uncini similar to thoracic ones, smaller, anteriorly saw-shaped but becoming rasp-shaped towards the pygidium, with up to 8 teeth in profile, up to 7 teeth in a row. Achaetous anterior abdominal zone absent. Posterior capillary chaetae present. Posterior glandular pad absent.

Remarks. The genus was previously known only from fossils. It was revised by Pillai & ten Hove (1994) to include 18 *Serpula*-like species that lack an apron, but most characteristically possess sharp ridges and spines (“internal tube structures”, ITS) sticking out into the lumen of their tubes. During the first contacts between Pillai, ten Hove, and Zibrowius in the startup of what ended with the revision by Pillai & ten Hove (1994), the three specially searched existing collections for the presence of what possibly might be representatives of what they thought to be a special group of *Serpula*. This action indeed revealed a fair number of candidates. It is only after that process of increasing awareness that ten Hove, diving in the Caribbean (1987–1992) found new material in almost every dive. Nevertheless, it is a rather cryptic genus, as evidenced too by the fact that after its revision in 1994 hardly any new material has been recorded.

*Spiraserpula snellii* Pillai & ten Hove, 1994

*Spiraserpula snellii* Pillai & ten Hove, 1994: 84, 88–89, 91, fig. 26–28 [Red Sea, Indonesia; Lizard Island, Boulton Reef, Australia; Loyalty Islands; Okinawa, Japan; original description].
*Spiraserpula sp.—ten Hove 1994: 112 [Amirantes, Seychelles].
*Spiraserpula snellii.—*Pillai 2009: 143–144, fig. 34A–E [Kimberley, WA, material studied].


Diagnosis. Tubes up to 0.6 mm in external diameter, brownish in live and fresh material, but appearing mustard coloured after a few months in alcohol, with a pair of darker longitudinal bands along each flank. Tubes may be coiled more or less parallel to one another in the horizontal plane, mutually bonded together or spread out on the substrate and branched in places. Operculum absent, or simple, nearly globular.

Distribution. Taka Bone Rate, Indonesia, widely distributed in the Indo-West Pacific.
Spiraserpula iugoconvexa Pillai & ten Hove, 1994
(Fig. 25)

Spiraserpula iugoconvexa Pillai & ten Hove, 1994: 82, figs 24–25 [Flores and Banda Seas, Indonesia; Lizard Island; original description, material studied].


Diagnosis. Tube rose, red in fresh material, with a translucent granular overlay, coiled posteriorly, but not anteriorly. The operculum, when present, Serpula-type, with about 12 radii, zygomorphic, markedly convex distally, separated by a sharp constriction from the peduncle.

Distribution. North-East Flores Sea, Indonesia, Central Indo-West Pacific.

FIGURE 25. Spiraserpula iugoconvexa. A. Live specimen, stn.G232, AM W.42093; B. Operculum of fixed paratype AM W.21676. Photo: A—G. Rouse, B—E. Wong. Scale bars: A = 0.5 mm, B = 0.1 mm.

Genus Spirobranchus de Blainville, 1818

Type-species. Serpula gigantea Pallas, 1766

Diagnosis. (from ten Hove & Kupriyanova 2009). Tube colour white, blue, pink or salmon, inside and/or outside. Tube typically (sub)triangular in cross-section, with median keel, rarely (sub)circular. Granular overlay absent. Operculum with inverse conical to rather shallow ampulla, covered by calcified endplate, with or without group of spines, sometimes branching. Peduncle broad, thickly triangular in cross-section, with distal lateral wings; inserted at base of branchial crown just left of medial line (formed between first and second normal dorsal radiole on left
side). Pseudoperculum absent. Operculum rarely lacking. Radioles may be arranged in a clear spiral of up to 8 whorls, but in most small species as well as in *Spirobranchus tetraceros* arranged in a circle. Up to 50–60 pairs of radioles in larger species. Inter-radiolar membrane present. Branchial eyes may be present; stylodes absent. Mouth palps present. Seven thoracic chaetigerous segments. Collar trilobed (exceptionally pentalobed). Tonguelets present. Thoracic membranes forming ventral apron across anterior abdominal segment. Collar chaetae bayonet-like, with numerous hairlike processes on its basal portion (*Spirobranchus* chaetae), and limbate. *Apomatus* chaetae absent. All uncini saw-shaped (9–25 teeth), incidentally with 2 teeth above peg; anterior peg blunt, clearly gouged underneath. Ventral ends of thoracic uncini uncinigersor tawi widely separated anteriorly, gradually approaching one another towards the end of thorax, thus leaving a triangular depression. Abdominal chaetae true trumpet-shaped, abruptly bent distally, with two rows of denticles separated by a hollow groove and forming long lateral spine. Achaetous anterior abdominal zone absent. Chaetae becoming increasingly longer posteriorly, but posterior capillary chaetae absent. Posterior glandular pad absent.

**Remarks.** The larger representatives of this genus, with spirallized branchiae, are spectacularly colourful and generally known as Christmas tree worms. They figure in many guides to reef animals, even in a travel guide (Finlay et al. 1998: 80). However, not all animals reported under this name are indeed *Spirobranchus giganteus* sensu latissimo as defined in Fiege & ten Hove (1999 fig. 4), there are quite a few mix-ups with *Protula bispiralis* and vice versa, even with phoroniids. Members of the genus have confusing synonymies, the infraspecific variability of its main diagnostic character, the operculum, resulted in many mistaken identifications. Small specimens are even more difficult to identify, the opercula of juveniles of large sized species such as members of the *Sp. giganteus*-complex may resemble full grown opercula of small sized species (e.g., ten Hove & Ben-Eliahu 2005, fig. 6). Longitudinal rows of foramina, characteristic for species as *Sp. cf. polytrema* (Imajima 1977 fig. 8j) may be present in juvenile tubes of larger sized species, but disappear with increasing size (ten Hove, unpubl.).

**Spirobranchus corniculatus** (Grube, 1862)

(Fig. 26)

*Serpula (Pomatoceros) corniculata* Grube, 1862: 66, fig. 5 [Java; original description].

*Spirobranchus giganteus* not (Pallas, 1766).—Stabaugh 1967b: 245, fig. 14e [Qld, Australia; in part, several of the synonyms included by Stabaugh belong to *Sp. tetraceros*]; Smith 1984a: 461–483 [Magnetic, Orpheus and Lizard Island, Qld, Australia; larval development].


*Spirobranchus giganteus corniculatus*.—ten Hove 1970: 24–32, 50–51, figs 63–73 [widely distributed in the Indo-West Pacific; including most of the extensive synonymy, the main diagnostic character, the operculum, resulted in many mistaken identifications. Small specimens are even more difficult to identify, the opercula of juveniles of large sized species such as members of the *Sp. giganteus*-complex may resemble full grown opercula of small sized species (e.g., ten Hove & Ben-Eliahu 2005, fig. 6). Longitudinal rows of foramina, characteristic for species as *Sp. cf. polytrema* (Imajima 1977 fig. 8j) may be present in juvenile tubes of larger sized species, but disappear with increasing size (ten Hove, unpubl.).

SERPULIDAE OF LIZARD ISLAND

Zootaxa 4019 (1) © 2015 Magnolia Press · 327


**Diagnosis.** Spiral branchiae. Peduncular wings with entire edge. Opercular endplate with two dorso-lateral antler-like spines originating from a short common stem, often each spine with 2–3 secondary spines and with basal short, dorsal tine; medio-ventral spines may be present. Spine morphology very variable, dorsal tines may be short and broad, with blunt abraded tips and meeting above the midline (“Sp. gaymardi” morphotype); all opercular spines may be small, and tines, if present, narrow (“Sp. corniculatus” morphotype); dorso-lateral spines may be long, unabraded thin dorsal tines terminating in sharp spines and spaced widely apart, and the medio-ventral spine long and branching (“Sp. cruciger” morphotype).
Remarks. Based on analysis of nuclear and mitochondrial markers, Willette et al. (2015) concluded that the Spirobranchus corniculatus-complex of morphospecies identifiable by their opercula mainly (see Smith 1985 for further differences), which includes Sp. corniculatus sensu stricto, Sp. cruciger and Sp. gaymardi (Smith’s 1985 Sp. giganteus sp. A, sp. C and sp. B respectively) is a single, morphologically variable species widely distributed across the Indo-Pacific. We have followed this genetic appraisal here and synonymized the former morphospecies. However, sampling in the study of Willette et al. (2015) was limited to the Central Indo-Pacific, excluding the West and East Indo-Pacific regions. According to unpublished observations of one of us (HtH), the “cruciger”and “gaymardi” morphotypes are very common on the Red Sea, but “corniculatus” type opercula are very uncommon. The range of variation given for the "gaymardi" morphotypes from the Central Indo-Pacific is enormous as compared to that in the Red Sea. Further molecular studies are needed to determine whether or not the specimens from the Red Sea belong to different species as those found in Indo-Pacific. In view of the remarks given with the generic diagnosis, the many mistaken identifications (see for instance above, Spirobranchus giganteus not (Pallas, 1766) — Straughan 1967b), the difficulties in interpreting figures as (if) given in the literature, we have refrained from an extensive synonymy.


_Spirobranchus corniculatus_ Straughan, 1967a
(Fig. 27A)

_Spirobranchus corniculatus_ Straughan, 1967a: 247–248, fig. 15 [Qld, Australia, material studied; diagnosis, see Remarks].
_Spirobranchus corniculatus._— Straughan 1976b: 39 [Qld, Australia].


**Diagnosis.** Opercular plate with eight or ten almost erect and almost separate spines, basally arranged in 3 or 4 dichotomously branching groups. Peduncular wings without terminal digitate processes but may be laterally crenulated.

**Remarks.** Straughan’s poor description and figures led ten Hove (1970: 48) to synonymise this taxon with _Sp. tetraceros_. In 1983 and 1986, ten Hove (unpubl.) studied Straughan’s holotype (AM W.4025) and two presumed paratypes (AM W.4038 and AM W.4123), and based on this he reinstated the name (1993: 83; 1994: 112) for material from the Seychelles. However, Pillai (2009: 148–150, fig. 37 A–H) described _Sp. baileybrockae_ from Western Australia, differing from _Sp. corniculatus_ mainly in the presence of centrally directed spinules on the not branching opercular spines and the presence of a central spine. The latter characters were figured by Bailey-Brock (1985: fig. 8d–e) for material from Fiji as well. In this light, the material from the Seychelles should be restudied and held against the variability of the Lizard Island population (and Straughan’s original material which included some variation as well), but a full revision of these forms falls outside the scope of this paper.

**Distribution.** Qld, Australia.

_Spirobranchus corrugatus_ Straughan, 1967a
(Fig. 27B–D)

_Spirobranchus corrugatus_ Straughan, 1967a: 39–41, fig. 5a–e [Heron Island, Qld; diagnosis].
_Spirobranchus corrugatus._—ten Hove 1994: 112 [Amirantes Island, Seychelles; diagnosis, synonymy]; ten Hove & Nishi 1996: 87–93, figs 1–5 [Lizard Island and other Old localities; Abrolhos Islands, WA; Indonesia, Japan, Seychelles, Red Sea; re-description]; Hassan 1998: 53 [Red Sea; figure]; Fiege & Sun 1999: 124–125, fig. 13A–D [Hainan Island, South China Sea; description]; Sun & Yang 2001a: 195 [Hainan Island; South China Sea]; ten Hove & Kupriyanova 2009: 18, figs 4A, 98 [colour photo, name; Lizard Island].
Spirobranchus sp.—Vine & Bailey-Brock 1984: 146, fig. 5B–C [Sudanese Red Sea; synonymy fide ten Hove & Nishi 1996: 87].

Spirobranchus denisdevaneyi Bailey-Brock, 1985: 207–208, fig. 9a–e [Fiji; fide ten Hove & Nishi 1996: 87].

Spirobranchus denisdevaneyi.— Bailey-Brock 1987: 283 [Tonga].


Diagnosis. Operculum with slanting, flat to subconical endplate, sometimes with smooth surface but most typically with 10–20 radiating ridges ending in as many marginal teeth. In fresh material a very diagnostic feature is the intensely red band of single lensed ocelli in the ventral edge of the opercular ampulla immediately below the calcareous endplate, thinning out towards the dorsal side (Fig. 21B–D). However, ocelli are difficult to see in preserved material. Peduncular wings with entire edge, at most slightly crenulated, but terminal digitate processes absent.

Remarks. Tube may be difficult to find, deeply imbedded into substrate and having a greenish to pink tinge in fresh material. The material from North Point still showed the typical band of ocelli in their opercula upon re-examination in 2015.

Distribution. Qld Australia, widely distributed in the Indo-West Pacific.

Spirobranchus decoratus Imajima, 1982

Spirobranchus tricornigerus decoratus Imajima, 1982: 48–50, fig. 5a–m [Palau and Yap Islands; original description].

Spirobranchus tricornigerus var. racemosus Pillai, 1971: 99–100, fig. 3e [Sri Lanka; description].

Spirobranchus decoratus.—Imajima & ten Hove 1984: 52–53, fig. 5d [Truk Islands, Ponape and Majuro Atoll; discussion, synonymy]; Imajima & ten Hove 1986: 8 [Nauru, the Gilbert Islands, the Solomon Islands]; Imajima 1987: 79 [Okinawa, Japan]; Fiege & Sun 1999: 125–126, fig. 14a–d [Hainan Island, China; description]; Sun & Yang 2001a: 195–196, fig.7A–F [Hainan Island, South China Sea]; Bailey-Brock et al. 2012: 979–980, fig. 8A–H [Marshall Islands].


Diagnosis. Tubes wine-red to pink and white, triangular in cross-section with median keel of coarse spines flanked at both sides by a row of pits. Opercular plate flat, bearing a crown of 5–6 (or even more) dichotomously branching spines. Spines bear small paired denticles along their length. Spines all in same plane giving a finely pinnate, stellate appearance to the operculum. Peduncle with wide distal wings ending in a single (exceptionally two) process(es).

Remarks. See the discussion in Imajima & ten Hove (1984: 53).

Distribution. Indo-West Pacific, recorded from South Japan, South China Sea, the Islands Palau, Truk and Ponape, Majuro Atoll, Solomon Islands; Lizard Island, Australia and Sri Lanka.
Spirobranchus gardineri Pixell, 1913
(Fig. 28A, B)

Spirobranchus gardineri Pixell, 1913: 81–82, fig. 7a–f [Providence Reef, N. of Madagascar; original description].


Spirobranchus giganteus corniculatus not (Grube, 1862).—Bailey-Brock 1985: 203–204, fig. 6a–c [Fiji; diagnosis].

Spirobranchus tetraceros not (Schmarda, 1861).—Erhardt & Moosleitner 1995: 872 [the colour photograph clearly is not Sp. tetraceros but Sp. gardineri by spiraled branchiae and opercular set-up].


Diagnosis. Opercular plate bearing a (fairly long) column ending in a pair of latero-dorsal spines and a bifid medioventral spine, all with tips curved away from the opercular plate. Latero-dorsal spines each bear one pair of short spinules and two unpaired ones, the largest one located latero-ventrally, and the other three located subterminally. Peduncle with wide distal wings with entire edge (no processes).

Remarks. Spirobranchus gardineri resembles Sp. richardsmithi in having a column arising from distal plate and bearing three spines/processes distally. However, the three distal processes in Sp. gardineri are less elaborate, and are all directed anteriorly, away from the opercular plate, while the ventral bifurcate spine as well as the proximal side spinules of the two latero-dorsal spines are recurving towards the opercular plate in Sp. richardsmithi. This was noted for the first time by Smith (1985: 43–47, fig. 3G–H versus I–L), and formalized in a new description by Pillai (2009: 154–158). All records from before the last date should be checked whether or not they belong to Sp. gardineri sensu stricto; we have only given references where the identity is clear from either description or figures.

Pillai (2009: 182–184, fig. 60A–G) describes as Spirobranchus sp. 6 a single specimen from the South China Sea with an operculum almost intermediate between those of Sp. gardineri and Sp. richardsmithi, however, more complicated in that the two dorsal spines are bifid as well as the ventral one, which is pointing upward as in Sp. gardineri. It remains to be seen if this falls within the (as yet poorly documented) variability of Sp. gardineri or indeed merits a specific status.

FIGURE 28. A. *Spirobranchus gardineri*, live specimen *in situ*, AM W.45089; B. Opercula of fixed specimens of *Sp. gardineri* AM W.41832 (middle) & AM W.41756 (left, right); C. Opercula of fixed specimens of *Sp. richardsmithi*, AM W.41955. Photo: A—A. Semenov, B, C—E. Wong. Scale bars: A = 3 mm, B–C = 1 mm.
Spirobranchus laticapus (Marenzeller, 1885)  
(Fig. 29A, B)  

*Pomatostegus laticapus* Marenzeller, 1885: 218–219, pl. 4, fig. 5 [South Japan, 183 m; description].  

*Pomatoceros auritus* Moore & Bush, 1904: 174–175, pl. 11 fig. 20, pl. 12, figs 33–37 [Suruga Bay, Japan, 82 m; description].  


*?Spirobranchus sinensis* Wu & Chen, 1981b: 247–248, fig. 1 [South China Sea, 28 m; see Remarks].  


**Diagnosis.** Operculum with 1–5 (3–7) calcareous diabolo-like tiers, decreasing in size distally, with flat to conical tip. Tube: colour shades of reddish/orange (colour may be lost in preservation), triangular, with one large keel and a pair of lower lateral keels, with or without paired rows of pits at sides when attached, free parts often hexagonal. Peduncle with long (2/3rd to 4/5th of length) wings, with entire edge (no processes).  

**Remarks.** Because *Spirobranchus laticapus* has a confusing synonymy, we have only given the most likely synonyms/references. Being originally described from Southern Japan, the nominal taxon subsequently has been reported from areas as distant as Gulf of Suez to New Zealand, from diving depths in tropical seas to temperate New Zealand, down to almost 200 m, an unlikely distribution. Pillai (2009: 165, 170–174, 184–190) split the nominal taxon in 5 species, reinstating and redescribing *Sp. maldensis* Pixell, 1913 from the Maldives and Gulf of Oman, and describing 3 new species: *Sp. murrayi* from the Gulf of Oman, *Sp. tenhovei* from Tasmania and *Sp. zelandicus* from New Zealand, all formerly labelled *Sp. laticapus*. From New South Wales he described *Sp. zibrowii*, also similar in operculum and tube. *Spirobranchus laticapus* is the only taxon with a rose-red tube, as shown by our specimen AM W.201837 as well. All other nominal taxa have orange to caramel, to white or even bluish tubes. Furthermore, *Sp. sinensis* Wu & Chen, 1981b (247–248, fig. 1) is very similar if not the same, the “distinctive character” of chitinous spines on the operculum in the latter being remnants of epibiotic Hydrozoa (cf. Bouillon 1974). The complex should be revised.  

**Distribution.** South Japan to tropical Australia; usually off shore, in deeper water.

---

**Spirobranchus nigranucha** (Fischli, 1903)  
(Fig. 29C, D)  

*Protula (Protulopsis) nigranucha* Fischli, 1903: 128–129, pl. 5 fig. 31, pl.7 figs 73–75, pl. 8 figs 87–88 [Ternate, Indonesia; original description].  

*Protula nigro-nucha.*—Hartman 1959: 590 [name].  


*Sp. giganteus* sp. D.—Smith 1985: 37–40, figs 2D, 5D, L, M, S [Lizard Island and other Qld localities, Australia; extensive description, material partly studied by HtH 1986].


---

334 - Zootaxa 4019 (1) © 2015 Magnolia Press  

KUPIRIYANOVA ET AL.
FIGURE 29. A. Spirobranchus latiscapus, operculum of fixed specimen (stained with methyl green), AM W.201802; B. Sp. latiscapus, anterior end (stained with methyl green), AM W.201837; C. Sp. nigranucha, dorsal view of radiolar crown showing lack of peduncle (arrow indicates a tonguelet), AM W.41948; D. Close-up view of the same specimen (stained with methyl green). Photo: A–D—E. Wong. Scale bars: A–D = 1 mm.
**Diagnosis.** Operculum or scar of peduncle absent, yellowish orange radioles in 4–5 whorls, clear reniform eyes at base, tube deeply embedded inside *Acropora* colonies. A further distinction with *Protula bispiralis* is the presence of tonguelets between latero-dorsal and ventral collar parts in *Spirobranchus* (Fig. 25C, D).

**Remarks.** *Sp. nigranucha* is unique among all *Spirobranchus* spp. because it lacks an operculum.

**Distribution.** Ternate, Indonesia, Indo-West Pacific. New record for Australia.

---

**Spirobranchus cf. polytrema** (Philippi, 1844)

(Fig. 30A, B)

*Vermilia polytrema* Philippi, 1844: 194. Pl. 6, fig. N [Mediterranean; original combination, however, probably different species].

*Not Temporaria polytrema.* —Straughan 1967a: 239 [NSW, Australia; at least for the larger part split and redescribed as *Sp. pseudopolytrema* Pillai, 2009 (p. 176–178, fig. 56A–I) and *Sp. zibrowii* Pillai, 2009 (p. 188–190, fig. 63A–L)].

*Temporaria polytrema.* —Pillai 1971: 94–96, fig. 3A–D [Sri Lanka].


*Spirobranchus cf. polycerus* not (Schmarda, 1861).—Sun & Yang 2001a: 188–199, fig. 9 [South China Sea].

*Spirobranchus polytrema.* —Hartmann-Schröder 1979: 154, fig. 369 [Port Hedland, WA, Australia]; Imajima & ten Hove 1986: 8 [Solomon Islands].


---


**Diagnosis.** Calcareous part of operculum variable in shape, from almost simple plate with two dorsal knobs only to conical or even a diabolo; never with spines. Peduncular wings either with 4–6 digitate processes or simple narrow without such processes (exceptionally with 2 fingerlike processes). Tube one to three longitudinal keels flanked by rows of foramina (pits).

**Remarks.** The occurrence of the temperate/subtropical Atlantic/Mediterranean species *Spirobranchus polytrema* (Philippi, 1844) in the tropical Indo-West Pacific is rather doubtful (discussions in Imajima (1977: 106) and Pillai (2009: 153)). Likely this material will prove to be genetically different, therefore, we prefer to indicate this taxon with *Sp. cf. polytrema*. Records of *Spirobranchus cf. polytrema* from the Indo-West Pacific include two morphotypes, type A and type B (Imajima 1977; also in Fiege & Sun 1999), differing in the distal calcareous opercular cone, peduncular wings with or without digitate processes and expression of longitudinal rows of foramina in the tube. Our material resembles type B in the shape of peduncular wings and tube. However, Straughan's material (of *Temporaria oligotrema*) mostly is conform Imajima's type A, with many foramina (contrary to the name which suggests few; in fact the tube is indistinguishable from that of *Spirobranchus minutus* Rioja, 1941), as well as Hartmann-Schröder's (1979) from Western Australia, Pillai's (1971) material from Sri Lanka and that of Sun & Yang (2001a) from the South China Sea. Under the Caribbean name *Sp. cf. polycerus* the
latter authors describe a form with intermediate characters between Types A and B. Some of Straughan’s material identified as oligotrema and restudied by one of us (HHH, between 1983 and 2005, unpublished) probably belongs to Sp. corrugatus or even juvenile corniculatus or tetraceros. A complete revision is badly needed but falls out of the scope of this paper. The specific name polytrema is a noun in apposition and need not get the same ending as the generic name (contrary to Pillai 2009), see Article 34.2.1 of ICZN (1999).

**Distribution.** The nominal species is quite common in the Mediterranean, Atlantic; however, records from the Indo-West Pacific form probably a complex of species by themselves.

*Spirobranchus richardsmithi* Pillai, 2009

(Fig. 28C)


*Spirobranchus gardineri* not Pixell, 1913.—Smith 1985: 43–47, fig. 31–L [Lizard Island, Australia; partim, variant types 1 and 2 only]; Fiege & ten Hove 1999: 362–363 [in part; discussion and mention of 2 taxa under this name; the material from Hainan Island belongs to Sp. richardsmithi]; Fiege & Sun 1999: 126, fig. 15A, B [Hainan Island, China].


**Diagnosis.** Opercular plate bearing a column ending in a pair of latero-dorsal spines with tips almost curving upright and a bifid medio-ventral spine with tips recurving towards opercular plate. Latero-dorsal spines each bear three short spinules, one single located latero-ventrally and clearly recurving towards opercular plate, the other pair located sub-terminally, not recurving. Peduncle with wide distal wings with entire edge (no processes).

**Remarks.** See remarks under *Sp. gardineri*.

**Distribution.** Widely distributed in the Indo-West Pacific.

*Spirobranchus tetraceros* (Schmarda, 1861)

(Fig. 30C, D)

*Pomatoceros tetraceros* Schmarda, 1861: 30, plate 21 fig. 179 [NSW, Australia].

*Pomatoceros tetraceros*.—Beesley et al. 2000: 8, Fig. 1.6B [reproduction of Schmarda’s original figure].

*Pomatoceros elaphus* Haswell, 1885: 663–665, pl. 31 fig. 7, pl. 32 figs 9–10 [Port Jackson, NSW].

*Spirobranchus semperti*.—Augener 1913: 82 [Sharks Bay, WA; extensive description]; 1914: 148–142 [same]; Straughan 1967b: 246–247 [Qld, Australia; diagnosis].

*Spirobranchus tetraceros*.—Johansson 1918: 7–10, fig. 2 [Cape Jaubert, WA]; ten Hove 1970: 3–13, 47–49, figs 1–25 [synonymy, in part; see Remarks]; Imajima & ten Hove 1984: 51–52 [Truk Islands, Ponape and Majuro Atoll; Lizard Island, Qld and Capes Farquhar and Jaubert, WA]; Pillai 2009: 158–162, fig. 44A–C, 45A–I, 46A–K [Kimberley, WA, Australia].

*Spirobranchus giganteus* not (Pallas, 1766).—Dew 1959: 45, fig. 17 [at least in part, see Remarks].

*Spirobranchus tricornis*.—Straughan 1967a: 39 [Qld; diagnosis]; 1967b: 244, fig. 14b–d [NSW, Qld, Australia; diagnosis].

*Spirobranchus coutierei*.—Straughan 1967c: 224, fig. 1a–d [NT, Australia; diagnosis].

Diagnosis. Opercular plate mostly flat, sometimes conical; basally carrying 1 medio-ventral spine and 2 laterodorsal spines (“tricornis”); alternatively the medio-ventral spine appears as two fully separate spines which with the two latero-dorsal spines leads to 4 primary spines (“tetraceros”). All spines are at least split once, generally twice or three times resulting in 6–14 spine tips. Completely conical opercula just with 3 rudimentary spines or without. Peduncular wings with finger-like processes distally (rarely without).

Remarks. We have refrained from giving an exhaustive list of synonyms and given some “trusted” Australian records only. This taxon is regarded to be a complex of species in recent years (e.g., Smith 1985: 51–61; Fiege & ten Hove 1999: 362; ten Hove & Kupriyanova 2009: 12, 98; Ben-Eliahu & ten Hove 2011: 91). Its synonymy is very complicated and far from settled. WoRMS (http://www.marinespecies.org/polychaeta/aphia.php?p=taxdetails&id=131055)—based mainly on ten Hove (1970) as last revision and not fully taking into account Pillai (2009)—lists for this species 33 combinations (including spelling errors) of names, under essentially 8 generic and 17 specific names, as well as 4 more likely synonyms in the remarks. This does not even take into account the frequent misidentifications of Indo-West Pacific material ranging from Pomatoceros triqueter (Linnaeus, 1758) to Spirorbis giganteus (Pallas, 1776). Ben-Eliahu & ten Hove (2011: 91) give an extensive discussion. The (certainly partly anthropogenic) distribution is very unlikely for a single species in our present view: circumtropical, Lessepsian migrant to the Levantine Mediterranean and in Australia down to subtropical/temperate New South Wales, moreover from intertidal rocks to endobiotic in corals.

Indicative of the problems in this taxon is Dew’s (1959: 45–46) record. Following e.g., Fauvel (1933a: 78–79, Gulf of Suez, Gulf of Aqaba) and Mono (1937: 317, Arabian Sea) she identified her material as Vermilia multivaricosa Mörch, 1863, new name for Vermilia infundibulum sensu Philippi, 1844. However, her figure 17 clearly belonged to Sp. tetraceros as well as her essentially NSW samples, while (part of) her material from Queensland belonged to what we presently would attribute to Sp. corniculatus. The (material largely restudied by HtH in 1970, 1986). Straughan (1967a, b, c) attributed three different names to her material, but checking that ten Hove (1970: 47–49) could not find consistent agreement between morphology and attributed names.

Distribution. Indo-West Pacific, including Australia (NSW, Qld, WA).

Genus Vermiliopsis Saint-Joseph, 1894

Type-species. Vermilia multivaricosa Mörch, 1863, new name for Vermilia infundibulum sensu Philippi, 1844

Diagnosis. (from ten Hove & Kupriyanova 2009). Tube white, opaque, circular to sub-quadrangular in cross-section; generally with 3–7 longitudinal keels and peristomes. Granular overlay absent. Operculum an inverse conical ampulla, with flat to conical chitinous endplate, sometimes a partitioned cap. Peduncle wrinkled, cylindrical, separated from opercular ampulla by a constriction; without distal wings, but a proximal wing may be present. Peduncle ontogenetically formed from second dorsal radiole on one side, but in adults at base of branchial crown covering 3–6 normal radioles. Pseudoperculum generally absent (but present as under-developed second radiole in V. striaticeps). Radioles arranged in (semi-)circles, up to 20 per lobe. Inter-radiolar membrane absent.

**Remarks.** The genus *Vermiliopsis* is ill-defined, and designation of a neotype is unavoidable. The binomen *Vermiliopsis infundibulum* generally has been used for Mediterranean-Lusitanian forms, and only rarely for Indo-Pacific forms which normally have been identified as *Vermiliopsis glandigera/us* Gravier, 1906a or *Vermiliopsis pygidialis* Willey, 1905. More extensive discussions on the taxonomic problems in this group have been given by ten Hove (1975: 55–59), ten Hove & Kupriyanova (2009: 100–101), Pillai (2009: 104–109), and Ben-Eliahu & ten Hove (2011: 95–96). Pillai (2009) added yet another name (*V. cylindrica*) been given by ten Hove (1975: 55–59), ten Hove & Kupriyanova (2009: 100–101), Pillai (2009: 104–109), and Willey, 1905. More extensive discussions on the taxonomic problems in this group have been given by ten Hove (1975: 55–59), ten Hove & Kupriyanova (2009: 100–101), Pillai (2009: 104–109), and Ben-Eliahu & ten Hove (2011: 95–96). Pillai (2009) added yet another name (*V. cylindrica*) Pillai, 2009 from Western Australia to the number of available names, based on the fact that this material had a cylindrical operculum, which should be “domeshaped or conical in the other known species of *Vermiliopsis*”. However, such cylindrical opercula have been reported in the literature for other nominal taxa in the complex as well (e.g., Augener 1906 fig. 154 for his nominal species *V. annulituba* from the Caribbean; Saint-Joseph 1894 pl. 5 fig. 116, Bianchi 1981 fig. 1; 1981 fig. 25h for *V. infundibulum* (Philippi, 1844) from the Mediterranean; Imajima 1976b fig. 11a, f; Fiege & Sun 1999 fig. 21C, D; Sun & Yang 2001a fig. 12C for *V. infundibulum/glandigera* from the Indo-West Pacific), thus the validity of Pillai’s new species should be checked. He, however, attributed most of his other material (and many other Indo-West Pacific records) of *Vermiliopsis* to *V. glandigera* Gravier, 1906a. See further remarks on the *Vermiliopsis glandigera/pygidialis*-complex below. We only have given some well illustrated literature records, as well as Australian references.

**Vermiliopsis glandigera/pygidialis**-complex

(Fig. 31A–C)

*Vermiliopsis glandigera* Gravier, 1906a: 112–113 [Red Sea; description].


*Vermiliopsis pygidialis*.—Dew 1958: 54–57 [Aquarium at Taronga Zoo, Sydney, NSW, Australia]; Kupriyanova et al. 2006: 423, table 1, figs 4–7 [Qld, Australia; DNA].


*Vermiliopsis infundibulum* *glandigera*—ten Hove 1975: 55–59 [discussion of the complex]; Imajima 1976b: 139–141, fig. 11a–o [description; Tanega-shima, Japan]; Fiege & Sun 1999: 133, fig. 21A–E [Hainan Island, China].

? *Vermiliopsis cylindrica* Pillai, 2009: 100–103, figs 3A–N, 3A–E [Western Australia; description].

Serpula labiata


**Diagnosis.** Operculum a soft basal ampulla and a distal brown chitinous cap, which may be elongated and divided into up to 7 layers by partitions. Cap conical or flat, then often with simple terminal spinelet. Peduncle cylindrical or slightly compressed and wrinkled (see, however, remarks). Tube semicircular to trapezoidal in cross-section, rugose, generally with 4 (3–7) longitudinal keels and some peristomes.

**Remarks.** In addition to the generic remarks, above, we want to draw the attention to the following observations. Some of Dew’s specimens (1958: 54–57) from the aquarium at Taronga Zoo were restudied by one of us (HH, 1975) and were exceptional in the presence of a kind of pseudoperculum. This character only has been observed in the syntypes of *Vermiliopsis glandigera* (Grube, 1862) and *Vermiliopsis striaticeps* (Grube, 1862), see ten Hove & Kupriyanova (2009: 14). Since this character hardly ever has been mentioned in the literature, its value should be checked in a necessary revision of the genus. The same applies to the absence/presence of “wings” on the opercular peduncle, clearly present in the syntypes of *Vermiliopsis glandigera* Gravier, 1906a, though not mentioned in the original description (see ten Hove & Kupriyanova 2009: 22). Molecular genetic studies are needed to resolve the complex.

**Reproduction.** Specimen from SAM E3590 was found brooding lecithotrophic larvae in the tube.

**Distribution.** Unknown, likely Indo-Pacific.

**Vermiliopsis labiata** (Costa, 1861)

(Fig. 31D)

*Serpula labiata* Costa, 1861: 32, pl. 7, fig. 2 [Italy, Mediterranean Sea; diagnosis].


SERPULIDAE OF LIZARD ISLAND

Zootaxa 4019 (1) © 2015 Magnolia Press · 341
**Key to serpulids from Lizard Island**

1. Body symmetrical, tubes not coiled into flat spirals .................................................. 2
   - Body asymmetrical, tubes coiled into flat spirals ........................................................ spiorbins
2. (1) Tube (semi) transparent, collar region with a band of reddish ocelli. .................. Placostegus sp. (Fig. 14B, C)
   - Tube opaque, collar region without reniform band of reddish ocelli. ......................... 3
3. (2) Operculum present. ................................. 4
   - Operculum absent ........................................ 38
4. (3) Stylostyles on radioles present. .................... Dasynema chrysogyrus (Fig. 1C)
   - Stylostyles on radioles absent ........................................ 5
5. (4) Tubes only about 0.1 mm wide, operculum delicate membranous cup with a flat distal surface surmounted by a marginal crown of fine teeth joined by a transparent membrane; borne on normal pinnulated radioles ................................................................. Josephella marenzelleri (Fig. 12)
   - Tubes 0.1–7 mm in diameter, operculum otherwise, borne on smooth (lacking pinnules) peduncle ......................... 6
6. (5) Tubes no more than 0.1 mm, operculum pear-shaped, laterally compressed, bearing chitinous (infolded) plate with multiple spines ................................................................. Rhodopsis pusilla (Fig. 18A)
   - Tubes maybe more than 0.1 mm, operculum otherwise ................................................. 7
7. (6) Peduncle flat, ribbon-like .......................................................... Metazavrella 8
   - Peduncle cylindrical ........................................... 10
8. (7) Operculum simple globular, covered with simple chitinous convex distal cap; tube with 5–7 longitudinal keels and some transverse annulls ................................................ M. multiricristata
   - Operculum complex, distal part composed of 4–10 parallel tiers or disks fringed by simple or bifurcated spines ................... 9
9. (8) Distal chitinous part of the operculum terminates with unadorned disk; tube with 5–9 longitudinal keels ................................................................. M. nates (Fig. 13C, D)
   - Distal chitinous part of the operculum terminates with a single distal spine or hook; tube with one or three irregular longitudinal keels ................................................................. M. acanthophora (Fig. 13A, B)
10. (7) Peduncle without well-developed membranous distal lateral wings .................... 11
    - Peduncle with well-developed membranous distal lateral wings ................................ 24
11. (10) Pseudoperculum (rudimentary operculum) present, functional operculum consisting of basal funnel of fused radii with or without distal verticil (crown) of chitinous spines ................................................................. 12
    - Pseudoperculum (rudimentary operculum) absent, functional operculum otherwise ........ 32
12. (11) Operculum two-tiered, with proximal funnel of fused radii and distal verticil (crown) of chitinous spines. .......................... Hydroides 13
    - Operculum a simple funnel made of fused radii ......................................................... 20
13. (12) Spines of opercular verticil all similar in size and shape, no special dorsal spines. ......................................................... 14
    - Spines of opercular verticil dissimilar, one or two dorsal spines distinctly different ........ 15
14. (13) 13–15 verticil spines with straight tips, each with 4–6 lateral spines and 4–6 internal spines; central tooth short ......................................................... H. longispinosa (Fig. 6)
    - 7–8 verticil spines with tips curved outwards, each with a pair of outwardly curved lateral spines and an internal spine, central tooth absent ................................................................. H. tambalagamensis (Fig. 9)
15. (13) Large dorsal spine raising above other verticil spines and ending in a hook incurving over other spines ......................... 16
    - Large dorsal spine straight or slightly curved inwards, not ending in an incurving hook .................. 17
16. (15) Distal hook of dorsal spine with two distal lateral spines, length of other verticil spines about 1/4 of that of dorsal spine, internal spines on other verticil spines absent ................................................ H. minax (Fig. 7)
    - Distal hook of dorsal spine with two distal lateral spines, length of other verticil spines about 1/2 of that of dorsal spine, all other verticil spines with an internal spine at about mid-length each. ................................................ H. liris n. sp. (Figs 4, 5)
17. (15) Dorsal spine more or less bulbous, thicker than other verticil spines ...................(Fig. 8)
    - Dorsal spine narrow, with pointed tip ......................................................... H. cf. recta (Fig. 8)
18. (17) Bulbous dorsal verticil spine exceptionally large ............................................... H. trivesiculosa (Fig. 10)
    - Bulbous dorsal verticil spine slightly larger than other spines ........................................ 19
19. (18) Dorsal verticil spine straight ......................................................... H. albiceps (Fig. 2)
- Dorsal verticil spine curved over remaining verticil spines .......................... H. tuberculata (Fig. 11)
20. (12) Basal processes below opercular funnel absent ............................... 21
- Basal processes below opercular funnel present ........................................... Cruciger tricornis (Fig. 1A, B)
21. (20) Tube white with or without brown stripes, without internal structures .................................................. Serpula 23
- Tube rose, bright red or mustard, with internal structures .......................... Spiraserpula 22
22. (21) Tube rose or brigh red ................................................................. Spiraserpula iugo-convexa (Fig. 25)
- Tube mustard-coloured ............................................................................. Spiraserpula snelli
23. (21) Tube white with brown (to orange) transverse stripes, operculum simple grooved bulb or opercular funnel relatively short . Serpula vittata (Fig. 24A)
- Tube white without brown stripes, long opercular funnel .......................... Serpula watsoni (Fig. 24B)
24. (10) Operculum with chitinious column bearing several serrated disks ........................................ Pomatostegus actinoceras (Fig. 14D)
- Operculum with calcareous endplate, sometimes with non-movable spines ................................. Spirobranchus 25
25. (24) Branchiae spiral, tubes mostly embedded into corals, operculum with calcareous distal plate bearing spines ..................... 26
- Non-spiral branchiae, tubes may not be embedded into corals; spines present or absent ........................................ 28
26. (25) Three-four antler-like spines of opercular plate originating from a long common central stem ......................................... 27
- No long common stem, opercular spines (ventral and dorsal) originate from the central knob on opercular distal plate ................................................................. Sp. corniculatus (Fig. 26)
27. (26) All spines facing forward ................................................................ Sp. gardineri (Fig. 28A, B)
- Some spines facing backward ................................................................. Sp. richardsmithi (Fig. 28C)
28. (25) Inter-radial membrane with lappets between radioles, operculum with spines .................................................... 29
- Inter-radial membrane without lappets or frills between radioles, opercular distal plate without spines .......................... 30
29. (28) Four groups of 2 major spines each with numerous spinules ................................................................. Sp. tetraceros (Fig. 30C, D)
- Five major spines each branching at least 2 times resulting in 20 main spines bearing 5~7 pairs of lateral spinules each .......... 31
- Eight or more almost erect and almost separate spines ................................................. Sp. coronatus (Fig. 27A)
30. (28) Tube white, opercular distal plate with 10~20 ridges radiating from the center and ending in as many marginal teeth ................................................................. Sp. corragatus (Fig. 27B~D)
- Tube pink, opercular distal plate without radiating ridges .................................................. 31
31. (30) Peduncular wings not branching, single or multiple disks on opercular plates .......................................................... Sp. latiscapus (Fig. 29A, B)
- Peduncular wings branching, often opercular distal plate with 2 rounded knobs .......................................................... Sp. cf. polymotrema (Fig. 30A, B)
32. (11) Thoracic membranes ending at chaetiger 3 or 4; anterior tooth of thoracic uncini simple ..................................... Vermiliosipsis 33
- Thoracic membranes ending at chaetiger 2; anterior tooth of thoracic uncini gouged ................................................. 34
33. (32) Operculum with elongated brown chinous distal cap subdivided by numerous partitions ............................................................... Vermiliosipsis glandigera/pygidialis-complex (Fig. 31A~C)
- Operculum covered with simple concave endplate additionally enforced with calcareous deposits ................................. Vermiliosipsis labiata (Fig. 31D)
34. (33) Operculum with simple distal plate/cap, flat or concave .................................................. 35
- Operculum with elongated endcap subdivided by numerous partitions ................................................................. 36
35. (34) Operculum simple transparent cone covered with semi-transparent flat distal plate, paired elongated chambers along the distal end of tube present .......................................................... Semivermilia annelhoggertiae n. sp. (Figs 18, 19)
- Operculum with simple asymmetrical convex endcap; paired elongated chambers along the distal end of tube absent .................. Semivermilia lylevaili n. sp. (Figs 20, 21)
36. (34) Tube triangular, with single smooth keel; thoracic uncini saw-shaped .......................... Pseudovermilia pacifica (Fig. 16)
- Tube with three keels; thoracic uncini saw-to-rasp shaped ................................................ 37
37. (36) Tube triangular in cross section, with a well-defined median ridge, two lateral longitudinal ridges, and broad lateral flanges ................................. Semivermilia pomatoslideogidae (Figs 22A, 23)
- Tube trapezoidal in cross section, with one erect and two oblique irregularly serrated longitudinal keels and at most with narrow lateral flanges ................................................ Semivermilia uchidai (Fig. 22B)
38. (3) Collar chaetae simple only, special chaetae absent .......................................................... 39
- Collar chaetae simple and special ............................................................... 41
39. (38) Apomatus chaetae absent; thoracic membranes narrow; brooding appendage in branchial crown ................................................. Paraprotis dendoava (Fig. 14A)
- Apomatus chaetae present, thoracic membranes wide; no brooding appendages in branchial crown ......................................... Protula 40
40. (39) Large animals, with radioles arranged in two spires of up to 6 whors, up to 4 cm across and 4.5 cm high ................................................................. Protula bispinalis (Fig. 15D)
- Much smaller animals, radioles arranged in semicircles ........................................................................ Protula spp. (Fig. 15A~C)
41. (38) Special collar chaetae bayonet-type, mustard-coloured tubes with internal tube structures present ........... Spiraserpula snelli
- Special collar chaetae fin-and-blade, tubes forming pseudocolumnies consisting of large number of tiny white tubes ........................................... Salmacina sp. (Fig. 17B, C)
- Special collar chaetae Spirobranchus-type; yellow spiral radioles, tubes embedded into corals ........................ Spirobranchus nigraenhara (Fig. 29C, D)
Acknowledgements

The study was funded by a Lizard Island Reef Research Foundation grant to Pat Hutchings, Anne Hoggett, and Elena Kupriyanova, and Australian Biological Research Study (ABRS) grant RF213-19 to Elena Kupriyanova and Pat Hutchings. Harry A. ten Hove was supported by an Australian Museum visiting fellowship in 1986 when he and Pat Hutchings collected polychaetes at Lizard Island. Collecting at LIRS in 2005 was funded by Australian Research Council (ARC) Discovery grant DP0558736 to Greg Rouse. The most recent material was collected during the Polychaete Workshop held in Lizard Island, 2013 (permit number G12/35718.1 issued by the Great Barrier Reef Marine Park Authority). Special thanks are due to Anne Hoggett and Lyle Vail for hosting the workshop. We thank Alexander Semenov who took photos in 2013 during the polychaete workshop and Sue Lindsay who helped with SEM. Finally, we thank Julie Brock and João Nogueira for their helpful comments in review.

References

Ben-Eliahu, M.N. & Hove, H.A. ten (1989) A Redescription of Rhodopsis pusilla Bush, a little known but widely distributed


http://dx.doi.org/10.1111/j.1096-3642.1922.tb01843.x


http://dx.doi.org/10.1098/rstb.1969.0020


---

**Serpulidae of Lizard Island**

Zootaxa 4019 (1) © 2015 Magnolia Press · 347


http://dx.doi.org/10.1071/IS12024


http://dx.doi.org/10.1139/f71-215


http://dx.doi.org/10.1139/f71-215


http://dx.doi.org/10.1139/f71-215


http://dx.doi.org/10.1139/f71-215


http://dx.doi.org/10.1139/f71-215


http://dx.doi.org/10.1139/f71-215


http://dx.doi.org/10.1139/f71-215


### Zootaxa

**ISSN:** 1175-5326  
**Title:** Zootaxa  
**Publishing Body:** Magnolia Press  
**Country:** New Zealand  
**Status:** Active  
**Start Year:** 2001  
**Frequency:** Irregular ((weekly with several issues))  
**Document Type:** Journal; Academic/Scholarly  
**Refereed:** Yes  
**Abstracted/Indexed:** Yes  
**Media:** Print  
**Alternate Edition ISSN:** 1175-5334  
**Language:** Text in English  
**Price:** USD 4,500 subscription per year Entomology Or Non-Insect Issues (Print & Online Eds.)  
USD 8,000 combined subscription per year Entomology & Non-Insect (Print & Online Eds.) (effective 2009)  
**Subject:** BIOLOGY - ZOOLOGY  
**Dewey #:** 590.12  
**Editor(s):** Zhi-Qiang Zhang  
**E-Mail:** zootaxa@mapress.com  
**URL:** http://www.mapress.com/zootaxa  
**Description:** Aims for the rapid publication of papers and monographs on all aspects of zootaxonomy.

---

**Copyright © 2010 ProQuest LLC | Privacy Policy | Terms of Use | Contact Us**