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Serpulinae (Annelida, Polychaeta) from the Truk Islands, Ponape and Majuro Atoll, with Some Other New Indo-Pacific Records[1)]

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Synopsis

IMAJIMA, M. and TEN HOVE, H. A. 1984——Serpulinae (Annelida, Polychaeta) from the Truk Islands, Ponape and Majuro Atoll, with some other new Indo-Pacific records. *Proc. Jap. Soc. syst. Zool., Tokyo*, No. 27: 35–66.

Serpulids collected from the Truk Islands, Ponape and Majuro Atoll, washed by the North Equatorial Current have been examined. The present study deals with 24 taxa in 10 genera; *Dasynema chrysogyrus* (GRUBE, 1876), known from its original record from the Philippines only, is redescribed. Of the thirty serpulids obtained from areas between the Western Caroline and Marshall Islands, the following seven species *Serpula hartmanae, S. vittata, Hydroides brachyacantha, H. novaepommeraniae, H. furcifera, Spirobranchus decoratus, Dasynema chrysogyrus* apparently do not range to Japan.

In sequel to the survey of the marine fauna around the Palau and Yap Islands (IMAJIMA, 1980) a second survey was carried out in the Truk and Ponape Islands (Eastern Caroline Islands), and Majuro Atoll (Marshall Islands), by six persons in June to August, 1982. The survey was undertaken as part of a project to elucidate the origin of that part of the Japanese marine fauna, which may have been conveyed and dispersed by the Kuroshio Current, a branch of the North Equatorial Current.

Although in this survey many polychaetes have been obtained by the first author (the leader of the expedition), this report deals with Serpulidae only. The calcareous tubes of serpulids are attached to rocks, corals, shells, and other hard substrates. The specimens were collected by hand in the intertidal zone, and by dredging in depths up to 17 m.

Up till now only one serpulid species, *Salmacina incrustans* CLAPARÈDE had been recorded from Majuro Atoll by REISH (1968).

The present study deals with 24 taxa in 10 genera, including two new species. A redescription is given of *Dasynema chrysogyrus* (GRUBE), known from its original record only.

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Serpula LINNAEUS, 1758

Serpula vermicularis LINNAEUS, 1767

Serpula vermicularis: STRAUGHAN, 1967a, p. 206, fig. 3 (a); ZIBROWIUS, 1968, pp. 96–98, pl. 1, figs. 1–5; IMAJIMA, 1976a, p. 141; 1982, p. 38.

Material examined. Truk: Nemwan, Moen (1 specimen). Ponape: outer reef, north of Takatik (1). Majuro: Ajukwola (1).

Remarks. Although we conform to the current idea of this nominal species *S. vermicularis*, it should be noted that it is ill-defined, as are most other species of the genus (TEN HOVE & JANSEN-JACOBS, ms). Close examination of Australian material of this nominal taxon, identified by various authors, revealed presence of at least two different species, one of them similar to Mediterranean material (TEN HOVE, unpublished data). A revision of the genus is necessary.

Distribution. Cosmopolitan (?).

Serpula hartmanae REISH, 1968

(Fig. 1, a–d)

Serpula sp., HARTMAN, 1954, p. 641.

Serpula hartmanae REISH, 1968, pp. 228–229, fig. 5 (11–16); GIBBS, 1971, p. 203; RULLIER, 1972, p. 154.

Serpula concharum (not LANGERHANS, 1880): IMAJIMA, 1982, pp. 38–39, fig. 1.

Material examined. Bikini, Ocean side of Enyu Island, 6.IX.1965, D. REISH coll. (Holotype & Paratype, USNM 38400, 38401); Truk:

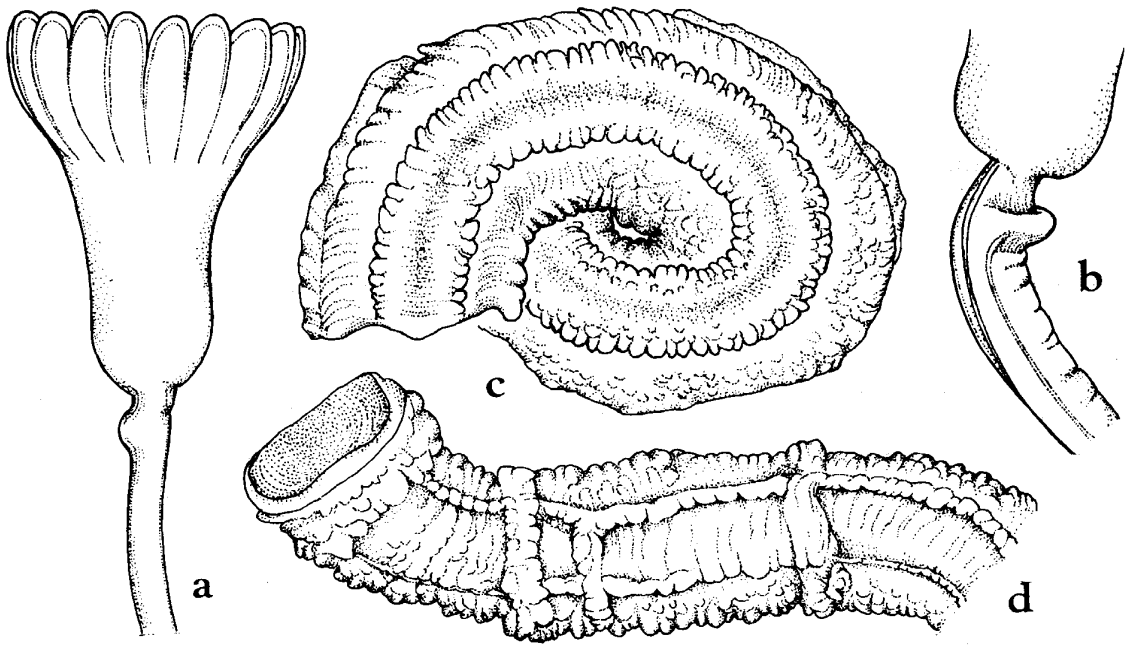


Fig. 1. *Serpula hartmanae* REISH. a, operculum, in lateral view, ×35; b, opercular peduncle, showing a protrusion distally, ×35; c, entire tube, in dorsal view, ×8; d, anterior end of tube, ×8.

Nemwan, Moen (2); Sapuk, Moen (4); Epinup, Moen (12); Northeast Is. (12); Kutua Point, Dublon Is. (5); east coast of Fefan Is. (1); Eten Is. (3). Ponape: Nankapenparam reef (4); outer reef, north of Takatik (1). Majuro: Calalin (86); Eroj (18); Roguron (10); Ajukwola (3); Bwokwtoonal (2); near Woja (3).

Description. The opercular funnel is shallow, and shaped like an inverted bell; it has 11 to 20 blunt marginal teeth. The grooves between the teeth reach nearly to the center of the funnel; at the outer side they cover only 1/3 of the length of the funnel. The opercular peduncle is cylindrical and arises from the left or right branchial lobes, just below the first normal filament; there is a constriction between basal part of the funnel and the peduncle. The distal part of the peduncle is enlarged and forms 2 knobs or a semicircular protrusion (Fig. 1, a, b).

The thorax has 7 segments, 6 of which are uncinigerous. The collar setae are limbate capillaries and bayonet-shaped setae, with two or three heavy conical teeth and a variable number of small accessory teeth at the base of the pointed distal portion. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 8 teeth in a row. The anterior abdominal uncini have 8 teeth in a row; posteriorly they are rasp-shaped, with 1 to 4 rows of sharp teeth, 8 teeth are visible in profile. The abdominal setae are flat trumpet-shaped distally, with about

40 minute teeth in lateral view; they are replaced by long capillary setae in the posterior segments.

The tube is white, thick-walled, with a granular surface; it is irregularly coiled (Fig. 1, c) to nearly straight with some "peristomes" on the dorsal surface (Fig. 1, d). It is subtrapezoidal in cross-section, with 2 longitudinal ridges.

Remarks. Although REISH (1968, p. 228) mentions 16–25 crenulations along the opercular margin, his holo- and paratype showed 18 and 21 only. This difference with our material (11–20 teeth) is insufficient for a taxonomic distinction. A comparison of our material with the types showed such an overall similarity, including the characteristic granular tube-surface, that we are sure that the material belongs to one and the same species. *S. hartmanae* resembles *S. rubens* STRAUGHAN, 1967 in form and number of marginal crenulations of the operculum, and in collar setae. However, *S. rubens* is a much smaller species, with up to 7 pairs of branchial filaments only, instead of 15–17 pairs; moreover it has a variable number of thoracic segments (8–11).

The material from the Palau Islands (*S. concharum*, IMAJIMA, 1982, pp. 38–39, fig. 1) differs in number of longitudinal ridges on the tube (3–5) only. Although there is indeed a great resemblance with the description of *S. concharum* LANGERHANS, as for instance given by ZIBROWIUS (1968, pp. 98–100), the tubes of the Micronesian specimens show a granular surface, not present in the Mediterranean material. Number of teeth in the thoracic uncini (5–6) and number of radioles (12–15) appear to be lower in the Mediterranean specimens, while the number of marginal teeth in the operculum may be higher (15–25). Though not impossible as shown in the table (p. 59), a distribution for a given species from Mediterranean through Indo West Pacific is unlikely. Until it is possible to define *Serpula* species in better ways, in which statistics cannot be avoided, we prefer the use of the name *S. hartmanae* for our Micronesian material.

Distribution. Marshall Islands (Bikini, Majuro), Solomon Islands; Nouv. Calédonie; Palau Islands; Truk Islands; Ponape Island.

Serpula watsoni WILLEY, 1905

(Fig. 2)

Serpula watsoni WILLEY, 1905, p. 317, pl. 7, fig. 187, pl. 8, fig. 6; IMAJIMA, 1977, pp. 91–92, fig. 2; 1982, p. 40; DAY & HUTCHINGS, 1979, p. 146.

Serpula vermicularis var. *watsoni*: FAUVEL, 1953, p. 456.

Material examined. Truk: Sapuk, Moen (12); Epinup, Moen (11); near airport, Moen (11); Nemwan, Moen (13); Kutua Point, Dublon Is. (16); east coast of Fefan Is. (10); Eten Is. (19); Falo Is. (25); North-

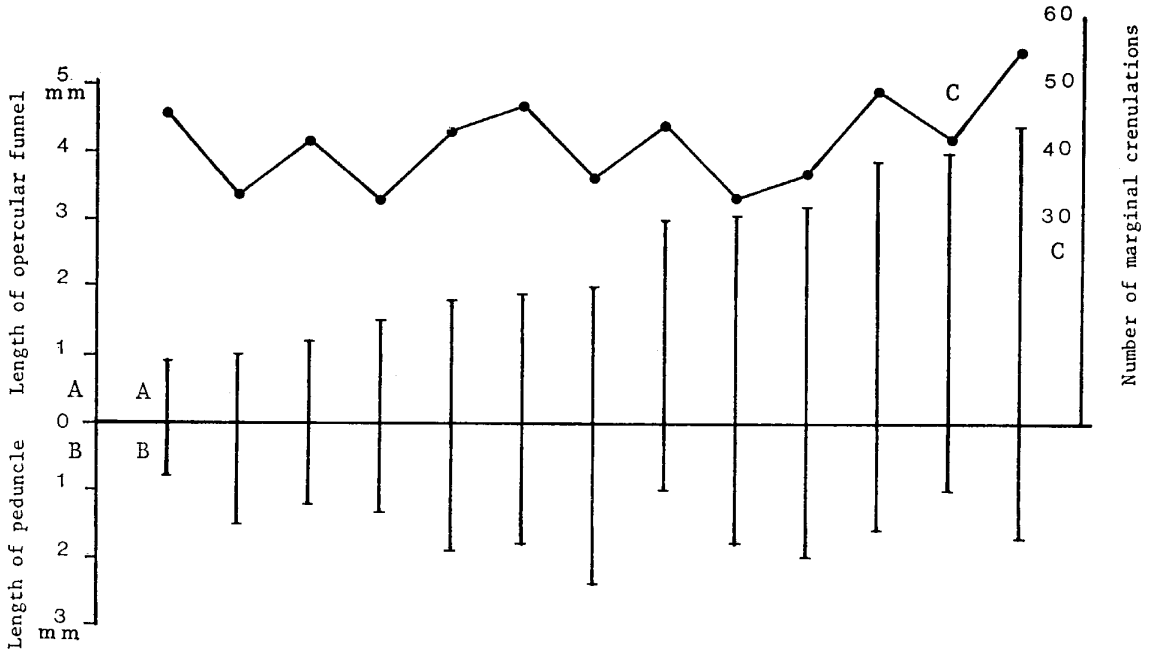


Fig. 2. Relation between length of opercular funnel and peduncle, and number of marginal crenulations of funnel in *Serpula watsoni*.

east Is. (28). Ponape: Nankapenparam reef (42); outer reef, north of Takatik (32); off Jokaj (18); outer reef, northwest of Sokehs (25); off Aumar (14). Majuro: Calalin (54); Ajukwola (40); Eroj (27); near Arrak (16); Bwokwtoonal (10); Woja (36). Amoy, S. China Sea (1, under *S. granulosa* det. T. Y. CHEN, BMNH 1933.3.10.6); Australia, Queensland, Lizard Island, subtidal, 16–23.VI.1983, TEN HOVE coll. (several).

Remarks: The opercular funnel and the peduncle are variable in size, the length of the funnel is 0.9 to 4.4 mm, and the peduncle is 0.8 to 2.4 mm long. The number of the marginal crenulations of the operculum varies between 33 and 55. There is no fixed relation between the length of the funnel and number of marginal crenulations (Fig. 2).

Distribution. Sri Lanka; N. Queensland; South China Sea; southern Japan (Ogasawara Islands); Palau Islands; Truk Islands; Ponape Island; Majuro Atoll.

Serpula tetratropia sp. nov.

Serpula vittata (not AUGENER) IMAJIMA, 1979, pp. 160–162, fig. 2; 1982, pp. 39–40.
Serpula concharum (not LANGERHANS) UCHIDA, 1978, p. 21.

Material examined. Malakal, Palau Islands (6); Truk: Nemwan, Moen (1).

Remarks. In 1979 one of us (IMAJIMA, 1979, pp. 160–162) described

this species as *S. vittata*. We however, already indicated that there were some differences with the original description, in operculum, colouration of the tube and in the collar setae. In the meantime we studied the syntypes of *S. vittata*, as well as additional material (as *S. palauense* IMAJIMA, 1982, pp. 40–42, fig. 2). It is evident now that this is a different species.

In better preserved material of *S. tetratropia* we found that the thoracic membranes do not end at the last thoracic segment, but form a narrow apron across the first abdominal segment. About 8 Indo-Pacific species of *Serpula s.l.* are characterised by 15–25 opercular radii, as in *S. tetratropia: S. hartmanae* REISH, 1968, *S. japonica* IMAJIMA, 1979, *S. lineatuba* STRAUGHAN, 1967, *S. oshimae* (see below), *S. rubens* STRAUGHAN, 1967, *S. vasifera* HASWELL, 1885, *S. vittata* AUGENER, 1914 and *S. zelandica* BAIRD, 1865.

We studied all types of these species, with the exception of *S. vasifera*, of which the type is lost (fide DAY & HUTCHINGS, 1979, p. 146). The present species differs from *S. hartmanae* in size, tube, number of branchial filaments; from *S. japonica* in tube and zygomorf operculum of the latter; from *S. lineatuba* and *S. rubens* in the number of thoracic segments; from *S. oshimae* in collar setae, size and number of branchial filaments; from *S. vasifera*, according to the description, in size and number of branchial filaments, moreover HASWELL's figure shows 31 opercular radii; *S. zelandica* finally has a smooth tube and fewer branchial filaments.

Type locality. Sabiura, Wakayama Pref., Japan.

Type series. Holotype, NSMT-Pol. H 176; 3 paratypes, NSMT-Pol. P 177, 3 tHU 378.

Etymology. From the Greek tetra=four, tropis=keel.

Distribution. Southern Japan; Palau Islands; Truk Islands.

Serpula oshimae sp. nov.

Serpula cf. *kaempferi*: IMAJIMA, 1978, pp. 50–52, fig. 2; 1979, p. 163; 1982, p. 40.

Remarks. In 1978 one of us (IMAJIMA, 1978, pp. 50–52, fig. 2) described this species as *Serpula* cf. *kaempferi*. In the meantime we studied the few remnants of the holotype of *Zopyrus kaempferi*, Zoological Museum Stockholm nr. 1192. The material is badly damaged and incomplete. The vial showed a smooth, cylindrical tubefragment of 6 cm length and 1.2 mm breadth. Glued to it were two dried fragments, which might be a half branchial crown without operculum, and a serpulid thorax. If the largest setae are collar setae, they are limbate setae in two sizes only. The fragments are insufficient for identification, though the smooth

cylindrical tube and possibly the setae (uncini are absent) indicate a similarity with *Semiserpula longituba* IMAJIMA, 1979.

According to our differential diagnosis of 1978, the present species differs from the remaining Indo-Pacific *Serpula* species. It is a new species, which we recognize here.

Type locality. Ô-shima (dredge sta. 6), Japan.

Type series. Holotype, NSMT-Pol. H 178; 35 paratypes, NSMT-Pol. P 179.

Distribution. Southern Japan; Palau Islands; not recorded from Truk, Ponape Islands and Majuro Atoll.

Serpula vittata AUGENER, 1914

Serpula vittata AUGENER, 1914, pp. 137–139, fig. 17, pl. 1, fig. 18–19.
not *Serpula vittata* ?: AUGENER, 1927, pp. 148–149. See Remarks.
not *Serpula vittata*: STRAUGHAN, 1967, p. 30. See Remarks.
not *Serpula vittata*: IMAJIMA, 1979, pp. 160–162, fig. 2. Referred in this paper to *Serpula tetratropia*, see Remarks on pp. 39–40.
Serpula palauense IMAJIMA, 1982, pp. 40–42, fig. 2a–m.

Material examined. W. Australia, Sharks Bay, HARTMEYER & MICHAELSEN coll., Syntypes (2 fragmentary specimens); several localities in Palau & Yap (IMAJIMA, 1982, p. 40).

Remarks. As already indicated on p. 39 and the synonymy above, the known descriptions of this species left room for doubt and thus for erroneous identifications. The name *vittata* being associated with a different species, IMAJIMA (1982) described a new species *S. palauense*. In the meantime, however, we have been able to compare material with various types of *Serpula*, and we thus can rectify some earlier mistakes.

Serpula vittata differs from all other known *Serpula* species in its highly characteristic tube. A further difference with the group, mentioned on p. 40 in the discussion of *S. tetratropia* may be found in the extreme length of the outer grooves on the opercular funnel. The only other known species with grooves of a similar length, *S. vasifera*, at least according to HASWELL's plate 32, fig. 6 which is in contradiction with plate 31, fig. 6, is not diagnosed well enough to be certain of its real status.

S. vittata ?: AUGENER, 1927 is diagnosed in having thoracic membranes forming an apron and collar setae with 2 heavy teeth and accessory ones. As such this specimen cannot belong to *S. vittata*, but more probably should be placed in *S. hartmanae* or *S. tetratropia*. This, however, can only be done by checking the original material, which we could not. The diagnosis given by STRAUGHAN (1967, p. 30) is too short to enable a tentative correction of the identification. From her remarks

on the tube (round and white) her material evidently belongs to a different species.

Type series. 2 syntypes ZMH V. 8289.

Distribution. W. Australia; Palau Islands; not recorded from Truk, Ponape Islands and Majuro Atoll.

Crucigera tricornis GRAVIER, 1906

(Fig. 3, a–b)

Serpula (*rucigera*) *Websteri* var. *tricornis* GRAVIER, 1906, pp. 111–112; 1906, pl. 8, fig. 289; 1908, pp. 117–119, figs. 473–475.

Crucigera tricornis: IMAJIMA, 1977, pp. 92–94, fig. 3; TEN HOVE & JANSEN-JACOBS (ms).

Material examined. Ponape: off Jokai (1). Majuro: Calalin (1).

Description. The larger specimen collected from Calalin, Majuro measures 15 mm in length, including operculum, and about 1.3 mm in width in the thorax; it consists of 79 segments.

The branchiae have 22 gill-radioles on either side, which end in slender pinnule-free tips. The basal 1/6th portions of gill-radioles are connected by a branchial membrane; the radioles are arranged in two semicircles.

The opercular peduncle is cylindrical and is inserted to the left; a rudimentary operculum is situated at the opposite side. The operculum consists of a shallow distal funnel, with three large proximal processes. The brim of the opercular funnel has 63 marginal crenulations with pointed tips. Externally these extend as smooth grooves for about 1/2–2/3 of the length of the funnel; internally some of the grooves reach farther down to the centre than others. There are three subequal proximal processes at the base of the funnel; each is digitiform and subtriangular in cross-section (Fig. 3, a).

The thorax has 7 segments, 6 of which are uncinigerous. The collar

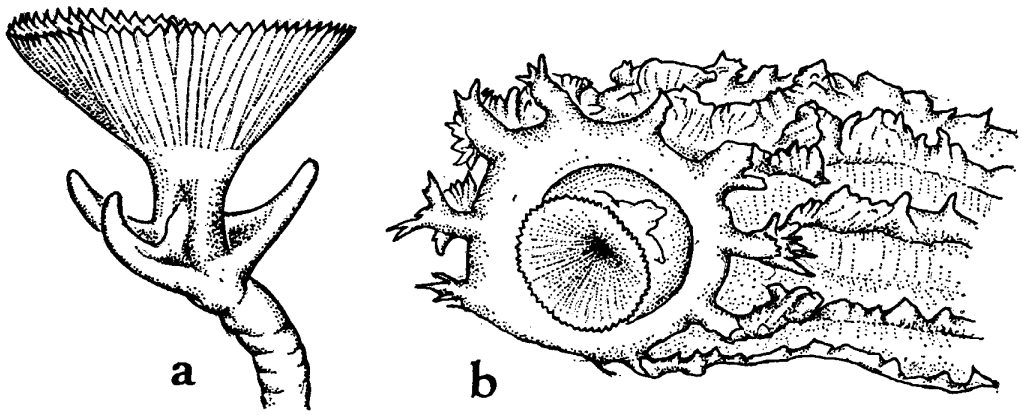


Fig. 3. *Crucigera tricornis* GRAVIER. a, operculum, ×23; b, anterior end of tube, in antero-lateral view, ×10.

setae are limbate capillaries and bayonet-shaped setae, with two heavy conical teeth. The remaining thoracic setae are limbate capillaries; the thoracic uncini have 5 teeth in one row. The anterior abdominal uncini are similar to those of the thorax; posteriorly they have 1 to 3 rows of sharp teeth. The abdominal setae are flat trumpet-shaped distally, with about 20 minute marginal teeth in lateral view; they are replaced by long capillary setae in the posterior segments.

The tube is white, and sub-cylindrical in cross-section, measuring 1.5 mm in diameter near the mouth; it has 9 irregularly sinuous longitudinal ridges (Fig. 3, b).

This is the first report of the species from the Micronesian Area.

Distribution. Malagasy; Red Sea; Gulf of Oman (ZIBROWIUS, pers. comm.); Bay of Bengal; southern Japan (Ogasawara Is.); Ponape Island; Majuro Atoll; N.E. Australia (Lizard Island).

Hydroides GUNNERUS, 1768

Hydroides albiceps (GRUBE, 1870)

Serpula (*Eupomatus*) albiceps GRUBE, 1870, pp. 520–521.

Hydroides albiceps: FAUVEL, 1953, p. 460, fig. 241, d, e; PILLAI, 1960, p. 12, fig. 4, F–M; 1971, pp. 112–113; KUMARASWAMY ACHARI, 1969, p. 40; ZIBROWIUS, 1971, p. 714; 1979, pp. 132–133; IMAJIMA, 1976a, pp. 133–135, fig. 8, a–v; 1979, p. 168; 1982, p. 44.

Serpula (*Hydroides*) *multispinosa* var. *ternatensis* FISCHLI, 1903, pp. 130–131, pl. 5, fig. 32, 33, pl. 7, fig. 76–78, pl. 8, fig. 89, 90.

Eupomatus albiceps: WILLEY, 1905, p. 312, pl. 7, fig. 180, 180A, 181; HARTMAN, 1954, p. 641; REISH, 1968, p. 228.

Material examined. Truk: near airport, Moen (24); Nemwan, Moen (1); Sapuk, Moen (2); Epinup, Moen (1); Eten Is. (10); Falo Is. (1); east coast of Fefan Is. (4); Kutua Point, Dublon Is. (1). Ponape: Nankapenparam reef (1); off Tumu Point, in 17 m (2). Majuro: Ajukwola (2). W. Australia, Sharks Bay, Sta. 28, HARTMEYER & MICHAELSEN (1, separated from ZMH V. 8288, *Serpula vittata* Syntypes); Gulf of Thailand, 12°44′N, 100°48′E, US Naval Oceanogr. Off., exp. fouling panels, J. R. DEPALMA ref. nr. 101 (1); Java, Siboga Sta. 7, récif, MESNIL & FAUVEL, 1939 det. *Hydroides exaltatus* varieté *vesiculosus* (1, ZMA V. Pol. 1646); E. Samoa, Tutuila Is., Pago Pago Harbour, Pilings, 23.IX.1971 (5); Pac. Panama, Balboa, coll. CROSSLAND (1 BMNH ZB 1972.127).

Remarks. As already indicated before (IMAJIMA, 1976a, p. 135), *H. trivesiculosa* STRAUGHAN, 1967, from Heron Island is a very similar form. The main difference is the smaller number (4–6) of spines in the opercular crown of the latter. The much longer vesicular dorsal

spine in the holotype of *H. trivesiculosa* (Austr. Mus. W 4111, STRAUGHAN, 1967b, fig. 3h–j) is not as diagnostic as it appears to be from the figures, since it is much shorter and approaching that of *H. albiceps* in most of STRAUGHAN's remaining material (AM W 4110). A revision of the infraspecific variability of both nominal species is necessary.

Distribution. Red Sea; S. India; Sri Lanka; Java; Moluccas; Australia; Palau Islands; Truk Islands; Ponape Island; Majuro Atoll; Samoa; Pac. Panama.

Hydroides tuberculata IMAJIMA, 1976

Hydroides tuberculata IMAJIMA, 1976a, pp. 132–133, fig. 7, a–j; 1976b, p. 233; 1978, p. 53; 1979, p. 168; 1982, p. 44.

pro parte *Hydroides brachyacantha*: DEW, 1959, pp. 28–29 (see Remarks pp. 49–51).

Hydroides perezi (not FAUVEL) STRAUGHAN, 1967a, p. 221, fig. 6, O (see Remarks below).

Material examined. Truk: near airport, Moen (2); Eten Is. (1). Ponape: outer reef, north of Takatik (51); outer reef, northwest of Sokehs (48); Nankapenparam reef (3); off Jokaj (13). Okinawa Is., White beach, 26°18'N, 127°54'E, US Naval Oceanogr. Off., exp. fouling panels, J. R. DEPALMA ref. nr. 113 (1). Australia, Queensland, Lizard Island, exp. fouling panels exposed 7 months, coll. HUTCHINGS & WEATE (11, AM W 16983–5, tHU 449); Noosa Head, top of algal zone, on *Serpula rubens* coll. STRAUGHAN, 19.12.1962 (1, AM W 4057); Heron Island, June 1964 (6, AM W 4103, tHU 488, as *H. perezi*, STRAUGHAN det.).

Remarks. The material from Queensland shows that the species is very variable with respect to its dorsal opercular valve, which may have a large inwardly curved beak as figured by IMAJIMA (1976, fig. 7 a, b), a mall hook (fig. 7 c) or even may be entirely smooth, rounded. All specimens, however, show the external swelling in the remaining opercular valves. As already stated before (IMAJIMA, 1976, p. 133) *H. tuberculata* resembles *H. perezi* FAUVEL, 1918 from the Iranian Gulf. However, the opercular valves of *H. tuberculata* are subtriangular in cross-section, flattened in *H. perezi*. The figure given by STRAUGHAN (1967, p. 217, fig. 6, 0) shows a greater resemblance with *H. tuberculata* than with *H. perezi*, as does her material. A further difference between *H. tuberculata* and *H. perezi* may be found in the collar setae, with accessory teeth in the former (IMAJIMA, 1976, fig. 7 d; TEN HOVE unpublished), without them in *H. perezi* (TEN HOVE, 1970b, fig. 10). The question whether the two species are different or not can only be settled by comparison of more material.

The differences between *H. tuberculata* and species of the *H. brachy-*

acantha-group are discussed on pp. 50–51. There are a few more species, which show a certain resemblance with *H. tuberculata*, viz.: *H. helmata* IROSO, 1921, *H. inermis* MONRO, 1933, *H. inornata* PILLAI, 1960 and *H. nigra* ZIBROWIUS, 1971. We compared material of these species with our material. *H. helmata* has simple straight opercular spines, except for the dorsal hooked spine, and rounded radii. In *H. inermis* the dorsal spine of the operculum is rounded without pointed beak, and flat; the other spines are extremely short. The opercular spines in *H. nigra* and *H. inornata* are slender, in comparison with the valvular aspect of those of *H. tuberculata*.

Distribution. Japan; Palau Islands; Truk Islands; Ponape Island; Australia, Queensland.

Hydroides novaepommeraniae AUGENER, 1925

(Fig. 4, a–d)

Hydroides (*Eupomatus*) *Novae-Pommeraniae* AUGENER, 1925, pp. 69–70, fig. 5, 5a; OKUDA, 1937, pp. 308–309, fig. 54–55.

not *Hydroides novaepommeraniae*: DEW, 1959, pp. 26–27, fig. 5; STRAUGHAN, 1967a, pp. 221–222 (=*H. recta*, see Remarks).

Hydroides grubei PILLAI, 1965, pp. 166–168, fig. 22 A–G; 1972, pp. 11, 19, 24; ZIBROWIUS, 1979, pp. 132–133; ZIBROWIUS & BITAR, 1981, pp. 159–160.

Hydroides malleolaspina (not STRAUGHAN, 1967a): IMAJIMA, 1982, p. 45, fig. 3, k–s.

Material examined. Palau Islands (23). Truk: Sapuk, Moen (2); near airport, Moen (7). Philippines, Cavite, 27.V.1909, USS *Albatross*, from ship's bottom, AMNH 1650 (3).

Remarks. On the basis of the dilated tips of the spines and radii

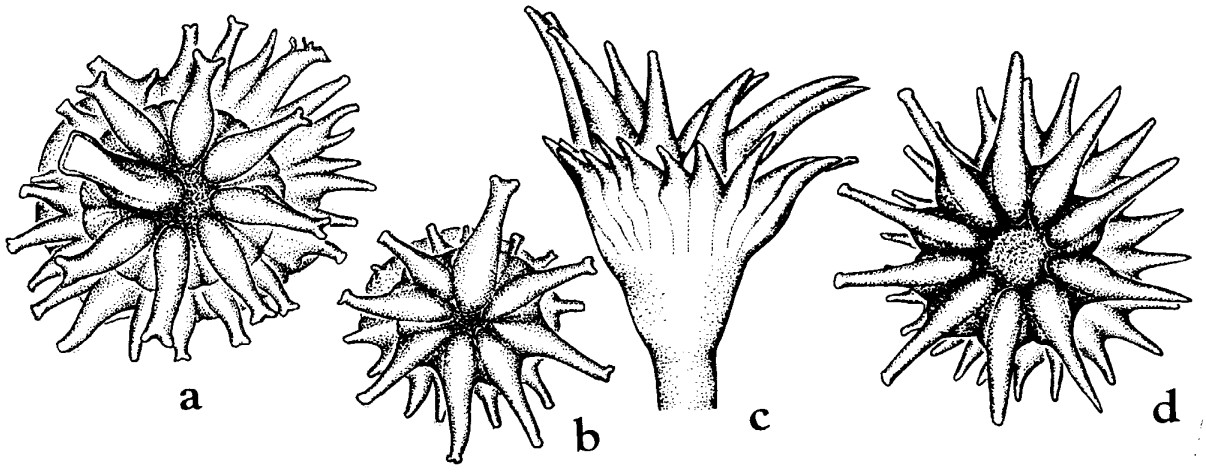


Fig. 4. *Hydroides novaepommeraniae* AUGENER, a, b, opercula collected from Moen, Truk Is., in frontal views, ×42; c, d, opercula of holotype from New Britain, in lateral (c) and frontal (d) views, ×28.

of opercular crown and funnel, one of us (IMAJIMA, 1982, p. 45) attributed material to *Hydroides malleolaspina* STRAUGHAN 1967, figured likewise. In the meantime, however, we studied some specimens of the latter species (AM W 4109, tHU 466 and types AM W 3999, 3996), showing details not well figured by STRAUGHAN. Firstly the scale given by STRAUGHAN is incorrect: her largest specimens measures 1.5 mm across the operculum and not 7 mm as suggested. Secondly the dorsal spine of the opercular crown shows a large rounded to pointed recurved beak, in a small specimen this spine is shaped as figured by PILLAI (1971, fig. 6 A, B) for *H. ancorispina*. Evidently STRAUGHAN used the name *malleolaspina* for this spine only, and thus in a different sense as RIOJA for *H. malleophora* (1942, pp. 126–130, figs. 7–14, =*H. dirampha* MÖRCH, 1863). Thirdly all opercular spines and radii show crescentic tips, as figured by PILLAI (1971, fig. 6 A, B). In conclusion we are now of the opinion that *H. malleolaspina* is a different species.

In the present material we could study the variability of the operculum. Although suggested otherwise by the figured specimens (IMAJIMA, 1982, fig. 3 l–m), most of the opercular spines and radii do not show club-shaped tips all around. More frequently one finds a few bluntly truncated spines, generally including the larger dorsal one, while the remaining spines vary from rather acute to truncated or club-shaped, even within one specimen. In side view it sometimes is impossible to see the truncated tips of opercular spines and radii, the operculum resembling OKUDA's (1937, fig. 54b) figure. Finally there is one operculum where the dorsal spine is equal in size to the other ones (Fig. 4, a, b).

Hydroides grubei PILLAI (1965, pp. 166–168, fig. 22 A–G) is figured as having rounded opercular spines and more or less acute marginal radii, although PILLAI states that the latter are somewhat blunt. Topotypical material studied by us is in complete agreement with PILLAI's figure when seen from the side; however, studied in frontal view all spines and radii show blunt truncated tips, more or less as in IMAJIMA's (1982, fig. 3 l) figure.

The ratio opercular spines/radii is 7/21 respectively 10/23 in *novaepommeraniae* (OKUDA: AUGENER); 7/19 resp. 6/18, 7/19, 7/22 in *grubei* (PILLAI: material mentioned above); 5–8/15–20 (IMAJIMA); 7/14, 7/14, 7/15, 7/17, 7/19, 8/16, 8/18, 8/20, 8/23 in the present material. It is 7/19 in *ancorispina*, 8/20, 8/23, 10/21, 11/24 in *malleolaspina*. All nominal species show simple bayonet setae, with 2 heavy conical teeth only; in *H. grubei* setae with 3 and 4 teeth have been found as well.

The holotype of *H. novaepommeraniae* is figured reasonably well by

AUGENER, although this operculum too shows in frontal view 4 dorsal spines with a slightly club-shaped tip (Fig. 4, c, d). The thoracic breadth of the specimen is 2.5 mm, its length 30 mm, the diameter of the operculum is 1.2–1.4 mm. It has 16 pairs of branchial radioles, and approximately 165 abdominal setigers. As such it is considerably larger than our material. In our opinion these differences are insufficient to distinguish between our present material and *H. novaepommeraniae* (incl. *grubei*). There is one more form which has been figured as having crown and funnel with simple outwardly directed spines and radii: *H. novaepommeraniae* sensu DEW (1959, pp. 26–27, also mentioned in STRAUGHAN, 1967a, pp. 221–222). In the material (BMNH ZK 1959.10. 19. 1/2, AM M 3625), however, there are two small specimens only which agrees with DEW's figure; the remaining four specimens show a larger dorsal spine with a recurved sharply pointed hook and rounded to blunt marginal teeth. As such they agree with the types of *H. recta* STRAUGHAN (1967a, pp. 224–225, fig. 8; AM W 4006, tHU 463).

Summarising we presently distinguish three species in the Indo-Pacific region:

H. novaepommeraniae (incl. *grubei* and *malleolaspina* sensu IMAJIMA)
H. malleolaspina (incl. *ancorispina*)
H. recta (incl. *novaepommeraniae* sensu DEW).

As is evident from the confusion in this complex, distinction between the species is not easy. This is demonstrated too by the fact that in one of STRAUGHAN's samples of *H. recta* a specimen of *H. malleolaspina* was present, overlooked by STRAUGHAN. We even cannot exclude the possibility that *H. bandaensis* ZIBROWIUS (1972, p. 91, fig. 2.) will prove to be *H. novaepommeraniae* too. The only difference with the latter species as shown ZIBROWIU's figure and an additional specimen from Sumbawa (ZMA V. Pol. 1854–1, *Siboga* Sta. 313, MESNIL & FAUVEL det. tube de serpulien) is the radial symmetry of the opercular crown.

For the time being we assume that the W. African *H. arnoldi* AUGENER, 1918, as described and figured extensively by ZIBROWIUS (1973, pp. 24–26, fig. 1), with its stubby opercular spines is a different species (material studied, BMNH 1939.7.17.20–22).

Whether our present opinions are correct or not only can be solved by study of larger series of material, which unfortunately is not yet available.

Distribution. New Britain, Palau Islands, Truk Islands, Philippines.

Hydroides longispinosa IMAJIMA, 1976

Hydroides longispinosa IMAJIMA, 1976b, pp. 240–246, fig. 5, a–q; 1982, p. 46.

Material examined. Ponape: outer reef, north of Takatik (1). Australia, Queensland, Lizard Island, exp. fouling panels, HUTCHINGS coll. (100, AM W 16981, 16986, 16987, tHU 446).

Remarks. Hydroides longispinosa resembles *H. centrospina* WU & CHEN (1981, pp. 354–357, fig. 1) in its operculum. However, it differs by the central spine in the crown, smooth in *centrospina*, with sidespines in *longispinosa*.

Distribution. Japan; Palau Islands; Ponape Island; Australia, Queensland.

Hydroides minax (GRUBE, 1878)

Serpula minax GRUBE, 1878, p. 269, pl. 15, fig. 5.

Hydroides minax: IMAJIMA, 1976b, pp. 233–234 (synonymy); FAUVEL, 1939, pp. 361–362; WU, 1968, p. 45; KUMARASWAMY ACHARI, 1969, p. 40; PILLAI, 1971, p. 110; ZIBROWIUS, 1979, pp. 133–134; ZIBROWIUS & BITAR, 1981, p. 160.

Hydroides monoceros: FAUVEL, 1919, p. 342; 1923, p. 48; 1930, p. 63; 1947, pp. 95–96, fig. 89e; DAY, 1957, p. 118; GIBBS, 1969, p. 446; KUMARASWAMY ACHARI, 1969, p. 40; AMOUREUX, RULLIER & FISHELSON, 1978, p. 145, fig. 12.

Material examined. Majuro: Calalin Is. (3); Roguron Is. (2). Queensland, Lizard Island, exp. fouling panels, HUTCHINGS & WEATE (2).

Distribution. Southern Africa; Indian Ocean; Red Sea; Lebanon; Sri Lanka; Vietnam; Taiwan; Australia, Queensland; Philippines; Japan; Solomon Islands; French Polynesiai; Palau Islands; Majuro Atoll.

Hydroides exaltata (MARENZELLER, 1884)

Eupomatus exaltatus MARENZELLER, 1884, p. 217, pl. 4, fig. 3; MOHAMMAD, 1975, p. 7.

Hydroides exaltata: IMAJIMA, 1976, pp. 127–128, fig. 4; 1976b, pp. 232–233 (for synonymy); 1977, p. 94; 1979, p. 168; 1982, pp. 42–43; HARTMANN-SCHRÖDER, 1979, p. 152; 1981, p. 80; WU, SUN & CHEN, 1980, p. 124.

Material examined. Ponape: off Aumar (1); outer reef, north of Takatik (7); outer reef, northwest of Sokehs (15); Nankapanparam reef (2). Japan, Okinawa, White beach, 26°18′N, 127°54′E, US Naval Oceanogr. Off., exp. fouling panels, J. R. DEPALMA ref. nr. 114 (1); W. Australia, Sharks Bay, Sta. 28, HARTMEYER & MICHAELSEN (4, from types of *Serpula vittata*, ZMH. V. 8288).

Distribution. Red Sea; Arabian Gulf; Sri Lanka and S. India; Sumatra; W., N.W. and E. Australia; Taiwan; Japan; Solomon Islands; Palau Islands; Ponape Island.

Hydroides tambalagamensis PILLAI, 1961

Hydroides tambalagamensis PILLAI, 1961, pp. 36–38, fig. 12, A–G; IMAJIMA, 1976b, pp. 231–232 (for synonymy); 1979, p. 167; 1982, p. 42.

Material examined. Majuro: Bwokwtoonal (7); Roguron (12); Ajukwola (6); Eroj (5); Calalin (13). Australia, Queensland, Lizard Island, subtidal, 16–23.VI.1983, TEN HOVE coll. (several).

Distribution. Sri Lanka; Sumatra; Australia; southern Japan; Palau Islands; Majuro Atoll.

Hydroides brachyacantha RIOJA, 1941

(Fig. 5, a–c)

Hydroides brachyacantha RIOJA, 1941, pp. 169–172, pl. 3, fig. 2, pl. 4, figs, 1–9; pro parte DEW, 1959, p. 28, fig. 7; STRAUGHAN, 1967, p. 222; 1969, p. 232; BAILEY-BROCK, 1976, pp. 77–78; IMAJIMA, 1982, pp. 43–44, fig. 3, a–j.

Material examined. Truk: Nemwan, Moen (4); Epinup, Moen (3); Sapuk, Moen (26); Falo Is. (71); Northeast Is. (39); Eten Is. (45); Kutua Point, Dublon Is. (10); east coast of Fefan Is. (6). Ponape: Nankapenparam reef (2); outer reef, northwest of Sokehs (16); outer reef, north of Takatik (5); off Aumar (17). Majuro: Calalin (34); Eroj (9); Bwokwtoonal (1); Ajukwola (2); Roguron (6). Gulf of California, La Paz, on pearl oyster, coll. W. SHEPHERD (1); Pacific Panama, Taboguilla, 35 ft, on plexiglass, coll. BIRKELAND (6); Coiba Island, 5–10 fms, on *Pomatostegus stellatus*, coll. CROSSLAND, (3, BMNH ZB 1933.7.10.445). Australia, Queensland, det. B. DEW (2, BMNH 1959; 10:19:5/6); Southport Esplanade, below L.W.M., coll. det. STRAUGHAN (4, AM. W 3968, tHU 464); W. Australia, Sharks Bay, St. 28, HARTMEYER & MICHAELSEN (1, on syntypes of *S. vittata*, ZMH. V. 8288).

Description. The tube is white, and may be irregularly coiled upon itself (Fig. 5, a); it is trapezoidal in cross-section with two or three ridges (Fig. 5, b). The tube-surface and ridges have a minute granular appearance. The anterior part of the tube may turn away from the substrate; it then is subcylindrical and about 1 mm in diameter. There are some conspicuous "peristomes" encircling the tube (Fig. 5, c). For a further description see IMAJIMA (1982, pp. 43–44).

Remarks. Unfortunately RIOJA did not leave any collection. However, he gives the following numbers: of opercular spines, 10–11; of radii 25–30. Material from Panama and the Gulf of California, studied by us, shows a range of 8–11, 24–34 respectively, which is in accord with RIOJA's data, but our present material, as well as that from the Palau Islands, is slightly different in respect to these numbers, which are 5–7, 38–46 respectively. Six specimens from Australia show the

same numbers, 8–10, 24–31, as the American material. A further difference between the populations from Pacific America and Micronesian area may be found in the dorsal spine, which is shaped like a sharp knee in the former, and is smoothly curved in the latter. The sub-apical incurving hooks (compare IMAJIMA, 1982, fig. 3, f, g and RIOJA, 1941, pl. 4, fig. 6) are least developed in the Australian material. A similar variation is occurring in *H. parva* TREADWELL, 1901 (ZIBROWIUS, 1970b, fig. 5–6, and TEN HOVE, unpublished). Finally, the radii of the opercular funnel are less sharply pointed in the material from Pacific America. However, the remaining characteristics of both populations do agree with each other and with RIOJA's description.

According to ZIBROWIUS (pers. comm.) part of DEW material belongs to *Hydroides perezi* sensu STRAUGHAN, which should be named *H. tuberculata* (see Remarks pp. 44–45). This already indicates that the species show a certain resemblance. Distinguishing, however, are the number (5) and form of opercular spines, which are broad valves in *tuberculata*, without subapical hook.

Hydroides rostrata PILLAI (1971, pp. 107–108, fig. 5, B–H) apparently has longer beaks in its opercular spines.

The very similar *Hydroides monroi* ZIBROWIUS (1973, pp. 29–31, fig. 3) apparently has longer opercular spines. Since the diagnoses of "*Hydroides brachyacantha*" from Brasil, as mentioned by ZIBROWIUS (1970, p. 6) and RULLIER & AMOUREUX (1979, p. 193) are very short, we did not mention

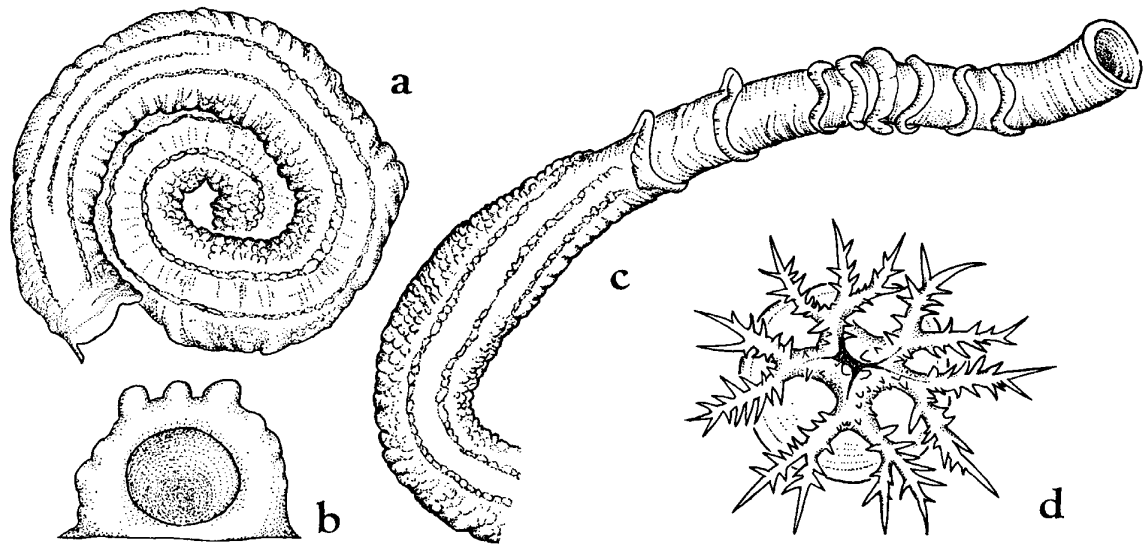


Fig. 5. *Hydroides brachyacantha* RIOJA. a, entire tube, in dorsal view, ×8; b, cross-section of tube, ×18; c, anterior end of other tube, ×8.
Spirobranchus decoratus IMAJIMA. d, operculum of young individual, in frontal view, ×35.

these specimens in the list of synonyms. Moreover, material from the shelf of Surinam and Venezuela (in TEN HOVE's collection) does not show the subapical hooks in the opercular spines, typical for our material of *H. brachyacantha*. Therefore, the material from the tropical W. Atlantic probably belongs to a different, new species. We agree with ZIBROWIUS that all these forms should be studied by comparison, preferably of large series.

Distribution. Mexico; Australia; Palau Islands; Truk Islands; Ponape Island; Majuro Atoll.

Hydroides furcifera (GRUBE, 1878)

Serpula furcifera GRUBE, 1878, pp. 268–269, pl. 15, fig. 4; WIKTOR, 1980, p. 281.
Schizocraspedon furcifera: BUSH, 1905, pp. 179, 225, 287.
Hydroides furcifera: PILLAI, 1972, pp. 7, 11, 21–23, 26.
Hydroides bifidus IMAJIMA, 1982, pp. 46–48, fig. 4, a–o.

Material examined. Philippines, Ubay, leg. SEMPER (1 syntype, Mus. Wroclaw nr. 383); off Arumonogui, Palau Islands (1).

Remarks. Not having access to the type-material, IMAJIMA (1982, pp. 46–48) though this to be a new species. However, comparison with one of the syntypes of *H. furcifera*, a slightly macerated specimen, showed a detailed agreement in shape of operculum, setae, etc. Though GRUBE mentions 16 spines in the opercular crown, we counted 18, and 20 radii.

BUSH (1905, pp. 179, 225, 287) erected a new genus for the species. She, however, was working from the literature only and attributed too much value to the form of the operculum, distinguishing the species "at once ..... from the typical species of that genus" [*Hydroides*]. In the meantime PILLAI (1971, pp. 113–114, Fig. 6, 7 A–C) described *H. heterofurcata* with simply pointed radii in the proximal funnel and a distal crown of bifurcate spines, as such intermediate in form between the more conventional species of *Hydroides* and *H. furcifera*.

Distribution. Philippines; Palau Islands. Not recorded from Truk, Ponape Islands and Majuro Atoll.

Spirobranchus BLAINVILLE, 1818

Spirobranchus tetraceros (SCHMARDA, 1861)

Spirobranchus tetraceros: TEN HOVE, 1970, pp. 3–14, figs. 1–27; IMAJIMA, 1979, pp. 177–178, fig. 8; 1982, p. 48; ZIBROWIUS, 1979, p. 55; ZIBROWIUS & BITAR, 1981, pp. 159–160.
Serpula tricornigera: WIKTOR, 1980, p. 281.

Material examined. Ponape: outer reef, northwest of Sokehs (6); off Aumar (1). Majuro: near Woja (1); Ajukwola (2). Japan, Yokosuka, Sasebo and Shimonoseki, US Naval Oceanogr. Off., exp. fouling

panels, J. R. DEPALMA ref. nr. 38, 55, 83, 148 (14, USNM) ; Philippines, Pandanon, leg. SEMPER (syntype of *Serpula tricornigera*, Mus. Wroclaw nr. 385) ; Thailand, Sattahip and 12°44'N, 100°48'E, US Naval Oceanogr. Off., exp. fouling panels, 30–50 ft, J. R. DEPALMA ref. nr. 34, 132, 149, 151 (7, USNM, tHU) ; Australia, Queensland, Lizard Island, 6–14 m, 19–23. IV.1983, TEN HOVE coll. (10) ; Cape Jaubert, 54–70 ft, E. MJÖBERG coll., AUGENER det. *S. semperi*, JOHANSSON det. *S. tetraceros* (2, Mus. Stockholm nr. 2233, 1888) ; Cape Farquhar, RV Anton Bruun cruise 9, GOODING coll. (1, USNM).

Remarks. In 1970 one of us gave a redescription and extensive synonymy of *S. tetraceros*. In the meantime we studied a few hundred more specimens of this species, from various localities, mainly Caribbean. The syntype of *Serpula tricornigera* shows a slightly more elaborate operculum than the ones figured by TEN HOVE (1970, fig. 24) and IMAJIMA (1979, fig. 8). The horns of the operculum indeed are branching in a more or less horizontal plane, but we do not agree with WILLEY (1905, p. 318) that this feature distinguishes the nominal species *S. tricornigera* from *S. tetraceros*. We confirm TEN HOVE's (1970, p. 3) opinion that both species are synonymous.

From the complicated synonymy in *S. giganteus* and *S. tetraceros* it will be evident that the variability in both species is extreme. Variation in opercular structure may be caused by interaction with associated sponges (in *Pseudovermilia*, TEN HOVE, 1975, p. 79). Many *Spirobranchus* forms occur in living corals. A field study on characters of branchiae, form of operculum, habitat and tube-morphology, widely neglected in the literature, may shed new light upon this complicated matter.

Distribution. Circumtropical, except for the West coast of Africa; Natal; Sydney; Japan; E. Mediterranean, immigrated. Essentially a species from sheltered (lagoonal) habitats.

Spirobranchus decoratus IMAJIMA, 1982

(Fig. 5, d)

Spirobranchus tricornigerus decoratus IMAJIMA, 1982, pp. 48–50, fig. 5.
Spirobranchus tricornigerus var. *racemosus* PILLAI, 1971, pp. 99–100, fig. 3 E.
not *Serpula tricornigera* GRUBE, 1878, pp. 273–275, pl. 15, fig. 7 (see Remarks under *S. tetraceros*).

Material examined. Truk: Sapuk, Moen (1) ; Northeast Is. (2). Ponape: Nankapenparam reef (3) ; off Jokaj (2) ; off Aumar (7) ; outer reef, northwest of Sokehs (5) ; outer reef, north of Takatik (4). Majuro: Eroj (1) ; Calalin (7) ; Bwokwtoonal (1) ; Roguron (2). Sri Lanka, Colombo, Wellawatte 5.VI.1966 (1, holotype of *S. tricornigerus* var. *racemosus* PILLAI, 1971, BMNH ZK 1968.141).

Remarks. The large series collected in this study enabled us to make some observations, additional to the original description.

As for the thoracic membranes, they do not end at the 7th setiger but form a narrow apron across the first abdominal segment.

The opercular peduncle may arise from the base of the right or left branchial lobe. Its wings are long, as compared to the short triangular wings in *S. tetraceros* (TEN HOVE, 1970a, figs. 6, 7, 15, 23, 25, 27, 30).

The form of the operculum of large individuals corresponds with the original description. However, the spines of the operculum in a young specimen are more elevated from the disc, less compact, and have 3–7 lateral slender denticles, which are more sparsely distributed (Fig. 5, d) than those in large individuals.

The number of spines in the operculum can cause some problems. Basically, however, there are 3 branched spines: two broad ones laterodorsally and one smaller ventrally. Each of the 3 spines is bifurcated at least two, generally three times. Depending upon the place of the first bifurcation one can find 5, 6 or even approximately 12 "main" spines; along the margin the repeated bifurcation results in up to 24 tips.

PILLAI (1971, pp. 99–100) described *Spirobranchus tricornigerus* var. *racemosus*. He handled the taxon as a species, depositing holo- and paratype in the British Museum (Natural History). We compared the holotype with our material, it is the same. The International Code of Nomenclature does not recognize varieties, therefore IMAJIMA's (1982) name is the available one. However, study of the type of *Serpula tricornigera* showed that this is a synonym of *Spirobranchus tetraceros* (see above). *Spirobranchus decoratus* doubtlessly resembles *S. tetraceros* more than any other *Spirobranchus* species. Both have the branchial radioles arranged in a circle, with a folded branchial membrane (TEN HOVE, 1970a, fig. 4–5; IMAJIMA, 1982, fig. 5 a) and peduncular wings with serrated margin. The general pattern of the operculum in both species shows basically 3 spines (TEN HOVE, 1970a, pp. 6–8, fig. 8, 24 and our present figure 5 d). In our opinion distinction on species level nevertheless is justified by the very characteristic tube of *S. decoratus*, with longitudinal rows of pits, by the typical denticles of the opercular spines, and maybe by the long wings of the opercular peduncle.

Distribution. Palau Islands; Truk Islands; Ponape Island; Majuro Atoll; Sri Lanka.

Spirobranchus giganteus corniculatus (GRUBE, 1862)

Spirobranchus giganteus corniculatus: TEN HOVE, 1970a, pp. 24–32, figs. 63–73, pl. 2 c; IMAJIMA, 1967a, pp. 136–137, fig. 9; 1982, p. 48.

Material examined. Truk: Northeast Is. (3). Ponape: off Jokai (1); outer reef, northwest of Sokehs (3). Majuro: Calalin (9); Eroj (2). Australia, Queensland, Lizard Island, in 6–10 m, 20–21.VI.1983, TEN HOVE coll. (3).

Distribution. Indo-West-Pacific: from Natal to Hawaii and from S. Japan to Australia, New South Wales.

Pomatostegus SCHMARDA, 1861

Pomatostegus stellatus (ABILDGAARD, 1789)

Terebella stellata ABILDGAARD, 1789, p. 142, pl. 3, fig. 5 a–b.

Pomatostegus stellatus: IMAJIMA, 1977, pp. 101–102, fig. 7 [for a selected synonymy]; 1982, p. 51.

Material examined. Truk: near airport, Moen (13); Nemwan, Moen (4); Sapuk, Moen (1); Epinup, Moen (2); Eten Is. (11). Ponape: off Aumar (15); Nankapenparam reef (2); outer reef, northwest of Sokehs (4); outer reef, north of Takatik (1).

Distribution. Circumtropical.

Metavermilia BUSH, 1904

Metavermilia nates ZIBROWIUS, 1971

Metavermilia nates: IMAJIMA, 1979, pp. 171–173, fig. 5 [for synonymy].

Material examined. Ponape: off Tumu Point, in 17 m, dredge (3).

Distribution. Western Indian Ocean; southern Japan; Ponape Island.

Dasynema SAINT-JOSEPH, 1894

Type species: *Dasynema chrysogyrus* (GRUBE, 1876), by original designation. Gender: neuter.

Diagnosis, emended. Branchiae arranged in two semicircles. Radioles with eye-spots and outwardly directed stylodes. Operculum with fleshy globular part proximally, calciumcarbonate infested horny cone distally. Peduncle without pinnules, broadly flattened, inserted at left or right base of branchial crown below first 2–3 normal radioles. 7 thoracic segments. Thoracic membranes ending at 7th setiger. Tonguelets as in f.i. *Spirobranchus* (TEN HOVE, 1970a, p. 8) are absent. Without special collar setae, "*Apomatus*"-setae present in posterior thoracic setigers. Abdominal setae geniculate. Thoracic uncini saw-shaped, with numerous (approx. 17) teeth, anterior tooth blunt; abdominal uncini saw-shaped anteriorly, rasp-shaped posteriorly. Tube with "peristomes".

Discussion. Originally described as a species of *Serpula*, SAINT-JOSEPH decided to give it a generic status on the basis of the for serpulids unique character of external appendages to the branchial radioles, reminding him (and GRUBE) of *Dasychone*, a synonym of *Branchiomma* (Sabellidae). Except for this character the genus keys out with *Vermiliopsis*, in BUSH (1905, p. 221) and SOUTHWARD (1963, pp. 585–587); it would have done so in SAINT-JOSEPH'S (1894, p. 262) key too, if this author had not been misinformed about the abdominal and thoracic setae.

It would appear that *Dasynema* can be distinguished from *Vermiliopsis* by its thoracic membranes, ending at the 7th setiger instead of the 4th. Although this is correct for about one thousand specimens studied of the *Vermiliopsis infundibulum/glandigera*-group, *V. labiata* (COSTA, 1861), *V. striaticeps* (GRUBE, 1862) and *V. monodiscus* ZIBROWIUS, 1968, five specimens of *Vermiliopsis* s. str., misidentified *Vermiliopsis acanthophora* by DAY (1962, p. 654), do have thoracic membranes up to the 7th setiger.

The thoracic uncini in *Vermiliopsis* generally have fewer teeth (approximately 12–14), although ZIBROWIUS (1968, p. 122) counted up to 16 in his Mediterranean material.

The flattened opercular stalk reminds of *Metavermilia*, however, it is the second radiole in this genus, and not placed outside the normal row of radioles as it is in *Dasynema* and *Vermiliopsis*. Although mentioned by PILLAI (1971, fig. 2B) for *Vermiliopsis leptochaeta* only, somewhat flattened almost winged peduncles occur in several of the nominal *Vermiliopsis* species, including the syntypes of *V. glandigera* GRAVIER, 1906 (TEN HOVE, unpublished).

A further distinctive character might be the presence of eyes on the branchial radioles. However, this character is difficult to find in preserved material and for this reason largely neglected in the literature. For example branchial eyes, though not mentioned by TEN HOVE (1970), are present in some *Spirobranchus* species (R. SMITH, pers. comm.). In the genera *Apomatus* and *Protula* they possibly can be used to distinguish between species (TEN HOVE & PANTUS, in preparation).

In conclusion, little quantitative work has been done on character-variability in serpulids. A comparison with partly literature based data, as done above, remains hazardous.

Dasynema chrysogyrus (GRUBE, 1876)

(Fig. 6, a–t)

Serpula chrysogyrus GRUBE, 1876, p. 73; 1878, pp. 276–278, pl. 15, fig. 8; ANDREWS, 1891, p. 289; MCINTOSH, 1926, p. 412.

Dasynema chrysogyrus: SAINT-JOSEPH, 1894, pp. 262, 264; BUSH, 1905, pp. 221–222; FAUCHALD, 1977, p. 144.

Material examined. Ponape: outer reef, north of Takatik (2).

Description. The specimens measure 8.5–11 mm in length, including the branchiae, and 1–1.2 mm in width in the thorax. The largest specimen consists of 61 segments including the 7 thoracic ones.

The 11–15 radioles of the branchiae are arranged in two semicircles. They are connected by a very short branchial membrane. The distal tips of the radioles taper to a fingerlike process, about two times as large as the nearest pinnules. Each radiole has seven (dorsally) to four (ventrally) external stylodes, arising from the dorsal side of the axis. The distal stylodes are accompanied by paired eye-spots, which continue distally after the last stylode; altogether 5–6 pairs of eye-spots are present, with 2–11 lenses each (Fig. 6, a, b, c).

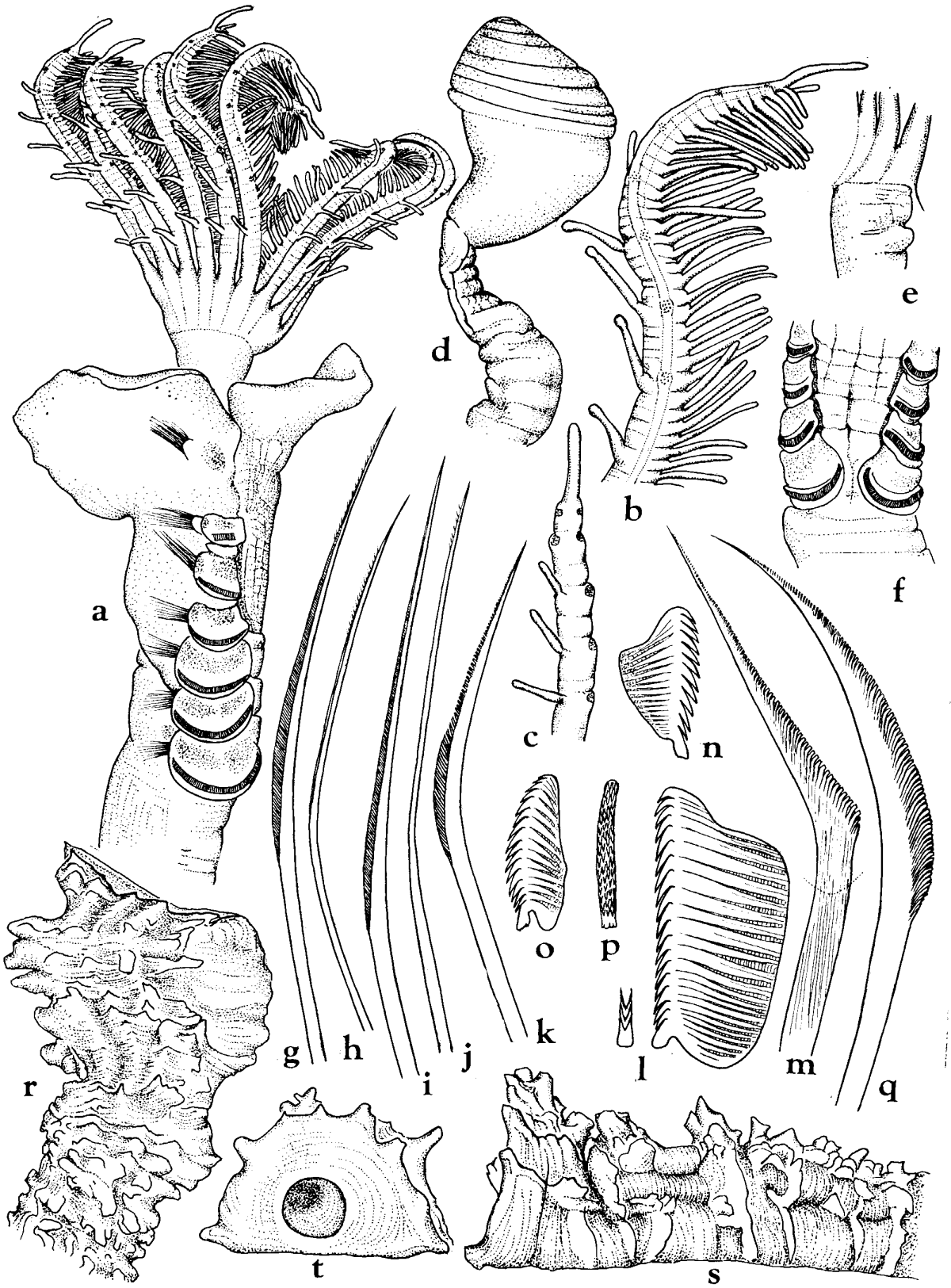
The peduncle is inserted below the 1st and 2nd normal filament, at the left or right side. It is flattened dorso-ventrally, appearing almost winged, and covers at least 3 normal filaments (Fig. 6, e).

The operculum consists of a proximal fleshy globular part, and a distal horny cone. This yellowish brown cone is infested with calcareous material; it shows 5–6 rings, probably corresponding with internal septa.

The collar has a large medio-ventral lobe and two equally wide latero-dorsal ones. The latter are continuous with the thoracic membranes, narrowing abruptly at the second segment and tapering at the 5th segment to a narrow ribbon which extends to the 7th segment.

The thorax has 7 segments, of which 6 are uncinigerous. The rows of uncini increase markedly in length at the posterior end of the thorax (Fig. 6, f). The collar fascile contains limbate setae of two sizes only, the limba gradually merges into a hairy tip (Fig. 6, g, h). The subsequent thoracic bundles have limbate capillaries of two sizes too (Fig. 6, i, j), from the 4th setiger onwards "*Apomatus*"-setae with a well-developed proximal limba occur as well (Fig. 6, k). Thoracic uncini are subrectangular, saw-shaped with a single row of 17–18 teeth; the anterior

Fig. 6. *Dasynema chrysogyrus* (GRUBE). a, anterior end of worm, in lateral view, left branchia including operculum is omitted, ×18; b, c, distal ends of branchiae-radioles, in lateral (b) and external (c) views, ×35; d, operculum, ×20; e, bases of the 1st, 2nd and 3rd branchiae-radioles and peduncle, ×20; f, thorax, in ventral view, ×18; g, h, collar setae, ×170; i, j, thoracic limbate setae, ×210; k, thoracic "*Apomatus*-seta", ×210; l, thoracic uncinus and its anteriormost tooth, ×550; m, geniculate abdominal seta, ×550; n, anterior abdominal uncinus, ×830; o, p, posterior abdominal uncinus, in side (o) and frontal (p) views, ×830; q, posterior abdominal seta, ×550; r, s, t, tubes, in dorsal (r), lateral (s) views and in cross-section (t), ×8.



tooth is blunt, not gouged or pointed, and larger than the others (Fig. 6, l). Abdominal uncini are subtriangular, saw-shaped with 11–12 teeth anteriorly (Fig. 5, n), rasp-shaped with 2–4 rows of teeth posteriorly, with 14–15 teeth visible in profile (Fig. 6, o); the anterior tooth appears to be blunt, somewhat irregular (Fig. 6, p). Abdominal setae vary from short, abruptly geniculate anteriorly (Fig. 6, m), to long gradually bent posteriorly (Fig. 6, q); neuropodia containing one pair of setae per segment only. The posterior 17 segments have a dorsal glandular area, as in some species of *Vermiliopsis*.

The tube is white, and about 3.3 mm in diameter near the mouth. It has 5 highly irregular longitudinal ridges of coarse tubercles. Many irregular former peristomes encircle the tube (Fig. 6, r,s,t).

Remarks. Although the species has been mentioned by a few authors, this is the second record based on material.

GRUBE (1878, pp. 277–278) explicitly states that the stylodes are paired ("paribus appendicum exteriorum ..... ornata", "paarige griffelförmige Anhänge"). However, his figure 8a more closely resembles our figure 6 b, and leaves room for doubt. We therefore assume that he was in error, understandably so since the asymmetrical placement of the stylodes is unexpected in the otherwise bilateral symmetrical radioles. In other respects his description fits ours very well, except for the fact that he apparently had a more than 2-times larger specimen (incomplete 24.5 mm in length, with 25–27 radioles, diameter of operculum 2.6 mm, of tube 5.5 mm).

MCINTOSH (1926, p. 412) mistakenly compares the operculum of *S. chrysogyrus* (from literature) with that of a deep-water form from the Atlantic, which in reality most probably is a *Hyalopomatus* species (TEN HOVE & AARTS, in preparation).

Distribution. Philippines; Ponape Island.

Pseudovermilia BUSH, 1907

Pseudovermilia pacifica IMAJIMA, 1978

Pseudovermilia pacifica IMAJIMA, 1978, pp. 57–59, fig. 4; 1979, p. 170.

Material examined. Ponape: off Tumu Point, in 17 m, dredge (10). Majuro: Bwokwtoonal (1).

Distribution. Southern Japan, 30–75 m in depth; Ponape Island; Majuro Atoll.

Vermiliopsis SAINT-JOSEPH, 1894

Vermiliopsis labiata (COSTA, 1861)

Vermiliopsis labiata: IMAJIMA, 1977, pp. 95–97, fig. 4, b–o [for a selected synonymy]; 1979, p. 170; BIANCHI, 1981, pp. 76–77, fig. 27.

Material examined. Ponape: off Tumu Point, in 17 m, dredge (1).

Distribution. Mediterranean Sea; Gulf of Guinea; southern Japan; Ponape Island; Red Sea, Iranian Gulf and Malagasy (ZIBROWIUS, pers. comm.).

Vermiliopsis infundibulum/glandigera-group

Vermiliopsis infundibulum/glandigera-group: IMAJIMA, 1976a, pp. 139–141, fig. 11, a–o [for synonymy]; 1978, p. 57; 1982, p. 51.

Material examined. Truk: Nemwan, Moen (34); Mechitiu, Moen (32); Neouo, Moen (28); Epinup, Moen (12); Sapuk, Moen (4); Falo Is. (18); east coast of Fefan Is. (12); Eten Is. (32); Kutua Point, Dublon Is. (11); Northeast Is. (4). Ponape: outer reef, northwest of Sokehs (37); off Aumar (26); outer reef, north of Takatik (31); Nankapenparam reef (6); off Jokai (9); off Tumu Point, in 17 m, dredge (5). Majuro: Eroj (25); Ajukwola (8); Calalin (22); near Woja (34); Bwokwtoonal (8); Roguron (5); near Arrak (13).

Distribution. Circum (sub-) tropical.

Salmacina CLAPARÈDE, 1870

Salmacina sp.

Salmacina dysteri: DEW, 1959, p. 50, fig. 19; STRAUGHAN, 1967a, pp. 250–251.

Material examined. Truk: Sapuk, Moen (many); near airport, Moen (many); Kutua Point, Dublon Is. (many); east side of Fefan Is. (many); Falo Is. (many); Eten Is. (many). Ponape: outer reef, northwest of Sokehs (many); outer reef, north of Takatik (many). Majuro: Eroj (many); Calalin (many); Roguron (many).

Remarks. We refrained from attributing a specific name to the material in view of the taxonomic confusion in the *Filograna / Salmacina*-complex (for a discussion, see TEN HOVE & WOLF, ms). In the choice of the generic name we signalize that our material did not have opercula.

Distribution. Circummundane in tropical and temperate waters.

Zoogeographical remarks

The Truk, Ponape and Majuro Islands are located roughly at 7° North Latitude, and are washed by the North Equatorial Current. They belong to the Indo-Polynesian Province (in the sense of BRIGGS, 1974, p. 21), and are of interest as a possible source region for the S. Japanese fauna.

The distributions of serpulid taxa, discussed in this paper and in IMAJIMA (1982, p. 52), are summarized in Table 1, and compared with the other known distributions. Differences in species composition be-

Table 1. Geographic distribution of the serpulid species found in the Truk Islands, Ponape and Majuro Atoll.

	Majuro	Ponape	Truk	Palau & Yap	Elsewhere in Indo-Poly. Prov.	Southern Japan	Western Indian Prov.	Hawaiian Prov.	Eastern Pac. Region	Elsewhere
Serpula vermicularis	+	+	+	+	+	+	+	+	+	"world-wide"
Salmacina sp.	+	+	+	+	+	+	+	+	+	"world-wide"
Vermiliopsis infundibulum/ glandigera-group	+	+	+	+	+	+	+	+	+	circum (sub) tropical temperate
Pomatostegus stellatus		+	+	+	+	+	+		+	circumtropical
Spirobranchus tetraceros	+	+		+	+	+	+		+	circumtropical, Lusitania (immigrated)
Hydroides elegans				+	+	+	+	+	+	circum (sub) tropical fouling
H. brachyacantha	+	+	+	+	+			+	+	
H. albiceps	+	+	+	+	+	+	+		+	
Pomatoleios kraussii				+	+	+	+	+	+	S. Africa
Spirobranchus giganteus corniculatus	+	+	+	+	+	+	+	+		
Vermiliopsis labiata		+			+	+	+			Lusitania
Crucigera tricornis	+	+			+	+	+			
Metavermilia nates		+				+	+			
Hydroides minax	+			+	+	+	+			Lusitania (immigrated)
Ditrupa arietina				+	+	+	+			Lusitania
Hydroides exaltata		+		+	+	+				NW Australia
H. longispinosa		+		+	+	+				
H. tambalagamensis	+			+	+	+				
H. tuberculata		+	+	+	+	+				
Pseudovermilia pacifica		+				+				
Serpula watsoni	+	+	+	+	+	+				
S. tetratropia			+	+		+				
S. oshimae				+		+				
Metavermilia acanthophora				+	+	+				
Serpula hartmanae	+	+	+	+	+					
Spirobranchus decoratus	+	+	+	+	+					
Hydroides novaepommeraniae			+	+	+					
H. furcifera (incl. *bifidus*)				+	+					
Serpula vittata (incl. *palauense*)				+						NW Australia
Dasynema chrysogyrus		+			+					

tween Truk, Ponape and Majuro may be real, but more probably reflect incomplete sampling. For instance *Pseudovermilia pacifica*, *Metavermilia nates* and *Vermiliopsis labiata* are known from Ponape Island only, but from a dredging station. In the other isalnds no dredging was done. Thus the considerations below can only be preliminary indications.

For biogeographical comparisons the very widely distributed taxa *Serpula vermicularis* through *Hydroides elegans* will be disregarded, leaving 24 species to be dealt with.

The next group, *Hydroides brachyacantha* through *Spirobranchus giganteus corniculatus*, consists of species with a wide Indo-Pacific distribution; except for *S. giganteus corniculatus*, which in the E. Pacific Region is replaced by its tropical W. Atlantic counterpart *S. giganteus giganteus*, these species are transpacific. TEN HOVE and TROMP (unpublished) found 27 taxa in the E. Pacific Region, mainly Panama, including the first nine of Table 1. Thus three out of 45 (7%) of the species are transpacific.

The next group of five species, *Vermiliopsis labiata* through *Ditrupa arietina*, shows an Indo-West Pacific distribution. The two species mentioned by name occur quite commonly in the Atlantic N. warm temperate Lusitania Province too. The other three apparently are Indo-West Pacific endemics.

As far as known yet, the remaining 15 taxa are mainly Indo-Polynesian endemics; of them eight reach as far north as the Ogasawara Islands; two (*Hydroides exaltata* and *Serpula vittata*) are known from the NW Australia Province too.

摘　　要

今島　実（国立科学博物館　動物研究部）・H. A. TEN HOVE（ユトレヒト大学）——トラック諸島，ポナペ島，マジュロ環礁と他のインド・太平洋域のカンザシゴカイ類（多毛類）.

昭和57年度文部省科学研究費補助金による海外学術調査（研究代表者　今島実，課題番号 57041056）が昭和57年6月23日～8月17日間に東カロリン群島のトラック諸島，ポナペ島とマーシャル群島のマジュロ環礁で海産動物相を明らかにする目的で実施された.

多くの多毛類が採集された中で，カンザシゴカイ科が研究され，併せて日本ならびにパラオ諸島産の3種を再検討して2新種を含む10属24種を明らかにした．この調査海域からは現在までに *Salmacina incrustans* 1種のみが知られていたに過ぎなかった．フィリピンから1876年に記載された *Dasynema chrysogyrus* (GRUBE) がポナペ島で2個体採集されたが，原記載以来報告がなかったものである.

西カロリン群島のパラオ諸島からマーシャル群島間の海域に産するカンザシゴカイ類

30種のうち，*Serpula hartmanae, S. vittata, Hydroides brachyacantha, H. novae-pommeraniae, H. furcifera, Spirobranchus decoratus, Dasynema chrysogyrus* の7種（23%）は日本沿岸まで分布していないことがわかった．

Literature cited

ABILDGAARD, P. C. 1789. Beschreibung 1. Einer groszen Seeblase (*Holothuria Pirapus* LINN.), 2. Zween Arten des Steinbohrers (*Terebella* LINN.), 3. Einer groszen Sandröhre (*Sabella* LINN.). *Schr. Ges. naturf. Freunde Berl.*, **9**: 133–146.

AMOUREUX, L., F. RULLIER and L. FISHELSON 1978 Systématique et écologie d'annélides polychètes de la presqu'il du Sinai. *Israel J. Zool.*, 27: 57–163.

ANDREWS, E. A. 1891. Compound eyes of Annelids. *J. Morphol.*, **5**: 271–299.

AUGENER, H. 1914. Polychaeta II. Sedentaria. *In* W. MICHAELSEN and R. HARTMEYER (ed.), *Die Fauna Südwest-Australiens*, **5**: 1–170.

——— 1918. Polychaeta. *In* MICHAELSEN, W. and L. FRIELRICHSEN (ed.), *Beiträgen zur Kenntnis der Meeresfauna Westafrikas* 2, **2**: 69–625.

——— 1925. Die Polychaeten der Südsee-Expedition der Hamburgischen Wissenschaftlichen Stiftung 1908–1909. *Mitt. zool. Staatsinst. Mus. Hamburg*, **41**: 53–70.

BAILEY-BROCK, J. H. 1976. Habitats of tubicolous polychaetes from the Hawaiian Islands and Johnston Atoll. *Pacif. Sci.*, **30**: 69–81.

BAIRD, W. 1865. Description of several new species and varieties of tubicolous annelids (=tribe Limivora of GRUBE), in the collection of the British Museum. *J. Linn. Soc. Lond. (Zool.)*, 8: 10–22.

BIANCHI, C. N. 1981. *Policheti Serpuloidei.* Guide per il riconoscimento delle specie animali delle acque lagunari e costiere italiane, AQ/1/96, **5**: 1–187.

BRIGGS, J. C. 1974. Marine Zoogeography. xi+475 pp. McGraw-Hill, New York.

BUSH, K. J. 1905. Tubicolous annelids of the tribes Sabellides and Serpulides from the Pacific Ocean. *Harriman Alaska Exped.*, 1904 [publ. 1905]: 169–355.

DAY, J. H. 1957. The polychaete fauna of South Africa. Part 4. New species and records from Natal and Moçambique. *Ann. Natal Mus.*, **14**: 59–129, 8 figs.

——— 1962. Polychaeta from several localities in the western Indian Ocean. *Proc. zool. Soc. Lond.*, **139**: 627–654.

——— 1967. *A monograph on the Polychaeta of southern Africa.* Part 2. *Sedentaria.* Brit. Mus. (Nat. Hist.): 459–878.

DAY, J. H. and P. A. HUTCHINGS 1979. An annotated checklist of Australian and New Zealand Polychaeta, Archiannelida and Myzostomida. *Rec. Austr. Mus.*, **32**(3): 80–161.

DEW, B. 1959. Serpulidae (Polychaeta) from Australia. *Rec. Austr. Mus.*, **25**: 19–56.

FAUCHALD, K. 1977. Th polychaete worms. Definitions and keys to the orders, families and genera. *Nat. Hist. Mus. Los Angeles Cy. Sci. Ser.*, 28: 188 pp.

FAUVEL, F. 1918. Annélides polychètes des côtes d'Arabie recoltées par M.Ch. PÉRÈZ. *Bull. Mus. Hist. nat. Paris*, 24: 329–344.

——— 1919. Annélides polychètes des îles Gambier et Touamotou. *Ibid.*, **25**: 336–343.

——— 1923. Annélides polychètes des îles Gambier et de la Guyana. *Mem. Pont. Acc. Rom. Nuovi Lincei*, (2) **6**: 1–59.

——— 1930. Annelida Polychaeta of the Madras Government Museum. *Bull. Madras Govt. Mus.*, (*n.s. Nat. Hist*) **1**(2): 1–72.

——— 1939. Annélides polychètes de l'Indochine receuillies par M. C. DAWYDOFF. *Commentationes Pont. Acc. Sci., Ann. (III)*, **3**: 243–368.

——— 1947. Annélides polychètes de Nouvelle-Calédonie et des îles Gambier. *Faune Empire Français*, 8: 1–107.

——— 1953. Annelida Polychaeta. The Fauna of India, including Pakistan, Ceylon, Burma and Malaya, 507 pp. The Indian Press Ltd., Allahabad.

FISCHLI, H. 1903. Polychaeten von Ternate. *Abh. Senckenberg Naturf. Ges.*, **25**: 90–136.

GIBBS, P. E. 1969. Aspects of polychaete ecology with particular reference to commensalism. *Phil. Trans. Roy. Soc. Lond. (B)*, **255**: 443–458.

——— 1971. The polychaete fauna of the Solomon Islands. *Bull. Brit. Mus. nat. Hist., (Zool.)* **21**(5): 101–211.

GRAVIER, Ch. 1906. Sur les Annélides polychètes de la Mer Rouge (Serpulides). *Bull. Mus. natn. Hist. nat. Paris*, **12**: 110–115.

——— 1906–1908. Contribution à l'étude des Annélides polychètes de la mer Rouge (suite). *Mem. Nouv. Archs. Mus. His. nat., Paris*, (4) 8: 123–236, 8 pls.; **10**: 67–168.

GRUBE, A. E. 1870. Beschreibungen neuer order weniger bekannter von Hrn. EHRENBERG gesammelter Anneliden des rothen Meeres. *Mber. K. Preuss Akad. Wiss. Berl.*, 1869: 484–521.

——— 1876. "Vorttragende dass unter der Semperschen Annelidenausbeute von den Philippinen eine *Serpula*: *Serpula chrysogyrus* GR. gefunden." *Jahres-Ber. Schles. Gesellsch. f. vat. Cultur*, **53**: 73.

——— 1878. Annulata Semperiana. Beiträge zur Kenntniss der Annelidenfauna der Philippinen nach den von Herrn Prof. SEMPER mitgebrachten Sammlungen. *Mem. Acad. Imp. Sci. St. Petersburg.*, (7) **25** (8): ix+300 pp.

HARTMAN, O. 1954. Marine annelids from the northern Marshall Islands. *Prof. Paper US Geol. Survey, 260 Q*: 615–644.

HARTMANN-SCHRÖDER, G. 1979. Die Polychaeten der tropischen Nordwestküste Australiens (zwischen Derby im Norden und Port Hedland im Süden). *In* HARTMANN-SCHRÖDER, G. and G. HARTMANN (eds.), Zur Kenntnis des Eulitorals der australischen Küsten unter besonderer Berücksichtigung der Polychaeten und Ostracoden. Teil 2, *Mitt. hamb. zool. Mus. Inst.*, **76**: 75–218.

——— 1981. Die Polychaeten der tropisch-subtropischen Westküste Australiens (zwischen Exmouth im Norden und Cervantes im Süden). Teil 6. Zur Kenntnis des Eulitorals der australischen Küsten unter besonderer Berücksichtigung der Polychaten und Ostracoden. *Mitt. hamb. zool. Mus. Inst.*, 78: 19–96.

HASWELL, W. A. 1884. The marine annelides of the order Serpulea: some observations on their anatomy, with the characteristics of the Australian species. *Proc. Linn. Soc. N.S.W.*, **9**: 649–675.

HOVE, H. A. TEN 1970a. Serpulinae (Polychaeta) from the Caribbean: I. The genus *Spirobranchus. Stud. Fauna Cur.*, **32**: 1–57.

——— 1970b. Additional notes on the polychaetes of the Iranian Gulf (Annelida, Polychaeta, Serpulidae). *Steenstrupia*, **1**(7): 55–60.

——— 1975. Serpulinae (Polychaeta) from the Caribbean: III—The genus *Pseudovermilia* (including species from other regions). *Stud. Fauna Curaçao*, **47**: 46–101.

HOVE, H. A. TEN and M. J. JANSEN-JACOBS (ms). A revision of the genus *Crucigera* (Polychaeta, Serpulidae): remarks on serpulid methodology with special reference to the variation in *Serpula* and *Hydroides*. *Proc. Linn. Soc. NSW* (offered for publ.)

HOVE, H. A. TEN and P. S. WOLF, 1983/1984. Serpulidae (Chapter 55). *In* UEBELACKER, J. M. (ed.), *Polychaete Taxonomic Standardization Project*. 34 pp.

HOVE, H. A. TEN and M. O. M. AARTS (in prep.) Serpulidae (Polychaeta) from the Eastern Atlantic collected by the CANCAP Expeditions.

HOVE, H. H. TEN and M. J. JANSEN-JACOBS (ms). A revision of the genus *Crucigera* the genera *Apomatus* and *Protula* (Polychaeta, Serpulidae), a statistical approach to the complex.

IMAJIMA, M. 1976a. Serpulid polychaetes from Tanega-shima, southwest Japan. *Mem. natn. Sci. Mus., Tokyo,* (9) : 123–143.

——— 1976b. Serpulinae (Annelida, Polychaeta) from Japan. I. The genus *Hydroides*. *Bull. natn. Sci. Mus., Tokyo,* (A–Zool.), 2: 229–248.

——— 1977. Serpulidae (Annelida, Polychaeta) collected around Chichi-jima (Ogasawara Islands). *Mem. natn. Sci. Mus., Tokyo,* (10) : 89–111.

——— 1978. Serpulidae (Annelida, Polychaeta) collected around Nii-jima and Ô-shima, Izu Islands. *Ibid.,* (11) : 49–72.

——— 1979. Serpulidae (Annelida, Polychaeta) collected around Cape Shionomisaki, Kii Peninsula. *Ibid.,* (12) : 159–183.

——— 1982. Serpulinae (Polychaetous Annelids) from the Palau and Yap Islands, Micronesia. *Proc. Jap. Soc. syst. Zool., Tokyo,* (23) : 37–55.

IROSO, I. 1921. Revisione dei Serpulidi e Sabellidi del Golfo di Napoli. *Publ. Staz. Zool. Napoli,* 3: 47–91.

KUMARASWAMY ACHARI, G. P. 1969. Catalogue of polychaetes in the reference collections of the Central Marine Fisheries Research Institute. *Bull. cent. mar. Fish. Res. Inst.,* 7: 31–40.

MARENZELLER, E. von 1884. Südjapanische Anneliden. II. *Denkschr. Akad. Wiss. Wien,* (Math. Nat. Kl.), 49: 197–224.

MCINTOSH, W. C. 1926b. Notes from the Gatty Marine Laboratory, St. Andrews. No. XLIX. 1. On the structure and functions of the operculum and neighbouring parts of *Mercierella enigmatica* FAUVEL, and other serpulids. *Ann. Mag. nat. Hist., Lond.,* (9) 18: 402–424.

MESNIL, F. and P. FAUVEL 1939. Polychètes sédentaires de l'Expédition du "Siboga". Maldanidae, Cirratulidae, Capitellidae, Sabellidae et Serpulidae. *Siboga Exped.,* 24(2) : 1–42.

MOHAMMAD, M. B. M. 1975. Competitive relationship between *Balanus amphitrite amphitrite and Pomatoleios kraussii* with special reference to their larval settlement. *Hydrobiologia,* 46: 1–15.

MONRO, C. C. A. 1933. The Polychaeta Sedentaria collected by Dr. C. CROSSLAND at Colón in the Panama region and the Galapagos Islands during the expedition of the S.Y. St. George. *Proc. zool. Soc. Lond.,* 2: 1039–1092.

OKUDA, S. 1937. Polychaetous annelids from the Palau Islands and adjacent waters, the South Sea Islands. *Bull. biogeogr. Soc. Japan,* 7(12) : 257–316.

PILLAI, T. G. 1960. Some marine and brackish-water serpulid Polychaeta from Ceylon, including new genera and species. *Ceylon J. Sci. (Biol. Sci.),* 3: 1–40.

——— 1961. Annelida Polychaeta of Tambalagam Lake, Ceylon. *Ibid.,* 4: 1–40.

——— 1965. Annelida Polychaeta from the Philippines and Indonesia. *Ibid.,* 5: 110–177.

——— 1971. Studies on a collection of marine and brackish-water polychaete annelids of the family Serpulidae from Ceylon. *Ibid.,* 9: 88–130.

——— 1972. A review and revision of the systematics of the genera *Hydroides* and *Eupomatus* together with an account of their phylogeny and zoogeography. *Ibid.,* 10, 1:7–31.

REISH, D. J. 1968. Polychaetous annelids of the Marshall Islands. *Pac. Sci.,* 22(2) :

208–231.

RIOJA, E. 1941. Estudios anelidologicos II. Observaciones acerca de varias especies del genero *Hydroides* GUNNERUS (sensu FAUVEL) de las costas Mexicanas del Pacific. *An. Inst. Biol. Univ. Méx.*, 12: 161–175.

——— 1942. Estudios anelidologicos IV. Observaciones sobre especies de Serpúlidos de las costas del Pacífico de México, con descripción de una especie nueva del genero *Hydroides*. *Ibid.*, **13**: 125–135.

RULLIER, F. 1972. Annélides Polychétes de Nouvelle Calédonie recueillies par Y. PLESSIS et B. SALVAT. Exp. *Franç. Récifs Corall. Nouv.-Caléd.*, **6**: 1–169.

RULLIER, F. and L. AMOUREUX 1979. Annélides Polychètes. Résultats scientifiques des campagnes de la Calypso, fasc. II. Campagne de la Calypso au large des côtes atlantiques de l'Amerique du Sud (1961–1962). I. 33. *Annls Inst. océanogr., Paris*, 55 (Suppl.): 145–206.

SAINT-JOSEPH, A. DE. 1894. Les Annélides Polychètes des Côtes de Dinard. III. *Ann. Sci. Nat.* (*7*) *Zool., Paris*, **17**: 1–395.

SOUTHWARD, EVE C. 1963. Some new and little-known serpulid polychaetes from the continental slope. *J. mar. biol. Ass. U.K.*, **43**: 573–587.

STRAUGHAN, D. 1967a. Marine Serpulidae (Annelida: Polychaeta of Eastern Queensland and New South Wales. *Austr. J. Zool.*, **15**: 201–261.

——— 1967b. Some Serpulidae (Annelida: Polychaeta) from Heron Island, Queensland. *Univ. Queensl. Pap.*, **1**: 27–45.

——— 1969. Serpulidae (Annelida, Polychaeta) from Oahu, Hawaii. *Bull. So. Calif. Acad. Sci.*, **68**(4): 229–240.

TREADWELL, A. L. 1901. The polychaetous annelids of Porto Rico. *Bull. U.S. Fish Com. Wash.*, **20**: 181–210.

UCHIDA, H. 1978. Serpulid tube worms (Polychaeta, Sedentaria) from Japan with the systematic review of the group. *Bull. Marine Park Res. St.*, **2**: 1–98.

WIKTOR, J. 1980. Type specimens of Annelida Polychaeta in the Museum of Natural History of the Wroclaw University. *Annales zool.*, **35**: 267–283.

WILLEY, A. 1905. Report on the Polychaeta collected by Professor HERDMAN, at Ceylon, in 1902. *In* HERDMAN, W. A. (ed.), Report to the government of Ceylon on the pearl oyster fisheries of the Gulf of Manaar. *Lond. Roy. Soc.* 4, *Suppl. Rep.*, **30**: 243–342.

WU, S. K. 1968. On some polychaete worms from the northern coast of Taiwan. *Bull. Inst. Zool. Acad. Sinica*, **7**: 27–48.

WU, B. L. and M. CHEN 1981. Two new species of *Hydroides* (Polychaeta: Serpulidae) from South China Sea. *Oceanol. Limol. Sinica*, **12**(4): 354–357.

WU, B. L., R. SUN and M. CHEN 1980. Zoogeographical studies on Polychaeta from the Xisha Islands and its adjacent waters. *Acta Zool. Sinica*, **2**: 111–130.

ZIBROWIUS, H. 1968. Étude morphologique, systématique et écologique, des Serpulidae (Annelida Polychaeta) de la région de Marseille. *Rec. Trav. St. Mar. End., Bull.*, **43**: 81–252.

——— 1970. Contribution à l'étude des Serpulidae (Polychaeta Sedentaria) du Brésil. *Bolm Inst. oceanogr. S Paulo*, **19**: 1–32.

——— 1971. Les espèces Méditerranéennes du genre *Hydroides* (Polychaeta Serpulidae). Remarques sur le prétendu polymorphisme de *Hydroides uncinata*. *Tethys*, **2**: 691–746.

——— 1972. Deux espèces nouvelles du genre *Hydroides* (Polychaeta, Serpulidae) de la Mer Jaune et des Iles Banda. *Bull. Soc. zool. France*, **97**: 89–83.

——— 1973. Serpulidae (Annelida Polychaeta) des côtes ouest de l'Afrique et des

archipels voisins. *Annls. Mus. r. Afr. cent., sér.* 450, **207**: 1–93.

——— 1979. Serpulidae (Annelida Polychaeta) de l'Océan Indien arrivés sur des coques de bateaux à Toulon (France, Méditerranée). *Rapp. Comm. int. Mer Médit.*, **25/26** (4) : 133–134.

ZIBROWIUS, H. and G. BITAR 1981. Serpulidae (Annelida, Polychaeta) Indo-pacifiques établis dans la région de Beyrouth, Liban. *Ibid.*, **27** (2) : 159–160.

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