HYDROIDS FROM FRENCH POLYNESIA WITH NOTES ON DISTRIBUTION AND ECOLOGY

by

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With 36 text-figures

INTRODUCTION

Distribution and ecology of hydroids from coral reefs of high islands and atolls of French Polynesia so far have received little attention. Redier (1967, 1971) published a preliminary list of 14 species from Salvat's collections, sampled during several trips to Tahiti, Tuamoto (Mururoa, Reao and Maturei Vavao Atolls), to the Australes Islands (Rapa) and to Gambier.

The present paper results from researches carried out by one of us (P.V.) [1] concerning the benthic bionomy of reef sciophilous communities of hard bottoms. They have been carried out at Tiahura, Moorea, Society Islands (fig. 1A) and on Takapoto Atoll, Tuamoto Archipelago (fig. 2A) in 1973 and 1974. They gave us occasion to compile a revised list of about 22 species of hydroids from French Polynesia.

Regarding the general environmental conditions, the tides are of a semi-diurnal type and the amplitude during spring tides does not exceed 40 to 50 cm. The water temperature varies between 25° C, during the cold season, and 28° C, during the hot season. Moorea island is under the trade winds, blowing from a southwesterly direction and turning to the N.E. Accordingly the Tiahura region (fig. 1B), which is located at the N.W., is sheltered from the trade winds. Nevertheless, those winds induce a water circulation from W. to E. around the fringing reef and the barrier reef. Takapoto Atoll, to the contrary, is submitted to prevailing winds, blowing from N.E. to S.E. with a dominance in the eastern sector.

1) This study is part of the program "Man and Biosphere" (M.A.B.), Theme VII: Ecology and rational uses of insular ecosystems; funds were made available from the "Territoire de la Polynésie Française". It was carried out in collaboration with Antenne du Museum et E.P.H.E., B.P. 562, Papeete, Tahiti.

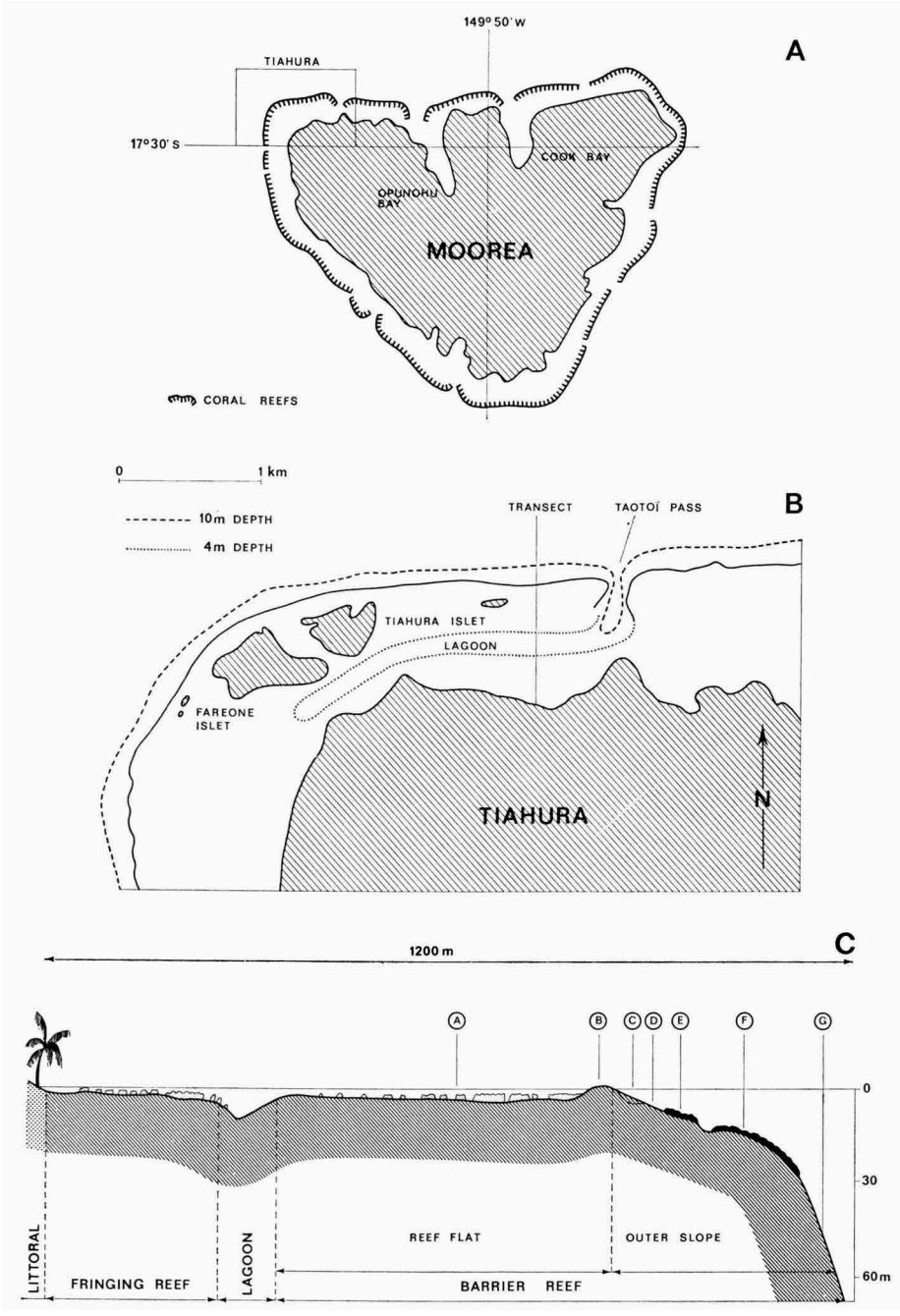

Fig. 1. Moorea island. A, diagrammatic map of the island; B, diagram of the Tiahura region, Moorea island. a, reef flat with scattered coral growth; b, outer biogenic ridge; c, furrowed platform; d, non-furrowed platform; e, buttress-and-valley zone; f, spur-and-groove zone of outer slope; g, precipitous slope.

Concerning the aspect of the reefs, those from the Tiahura region of Moorea have been particularly studied by Salvat et al. (1972) and by Jaubert, Thomassin & Vasseur (1976). The Tiahura reef complex (fig. 1C) is characteristic of high islands and is composed of a fringing reef, a narrow

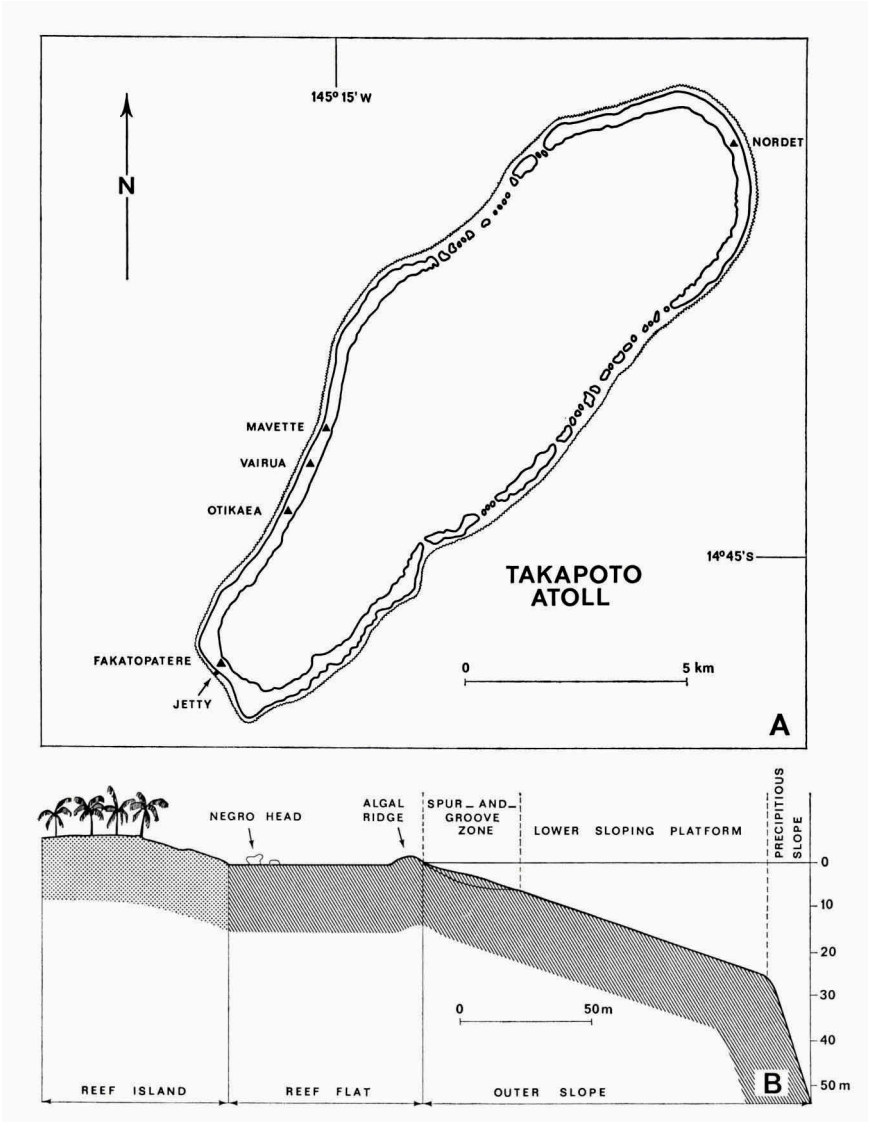

Fig. 2. Takapoto Atoll. A, diagrammatic map of the atoll; B, diagrammatic section through the reefs.

and shallow lagoon and a barrier reef, successively. The outer slope presents the following zones:

— from 0 to 15 m, a buttress-and-valley zone which is divided into a furrowed platform (0 to 3-4 m), a non-furrowed platform (3-4 m to 7 m) and a coral buttress-and-valley zone (7 to 15 m);
— from 15 to 27 m, a coral spur-and-groove zone;
— from 27 to 50 h, a biodetritical lower sloping platform.

At Tiahura, all phytosociological samples concerning the sciophilous communities, as well as the hydroid samples, have been collected along a transect passing through the different zones of the reef complex (fig. 1B).

Takapoto Atoll, in the western part of the Tuamotu Archipelago, is situated parallel to the direction of the prevailing N.E. winds. Its lagoon is of the enclosed type, without any pass communicating with the ocean. The reef flat, very poorly colonized and relatively narrow (about 100 m), is completely emerged during ebb tides. It ends at the reef front with a characteristic, well developed algal ridge. The outer slope (fig. 2B) is different from that at Tiahura. In the upper level, 0 to 5 m, it shows a tortuous spur-and-groove zone, continuing in a gently sloping lower platform, fully colonized by corals and calcareous algae, from 5 to 25 m deep and over 100 m wide. From 30 m onwards the slope begins to drop and forms a precipitous incline of several hundred meters. The SCUBA divings were mainly done along the outer slope of the less rough part of the atoll, situated at the west coast between Otikaea and Vairua, and at the southern trough of Fakatopatere.

In the course of our investigations it became imperative to study the types of certain species. For the opportunities to do this we are indebted to Dr. P. F. S. Cornelius, Coelenterate Section, British Museum (Natural History), Londen, and Dr. R. W. M. van Soest, Institute for Taxonomic Zoology (Instituut voor Taxonomische Zoölogie), University of Amsterdam.

List of the localities

A. Moorea, reefs of Tiahura, French Polynesia

Sample	Date	Locality	No.	Species
R 1	21.7.1973	Outer slope, under ledge, 1.5-2 m depth	1	*Synthecium samauense* Billard
			2	*Gymnangium eximium* (Allman)
			3	*Gymnangium hians* (Busk)
			4	*Gymnangium eximium* (Allman)
R 12	30.7.1973	Outer slope, under block, 6-7 m depth	5	*Synthecium samauense* Billard (common)
R 13	31.7.1973	Outer slope, under block, 4-5 m depth	6	*Synthecium samauense* Billard (common)
			7	*Sertularia ligulata Thornely*

Sample	Date	Locality	No.	Species
			8	*Gymnangium eximium* (Allman)
			9	*Synthecium samauense* Billard
			10	*Antennella secundaria* (Gmelin)
			11	*Sertularia turbinata* (Lamouroux)
R 14	31.7.1973	Outer slope, under block, 4-5 m depth	12	*Sertularia ligulata* Thornely (very common)
			13	*Synthecium samauense* Billard
R 15	1.8.1973	Outer slope, under ledge, 2-3 m depth	14	*Synthecium samauense* Billard (common)
			15	*Sertularella robusta* Coughtrey
			16	*Gymnangium hians* (Busk)
			17	*Halopteris constricta* Totton
R 16	3.8.1973	Outer slope, under block, 9-10 m depth	18	*Sertularella robusta* Coughtrey
R 17	3.8.1973	Outer slope, under block, 9-10 m depth	19	*Synthecium samauense* Billard
				Hebella scandens (Bale) var. *contorta* Marktanner-Turneretscher
			20	*Sertularella robusta* Coughtrey
R 18	3.8.1973	Outer slope, under block, 9-10 m depth	21	*Halopteris buskii* (Bale) (common)
			22	*Sertularella robusta* Coughtrey
R 23	8.8.1973	Outer slope, under ledge, 1.5-3 m depth	23	*Synthecium samauense* Billard
R 34	14.8.1973	Outer slope, under block, 14 m depth	24	*Synthecium samauense* Billard
			25	*Sertularella robusta* Coughtrey
			26	*Gymnangium eximium* (Allman)
R 36	15.8.1973	Outer reef flat, in cavity	27	*Plumularia setacea* (L.)
R 38	15.8.1973	Outer slope, under ledge, 2-3 m depth	28	*Synthecium samauense* Billard
R 39	15.8.1975	Outer slope, under ledge, 2-3 m depth	29	*Gymnangium hians* (Busk)
				Antennella secundaria (Gmelin)
			30	*Synthecium samauense* Billard
			31	*Sertularia turbinata* (Lamouroux)
			32	*Antennella secundaria* (Gmelin)
R 42	17.8.1973	Outer slope, under blocks and in cavities, 18 m depth	33	*Synthecium samauense* Billard (common)
			34	*Thecocarpus phyteuma* (Kirchenpauer)
			35	*Sertularella robusta* Coughtrey
R 44	10.8.1974	Outer slope, under ledge, 15 m depth	36	*Sertularella robusta* Coughtrey (fairly common)
				Hebella parasitica (Ciamician)
			37	*Plumularia setacea* (L.)
			38	*Thecocarpus phyteuma* (Kirchenpauer)
R 51 & R 52	5&6.9.1974	Barrier reef, in coral depression,	40	*Sertularella robusta* Coughtrey (very common)

Sample	Date	Locality	No.	Species
		1 m depth	40A	*Halopteris constricta* Totton
				Hebella parasitica (Ciamician)
			40B	*Dynamena heterodonta* (Jarvis)
R 53	7.9.1974	Outer slope, under ledge, 15 m depth	42	*Halopteris buskii* (Bale) (very common)
				Sertularella tongensis Stechow
R 55	7.9.1974	Outer slope, under ledge, 15 m depth	41	*Sertularella robusta* Coughtrey (fairly common)
R 56	8.9.1974	Outer slope, in cavity,	43	*Thecocarpus phyteuma* (Kirchenpauer) (fairly common)
		20 m depth	44	*Synthecium dentigerum* Jarvis
R 58	11.9.1974	Outer slope, in cavity,	45	*Halopteris buskii* (Bale)
		25 m depth	45A	*Antennella secundaria* (Gmelin)
B. Takapoto, Tuamotu Archipelago				
R 65 A	22.8.1974	Algal ridge, Mavette Reef, in depressions	51	*Dynamena crisioides* Lamouroux (fairly common)
R 66 A	23.8.1974	Outer slope, reef between Otikaea and Vairua, under ledge, 20 m depth	52	*Halopteris buskii* (Bale) (fairly common)
R 66 B	23.8.1974	Outer slope,	53	*Lictorella rufa* (Bale) (common)
		reef between	54	*Synthecium dentigerum* Jarvis
		Otikaea and Vairua, under ledge, 20 m depth		(fairly common)
				Sertularella robusta Coughtrey (fairly common)
			56	*Solanderia minima* (Hickson)
R 67 A	24.8.1974	Nordet Reef, outer slope spurs and grooves, under ledge, 1.5-2 m depth	57	*Dynamena crisioides* Lamouroux (common)
R 69 A	26.8.1974	Outer slope, Fakatopatere Reef, zone of jetty, in cavity,	58	*Halopteris buskii* (Bale) (common)
				Antennella secundaria (Gmelin)
				Synthecium dentigerum Jarvis (common)
		7-10 m depth	60	*Plumularia strobilophora* Billard (fairly common)
			61	*Sertularia ligulata* Thornely
			62	*Sertularella robusta* Coughtrey
R 69 B	26.8.1974	Outer slope, Fakatopatere Reef,	63	*Lictorella rufa* (Bale) (fairly common)
		zone of jetty, in cavity,	64	*Antennella secundaria* (Gmelin) (common)
		7-10 m depth	65	*Synthecium dentigerum* Jarvis (fairly common)

Sample	Date	Locality	No.	Species
R 69 C	26.8.1974	Outer slope, Fakatopatere Reef, zone of jetty, in cavity, 7-9 m depth	66	*Halopteris buskii* (Bale) (common)
			67	*Lictorella rufa* (Bale) (fairly common)
			68	*Synthecium dentigerum* Jarvis (fairly common)
				Sertularia malayensis Billard
			69	*Lictorella rufa* (Bale) (fairly common)
			70	*Sertularia malayensis* Billard
				Eudendrium spec. (fairly common)

List of the species

Fam. Eudendriidae
Eudendrium spec.
Fam. Solanderiidae
Solanderia minima (Hickson)
Fam. Hebellidae
Hebella parasitica (Ciamician); *Hebella scandens* (Bale) var. *contorta* Marktanner-Turneretscher
Fam. Lafoeidae
Lictorella rufa (Bale)
Fam. Syntheciidae
Synthecium samauense Billard; *Synthecium dentigerum* Jarvis
Fam. Sertulariidae
Dynamena crisioides Lamouroux; *Dynamena heterodonta* (Jarvis);
Sertularella robusta Coughtrey; *Sertularella tongensis* Stechow;
Sertularia ligulata Thorneley; *Sertularia malayensis* Billard;
Sertularia turbinata (Lamouroux)
Fam. Plumulariidae, sub-family Halopterinae
Antennella secundaria (Gmelin); *Halopteris constricta* Totton; *Halopteris buskii* (Bale)
Fam. Plumulariidae, sub-family Plumulariinae
Plumularia setacea (L.); *Plumularia strobilophora* Billard
Fam. Plumulariidae, sub-family Aglaopheniinae
Gymnangium eximium (Allman); *Gymnangium hians* (Busk); *Thecocarpus phyteuma* (Kirchenpauer)

Eudendrium spec.

Locality. — Takapoto, no. 70. One 8 mm high specimen, rising from a creeping stolon. Male gonophores present; no hydranths.

Description. — The specimen consists of a stolon with yellowish, wrinkled periderm, from which rises a single stem, ringed at the base and with generally smooth, thin periderm. There is no terminal hydranth. The stem bears a single side-branch, terminating into a much reduced hydranth with two (male) gonophores.

The condition of this specimen excludes specific identification. It might represent a small colony of *Eudendrium capillare* Alder, 1856, a species of almost cosmopolitan distribution.

Ecology. — This species has only been found at Takapoto Atoll, where it occurs at the spur-and-groove zone of the outer slope, between 7 and 10 m depth, near the trough of Fakatopatere. It is attached to the deeply shadowed, overhanging wall, that is covered by a hydrozoan community (*Synthecium dentigerum, Sertularia malayensis, Lictorella rufa*), several sponges (dominated by *Astrosclera willeyana*), bryozoans, didemnid ascidians and calcareous algae.

Solanderia minima (Hickson, 1903)

Ceratella minima Hickson, 1903: 114, pl. 13; Thornely, 1908: 85.
Solanderia minima — Stechow, 1909: 41; Bedot, 1925: 413; Vervoort, 1962: 531; Vervoort, 1967: 25, fig. 2, pl. 3 figs. 3, 4; Millard & Bouillon, 1973: 16,fig. 2a, b, pl. 1.

Locality. — Takapoto, no. 56. One diffusely branched colony of 10 cm height and a spread of 8 cm; several fragments. Hydranths and some (young) gonophores are present.

Description. — The colony consists of a single stem and side-branch, both diffusely branched, leaving large, open mashes. Branching is more or less in one plane, so that the colony is fan-shaped. Diameter of the stem about 1,200 microns near the base; extreme basal part flattened to form a small disk, by means of which the specimen was attached to the substratum (presumably corals). Colour of the stem reddish brown, gradually changing to light horny brown in the finer ramifications. The skeletal structure of this specimen is exactly as described previously (Vervoort, 1967: 25), the peridermal structure leaves open meshes filled by the coenosarc; longitudinal fibres, also showing the reticulated structure, are visible on the surface of the colony. On both sides of the hydranths these fibres form elevated wing-like spines of variable height but with rounded apices, exactly as in the East African material described earlier. Some of these spines, notably on the thicker branches and on the stem, are more acutely pointed and have a narrow base, approaching the condition found in *Solanderia secunda* (Inaba, 1892).

Though the hydranths are preserved, their condition of preservation is such that no counts of the tentacles could be made, but it was noticed that they are capitate and distributed over the body of the hydranth. Those hydranths, moreover, have the tendency to be placed in the plane of ramification of the colony; they are, however, not particularly abundant and widely spaced. On microscopic examination of some of the branches young gonophores of unknown sex were observed.

Ecology. — *S. minima* only occurred at Takapoto Atoll, where a single

specimen was found in a dark cavity on the outer slope of the atoll, between Otikaea and Vairua, at 15 to 20 m depth. This zone corresponds with the lower sloping platform, where many cavities are characterized by a varied sessile fauna of sponges, hydrocorals (*Stylaster* spec. and *Distichopora* spec.), bryozoans and ascidians. Besides *S. minima* the following hydroids were observed: *Lictorella rufa, Synthecium dentigerum* and *Sertularella robusta.*

Remarks. — We would not be surprised if on the examination of a more copious material than we have at our disposal at the moment, *Solanderia secunda* (Inaba, 1829), *S. crosslandi* (Thornely, 1908) and *S. minima* (Hickson, 1903) proved to belong to one variable species of more general distribution in the Indo-Pacific. Unfortunately details of the nematocysts of these three "species" are unknown. Certainly the differences in shape of the colony are of no importance to distinguish between the species, and the development of the spines flanking the hydranths, though of limited variability in each colony, is different in every specimen so far examined.

S. minima has previously been recorded from Wassin, south of Mombassa, Kenya, East Africa (Hickson, 1903) and Mahé, Seychelles (Millard & Bouillon, 1973).

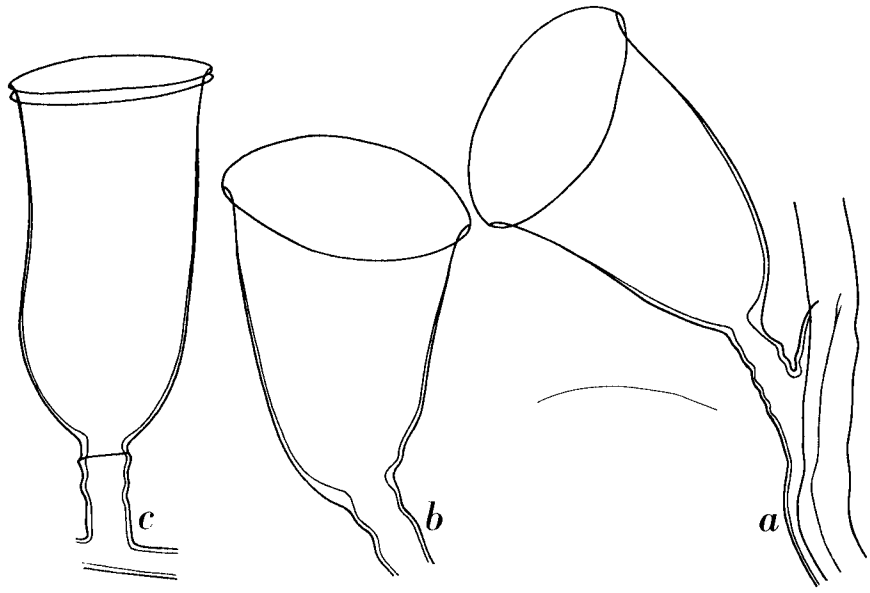

Fig. 3. *Hebella parasitica* (Ciamician), Moorea, no. 40A. a, b, hydrothecae rising from stolon creeping on *Halopteris constricta* Totton; c, hydrotheca from stolon on *Sertularella robusta.* a, b, × 70; c, × 90.

Hebella parasitica (Ciamician, 1880) (fig. 3)

Lafoea parasitica Ciamician, 1880: 673, fig. 39.

Hebella parasitica — Marktanner-Turneretscher, 1890: 213; Stechow, 1913: 103, figs. 75-78; Stechow, 1919: 76; Stechow, 1923: 9; Leloup, 1934a: 8; Leloup, 1937a: 4, 28; Leloup, 1938: 8, fig. 5; Da Cunha, 1950: 124; Rossi, 1950: 25, fig. 12b; Dawydoff, 1952: 55; Yamada, 1958: 51, 55; Yamada, 1959: 45.

Localities. — Moorea, no. 36. Two hydrothecae from a stolon creeping on *Sertularella robusta* Coughtrey. No gonothecae.

Moorea, no. 40A. Three hydrothecae from a stolon creeping on stems of *Halopteris constricta* Totton.

Description. — The present specimens show no trace of parasitism; the stolon is a rounded or slightly flattened tube creeping on the external surface of stems of *Sertularella robusta* and *Halopteris constricta.* The hydrothecae (fig. 3a-c) arise at irregular intervals and are shortly stalked: the pedicels have wrinkled periderm without distinct spiral torsion. In some cases there is an abrupt peridermal constriction of the pedicel, suggesting that a hydrotheca has been broken off and a new one regenerated. Hydrothecae large, campanulate, distinctly asymmetrical at the basal portion, which is generally rounded and provided with an internal peridermal thickening to which the hydranth is attached. No diaphragm could be observed. The hydrothecae gradually widen towards the aperture, which is circular, usually slightly irregular and always distinctly everted. The periderm on the hydrotheca and the pedicel is firm and yellowish; from the peridermal thickening onwards it rapidly thins out, so that the hydrothecae are easily collapsible. The hydrothecae on *S. robusta* are remarkably larger, being more or less cylindrical, much longer and with renovated margins (fig. 3c).

The hydranths are well preserved and have 14 tentacles; they are, however, completely retracted.

Measurements of hydrotheca (in microns). — Total length, 945-1,055 (Moorea, no. 36), 550-620 (Moorea, no. 40A), diameter at aperture, 540-675 (Moorea, no. 36), 430-485 (Moorea, no. 40A).

Ecology. — This epibiotic species, judged by the very small number of hydrothecae observed, seems to be of very infrequent occurrence and has only been found at the Tiahura barrier reef. It occurred on *Sertularella robusta* sampled under an overhanging wall of the spur-and-groove zone at 15 m depth, and on *Halopteris constricta,* present at 1 m depth in cavities between scattered coral growth of the reef flat.

Remarks. — There is little to distinguish this species from *Hebella furax* Millard, 1957; the occasional parasitic occurrence of that species can scarcely suffice to keep both forms separated, the more so since Millard observed that the epizoic mode of life in *H. furax* is far more common than the parasitic.

We should prefer, nevertheless, to base synonymy on the inspection of more material, particularly since the gonothecae of *H. parasitica* appear to be unknown.

H. parasitica is widely distributed in tropical and subtropical parts of both Pacific and Atlantic Oceans, being recorded from Japan (Stechow, 1913, 1923), Indochina (Dawydoff, 1952), the Mediterranean (Rossi, 1950), the Atlantic coast of Portugal (Da Cunha, 1950), etc.

Hebella scandens (Bale, 1888) var. **contorta** Marktanner-Turneretscher, 1890, (figs. 4, 12a)

Hebella contorta Marktanner-Turneretscher, 1890: 215, pl. 3 fig. 17.
? *Hebellopsis contorta* — Stechow & Müller, 1923: 464, pl. 27 fig. 5.
Hebella spiralis Nutting, 1927: 208, pl. 40 figs. 4-6.
Hebella scandens var. *contorta* — Leloup 1937a: 4, 26, fig. 17; Vervoort, 1946a: 305; Vervoort, 1959: 239, fig. 14; Gravier, 1970: 116.

Locality. — Moorea, no. 19. Some hydrothecae rising from stolon creeping on *Synthecium samauense* Billard. No gonothecae.

Description. — The hydrothecae arise from a stolon creeping on axis and side-branches of several colonies of *Synthecium samauense*. The hydrothecae are cylindrical, with distinct distortion of part of the wall at about half the hydrothecal length. The degree of distortion is subject to some variation, moreover, its visibility depends upon the angle at which the hydrotheca is inspected. The exact nature of the distortion, resulting from a slight proliferation of part of the hydrothecal wall, can best be judged from fig. 4c, d. The hydrothecal aperture is circular, slightly but distinctly everted and with 2 or 3 renovations. With the exception of the proliferation the hydrothecal wall is smooth or slightly undulated. The basal part of the hydrotheca is smoothly rounded and narrowed into a short, straight pedicel. Internally the hydrotheca bears a ring-shaped peridermal thickening near the attachment of the pedicel, and a very thin diaphragm. Periderm of stolon and hydrotheca is firm, though not particularly thick, gradually thinning distally along the hydrothecal wall.

No gonothecae have been observed.

Ecology. — A few hydrothecae of this species have been observed on a specimen of *Synthecium samauense* taken from a coral-block from the buttress-and-valley zone of the Tiahura barrier reef, between 9 and 10 m depth.

Remarks. — We have provisionally retained this variety, though in some cases nearly "normal" hydrothecae have been observed to occur between the

distorted hydrothecae; "normal" colonies without a single distorted hydrotheca have also been observed. The area of geographical distribution of this variety includes tropical and subtropical parts of the Atlantic and Pacific Oceans; it is apparently well distributed in the waters of the Malay Archipelago (Nutting, 1927, as *Hebella spiralis*; Leloup, 1937a; Vervoort, 1946a).

Measurements of hydrotheca (in microns). — Total length, 445-475; length primary hydrotheca, 390-460; diameter at aperture, 150-160; maximal diameter, 135-160; length pedicel, 40-95; diameter of pedicel, 60-80.

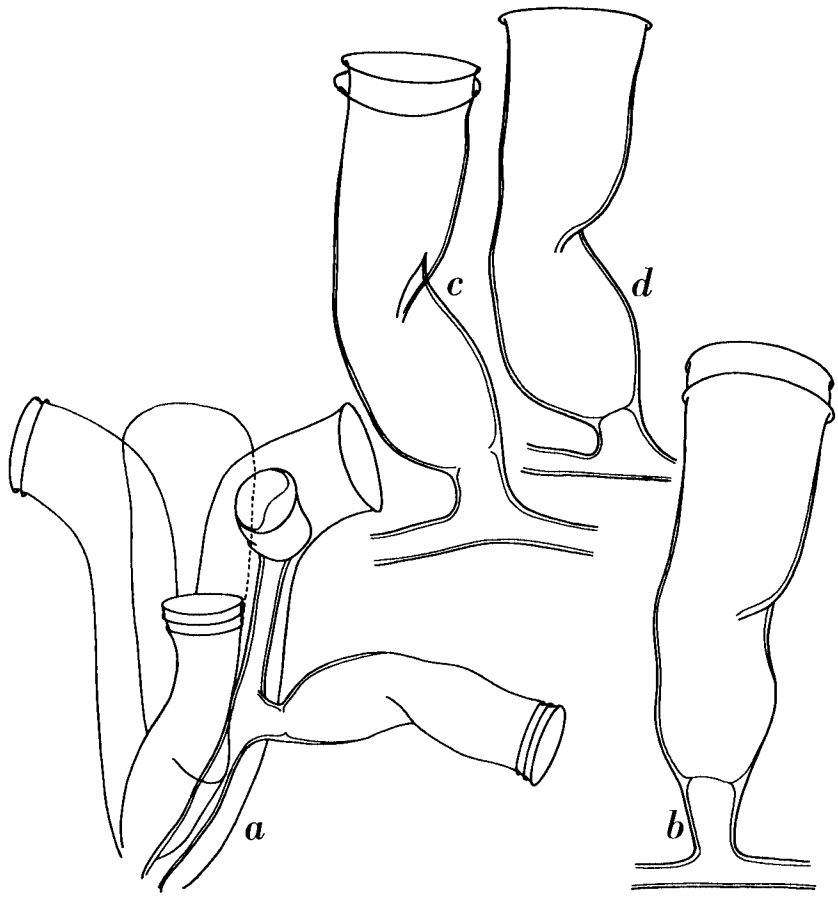

Fig. 4. *Hebella scandens* (Bale) var. *contorta* Marktanner-Turneretscher, Moorea, no. 19. a, fragment of stolon with three hydrothecae; b, c, d, individual hydrothecae. All creeping on *Synthecium samauense* Billard. a, × 70; b-d, × 90.

Lictorella rufa (Bale, 1884) (figs. 5-8, 9b)

Campanularia rufa Bale, 1884: 54, pl. 1 fig. 1; Bale, 1887: 91; Levinsen, 1913: 292.
Zygophylax rufa — Bale, 1914: 90; Rees & Thursfield, 1965: 79.

Localities. — Takapoto, no. 53. Ten young, up to 20 mm high, strictly pinnate colonies and many fragments. No gonothecae.

Takapoto, no. 63. One 25 mm high colony with coppinia; some smaller colonies and many fragments.

Takapoto, no. 67. Five, up to 20 mm high colonies and various fragments. No gonothecae.

Takapoto, no. 69. Three colonies, up to 20 mm high and a number of fragments. No gonothecae.

Description. — Erect, strictly pinnate colonies (fig. 5a) rising from a flattened mass of hydrorhizal fibres. The stem is distinctly discernible throughout the colony, straight in the lower parts of the colony, slightly geniculate between the branches in the higher parts. Stem polysiphonic basally because of the presence of secondary tubes; these are not visible on the branches.

Side-branches strictly pinnately arranged along two opposite sides of the stem, alternate, usually with two hydrothecae (one on each side) between two successive branches (fig. 6). Occasionally there are three or four hydrothecae between two successive branches, or the number is reduced to one. The branches have about the same diameter as the stem from which they spring and are not placed on well defined apophyses; each branch has an axillary hydrotheca.

Hydrothecae alternately arranged along stem and branches, leaving the stem or branch at an angle of about 80°. They are deeply tumbler-shaped, somewhat asymmetrical, slightly variable in size, usually with a distinct curvature of the basal part of the adcauline wall and an almost straight abcauline wall (fig. 7a-c). This abcauline wall, in a number of hydrothecae, has a scarcely perceptible swelling at the base or at about half its length. The hydrothecal margin is circular, slightly but distinctly everted and perpendicular to the length axis of the hydrotheca. Many hydrothecae have renovated margins, the number of renovations being two or three. The hydrothecae are placed on a short, massive pedicel, separated from the hydrotheca proper by a strong, peridermal diaphragma, over which a thin membrane is stretched. This diaphragma is considered here as forming the demarkation between pedicel and hydrotheca. Normally the pedicels spring from the stem or branch without noticeable apophysis (fig. 7a-c), but this condition changes when a complete hydrotheca is renovated (fig. 8a-c).

Nematothecae sparingly present, usually on the branches near the insertion

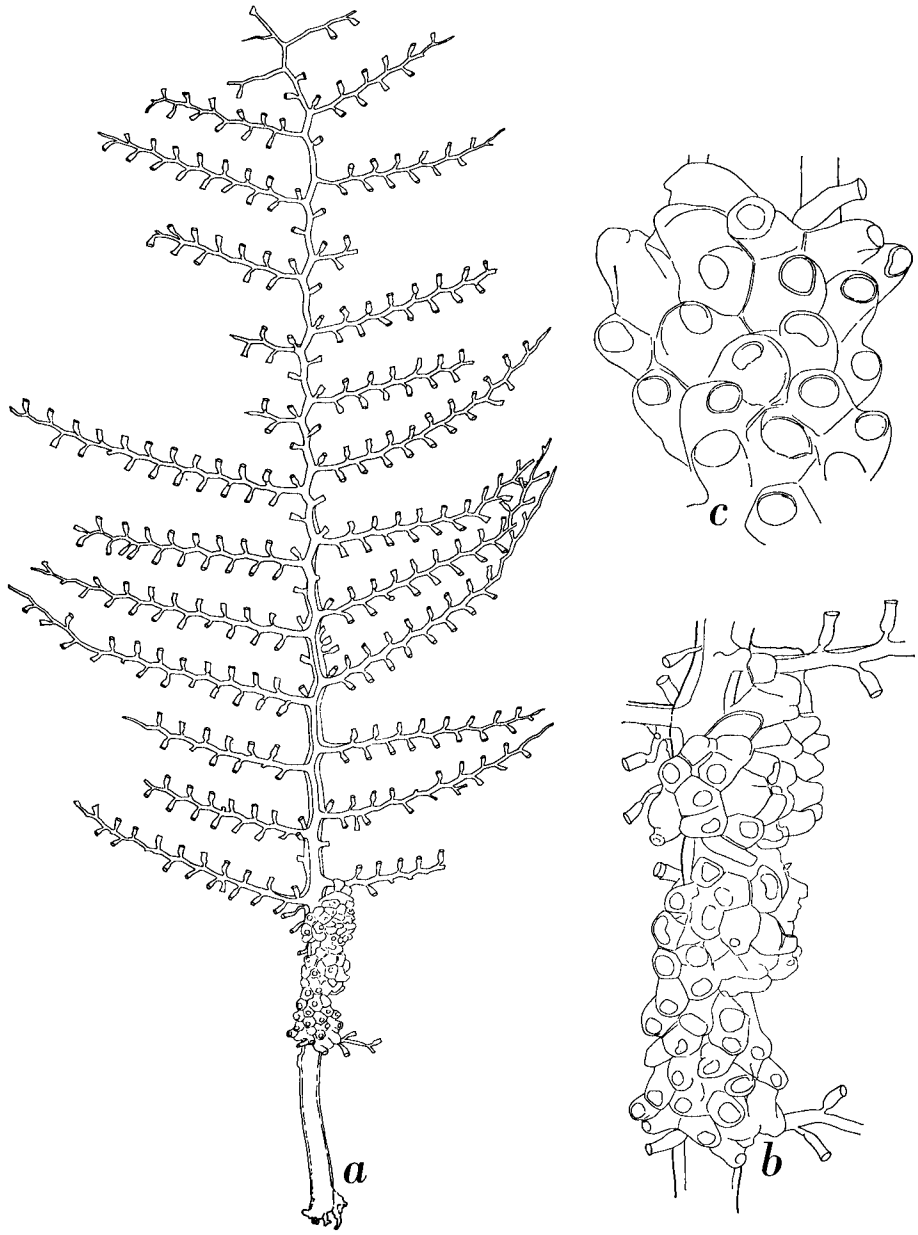

Fig. 5. *Lictorella rufa* (Bale), Takapoto, no. 63. a, complete colony with coppinia; b, coppinia; c, detail of upper part of coppinia. a, × 6½; b, × 25; c, × 50.

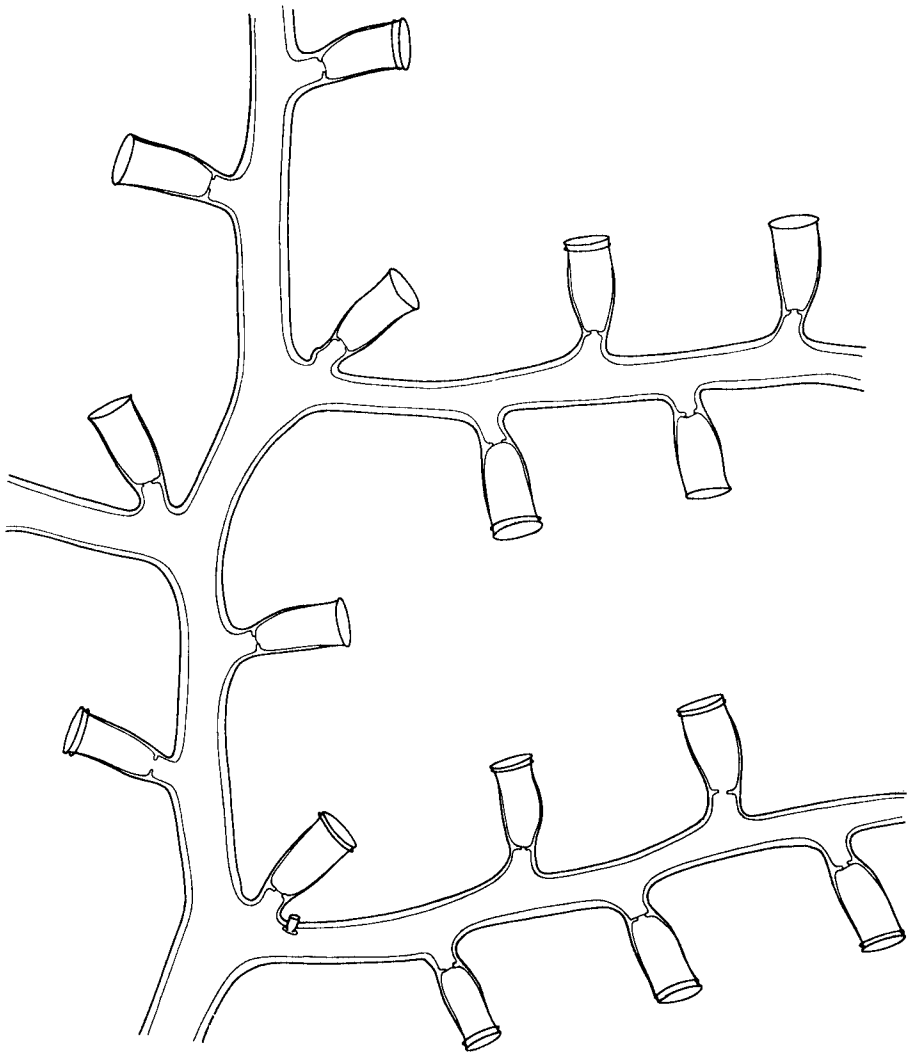

Fig. 6. *Lictorella rufa* (Bale), Takapoto, no. 67, top part of a colony. × 40.

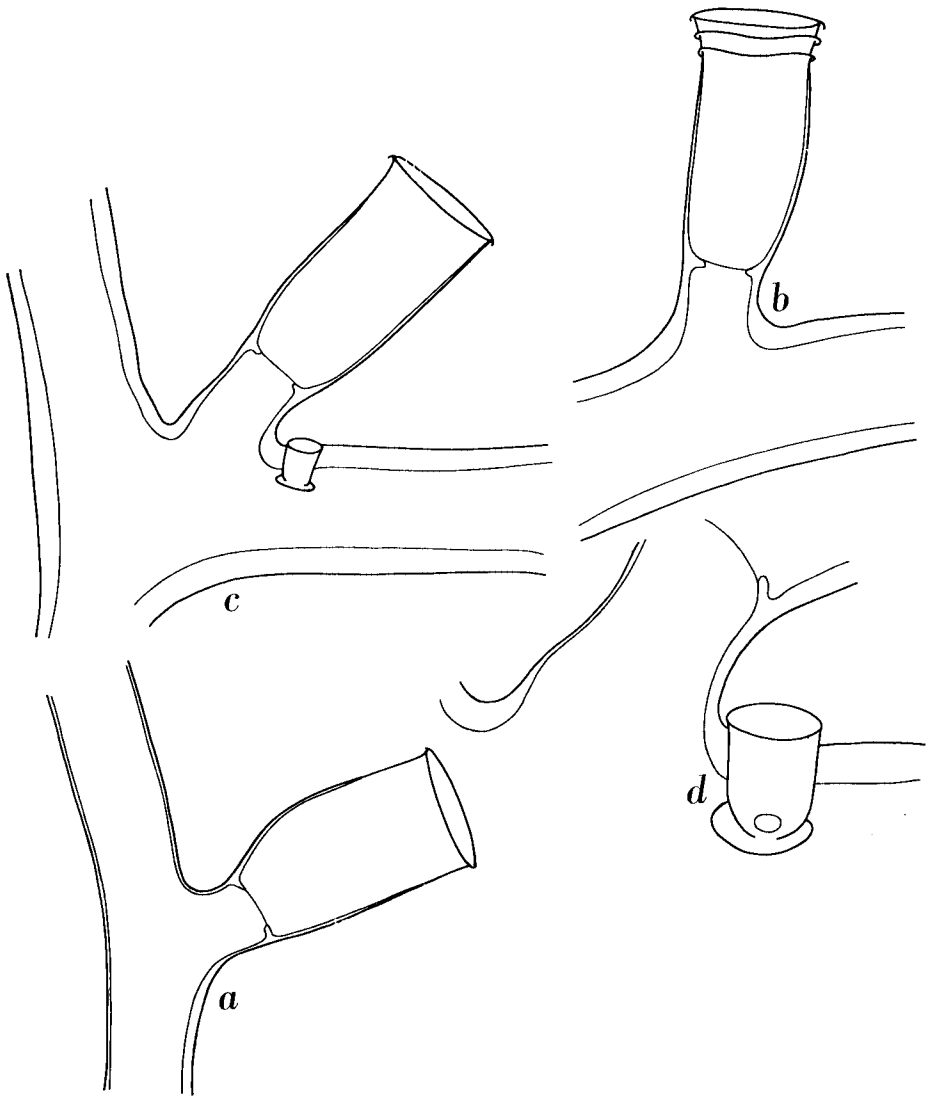

Fig. 7. *Lictorella rufa* (Bale), Takapoto, no. 67. a, b, hydrothecae from side-branches; c, axillary hydrotheca with nematotheca; d, nematotheca. a-c, × 115; d, × 300.

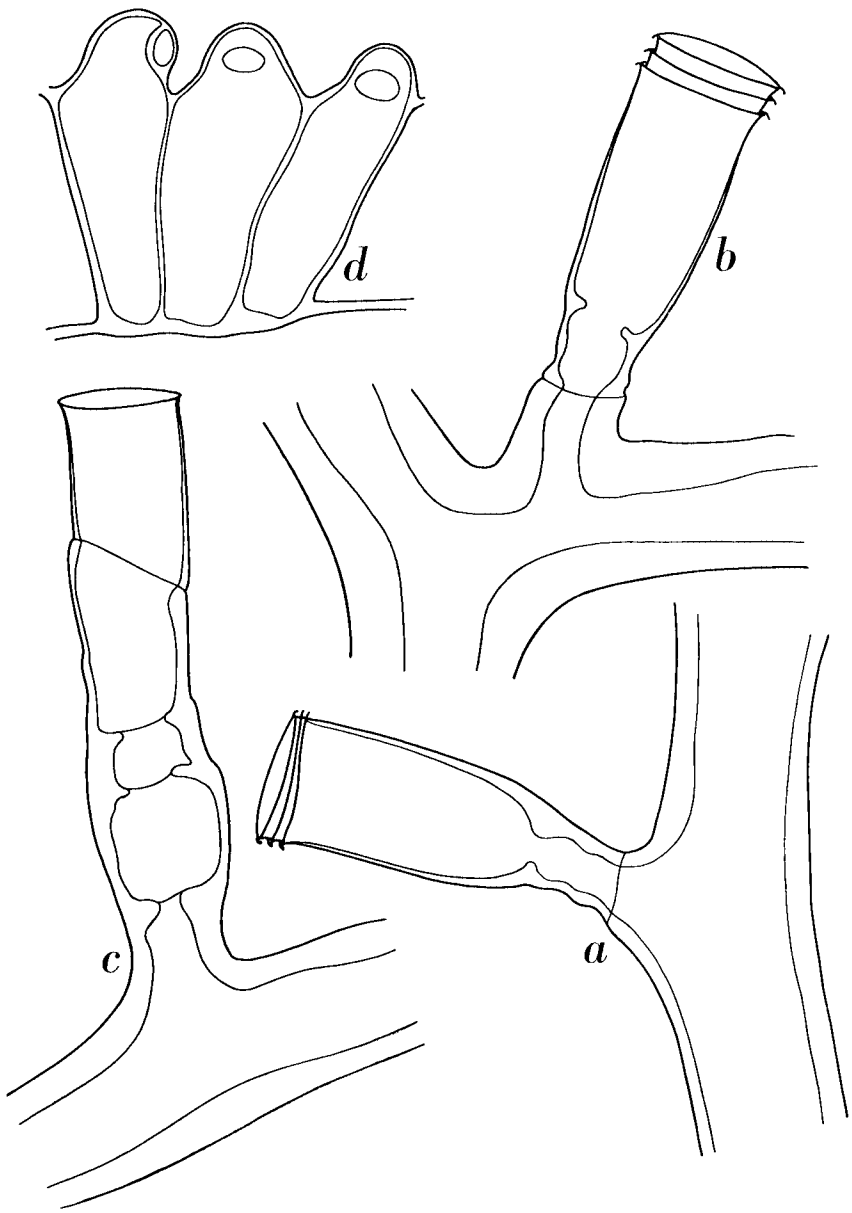

Fig. 8. *Lictorella rufa* (Bale), Takapoto, no. 63. a, regenerated hydrotheca from side-branch; b, regenerated axillary hydrotheca; c, repeatedly regenerated hydrotheca; d, female (?) gonothecae from basal part of coppinia. a-c, × 140; d, × 45.

of the axillary hydrotheca, of almost cylindrical, tumbler-shaped appearance, their place of attachment marked by a circular depression of the periderm (fig. 7d).

Periderm very firm on the whole colony, of a very characteristic, bright red colour, thinner on the hydrothecal pedicel and gradually thinning along the hydrothecal wall. The periderm gives the colonies a very distinct, brick-red colour, gradually fading along the branches; the hydrothecae, with much thinner periderm, are pinkish.

Many of the hydrothecae have hydranths, but these are so strongly contracted that the number of tentacles could not be counted.

The regenerative properties of the vegetative parts of this species are remarkable. The large number of hydrothecae with renovated margins shows that regeneration of the hydrothecal margin happens frequently. Some colonies show damaged hydrothecae, that have repeatedly been regenerated, resulting in tubular structures with several diaphragms (fig. 8c). Complete regeneration of hydrothecae after rupture of the pedicel is also frequently observed and in such cases the remnant of the primary pedicel acts as an apophysis (fig. 8a, b). The regenerated hydrotheca may have a pedicel with almost identical diameter, in which case the place of rupture is marked by a distinct line, or a much slenderer pedicel may spring from a distinct apophysis, separated from the pedicel by a distinct line, at which the diameter of the pedicel diminishes suddenly.

One larger (25 mm high) colony from Takapoto (no. 63) is remarkable because of the presence of the hitherto unknown coppinia. The coppinia is found at the basal part of the stem, where it is still polysiphonic, and consists of two masses of gonothecae, arranged one above the other around the stem, each mass composed of a large number of closely adpressed, flask-shaped bodies, each representing a gonophore with its gonotheca (fig. 5a-c). The various gonothecae have fused and cannot be isolated without damaging the coppinia. Each is a cylindrical body, hexagonal in cross section, slightly widening from the base onwards and near the apex narrowing fairly suddenly into a rounded "hood" with oval- to slit-like, lateral opening (figs. 5c, 8d). The periderm of the gonotheca is quite firm and reddish. We could not determine the sex of the gonothecae, but as far as we could see the upper part of the coppinia contains the male, the basal part the female gonothecae, which would point towards the species being monoecious. As the majority of the female gonothecae is empty the species is possibly protogynous. We could not accurately measure the length of the gonothecae, that are between 0.75 and 1 mm long.

Measurements (in microns). — Material from Takapoto (no. 67). Dia-

meter of stem at base, 270-300; hydrotheca, length diaphragma-rim, 255-295; idem, diameter at rim, 120-135; idem, diameter at diaphragm, 75-80; pedicel, length, 160-205; idem, diameter, 65-80; nematotheca, length, 60-75; idem, diameter at rim, 35-40.

Ecology. — *Lictorella rufa* is a very abundant species on the outer slope of Takapoto Atoll, occurring between 7 and 25 m depth. It is mainly found in dark cavities of the sloping reef platform at 15 to 20 m depth, between Otikaea and Vairua, together with such hydroids as *Synthecium dentigerum, Sertularella robusta* and *Solanderia minima,* as well as various sponges, sessile foraminiferans, bryozoans, hydrocorals and ascidians.

This species also occurs under overhanging slopes and in cavities of the spur-and-groove zone of Fakatopatere Reef, between 7 and 10 m depth. The associated fauna there shows a great abundance of hydroids (*Halopteris buskii, Antennella secundaria, Synthecium dentigerum, Plumularia strobilophora, Sertularia ligulata* and *Sertularella robusta*), stylasterids and silicocalcareous sponges (*Astrosclera willeyana*).

Remarks. — In referring the present species to the genus *Lictorella* Allman, 1888, we have followed Totton's definition of the genera *Zygophylax* Quelch, 1885, and *Lictorella* Allman, 1888. We have not accepted Stechow's point of view and expressed in several of his publications (e.g., Stechow, 1923: 137) that the presence of absence of nematothecae determines whether or not a species ought to be referred to *Zygophylax* or *Lictorella.* It seems quite clear now that in this particular instance the presence or absence of nematothecae cannot be considered conclusive taxonomic evidence for distinction between the two genera. If *Zygophylax* and *Lictorella* should be separated, and it seems convenient to do so for the species in which the gonosome is known, the differences in gonosome as enumerated by Totton (1930: 165, 166) should be used.

According to Totton's definition the coppinial mass in species of *Zygophylax* consists of (usually conjointed) gonothecae with a varying number of tubular openings, provided with flaring mouths. Usually, but apparently not exclusively, nematotheca-bearing ramules are present between and around the gonothecae.

In *Lictorella* the coppiniae are composed exclusively of conjoined gonothecae with one or more hooded apertures of highly characteristic appearance.

According to the above listed characters the specimens described above clearly belong in *Lictorella* Allman, 1888, of which genus *Lictorella halecioides* Allman, 1888 = *Sertularia antipathes* Lamarck, 1816 (non *L. halecioides* Allman, 1874 = *Lictorella pinnata* G. O. Sars, 1874) is the type.

In referring this species to *Lictorella rufa* and not to *Lictorella antipathes*

we take the point of view that the two species are not identical, such in contradistinction to the opinion expressed e.g., by Watson (1973: 164).

Lictorella rufa Bale, 1884, was originally described by Bale from Holborn Islands (apparently Holborne Island, a small Barrier Reef Island off the Queensland coast) and subsequently (Bale, 1914; 90) referred to *Zygophylax*. Though the species was generally considered to be identical with *Lictorella antipathes* (cf. Ritchie, 1911: 821-823) it was recognized as a separate species by Totton (1930: 165), a point of view also accepted by Rees & Thursfield (1965: 79). Watson (1973: 165), after the inspection of South Australian material of *Zygophylax antipathes* and re-inspection of some of Bale's slides of *Zygophylax rufa* in the National Museum of Victoria, Melbourne, reached the conclusion that the two species are identical.

Inspection of the present material and of some of Bale's slides in the British Museum (Natural History) London (slide no. 1964.8.7.48, *Zygophylax rufa*, Torres Strait) has, however, convinced us that the two species, though related, are distinct. As in the slides studied by Watson, Bale's material seems to have been taken from a much regenerated colony; the majority of the hydrothecae, being placed on distinct apophyses (the remnants of primary pedicels), have a fairly slender pedicel, separated from the hydrotheca by means of a distinct, ring-shaped diaphragm (fig. 9b). The general shape of the hydrothecae, as well as their size, closely agrees with the present (Takapoto) material; there are one or two renovated hydrothecal margins per hydrotheca. Exceptionally complete branches seem to have been regenerated, in which case the side-branch seems to originate from an apophysis and a septum seems to be present. The development of the periderm is similar to that observed in the Takapoto specimens.

Lictorella antipathes (Lamarck, 1816) appears to be a generally larger species, the colonies reaching a considerably height (12 cm in Watson's specimens), with the branches given off randomly around the main stem. The hydrothecae are arranged alternately as in *L. rufa*, but are generally larger and wider (fig. 9a). The colour of the periderm is variable but generally brownish, varying from bright brown to blackish brown.

Lictorella rufa has strictly pinnate colonies with alternately arranged branches, placed in one plane, with smaller hydrothecae with a narrower rim. The colonies are generally smaller, being reproductive at a height of about 25 mm. The periderm is bright red and gives the colonies a distinguishing, brick-red colour.

L. rufa so far has been recorded from Holborne Island, off the coast of Queensland, depth 20 fms, and from Torres Strait (Rees & Thursfield, 1965). *L. antipathes* has a wider distribution in the Pacific and has been recorded from greater depths.

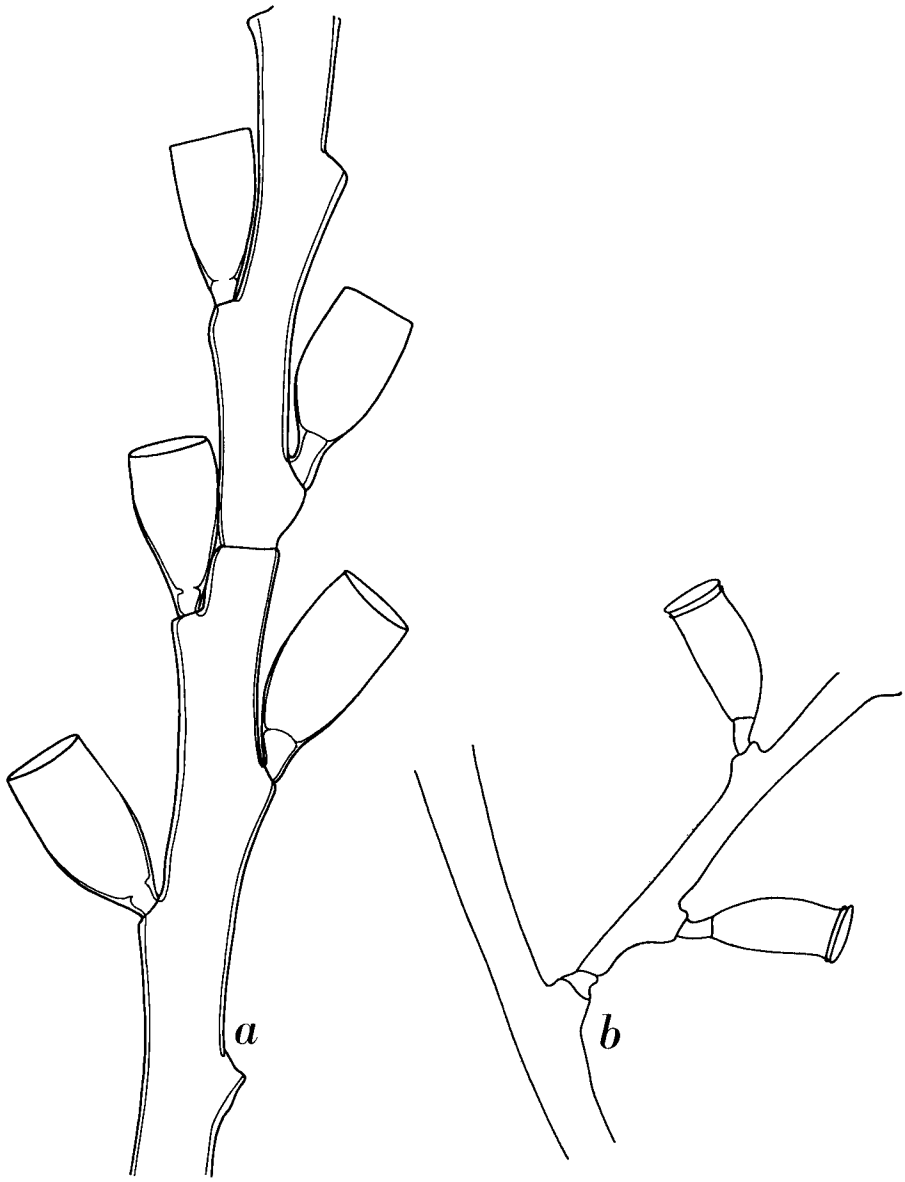

Fig. 9. a, *Lictorella antipathes* Lamarck, Challenger Expedition, off Somerset, Cape York, Torres strait, 8-12 fms., British Museum (Natural History), no. 88.11.18.23 (as *L. halecioides* Allman), side-branch with hydrothecae; b, *Lictorella rufa* (Bale), Torres Strait, British Museum (Natural History, no. 1964.8.7.48, as *Zygophylax rufa* Bale), branch with regenerated hydrothecae. a, × 80; b, × 65.

Synthecium samauense Billard, 1924 (figs. 10-13)

Synthecium samauense Billard, 1924: 464, fig. 1a, b; Billard, 1925: 16, fig. 7, pl. 7 figs. 3; Redier, 1966: 82.

Localities. — Moorea, no. 1. Eight up to 12 mm high, pinnately branched colonies, partly rising from creeping stolon. No gonothecae.

Moorea, no. 5. Numerous up to 18 mm high, pinnately branched colonies from a stolon creeping on coral fragments. Several colonies with female gonothecae.

Moorea, no. 6. Numerous up to 20 mm high, pinnately branched colonies, rising from a stolon creeping on coral blocks. Some colonies bear immature, male gonothecae. Some stems with *Hebella scandens* var. *contorta* Marktanner-Turneretscher.

Moorea, no. 13. One colony of 20 mm height and some fragments; colony pinnately built. Mature and empty female gonothecae are present.

Moorea, no. 14. Numerous up to 25 mm high, pinnate colonies, rising from stolon creeping on coral fragments. Many colonies with mature and empty male gonothecae.

Moorea, no. 19. Several about 10 mm high, pinnate colonies, rising from stolon creeping on coral debris, and several fragments. Some stems with *Hebella scandens* var. *contorta* Marktanner-Turneretscher. Three female gonothecae are present, one of which is empty. The remaining two gonothecae not completely mature (no lid visible).

Moorea, no. 23. Nine up to 12 mm high, pinnate colonies, partly rising from a stolon creeping on coral fragments. Empty and apparently mature female gonothecae are present.

Moorea, no. 24. About 10 basal parts and several fragments of colonies, partly rising from stolon creeping on coral fragments. Maximal height 12 mm. No gonothecae.

Moorea, no. 28. Five up to 10 mm high colonies and some fragments, the colonies rising from a creeping stolon, free from substratum. No gonothecae.

Moorea, no. 30. Five up to 88 mm high colonies and several fragments; the stems rise from a creeping stolon. No gonothecae.

Moorea, no. 33. A very large number of up to 15 mm high, pinnate colonies, branches up to 10 mm long, all rising from a stolon creeping on coral fragments. Some quite young colonies are present. No gonothecae.

Description. — Colonies rising straight from a creeping hydrorhiza. Hydrorhiza an occasionally slightly flattened tube with thick, yellowish periderm, from which the hydrocauli rise at right angles. Hydrocauli straight, not broken up into internodes, though the appearance of nodes is brought about at the main stem and the branches by renovation of broken parts. The branches are pinnately arranged along the axis and strictly opposite; they leave the axis at an almost straight angle (fig. 10a). The greatest length of hydrocaulus observed is 20 mm; the greatest length of the branches about 10 mm. The branches invariably occur between a pair of widely separated, axial hydrothecae. The periderm on the hydrocaulus is very firm and notably thinner on the branches. Some of the branches at times continue as a hydrorhiza-like tube, from which a new colony may emerge. The hydrothecae are best described as tubular, with curved apical portion; they are invariably arranged in pairs. The hydrothecae are deeply imbedded into the stem or branch (cf. figs. 10b, 11b) and free for about one-third of their length. The

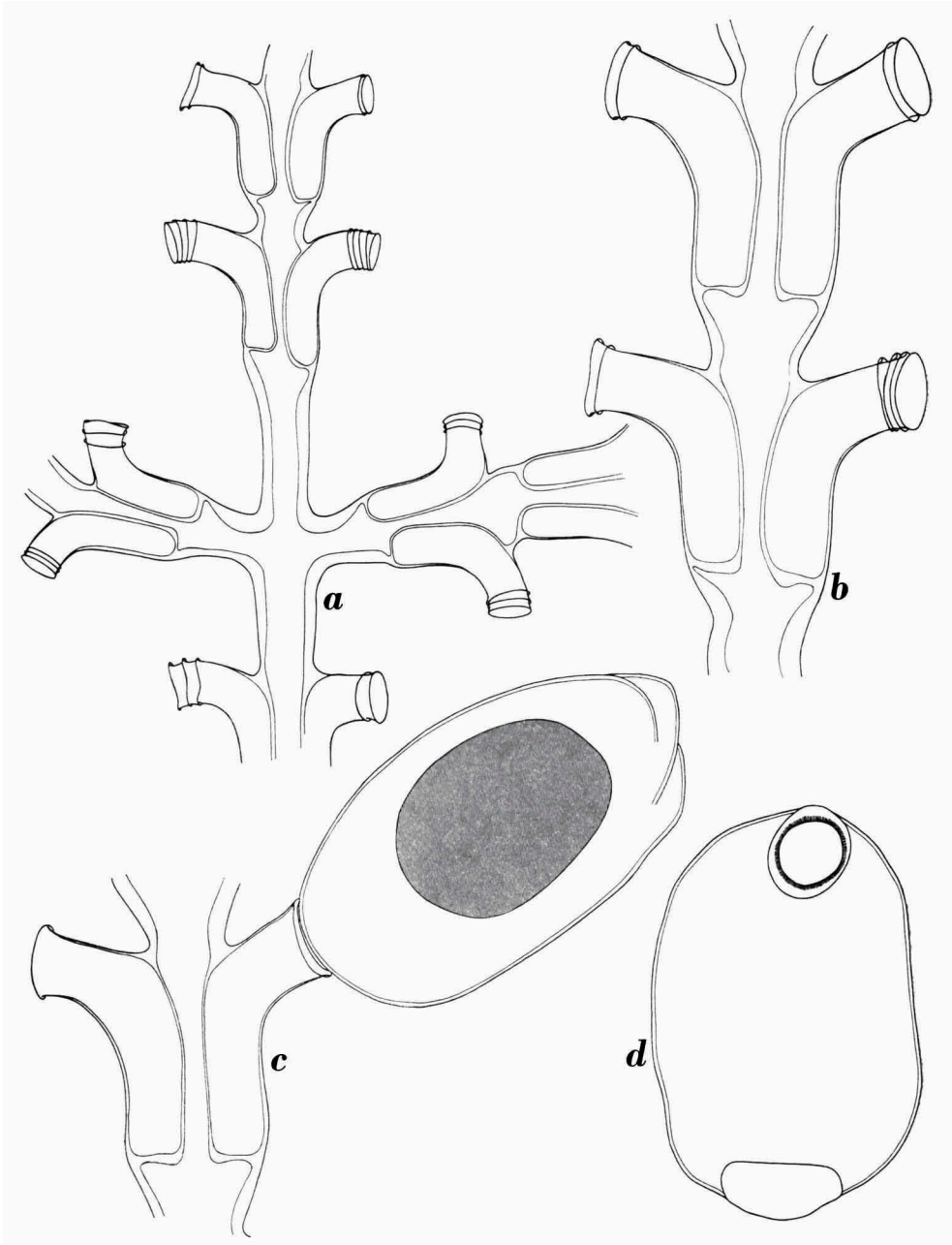

Fig. 10. *Synthecium samauense* Billard, Moorea, no. 19. a, stem with side-branches; b, two pairs of hydrothecae from side-branch; c, female gonotheca, lateral view; d, female gonotheca, frontal view. a, × 30; b-d, × 55.

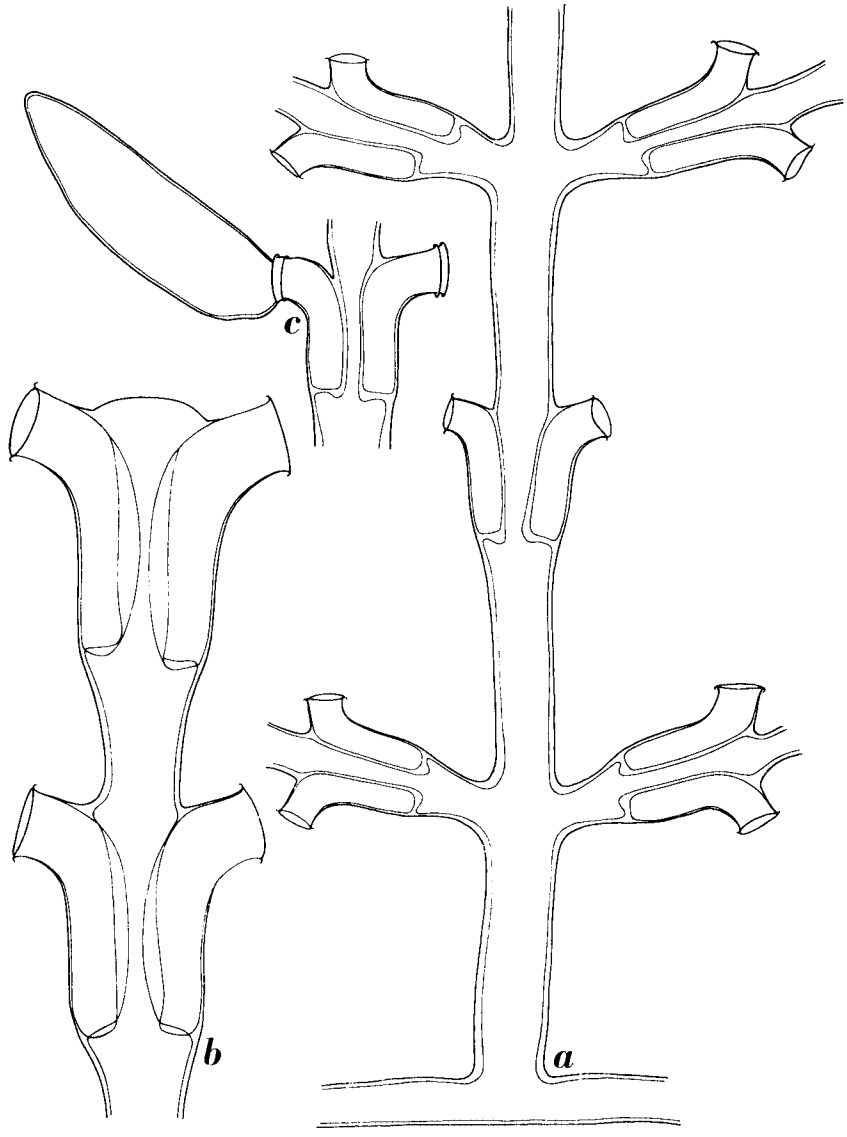

Fig. 11. *Synthecium samauense* Billard. a, young colony, Moorea, no. 33, stem with side-branches; b, idem, two pairs of hydrothecae from side-branch; c, pair of hydrothecae with young male gonotheca, Moorea, no. 6. a, c, × 30; b, 55.

fused part of the hydrothecae is parallel to the length axis of stem or branch; the free part curves away from the axis to leave the stem or branch at a sharp angle of about 60°. The periderm in the axil is thickened. The free part of the hydrotheca has about the same diameter as the fused part; the margin is slightly though quite distinctly everted and the thecal aperture is circular. Repeated renovations of the hydrothecal aperture may occur, especially in

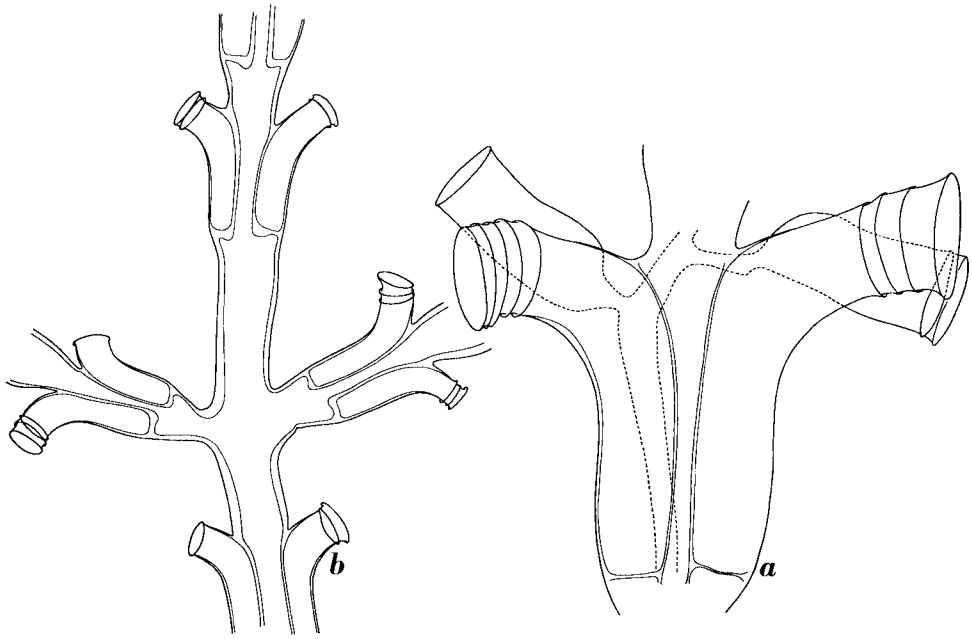

Fig. 12. *Synthecium samauense* Billard. a, pair of hydrothecae with stolon of *Hebella scandens* (Bale) var. *contorta* Marktanner-Turneretscher, Moorea, no. 19; b, schizosyntype, male colony, Siboga Expedition, Sta. 60, part of stem with two side-branches. a, × 70; b, × 25.

such colonies that are covered with *Hebella scandens* var. *contorta* Marktanner-Turneretscher (fig. 12a). The hydrothecae of a pair are strictly opposite, with the exception of the first pair of a branch; here the basally directed hydrotheca is slightly displaced in apical direction. Some of the colonies contain a large hydranth inside the hydrotheca; the number of tentacles could not be ascertained. The hydrothecal bottom is flat; the periderm is thickened on the axial side. There is a small hole through which the hydranth communicates with the perisarc.

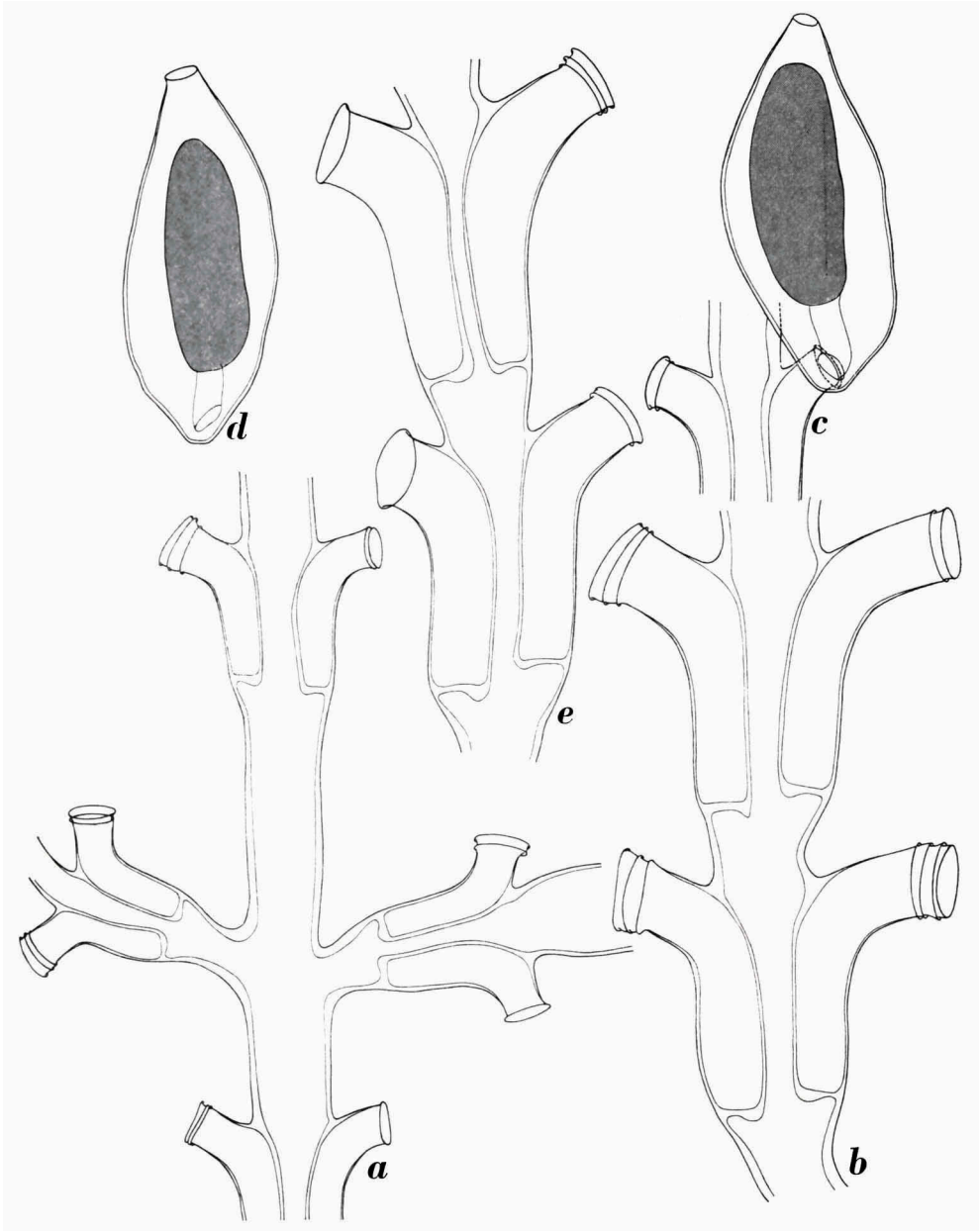

Fig. 13. *Synthecium samauense* Billard, schizosyntypes, Siboga Expedition, Sta. 60. a, part of female colony, stem with two side-branches; b, side-branch from female colony; c, pair of hydrothecae with male gonotheca; d, male gonotheca, lateral view; e, branch from male colony. a, c, d, × 30; b, e, × 55.

Female and male gonothecae occur on separate colonies and invariably are found to insert from a hydrotheca, either axial of branchial, usually, though not necessarily, in pairs.

The female gonothecae are lenticular bodies, the plane of depressions being perpendicular to that of the colony. Seen from aside they represent oval bodies, at the apex with three weakly developed folds, containing a large egg (fig. 10c). Some colonies have empty gonothecae; here the folds are no longer present, but there is a large, lateral but almost apical, circular opening with a smooth collar (fig. 10d).

The male gonothecae are larger and more elongated in longitudinal direction. In lateral view they appear as oval bodies, with wrinkled walls and the apical portion drawn out into a short conical funnel, opening with a circular hole (fig. 13c, d). As in the female gonothecae they are depressed in a plane perpendicular to that of the colony. They contain a large mass of developing spermatocytes. Some of the colonies have immature gonothecae, that, though exhibiting the same overall structure, are slightly more depressed and rounded at the apex, without a trace of funnel or opening (fig. 11c).

Ecology. — *Synthecium samauense* is the most common species of hydroid on the outer slope of the Tiahura barrier reef, between 1.5 and 20 m depth. Its maximal abundance is observed in the upper parts of the outer slope, at

Measurements (in microns). —

	Siboga Sta. 60 ♀ schizosyntype	Siboga Sta. 60 ♂ schizosyntype	Moorea, no. 6	Moorea, no. 19	Moorea, no. 33 (young colony)
Hydrotheca, length fused part adcauline wall	485-525	515-610	445-485	460-485	460-485
idem, length free part adcauline wall	190-340	230-255	230-245	270-380	120-135
idem, diameter at orifice	175-205	150-205	175-205	175-190	160-175
idem, diameter of pair across internode	320-325	325-390	340-350	320-325	340-350
Distance between successive pairs (hydrothecal base-free adcauline wall)	310-340	190-270	190-270	160-215	350-375
Male gonotheca (young), length			890-1,015		
idem, diameter			565-650		
Male gonotheca (mature), length		675-745			
idem, diameter		1,565-1,595			
Female gonotheca (mature), length				1,295-1,300	
idem, diameter				400-410	

the level of the overhang and in cavities of the walls of the furrows of the furrowed platform between 1.5 and 3 m depth, as well as in anfractuosities of the non-furrowed platform down to a depth of about 7 m. It is less abundant on the lower part of the outer slope, in the anfractuosities of the buttress-and-valley zone and the spur-and-goove zone, a depth of about 25 m.

Remarks. — This species is quite plentiful in the Moorea collection and although is has been recorded from New Caledonia (Redier, 1966) since the original record and description from Malayan waters by Billard, we thought it wise to compare our specimens with Billard's original colonies. Through the kindness of Dr. R. W. M. van Soest, Institute for Taxonomic Zoology (Zoological Museum), University of Amsterdam, we obtained some female and male colonies from the type series collected at Siboga Station 60, reefs of Haingsisi, Samau Island, Timor, for the purpose of comparison. Only the male colonies have gonothecae. The Moorea specimens are identical in every respect with Billard's syntypes of this species, although the Siboga colonies are much larger and more profusely branched. This is also borne out by the drawnings made after the syntypes (figs. 12b, 13). We cannot confirm Billard's observations concerning the sexual dimorphism of this species. The female colonies are described as being more strongly built, with the distances between the pairs of hydrothecae much larger than in the male and with greater dimensions. These statements are also not borne out by Billard's material, nor do they find confirmation in the Moorea colonies. On the contrary, all the material in our hands, the profuse material from Moorea and the schizosyntypes from the Siboga Expedition are quite uniform in structure; the male and female colonies can only be separated if gonothecae are present. There are, in the Moorea material, a couple of finely built colonies, that are at once remarkable by the almost complete absence of thecal renovations. Such colonies undoubtedly are quite juvenile and have never been observed to bear gonothecae (figs. 11a, b). I have not seen such colonies in the Siboga material in our possession, but they may have been present and may have influenced Billard's evidently incorrect observation. Measurements of such colonies, given above, show that the young colonies, with the exception of the free hydrothecal portion, have the same measurements as the older colonies.

The length of the free hydrothecal portion, as well as the direction of the plane of its aperture, are quite variable, the first as a result of the number of renovations, the second because of the same reason and a variability also observed in the non-renovated hydrothecae of the young colonies. The plane of the hydrothecal aperture may be almost perpendicular to the axis of stem or branch, or be slightly tilted in adcauline direction.

Synthecium dentigerum Jarvis, 1922 (figs. 14, 15)

Synthecium dentigerum Jarvis, 1922: 344, pl. 25 fig. 15; Totton, 1930: 172; Millard, 1964: 24, fig. 6; Millard & Bouillon, 1973: 63; Watson, 1973: 169, figs. 17, 18.
Synthecium singulare Billard, 1924: 648, fig. 1C; Billard 1925: 134, fig. 8.

Localities. — Moorea, no. 44. Ten unbranched, up to 12 mm high stems, with several developing, female gonothecae.

Takapoto, no. 54. About 10 unbranched stems, rising from a stolon creeping on coral fragments and Bryozoa, the highest about 15 mm. Some quite young gonothecae are present.

Takapoto, no. 59. A large number of up to 10 mm high, unbranched colonies, rising from a stolon creeping on Bryozoa. No gonothecae.

Takapoto, no. 65. Some small, 8 mm high, unbranched colonies rising from a creeping stolon. No gonothecae.

Takapoto, no. 68. Several about 5 mm high, unbranched colonies rising from a stolon creeping on coral fragments. Some young gonothecae are present.

Description. — Colonies composed of unbranched stems, between 8 and 15 mm high, rising, without apophysis, from a tubular stolon creeping on coral fragments or Bryozoa. The stems are straight and thin, bearing pairs of hydrothecae that are strictly opposite and arranged in one plane. Occasionally there is a septum in the stem just above a pair of hydrothecae, but this condition is exceptional; more often there is a peridermal constriction or no indication of a node at all. The hydrothecae are tubular, fused with the stem for a considerable part of their adcauline wall, but the hydrothecae of a pair do not touch. Portion of internode between hydrothecae of a pair on front of the colony smaller than on the back. Free portion of hydrotheca smoothly curving outwards, about two-thirds the length of the fused part, but occasionally greatly lengthened by repeated renovation of the opening. The angle between internodal axis and adcauline wall is about 75°; the plane of the aperture is almost parallel with the length axis, or slightly tilted in adcauline direction. Internal corner of the hydrothecal floor marked by a distinct peridermal notch. Internally the hydrotheca has three peridermal folds or carinae, one adcauline and two abcauline (fig. 14a). That on the adcauline side is constantly present; the development of the abcauline carinae is variable; at times the abcauline folds are completely absent. The folds are only present in the primary, non-renovated part of the hydrotheca. Hydrothecal margin circular, with distinctly everted margin. In the Moorea material the number of renovations is two or three, not greatly lengthening the hydrotheca. In the Takapoto colonies many hydrothecal renovations occur (up to 20 have been noticed), greatly lengthening the free portion of the hydrotheca. The distance between the consecutive pairs of hydrothecae is generally considerable, particularly in the basal parts of the colonies, gradually decreasing

in the higher parts. In some of the Takapoto colonies, however, the pairs of hydrothecae are fairly closely packed.

Several of the colonies have developing gonothecae, but one colony (from Moorea, no. 44) has an apparently mature gonotheca (fig. 14b). It contains a large, homogeneous yellow body that we take to be an egg. This female gonotheca emerges from one of the basal hydrotheca (the other of the pair has a younger gonotheca) without any trace of a pedicel. It is a flattened, disk-shaped body, flattened in a plane perpendicular to the plane of symmetry of the colony, almost circular in outline and comparatively strongly compressed. There are four depressions on the surface of the gonothecae that give it a ribbed appearance. No terminal opening has been observed.

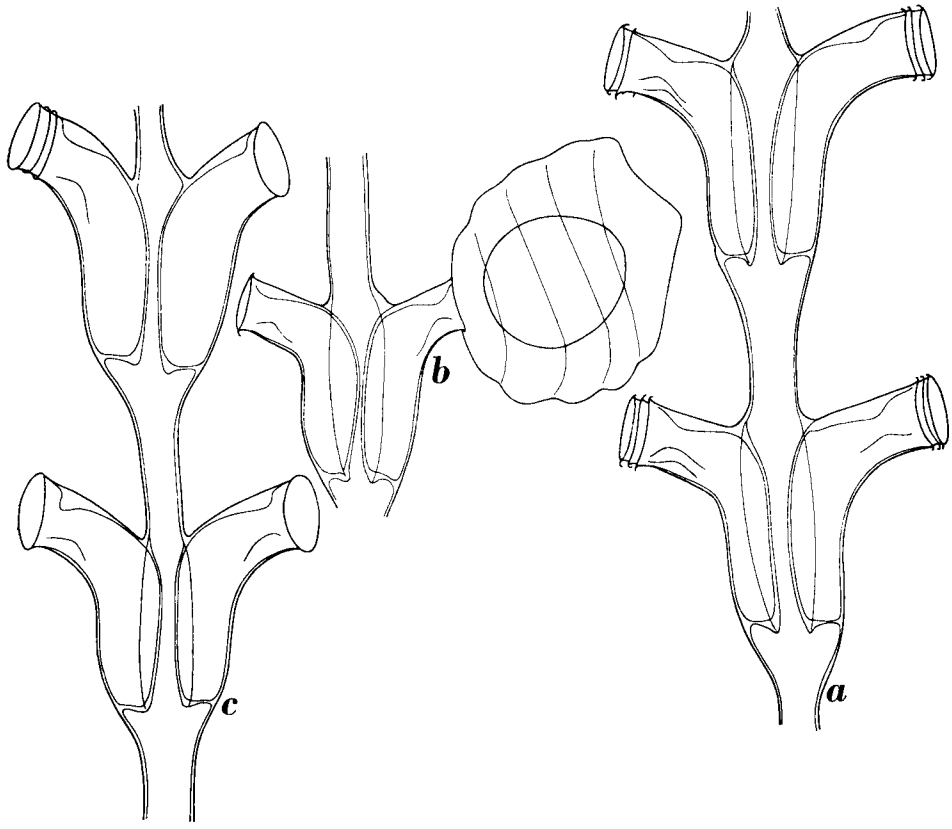

Fig. 14. *Synthecium dentigerum* Jarvis. a, part of stem, Moorea, no. 44; b, pair of hydrothecae, with young gonotheca, Moorea, no. 68; c, part of stem, Siboga Expedition, Sta. 257 (syntype of *Synthecium singulare* Billard). a-c, × 55.

Measurements (in microns). —

	Moorea, no. 44	*S. dentigerum* Jarvis (after Totton, 1930)	*S. dentigerum* Jarvis (own measurements)	*S. singulare* Billard (after Billard, 1925)	*S. singulare* Billard (own measurements)
Hydrotheca, length fused part adcauline wall	420-475	490	525-540	530-595	365-405
idem, length free part adcauline wall	190-255	250	200-415	345-445	300-340
idem, diameter at orifice	135-165	220	240-260	220-215	160-175
diameter across node	285-300		325-355		310-325
Distance between pairs	375-540		245-260	575-875	470-490
Female gonotheca, length	580				
idem, width	540				
idem, diameter	245				

Ecology. — This species is not very abundant. It occurs locally in microcavities and under small overhangs of the spur-and-groove zone at Tiahura, between 18 and 20 m depth. It is associated there with various algae, sponges, some didemnid ascidians and bryozoans. The hydroid *Thecocarpus phyteuma* occurred in the same sample .

At Takapoto Atoll *S. dentigerum* appears to be much more abundant, particularly under overhangs and in cavities of the spur-and-groove zone at Fakatopatere, between 7 and 10 m depth. The species appears to be less frequent at the sloping reef platform in the Otikaea-Vairua sector, occurring there between 15 and 20 m depth.

Remarks. — There can scarcely by any reasonable doubt that the present material is identical with *S. dentigerum* as described and figured by Jarvis (1922: 334, pl. 25 fig. 15). The shape and localisation of the adcauline, internal lamella is very characteristic; abcauline lamellae are not mentioned or figured by Jarvis and have probably been overlooked.

We have studied a schizoholotype slide of Jarvis' *S. dentigerum* in the collections of the British Museum (Natural History), placed at our disposal by Dr. P. F. S. Cornelius. This slide, nr. 32.2.151.141, contains a stained, unbranched fragment of 15 mm length, collected by J. S. Gardiner at Centurion Bank, Chagos, depth 10-12 fms. It was presented by to the B.M.N.H. by Dr. H. W. M. Tims. This fragment has 14 pairs of closely packed hydrothecae and bears no gonothecae. The hydrothecae (fig. 15a-c) are arranged in strictly opposite pairs, placed all in one plane. The hydrothecal apertures are circular and slightly everted: nearly all thecae are renovated. The adcauline internal wall has a distinct internal lamella. There are no distinct lamellae at the abcauline internal wall, though occasionally longitudinal,thickened ridges are present. Measurements of this specimen

have already been published by Totton (1930: 172); a comparison of these and some additional measurements with those of the present Pacific material shows that Jarvis' material is slightly larger.

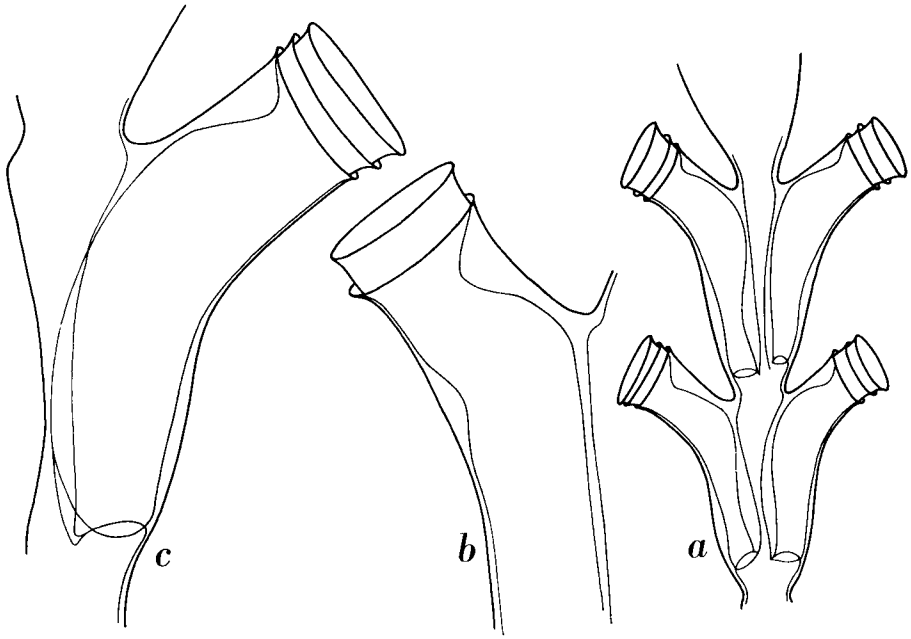

Fig. 15. *Synthecium dentigerum* Jarvis, schizoholotype, Centurion Bank, Chagos, 10-12 fms, British Museum (Natural History) no. 23.2.151.141. a, part of stem; b, c, hydrothecae. a, × 40; b, c, × 120.

S. singulare Billard, 1924, has been figured by Billard (1925, fig. 8) with an acutely pointed adcauline lamellar tooth and two internal, abcauline lamellae; the tip of the adcauline tooth points towards the aperture of the hydrotheca. We have never observed this condition in our material, but we have recently had an opportunity to check the condition of the intrathecal lamella and teeth in Billard's type of *Synthecium singulare*, kindly placed at our disposal by Dr. R. W. M. van Soest (Siboga Expedition, Sta. 257, Strait Du-Roa, Kai Islands, up to 52 m depth). This material is fairly poor, being composed of only two fragments, 6 and 10 mm high, with 5 and 10 pairs of hydrothecae, respectively. There are fragments of a stolon at the base of both specimens. We have figured some hydrothecae of the larger specimen (fig. 14c); as a comparison with the relevant figure of *S. denti-*

gerum shows, the differences are minute. The hydrothecae appear to be very slightly larger, but have the same general appearance, with the distal part of the hydrotheca pointing away from the internode at an angle of about 75°. The hydrothecal aperture is circular and slightly but distinctly everted; some of the hydrothecae are considerably renovated. The majority of the hydrothecae have an internal, adcauline lamella, that usually has the shape also observed in *S. dentigerum*, though in some specimens it may be more acutely pointed. Some hydrothecae lack the adcauline lamella altogether. Other thecae have, in addition to the adcauline lamella, a very weakly developed pair of abcauline folds or lamellae. The measurements of the syntype are consistently smaller than those listed by Billard and consequently are in better agreement with those of the Moorea material of *S. dentigerum*. We have no doubt whatever that this type material belongs to *S. dentigerum*; *S. singulare* Billard thus can definitely be sunk into the synonymy of this species. The type locality is Du-Roa Strait, Kai Islands, Malay Archipelago.

We consider *Synthecium carinatum* Totton, 1930, to be a separate species. This species, in all details, is so much smaller than *S. dentigerum* that it does not fall into the now extended pattern of variability exhibited by *S. dentigerum*. Moreover, the free portion of the hydrotheca is much shorter than in the latter species and there are no abcauline lamellae inside the hydrotheca. The female gonotheca is a large, strongly ribbed affair, quite different from that observed in *S. dentigerum*.

Totton's remark concerning size differences between both sexes in species of *Synthecium* is based on Billard's observations in *S. samauense*, which we consider to be incorrect (see page 30). They must consequently be taken with reserve.

Dynamena crisioides Lamouroux, 1824

Dynamena crisioides Lamouroux, 1824: 613, pl. 90 fig. 11; Vervoort, 1959: 260, fig. 27a, b; Mammen, 1965: 51, figs. 84, 85; Vervoort, 1968: 38, fig. 18; Millard & Bouillon, 1974: 32, fig. 6D.

Dynamena crisioides crisioides — Vervoort, 1967: 38, fig. 10; Millard & Bouillon, 1973: 68.

Localities. — Takapoto, no. 51. Ten pinnate colonies, 10-30 mm high, detached from substratum, and some fragments. No gonothecae.

Takapoto, no. 57. Five pinnate colonies, up to 10 mm high, on coral fragments and Bryozoa. No gonothecae.

Description. — The colonies agree with those described from the tropical Atlantic (Vervoort, 1968: 38, fig. 18). The stem is fairly thin and geniculated between the various apophyses, broken up into internodes, in principle

bearing a basal apophysis, an axillary hydrotheca and a subopposite pair of distal hydrothecae. The apophyses, alternately pointing left and right, support the side-branches, that are about 8 mm long and usually divided into internodes by constrictions of the periderm. Each internode bears one, two or various pairs of hydrothecae, those of the basal internodes are sub-opposite, gradually becoming opposite along the branch. The development of the nodes is quite variable; those on the stem are best visible in the higher parts, they are absent in the basal portion of the stems. On the side-branches the development of the nodes is quite unpredictable; some have regular nodes between each pair or second pair of hydrothecae, others have none. The hydrothecae are deeply sunken into the internodes, with only a fraction of the adcauline wall free. Free part of hydrotheca curving outwards. Hydrothecal margin and closing apparatus as described previously.

Ecology. — *D. crisioides* only occurs in shallow water and wave-beaten zones of Takapote Atoll. It is not particularly abundant, but was found to occur regularly in cavities of the algal ridge of Mavette Reef, together with sponges and didemnid ascidians. It occurs more abundantly on the outer slope of Nordet Reef, under overhangs of the upper part of the spur-and-groove zone at 2 m depth. Such overhangs are characterized by calcareous algae, sessile Foraminifera, hydrocorals (*Distichopora* spec. and *Stylaster* spec.) and a very abundant species of soft coral.

Remarks. — The present material belongs to the typical form of this variable species, formerly recognized as *Dynamena crisioides crisioides*. We agree with Mammen (1965) and Millard & Bouillon (1974) that the various forms of this variable species deserve no separate status. The geographical distribution of this species is very wide, covering nearly the whole of the tropical and subtropical Atlantic, Pacific and Indian Oceans.

Dynamena heterodonta (Jarvis, 1922) (figs. 16, 17)

Sertularia gracilis Billard, 1905: 334.

Pasythea heterodonta Jarvis, 1922: 344, pl. 24 figs. 11, 12.

Dynamena heterodonta — Billard, 1925: 198, fig. 44; Leloup, 1934: 13; Redier, 1966: 86.

Dynamena quadridentata f. *heterodonta* — Vannucci, 1951: 83; Vannucci, 1951a: 108, 112, 114.

Locality. — Moorea, no.40B. One unbranched stem of 12 mm height. No gonothecae.

Description. — The only colony at our disposal is 12 mm high, rising from a small fragment of stolon, that gives rise to a short internode, separated from the hydrotheca-bearing rest of the stem by means of an oblique node. The remaining part of the stem bears pairs of hydrothecae, arranged along the frontal aspect of that stem and separated by slender stem fragments, that

may occasionally show the indication of a transverse node by the presence of a peridermal constriction (fig. 16a). The distal portion of the stem, separated from the proximal part by a distinct, oblique node, bears two pairs of hydrothecae in characteristic arrangement. The hydrothecae can best be described by reference to fig. 16b; they are more or less tubular, slightly swollen adcaudally and gracefully curved laterally; the longitudinal axis of the proximal

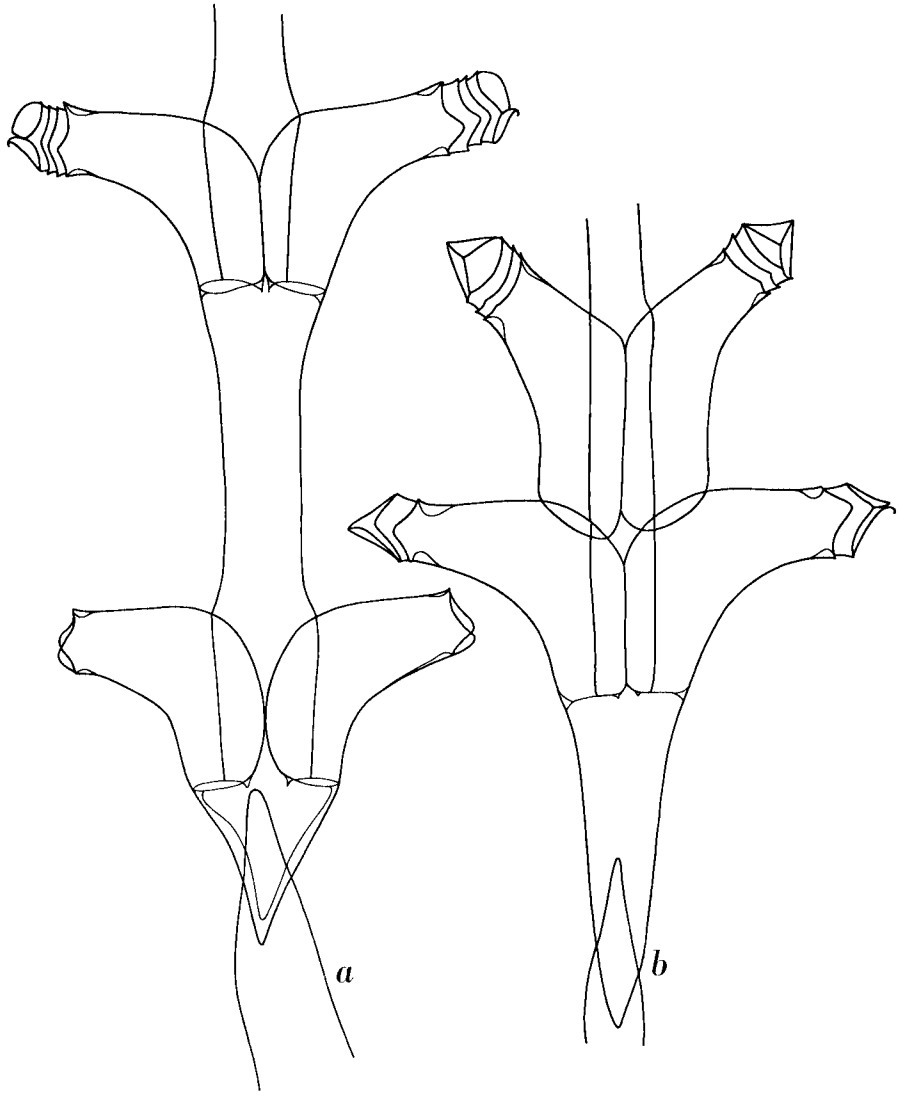

Fig. 16. *Dynamena heterodonta* (Jarvis), Moorea, no. 40B. a, basal part of stem, dorsal aspect; b, idem, frontal aspect. a, b, × 100.

part makes an angle of about 90° with that of the distal part. The plane of the aperture is more or less parallel with the length axis of the stem. There are four rounded teeth, two lateral (which are best developed) and an ab- and adcauline tooth of weaker development. The aperture flares slightly. Internally distinct peridermal teeth are present on ab- and adcauline sides; such

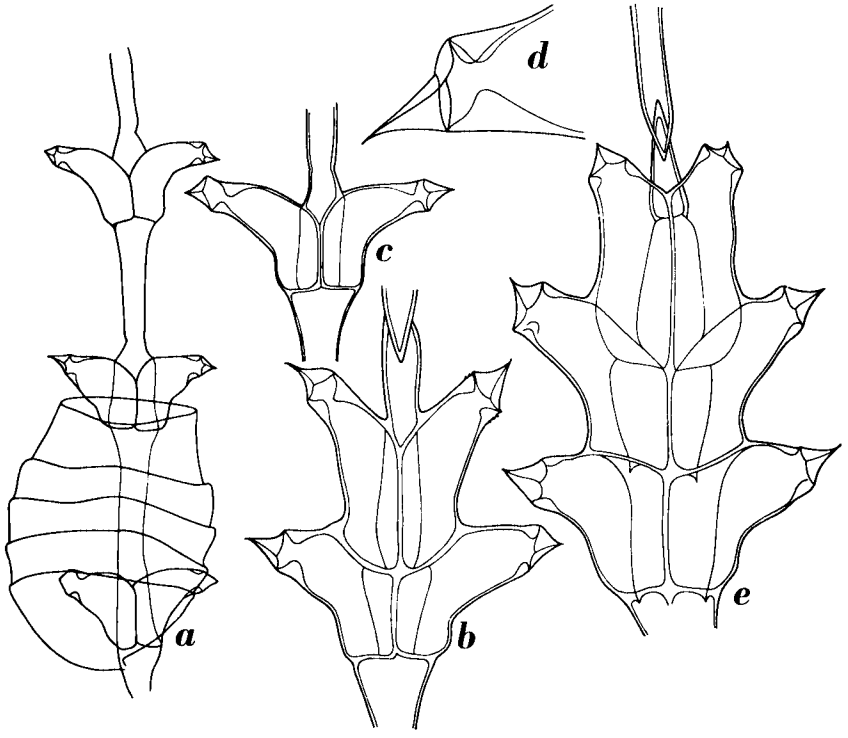

Fig. 17. *Dynamena heterodonta* (Jarvis) from Cargados Carajos shoals (as *Pasythea heterodonta* Jarvis). a, holotype, British Museum (Natural History) no. 23.2.15.225, basal part of stem with hydrotheca, frontal view; b. idem, distal stem internode, frontal view; c, idem, proximal stem internode, dorsal view; d, idem, terminal part of hydrotheca; e, British Museum (Natural History), no. 23.2.15.152, distal stem internode with three pairs of hydrothecae, frontal view. a, × 30; b, c, e, × 55; d, × 90.

teeth vary slightly in development but are a characteristic feature of all hydrothecae. The hydrothecal aperture may be considerably renovated, in extreme cases leading to the development of a trunk-shaped elongation of the theca. The closing apparatus is present in several hydrothecae and can be seen to be composed of a roof-shaped adcauline flap and an abcauline membrane, usually curved at the apex. The pairs of hydrothecae are contiguous on the frontal part of the colony for slightly less than half the length of the

adcauline wall; on the dorsal side they are separated by the internode. The second pair of hydrothecae on the distal internode of the stem does not materially differ from the other pairs, but here the hydrothecae point more directly forward, as a consequence appearing shortened in horizontal projection. Development of marginal teeth, intrathecal teeth and closing apparatus, however, is as in the remaining hydrothecae.

No gonothecae have been observed.

Measurements (in microns). — Distance between pairs of hydrothecae, 350-485; diameter across node, 75-90; maximal diameter across pair of hydrothecae, 595-675. Hydrotheca: length fused part adcauline wall, 135-190; length free part adcauline wall, 200-270; length abcauline wall, 230-255; diameter at aperture, 80-95.

Ecology. — This is an uncommon species of the Tiahura barrier reef, only recorded from a dark cavity of the reef flat, at a depth of 1 m. The surrounding community is mainly composed of calcareous algae, sponges, bryozoans and some ascidians. *Sertularella robusta, Halopteris constricta* and *Hebella parasitica* were observed in the same sample.

Remarks. — We have compared the Moorea material with the type lot in the British Museum (Natural History). This lot consists of four slides, viz.

No. 23.2.15.146, Cargados Carajos shoals, 24 fms. This is a 2 mm long fragment with 1, 3 and 3 pairs of hydrothecae.

No. 23.2.15.148, Cargados Carajos, 24 fms. There is one stem of 10 mm length and a 9 mm long fragment of *Sertularia turbinata* (Lamouroux).

No. 23.2.15.152, Cargados Carajos shoals, 30 fms. There are two stems of 9-10 mm length, the first with 1, 1, 1, 1, 1, 1, 1, 1, 2 and 2 pairs of hydrothecae, the second with 1, 1, 1, 1, 1, 1, 1, 1, 2, 3, and 3 pairs of hydrothecae (fig. 17e).

No. 23.2.15.225, Cargados Carajos shoals, 45 fms. There is a 5 mm long stem with 1, 1, 2, and 2 pairs of hydrothecae and one basal gonotheca. This specimen is here designated as the holotype (fig. 17a-d).

This material is in complete agreement with the Moorea colony. Because the material has been embedded in Balsam the hydrothecae have become very hyaline, so that the renovations of the hydrothecae are less distinctly visible; they are, nevertheless, present on many hydrothecae. The gonotheca is barrel-shaped, attached to the internode under the basal pair of hydrothecae by means of a short pedicel. The gonotheca closes by means of a large, circular lid. There are five apparently circular constrictions (fig. 17a).

Though this species has undoubtedly many affinities with *Dynamena quadridentata* (Ellis & Solander, 1786) we consider it specifically distinct because of a number of characters.

First of all shape and arrangement of the hydrothecae differs from that found in *D. quadridentata.* The hydrothecae have a longer free portion,

curving away from the internode. The hydrothecal aperture and closing apparatus appear to differ, in *D. heterodonta* the development of the lateral teeth is asymmetrical and the closing apparatus forms a very acutely pointed cone. Considerably developed intrathecal teeth are invariably present in *D. heterodonta.*

Dynamena heterodonta mainly occurs in the Indo-Pacific. It was originally described from Cargados Carajos shoals, 24-45 fms depth (Jarvis, 1922). Further records are from the Tuamotu Archipelago, Gambier Island (Billard, 1905, as *S. gracilis*), from two localities in the Malay Archipelago (Borneo Bank and Sapeh Bay, Sumbawa, 34-36 m depth, Billard, 1925), and from Ile des Pins, New Caledonia (Redier, 1965), where it was found in the littoral zone. Atlantic records are from the Mediterranean, near Villefranche (Leloup, 1934a) and from San João da Barra, Argentina, 20°50'S 40'W at 22 m depth (Vannucci, 1951, 1951a).

Sertularella robusta Coughtrey, 1876 (figs. 18-22)

Sertularella simplex p.p. Coughtrey, 1875: 283, figs. 9, 10.

Sertularella robusta Coughtrey, 1876: 300; Bale, 1924: 240; Trebilcock, 1928: 16, pl. 6 figs. 3-3c; Totton, 1930: 195; Blackburn, 1937: 367; Blackburn, 1937a: 171, fig. 1; Blackburn, 1938: 320; Blackburn, 1942: 115; Hodgson, 1950: 30, fig. 58; Leloup, 1960: 234, fig. 7; Ralph, 1961: 236; Ralph, 1961a: 824, fig. 22a-d; Ralph, 1966: 159; Blanco, 1968: 215, pl. 4 figs. 4-7; Vervoort, 1972: 129, figs. 40, 40a; Watson, 1973: 171, fig. 21; Leloup, 1974: 33, fig. 27.

Sertularella microgona Von Lendenfeld, 1884: 416, pl. 7 figs. 1-3; Billard, 1925: 145, fig. 14.

Sertularella angulosa Bale, 1894: 102, pl. 4 fig. 6; Billard, 1925: 143, fig. 13; Plante, 1965: 259, 307; Millard & Bouillon, 1973: 70, fig. 9B.

Sertularia tenella Hartlaub, 1901: 370; Jäderholm, 1905: 31, pl. 12 fig. 8; Jäderholm, 1919: 17, pl. 4 fig. 4.

Localities. — Moorea, no. 15. Fifteen about 8 mm high colonies, rising from stolons on coral fragments or detached, and a number of fragments. Some hydrocauli have branches. No gonothecae.

Moorea, no. 18. Many up to 12 mm high, unbranched colonies, rising from a stolon creeping on coral fragments, and some fragments. No gonothecae.

Moorea, no. 20. Three up to 6 mm high, unbranched colonies, rising from a stolon creeping on coral fragments. No gonothecae.

Moorea, no. 22. Five colonies, up to 12 mm high, four have a single side-branch. All colonies rise from a stolon creeping on coral fragments. No gonothecae.

Moorea, no. 25. Five colonies, up to 8 mm high, rising from stolon creeping on coral fragments. One of the colonies with a single side-branch. No gonothecae.

Moorea, no. 35. Ten up to 10 mm high stems, rising from fragments of stolon creeping on coral debri. One of the colonies with side-branch halfway the hydrocaulus. One of the colonies with empty gonothecae.

Moorea, no. 36. Five 12-15 mm high colonies rising from creeping stolon and some fragments. No gonothecae. Some stems with *Hebella parasitica* (Ciamician).

Moorea, no. 40. A very large number of stems, maximal height 18 mm, some with one or two branches. Several gonothecae are present.

Fig. 18. a-c, *Sertularella robusta* Coughtrey, Moorea, no. 35. a, part of stem with empty gonotheca; b, c, hydrothecae. d, e, *Sertularella inconstans* Billard, holotype, Siboga Expedition, Sta. 150. a, × 55; b-e, × 90.

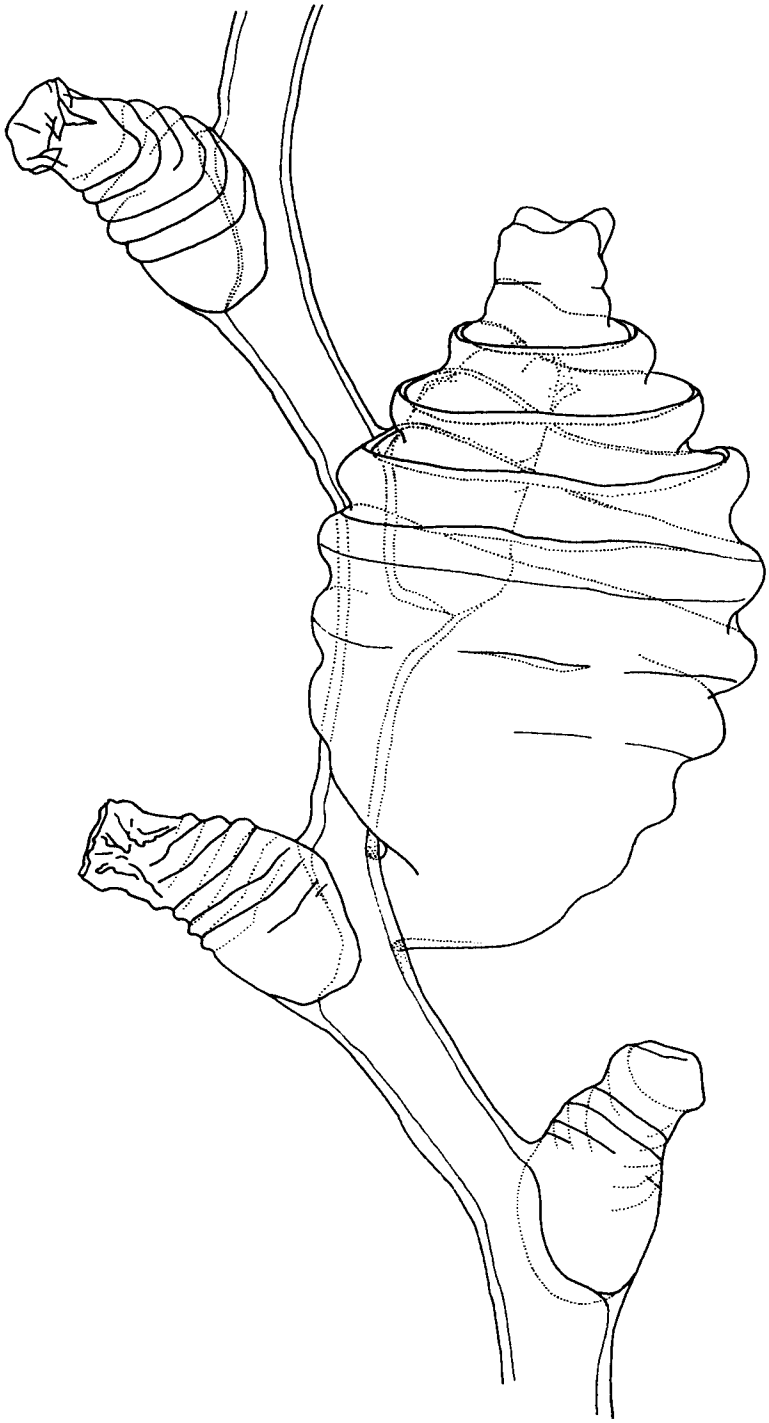

Fig. 19. *Sertularella robusta* Coughtrey, Moorea, no. 35, part of stem with empty gonotheca. × 20.

Moorea, no. 41. Many, up to 15 mm high colonies from stolon creeping on coral fragments. Some stems with one or two branches. Some gonothecae are present.

Takapoto, no. 55. Ten unbranched, up to 12 mm high colonies and some fragments. Many gonothecae are present.

Takapoto no. 62. One 10 mm high, unbranched stem and a 8 mm long fragment. No gonothecae are present.

Description. — Upright, unbranched or branched, up to 15 mm high colonies, rising from a stolon creeping on coral fragments. The stolon is a

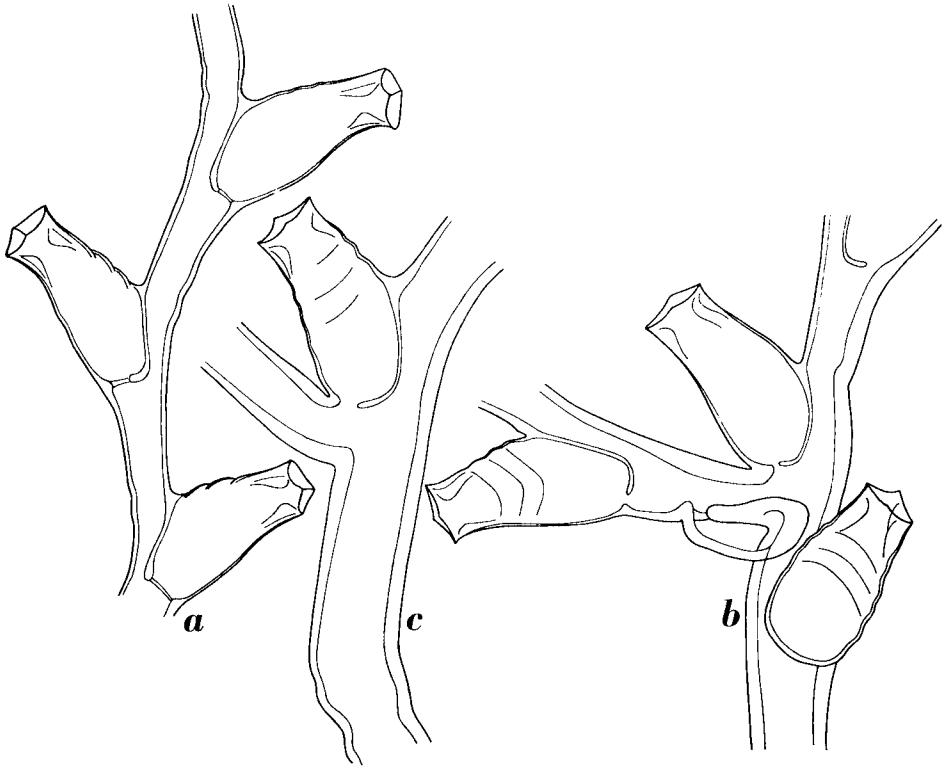

Fig. 20. *Sertularella robusta* Coughtrey. a, b, Moorea, no. 25; a, branch with three hydrothecae; b, part of stem with side-branch. c, Moorea, no. 22, part of branched stem. a-c, × 55.

rounded, at times slightly flattened tube, 160-165 microns wide, with thick periderm. The stems arise at right angles, diameter at the base 200-210 microns. No division of the stem into internodes is apparent, though the periderm is slightly but distinctly constricted just above each hydrotheca (fig. 18a). No internodial septa have been observed. The periderm on the stems is

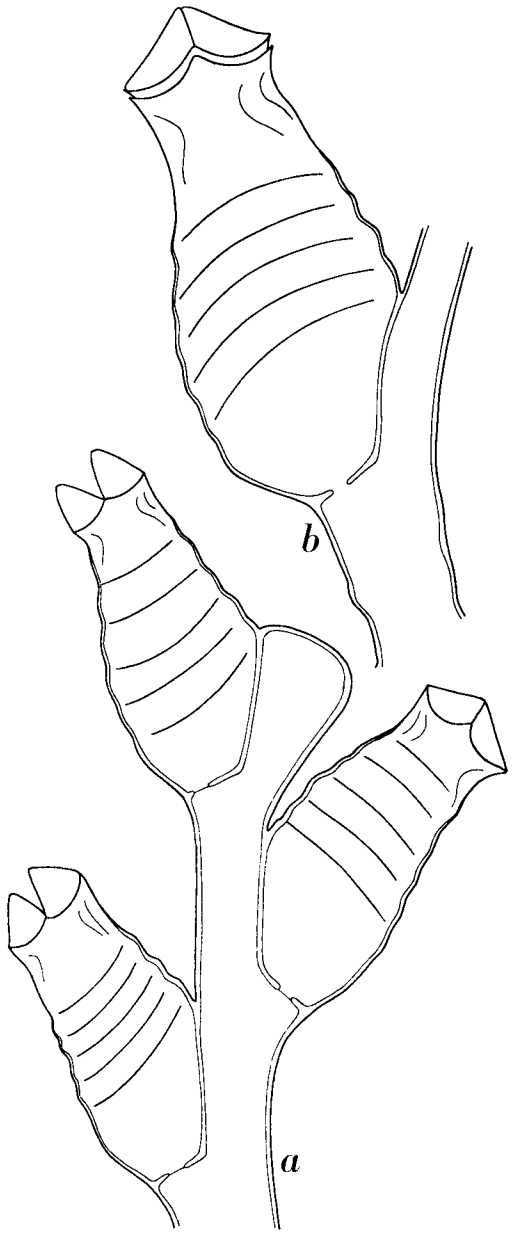

Fig. 21. *Sertularella robusta* Coughtrey, Siboga Expedition, Sta. 7 (as *S. microgona* Von Lendenfeld). a, part of stem with three hydrothecae; b, hydrotheca. a, × 75; b, × 115.

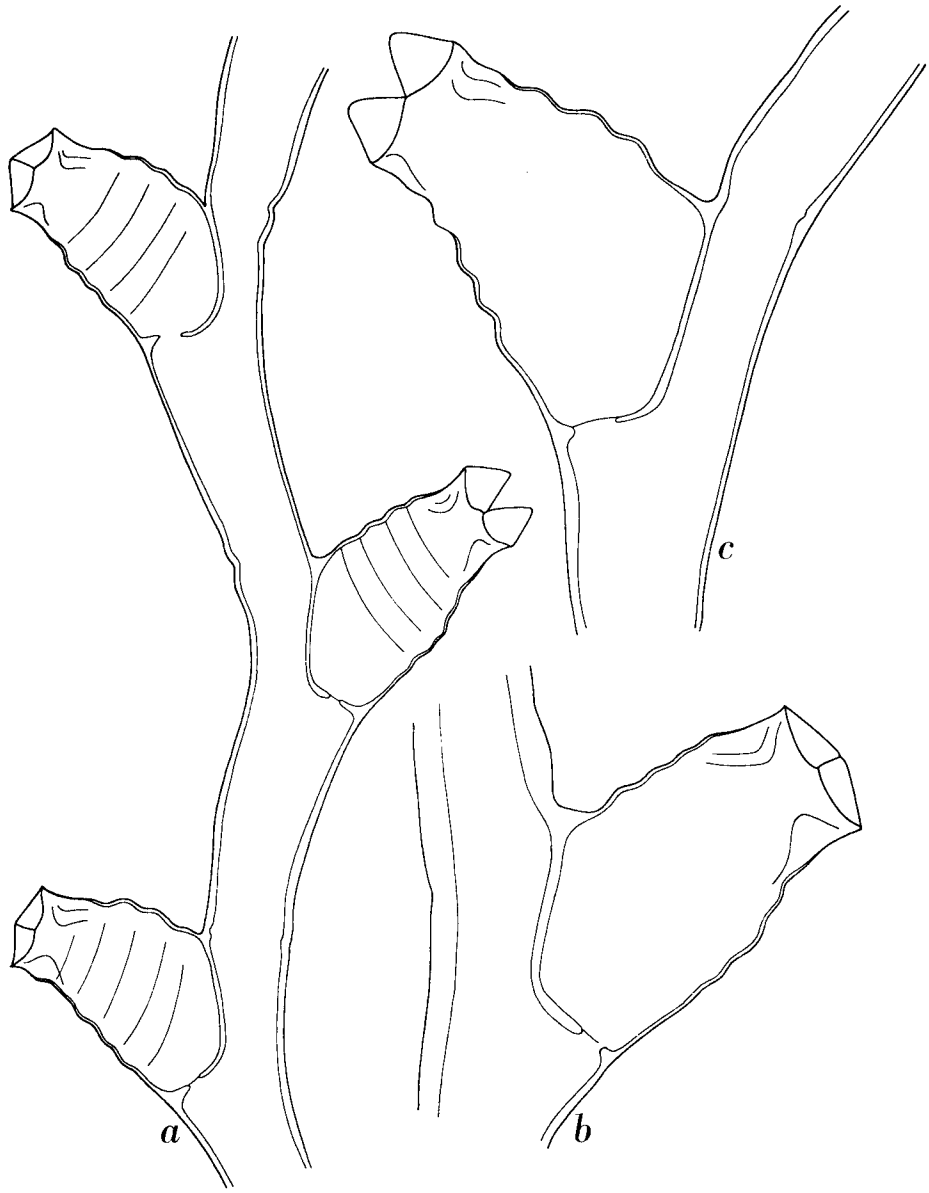

Fig. 22. *Sertularella robusta* Coughtrey, Siboga Expedition, Sta. 77 (as *S. angulosa* Bale). a, part of branch with three hydrothecae; b, c, individual hydrothecae. a, × 75; b, c, × 115.

quite firm and sometimes of yellowish colour; the part under the first hydrotheca it not ringed, but the periderm is irregularly wrinkled; the periderm on the stem is smooth.

The hydrothecae are biserially arranged along the stem, pointing alternately left and right and with a slight tendency to curve forward. Each "internode" bears a single hydrotheca, that can best be described as being flask-shaped, with a moderately swollen proximal part and a narrowed distal part (fig. 18b, c). The hydrothecae are placed in such a fashion that slightly less than half the length of the adcauline thecal wall is fused with the stem; the stem, between the successive hydrothecae, is geniculated to some extent, variable in the various colonies. The adcauline hydrothecal wall makes an angle of about 60° with the stem; the angle, however, is slightly variable and may amount as such as 90°. Hydrothecae smooth to more or less distinctly transversely ringed, variable amongst the various colonies, but also variable in a single colony, where the ringed condition is usually best observed in the basal hydrothecae and fades distally. Well ringed hydrothecae (fig. 18b, c) have 5 or 6 distinct rings, though thecae with 3 or 4 rings also occur. In such cases the hydrothecae show well marked, fairly deep constrictions separated by obtuse ribs. Hydrothecae with intermediate conditions (fig. 20a) have the adcauline wall distinctly ribbed and the indication of ribs on the lateral thecal walls, fading away near the abcauline wall. Smooth hydrothecae have also been observed. The apical part of the hydrotheca at times seems to be slightly elongated, particularly in renovated hydrothecae. These renovations commonly occur, even in great (up to 10) numbers. Hydrothecal margin with four distinct but low marginal teeth, one abcauline, one adcauline and two lateral, separated by very shallow embayments. The closing apparatus is very seldom complete and undamaged, in that case forming a low roof, composed of four hyaline flaps. Interiorly each hydrotheca has three high, strongly developed teeth, one abcauline and two lateral. In renovated thecae these teeth are placed a considerable distance from the hydrothecal aperture.

Branches occur both in the athecate, basal part of a colony or between the hydrothecae (fig. 20c). Fig. 20b illustrates a colony which bears a branch about halfway the stem, just under a hydrotheca. The previous hydrotheca is displaced, while the non-thecate axil is reinforced by a curious thickening of the periderm. Normally branching takes place just under the first hydrotheca of the stem, which does not become displaced.

Some of the colonies bear a gonotheca, inserting on the stem next to a hydrotheca be means of a short pedicel. The gonotheca is elongated ovoid, with the greatest diameter at about the middle and gradually narrowing basally and apically. It is distinctly ringed; on close inspection a spirally

curved groove furrows the gonotheca, making about 8 convolutions. The embayments between the ribs are hollowed and rounded; the ribs are obtusely keeled. There is a short apical neck with four symmetrical, obtuse teeth (figs. 18a, 19).

Some of the hydrothecae have well preserved, contracted hydranths without blindsack. The gonothecae are empty.

Measurements (in microns). —

	Moorea, no. 25	Moorea, no. 35
Diameter of stem at base		165-210
Length of "intermode"		540-565
Diameter of internode		120-125
Hydrotheca, total depth	400-410	430-500
idem, length free part adcauline wall	270-275	255-300
idem, length fused part adcauline wall	215-220	225-235
idem, length abcauline wall	350-360	390-430
idem, maximal diameter	200-205	210-215
idem, diameter at aperture	150-155	150-170
Gonotheca, total length		1,175
idem, maximal diameter		745

Ecology. — *S. robusta* is the most common species of hydroid on the whole of the Tiahura barrier reef. It occurs from the reef flat, with scattered coral growth, at 1 m depth down to the spur-and-groove zone of the outer slope at 20 m depth. The species reaches its maximal abundance at the level of the reef flat cavities. In contradistinction it occurs less frequently in the various biotopes of the outer slope. In the furrows of the furrowed platform it colonizes mainly the overhanging slopes, sometimes in very dense patches, where the surrounding community is composed of red algae, sponges, bryozoans, hydroids (*Synthecium samauense*, *Gymnangium hians*, *Halopteris constricta*), an ahermatypic madreporarian (*Tubastraea* spec.) and the hydrocoral *Distichopora violacea.*

In the buttress-and-valley zone, between 9-10 and 14 m depth, *S. robusta* occurs under blocks of concretions constituting micro-overhangs and forming small, dark cavities. This particular biotope is characterized by a sciophilous community composed of several algae (*Halimeda* spec., Corallinacea and Squamariaceae), sponges, bryozoans and didemnid ascidians. Besides *S. robusta* the following hydroids have been observed: *Synthecium samauense*, *Hebella scandens* var. *contorta*, *Halopteris buskii* and *Gymnangium eximium.*

In the spur-and-groove zone, finally, between 15 and 20 m depth, the species is regularly met with under overhangs or in spur-anfractuosities,

where it occurs together with *Synthecium samauense, Thecocarpus phyteuma, Hebella parasitica* and *Plumularia setacea.*

At Takapoto Atoll the species is less abundant; it was sampled under overhangs and in anfractuosities of the spur-and-groove zone near the jetty at the Fakatopatere Reef, between 7 and 10 m depth, as well as at the sloping reef platform at the Otikaea-Vairua sector, between 20 and 25 m depth.

Remarks. — The identification of this species is largely based on the description of New Zealand material by Ralph (1961a: 824, figs. 22a-d), with which the present material is in general agreement. The gonothecae, in our specimen, are more deeply furrowed than those described by Ralph. Describing that structure, Ralph refers to three to four well developed, complete annulations, variable in development and sometimes not easily observed. Here a distinct, spirally coiled furrow is present, but the general outline of the hydrotheca is identical, as is the apical portion. The development of the spiral furrow or the "rings", known to be variable, might well in extreme cases lead to a condition observed in the Moorea material. Moreover, sexual differences in the gonothecae are not to be altogether excluded. The measurements of the present material agree fairly well with those of the New Zealand material; the gonothecae are smaller.

Sertularella robusta seems to have a wide distribution in the south-eastern and western Pacific, being recorded from New Zealand, Australia, and Tierra del Fuego (vide Ralph, 1961a: 825). It has been recorded from a number of localities in East-malayan waters by Billard (1925), both as *Sertularella microgona* Von Lendenfeld and *Sertularella angulosa* Bale. It also occurs in the southern Atlantic (Vervoort, 1972).

We have compared the present material with the holotype of *Sertularella inconstans* Billard, 1925, a species recorded from deep water in the Djilolo Passage, Halmahera Sea (Siboga Sta. 150, 1,089 m depth). Only a single colony was obtained, showing the beginning of polysiphony. The possibility to inspect this material we owe to Dr. R. W. M. van Soest, Curator of Coelenterates, Institute for Taxonomic Zoology, University of Amsterdam, where the bulk of the Siboga hydroids are preserved.

S. inconstans (fig. 18d, e) undoubtedly shows a great resemblance with *S. robusta,* as also appears from Billard's description. The arrangement of the hydrothecae along the stem and the shape of the hydrothecae are almost identical, there are no internodes. Points of difference are the greater overall size of *S. inconstans,* the smaller internal hydrothecal teeth and the presence of an additional tube on the basal part of the stem in *S. inconstans.* The distance between the successive hydrothecae is slightly larger in *S. inconstans* and the periderm is remarkably thick on the stem. The material further

shows a completely ringed condition of the hydrothecae basally and almost complete disappearance of the rings apically. This condition, however, is not uncommon in *S. robusta.*

We hesitate, nevertheless, to synonymise the two species. *S. robusta,* in spite of its variability, seems to be generally smaller and seems to possess larger internal hydrothecal teeth. Absence of gonothecae is a major set back in considering the taxonomic position of *S. inconstans,* which for the present we should like to preserve as a separate species, though undoubtedly allied to *S. robusta.*

Measurements (in microns). —

	Sihoga Sta. 150
Diameter of stem at base	162
Length of "internode"	525-610
Diameter of internode	165
Hydrotheca, total depth	660-670
idem, length free part adcauline wall	445-450
idem, length fused part adcauline wall	285-310
idem, length abcauline wall	540-595
idem, diameter at aperture	190-215
idem, maximal diameter	270-285

Ralph (1961a: 824) synonymized *S. robusta* with both *Sertularella microgona* Von Lendenfeld, 1894, and *Sertularella angulosa* Bale, 1894. Part of the material described by Billard, 1925, from the Siboga Expedition and referred by him to *S. microgona* and *S. angulosa* has been studied and is redescribed below.

Redescription of *Sertularella microgona* Von Lendenfeld, 1844, from Siboga Expedition, Sta. 7, near Batjulmati reef, Java, 7°55'S 114°26'E, 15 m depth. — This material is composed of five very small and evidently quite young colonies, of which the largest is about 5 mm high and consists of five hydrothecae arranged along a monosiphonic hydrocaulus. Nearly all specimens have fragments of a stolon and were obviously detached from the substratum. We judge the colonies to be young because in some specimens there are only one or two hydrothecae that are almost free from the stem; in the larger specimen they are partly fused with the stem but here the arrangement along the hydrocaulus is quite irregular and not (yet) biserially.

The shape of the hydrothecae conforms to the pattern found in *S. robusta.* The hydrothecae (fig. 21a, b) are more or less barrel-shaped, with the adcauline margin fused for about half its length with the stem, the hydrothecae diverging from the stem at an angle of about 45°. The greatest diameter of

the hydrothecae is below the middle; they narrow towards the apex but reach their minimal diameter just below the margin, so that they are slightly dilated at the orifice. There are five distinct annular constrictions and one or two that are only indicated; the surface of the hydrotheca, however, is undulated rather than furrowed. The hydrothecal margin is slightly though distinctly thickened and renovated in many hydrothecae. The closing apparatus is intact in the majority of the hydrothecae and consists of four triangular flaps, in closed condition forming a low, roof-like structure. The thecal margin has four distinct teeth separated by shallow, rounded embayments, into which the opercular plates are attached. There are three internal hydrothecal teeth, that are very difficult to observe because of the opacity of the hydrothecae. There is one abcauline tooth and two more teeth placed between the adcauline marginal tooth and the lateral teeth.

The arrangement of internodes is very obscure; there are only indications of constrictions, indicating the limits of such internodia; no septa are present. The hydrothecae approach each other very closely. No gonothecae are present.

Measurements (in microns). —

	Siboga Sta. 7.
Diameter of stem at base	120-135
Length of internode	475-515
Diameter of internode	150-160
Hydrotheca, total depth	540-580
idem, length free part adcauline wall	325-380
idem, length fused part adcauline wall	285-300
idem, length abcauline wall	515-540
idem, diameter at aperture	150-190
idem, maximal diameter	255-300

Comparing the Siboga specimen of *S. microgona* with the much more abundant material of *S. robusta* shows only very little difference between the two. The shape of the hydrothecae is nearly completely identical and the differences in structure of the colony can be fully explained by the juvenile state of the Siboga specimens. The Siboga material of *S. microgona*, both by comparison of the material and by Billard's description, cannot possibly be separated from *S. robusta* as described above. The question whether the species *S. microgona* Von Lendenfeld should be considered a synonym of *S. robusta*, as Ralph (1961a: 824) suggests, remains open as long as the holotype has not been redescribed.

Redescription of *Sertularella angulosa* Bale, 1899. — Of this species we have inspected some 10 to 15 mm high, sterile, monosiphonic colonies from

Siboga Sta. 77, Borneo Banc, 3°27'S 117°36'E, 59 m depth. These few stems are from a much larger material studied by Billard and from which a single gonotheca has also been described.

The general impression of this material is that of a delicate, finely branched species with monosiphonic stems with slightly yellowish, strong periderm. The ramifications are few and generally occur on one side of the stems, originating just under a hydrotheca, that becomes slightly displaced. The internodes are long and slender; there are no septa, the limits are indicated by constrictions of the periderm. They follow each other in indistinct zigzag fashion. The hydrothecae are smaller than those observed in *S. microgona* and *S. robusta*, though having the same general outline. They are evidently much weaker as the number of collapsed thecae is fairly high. They are barrel-shaped, slightly swollen, best visible on the adcauline side, diverging from the stems at angles of about 45° and fused with the adcauline wall for slightly less than half their length (fig. 22a-c). The undulations of the hydrothecal wall are well marked, being deeper than those observed in *S. microgona*, though never having the character of ribs. The number of undulations is 5 or 6. The hydrothecal margin is produced into four obtuse teeth, separated by rounded embayments and supporting a closing mechanisms identical to that found in both *S. robusta* and *S. microgona*. No renovated hydrothecae have been observed and the hydrothecal margin, as a result, is not thickened. There are the usual three intrathecal teeth (one abcauline and two lateral) that are quite hyaline. As a result of the weakly sclerotized condition of the hydrothecal wall deviations from the plane in which the hydrothecal opening is normally situated, are frequent. Such displacements can be traced by the strongly folded condition of the abcauline hydrothecal wall.

Measurements (in microns). —

	Siboga Sta. 77
Diameter at base of stem	150-205
Length of internode	675-745
Diameter of internode	150-160
Hydrotheca, total length	420-445
idem, length free part adcauline wall	300-325
idem, length fused part adcauline wall	215-255
idem, length abcauline wall	325-375
idem, diameter at aperture	160-190
idem, maximal diameter	225-270

This species, as well as *S. microgona*, from which it seems to differ in several respects, in our opinion falls within the variational amplitude of *S.*

robusta, known by now to be an extremely variable species. Comparison of the considerable material referred to above will show that, though differences do exist between various colonies, no distinct characters present themselves that might be considered specific differences. The gonotheca of *S. angulosa* described by Billard (1925, p. 144, fig. 13 J) seems to support this assumption. Billard described the apex as being rounded and without points, but in general outline and presence of spirally arranged furrows it agrees perfectly with the Moorea gonotheca of *S. robusta*; the rounded and untoothed condition being the result of its youthful state.

Sertularella tongensis Stechow, 1919 (fig. 23)

Sertularella tongensis Stechow, 1919: 89, figs. F1-G1.

Locality. — Moorea, no. 42. A single stem, 12 mm high, with 15 hydrothecae. No gonothecae.

Description. — To this species we have brough a single about 12 mm high stem with 15 alternately arranged hydrothecae. The stem apparently was snapped off at the base; it is divided into internodes by peridermal constrictions, sometimes distinct septa are present (fig. 28a). The periderm of the hydrocaulus is wrinkled at the nodes; the stem is slightly geniculate between those nodes. The hydrothecae insert on the distal part of the internodes, occasionally two thecae are observed on one internode. The hydrothecae can best be described as tubular, slightly swollen at about half the length and gracefully curving away from the internode; the adcauline wall makes an angle of about 60° with the internode (fig. 23b). The free part of the adcauline wall is slightly longer than the adnate part; the free portion is almost smooth and very slightly convex. The abcauline hydrothecal wall is distinctly concave, the concavity being some distance under the margin. Hydrothecal periderm very soft and hyaline; the apical portion of several hydrothecae collapsed. Hydrothecal aperture renovated repeatedly in various thecae; the hyaline condition of the apical hydrothecal portion makes it difficult to distinguish the exact structure; some thecae even appear to be more or less scaly as parts of the renovated opercular apparatus are still present. There are four marginal hydrothecal teeth, one ab- and one adcauline and two lateral, separated by shallow embayments. The opercular apparatus consists of four triangular plates, forming, in folded condition, a low roof over the hydrotheca. Renovation of the hydrothecal aperture seems to occur regularly, with parts of the former closing apparatus still adhering to the hydrotheca, thus accounting for the scaly appearance of the distal thecal portion.

No gonothecae have been observed.

Measurements in microns. —

Stem, diameter at base	85
Internode, total length	375-645
idem, diameter at node	48-60
Hydrotheca, total depth *	285-325
idem, length free part adcauline wall	150-215
idem, length fused part adcauline wall	120-160
idem, length abcauline wall	200-270
idem, maximal diameter	120-150
idem, diameter at aperture	95-110

* including renovations.

Ecology. — *S. tongensis* is evidently an uncommon species, recorded only once from under an overhang of the spur-and-groove zone of the Tiahura reef, at 15 m depth.

Remarks. — This is undoubtedly the species recorded and described from the Tonga Islands by Stechow (1919) as *Sertularella tongensis*. Though the present specimen is sterile, the shape of the hydrothecae and particularly their scaly appearance leave no room for doubt. The Moorea material, moreover, is in perfect agreement with Stechow's description. The original description is not accompanied by a depth record; the Moorea colonies were obtained at 15 m depth. This is the first record since the species was described.

Sertularia ligulata Thornely, 1904 (fig. 24)

Sertularia ligulata Thornely, 1904: 116, pl. 2 fig. 1, 1a, 1b; Billard, 1925: 178, fig. 35; Leloup, 1937a: 5, 44, fig. 30; Blackburn, 1942: 116; Dawydoff, 1952: 55; Millard, 1958: 193, figs. 8c, 9a, b; Vervoort, 1959: 277, fig. 37; Millard & Bouillon, 1973: 74, fig. G; Hirohito, 1974: 22, fig. 9; Millard & Bouillon, 1974: 8.

Localities. — Moorea, no. 7. A large number of unbranched, up to 8 mm high colonies, rising from a stolon creeping on coral fragments. No gonothecae.

Moorea, no. 12. A very large number of unbranched, 5 to 9 mm high colonies from stolonial filaments creeping on coral debri, Alcyonacea, etc. Many gonothecae are present.

Takapoto, no. 61. Several 8 mm high colonies, rising from a stolon detached from substratum. No gonothecae.

Description. — The Moorea material can be positively identified as this species because of the presence, in the well preserved hydranths, of a very distinct, adcauline linguiform process, usually withdrawn within the hydrothecal cavity. The material differs in so far from previously described specimens that the free portion of the hydrotheca is longer. While in previously described specimens the fused portion of the adcauline thecal wall is generally longer than the free part, here the free part is distinctly longer (fig. 24a-c). Moreover, the adcauline wall, in frontal view of the hydrothecal pair, is smoothly curved and only quite occasionally shows the abrupt cur-

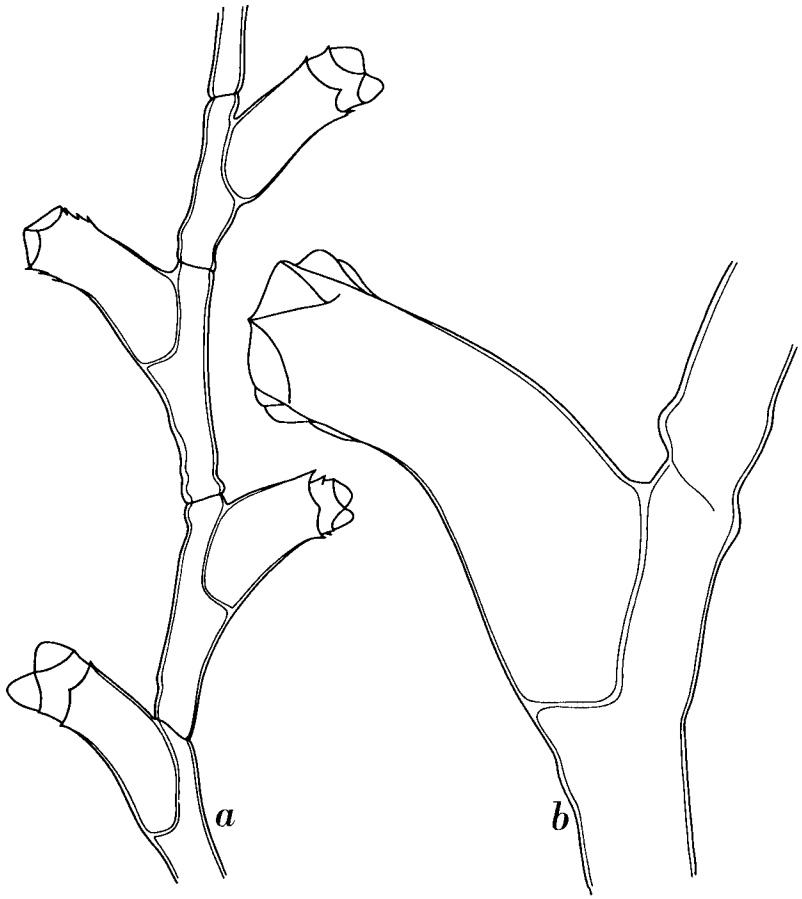

Fig. 23. *Sertularella tongensis* Stechow, Moorea, no. 42. a, part of stem with four internodes; b, hydrotheca. a, × 75; b, × 175.

vature demonstrated, e.g., by the Siboga and Atlantide specimens. As in previously described specimens the hydrothecal aperture and the closing membranes are hyaline and collapsed, though the adcauline and abcauline thecal walls are slightly thickened and terminate in a distinct though small tooth. There are two very weakly developed lateral teeth, that sometimes are very indistinct, so that the thecal aperture seems nearly circular. Very few hydrothecae show the flaps in more or less complete state, viz., a large abcauline flap and a smaller adcauline flap, folded to form a roof-like structure. In the majority of hydrothecae the large abcauline flap only can be observed, usually folded inwards. The position of the intrathecal peridermal fold is

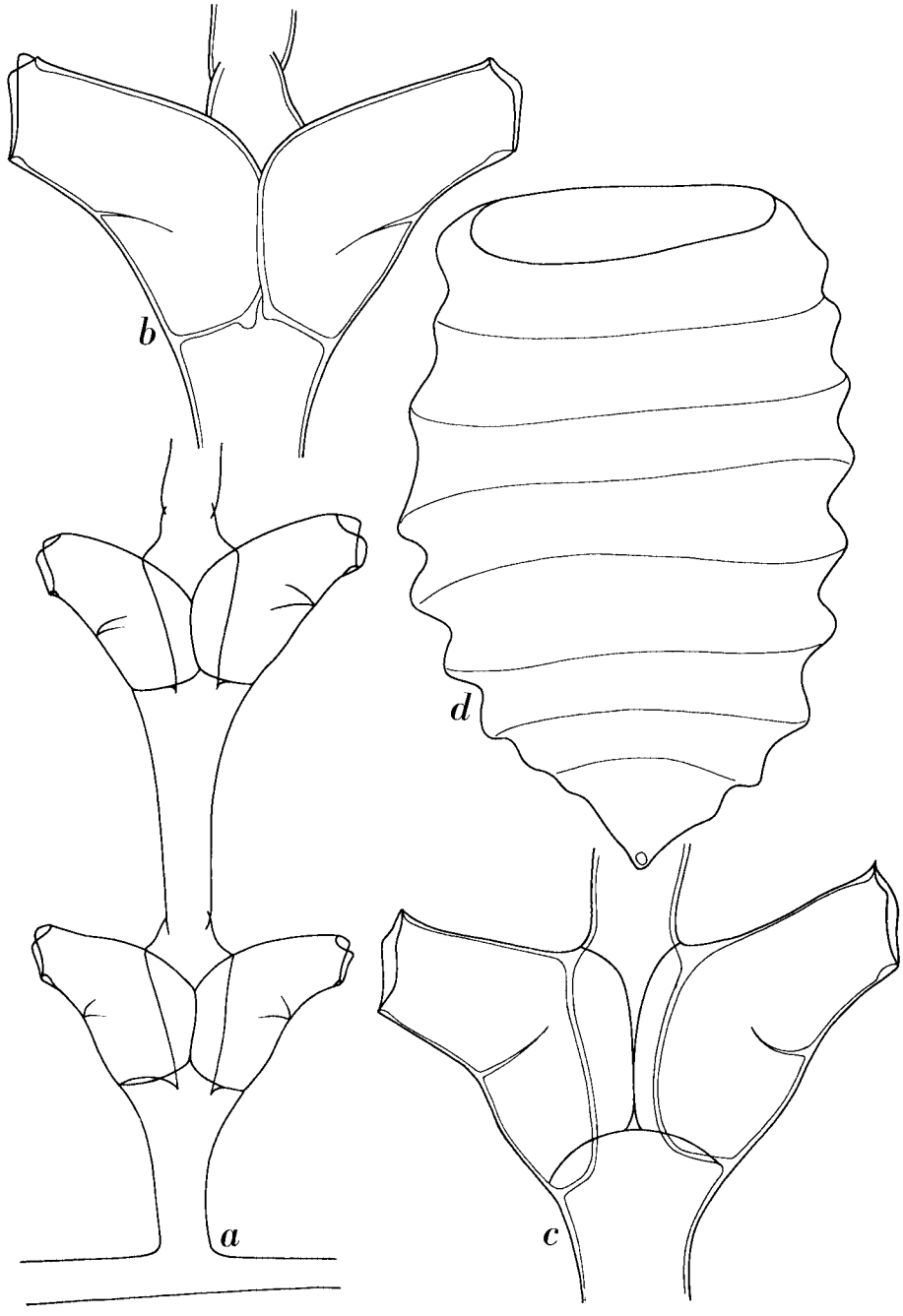

Fig. 24. *Sertularia ligulata* Thornely, Moorea, no. 12. a, basal part of stem, frontal view; b, pair of hydrothecae, frontal view; c, idem, dorsal view; d, gonotheca. a, d, × 75; b, c, × 115.

oblique as appears from a comparison of the frontal (fig. 24b) and dorsal (fig. 24c) aspects of the hydrothecal pairs.

The material from Moorea, no. 12, richly bears gonothecae (fig. 24d), found attached to the internode directly under a hydrothecal pair. They are large, barrel-shaped structures with swollen, sometimes conical sides and cut off abruptly at the apex, where they open by means of a circular lid. There are no marginal teeth. The surface of the gonotheca is undulated because of the development of a spirally curved constriction. As a result the mature gonothecae have a distinct and spirally arranged keel on the surface, making 9 to 10 convolutions. All gonothecae are empty.

Measurements (in microns). —

	Moorea, no. 12
Stem, distance of pairs of hydrothecae	430-475
idem, diameter at node	96-125
Hydrotheca, length abcauline wall	245-260
idem, length adnate part adcauline wall	175-200
idem, diameter at margin	240-260
idem, maximal diameter across pair	540-595
Gonotheca, total length	1,200-1,300
idem, maximal diameter	675-840

The material from Takapoto, no. 61, differs from the Moorea material by the shorter free portion of the adcauline hydrothecal wall, curving away at right angles from the length axis of the internode. They conform in shape of the hydrothecae with the type generally met with in this species and described, e.g., from the tropical Atlantic (Vervoort, 1959, fig. 37). The absence of renovations and the perfectly hyaline condition of the hydrotheca suggests that the Takapoto specimens are quite young.

Ecology. — This species occurs commonly under blocks of concretions that were removed from the non-furrowed platform of the Tiahura reef, between 4 and 5 m depth, where it was found associated with several other hydroids (*Synthecium samauense, Gymnangium eximium, Sertularia malayensis, S. turbinata* and *Antennella secundaria*), as well as bryozoans, some algae, sponges and ascidians.

At Takapote this is quite a rare species, that was only recorded from a very dark cavity of the spur-and-groove zone at Fakatopatere, near the jetty, between 7 and 10 m depth.

Remarks. — *Sertularia ligulata* is widely distributed over the tropical and subtropical Indian and Pacific Oceans (Billard, 1925; Leloup, 1937a; Millard, 1958; Hirohito, 1974), but has also been observed in the tropical eastern Atlantic, off French Guinea (Vervoort, 1959). Hirohito (1974) has

commented upon the aberrant condition of the hydrothecal operculum and the presence of a ligula, characters which give this species an isolated position. We prefer, for the moment, to retain this species in *Sertularia* and consequently have not followed Hirohito's suggestion that it might deserve separate generic distinction. The definition of genera in Sertulariidae, at the present moment, is certainly far from satisfactory and we should prefer to await the results of a thourough study of a number of genera of Sertulariidae before instituting new genera. As recorded below, we also consider the position of the genus *Tridentata* Stechow, 1920, as very doubtful.

Sertularia malayensis Billard, 1924 (fig. 25)

Sertularia malayensis Billard, 1924: 649, fig. 1E; Billard, 1925: 173, fig. 32.
?*Tridentata* spec. Hirohito, 1974: 26, fig. 11.

Localities. — Moorea, no. 9. Small, up to 5 mm high, monosiphonic colonies from a stolon creeping on *Halimeda*. No gonothecae.

Takapoto, no. 68. Two fragments of 5 mm length, occurring between *Synthecium dentigerum*. Each fragment with five pairs of hydrothecae. No gonothecae.

Takapoto, no. 70. Several 6 mm high stems from a stolon creeping on coral debri. No gonothecae.

Description. — The stems rise from a filiform stolon with hyaline periderm and consist of a tube with circular cross-section and of variable length, either directly bearing the first pair of hydrothecae or terminating into an oblique joint with the first hydrothecate internode. There may occasionally be a few straight septa between stolon and first pair of hydrothecae. The division of the stem into internodes is slightly irregular; normally there are three to four thecate internodes, separated by oblique joints, but some straight septa may interfere and the length of the internodes varies considerably. The hydrothecae (fig. 25a, b) are arranged in strictly opposite pairs borne on the basal part of the internode; about five pairs are normally present. The hydrothecae are quite hyaline, more or less tubular, narrowing slightly towards the orifice, coalescent on the frontal part of the internode and then diverging from the internode at an angle of about 60°. All hydrothecal pairs from a colony are coalescent on the frontal side of the colony, while dorsally they are separated by the internode, consequently they point slightly forward. Each hydrotheca is provided with a pair of lateral teeth, separated by ad- and abcauline embayments into which fits the closing apparatus. The adcauline embayments seems to be slightly larger than the abcauline, but the apical portion of the hydrotheca is very fragile and only few thecae are in proper shape. In such hydrothecae the adcauline valve appears to be folded medially so as to form a roof-shaped structure; the abcauline valve appears to be straight. Quite a number of hydrothecae shows signs of renovation, demon-

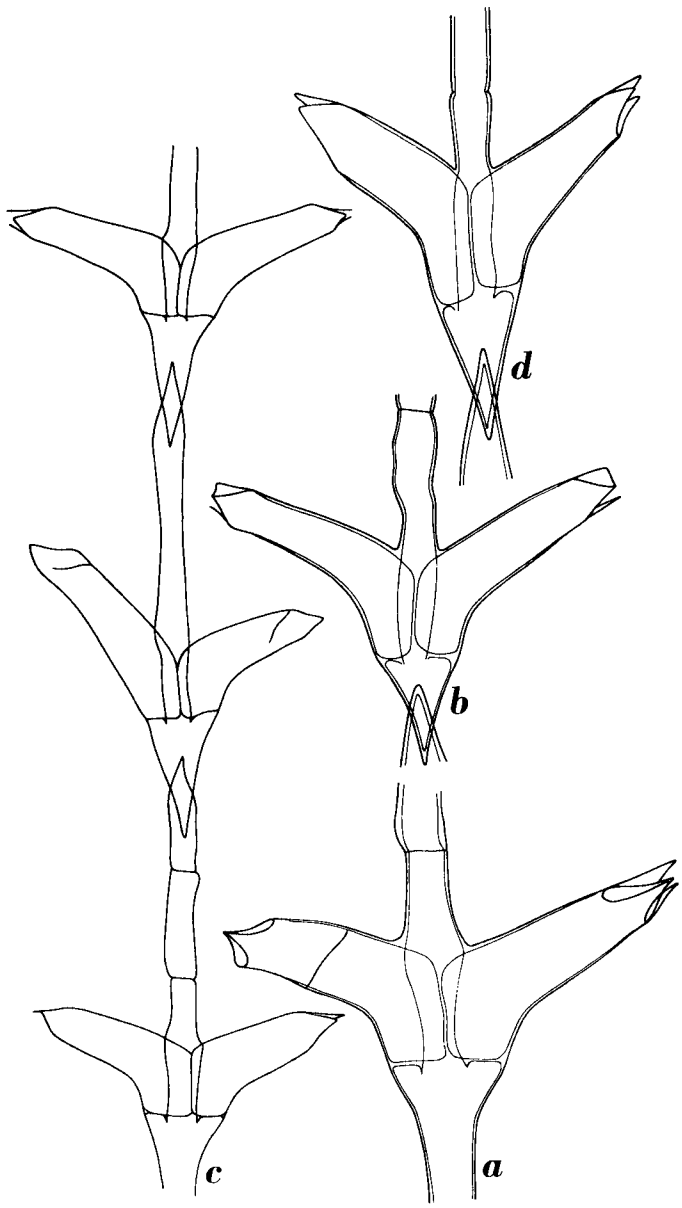

Fig. 25. *Sertularia malayensis* Billard. a, b, Moorea, no. 9; a, pair of hydrothecae from basal part of stem, frontal view; b, pair of hydrothecae from one of the internodes, frontal view. c, d, schizoholotype, Siboga Expedition, Sta. 80; c, part of stem, frontal view; d, pair of hydrothecae from one of the internodes. a, b, d, × 135; c, × 90.

strated by the presence of renovated apertures, partly ruptured valves that have been repaired, or collapsed valves in the inside of the hydrotheca that apparently serve no purpose. Hydranths are present, showing a small adcauline sinus. No gonothecae have been observed.

We have compared the Moorea material with schizoholotype colonies from the Siboga Expedition, kindly sent by Dr. R. W. M. van Soest. The material originates from Sta. 80, Borneo Bank, 2°25'S 117°43'E, 50-40 m depth; a few up to 8 mm high, monosiphonic colonies from stolons creeping on other hydroids, amongst which *Idiellana pristis* (Lamouroux). No gonothecae are present. The identity is almost complete, the Siboga material being as a whole very slightly larger. The Siboga colonies are of a more regular construction, the internodes are longer and the hydrothecae slightly larger (fig. 25a, d). There is, nevertheless, such perfect agreement in the shape of the hydrothecae that the conspecificity of the material cannot be doubted. The species is only known from the Borneo Bank, from Moorea and from Takapoto, but its small size and particularly the hyaline condition of the colony defy its detection. The possibility that this species only represents the juvenile stage of a better known species of *Sertularia* cannot altogether be ruled out.

Measurements (in microns). —

	Moorea, no. 9	Siboga Sta. 80
Diameter of stem at base	35-40	45-55
Length of internodes	385-410	605-635
Diameter of internodes	40-45	40-45
Distance between pairs of hydrothecae	110-250	450-520
Hydrothecae, depth [1])	230-275	275-300
idem, length abcauline wall [1])	190-200	200-220
idem, length fused part adcauline wall [1])	85-100	100-110
idem, length free part adcauline wall [1])	170-190	190-210
idem, diameter of orifice	45-50	50-55

[1]) including the hydrothecal teeth.

Ecology. — At Tiahura this species is uncommon; it was only sampled in dark cavities of the non-furrowed platform, between 4 and 5 m depth. Here, under the blocks that were removed from the platform, the community of which it forms a part covers up to 100 per cent of the available surface, the species composition being in addition calcareous algae, *Halimeda*, sponges, bryozoans and ascidians.

At Takapoto this species also occurs infrequently, being recorded from the outer slope, at a depth of 7 to 10 m, under overhangs of the spur-and-groove zone near the jetty. *S. malayensis* was associated there with several species of hydroids (*Synthecium dentigerum, Lictorella rufa, Eudendrium* spec.),

with sponges (mainly the silico-calcareous sponge *Astrosclera willeyana*). Stylasterids and bryozoans were also observed to occur in great profusion, as well as sessile foraminiferans (*Homotrema rubrum* and *Carpentaria* spec.).

Remarks. — Comparison of our figures with those of *Tridentata* spec. by Hirohito (1974, fig. 11) shows almost complete conformity, moreover the measurements are nearly identical. We refrain from synonymizing the two species for the following reasons. First of all Hirohito mentions a small adcauline hydrothecal tooth, absolutely invisible in the specimens of *S. malayensis* at our disposal. Secondly the anatomical structure of *Tridentata* spec. is unknown, particularly the presence or absence of a blind sac could not be ascertained. Hirohito has compared his species with *Sertularia stookeyi* Nutting, 1904 (: 59, pl. 5 figs. 6-7), an Atlantic species of uncertain relationship, but certainly near to *Sertularia distans* (Lamouroux, 1816).

The genus *Tridentata* Stechow, 1920, was split off from *Sertularia* Linnaeus, 1758 (type *Sertularia cupressina* Linnaeus, 1758) because of the presence of a small adcauline hydrothecal tooth and the strictly opposite arrangement of the hydrothecae. In *Sertularia* such an adcauline tooth is (usually) absent and in several species the arrangement of the hydrothecae is sub-opposite rather than opposite. Both characters, however, are subjected to a considerable degree of variation. There are species without adcauline tooth and strictly opposite hydrothecae and species with adcauline tooth and sub-opposite arrangement of the hydrothecae. There are, however, many species that occupy an intermediate position and we hesitate therefore to attach to those characters the value given them by Stechow. For the present we definitely prefer to sink *Tridentata* Stechow, 1920 (type *Sertularia perpusilla* Stechow, 1919) into the synonymy of *Sertularia* Linnaeus, 1758.

The presence of an adcauline hydrothecal tooth may be accentuated by the upturned condition of the extreme end of the adcauline thecal wall.

Sertularia turbinata (Lamouroux, 1816) (figs. 26, 27)

Dynamena turbinata Lamouroux, 1816: 186.

Sertularia turbinata — Bale, 1913: 124, pl. 12 fig. 6; Billard, 1925: 177, fig. 34; Billard, 1931: 248; Leloup, 1935: 50; Leloup, 1937: 106, 117; Vannucci, 1951a: 108, 109, 113, 117; Millard, 1958: 197, fig. 8b; Vervoort, 1959: 275, figs. 35, 36; Yamada, 1959: 79; Redier, 1971: 143; Millard & Bouillon, 1973: 76, fig. 9H; Millard & Bouillon, 1974: 8.

Tridentata turbinata — Stechow, 1923: 15.

Sertularia borneensis Billard, 1925: 171, fig. 31.

Localities. — Moorea, no. 11. Some unbranched, about 8 mm high stems, rising from stolon creeping on Bryozoa. No gonothecae.

Moorea, no. 31. Several about 10 mm high, unbranched stems, rising from stolon creeping on Bryozoa. No gonothecae.

Description. — The monosiphonic stems rise from a stolon with circular cross-section. The basal part of the stem is of variable length, bears no hydrothecae and terminates in an oblique joint, with which it articulates with the first hydrothecate internode. The remainder of the stem is broken up into internodes separated by weakly indicated, straight nodes just above each hydrothecal pair. There are no septa, the position of the nodes being indicated by peridermal constrictions (fig. 26a). Hydrothecae borne on the frontal part of the stems, pointing laterally and very slightly forward, arranged in strictly opposite pairs, one pair to each internode. Hydrotheca with distinctly swollen

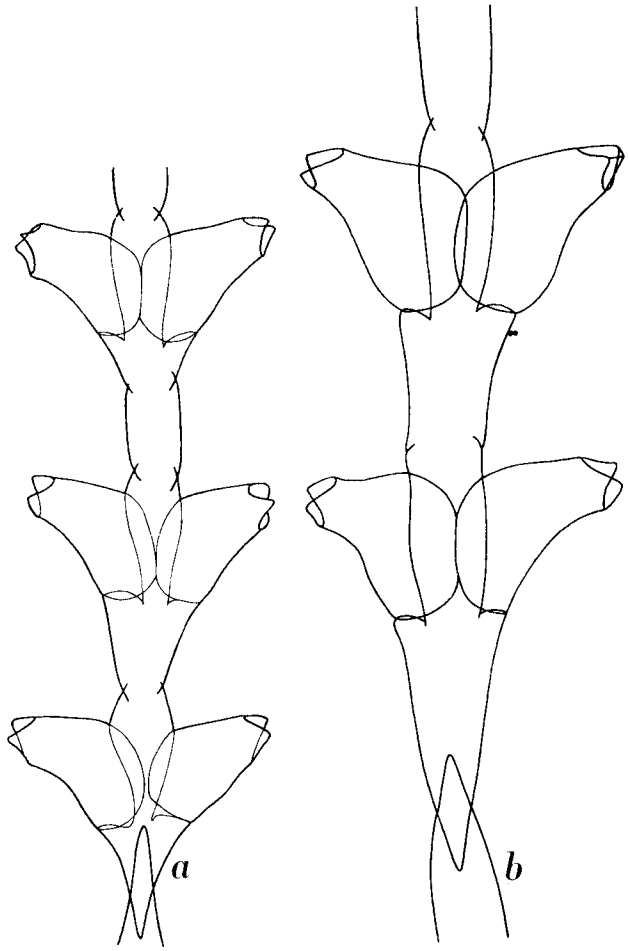

Fig. 26. *Sertularella turbinata* (Lamouroux). a, Moorea, no. 31, basal part of stem, frontal view; b, Siboga Expedition, Sta. 80, holotype of *S. borneensis* Billard, basal part of stem, frontal view. a, b, × 75.

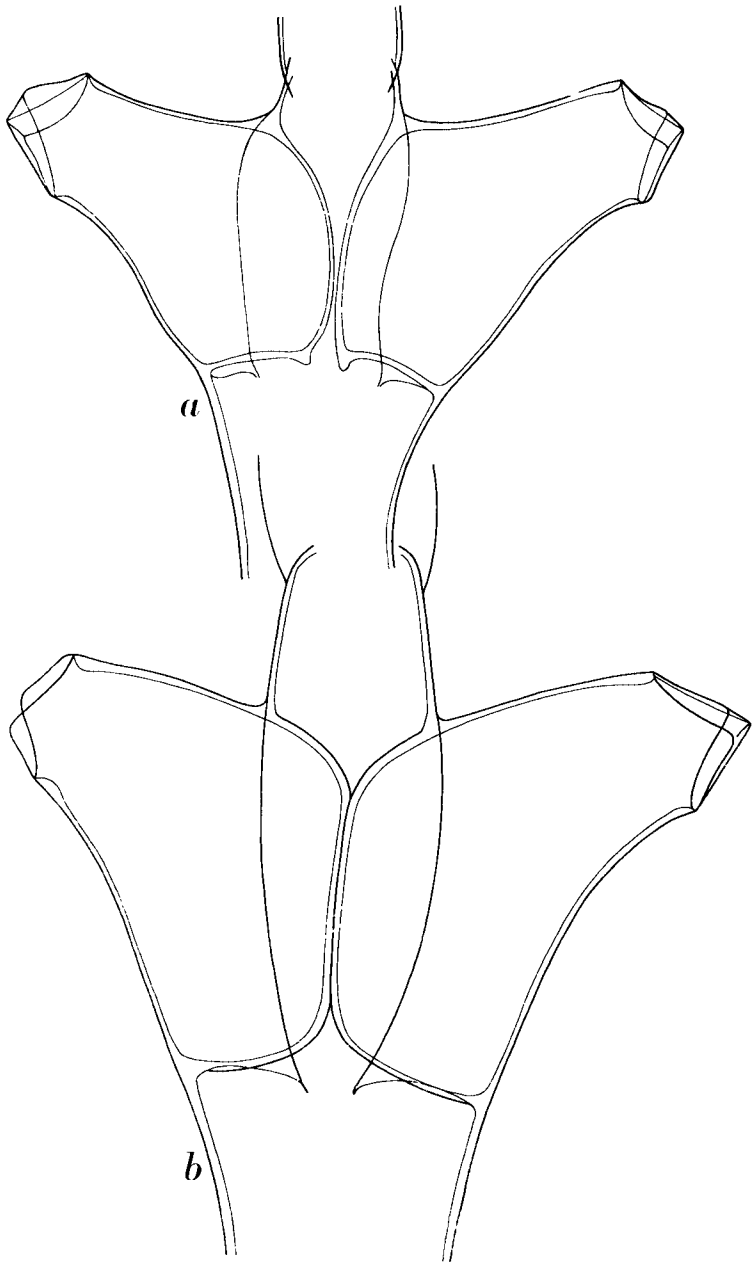

Fig. 27. *Sertularia turbinata* (Lamouroux). a, Moorea, no. 31, pair of hydrothecae, frontal view; b, Siboga Expedition, Sta. 80, holotype of *S. borneensis* Billard, pair of hydrothecae, frontal view. a, b, × 180.

distal portion, curving laterally and narrowing slightly towards the orifice. On the frontal part of the colony each pair is coalescent with a portion of the adcauline walls; the distinctly longer free adcauline wall is almost straight. Abcauline wall concave, at times with a fairly distinct bend, but without any trace of peridermal ridge or internal peridermal thickening. Abcauline thecal wall slightly thickened at the orifice. Hydrothecal aperture with two lateral, blunt and little prominent teeth, and a small adcauline tooth, best visible in lateral view by the distinct peridermal swelling at that place (fig. 27a). Closing apparatus hyaline and collapsible, composed of a roof-shaped adcauline plate and a smaller abcauline plate. The hydrothecae of a pair are separated by part of the stem on the dorsal aspect. Periderm of the whole colony perfectly transparent, very slightly yellowish.

No gonothecae have been observed.

Remarks. — The present material differs from the usual accounts of this species, e.g., the material from the Gulf of Guinea described previously (Vervoort, 1959), by the absence of an intrathecal, abcauline ridge or ledge, or peridermal fold on the abcauline hydrothecal wall. We are inclined to ascribe this difference exclusively to the young state of the present material; the colonies obviously are in development, as is demonstrated by the apical hydrothecae, that though completely formed contain a developing hydranth. We have compared the Moorea material with part of the holotype of *Sertularia borneensis* Billard, 1924, from the Siboga collection (Sta. 80, Borneo Bank, 2°25'S 117°43'E), which we find slightly larger in all details, but in such perfect agreement with the present material that there can be no doubt about their conspecificity (figs. 26b, 27b). We have decided, therefore, to sink *S. borneensis* into the synonymy of *S. turbinata* Lamouroux. The principal point of difference that we have been able to lift from Billard's descriptions of both species (Billard, 1925, also described *S. turbinata* from the Siboga collection) is the absence of the aforementioned intrathecal, abcauline ledge or ridge, a character highly influenced by the age of the specimen.

Measurements (in microns). —

	Moorea, no. 31	Siboga Sta. 80
Stem, distance between pairs of hydrothecae	245-270	365-380
idem, diameter at node	70-80	95-110
Hydrothecae, length abcauline wall	255-260	295-325
idem, length adnate part adcauline wall	120-135	160-175
idem, length free part adcauline wall	200-215	245-260
idem, diameter at margin	70-80	95-110
idem, maximal diameter across pair	475-500	460-515

Ecology. — *S. turbinata* is of infrequent occurrence at Tiahura, where it was chiefly found at the upper part of the outer slope, viz.:

a. Under an overhang of the furrowed platform at 2 m depth, where it was associated with Corallinaceae and red algae, several species of hydroids (*Gymnangium hians, Antennella secundaria, Synthecium samauense*), bryozoans, sessile foraminiferans (*Carpentaria monticularis, Homotrema rubrum*), some ascidians, a very common species of *Tubastraea* and the hydrocoral *Distichopora violacea.*

b. In an anfractuosity of the non-furrowed platform at 4 to 5 m depth.

Remarks. — The accurate geographical distribution of this species cannot be given because of the much confused synonymy. It is widely distributed, however, over the tropical and subtropical parts of Atlantic, Indian and Pacific Oceans. The occurrence of this species in French Polynesia fits very well into this general picture. Its presence there has previously been recorded by Redier (1971), who described the species from the neighbouring atoll Mururoa, Tuamotu Archipelago.

Antennella secundaria (Gmelin, 1789) (fig. 28)

Sertularia secundaria Gmelin, 1789: 3854.
Plumularia secundaria — Pictet, 1893: 53, pl. 2 fig. 46; Blackburn, 1938: 316.
Schizotricha secundaria — Blackburn, 1942: 108.
Antenella secundaria — Stechow, 1923a: 222; Broch, 1933: 19, fig. 17; Leloup, 1934a: 15; Leloup, 1935: 53; Leloup, 1937a: 5, 45; Leloup, 1938: 18, fig. 13; Yamada, 1959: 7; Hirohito, 1969: 24.
Antennella secundaria — Stechow, 1909: 84; Billard, 1913: 8, fig. 1, pl. 1 figs. 1-3; Stechow, 1913: 89; Jäderholm, 1919: 20; Bedot, 1921: 9; Stechow & Müller, 1923: 473; Leloup, 1940: 21; Millard, 1958: 199; Yamada, 1958: 59; Pennycuik, 1959: 176, pl. 3 figs 4, 5; Millard & Bouillon, 1973: 77, fig. 10E; Hirohito, 1974: 28, fig. 12; Millard & Bouillon, 1974: 8.
Plumularia dubiaformis Mulder & Trebilcock, 1910: 119, pl. 2 fig. 7.
Antennella secundaria dubiaformis — Watson, 1973: 183, figs. 45, 46.

Localities. — Moorea, no. 10. Several unbranched, up to 10 mm high colonies without gonothecae.
Moorea, no. 29. Two branched, 10 to 15 mm high colonies, no gonothecae.
Moorea, no. 32. Several unbranched hydrocauli, about 8 mm high. No gonothecae.
Moorea, no. 45A. A single, 20 mm high, branched specimen. No gonothecae.
Takapoto, no. 58. A large number of 15-20 mm high, branched colonies, some with a few gonothecae.
Takapoto, no. 64. A large number of 15 mm high, branched colonies with a single empty gonotheca.

Description of the unbranched variety (mainly based on the specimens from Moorea, no. 10 and 32). — The stems rise from a thin stolon creeping on algae and Bryozoa, having some athecate internodes with nematothecae, before breaking up into regular thecate and athecate internodes. Each thecate

internode basally has an oblique joint and apically a straight septum; the athecate internodes basally have a straight septum and apically the oblique joint. The straight septa at times are indistinct or absent. The thecate internode bears a large, cylindrical hydrotheca, with straight, thin adcauline and very slightly convex, thickened abcauline wall (fig. 28a). The hydrothecae diverge from the internode at an angle of about 30°; the aperture is perfectly

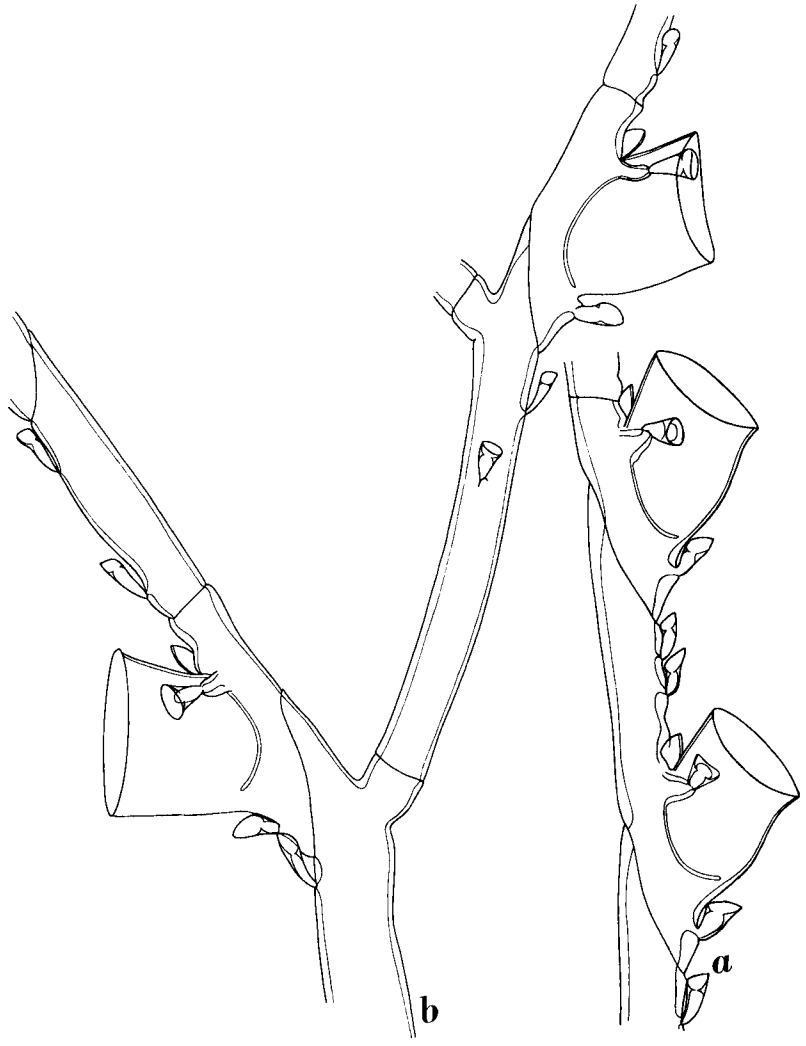

Fig. 28. *Antennella secundaria* (Gmelin). a, part of stem of unbranched variety, Moorea, no. 10, lateral view; b, part of branched variety, Moorea, no. 29, lateral view. a, b, × 135.

circular. Each hydrotheca has a basal, apparently immovable nematotheca, a pair of lateral nematothecae and a reduced nematotheca in the axil formed by adcauline thecal wall and internode. The unpaired basal nematotheca is distinctly two-chambered; the apical chamber is shallow. The flanking nematothecae are comparatively short, placed on distinct apophyses, have a distinct diaphragm that divides the theca into two chambers, and do not reach the hydrothecal aperture. The reduced, axillar nematotheca is more or less squamiform and distinctly visible. There are two movable nematothecae on the athecate internode that, though slightly smaller, have the same appearance as the basal nematothecae on the hydrothecate internode. All hydrothecae and unpaired nematothecae occur on the frontal side of the stem.

No gonothecae have been observed.

Measurements (in microns). —

	Moorea, no. 10
Hydrothecate internode, maximal length	345-360
idem, diameter	80-85
Intermediate internode, maximal length	370-380
idem, diameter	90-95
Hydrotheca, length abcauline wall	155-165
idem, length fused part adcauline wall	145-155
idem, length free part adcauline wall	100-110
idem, diameter at aperture	175-190
Lateral nematothecae, length	40-55
idem, diameter at aperture	45-50

Description of the branched specimen from Moorea, no. 29. — The material consists of two colonies, both composed of a long basal internode without hydrothecae but bearing a variable number of nematothecae with an oblique terminal joint and a lateral apophysis. The apophysis supports a similar but shorter athecate internode, also bearing nematothecae, with a terminal oblique joint and an apophysis. This apophysis in one of the specimens bears no further internodes; in the other specimen it supports another athecate internode and a further series of thecate and athecate internodes. The structure of the colonies appears from fig. 28b.

The thecate internodes are short and bear a large, slightly campanulate hydrotheca of which the aperture is slightly everted. The abcauline wall is slightly convex, the adcauline wall is straight. The basal nematotheca is large and immovable; behind the adcauline hydrothecal wall there is a reduced, squamiform nematotheca. The lateral nematothecae are placed on fairly long

apophyses; they are conical, two-chambered structures, usually slightly surpassing the hydrothecal margin. Thecate and athecate internodes separated by oblique and straight septa; the straight septa may be very obscure. Athecate internodes with two movable, two-chambered nematothecae. All unpaired nematothecae and the hydrothecae are borne on the same aspect of the series of articles.

Measurements (in microns). —

	Moorea, no. 29
Thecate internodes, length	350-440
idem, diameter	75-80
Athecate internodes, length	470-550
idem, diameter	70-75
Hydrotheca, length abcauline wall	190-220
idem, length fused part adcauline wall	180-190
idem, length free part adcauline wall	120-130
idem, diameter	240-265
Lateral nematothecae, length	80-85
idem, diameter at aperture	55-60

The gonothecae, occurring in the (branched) Takapoto material, are elongated oval bodies with a short, curved, more a less excentric pedicel, bearing a pair of two-chambered nematothecae; they are attached to the thecate internode just under the hydrotheca. The mature gonotheca is 550 microns long and has a maximal diameter of 300 microns. They have a large, circular lid at the apex.

Ecology. — *Antennella secundaria* is of infrequent occurrence. At Tiahura it is mainly found at the upper part of the outer slope, between 1.5 and 5 m depth, as well as at the base of the slope, at 25 m depth. As all other hydroids found there, it lives under sciophilous conditions, prefering overhangs or dark cavities.

At Takapoto the species appears to be rare; it has only been found in cavities of the spur-and-groove zone near the jetty, between 7 and 10 m depth.

Remarks. — The Moorea and Takapoto material agrees with Indo-Pacific material described e.g., by Millard & Bouillon (1973: 77, fig. 10E) and Hirohito (1974: 28, fig. 12). The number of nematothecae on the athecate internodes, at least in the specimens examined, is two. We entirely agree with Hirohito that no specific of even subspecific value should be attached to the number of nematothecae on the athecate internodes of the stems, the number varying normally between one and two, even within the same colony. Con-

sequently there is no reason to retain *Plumularia dubiaformis* Mulder & Trebilcock, 1910, at subspecific level; this species should be sunk completely into the synonymy of *Antennella secundaria* (Gmelin, 1789).

Halopteris constricta Totton, 1930 (figs. 29, 30a, b)

Halopteris constricta Totton, 1930: 217, fig. 56a; Millard, 1957: 227, fig. 14a; Ralph, 1961b: 43, fig. 6a-e; Plante, 1965: 259, 307; Berrisford, 1969: 394; Day, Field & Penrith, 1970: 13.

Localities. — Moorea, no. 17. Several small, pinnate colonies rising from a stolon creeping on algae, 4-5 mm high. No gonothecae.

Moorea, no. 40A. About 15 stems, 5 to 10 mm high, on *Sertularella robusta* (Coughtrey) and Bryozoa. Some stems covered with *Hebella parasitica* (Ciamician). No gonothecae.

Description. — The monosiphonic stems arise from a flattened stolon creeping on algae, hydroids and Bryozoa. Stolonial tube with some internal

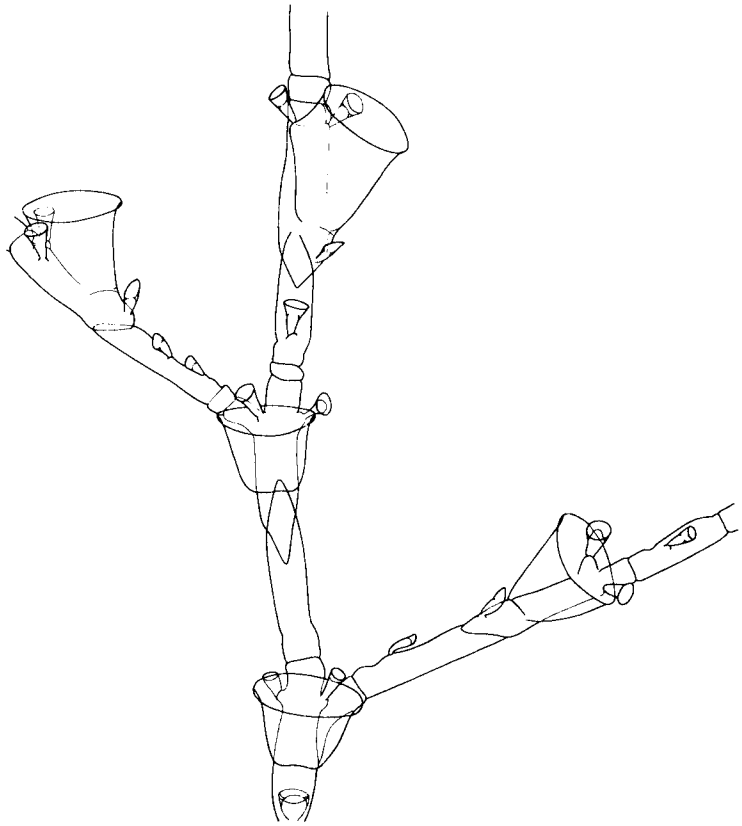

Fig. 29. *Halopteris constricta* Totton, Moorea, no. 17, part of stem with two side-branches. × 90.

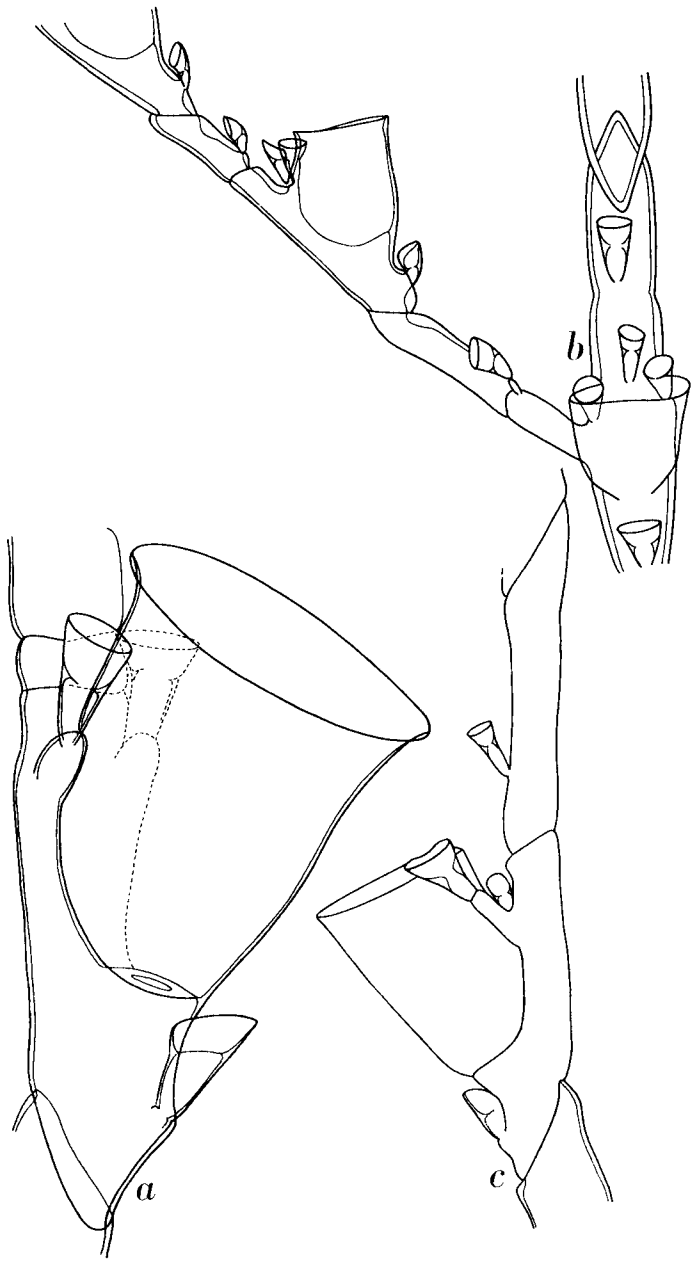

Fig. 30. a, b, *Halopteris constricta* Totton; a, Moorea no. 17, thecate internode from side-branch (hydroclade), lateral view; b, stem internode and side-branch from holotype slide, British Museum (Natural History), no. 1929.10.28.183. c, *Halopteris buskii* (Bale), Christmas Island, British Museum (Natural History), no. 1964.8.7.197, thecate and athecate internode from branch, lateral view. a, × 295; b, × 175; c, × 120.

perisarcal ribs or rings and bearing some two-chambered nematothecae. Hydrocauli (stems) erect, either with some branches (primary hydrocladia), or without hydrocladia, broken up into internodes. The basal internodes are athecate and bear some frontal, two-chambered nematothecae; there are two or three of such internodes, separated by transverse septa, with the exception of the distal athecate internode, that bears an oblique septum which separates it from the thecate internode. Each thecate internode is followed by a short athecate internode (proximal septum transverse, distal transverse) and a long athecate internode (proximal septum transverse, distal septum oblique). The hydrocladia are borne on distinct apophyses on the thecate stem internodes, occurring behind the hydrotheca at the level of the attachment of the flanking nematothecae and, at least in our specimens, pointing alternately left and right (fig. 29). There are no opposite hydroclades. The hydroclades are as in the main stem, being composed of a regular succession of athecate and thecate internodes; the first internodes being a short athecate and a long athecate internode; the development of the septa is as in the main stem. The division between short and long athecate internodes may be quite obscure, sometimes indicate by no more than a peridermal constriction. The oblique septa are always very distinct. The stem apophyses project slightly above the level of the hydrotheca. Short athecate internodes without nematothecae; long athecate internodes invariably with two frontal, two-chambered nematothecae. Hydrotheca (fig. 30a) campanulate; adcauline wall straight; abcauline wall slightly below the margin. Hydrothecal margin slightly but distinctly everted, circular. The part of the internode projecting above the hydrotheca of variable length; usually slightly surpassing the hydrothecal margin. Each thecate internode has an (apparently immovable) proximal nematotheca with scooped aperture and distinct septum. Lateral (flanking) nematothecae of the usual, conical shape, with circular, slightly everted margin and distinct septum, usually projecting slightly above the hydrothecal margin, placed on small though distinct apophyses. The nematothecae on the athecate internodes identical in shape to the lateral nematothecae, though usually slightly smaller. There is no difference between hydrothecae borne on stem or hydroclades. Careful observation of the nearly hyaline colonies under high power has convinced me that no reduced unpaired nematotheca occurs behind the adcauline hydrothecal wall and that no nematotheca occurs in the axil of the hydroclaudia. Such an axillar nematotheca is specifically mentioned by Ralph (1961, p. 43: "a single nematotheca in the axil of each hydrocladium"). We are certain that no such nematotheca occurs in our specimens, the nematotheca which can be observed there is one of the slightly displaced flanking hydrotheca of the thecate stem internode. No gonothecae have been observed.

Measurements (in micron). —

	Moorea, no. 17
Stem, length thecate internodes	245-255
idem, diameter	65-80
idem, length short athecate internodes	34-45
idem, length long athecate internodes	210-245
Hydroclades, length thecate internodes	200-240
idem, diameter	40-45
idem, length short athecate internodes	20-30
idem, length long athecate internodes	220-260
Hydrotheca, length abcauline wall	120-155
idem, length fused part adcauline wall	100-110
idem, length free part adcauline wall	80-90
idem, diameter at margin	150-165
Lateral nematotheca, length	80-100
idem, diameter at aperture	40-45
Unpaired proximal nematotheca, length	50-55
idem, diameter at margin	45-50

Ecology. — This is a species of infrequent occurrence at Tiahura, where it mainly occurs at shallow depths, either in dark cavities between corals of the reef flat or under overhangs of the furrowed platform at 2 m depth.

Remarks. — This species has been described in detail by Ralph (1961: 43, fig. 6 a-e) and to some extent by Totton (1930: 217, fig. 56a) and Millard (1957: 227, fig. 14a). We have compared our material with the detailed description by Ralph; the only points of difference being the absence of opposite hydroclades in the lower parts of the colony, the absence of secundary hydrocladia, and the absence of an axillary nematotheca at the hydrocladial apophysis. The differences in structure of the colony may be due to the apparent youth of the present material; the slightly displaced flanking nematotheca of a stem internode with apophysis may have been mistaken by Ralph for an axillar nematotheca.

We have compared our material with the type material of this species in the British Museum (Natural History). This material consists of a holotype slide (1929.10.28.183), a paratype slide (29.10.28.184, schizoparatype) and a bottle of material marked "paratype". The resemblance between the holotype and the Moorea material is generally great (fig. 30b); in the type, however, the hydrothecal periderm is thicker. In the shape of the hydrotheca, structure of stem and hydroclades there is complete conformity. In the holotype there is no reduced, unpaired nematotheca behind the hydrotheca and no axillar nematotheca in the axil formed by apophysis and stem internode. The difference in development of the periderm between the Moorea material and

the holotype can be explained by the apparent juvenile condition of the Moorea colonies.

The distribution of the species in the Indo-Pacific is somewhat disjunct. It has been described from the New Zealand area by both Totton (1930) and Ralph (1961). Millard (1957) described specimens from False Bay, South Africa; Plante (1965) mentions specimens from the Madagascar area. Its vertical distribution seems to extend from the surface (attached to floating algae) to at least 40 fms depth.

Halopteris buskii (Bale, 1884) (figs. 30c, 31)

Plumularia Buskii Bale, 1884: 125, pl. 10 fig. 3, pl. 19 figs. 34, 35.
Plumularia buskii — Bale, 1914: 28; Bale, 1915: 296; Briggs, 1918: 34, 42; Hodgson, 1950: 45, fig. 75.
Plumularia buski — Billard, 1913: 21, fig. 11, pl. 1 fig. 15; Redier, 1966: 90, pl. 2 figs. 1, 3, pl. 3 fig. 1.
Schizotricha buski Blackburn, 1942: 107.
Heterotheca buski — Stechow, 1921: 260; Hirohito, 1974: 30, fig. 14.
Halopteris buski — Rees & Thursfield, 1965: 160; Watson, 1973: 184.

Localities. — Moorea, no. 21. A large number of pinnate colonies rising from a stolon creeping on algae, height about 20 mm. Many female gonothecae are present.
Moorea, no. 42. A very large number of 10 to 25 mm high, pinnate colonies. No gonothecae.
Moorea, no. 45. Nine pinnate stems of up to 20 mm height. No gonothecae.
Takapoto, no. 52. About 15 stems of 20 mm height and some fragments. Many gonothecae are present.
Takapoto, no. 58. A single 15 mm high, pinnate colony on Bryozoa. No gonothecae.
Takapoto, no. 66. Various badly presented specimens of about 15 mm height. A single empty gonotheca present.

Description (mainly based on the material from Moorea, no. 21). — The stems rise from an irregularly wrinkled tube, firmly attached to the substratum. Stems monosiphonic, basally with some athecate segments or internodes, separated by transverse septa. The thecate portion of the stem is separated from a basal portion by a very flexible oblique joint; occasionally two of such oblique joints are present, separated by an athecate internode. Thecate stem portion divided into internodes in the higher parts of the stem only; basally the division into internodes becomes obscure and it disappears altogether in the lower parts of the thecate stem. Stem internodes, if separated, with oblique septa, each with a hydrotheca, an apophysis and several nematothecae (fig. 31a). The hydrothecae do not differ from those observed on the hydroclades and will be described below. Each hydrotheca is flanked by a pair of slender, more or less trumpet-shaped, two-chambered nematothecae with deeply scooped aperture, placed on conspicuous socles beside the hydrotheca. Their varied position suggests that they are quite movable; their socle is closely appressed to the hydrothecal border and just fails to

reach the aperture; the lateral nematothecae project a considerable distance beyond that margin. In the axil of adcauline wall and internode there is a much smaller but distinctly two-chambered nematotheca; this nematotheca, as far as we have been able to observe, is never paired. In addition the basal part of the internode bears an unpaired, immovable, two-chambered, deeply gutter-shaped nematotheca, a considerable distance under the hydrothecal base. The

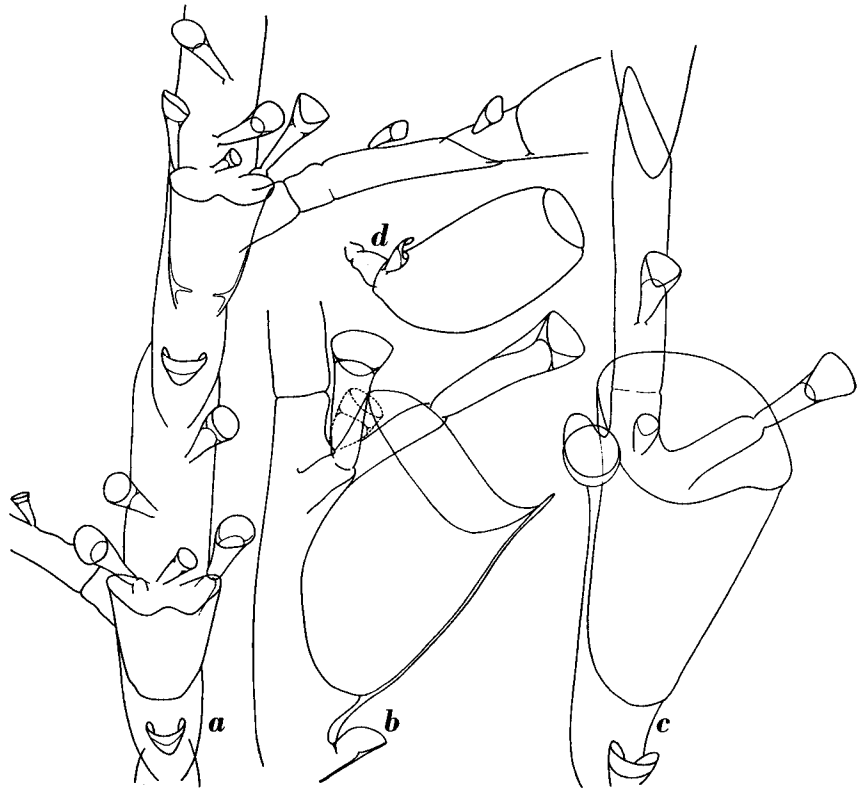

Fig. 31. *Halopteris buskii* (Bale), Moorea, no. 21. a, part of stem with two hydroclades; b, thecate internode from hydroclade, lateral view; c, idem, oblique view; d, gonotheca. a, × 110; b, c, × 175; d, × 70.

distal part of the internode bears two slender, two-chambered nemato-thecae with scooped margin, to left and right of the mesial plane. The hydro-thecae of the stem and the unpaired basal nematotheca, as well as the un-paired nematotheca in the hydrothecal axil, are placed in the mesial plane. In the lower parts of de colony the stem hydrothecae may be slightly displaced. The apophyses point alternately left and right and slightly surpass the hydrothecal border; there is no nematotheca in the axil. The hydrocladia

alternately point left and right and are gracefully curved, bearing two to five hydrothecae; they are broken up into athecate and thecate articles. Each hydroclade begins with a short internode, shorter than the apophysis, with transverse septa and no nematothecae, followed by an athecate internode with a single two-chambered nematotheca at about half its length, separated from the thecate internode by an oblique septum. The thecate internodes of the hydroclade are separated by slightly shorter athecate internodes, basal septum transverse, apical septum oblique, each bearing a single nematotheca. The thecate internodes, as on the stem, bear a hydrotheca, a pair of flanking nematotheca, an unpaired basal nematotheca and a reduced axillar nematotheca.

The hydrotheca can best be described as deeply campanulate, with slightly convex abcauline margin, slightly constricted just below the hydrothecal aperture, and with the adcauline margin free for about one fourth of its length. Depth of the hydrotheca and development of the hydrothecal margin variable, even in the same colony. Usually the hydrothecae are fairly deep, especially in the younger parts of the colony; they seem to broaden with increasing age. The hydrothecal margin may be perfectly circular, but more commonly it is slightly sinuated laterally so as to produce the effect of a rounded median tooth (fig. 31b, c). In lateral position of such thecae a distinct tooth may appear to be present, this, however, is certainly not the case, as observation of the hydrothecae in oblique position (fig. 31c) distinctly shows. It must also be pointed out that, even if a rounded elevation is present, the cross section of the hydrothecae just under its margin is circular; the hydrotheca is definitely unkeeled.

Gonothecae exclusively occur on the stems; all apparently are female. They are more or less pear-shaped (cf. fig. 31d), attached to the internodes between hydrothecal base and unpaired, basal nematotheca by means of a short, two- of three-jointed stalk. They are closed by a circular lid and contain a single egg.

Measurements (in microns). —

	Moorea, no. 21
Stem, diameter at base	150-170
idem, length of internodes in upper part	475-550
idem, diameter (of internodes)	100-125
Hydrocladia, length of short athecate internodes	45-55
idem, length long athecate internodes	210-250
idem, length thecate internodes	320-335
Hydrotheca, length abcauline wall	200-220
idem, length fused part adcauline wall	135-150
idem, length free part adcauline wall	40-55

Flanking nematothecae, length	85-95
idem, diameter at aperture	45-50
Female gonotheca, total length	400-420
idem, diameter	230-250

Ecology. — *Halopteris buskii* is a very common species at the lower part of the outer slope at Tiahura, between 10 and 25 m depth. Its maximal occurrence is at about 15 m depths, where it is found under overhangs and in micro-cavities of the spur-and-groove zone, characterized by a community composed of red algae, sponges, incrusting bryozoans and some didemnid ascidians. The hydroids *Sertularella robusta* and *S. tongensis* were also observed at such localities.

H. buskii also occurs abundantly at Takapoto, where it is found in shadowed localities of the spur-and-groove zone and at the lower sloping platform, down to a depth of 25 m.

Remarks. — In identifying this material as *Halopteris buskii* (Bale) we have been greatly influenced by Billard's (1913: 21) remarks concerning the variability of *H. buskii* in the development of the internodes, the number of nematothecae and the shape of the hydrotheca. Comparison of the available descriptions referring to this species clearly shows the enormous variability of this species over the extent of its wide area of distribution. In the condition of the hydrothecal border my specimens approach those described by Mulder & Trebilcock (1970: 121, pl. 3 figs. 1, 1a, 2) as *Plumularia alternatella* from Barwon Creek, Australia. This species is synonymized by Billard with *H. buskii.*

This species has recently been admirably redescribed and figured by Hirohito (1974: 30, fig. 14). The Moorea material differs from this very lucid account by the greater length of both apophyses and flanking nematothecae, and the fact that in the Bonin material a complete pair of (reduced) nematothecae occurs behind the hydrothecal adcauline wall. Additional material described by Hirohito (1974) from Sagami Bay also bears gonothecae on the hydroclades.

We should like to comment briefly on the use of the generic name *Heterotheca* Stechow, 1921, for this species by Hirohito. This genus *Heterotheca* was created by Stechow (1921: 260) to accomodate *Plumularia sulcata* Lamarck, 1816 (= *P. aglaophenoides* Bale, 1884), *P. campanula* Busk, 1852, *P. buskii* Bale, 1884 and *P. zygocladia* Bale, 1914. *P. sulcata* is explicitly indicated as its type. The grounds for this action are only indistinctly given in Stechow's 1921 paper, but can be lifted from a later publication (1923a: 216, 217). The condition of the nematothecae, in particular the condition of the mesial nematotheca on the basal part of the internode,

induced Stechow to discriminate four subfamilies of Plumulariidae, only two of which are of interest to our present discussion, viz. the Plumulariinae and the Acladiinae; the former with a movable, two-chambered mesial nematotheca and the latter with fixed mesial nematotheca, in both cases separated from the hydrothecal abcauline wall. In the first subfamily Stechow distinguishes between *Thecocaulus* Bale, 1915, and *Plumularia* Lamarck, 1816, on account of presence or absence of cauline hydrothecae; in the second he does so between *Heterotheca* Stechow, 1921, and *Heteroplon* Allman, 1877. In a later publication (Stechow, 1925: 491, 492) he is forced to withdraw the distinction made between Plumulariinae and Acladiinae on account of the varied condition of the mesial nematotheca in both Plumulariinae and Acladiinae; *Heteroplon* is considered a subgenus of *Plumularia, Heterotheca* a subgenus of *Schizotricha.* Both *Schizotricha* Allman, 1883, and *Halopteris* Allman, 1877, have been redefined by Totton, 1930 (: 299 and : 217, respectively) and types have been indicated. It seems quite clear now that *Plumularia buskii* Bale belongs in *Halopteris* where it should stand as *H. buskii* (Bale, 1914). In this genus there is no need for a subgenus *Heterotheca:* the condition of the mesial nematotheca is variable in the various species of *Halopteris* and, moreover, even Stechow thinks this to be of secundary importance; the bifurcation of hydroclades is an occasional and certainly not a regular condition (as it is in *Schizotricha*) and the presence of cauline hydrothecae is already a generic character of *Halopteris.* It seems best therefore to sink *Heterotheca* into the synonymy of *Halopteris* and not to revive its use.

H. buskii has a very wide distribution in tropical and subtropical parts of the Indo-Pacific, being recorded from Australian waters (Bale, 1884, 1914, 1915; Briggs, 1918; Hodgson, 1950), the Malay Archipelago (Billard, 1913), Gulf of Mannaar, Bay of Bengal (Thornely, 1904), Christmas Island (Ritchie, 1910a), Sagami Bay (Stechow, 1913; Hirohito, 1974), the Bonin Islands (Hirohito, 1974) and New Caledonia (Redier, 1966). The present records of this species fit into the general picture of its distribution.

Plumularia setacea (Linnaeus, 1758) (fig. 32)

Sertularia setacea Linnaeus, 1758: 813.

Plumularia setacea — Ritchie, 1911: 851; Billard, 1913: 32, fig. 24; Bedot, 1921: 10; Stechow, 1923: 17; Bale, 1924: 252, fig. 11; Trebilcock, 1928: 24; Billard, 1931: 247; Leloup, 1937a: 5, 46; Vervoort, 1942: 300; Vervoort, 1946: 175, figs. 27f, 73; Vannucci, 1946: 579, pl. 5 fig. 51; Leloup, 1947: 33, fig. 25; Hodgson, 1950: 43, fig. 73; Yamada, 1955: 4, pl. 2 figs. 1, 2; Millard, 1957: 232; Millard, 1958: 212; Millard, 1959: 252; Yamada, 1959: 78; Ralph, 1961: 236; Yamada, 1965: 362; Ralph, 1966: 100-102, fig. 1; Schmidt, 1972: 41, 43; Leloup, 1974: 49, fig. 43; Millard & Bouillon, 1974: 9.

Localities. — Moorea, no. 27. Several sterile, 5 to 8 mm high colonies rising from a stolon creeping on coral fragments. No gonothecae.

Moorea, no. 37. One colony of 10 mm height and a spread of 6 mm. No gonothecae.

Description. — The condition of the stolon could not be observed; two detached stems have been studied. These are completely broken up into internodes, gradually lengthening towards the apex, at the base fairly thick and with strong, yellowish periderm, at the apex with thin, hyaline periderm (fig. 32a). The stem internodes have an apophysis each, found almost at the end and alternately pointing left and right. The apophyses support the hydrocladia and have a movable, two-chambered nematotheca in the axil. A similar nematotheca occurs on the basal fourth of the internode on the opposite side of the apophysis. The hydroclades begin with a short, athecate internode, separated from the apophysis by means of a transverse septum and from the rest of the hydroclade by means of an oblique septum. The rest of the hydroclade is composed of a regular sequence of thecate and athecate internodes, the thecate proximally with an oblique and distally with a transverse node, the athecate internodes with proximally a transverse and distally an oblique septum. There is a distinct internal peridermal node in the first athecate internode of each hydroclade and the indication of such a node at the base of each following thecate or athecate internode. The hydroclades maximally have four to five hydrothecae. Hydrothecae cup-shaped, with straight abcauline wall, fused with the internode for the whole length of the adcauline wall and with smooth, circular aperture. A pair of trumpet-shaped flanking nematothecae occurs on a pair of very small apophyses to left and right sides of the end of the adcauline hydrothecal wall, projecting far above the hydrothecal border. The aperture of these nematothecae is perfectly circular and not scooped out. A smaller, also two-chambered, conical nematotheca occurs on the proximal part of the thecate and athecate internodes (fig. 32b).

No gonothecae have been observed.

Measurements (in microns). —

	Moorea, no. 27
Stem internodes, length	215-325
idem, diameter at base of stem	120-125
idem, diameter at apex of stem	50-55
Hydrocladia, length of short athecate internodes	50-55
idem, length of long athecate internodes	150-155
idem, length thecate internode	295-315
idem, diameter	40-47
Hydrotheca, length abcauline wall	60-70
idem, diameter at aperture	65-70
idem, flanking nematothecae, length	40-45
idem, diameter at aperture	20-25

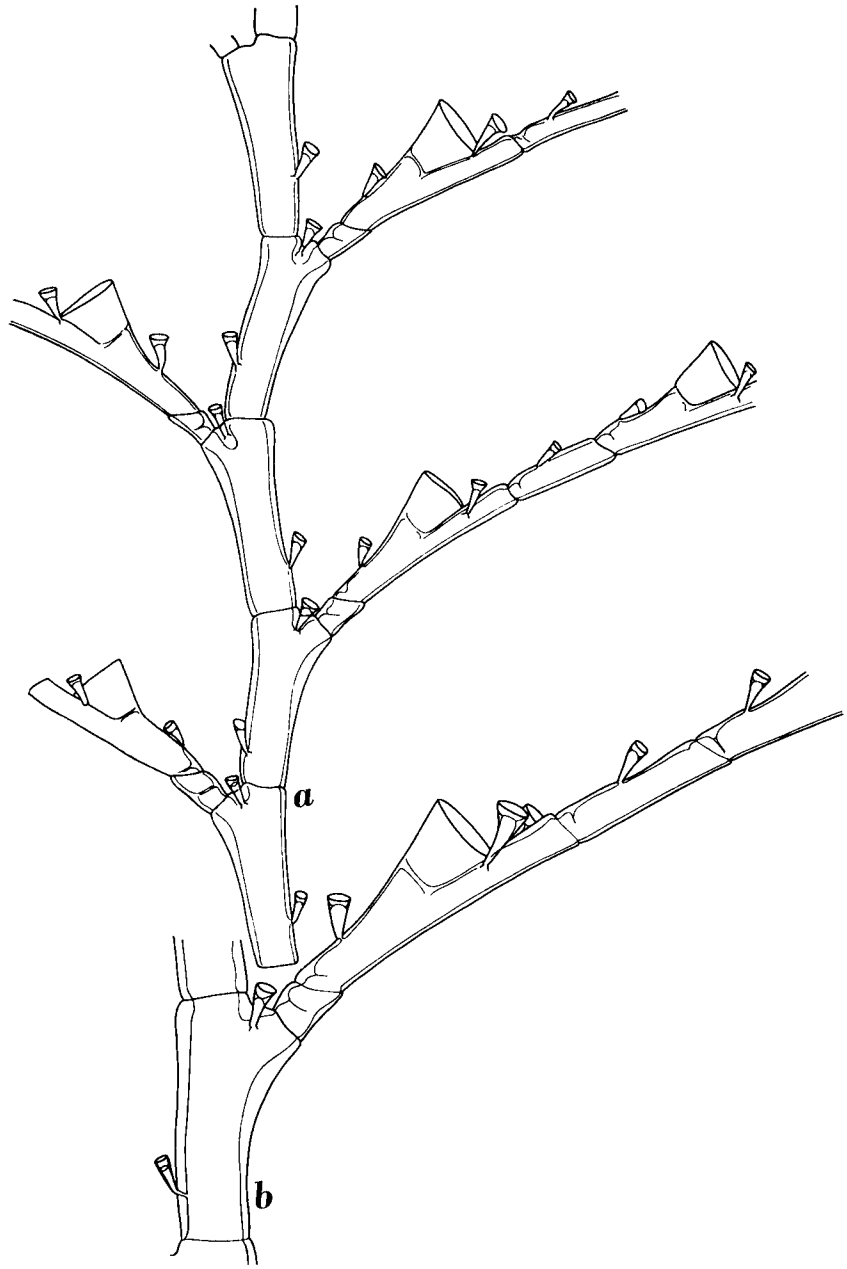

Fig. 32. *Plumularia setacea* (Linnaeus), Moorea, no. 27. a, part of stem with hydroclades; b, stem internode with hydroclade. a, × 90; b, × 135.

Ecology. — This species is of fairly common occurrence at Tiahura; it was mainly recorded from micro-cavities of the algal outer ridge, where it is attached to calcareous algae and corals, being exposed at ebb tide. A single colony of *P. setacea*, attached under an overhang, was obtained from the spur-and-groove zone.

Remarks. — Though in absence of the gonothecae this species can easily be confused with *P. strictocarpa* Pictet, 1893, we have been induced to identify our specimens as *P. setacea* because of the thickness of the basal stem internodes and the development of the periderm on these internodes.

P. setacea is widely distributed over the tropical, subtropical and temperate parts of Atlantic, Indian and Pacific Oceans, being recorded from a profusion of localities in those areas. The present localities fit into the general picture of its distribution.

Plumularia strobilophora Billard, 1913 (fig. 33)

Plumularia strobilophora Billard, 1913: 35, fig. 26; Vannucci, 1951: 87, pl. 3 figs. 17, 18; Vannucci, 1951a: 113, 114.

Plumularia strobilifera Billard, 1933: 23, fig. 9; Schmidt, 1972: 43.

Locality. — Takapoto, no. 60. Five 20 mm high colonies and some fragments. No gonothecae.

Description. — Erect, pinnate colonies with distinct stem, rising from a creeping stolon to a height of about 20 mm. The stem is broken up into internodes, separated by straight septa, not readily visible in the lower parts of the colony, but gradually becoming more distinct and very marked in the highest parts of the colonies. All internodes, with the exception of the basal one or two, have a distinct distal apophysis, alternately directed left and right (fig. 33a). In addition each internode bears a conical nematotheca on its proximal part and inserting on the wall opposite the apophysis. Apophysis with small "mamelon" and with three conical nematothecae maximally, viz., one pair under the "mamelon" and one unpaired above that "mamelon". The periderm on the stem internodes is quite firm and yellowish.

The apophyses support the hydroclades, originally pointing upwards and gracefully curving laterally. The basal internode of each hydroclade has a straight proximal septum and an oblique distal septum; there are no nematothecae or hydrothecae. The rest of the hydroclade consists of regularly alternating thecate and athecate internodes; maximally five thecate internodes have been observed; usually there are fewer. The hydrothecate internode has an oblique septum proximally and a straight septum apically. The hydrotheca is cup-shaped and remarkably low; the aperture is quite oblique, being tilted in abcauline direction (fig. 33b). On the proximal part of the thecate internode there is an unpaired, conical nematotheca; the hydrotheca is flanked by a

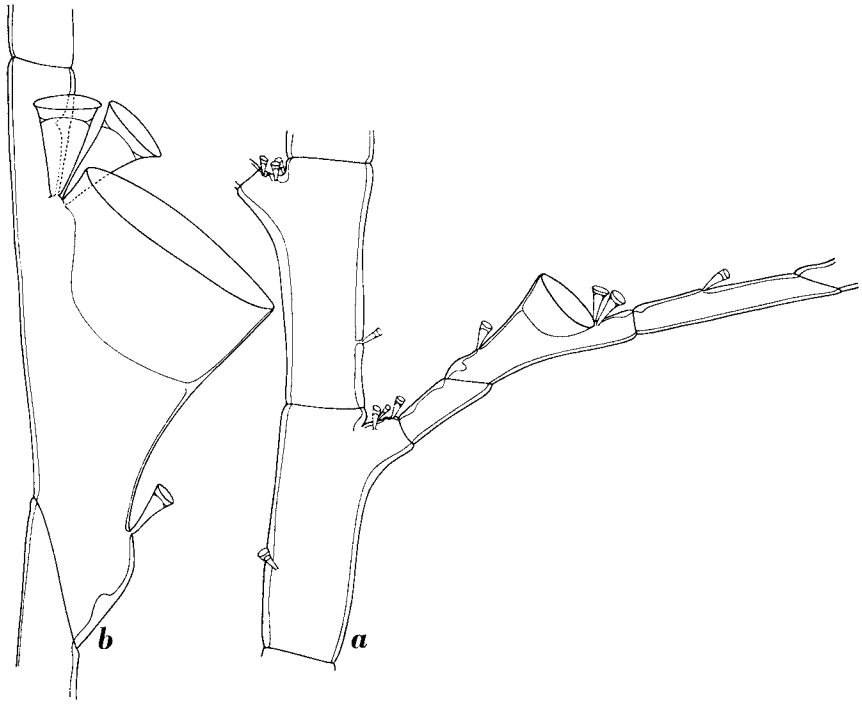

Fig. 33. *Plumularia strobilophora* Billard, Takapoto, no. 60. a, part of stem with hydroclade; b, thecate internode from hydroclade, lateral view. a, × 170; b, × 315.

pair of distinctly trumpet-shaped, slightly larger nematothecae. These flanking nematothecae insert at the level of the adcauline hydrothecal wall on small socles and project far above the hydrothecal rim. The intermediate, athecate internodes have a straight proximal septum and an oblique distal septum; they carry one conical nematotheca at about half way their length. Indications of an internal peridermal ring or ridge occur proximally and distally in the basal internode, the thecate internode and the athecate internode; the development of ridge or ring is subjected to great variability.

No gonothecae have been observed.

Measurements (in microns). —

Stem internode, length (base to apex)	400-255
idem, diameter (base to apex)	90-135
Basal internode of hydroclade, length	95-120
Thecate internode, length	230-255
Athecate internode, length	245-270
Hydrotheca, length abcauline wall	40-45
idem, diameter	70-75
Flanking nematotheca, length	45-48
idem, diameter at aperture	25-28

Ecology. — This is a rare species at Takapoto, recorded only from cavities and from under overhangs of the spur-and-groove zone near the jetty at Fakatopatere reef; it occurs between 7 and 10 m depth.

Remarks. — To this species we have brought a few colonies that differ from *Plumularia setacea* (L.) in the shape to the hydrotheca and built of the colony. Compared with *P. setacea* the present colonies show a stronger stem, with thick, yellowish periderm and broken up into short internodes. The apophyses have three nematothecae and a "mamelon". The hydrotheca is very shallow and the plane of its aperture is quite oblique. Though the present specimens are sterile we have identified them as *P. strobilophora* after comparison with fertile colonies from Mindoro Straits, Philippines, from which they cannot be distinguished. Though development of stem and hydrocladial internodes is quite variable in *P. setacea* we have never seen colonies of that species with the type of hydrotheca met with in *P. strobilophora*. The present colonies agree perfectly with the descriptions by Billard (1913: 35, fig. 26; 1933: 23, fig. 9). We wish to point out, nevertheless, that on many apophyses the number of nematothecae is less than three, probably as a result of damage, while in some stem internodes the number of nematothecae is slightly increased, two or three being occasionally present.

This species was originally described from Du-Roa Straits, Kai Islands, Malay Archipelago, 52 m depth (Billard). Additional specimens were recorded by Billard (1933) from the Gulf of Suez, 35-60 m depth. Vannucci (1951) recorded Atlantic specimens from Trinidad Island, off the coast of Brazil, 15-40 m depth. We have recently observed specimens on fouling panels from Mindora Straits, Philippines, obtained at about 37 m depth.

Billard (1933: 23) without any explanation changed the name of this species from *Plumularia strobilophora* to *P. strobilifera*, which name has been adopted by Schmidt (1972). There is no justification at all for such a change; the species should be referred to as *Plumularia strobilophora* Billard, 1913.

Gymnangium eximium (Allman, 1874) (fig. 34)

Taxella eximia Allman, 1874: 179.
Halicornaria bipinnata Allman, 1876: 276, pl. 22 fig. 5, pl. 33 fig. 2.
Halicornaria flabellata Marktanner-Turneretscher, 1890: 278, pl. 6 fig. 14.
Halicornaria copiosa Jarvis, 1922: 356, fig. 6, pl. 26 fig. 28.
Gymnangium eximium — Stechow, 1923a: 236; Schmidt, 1972: 39, 41, 43, fig. 2c, pl. 2 fig. C.

Localities. — Moorea, no. 2. Pinnately branched, 30 mm high colony. No gonothecae.
Moorea, no. 4. Several pinnate fragments of 10 to 15 mm height, bearing young gonothecae.
Moorea, no. 8. A single young, pinnate colony, 15 mm high. No gonothecae.
Moorea, no. 26. Several 10 to 12 mm high fragments. No gonothecae.

Description. — The colony originally develops as an unbranched, plume-shaped colony, composed of a series of stem internodes, each bearing an apophysis supporting a hydroclade and two nematothecae, the apophyses (and consequently the hydroclades) alternately point left and right (fig. 34b). Ramifications of the original stem develop through the action of secondary tubes, running the full length of the primary hydrocaulus and sending out side-branches, usually in quite a regular fashion, resulting in a pinnately branched colony; the side-branches having the same structure as the primary

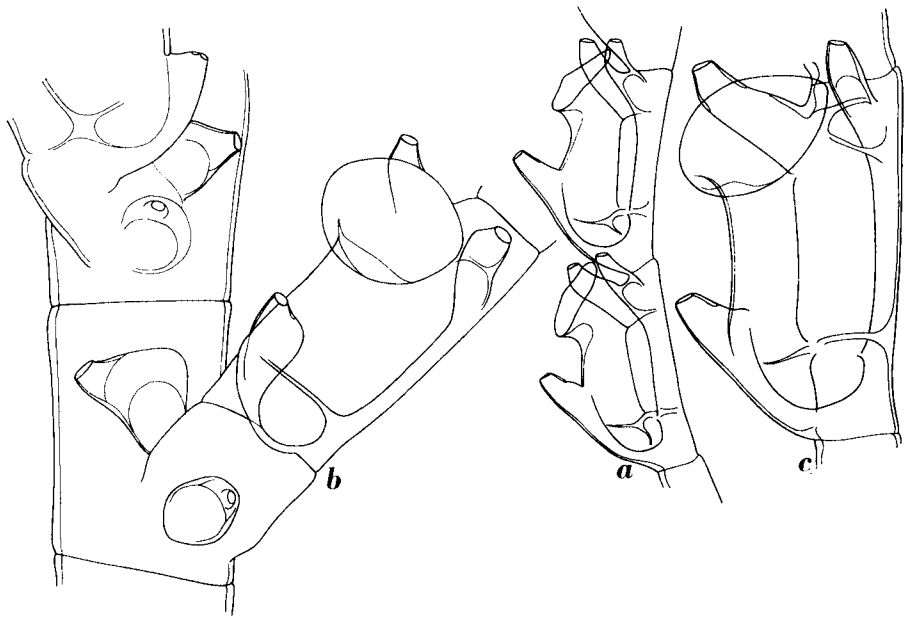

Fig. 34. *Gymnangium eximium* (Allman), Moorea, no. 4. a, two internodes from hydroclade, lateral view; b, stem internodes and hydroclade, frontal view; c, hydrotheca, oblique view. a, × 85; b, × 175; c, × 190.

stem and bearing alternately arranged hydroclades. Quite large, pinnate or irregularly shaped colonies may result in this way, the primary stem usually distinctly discernible from the secondary tubes. The internodes of stem and side-branches are short and have thick, yellowish-brown periderm; there is a large nematotheca in the axil of the apophysis and one on the apophysis; both nematothecae have a single aperture.

The hydrocladial internodes are slender and have thin, hyaline periderm. Greatest length of the hydroclades about 5 to 6 mm, bearing up to 25 hydrothecae. Each internode bears a single hydrotheca with its nematothecae; all hydrothecae are directed towards the front of the colony. The shape of the

hydrotheca can best be judged from fig. 34a, c; nearly the whole adcauline wall is coalescent with the hydrocladial internode. The apical portion of the hydrotheca is slightly narrowed and distinctly curved, the hydrothecal aperture making an angle of about 30° with the length axis of the internode. The hydrothecal aperture is provided with two blunt, triangular lateral teeth of varying development, one on each side of the aperture. Frontal part of the hydrotheca between aperture and insertion of mesial nematotheca thickened; the thickening extending on both sides just under the hydrothecal aperture. Mesial nematotheca covering about half the abcauline hydrothecal wall; development of free portion variable, directed from the hydrotheca. The terminal aperture is circular and there is an additional aperture near its insertion on the frontal hydrothecal wall; the nematotheca communicates both with the hydrotheca and with the internode.

The lateral nematothecae slightly surpass the hydrothecal border. The aperture is circular; they communicate with the hydrothecal cavity by means of a larger circular opening and are, naturally, in communication with the internode. There are two internodial septa, one almost opposite the septum in the basal part of the hydrotheca and one at the base of the lateral nematothecae.

Only young gonothecae have been observed; these are little disk-shaped bodies, borne, by means of a short pedicel, on the apophyses of stem and branches.

Measurements (in microns). —

	Moorea, no. 4
Hydrocladial internode, length	210-240
idem, diameter	45-55
Hydrotheca, total depth	200-210
idem, diameter at aperture	95-100
Mesial nematotheca, length	40-50
idem, diameter at aperture	15-20
Lateral nematotheca, length	100-110
idem, diameter at aperture	10-15

Ecology. — This species has only been obtained at Moorea, where it is rare and appears to be restricted to the upper part of the outer slope, between the furrowed platform and the buttress-and-valley zone, at 15 m depth. *G. eximium* lives under sciophilous conditions and is attached to the bottom of overhangs or occurs in micro-cavities.

Remarks. — *Gymnangium eximium* has so far been recorded from several localities in the Indian Ocean. Allman (1876) described the species from Ceylon; Jarvis (1922) from Amirante and Wasin, between 10 and 85 fms depth. Marktanner-Turneretscher (1890) described the species from the Red

Sea, without accurate locality. Schmidt (1972) records the species from the Gulf of Aqaba, where it occurred between the surface and 10 m depth. This very variable species probably has a much wider distribution in the tropical Indo-Pacific than the present records suggest.

Gymnangium hians (Busk, 1852) (fig. 35)

Plumularia hians Busk, 1852: 396.

Halicornaria hians — Bale, 1884: 179, pl. 13 fig. 6, pl. 16 fig. 7; Billard, 1913: 68; Jäderholm, 1916: 8, fig. 5; Briggs, 1918: 47; Vervoort, 1914: 22, figs. 7, 8; Millard, 1959: 219, figs. 15g, h; Pennycuik, 1959: 186.

Gymnangium hians — Stechow, 1923: 19; Yamada, 1958: 51, 61; Yamada, 1959: 84; Ooishi, 1964: 191; Millard & Bouillon, 1973; 92.

Aglaophenia balei Marktanner-Turneretscher, 1890: 272, pl. 7 figs. 19, 20; Billard, 1905: 334.

Halicornaria balei — Ritchie, 1910: 22, pl. 4 fig. 12.

Halicornaria balei var. *flava* Ritchie, 1910: 23.

Material. — Moorea, no. 3. One fragmentary colony of 15 mm height. No gonothecae.

Moorea, no. 16. About 10 pinnate colonies, maximal height 60 mm. No gonothecae.

Moorea, no. 29. About 10 pinnate colonies, maximum height about 65 mm. No gonothecae.

Description. — The monosiphonic stems rise from a few tangled, fairly thick stolons, that have apparently been dislodged from sponge tissue. The division of the stems into internodes is only visible in the highest parts of the colonies; here the internodes bear a single apophysis. The various stem apophyses alternately point left and right and slightly forward; the hydroclades alternately curve backward and to left or right and give the colony a graceful, delicate appearance. The hydroclades reach a maximal length of 12 mm; their division into internodes is only visible in the younger parts of the colony; the septa, in lateral view, are slightly oblique. The hydrothecae are placed closely together; the adcauline hydrothecal wall ending some distance above the internodal septum. The hydrothecae in shape agree best with *G. hians* var. *balei* (Marktanner-Turneretscher, 1890) (= *Aglaophenia balei* Marktanner-Turneretscher, 1890: 272, pl. 7 figs. 19, 20); their appearance may be judged from fig. 35a. The hydrothecal border has two distinct teeth, one on each side and close to the adcauline hydrothecal wall. The abcauline portion of the hydrothecal border is slightly convex or may bear another rouded, broadly triangular tooth, one on each side of the hydrothecal aperture. The free abcauline portion of the hydrothecal wall is thickened. The mesial nematotheca is slightly variable in length, projecting some distance above the abcauline hydrothecal wall; its proximal wall is greatly thickened. The hydrotheca has a distinct internal lamella, upturned at its distal end and projecting far into the interior of the hydrotheca (fig. 35a, b). Lateral, paired nematothecae, cup-shaped, with circular aperture, not

projecting above the hydrothecal margin. The periderm of the stem is thick and brownish; in the hydrocladial internodes the periderm is also thick and yellowish-brown. There are apparently no symbiotic algae; the perisarc is perfectly hyaline.

Ecology. — *G. hians* occurs infrequently and appears to be restricted to the bottom of shadowed overhangs of the furrowed platform at Tiahura,

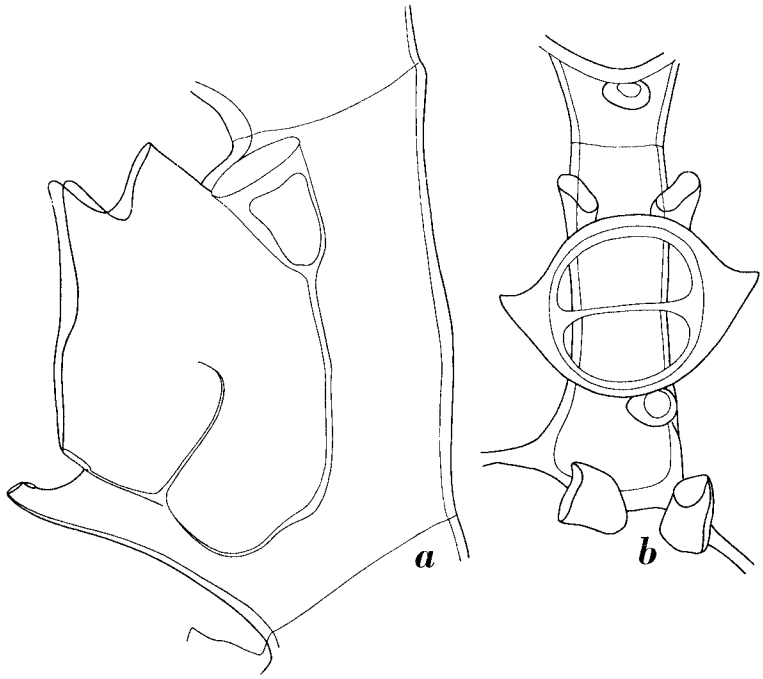

Fig. 35. *Gymnangium hians* (Busk), Moorea, no. 3. a, hydroclade with hydrotheca, lateral view; b, insertion of hydroclade on stem internode, seen from above. a, × 220; b, × 135.

between 1.5 and 3 m depth. Here it has been recorded together with several sponges, hydroids (*Antennella secundaria, Synthecium samauense, Sertularia turbinata, Sertularella robusta* and *Halopteris constricta*), the hydrocoral *Distichopora violacea*, the ahermatypic coral *Tubastraea*, ascidians, bryozoans and some species of sessile Foraminifera (*Carpenteria monticularis, Homotrema rubrum*).

Remarks. — We see no reason to maintain the variety *balei* (Marktanner-Turneretscher, 1890); the shape of the lateral hydrothecal margin being such a variable character in this widely distributed species. Billard (1913: 70), who reduced the specific rank of *Aglaophenia balei* Marktanner-Turneretscher to that of a variety, reserved that distinction for colonies in which the

majority of hydrothecae is of the type figured by Marktanner-Turneretscher (1890, pl. 7 figs. 19, 20). It has since become clear that the extent of the variability of the hydrothecal border, both individually and over the distributional area, is such that characters of that border alone do not suffice for the distinction of varieties. The geographical distribution of *Gymnangium hians* is very wide, covering the whole of the tropical Indo-Pacific area, locally penetrating into subtropical parts of the Indian and Atlantic Oceans.

Thecocarpus phyteuma (Kirchenpauer, 1876) (fig. 36)

Aglaophenia phyteuma Kirchenpauer, 1876: 23 (no. 3a).

Thecocarpus phyteuma — Stechow, 1919: 139, figs. C^2, D^2; Pennycuik, 1959: 187; Millard & Bouillon, 1973: 95, fig. 11 E, F.

Aglaophenia clavicula Whitelegge, 1899: 373, pl. 23 figs. 4-6.

Theocarpus leopoldi Leloup, 1930: 1, fig. 1; Leloup, 1930a: 11, figs. 8, 9, pl. 2 figs. 2-3.

Localities. — Moorea, no. 34. Several 12-15 mm high, pinnate, unbranched colonies. No corbula.

Moorea, no. 38. Three colonies, between 8 and 20 mm high, without corbula.

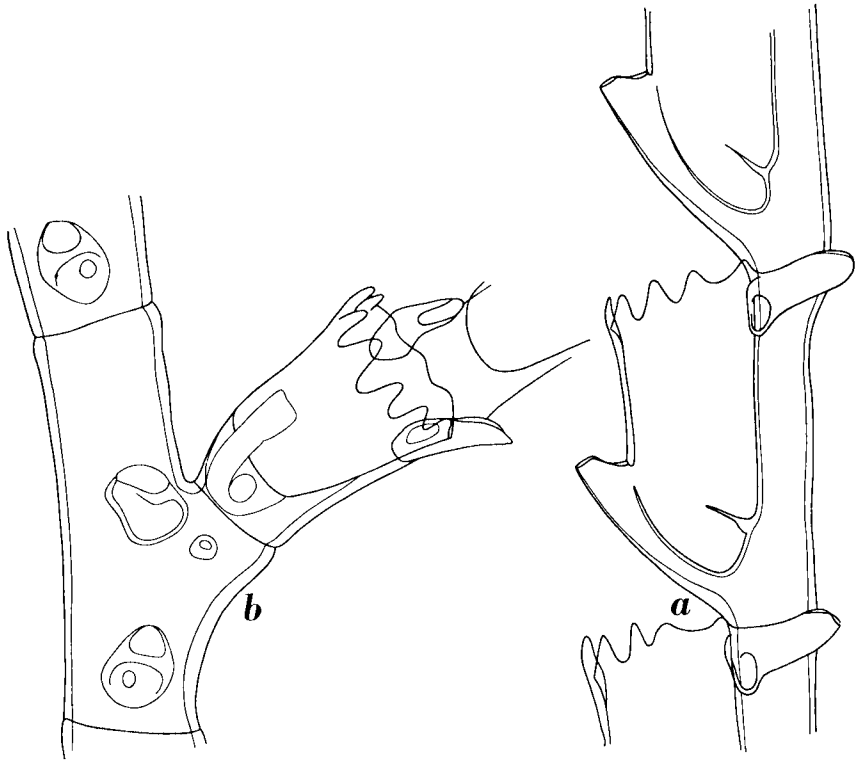

Fig. 36. *Thecocarpus phyteuma* (Kirchenpauer), Moorea, no. 34. a, internodes with hydrothecae, lateral view; b, stem internode with hydroclade, frontal view. a, b, × 135.

Moorea, no. 43. About 25 colonies, between 15 and 25 mm high, monosiphonic and unbranched. Two corbula are present.

Description. — The colonies consist of unbranched plumes of maximally 15 mm height, rising from some thick, brown hydrorhiza fibres; the lower parts of the hydrocauli without hydroclades, the higher part with alternately arranged hydroclades. The hydroclade-bearing part rises abruptly from a thicker portion of the stem, suggesting regeneration, and is divided into internodes. Hydrocauli composed of fairly long internodes; the septa are visible only in the youngest parts of the colonies; they usually are indicated by means of peridermal constrictions. Each stem internode bears an apophysis, two two-chambered nematothecae and a reduced nematotheca ("mamelon") (fig. 36b). The apophyses are short and alternately point left and right; the hydroclades insert directly on the apophyses without intermediate internode and are gracefully curved laterally. There is a distinctly two-chambered nematotheca in the axil of apophysis and internode, a slightly smaller, also two-chambered nematotheca on the proximal part of the internode and a much reduced nematotheca on the base of the apophysis. Hydrocladial internodes slightly longer than total length of the hydrothecae, slender; septa dividing the internodes only visible in the younger parts. Hydrothecae long and fairly tubular; their shape can best be judged from fig. 36a. Hydrothecal margin with a thickened, unpaired mesial tooth and three pairs of equally developed, triangular teeth with blunt apices. In addition there is a much smaller pair of marginal teeth almost hidden by the lateral nematothecae. There is no unpaired adcauline tooth, although the hydrothecal border may show an undulation at that point. Mesial nematotheca fairly short, covering the basal part of the adcauline hydrothecal wall and with gutter-shaped opening. Free part of the abcauline hydrothecal wall of considerable length, perfectly straight and with thickened periderm. There is a thin though distinct intrathecal septum in the basal part of the hydrotheca, springing from the adcauline wall. The paired lateral nematothecae are tubiform, directed backwards, pointing beyond the internodal wall, with large, gutter-shaped opening and near the base communicating with the internode through a circular hole. There are no internodal septa or ridges.

Measurements (in microns). —

	Moorea, no. 34
Stem internode, length	355-470
idem, diameter	120-185
Hydrocladial internode, length	300-320
idem, diameter	80-95

Hydrotheca, total depth	250-300
idem, diameter at aperture	150-160
idem, length free part abcauline wall	155-160
Mesial nematotheca, length free part	45-55
idem, diameter near aperture	20-25
Lateral nematotheca, total length	80-95
idem, diameter near aperture	25-35

The material from Moorea no. 43 has two corbula, one detached and one attached to a colony, where it occupies the place of a hydroclade. The detached corbula is complete. It has a short, one-segmented stalk with a single, normally developed hydrotheca. There are 8 pairs of ribs, generally agreeing with Stechow's drawing of the corbula of the type specimen. The ribs are flattened, leaf-like structures, attached along the rachis and forming an incompletely closed corbula; there are slits between the ribs and the corbula is not closed along the distal side. Each rib has a basal hydrotheca, slightly smaller than the hydrocladial thecae, with two lateral sarcothecae; the unpaired, median sarcotheca is absent unless the rib with its external row of nematothecae is considered as such. Each hydrotheca is supported by a distinct spur of variable development. There are, in this specimen, no distal spurs as figured by Stechow. Inside the corbula are 6 sack-shaped bodies, representing eggs or developing spermatogonia.

The attached corbula is incomplete, some of the distal ribs are missing. This corbula is characterized by the development of spurs on the ribs, some even longer than the supporting rib and carrying a number of nematothecae. The spurs point in various directions so that the structure of the corbula at first appears to be confusing.

Ecology. — *T. phyteuma* is uncommon at Tiahura, where is was occasionally found under overhangs and in anfractuosities of the spur-and-groove zone, between 15 and 20 m depth.

Remarks. — We agree with Pennycuik, 1959, that Leloup's *Thecocarpus leopoldi* (Leloup, 1930: 1, fig. 1) cannot possibly be separated from this species. The corbula as described by Leloup is in no ways different from those that have been described for *T. phyteuma* (including those mentioned above). Millard & Bouillon (1973) figure hydrothecae from the distal and proximal part of a colony, showing the amount of variation in one colony. The hydrothecae of *T. leopoldi*, as described by Leloup, entirely fit into that picture. *T. leopoldi*, therefore, must be sunk into the synonymy of *T. phyteuma*. The type locality of this species is the Tonga Archipelago; it was subsequently recorded from Funafuti, Ellice Islands (Whitelegge, 1899, as *A. clavicula*). Further records are from the coast of Queensland, Australia (Pennycuik, 1959), from Sorong, West Irian (Leloup, 1930, as *T. leopoldi*)

and from various localities in the Seychelles (Millard & Bouillon, 1973). The species seems to live in the littoral zone and prefers moderate depth (5-15 m).

General remarks of the Moorea and Takapoto hydroid fauna

Biogeographically, the great infuence of the Indo-Pacific fauna on the species composition of the 22 hydroids described from Moorea Island and Takapoto Atoll, is very distinct.

In Table 1 we have listed the species distribution according to the various morphological aspects of the coral reefs. We found 11 species to be restricted

Table 1

Distribution over and occurrence of hydroids in the various coral reef biotopes. CC, very common; C, common; AC, fairly common; +, presence of species demonstrated.

LOCALITY	MOOREA										TAKAPOTO			
LOCALIZATION at the coral reef	Reef flat with scattered coral growths	Outer biogenic ridge	OUTER SLOPE								Algal ridge	OUTER SLOPE		
			Furrowed platform	Non-furrowed platform		Buttress-and-valley zone		Spur-and-groove zone				Spur-and-groove zone		Lower sloping platform
DEPTH (m)	1	-	1.5-3	4-5	6-7	9-10	14-15	15	18-20	25	-	1.5-2	7-10	20-25
HABITAT	Cavity	Cavity	Overhang and cavity								Cavity	Over-hang	Overhang and cavity	
Species (Total: 22)														
Dynamena heterodonta	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Halopteris constricta	AC	.	AC	.	.	.	.	.	.	.	.	.	.	.
Hebella parasitica	+	.	.	.	.	.	.	+	.	.	.	.	.	.
Plumularia setacea	.	+	.	.	.	.	.	+	.	.	.	.	.	.
Gymnangium hians	.	.	AC	.	.	.	.	.	.	.	.	.	.	.
Antennella secundaria	.	.	AC	AC	.	.	.	.	.	+	.	.	C	.
Sertularia turbinata	.	.	+	+	.	.	.	.	.	.	.	.	.	.
Gymnangium eximium	.	.	+	+	.	.	+	.	.	.	.	.	.	.
Sertularia malayensis	.	.	.	AC	.	.	.	.	.	.	.	.	AC	.
Sertularia ligulata	.	.	.	CC	.	.	.	.	.	.	.	.	+	.
Sertularella robusta	CC	.	AC	.	.	AC	.	AC	AC	.	.	.	+	AC
Synthecium samauense	.	.	C	C	C	AC	.	.	C	.	.	.	.	.
Halopteris buski	.	.	.	.	.	C	.	CC	.	AC	.	.	C	AC
Hebella scandens var. contorta	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Sertularella tongensis	.	.	.	.	.	.	.	+	.	.	.	.	.	.
Thecocarpus phyteuma	.	.	.	.	.	.	.	+	AC	.	.	.	.	.
Synthecium dentigerum	.	.	.	.	.	.	.	.	AC	.	.	.	C	AC
Dynamena crisioides	.	.	.	.	.	.	.	.	.	.	AC	C	.	.
Eudendrium sp.	.	.	.	.	.	.	.	.	.	.	.	.	+	.
Solanderia minima	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Lictorella rufa	.	.	.	.	.	.	.	.	.	.	.	.	AC	C
Plumularia strobilophora	.	.	.	.	.	.	.	.	.	.	.	.	AC	.
Number of species per biotope	4	1	7	6		5		9			1	10		5

to Moorea, 5 to Takapoto; only 6 species were found to occur at both islands. Amongst these, only one is also mentioned in the list of hydroids from French Polynesia published by Redier (1971), viz. *Sertularia turbinata*, a species recorded by Redier from the lagoon at Mururoa Atoll (Tuamoto Archipelago), at 10 m depth.

It should be emphasized that hydroid distribution was not exclusively studied during the survey of Moorea and Takapoto; the investigations covering all groups of plants and animals (particularly invertebrates) showing sciophilous affinities, amounting to a total of 64 samples from the Tiahura area of Moorea and 21 from Takapoto, regularly distributed over the various zones of the coral reefs.

1. The Tiahura-Moorea hydroid assemblages

The 17 hydroid species identified from that area are mainly restricted to the barrier reef. As far as the fringing reef is concerned, no hydroids have so far been found in the micro-cavities between dead or living corals; this habitat is characterized by the deposition of fine terrigenous and biodetritical silt (Richard & Salvat, 1972), preventing the development of hydroids. The corals in this habitat are principally covered by sponges. From the table of hydroid distribution it is clear that the first species appear on the reef flat of the barrier zone, a habitat characterized by sheltered water and the development of many, more or less scattered reef-coral complexes, flattened at the top and at low tide at about 1 m depth. Of the four species listed from that area and living in anfractuosities of the reef structures, two species, *Sertularella robusta* and *Halopteris constricta*, are most abundant.

The outer ridge zone, completely emerged during low tides and roughed by an off-shore swell of medium amplitude, has a sessile cryptofauna rich in sponges and didemnid ascidians. A single hydroid species only has been found here, viz. *Plumularia setacea*, occurring at isolated localities and also found at the lower part of the outer slope.

On the outer slope the hydroid fauna is richer in species and in individual abundance. With the exception of *Dynamena heterodonta*, all species recorded from Tiahura are present here. Species of constant occurrence, present in a large number of samples, are *Synthecium samauense* and *Sertularella robusta*, distributed over the whole of the outer slope. *Halopteris buskii*, also very abundant here, seems to be characteristic of the lower part of the slope, between 9-10 and 25 m depth.

The table also clearly demonstrates that a greater number of species occurs in the upper parts of the outer slope than in the deeper parts; the largest number is found on the furrowed platform and diminishes towards the buttress-and-valley zone. If the most frequent species, *Sertularella robusta*

and *Synthecium samauense*, are left out of consideration, the buttress-and-valley zone acts as a boundary between two hydroid communities, viz.:

a. A shallow water community found between furrowed platform and non-furrowed platform, composed of such species as *Gymnangium hians, Sertularia turbinata, Gymnangium eximium, Sertularia malayensis* and *S. ligulata.*

b. A deeper water community, found between 10 and 25 m depth, composed of *Halopteris buskii, Sertularella tongensis, Thecocarpus phyteuma* and *Synthecium dentigerum.*

As far as *Antennella secundaria* is concerned, it seems to prefer the upper part of the outer slope, but is has also been found in one sample from the spur-and-groove zone, obtained at 25 m depth.

2. The Takapoto Atoll hydroid assemblages

With the exception of a single species, *Dynamena crisioides*, found in microcavities of the algal ridge, no hydroids occur under the coral blocks of the reef flat. This species, as well as the remaining 10 species recorded from Takapoto, also occur at the outer slope. It appears from the table that the three most common species occur in both zones that were studied morphologically, viz., the spur-and-groove zone and the lower sloping platform; these species are *Halopteris buskii, Synthecium dentigerum* and *Lictorella rufa.* To those species *Sertularella robusta* might be added, which species is rare in the spur-and-groove zone but occurs more plentifully in microcavities of the lower sloping platform.

The most luxurious hydroid fauna was met with in cavities and under overhangs of the spur-and-groove zone, where 10 of the total of 11 species are present. Five of these species, viz. *Antennella secundaria, Sertularia malayensis, S. ligulata, Eudendrium* spec., and *Plumularia strobilophora,* are here restricted to a water depth of 7 to 10 m. So far only one species, *Solanderia minima,* has exclusively been observed at the lower sloping platform.

In conclusion it should be pointed out that those species observed at both Moorea Island and Takapoto Atoll have almost identical bathymetrical distribution; this holds particularly for *Sertularia malayensis, S. ligulata* and *Halopteris buskii.*

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