Hydroids of the families Kirchenpaueriidae Stechow, 1921 and Plumulariidae McCrady, 1859 (Cnidaria, Hydrozoa) collected in the Western Pacific Ocean by various French Expeditions

José ANSÍN AGÍS
Departamento de Ecoloxía e Bioloxía Animal
Facultade de Ciencias do Mar, Universidade de Vigo
Campus Lagoas-Marcosende,
36310 Vigo (Spain)
ansinjose@gmail.com

Willem VERVOORT†
Nationaal Natuurhistorisch Museum, P.O. Box 9517
2300 RA Leiden (The Netherlands)

Fran RAMIL
Departamento de Ecoloxía e Bioloxía Animal,
Facultade de Ciencias do Mar, Universidade de Vigo
Campus Lagoas-Marcosende,
36310 Vigo (Spain)
framil@uvigo.es

Ansín Agís J., Vervoort† W. & Ramil F. 2014. — Hydroids of the families Kirchenpaueriidae Stechow, 1921 and Plumulariidae McCrady, 1859 (Cnidaria, Hydrozoa) collected in the Western Pacific Ocean by various French Expeditions. *Zoosystema* 36 (4): 789-840. http://dx.doi.org/10.5252/z2014n4a6

ABSTRACT
This publication is the third in a series of accounts on large collections of Plumularioidea McCrady, 1859 (Cnidaria, Hydrozoa, Hydroidolina) obtained during several French expeditions to the Philippines region, Vanuatu, New Caledonia, Fiji, and the Marquesas Islands. Additional material from Mozambique was also examined and is discussed. A total of 17 species, belonging to the families Kirchenpaueriidae Stechow, 1921 (two species) and Plumulariidae McCrady, 1859 (15 species), are scrutinized and illustrated in the present report. Three new species of the genus *Plumularia* Lamarck, 1816 are described (*Plumularia bathyale* n. sp., *Plumularia contraria* n. sp., *Plumularia pseudocontraria* n. sp.). The name *Plumularia milsteinae* n. nom., is proposed for *Plumularia spiralis* Milstein 1976, a permanently invalid junior homonym of *Plumularia spiralis* Billard, 1911. *Polyplumaria kossowskae* (Billard, 1911) is recorded for the first time since its original description. Two species of *Plumularia* are identified only to the genus level. Type materials of *Plumularia habereri* Stechow, 1909 and *Dentitheca hertwigi* Stechow, 1909, and the syntypes of all varieties of *Plumularia habereri* described by Billard (1913), have also been examined.

KEY WORDS
Cnidaria,
Hydrozoa,
Kirchenpaueriidae,
Plumulariidae,
Pacific Ocean,
new record,
new species,
new name.

RÉSUMÉ

Les Hydroïdes des familles Kirchenpaueriidae Stechow, 1921 et Plumulariidae McCrady, 1859 (Cnidaria, Hydrozoa) récoltées par plusieurs expéditions françaises dans le Pacifique occidental.

Ce travail est la troisième contribution à l'étude d'une grande collection d'Hydroïdes de la superfamille Plumularioidea McCrady, 1859 (Cnidaria, Hydrozoa, Hydroidolina), provenant de diverses campagnes françaises faites aux Philippines, au Vanuatu, en Nouvelle-Calédonie, aux îles Fidji et aux îles Marquises. Du matériel supplémentaire du Mozambique a été aussi étudié. Un total de 17 espèces appartenant aux familles Kirchenpaueriidae (deux espèces) et Plumulariidae (15 espèces) sont décrites ou mentionnées ici et toutes sont aussi illustrées. Trois espèces du genre *Plumularia* Lamarck, 1816 (*Plumularia bathyale* n. sp., *Plumularia contraria* n. sp. et *Plumularia pseudocontraria* n. sp.) sont décrites comme nouvelles. Le nom *Plumularia milsteinae* n. nov. est proposé pour *Plumularia spiralis* Milstein, 1976, homonyme junior invalide de *Plumularia spiralis* Billard, 1911. *Polyplumaria kossowskae* (Billard, 1911) est signalée pour la première fois depuis sa description originale et deux espèces de *Plumularia* ont été identifiées seulement au niveau du genre. Le matériel type de *Plumularia habereri* Stechow, 1909, *Dentitheca hertwigi* (Stechow, 1909) et les syntypes de toutes les variétés de *Plumularia habereri,* décrites par Billard (1913), ont été examinés.

MOTS CLÉS
Cnidaria,
Hydrozoa,
Kirchenpaueriidae,
Plumulariidae,
Océan Pacifique,
signalisation nouvelle,
espèces nouvelles,
nom nouveau.

INTRODUCTION

Since 1978, the Institut français de Recherche Scientifique pour le Développement en Coopération (ORSTOM, now Institut de Recherche pour le Développement), centre de Nouméa, has sampled the marine fauna of the New Caledonia region in the Southwestern Pacific Ocean between 10-30°S and 160-185°E. Also, additional material was collected from the Marquesas Islands, the Philippines, and the Mozambique Channel.

During these expeditions, large and interesting collections of Hydroidolina Collins, 2000 (Cnidaria, Hydrozoa) were obtained that thus far have been only partly studied. A detailed study of families Thyroscyphidae Stechow, 1920 and Sertulariidae Lamouroux, 1812 revealed high diversity and a considerable degree of endemism in the deep water hydroid fauna of this region (Vervoort 1993). Similar results were obtained by Peña Cantero & Vervoort (2010) in highlighting the extremely rich diversity within the genus *Acryptolaria* Norman, 1875 in the same area. Moreover, some new taxa within the superfamily Plumularioidea McCrady, 1859, all probably endemic to this region, were described by Ansín Agís, Ramil & Vervoort (2004), and Ansín Agís, Vervoort & Ramil (2009).

An account is given here of a large collection of hydroids referable to the families Kirchenpaueriidae Stechow, 1921 and Plumulariidae McCrady, 1859 from the region. In all, 17 species are described or discussed. Three of them are new to science.

This collection was originally entrusted to Dr W. Vervoort by Dr A. Crosnier (MNHN). After extensive collaborations during research on Atlantic hydroids, Dr Vervoort suggested our involvement in studies on Plumularioidea from the Western Pacific. Over the years we profited greatly from our involvement with Dr Vervoort in his training of junior researchers, and from his expertise during many discussions on hydroid taxonomy. As noted by Cornelius (1998), the work of Dr Vervoort was always guided by integrity, thoroughness, accurate perception, and readiness to change opinions im-

TABLE 1. — List of stations and species collected. Abbreviations: **Csc**, *Cladacanthella scabra* (Lamarck, 1816); **Kbo**, *Kirchenpaueria bonnevieae* (Billard, 1906); **P1**, *Plumularia* sp. 1; **P2**, *Plumularia* sp. 2; **Pba**, *Plumularia bathyale* n. sp.; **Pco**, *Plumularia contraria,* n. sp.; **Pcr**, *Polyplumaria cornuta* (Bale, 1884); **Pel**, *Plumularia elongata* Billard, 1913; **Pfi**, *Plumularia* cf. *filicula* Allman, 1877; **Pha**, *Plumularia habereri* Stechow, 1909; **Pko**, *Polyplumaria kossowskae* (Billard, 1911); **Pmi**, *Pycnoteca mirabilis* (Allman, 1883); **Pps**, *Plumularia pseudocontraria* n. sp.; **Pse**, *Plumularia setacea* (Linnaeus, 1758); ***Psp***, *Plumularia spiralis* Billard, 1911; **Pst**, *Plumularia strobilophora* Billard, 1913.

Locality	Cruise	Stations	Coordinates	Depth (m)	Date	Species collected
Chesterfield Islands	CHALCAL 1	Stn DC 29	19°30.60'S, 158°31.10'E	100	19.VII.1984	Pha
New Caledonia	LAGON	Stn 0110bis	22°23.8'S, 166°47.0'E	40	22.VIII.1984	Pha
		Stn 0114	22°23.6'S, 166°49.6'E	37	22.VIII.1984	Pha
		Stn 0116	22°25.2'S, 166°43.7'E	43	22.VIII.1984	Pha
		Stn 0127	22°30.6'S, 166°45.9'E	55	23.VIII.1984	Pha
		Stn 0354	22°32.0'S, 167°02.1'E	78	29.XI.1984	Pha
		Stn 0358	22°31.4'S, 167°05.2'E	50	29.XI.1984	Pha
		Stn 0373	22°27.5'S, 167°10.5'E	52-57	21.I.1985	Pha
		Stn 0374	22°30.2'S, 167°08.9'E	70-72	21.I.1985	Pha
		Stn 0379	22°31.4'S, 167°10.8'E	70	21.I.1985	Pha
		Stn 0387	22°28.2'S, 167°13.4'E	62-65	22.I.1985	Pha
		Stn 0398	22°37.0'S, 167°11.8'E	71	23.I.1985	Pha
		Stn 0426	22°43.1'S, 167°19.9'E	53	25.I.1985	Pha
		Stn 0477	18°20.3'S, 163°05.5'E	36	28.II.1985	Pha
		Stn 0491	18°56.0'S, 163°20.0'E	450-460	03.II.1985	Pha
Philippines	MUSORSTOM 3	Stn DR 117	12°31.2'N, 120°39.3'E	92-97	03.VI.1985	Pha, Pel, Pps, P2
		Stn CP 121	12°08.3'N, 121°17.3'E	73-84	03.VI.1985	Pst
		Stn CP 134	12°01.1'-12°01.2'S, 121°57.3'-121°56.6'E	92-95	05.VI.1985	Pel
		Stn CP 142	11°47.0'-11°47.3'N, 123°01.5'-123°03.0'E	27-26	06 VI.1985	Csc
New Caledonia	MUSORSTOM 4	Stn DW 169	18°54.3'S, 163°11.2'E	590	17.IX.1985	Pse
		Stn CP 172	19°01.2'S, 163°16.0'E	275-330	17.IX.1985	Pco
		Stn CP 178	18°56.3'S, 163°12.9'E	520	18.IX.1985	Pco
		Stn CC 201	18°55.8'S, 163°13.8'E	500	20.IX.1985	Pse
	LAGON	Stn 0600	22°17.9'S, 167°04.4'E	62-65	05.VIII.1986	Pha
		Stn 0615	22°06.7'S, 166°57.0'E	56-60	05.VIII.1986	Pcr
		Stn 0745	22°13.6'S, 167°02.8'E	78-80	13.VIII.1986	Pcr
	CHALCAL 2	Stn DW 80	23°26.70'S, 168°01.80'E	160	31.X.1986	Pmi, Pha
	BIOGEOCAL	Stn DW 313	20°58.95'-20°858.97'S, 166°59.04'-166°59.30'E	1600-1640	02.V.1987	Pba
Coral Sea	CORAIL 2	Stn CP 25	20°25.00'S, 161°05.00'E	70-67	22.VII.1988	Pha
Loyalty Islands	MUSORSTOM 6	Stn CP 464	21°02.30'S, 167°31.60'E	430	21.II.1989	Kbo
Norfolk Ridge	SMIB 4	Stn DW 57	23°21.5'-23°21.0'S, 168°04.6'-168°04.5'E	210-260	09.III.1989	P1
	SMIB 5	Stn DW 101	23°21.2'S, 168°04.9'E	270	14.IX.1989	Pfi, Pse, P1,
	BATHUS 3	Stn CP 833	23°03'S, 166°58'E	441-444	30.XI 1993	Pse
New Caledonia	LAGOON	Canal Woodin		25-40	13.IV.1995	Pha, Pcr
Vanuatu	MUSORSTOM 8	Stn DW 966	20°19'S, 169°52'E	128-150	21.IX.1994	Pko
		Stn CP 1001	18°49'S, 169°00'E	150-250	25.IX.1994	Pko
Marquesas Islands	MUSORSTOM 9	Stn DW 1170	08°45.1'S, 140°13.1'W	104-109	25.VIII.1997	Pse
NE Mozambique Channel	BENTHEDI	Stn CH 13	12°12.7'S, 46°40.8'E	2300-2500	20.III.1997	Psp

TABLE 2. — Measurements of *Kirchenpaueria bonnevieae* (Billard, 1906) in µm.

	MUSORSTOM 6 Stn CP 464
Height of colony (in mm)	13
Stem internode, length	1110-1440
Diameter at node	120-150
First hydrocladial internode, length	750-920
Length thecate hydrocladial internodes	1020-1180
Diameter at node	75-80
Hydrotheca	
Length abcauline wall	55-70
Length adcauline wall	60-65
Diameter at rim	90-100
Mesial nematotheca, length	55-65
Diameter at rim	20-30

mediately in the light of fresh evidence, a shining example for our own research. When he passed away, we (JAA, FR) continued working on this manuscript. A very important part of the results presented here is based on his preliminary notes. The only words that can express our feelings are: thank you very much Wim!

MATERIAL AND METHODS

Station data and the species collected are summarized in Table 1.

Holotypes and the most of the remaining material have been deposited in the collection of the MNHN. Additional material, including one paratype, is in the collections of the RMNH.

ABBREVIATIONS

Institutions

MNHN Muséum national d'Histoire naturelle, Paris;
RMNH Naturalis Biodiversity Center, Leiden;
ZSM Zoologische staatssammlung München, Munich.

Sampling gear

CP Beam trawl;
DC Charcot dredge;
DR Rocky bottom dredge;
DW Warén dredge.

SYSTEMATICS

Family KIRCHENPAUERIIDAE Stechow, 1921
Genus *Kirchenpaueria* Jickeli, 1883

Kirchenpaueria bonnevieae (Billard, 1906)
(Fig. 1; Table 2)

Plumularia Bonnevieae Billard, 1906: 203, fig. 14. — Van Praët 1979: 918, fig. 79.

Plumularia rubra Bonnevie, 1899: 90, pl. VII, fig. 2 [not *Plumularia rubra* von Lendenfeld, 1884 synonym of *Halopteris campanula* (Busk, 1852)].

Plumularia elegantula var. Pictet & Bedot, 1900: 28.

Plumularia bonnevieae – Bedot 1921: 26; 1923: 219, fig. 8.

Ventromma bonnevieae – Stechow 1923b: 220.

Plumularia triangulata Totton, 1930: 225, fig. 61.

Kirchenpaueria triangulata – Vervoort 1966: 136, figs 38a-f, 39a-c. — Millard 1975: 375, fig. 119E-H. — Rees & Vervoort 1987: 129, fig. 27a-d. — Hirohito 1995: 255, fig. 85c-h.

Kirchenpaueria bonnevieae – Ramil & Vervoort 1992: 151, figs 39d-g, 40b, e. — Schuchert 2001: 126, fig. 107A-D. — Ansín Agís, Ramil & Vervoort 2001: 175, fig. 72a-d. — Vervoort & Watson 2003: 365, fig. 89A-C.

Kirchenpaueria bonnevieae simplex Billard, 1930: 80. — Ramil & Vervoort 1992: 156, figs 39a-c, 40a, c-d.

MATERIAL EXAMINED. — **Loyalty Islands.** MUSORSTOM 6, stn CP 464, 21°02.30'S, 167°31.60'E, 430 m, 21.II.1989, one damaged colony as epibiontic on Plumulariidae; no gonothecae (MNHN).

DISTRIBUTION. — *Kirchenpaueria bonnevieae* is widely distributed in the Atlantic and Indian Oceans, with some isolated records in the West Pacific (Ansín Agís *et al.* 2001). In the Atlantic it has been recorded from many localities, from Norway (Trondhjem Fjord) to South Africa, and also from one locality in the Mediterranean Sea (Alborán Sea). In the Indian Ocean it has reported from South Africa, Mozambique, Zanzibar, Tanzania, Oman and Kerguelen. In the Pacific it is only known from Sagami Bay and New Zealand. Bathymetric distribution between 11 and 1280 m. Our material comes from a single station in the Loyalty Islands, at 430 m.

VARIABILITY

Many internodes with two mesial inferior nematothecae.

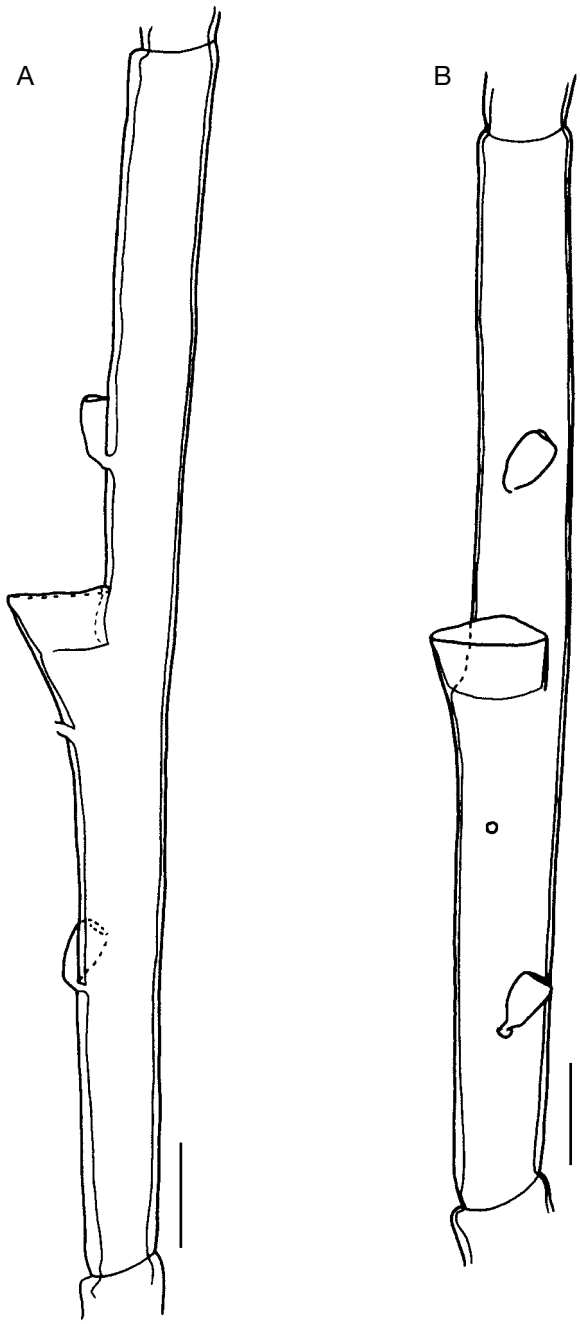

Fig. 1. — *Kirchenpaueria bonnevieae* (Billard, 1906), MUSORSTOM 6, stn CP 464: **A**, internode, lateral view; **B**, internode, frontal view. Scale bars: 0.1 mm.

TABLE 3. — Measurements of *Pycnotheca mirabilis* (Allman, 1883) in µm.

	Chalcal 2 Stn DW 80
Height of colony (in mm)	22
Stem internode, length	640-3070
Diameter at node	150-270
Length thecate hydrocladial internodes	530-570
Diameter at node	80-100
Hydrotheca	
Length abcauline wall	200-230
Length adnate adcauline wall	300-330
Length free part adcauline wall	35-60
Diameter at rim	230-250
Mesial nematotheca, length	50-60
Diameter at rim	40-60

REMARKS

Material studied from the Loyalty Islands is characterized by several internodes with two mesial inferior nematothecae. Despite this variation, the morphology of the colony is identical with those of *K. bonnevieae*.

Genus *Pycnotheca* Stechow, 1919

Pycnotheca mirabilis (Allman, 1883)
(Fig. 2; Table 3)

Diplocheilus mirabilis Allman, 1883: 49, pl. VIII, figs 4-7. — Stechow 1913: 9, 88, figs 55, 56.

Kirchenpaueria mirabilis – Mulder & Trebilcock 1909: 34, pl. I, fig. 8. — Hodgson 1950: 50, figs 81, 82.

Plumularia mirabilis – Billard 1910: 37.

Diplocheilus (*Kirchenpaueria*) *mirabilis* – Bedot 1923: 221, figs 14, 15.

Plumularia (*Diplocheilus*) *mirabilis* – Jäderholm 1919: 23.

Pycnotheca mirabilis – Totton 1930: 216, fig. 55b-e. — Rho 1967: 350, fig. 11A, B, pl. I, figs 2, 3. — Millard 1975: 377, fig. 120D-G. — Hirohito 1995: 256, fig. 86a-e. — Vervoort & Watson 2003: 366, fig. 89D-J. — Moazzam & Moazzam 2006: 230, fig. 7b, c.

Kirchenpaueria (*Diplocheilus*) *mirabilis* – Stechow 1925: 241.

Pycnotheca mirabilis var. *mirabilis* – Ralph 1961: 50, fig. 7a, b.

MATERIAL EXAMINED. — **New Caledonia.** CHALCAL 2, stn DW 80, 23°26.70'S, 168°01.80'E, 160 m, 31.X.1986, small colony composed of two plumes rising from stolon; no gonothecae (MNHN).

DISTRIBUTION. — Species with a wide distribution in the Indian and western Pacific Oceans, with isolated records from the Atlantic Ocean (Vervoort & Watson 2003). Reported from coastal waters of South Africa, Mozambique, Pakistan, India, Korea, Japan, Australia and New Zealand. In the Atlantic it is known only from Vema Seamount and South Africa (False Bay).
The presence of *P. mirabilis* in California should be confirmed with new data because the previous records [Torrey 1902 as *Halicornaria producta* (Bale, 1882); Torrey 1904 as *Diplocheilus allmani* Torrey, 1904] were included by some authors (Hirohito, 1995; Bouillon *et al.*, 2006) in *P. mirabilis*, but in *P. producta* by Totton (1930) and Vervoort & Watson (2003).
Bathymetrical distribution extends from littoral zone to 732 m (400 fathoms).
The present material was collected from a single locality in New Caledonia at 160 m.

DESCRIPTION

Hydrorhiza tubular, composed of tubules adhering to substrate, with short apophyses supporting a monosiphonic and unbranched axis. Basal part of the axis has one or two internodes with transverse septa and without nematothecae. Rest of stem composed of athecate internodes with oblique nodes (type hinge-joints). Stem internodes with one to four apophyses, typically two, alternately directed left and right, with one or two nematothecae between two successive apophyses. Axis nematothecae monothalamic, immobile, with deeply scooped adcauline wall.

Each apophysis with a well developed mamelon on upper surface and one axial nematotheca with structure identical to that stem nematothecae.

Hydrocladia composed of a succession of thecate internotes separated by oblique nodes, including proximal oblique node separating apophyses from first thecate internode. Each internode bearing one hydrotheca, one mesial nematotheca and a naked sarcostyle behind the hydrotheca.

Hydrotheca with adcauline wall almost fully adnate, with exception of distal border. Abcauline wall moderately convex at the basal part and concave distally. Hydrothecal aperture tilted forwards, rim smooth, circular and slightly deepened laterally. Intrathecal cavity with strong septum arising near

Fig. 2. — *Pycnotheca mirabilis* (Allman, 1883), CHALCAL 2, stn DW 80: **A**, colony; **B**, detail of stem; **C**, internodes of hydrocladia; **D**, detail apophysis and first internode; **E**, internode with cenosarc, sarcostyle. Scale bars: A, 1 cm; B-E, 0.1 mm.

TABLE 4.- Measurements of *Cladacanthella scabra* (Lamarck, 1816) in µm.

	MUSORSTOM 3 Stn CP 142
Height of colony (in mm)	250
Stem internode, length	980-3430
Diameter at node	250-440
Length thecate hydrocladial internodes	240-290
Diameter at node	60-90
Hydrotheca	
Length abcauline wall	100-120
Diameter at rim	95-110
Mesial nematotheca, length	80-95
Diameter at rim	40-50
Lateral nematotheca, length	70-90
Diameter at rim	35-40

the end of abcauline wall, visible in lateral view as a triangle with upturned top pointing towards interior of hydrotheca.

Mesial inferior nematotheca not reaching hydrothecal base, immobile, monothalamic, with deeply scooped adcauline wall. Sarcostyle in axil between free part of adcauline hydrothecal wall and internode, with basal part invested by shallow hyaline cup.

No gonothecae observed.

REMARKS

Watson & Vervoort (2003) consider that the differences between *Pycnotheca mirabilis* (Allman, 1883) and *Pycnotheca producta* (Bale, 1882), are based on variable characters and not clearly established, but they recognise both as valid species. Our material agrees with the descriptions given in the literature for *Pycnotheca mirabilis*, and therefore it is included in this species.

Family PLUMULARIIDAE McCrady, 1859
Genus *Cladacanthella* Calder, 1997

Cladacanthella scabra (Lamarck, 1816)
(Figs 3, 4; Table 4)

Plumularia scabra Lamarck, 1816: 127. — Billard 1913: 47. — Watson 2000: 52, fig. 40A-E. — Schuchert 2003: 212, fig. 61A-D.

Plumularia effusa Busk, 1852: 400. — Kirchenpauer 1876: 46, pl. I, fig. 4, pl. V, fig. 4. — Bale 1884: 129, pl. XVIII, fig. 5.

Acanthella effusa – Allman 1883: 27, pl. VI, figs 1-4. — Stechow & Müller 1923: 474.

Cladacanthella scabra – Bouillon *et al.* 2006: 365, 366, fig. 172 C-F.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3, stn CP 142, 11°47.0'-11°47.3'N, 123°01.5'-123°03.0'E, 27-26 m, 06.VI.1985: Many broken colonies; fragments up to 150 mm; no gonothecae (MNHN), (RMNH).

DISTRIBUTION. — *Cladacanthella scabra* is known from the Indo-Pacific: Indonesia, Philippines, Singapore and Australia (Schuchert 2003).
Bathymetrical range varies between 15 and 1270 m.
Our material originates from one station in the Philippines and was collected at 26-27 m depth.

DESCRIPTION

Hydrorhiza formed by a mass of intertwining tubules supporting a monosiphonic strongly ramified hydrocaulus with several internal coenosarcal canals. Lateral branches with a short basal internode with five nematothecae, one mamelon on upper surface and one apophysis supporting a hydrocladia. Rest of branch divided into internodes by oblique nodes like main stem, and with apophyses placed alternately directed left and right. Axis divided into internodes by oblique nodes, each internode with a varied number of apophyses and without nematothecae.

Apophyses in older parts arranged in three or four rows (not in true verticils) and in younger parts alternately directed left and right and slightly frontally, not in the same plane. Each apophysis with one mamelon on superior surface and three nematothecae: two longer in the axil and one impaired distal. All nematothecae bithalamic, movable, and distal chamber with scooped margin. Node between apophyses and first hydrocladial internode oblique.

Hydrocladia composed of a succession of thecate internodes with oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca cup-shaped, placed on middle of internode, adcauline wall fully

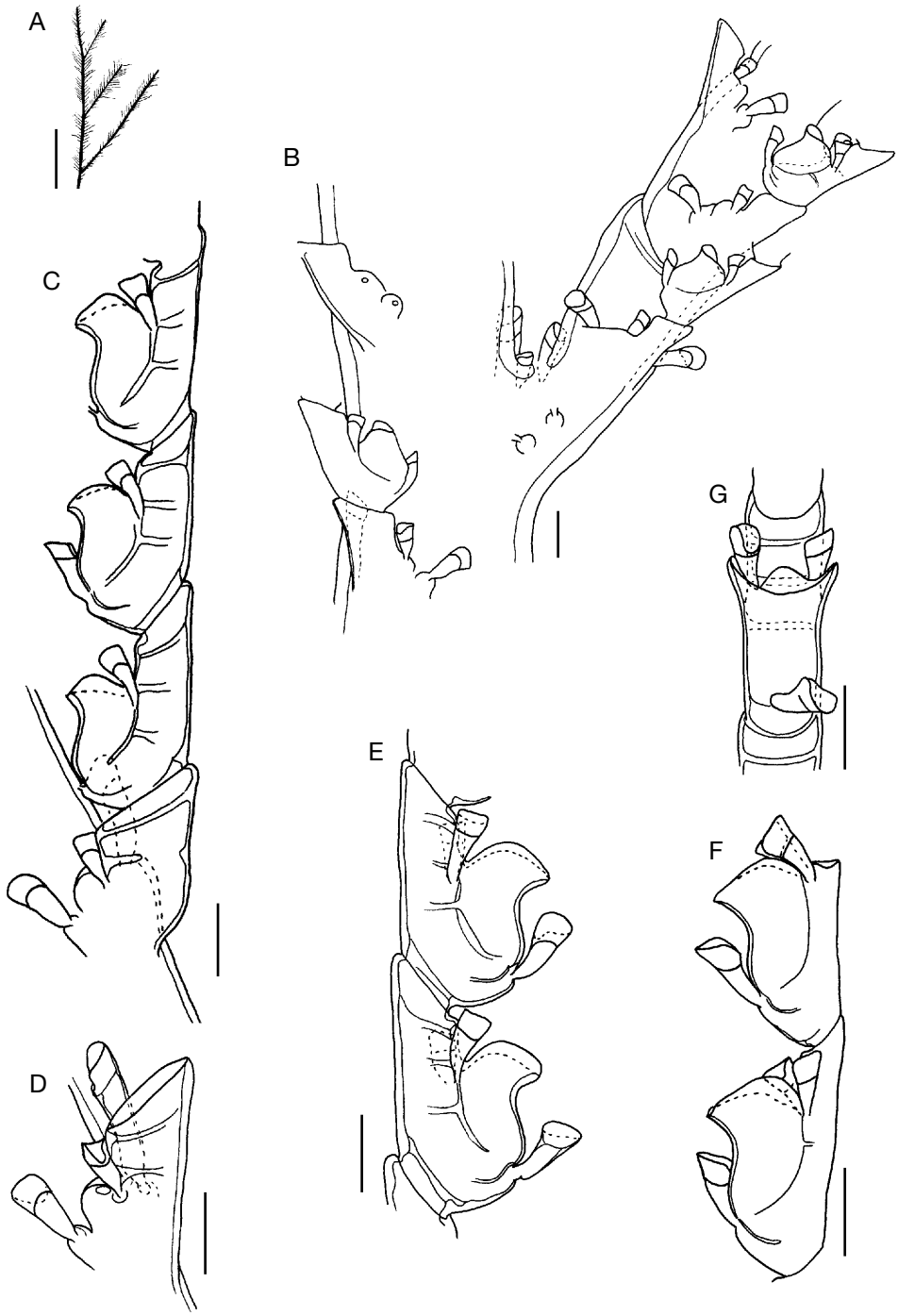

FIG. 3. — *Cladacanthella scabra* (Lamarck, 1816), MUSORSTOM 3, stn CP 142: **A**, fragment of the apical part of colony; **B**, detail of branch; **C**, basal internodes of hydrocladia; **D**, detail of apophyses; **E**, internodes, lateral view; **F**, internodes from distal part; **G**, internode, frontal view. Scale bars: A, 1 cm; B-G, 0.1 mm.

TABLE 5. — Measurements of *Plumularia bathyalis* n. sp. in µm.

	BIOGEOCAL stn DW 313
Height of colony (in mm)	35
Length thecate hydrocladial internodes	790-940
Length athecate hydrocladial internodes	245-330
Diameter at node	60-80
Hydrotheca, depth	260-330
Length abcauline wall	260-330
Length adcauline wall	260-320
Diameter at rim	150-160
Mesial nematotheca, length	85-90
Diameter at rim	30-40
Lateral nematotheca, length	80-90
Diameter at rim	30-40

adnate, abcauline wall sinuous, slightly convex on basis and strongly concave in the distal half; hydrothecal margin smooth and with two broad rounded lateral lobes.

Mesial nematotheca born immediately below hydrothecal base and reaching middle of hydrotheca. Lateral nematothecae inserted below hydrothecal margin. All nematothecae conical, movable and two chambered, basal chamber long and apical chamber with scooped rim.

Thecate internodes of basal part of hydrocladia with four internal perisarc rings, two at both extremities and two behind hydrotheca. Internal perisarc ring lacking on distal hydrocladial internodes or thin and little developed.

At distal part of branches hydrocladia replaced by thorn-like projections bearing several nematothecae.

Gonothecae not observed in the studied material.

Variability

In older parts of colonies modified hydrocladia with atrophied hydrotheca may occur, in which case the internodes have three nematothecae and a mamelon.

Remarks

Schuchert (2003) and Vervoort & Watson (2003) include this species in the genus *Plumularia*, but Bouillon *et al.* (2006) place it in *Cladacanthella* Calder, 1997, an opinion followed in this work.

Genus *Plumularia* Lamarck, 1816

Plumularia bathyalis n. sp.
(Fig. 5; Table 5)

Material examined. — **New Caledonia.** BIOGEOCAL, stn DW 313, 20°58.95'-20°858.97'S, 166°59.04'-166°59.30'E, 1600-1640 m, 02.V.1987: single 35 mm high colony in two parts, no gonothecae, holotype (MNHN-IK-2012-14252).

Etymology. — The specific name *bathyalis*, from the Greek "bathos = deep", refers to the bathyal region, where the species was collected.

Distribution. — Only known from New Caledonia (type locality) at 1600-1640 m depth.

Description

Colony plumose, unbranched, polysiphonic in basal part.

Hydrorhiza composed of tubules probably anchoring the colony in soft bottoms.

Stem irregularly divided by transverse nodes, slightly visible only in apical part of colony, with apophyses alternately directed left and right. Each apophysis with a well developed mamelon on superior surface, two axillary nematothecae and occasionally an imperfect perisarc ring at distal end. Main axis with two nematothecae between every two successive apophyses.

Hydrocladia, inserted on apophyses, composed by a succession of athecate and thecate internodes separated by straight nodes. Thecate internodes with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca placed in middle of internode, deep, conical, narrowing towards base, adcauline wall fully adnate and with a small projection in the middle part; abcauline wall straight, rim smooth. Mesial nematotheca placed on a distinct swelling close to the basal node. Lateral nematothecae born below and projecting above hydrothecal rim. Athecate internodes with one nematotheca on a distinct swelling proximal to the basal node. All nematothecae conical, bithalamic and movable.

Gonothecae absent.

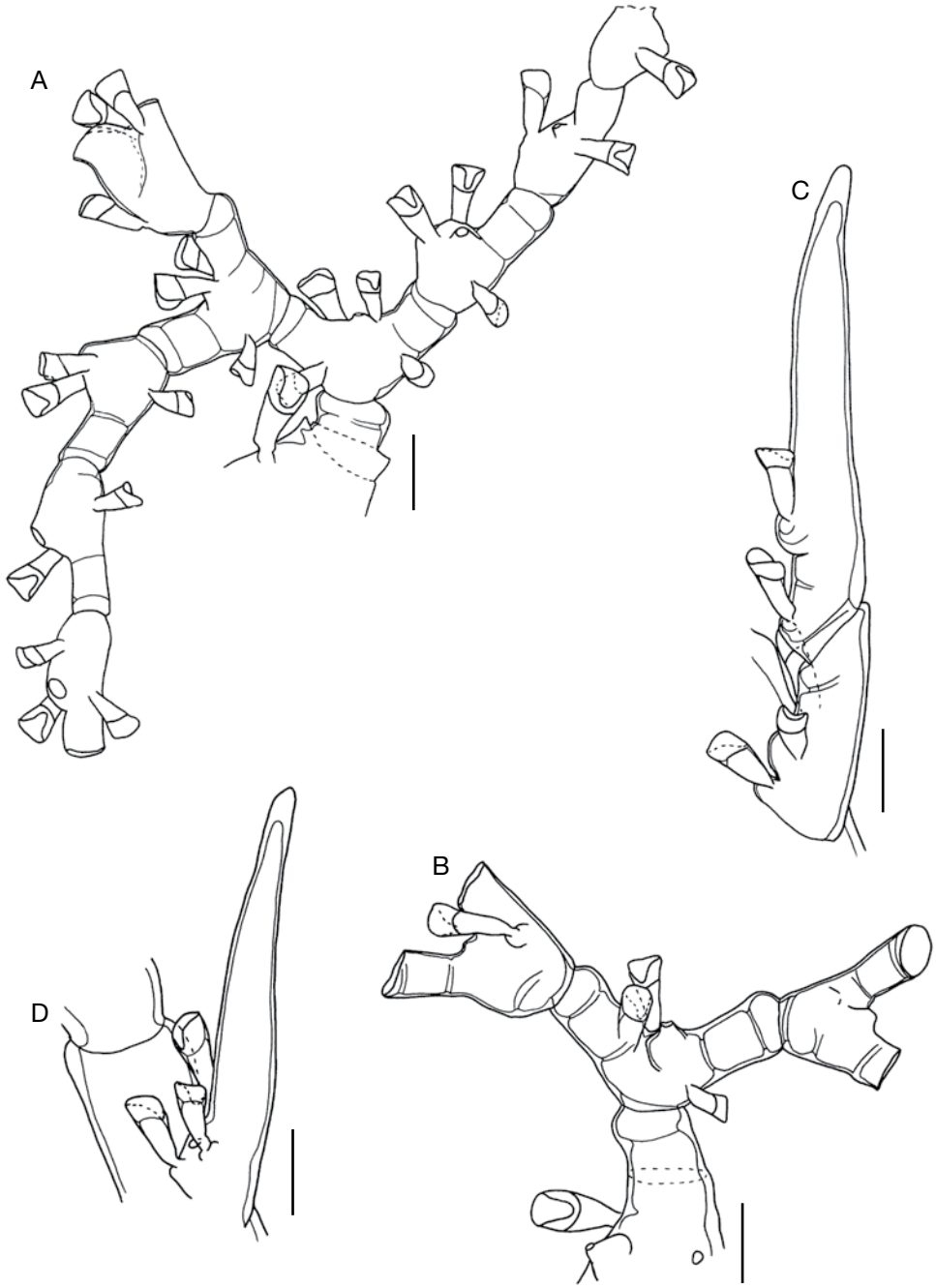

Fig. 4. — *Cladacanthella scabra* (Lamarck, 1816), MUSORSTOM 3, stn CP 142: **A**, **B**, anomalous hydrocladia; **C**, spines of basal part of branch; **D**, spines from distal part of branch. Scale bars: 0.1 mm.

TABLE 6. — Measurements of *Plumularia contraria* n. sp. in µm.

	MUSORSTOM 4 stn CP 178
Height of colony (in mm)	150
Stem internode, length	Variable
Length thecate hydrocladial internodes	580-640
Diameter at node	65-80
Hydrotheca	
Length abcauline wall	310-350
Length adcauline wall	210-250
Diameter at rim	75-100
Mesial nematotheca, length	65-70
Diameter at rim	20-30
Lateral nematotheca, length	60-85
Diameter at rim	20-30
Supracalycine nematotheca, length	60-70
Diameter at rim	20-30

VARIABILITY

The first thecate internode of hydrocladia usually bears two mesial inferior nematothecae: one near the basal node and other below the hydrotheca but with its margin reaching the base. Only the basal nematothecae is placed on a distinct swelling. Rest of thecate internodes with only one mesial inferior nematotheca, except in cases of damage and further regeneration where two nematothecae are possible.

REMARKS

The species is characterized by having deep hydrothecae and by the development of a shallow projection on the adcauline wall of the hydrothecae.

Plumularia contraria n. sp.
(Figs 6, 7; Table 6)

MATERIAL EXAMINED. — **New Caledonia.** MUSORSTOM 4, stn CP 172, 19°01.2'S, 163°16.0'E, 275-330 m, 17.IX.1985: one colony 83 mm height, without gonothecae, paratype (RMNH 41612). — Stn CP 178, 18°56.3'S, 163°12.9'E, 520 m, 18.IX.1985: one spirally built colony 150 mm long, no gonothecae, holotype (MNHN-IK-2012-14253).

ETYMOLOGY. — The specific name *contraria* refers to the orientation of the hydrothecal aperture towards the hydrocladial axis, unusual in this genus.

DISTRIBUTION. — This species is known only from two localities in New Caledonia and was collected between 275 and 520 m depth.

DESCRIPTION

Colony examined without basal part. Stem branched and polysiphonic (with exception of apical part of colony), composed of one central primary tube bearing hydrocladia in distal part and surrounded by several auxiliary tubes, number of auxiliary tubes reduced towards distal parts. Only primary tube bearing apophyses and divided into internodes by transverse nodes only visible in apical zone of colony. Each internode with several apophyses (usually three in apical part) and three or four nematothecae, in one or two rows respectively, between two consecutive apophyses.

Branches spirally arranged, polysiphonic in older parts, and arising between apophyses and stem (axilar branched). The base of the branch also originates in its upper part a secondary tube directed towards the apical part of the colony that adheres to the main axis, which helps to maintain the polysiphonic structure. Basal part of branch with several nematothecae placed in two rows, rest of branch with apophyses alternately directed left and right, with two or four nematothecae between two consecutive apophyses. Each apophysis with a small mamelon on superior surface and three nematothecae: two in the axil and one unpaired above mamelon; a perisarcal ring at distal end.

Hydrocladia inserted on apophyses, arranged alternately left and right and slightly frontally. Hydrocladia composed of a succession of thecate internodes with oblique nodes. Each internode with one hydrotheca and four nematothecae: one mesial inferior, two lateral and one supracalycine. Hydrotheca deep, tubular, adcauline wall fully adnate, abcauline wall straight with distal part curved towards hydrocladium, with a well developed internal septum in the middle of its length inclined distally. Aperture of hydrotheca oriented to hydrocladial wall, nearly vertical; rim smooth with a slight elevation or undulation on the adcauline side.

The mesial inferior and suprahydrothecal nematothecae are placed on an elevation and lateral nematothecae inserted over small apophyses. All

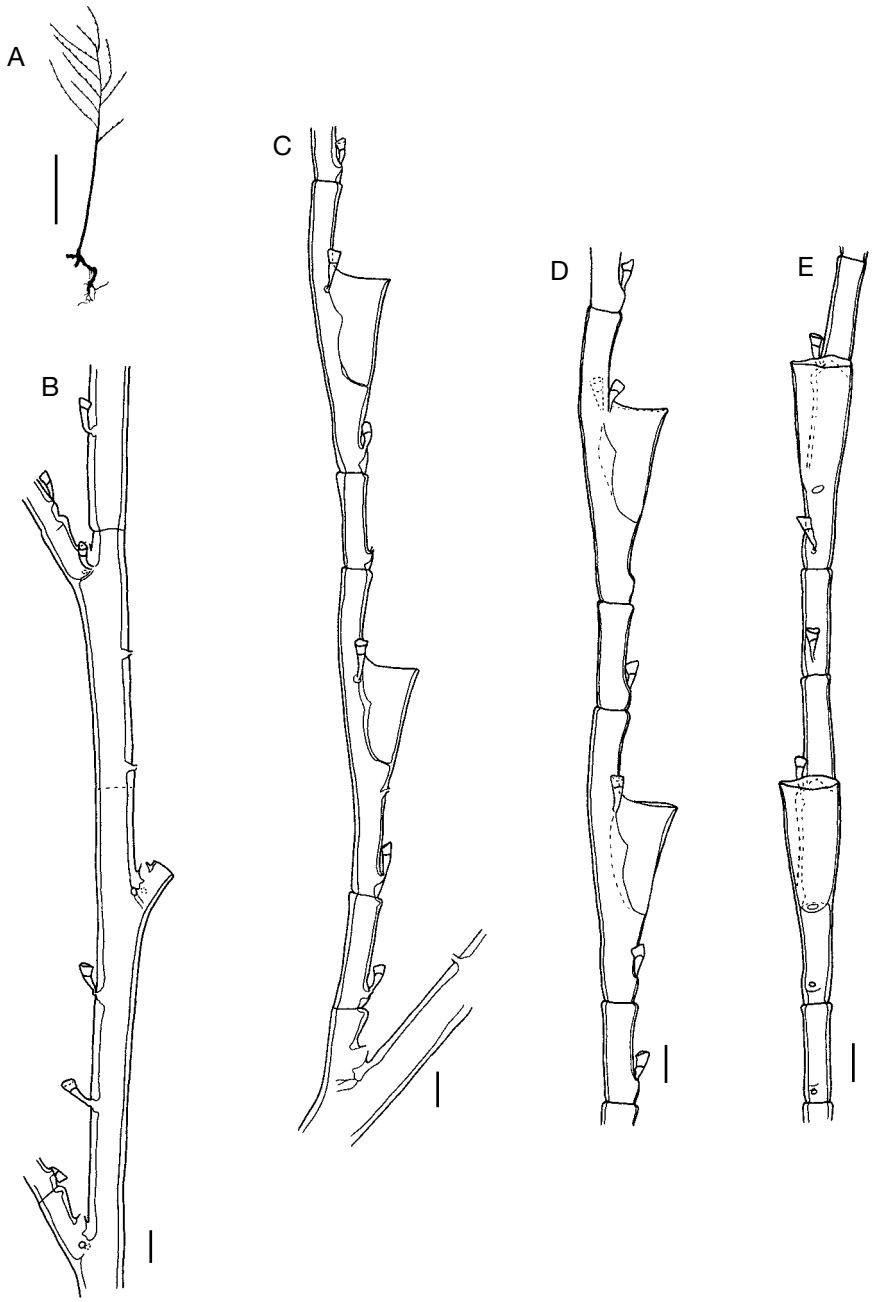

Fig. 5. — *Plumularia bathyalis* n. sp., BIOGEOCAL, stn DW 313 (holotype): **A**, colony; **B**, stem; **C**, basal internodes of hydrocladia; **D**, distal internodes of hydrocladia, lateral view; **E**, internodes, frontal view. Scale bars: A, 1 cm; B-E, 0.1 mm.

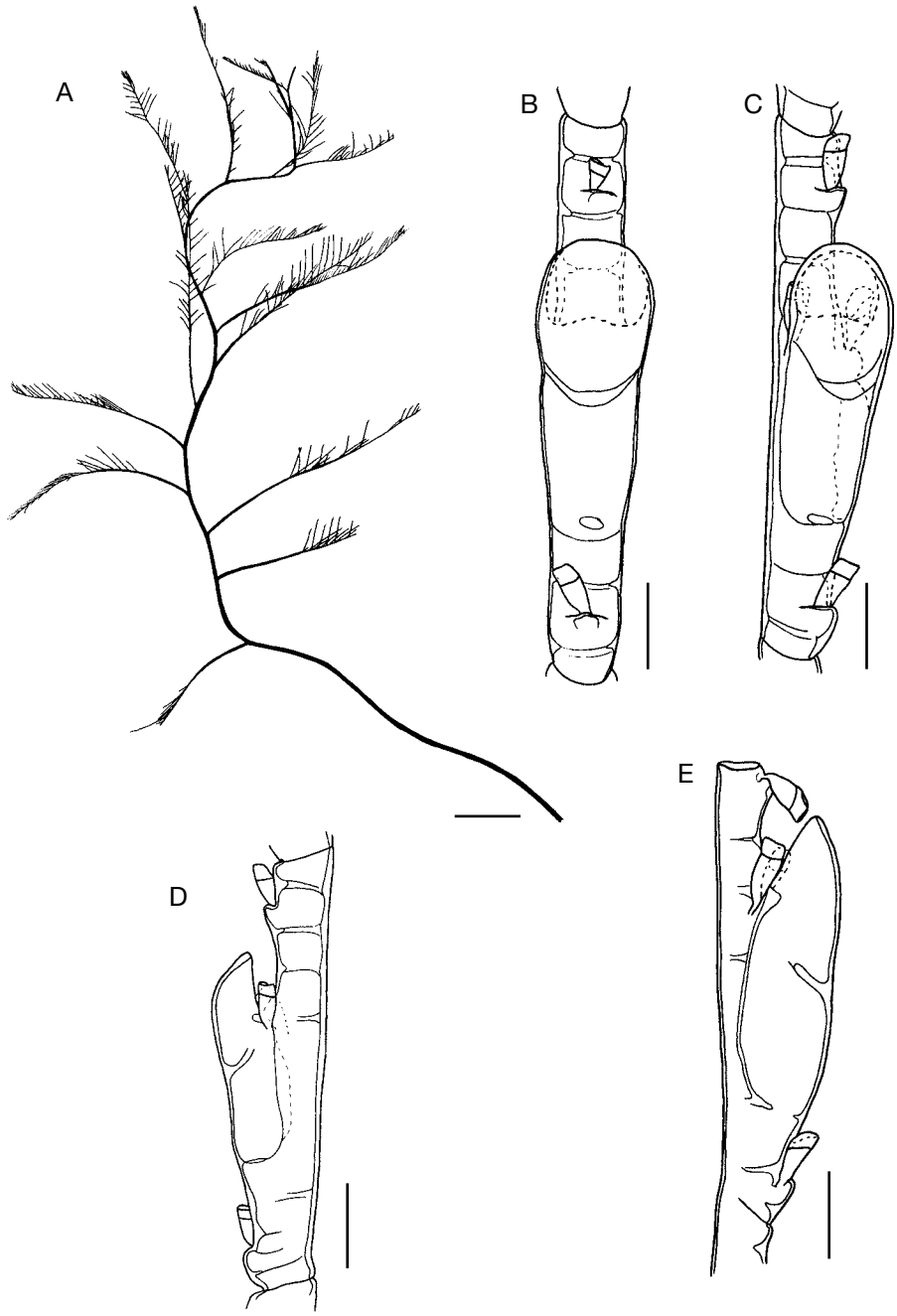

Fig. 6. — *Plumularia contraria* n. sp., MUSORSTOM 4; **A**, stn CP 172 (paratype), colony; **B**-**E**, stn CP 178 (holotype): **B**, **C**, internodes, frontal view; **D**, first internode of hydrocladia, lateral view; **E**, last internode of hydrocladia, lateral view. Scale bars: A, 1 cm; B-E, 0.1 mm.

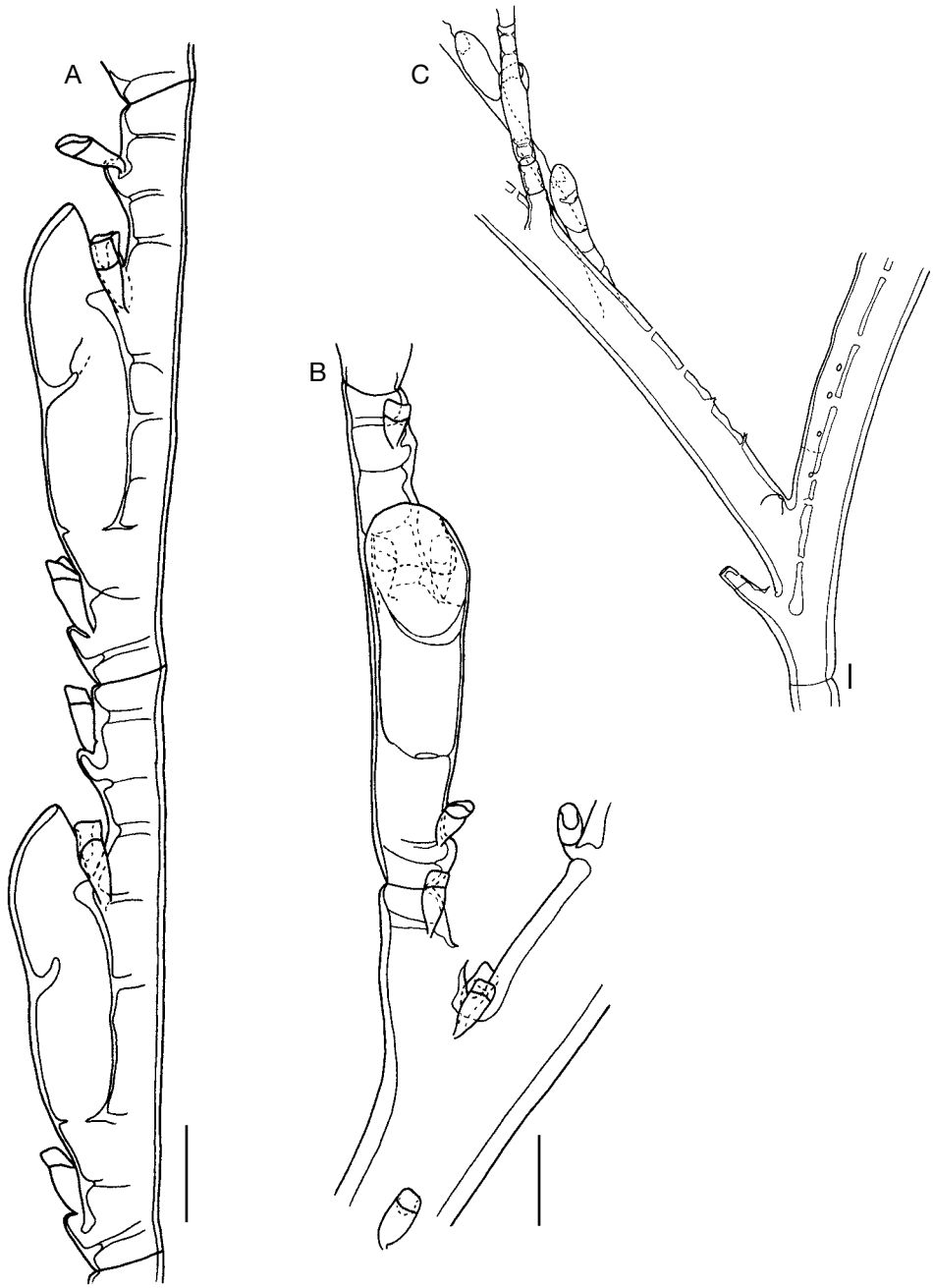

Fig. 7. — *Plumularia contraria* n. sp., MUSORSTOM 4; **A**, **B**, stn CP 178 (holotype): **A**, basal internodes, lateral view; **B**, apophyse and first internode; **C**, stn CP 172 (paratype), branch. Scale bars: 0.1 mm.

TABLE 7. — Measurements of *Plumularia* cf. *filicula* Allman, 1877 in µm.

	SMIB 5 stn DW 101
Height of colony (in mm)	7
Stem internode, length	240-360
Diameter at node	30-70
First hydrocladial internode, length	100-140
Length thecate hydrocladial internodes	230-270
Length athecate hydrocladial internodes	200-240
Diameter at node	25-35
Hydrotheca	
Length abcauline wall	55-60
Length adcauline wall	60-70
Diameter at rim	65-70
Mesial nematotheca, length	45-50
Diameter at rim	20-25
Lateral nematotheca, length	60-70
Diameter at rim	25-30

nematothecae mobile, two-chambered and with adcauline wall of upper chamber deeply scooped.

In each hydrocladial internode are variable numbers of internal septa, between four and eight, in the apical and lower parts respectively.

Hydrocladia of stem differing from those of branches in starting with a short athecate internode bearing one nematotheca in the basal part, arising at an elevation, and with an internal septum in distal part. Nematotheca having same morphology as the others.

Gonothecae not observed.

REMARKS

Plumularia contraria n. sp. shows some similarities to *P. elongata* Billard, 1913, in the morphology of the hydrothecae, in particular in its tubular form, in the presence of an intrathecal septum, and with the hydrothecal orifice oriented towards the hydrocladial axis. Nevertheless, both species clearly differ in the shape of the colony and the number of nematothecae on the thecate internodes. In *P. contraria* n. sp. the colony has a geniculate appearance with the lateral branches spirally arranged, whereas in *P. elongata* the ramifications are pinnate and always in the same plane, giving it a characteristic regular structure. Moreover, the apophyses and the hydrocladia are arranged latero-frontally in *P. contraria* n. sp. but in the same plane in *P. elongata*. In *P. contraria* n. sp. the suprahydrothecal nematotheca is a constant feature but it is always absent in *P. elongata*. There are also differences in the hydrothecal aperture: in *P. contraria* n. sp. the hydrothecal margin is straight and nearly parallel to the hydrocladial wall, whereas in *P. elongata* the margin is sinuous and depressed towards the adcauline side.

Plumularia cf. ***filicula*** Allman, 1877
(Fig. 8; Table 7)

Plumularia filicula Allman, 1877: 29, pl. 18, figs 1, 2. — Nutting 1900: 58, pl. 2 fig. 2. — Fraser 1944: 344, pl. 74 fig. 332. — Ramil & Vervoort 1992: 183, fig 47a-e.

Plumularia filicula – Hirohito 1983: 68, fig. 35; 1995: 275, fig. 94a (doubtful records).

Non *Plumularia filicula* – Vervoort & Watson 2003: 393, fig. 95C-F.

MATERIAL EXAMINED. — **Norfolk Ridge.** SMIB 5, stn DW 101, 23°21.2'S, 168°04.9'E, 270 m, 14.IX.1989, one colony with three plumes *c.* 7 mm high, no gonothecae (MNHN).

DISTRIBUTION. — *Plumularia filicula* is a species with an amphi-Atlantic distribution, being reported from the Atlantic coast of the United States and from the Ibero-Moroccan Gulf (Ramil & Vervoort 1992), between 146 and 1318 m. The records in the Pacific Ocean are considered dubious or excluded (see Remarks).
Our material was collected on the Norfolk Ridge at 270 m.

DESCRIPTION

Hydrorhiza tubular, adhering to substrate; hydrocauli monosiphonic, unbranched, divided into internodes by straight nodes, geniculate in younger parts. Cauline internodes all have a distal apophyses and one nematotheca in middle of opposite wall. Apophyses alternately directed left and right, with mamelon on superior surface and with two axillary nematothecae.

Hydrocladia with first internode having one nematotheca in the middle and a perisarc ring at each extremity. Rest of hydrocladium a succession of thecate and athecate internodes, separated by oblique nodes; thecate internodes with basal oblique and distal slightly oblique nodes, athecate internodes

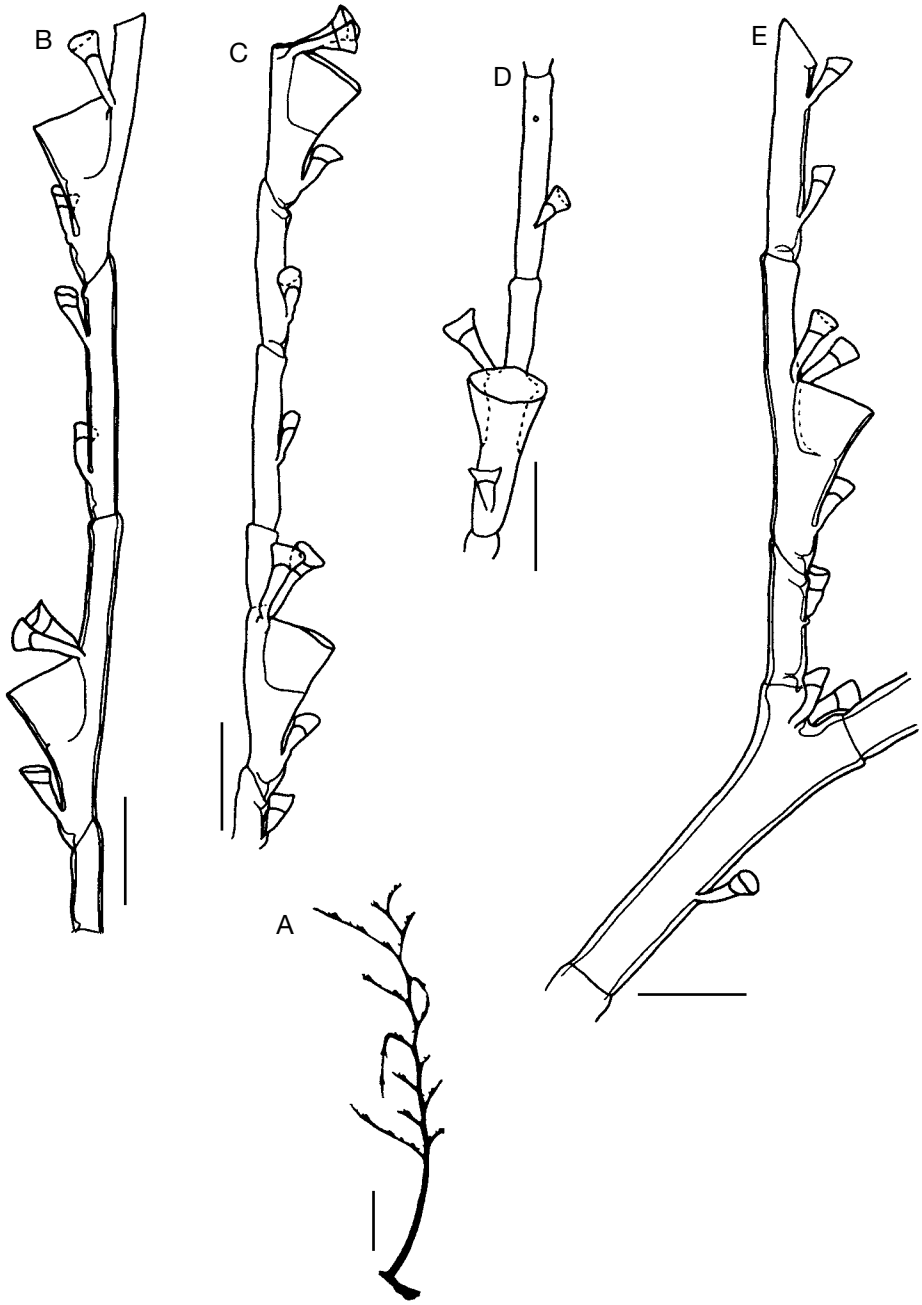

Fig. 8. — *Plumularia* cf. *filicula* Allman, 1877, SMIB 5, stn DW 101: **A**, colony; **B**, hydrocladia with first athecate internode without nematotheca, lateral view; **C**, two consecutives athecate internodes on distal part of hydrocladia, each one with one nematothecae; **D**, apical part of hydrocladia, frontal view; **E**, internode of stem with hydrocladia, lateral view. Scale bars: A, 1 mm; B-E, 0.1 mm.

TABLE 8. — Measurements of *Plumularia habereri* Stechow, 1909 in µm.

	Lagon Stn 116	Lagon Stn 127	Chalcal 1 Stn DC 29
Height of colony (in mm)	130	180	
Length thecate hydrocladial internodes	260-360	250-320	310-430
Diameter at node	60-85	70-110	65-80
Hydrotheca			
Length abcauline wall	160-200	160-205	165-190
Length adcauline wall	120-160	120-160	130-145
Diameter at rim	80-100	90-110	80-90
Mesial nematotheca, length	60-70	65-80	
Diameter at rim	25-30	30	
Lateral nematotheca, length	60-70	65-80	
Diameter at rim	25-30	30-35	

TABLE 9. — Measurements of type material of *Plumularia habereri* Stechow, 1909 in µm.

	ZSM 20041623	ZSM 20041622
Length thecate hydrocladial internodes	290-420	280-440
Diameter at node	50-90	60-95
Hydrotheca		
Length abcauline wall	160-220	160-230
Length adcauline wall	120-170	125-180
Diameter at rim	90-110	100-110
Mesial nematotheca, length	60-70	65-70
Diameter at rim	30-35	30
Lateral nematotheca, length	60-70	65-70
Diameter at rim	25-30	25-30

reverse. Each thecate internode with hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca cup-shaped, widening towards margin, adcauline wall fully adnate, abcauline wall straight, aperture circular, slightly tilted downwards, rim smooth. Internal perisarc ring with varied development sometimes occurring at the extremes. All nematothecae bithalamic, movable and conical. Athecate internodes with two nematothecae, one in the lower half and the other in the upper half; one basal and one distal perisarcal ring of much varied development.

Gonothecae not observed.

VARIABILITY

Sometimes one athecate internode with a single nematotheca placed in the middle was observed; two consecutives internodes, each with only one nematotheca, may also occur.

REMARKS

The morphology of our colony agrees well with existing descriptions of this species. We found only minor differences in the length of hydrocladial internodes, hydrothecae and nematothecae, but the absence of gonothecae made an accurate identification not possible.

The colonies from Japan (Hirohito 1983, 1995) are all devoid of gonothecae, and for this reason we consider the identification doubtful.

Nevertheless, the material described by Vervoort & Watson (2003) from New Zealand belongs, in our opinion, to a different species, because the morphology of gonotheca, provided with two nematothecae on the distal part, is quite different from those described by Allman (1877, type material) and by Ramil & Vervoort (1992, East Atlantic material). A similar opinion was expressed by Schuchert (2013b).

Plumularia habereri Stechow, 1909
(Figs 9-13; Tables 8, 9)

Plumularia habereri Stechow, 1909: 77, pl. VI, fig. 4; 1913: 91, figs 59, 60. — Ryland & Gibbons 1991: 532, fig. 5.

Plumularia habereri var. *attenuata* Billard, 1913: 42, fig. 34.

Plumularia habereri var. *mucronata* Billard, 1913: 46, fig. 40, pl. II, fig. 24.

Not *Plumularia habereri* – Van Gemerden-Hoogeveen 1965: 60, figs 34-36 [record included in *Denthitheca dendritica* (Nutting, 1900)].

Dentitheca habereri – Hirohito 1995: 259, fig. 87a-e. — Stechow 1923a: 18; 1923b: 227. — Kirkendale & Calder 2003: 167.

Not *Plumularia habereri* – Schuchert 2003: 211, fig. 60 (record included in *Plumularia elongata* Billard, 1913).

Not *Dentitheca habereri* – Di Camillo *et al.* 2010: 84, figs 2, 3, 5, 6 (record included in *Plumularia elongata* Billard, 1913).

Material examined. — **Chesterfield Islands.** CHALCAL 1, stn DC 29, 19°30.60'S, 158°31.10'E, 100 m, 19.VII.1984: single large, broken colony and some fragments up to 140 mm; no gonothecae (MNHN) (RMNH, three slides).
New Caledonia. LAGON, stn 0110bis, 22°23.8'S, 166°47.0'E, 40 m, 22.VIII.1984: four large colonies (one broken) *c.* 220 mm high, no gonothecae observed (MNHN). — Stn 0114, 22°23.6'S, 166°49.6'E, 37 m, 22.VIII.1984: one colony *c.* 150 mm high and some fragments, without gonothecae (MNHN). — Stn 0116, 22°25.2'S, 166°43.7'E, 43 m, 22.VIII.1984: single 130 mm high colony in two pieces; no gonothecae (MNHN) (RMNH, two slides). — Stn 0127, 22°30.6'S, 166°45.9'E, 55 m, 23.VIII.1984: large flabellate colony 180 × 140 mm; no gonothecae observed (MNHN) (RMNH, one slides). — Stn 0354, 22°32.0'S, 167°02.1'E, 78 m, 29.XI.1984: one fragmented colony *c.* 170 mm high; no gonothecae (MNHN). — Stn 0358, 22°31.4'S, 167°05.2'E, 50 m, 29.XI.1984: single colony 110 × 90 mm; without gonothecae (MNHN). — Stn 0373, 22°27.5'S, 167°10.5'E, 52-57 m, 21.I.1985: two colonies, 35-80 mm, and one fragment, no gonothecae (MNHN). — Stn 0374, 22°30.2'S, 167°08.9'E, 70-72 m, 21.I.1985: single large colony (*c.* 300 × 300 mm) broken in several fragments; no gonothecae observed (MNHN) (RMNH, one slides). — Stn 0379, 22°31.4'S, 167°10.8'E, 70 m, 21.I.1985: large colony *c.* 160 mm high and some fragments, no gonothecae (MNHN) (RMNH, two slides). — Stn 0387, 22°28.2'S, 167°13.4'E. 62-65 m, 22.I.1985: two colonies, 115-150 mm high, without gonothecae (MNHN). — Stn 0398, 22°37.0'S, 167°11.8'E, 71 m, 23.I.1985: forked, fan-shaped colony *c.* 80 × 120 mm; no gonothecae (MNHN) (RMNH, two slides). — Stn 0426, 22°43.1'S, 167°19.9'E, 53 m, 25.I.1985: 120 mm high, forked stem and some fragments; no gonothecae (MNHN). — Stn 0477, 18°20.3'S, 163°05.5'E, 36 m, 28.II.1985: two large colonies and many fragments (*c.* 150 × 150 mm); no gonothecae observed (MNHN). — Stn 0491, 18°56.0'S, 163°20.0'E, 450-460 m, 03.II.1985: *c.* 120 mm high colony; no gonothecae (MNHN).
Philippines. MUSORSTOM 3, stn DR 117, 12°31.2'-12°31.3'N, 120°39.3'-120°39.5'E, 92-97 m, 03.VI.1985: two broken colonies with many fragments up to 90 mm, no gonothecae (MNHN).
New Caledonia. LAGON, stn 0600, 22°17.9'S, 167°04.4'E, 62-65 m, 05.VIII.1986: large branched colony (150 mm high); no gonothecae (MNHN). — CHALCAL 2, stn DW 80, 23°26.70'S, 168°01.80'E, 160 m, 31.X.1986: two branched colonies, 40-45 mm, without gonothecae. (MNHN) (RMNH, two slides).
Coral Sea. CORAIL 2, stn CP 25, 20°25.00'S, 161°05.00'E, 70-67 m, 22.VII.1988: several fragments, 86 mm high, one with three gonothecae (possibly immature) (MNHN).
New Caledonia. Lagoon, Canal Woodin, 25-40 m, 13.IV.1995. Leg. Dr Richer de Forges Noumea. Coelenterate 27624: large colony 240 mm, without gonothecae. (MNHN)

Additional material. — Type material of *Plumularia habereri* Stechow, 1909: ZSM 20041623. Sagami Bay, V-1901, one slide; ZSM 20041622, ZSM 20041625, ZSM 20051002. Between Ito and Hatsu-Shima Island, depth 150 m, III-1903, three slides.
Syntype material of *Plumularia habereri* var. *attenuata* Billard, 1911: Siboga Expedition. Stn 144: MNHN H.L. 1267, one slide.
Syntype material of *Plumularia habereri* var. *mucronata* Billard, 1911: Siboga Expedition. Stn 80: MNHN H.L. 1272, one slide.

Distribution. — *P. habereri* is known from Japan (Stechow 1909, 1913, 1923b), Indonesia (Billard 1913), Fiji (Ryland & Gibbons 1991) and Guam (Kirkendale & Calder 2003). Their presence in Tulear, Madagascar (Di Camillo *et al.* 2010: Table 1) must be confirmed. The depth range varies between 17 and 150 m.
Our material comes from Philippines, Coral Sea, Chesterfield Island and New Caledonia, and was collected between 25 and 460 m depth, extending their bathymetrical distribution to the upper bathyal.

Description

Hydrorhiza composed of stolonial fibres mixed with sediment from which emerges one polysiphonic and branched axis; branches arising laterally from secondary tubes.

Stem divided into internodes by straight nodes visible only in distal part of stem and branches; each internode with several apophyses. Nematothecae placed in secondary tubules. Apophyses with a well developed mamelon on superior surface and three nematothecae: two axillary and one over mamelon slightly displaced laterally.

Hydrocladia inserted on apophyses, alternately directed left and right on stem and branches. Hydrocladia formed by a succession of thecate internodes separated by oblique nodes that may not be visible in the first internodes.

Each hydrocladial internode with one hydrotheca and three nematothecae: one mesial inferior above a well developed elevation and two laterals. Hydrotheca

cup-shaped, more or less deep, adcauline wall straight and fully adnate, abcauline wall straight, rim smooth and with adcauline side curved down. Mesial inferior and lateral nematothecae with adcauline wall of superior chamber deeply scooped. All nematothecae movable, two chambered and conical. In each internode at least two internal thickenings located near the basal and distal ends, in some internodes six perisarcal rings have been observed: two under, three behind and one above the hydrotheca.

Gonothecae, perhaps not fully developed, inserted on apophyses, pear-shaped and with distal end truncated.

Remarks

Plumularia habereri was described by Stechow (1909) from two samples collected in Sagami Bay (Japan), in May of 1901 (flask without number) and March of 1903 (Locality Nr 4781, between Ito and Hatsushima Island) (Stechow 1909: 78). Later Billard (1913), using the material collected by the Siboga Expedition, described five varieties inside *P. habereri*: *P. habereri* var. *attenuata*, *P. habereri* var. *elongata*, *P. habereri* var. *subarmata* Billard, 1913, *P. habereri* var. *mediolineata* Billard, 1913 and *P. habereri* var. *mucronata*. *Plumularia habereri* var. *attenuata* coincides with the material described by Stechow (1909) as *P. habereri*; *P. habereri* var. *elongata* is clearly distinct, especially in the morphology of the hydrothecae; the rest of the varieties display some variations that in our opinion can be assigned to one of these two forms.

Schuchert (2003) indicates that most of these forms are quite different from that described from the type locality, but includes all of them under the binomen *P. habereri* since they can not be considered as subspecies because of their sympatric origins. Nevertheless he indicates that some of these varieties, and especially *P. habereri* var. *mediolineata* to which his material corresponds, might represent different species.

As part of this work we reviewed some of the type material of *P. habereri* from the two localities reported by Stechow (1909), deposited in the Zoologische Staatssammlung München (ZSM 20041622, 20041623, 20041625, 20051002) (Rutensteiner *et al.* 2008: 20), as well as the syntypes of all varieties described by Billard (1913), deposited in the MNHN (Van Praët 1979: 923, 924). We conclude that two different species are represented: *Plumularia habereri* Stechow 1909 and *Plumularia elongata* Billard 1913 (described as *P. habereri* var. *elongata* Billard, 1913). In Van Praët's paper, *P. habereri* var. *mucronata* was not included, but the syntype of it is also in collections of MNHN (MNHN H.L. 1272).

Plumularia habereri is distinguished by the morphology of its hydrothecae, having the abcauline wall straight, the opening directed upwards, and with the hydrothecal margin straight and perpendicular to the hydrocladial axis but cut obliquely downwards in the adcauline side. In both the oldest parts of the colony of this species and in the youngest or juvenile parts, the morphology of the hydrothecae does not vary. Moreover, in neither the type material nor in numerous colonies examined from the Philippines, the Coral Sea, and the New Caledonia region, have we observed the characters of *P. elongata*. These include curvature of the abcauline wall, inclination of hydrothecal rim towards the hydrocladia, and presence of an intrathecal septum (see below).

Plumularia habereri var. *mucronata*, whose distinguishing features are the greater development of the projection on which the mesial inferior nematotheca is placed and disposition of lateral nematothecae on small domes (Billard 1913), is included here in *P. habereri*. Examination of the syntype reveals that while the mesial inferior projection is more developed than in material identified as *P. habereri* var. *attenuata*, this character is similar to that observed in type material of the *P. habereri*. Moreover, we have not observed the existence of the small lateral domes described by Billard (1913), and insertion of the lateral nematothecae are, in all aspects, similar to the rest of the studied material.

The descriptions and figures of Ryland & Gibbons (1991) and Hirohito (1995 as *Dentitheca habereri*) closely correspond with this species. We also consider valid the record of Kirkendale & Calder (2003 as *Dentitheca habereri*) because they indicate that their material is identical to hydroids described by Stechow (1909) and Hirohito (1995).

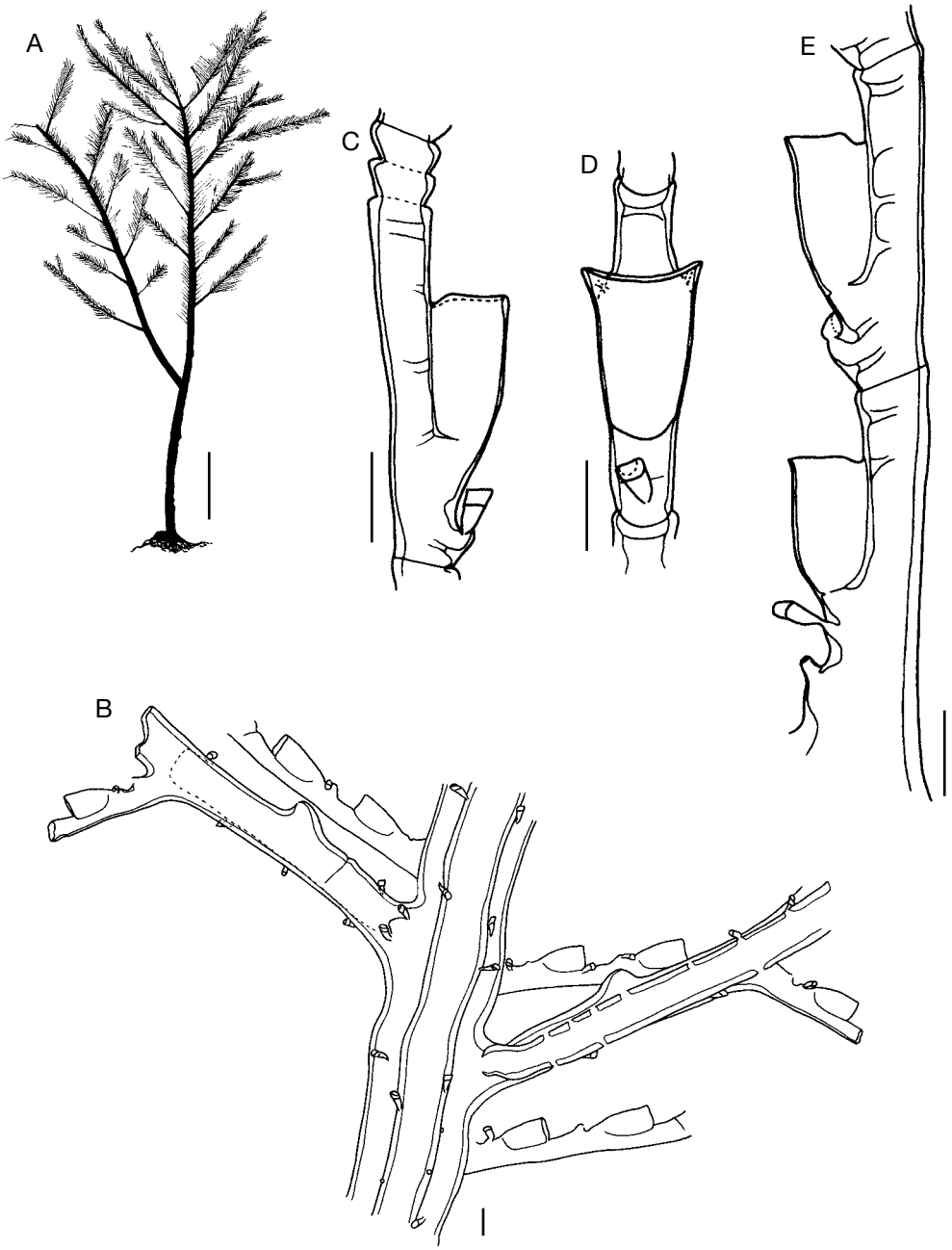

Fig. 9. — *Plumularia habereri* Stechow, 1909: **A**, LAGON, stn 0373, colony; **B**-**E**, CHALCAL 1, stn DC 29; **B**, detail of branch; **C**, internode with renovations after damaged; **D**, internode, frontal view; **E**, basal internodes of hydrocladia, lateral view. Scale bars: A, 1 cm; B-E, 0.1 mm.

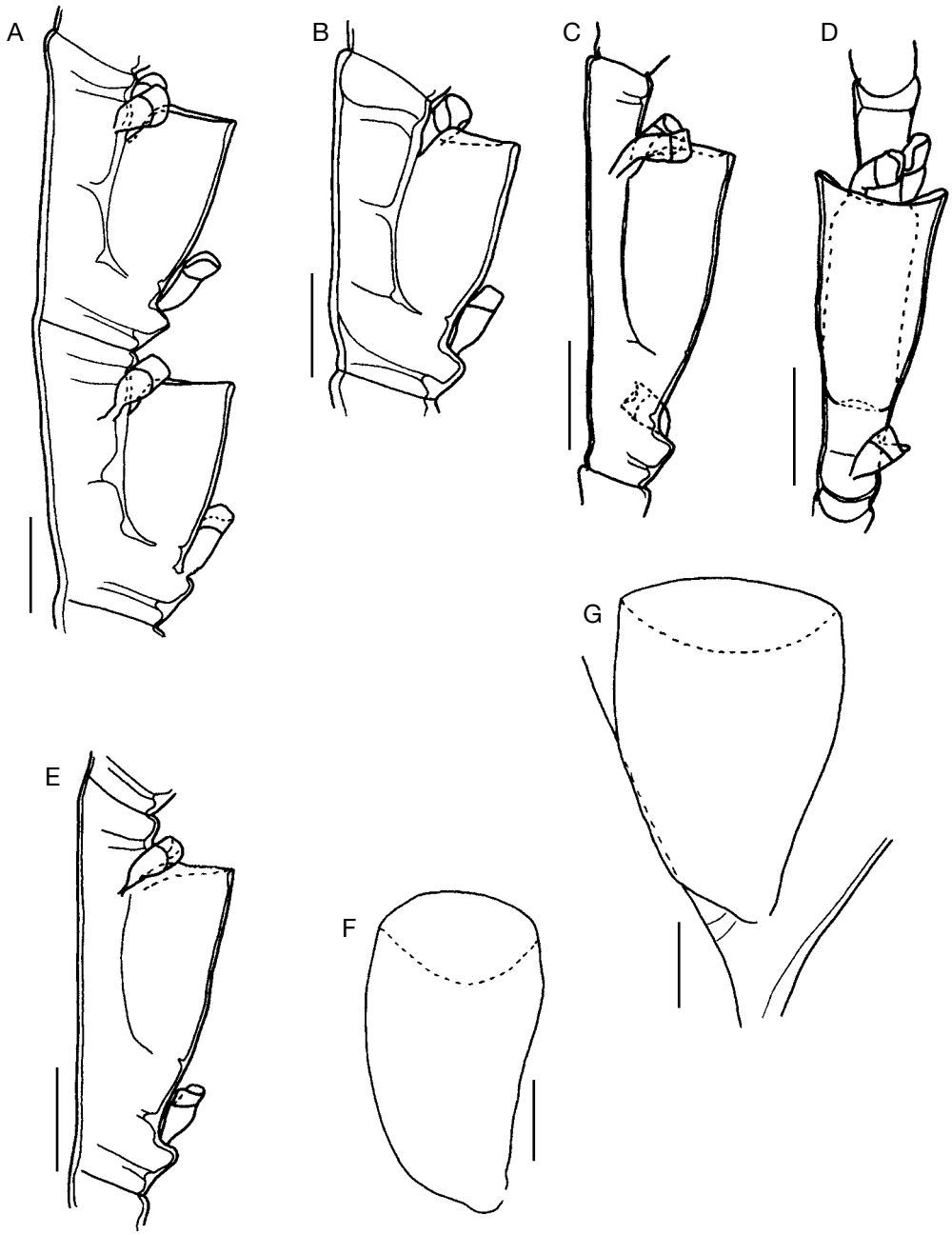

Fig. 10. — *Plumularia habereri* Stechow, 1909, **A**, **B**, LAGON, stn 0127: **A**, internodes, lateral view; **B**, internode from half of hydrocladia, lateral view; **C**-**E**, LAGON, stn 0116: **C**, internode from distal part of hydrocladia, lateral view; **D**, internode in frontal view; **E**, internode, lateral view; **F**, **G**, CORAIL 2, stn CP 25, gonothecae. Scale bars: 0.1 mm.

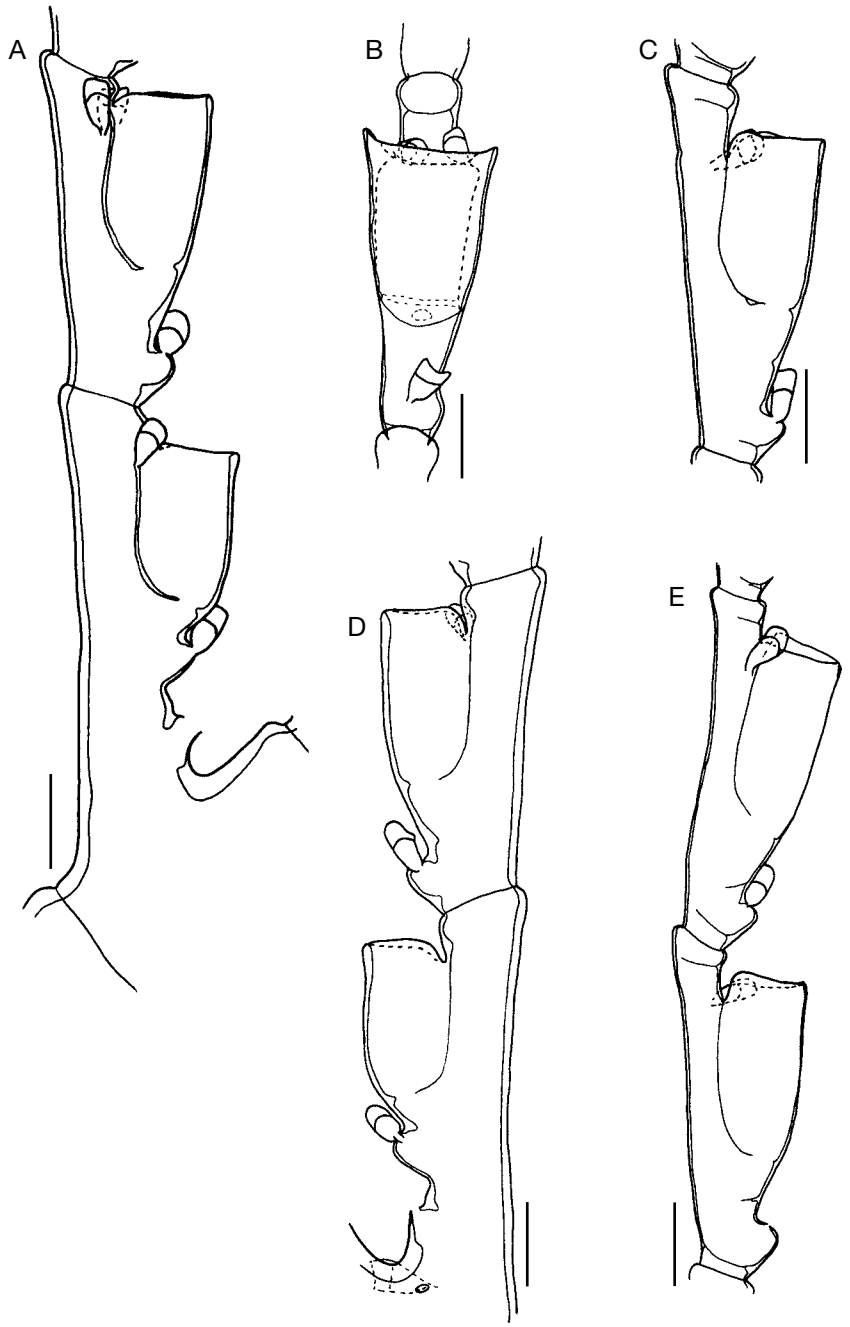

Fig. 11. — *Plumularia habereri* Stechow, 1909, type material: **A**-**C**, ZSM 20041622: **A**, basal internodes of hydrocladia, lateral view; **B**, internode, frontal view; **C**, internode from middle of hydrocladia, lateral view; **D**-**E**, ZSM 20041623: **D**, first internodes of hydrocladia, lateral view; **E**, distal internodes of hydrocladia, lateral view. Scale bars: 0.1 mm.

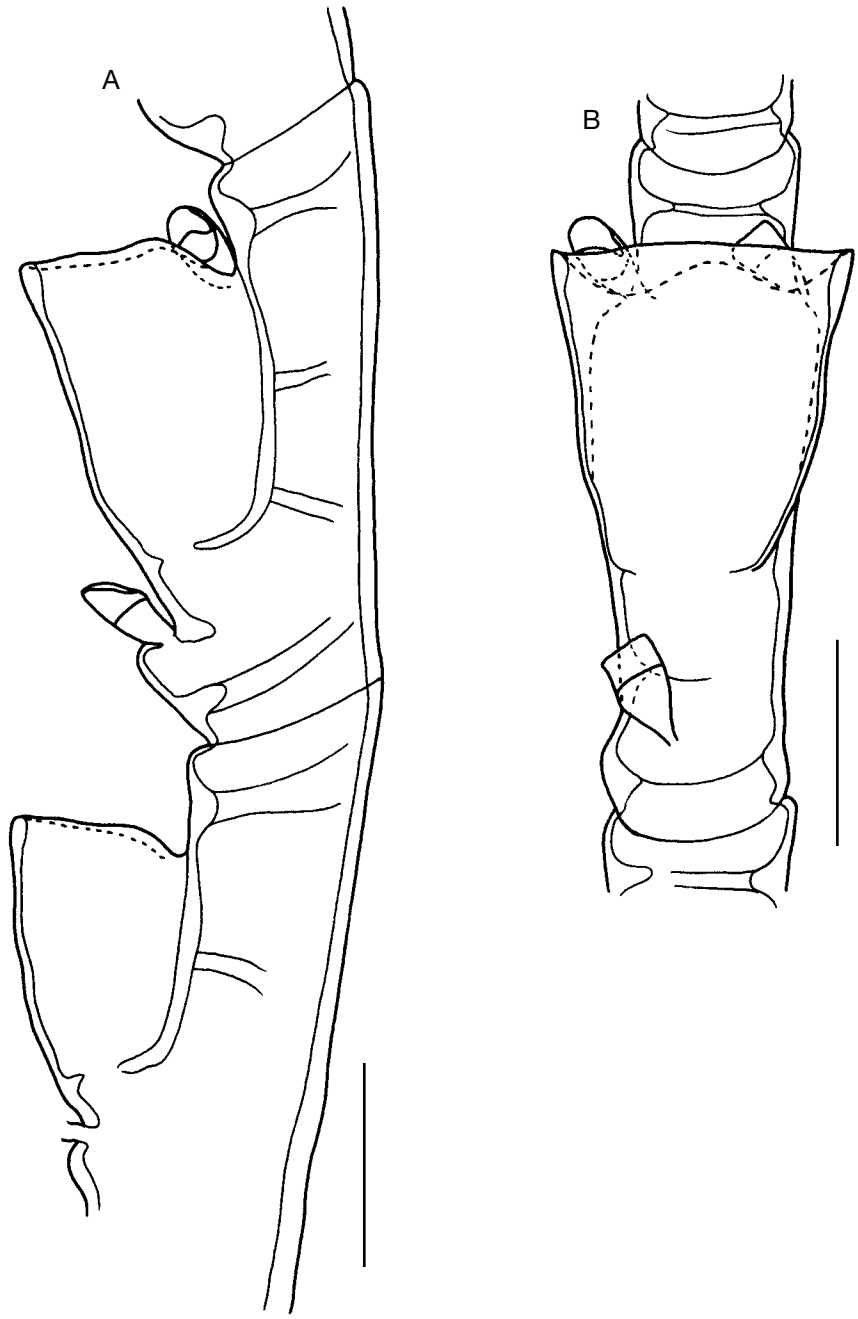

Fig. 12. — *Plumularia habereri* Stechow, 1909, syntype of *Plumularia habereri* var. *attenuata* Billard, 1913; SIBOGA EXPEDITION, stn 144, MNHN H.L. 1267: **A**, first internodes of hydrocladia, lateral view; **B**, internode, frontal view. Scale bars: 0.1 mm.

Plumularia habereri var. *mediolineata*, *P. habereri* var. *subarmata* and the records of *P. habereri* of Schuchert (2003) and Di Camillo *et al.* (2010) belong to *P. elongata* (see below). Records of this species from the Caribbean (Van Gemerden-Hoogeveen 1965, Flórez González 1983, Bandel & Wedler 1987) were included in *Dentitheca dendritica* (Nutting 1900) by Calder & Kirkendale (2005) and we agree. *Dentitheca dendritica* comes close to *P. habereri*, but, like Calder (2013), we hesitate in synonymizing the two. Their wide geographic separation makes a comparative study necessary before reaching a final conclusion. Regarding referral of this species to *Plumularia* or *Dentitheca* (Stechow, 1919), a matter of discussion in recent years, review of the type material of *Dentitheca hertwigi* (Stechow, 1909) (see below), type species of the genus (Stechow 1923b, Millard 1975), has convinced us, in agreement with Schuchert (2003) and Bouillon *et al.* (2006), that it must be placed in *Plumularia* because it lacks the two large triangular lobes characteristic of *Dentitheca*.

Genus *Dentitheca* Stechow, 1919

Dentitheca hertwigi (Stechow, 1909) (Fig. 14; Table 10)

Plumularia Hertwigi Stechow, 1909: 76, pl. I, fig. 9, pl. VI, figs 1-3; 1913: 93; 1919: 117, fig. T[1].

Dentitheca hertwigi – Hirohito 1995: 261, fig. 88a-e.

Material examined. — Type material of *Dentitheca hertwigi* Stechow, 1909: ZSM 20041700. Sagami Bay, near Misaki, Japan, depth 15-20 m, Doflein Expedition, 11-X-1904, One slide. ZSM 20051235, Sagami Bay, near Misaki, Japan, depth 15-20 m, Doflein Expedition, X-1904, one slide.

Distribution. — *Dentitheca hertwigi* is known only from Japan waters (Stechow 1909, Hirohito 1995).

Remarks

Dentitheca hertwigi, type species of *Dentitheca* Stechow, 1919 (Millard, 1975), is characterized by the morphology of its hydrothecae, with two large triangular lobes on the hydrothecal margin. This is the diagnostic character of the genus according to Stechow (1923b) and Bouillon *et al.* (2006)

Fig. 13. — *Plumularia habereri* Stechow, 1909, syntype of *Plumularia habereri* var. *mucronata* Billard, 1913; SIBOGA EXPEDITION, stn 80, MNHN H.L. 1272, internodes, lateral view. Scale bar: 0.1 mm.

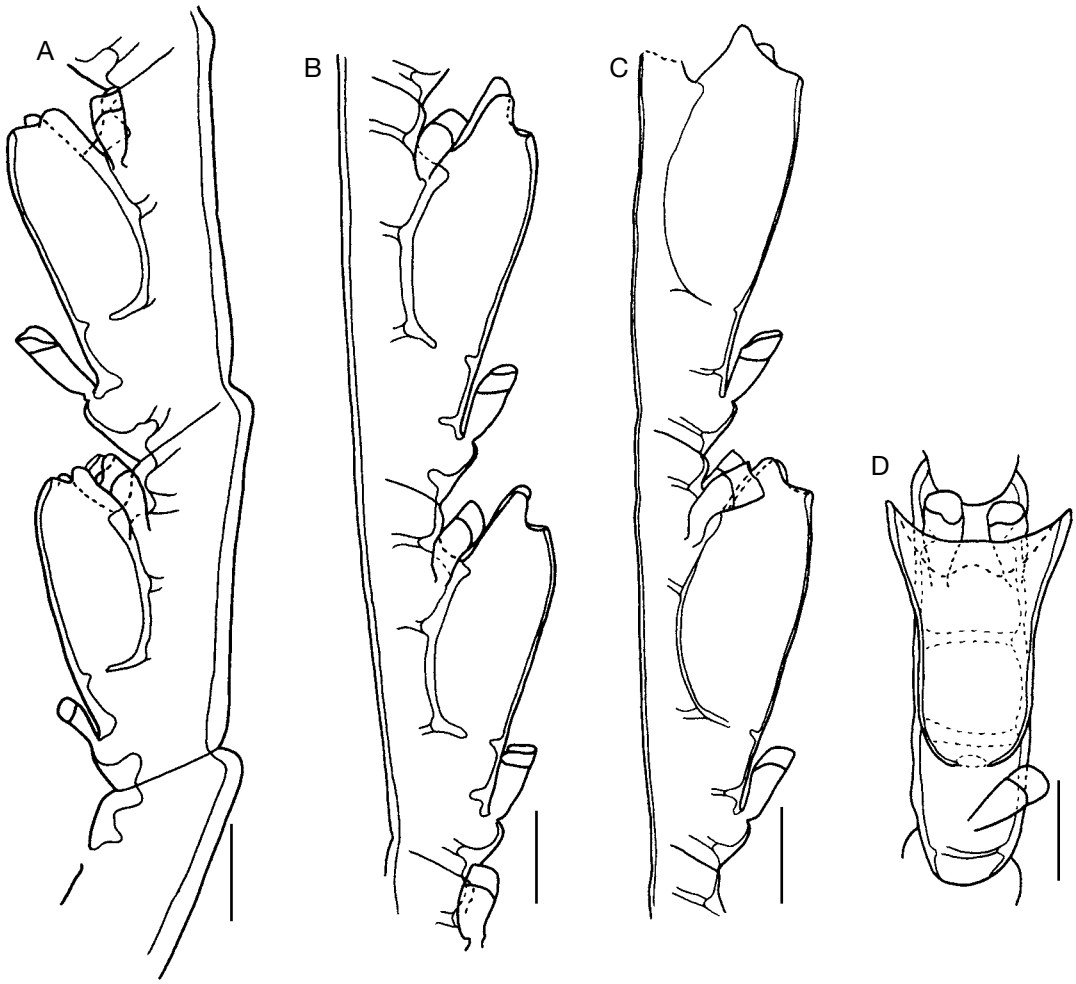

Fig. 14. — *Dentitheca hertwigi* (Stechow, 1909), type material, ZSM 20041700: **A**, first internodes of hydrocladia, lateral view; **B**, internodes from half of hydrocladia, lateral view; **C**, distal internodes of hydrocladia, lateral view; **D**, internode, frontal view. Scale bars: 0.1 mm.

(fig. 14B, C). *Plumularia habereri* lacks such triangular lobes, and its hydrothecal margin is straight and only lowered in the adcauline side, not produced.

Plumularia asymmetrica Bale, 1914 was included in the synonymy of *P. hertwigi* by Schuchert (2014b), but the asymmetrical morphology of the hydrothecal margin, with only one lateral lobe, and the presence of an intrathecal septum in the abcauline wall of the hydrotheca clearly separates both species. The presence of the intrathecal septum approaches that in *P. elongata,* but it is distinguished by the single marginal lobe (Bale 1914; pl. IV, figs 2-3).

Genus *Plumularia* Lamarck, 1816 (continue)

Plumularia elongata Billard, 1913 (Figs 15-19; Table 11)

Plumularia habereri var. *elongata* Billard, 1913: 44, figs 35-37.

Plumularia habereri var. *subarmata* Billard, 1913: 45, fig. 38.

Plumularia habereri var. *mediolineata* Billard, 1913: 45, fig. 39, pl. III, fig. 31.

Plumularia habereri – Schuchert 2003: 211, fig. 60.

Dentitheca habereri – Di Camillo *et al.* 2010: 84, figs 2, 3, 5, 6.

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3, stn DR 117, 12°31.2'-12°31.3'N, 120°39.3'-120°39.5'E, 92-97 m, 03.VI.1985: 7 mm high top part of a colony, no gonothecae (MNHN) (RMNH, two slides). — Stn CP 134, 12°01.1'-12°01.2'N, 121°57.3'-121°56.6'E, 92-95 m, 05.VI.1985: many fragments of a large, polysiphonic colony, no gonothecae (MNHN, one slide) (RMNH, two slides).

ADDITIONAL MATERIAL. — Syntype material of *Plumularia habereri* var. *elongata* Billard, 1911: Siboga Expedition. Stn 77: MNHN H.L. 1268-1269, slides.
Syntype material of *Plumularia habereri* var. *subarmata* Billard, 1911: Siboga Expedition. Stn 99: MNHN H.L. 1273, one slide.
Syntype material of *Plumularia habereri* var. *mediolineata* Billard, 1911: Siboga Expedition. Stn 71: MNHN H.L. 1270-1271, slides.

DISTRIBUTION. — This species is known only from the Indonesia region (Billard 1913, Schuchert 2003 Di Camillo *et al.* 2010) between 10-50 m depth.
Present material comes from the Philippines and was collected at 92-95 m.

DESCRIPTION

Hydrorhiza composed of a mass of intertwining tubules anchoring to sediment, supporting a polysiphonic and ramified axis, covered by the settlement of *Parazoanthus* sp. Main stem divided by transverse nodes which are rarely visible.

Branches originate from the secondary tubules and have the same structure as the main axis. Apophyses alternating right and left in the same plane. Each apophysis with well developed mamelon on superior surface and three nematothecae: two axillary and one above mamelon slightly displaced laterally; the node between apophyses and first hydrocladial internode is not visible.

Hydrocladia divided into thecate segments by oblique nodes not visible, there is only a weak indication of a node under mesial inferior nematotheca; they are visible only after rupture and subsequent regeneration in the apical zones of hydrocladia. Each hydrocladial internode with one hydrotheca and three nematothecae: one mesial inferior placed on a prominence of internode and two laterals.

TABLE 10. — Measurements of type material of *Dentitheca hertwigi* (Stechow, 1909) in µm.

	ZSM 20041700
Length thecate hydrocladial internodes	350-400
Diameter at node	70-120
Hydrotheca	
Length abcauline wall	210-250
Length adcauline wall adnate	150-200
Diameter at rim	80-110
Length adcauline wall and lateral teeth	220-310

TABLE 11. — Measurements of *Plumularia elongata* Billard, 1913 in µm.

	MUSORSTOM 3 Stn CP 134
Height of colony (in mm)	150
Length thecate hydrocladial internodes	340-430
Diameter at node	60-85
Hydrotheca	
Length abcauline wall	220-270
Length adcauline wall	150-200
Diameter at rim	80-90
Mesial nematotheca, length	60-70
Diameter at rim	25-30
Lateral nematotheca, length	60-70
Diameter at rim	25

Hydrotheca tubular, adcauline wall completely adnate with a thickened perisarc on rim; abcauline wall larger than adcauline wall, virtually straight except near the margin where it is curved, and with an internal septum in the middle of its length. Margin smooth with a slight lateral undulation, strongly tilted towards the adcauline side.

All nematothecae bithalamic, movable and with adcauline wall of distal chamber deeply scooped. Each internode with a variable number of internal thickenings.

Gonothecae absent.

VARIABILITY

The intrathecal abcauline septum is poorly developed or even absent in some hydrothecae, especially in those of the first hydrocladial internode; the same occurs in the young or regenerated parts of the colony and in juvenile colonies.

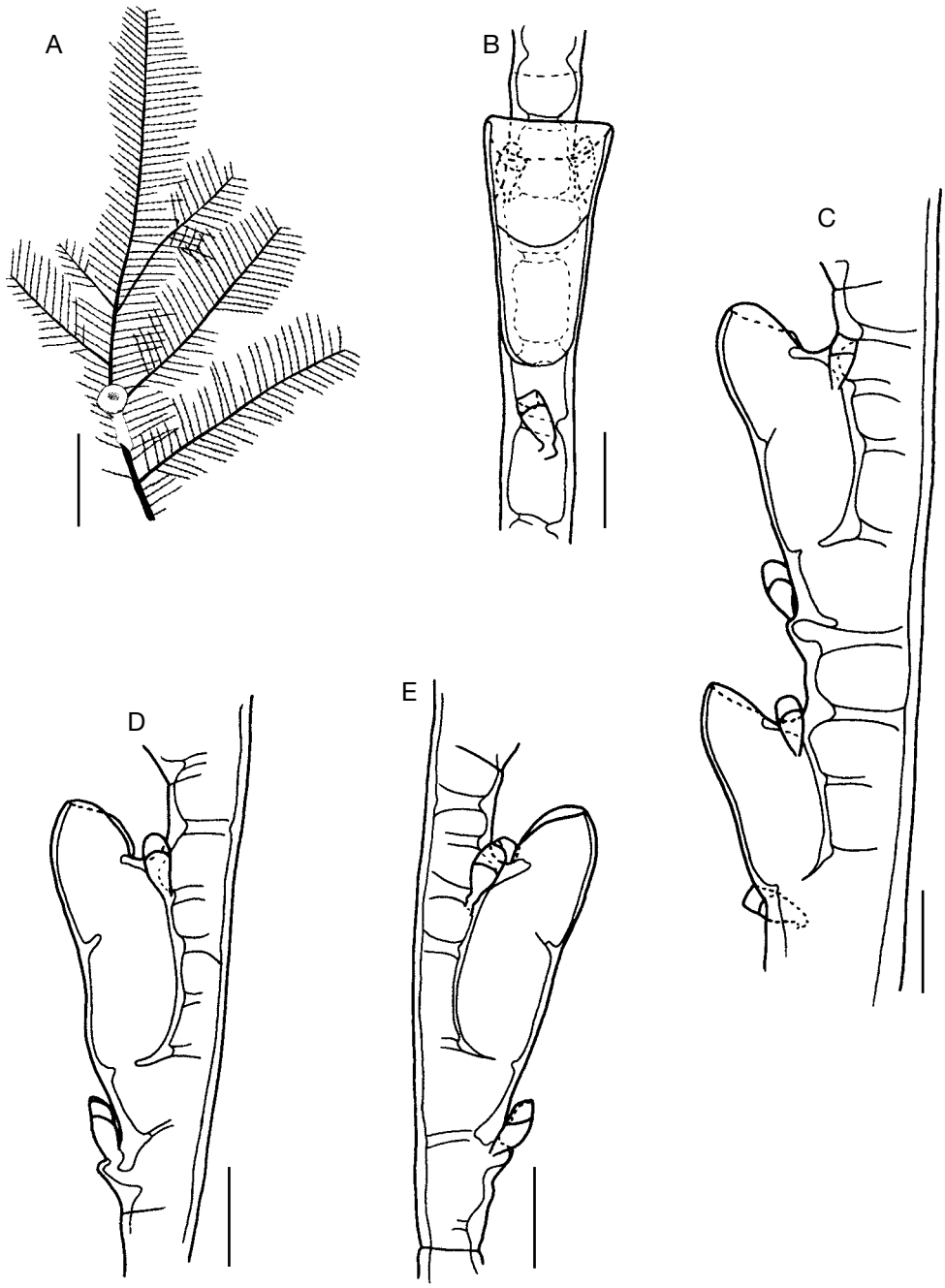

Fig. 15. — *Plumularia elongata* Billard, 1913, MUSORSTOM 3, stn CP 134: **A**, fragment of colony; **B**, internode, frontal view; **C**, first internodes of hydrocladia, lateral view; **D**, **E**, internodes from middle of hydrocladia, lateral view. Scale bars: A, 1 cm; B-E, 0.1 mm.

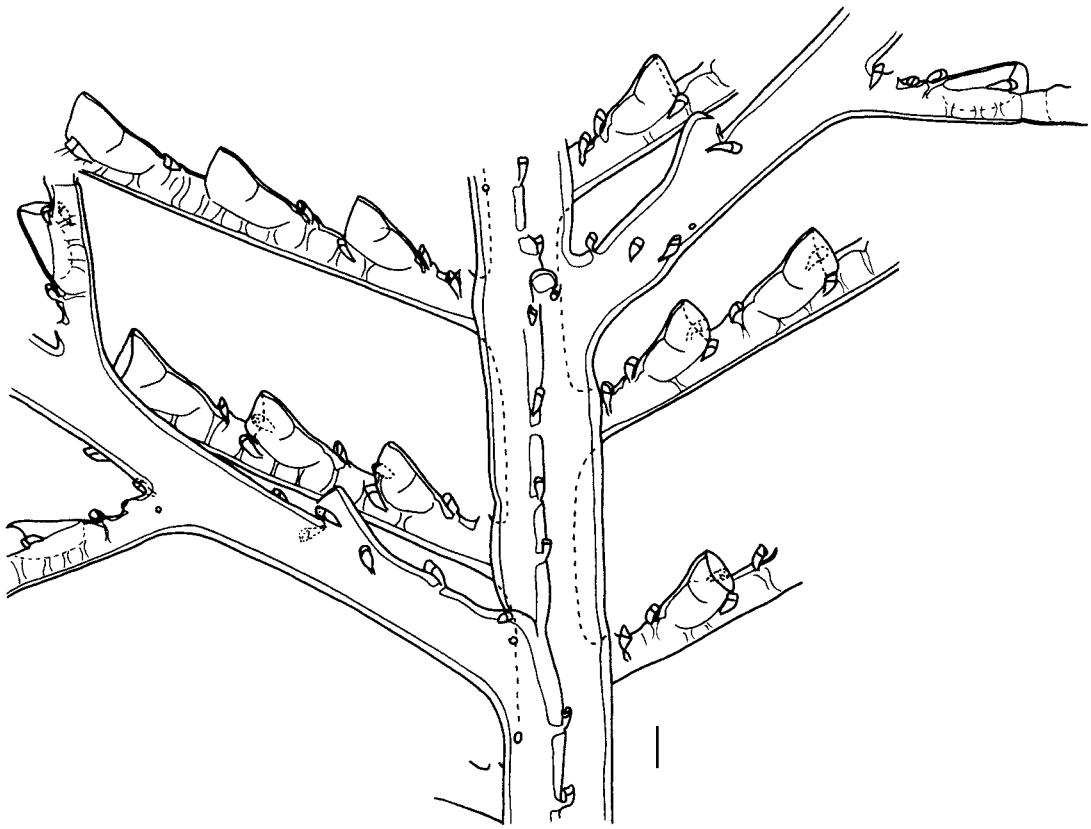

FIG. 16. — *Plumularia elongata* Billard, 1913, MUSORSTOM 3, stn CP 134, fragment with basal part of branchs. Scale bar: 0.1 mm.

REMARKS

Plumularia habereri (s.l., e. g. in Schuchert 2003) comprises two different species, one the nominal species, and another whose characteristics correspond better to those described by Billard (1913) as *P. habereri* var. *mediolineata*; however we propose as a valid name for this species *Plumularia elongata* Billard, 1913 because this name has page precedence over *P. habereri* var. *mediolineata*.

Adult colonies of this species are characterized by the presence of a well-developed intrathecal septum in at least some hydrothecae, but its development is not uniform throughout the colony and it seems linked to age and growth. In adult colonies, although hydrothecae with septa always appear, the septum is poorly developed or even absent in the first hydrotheca of each hydrocladium, in the youngest parts of the colony, in zones that have suffered breakage and subsequent regeneration, and in juvenile colonies.

Plumularia elongata is also distinguished by the characteristic curvature of the abcauline wall, giving the hydrotheca an oval profile; by hydrotheca narrowing towards both ends (basal and distal); and by the hydrothecal orifice, clearly directed towards the hydrocladia because of the brusque curvature on the abcauline side. This curvature can be observed only when hydrothecae are exactly lateral in view (Billard 1913), a feature that can be incorrectly interpreted in some cases.

As already indicated, an intrathecal septum has never been observed in *P. habereri* (s.s.).

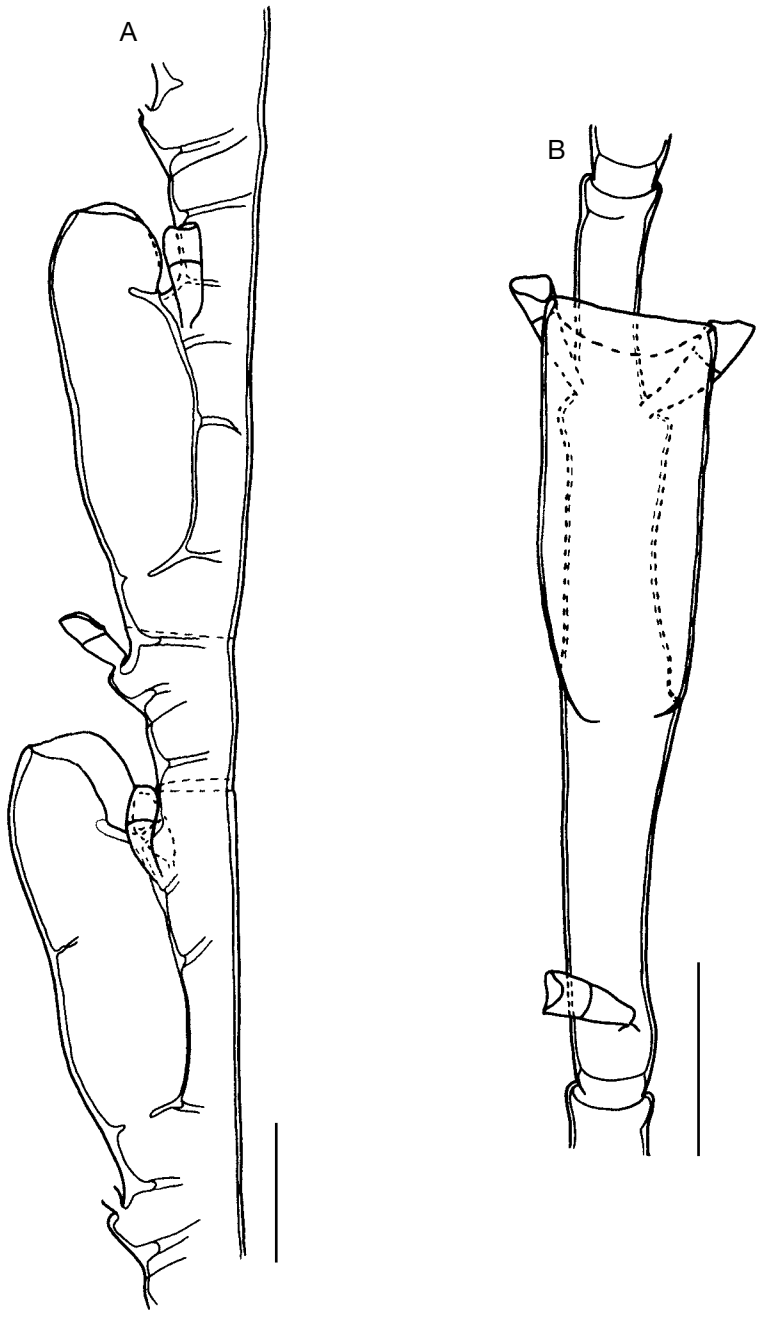

Fig. 17. — *Plumularia elongata* Billard, 1913, syntypes of *Plumularia habereri* var. *elongata* Billard, 1913; SIBOGA EXPEDITION stn 77; **A**, MNHN H.L. 1268, internodes, lateral view; **B**, MNHN H.L. 1269, internode, frontal view. Scale bars: 0.1 mm.

Moreover, no obvious differences exist in morphology of hydrothecae from different parts of the same colony (old and young) or in juvenile colonies and adults. In all cases, the abcauline wall is straight and either practically parallel to the hydrocladial axis or slightly divergent from hydrothecal base to rim, and the opening is always directed upwards.

In *P. elongata* we also include *P. habereri* var. *subarmata* and *P. habereri* var. *mediolineata*. The specimen of *P. habereri* var. *subarmata* (12 cm) presents numerous breakages followed by regeneration (Billard 1913: 45), it lacks an intrathecal septum but shows the same curvature of the abcauline wall that is typical of the species, and the hydrothecal margin is likewise tilted towards the hydrocladia. The disappearance of the mesial inferior nematotheca in some cases, considered by Billard (1913) as the distinctive character of the variety, seems related to the processes of regeneration after repeated breaks. In less-damaged parts of the colony, we observed the typical disposition of nematothecae.

The material of *P. habereri* var. *mediolineata* includes juvenile and adults colonies. The juvenile colonies (stn 164: 2 cm height) are similar to those of *P. habereri elongata* (stns 77 and 80: 2-3 cm height), unbranched and some hydrothecae without intrathecal septum. Adult colonies (stn 71: up to 13 cm) are branched and with the typical features of the species.

Material described by Schuchert (2003) and Di Camillo *et al.* (2010 as *Dentitheca habereri*) should also be included in this species. Di Camillo *et al.* (2010) indicated that they examined some type material of *P. habereri* (Nr 4781 Sammlung Haberer-Zoologische Staatssammlung Muenchen, part of the type material of *P. habereri* described by Stechow 1909), but they did not include a description of it. Type material of that species from the same station (ZSM 20041622, 20041625, 20051002) examined by us exhibited the typical characteristics of *P. habereri* and not of *P. elongata*.

Finally we retain the species in the genus *Plumularia* because it lacks large triangular lobes on the hydrothecal rim, a diagnostic character of the genus *Dentitheca* (Stechow 1923b, Bouillon *et al.* 2006).

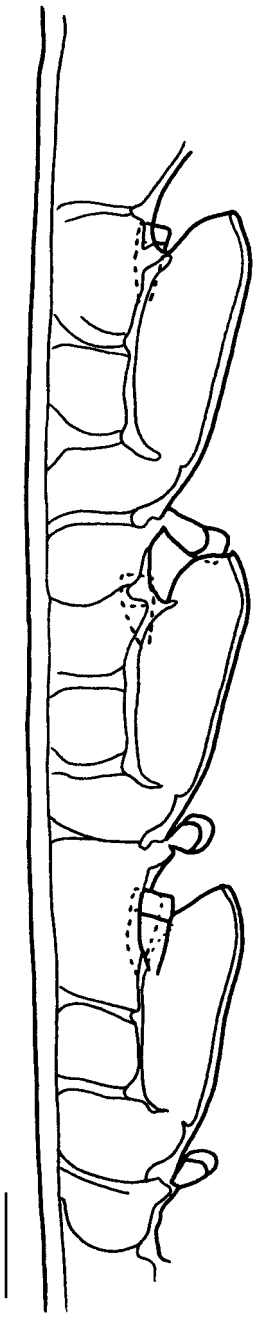

FIG. 18. — *Plumularia elongata* Billard, 1913, syntype of *Plumularia habereri* var. *subarmata* Billard, 1913; SIBOGA EXPEDITION stn 99, MNHN H.L. 1273, internodes, lateral view. Scale bar: 0.1 mm.

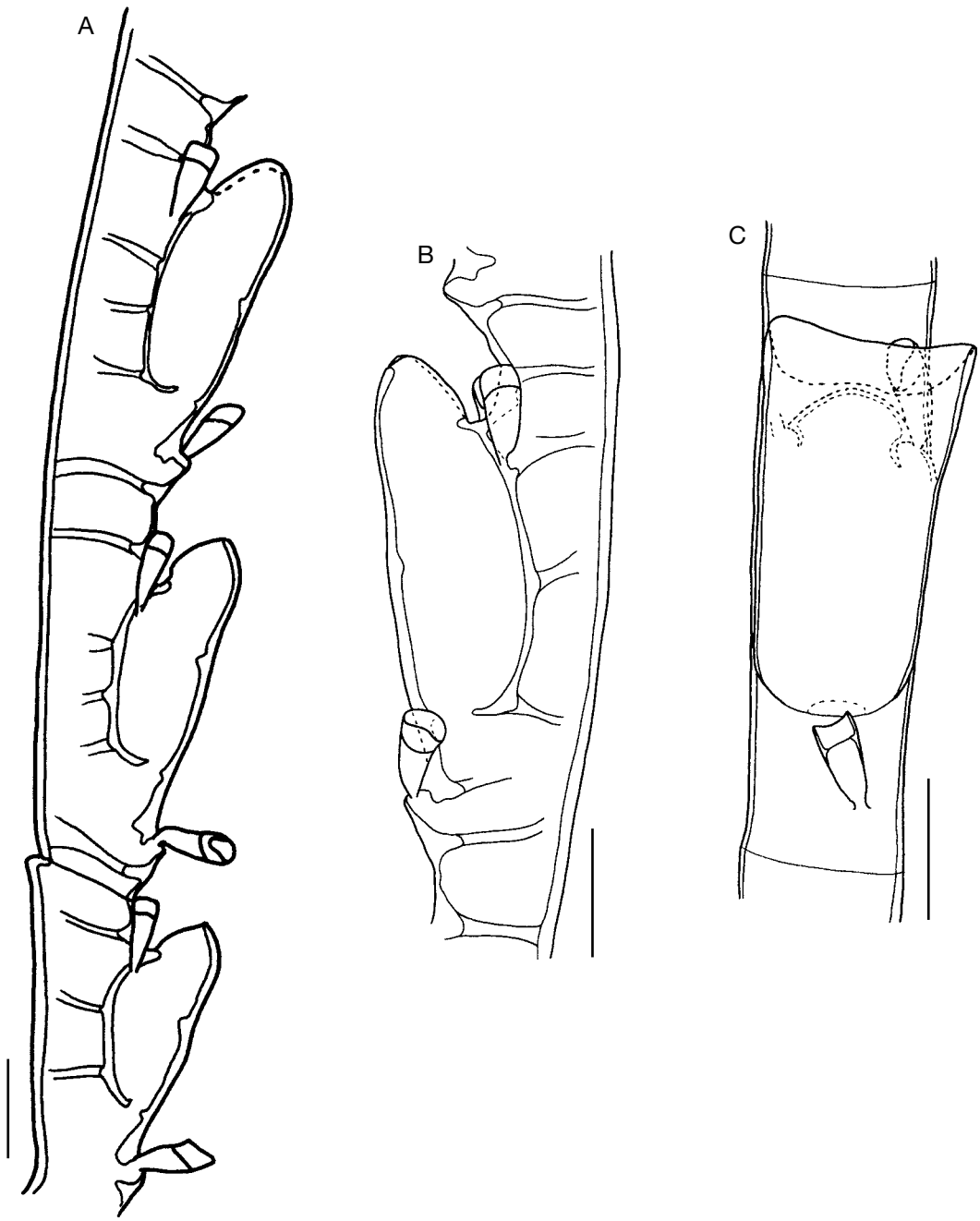

Fig. 19. — *Plumularia elongata* Billard, 1913, syntypes of *Plumularia habereri* var. *mediolineata* Billard, 1913; SIBOGA EXPEDITION stn 71: **A**, **B**, MNHN H.L. 1270: **A**, basal internodes; **B**, internode of distal part of hydrocladia lateral view; **C**, MNHN H.L. 1271, distal internode of hydrocladia, frontal view. Scale bars: 0.1 mm.

Plumularia pseudocontraria n. sp.
(Figs 20, 21; Table 12)

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3, stn DR 117, 12°31.2'-12°31.3'N, 120°39.3'-120°39.5'E, 92-97 m, 03.VI.1985: a branched fragment 30 mm high without gonothecae, holotype (MNHN-IK-2012-14254).

ETYMOLOGY. — The specific name *pseudocontraria* has been chosen because of the resemblance of this new species to *Plumularia contraria* n. sp.

DISTRIBUTION. — *Plumularia pseudocontraria* n. sp. is known only from a single locality in the Philippines (type locality), at a depth of 92-97 m.

DESCRIPTION

Apical part of colony with monosiphonic axis, branched. Branches arising from axil of a closed apophysis and one small secondary tube born from the axils of each branch but it does not continue its growth towards top of colony.

Apophyses alternately directed left and right almost frontally, each with one well developed mamelon on superior surface and two axillary nematothecae, two or four nematothecae between consecutive apophyses.

Hydrocladia formed by regular succession of hydrothecate internodes separated by slightly oblique nodes not very marked; each internode with one hydrotheca and four nematothecae: one median infracalycine, two laterals and one median distal. Hydrotheca tubular, deep, adcauline wall fully adnate, abcauline wall practically straight, hydrothecal rim smooth and with adcauline side curved down. Median inferior and distal nematothecae placed at an elevation, with adcauline wall of superior chamber scooped. Lateral nematothecae placed near hydrothecal margin and with adcauline wall of upper chamber clearly scooped. All nematothecae movable, bithalamic and conical.

Internodes with a variable number of internal thickenings, until eight in basal internodes of hydrocladium: one below, four behind and three above the hydrotheca. The development and number of perisarcal rings is lower in distal internodes of a given hydrocladium.

TABLE 12. — Measurements of *Plumularia pseudocontraria* n. sp. in µm.

	MUSORSTOM 3 stn DR 117
Height of colony (in mm)	30
Length thecate hydrocladial internodes	480-560
Diameter at node	55-65
Hydrotheca	
Length abcauline wall	230-270
Length adcauline wall	160-210
Diameter at rim	70-100
Mesial nematotheca, length	65-70
Diameter at rim	25
Lateral nematotheca, length	70-80
Diameter at rim	30
Supracalycine nematotheca, length	65-70
Diameter at rim	20-25

Gonothecae not observed.

VARIABILITY

The presence of two suprahydrothecal nematothecae normally present after damage and subsequent regeneration.

In the distal parts of hydrocladia, sometimes there are no signs of injury when there are two suprahydrothecal nematothecae.

REMARKS

Plumularia pseudocontraria n. sp. resembles *P. contraria* n. sp. in its spiral colony structure and in the number and arrangement of nematothecae on the thecate internodes. The two nevertheless differ in the morphology of their hydrothecae, with *P. pseudocontraria* n. sp. lacking an adcaulinar intrathecal septum, in having a hydrothecal orifice that is directed upwards, and in having a hydrothecal rim that is sinuous: it is straight on the abcauline side and curved downwards on the adcauline side.

In the absence of an intrathecal septum and in the form of the hydrothecal margin, this species is similar to *P. habereri*. However, it clearly differs in the morphology and ramification pattern of the colony, and in the number of nematothecae on hydrocladial internodes.

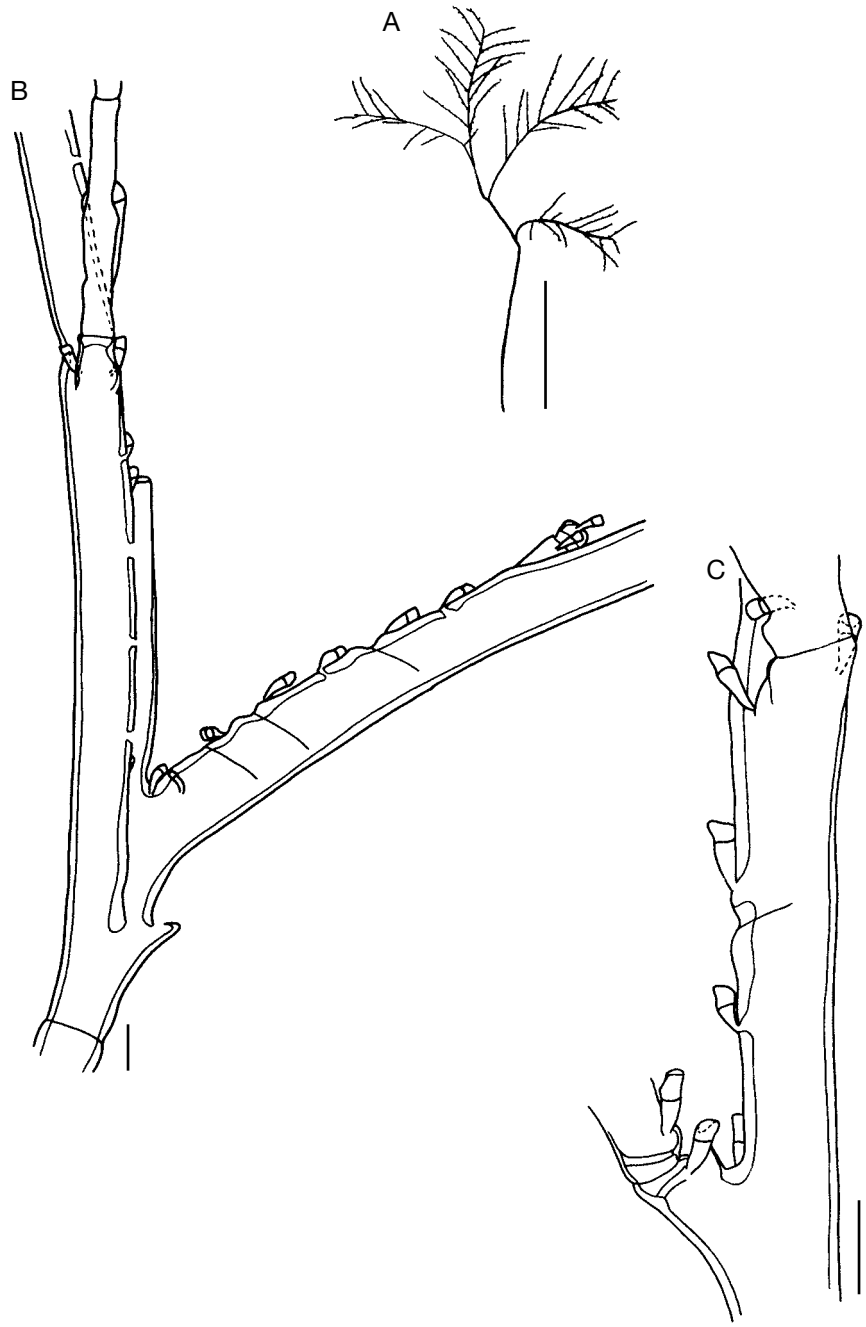

Fig. 20. — *Plumularia pseudocontraria* n. sp., MUSORSTOM 3, stn DR 117 (holotype): **A**, colony; **B**, detail of branch; **C**, two consecutive apophyses. Scale bars: A, 1 cm; B, C, 0.1 mm.

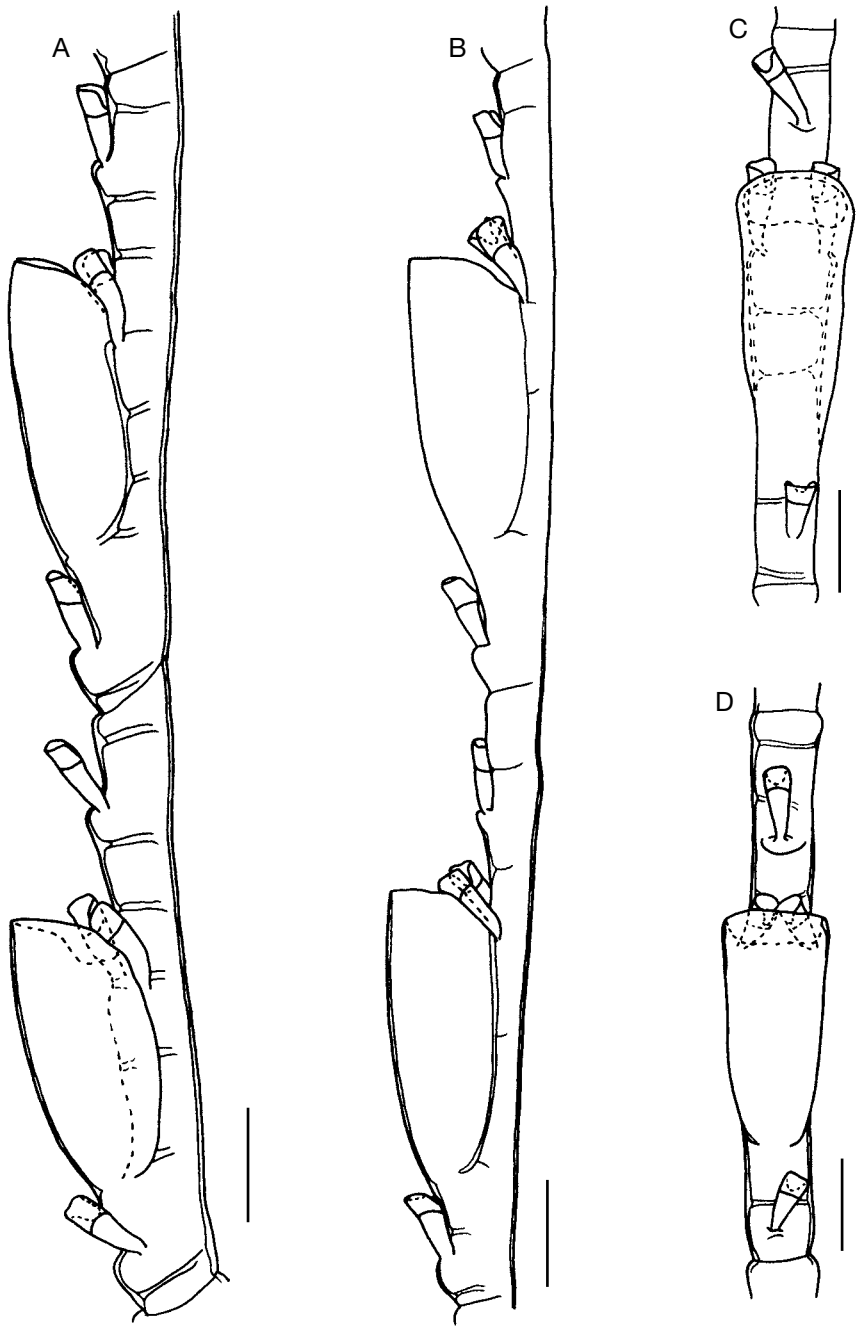

Fig. 21. — *Plumularia pseudocontraria* n. sp., MUSORSTOM 3, stn DR 117 (holotype): **A**, first hydrocladial internodes, lateral view; **B**, distal hydrocladial internodes, lateral view; **C**, **D**, internodes, frontal view. Scale bars: 0.1 mm.

TABLE 13. — Measurements of *Plumularia setacea* (Linnaeus, 1758) in µm.

	MUSORSTOM 4 CC 201
Height of colony (in mm)	33
Stem internode, length	520-750
Diameter at node	160-240
First hydrocladial internode, length	60-100
Diameter at node	60-80
Length thecate hydrocladial internodes	480-650
Length athecate hydrocladial internodes	270-360
Diameter at node	45-70
Hydrotheca	
Length abcauline wall	70-90
Length adcauline wall	80-100
Diameter at rim	90-105
Mesial nematotheca, length	70-80
Diameter at rim	25-35
Lateral nematotheca, length	70-85
Diameter at rim	30-35

Plumularia setacea (Linnaeus, 1758)
(Fig. 22; Table 13)

Sertularia setacea Linnaeus, 1758: 813.

Plumularia setacea – Vervoort 1966: 142, fig. 43a-e. — Ramil & Vervoort 1992: 191, fig. 47f-i. — Hirohito 1995: 278, fig. 95c, d. — Ansín Agís, Ramil & Vervoort 2001: 238, fig. 91a-j. — Vervoort & Watson 2003: 398, figs 96G, 97A-G, 98A. — Schuchert 2013a: 105, figs 4-6; 2014a: 1, figs 1, 2.

Plumularia corrugata Nutting, 1900: 64, pl. VI, figs 1-3.

Plumularia diploptera Totton, 1930: 222, fig. 59a, b. — Ralph 1961: 32, fig. 3f-j. — Rees & Vervoort 1987: 137-139, fig. 29.

Plumularia setacea var. *setacea* Ralph, 1961: 33, figs 3e, 4a, 4c, d.

Not *Plumularia corrugata* – Bennitt, 1922: 255. — Fraser 1944: 341. — Morris & Mogelberg 1973: 19. — Defenbaugh 1974: 101, fig. 14 (records included in *Plumularia strictocarpa* Pictet, 1893).

MATERIAL EXAMINED. — **New Caledonia.** MUSORSTOM 4, stn CP 169, 18°54.3'S, 163°11.2'E, 590 m, 17.IX.1985: several colonies 50-60 mm high rising from rampant stolon. No gonothecae (MNHN) (RMNH, two slides). — Stn CC 201, 18°55.80'S, 163°13.80'E, 500 m, 20.IX.1985: many 70 mm high plumes rising from stolon on worm-tube. One gonotheca observed (MNHN) (RMNH, one slide).
Norfolk Ridge. SMIB 5, stn DW 101, 23°21.2'S, 168°04.9'E, 270 m, 14.IX.1989: one colony 25 mm high with several stems on coral fragment and some fragments. No gonothecae (MNHN).
BATHUS 3, stn CP 833, 23°03'S, 166°58'E, 441-444 m, 30.XI.1993: two colonies 10-33 mm high without gonothecae (MNHN).
Marquesas Islands. MUSORSTOM 9, stn DW 1170, 08°45.1'S, 140°13.1'W, 104-109 m, 25.VIII.1997: six colonies 10-25 mm high with damaged gonothecae (MNHN).

DISTRIBUTION. — Many authors (Vannucci-Mendes 1946, Leloup 1947, Picard 1958, Ralph 1961, Millard 1975, Boero & Bouillon 1993, Blanco 1994) consider *Plumularia setacea* as a cosmopolitan species, although it has not been reported from Antarctic waters (Peña Cantero 2004). Schuchert (2013a) ascribe the species a circumglobal distribution in warm and temperate waters.

REMARKS
The current status of the *Plumularia lagenifera* Allman, 1885 is considered as problematic and difficult to separate from *P. setacea* by Schuchert (2013a). In his opinion, the only operational character to distinguish both species is the morphology of the hydrothecal abcauline wall, convex in the former and straight or even concave in the last one. Our material showed a straight abcauline wall and, therefore it was included in *P. setacea*. In addition, Schuchert (2014a), after molecular analyses of different populations of *P. setacea*, concluded that the current concept of this species could include either a species complex or a single near-cosmopolitan species with a strong population stratification.

Plumularia spiralis Billard, 1911
(Fig. 23; Table 14)

Plumularia spiralis Billard, 1911: LXIX, fig. 12; 1913: 49, fig. 54, pl. II, figs 26, 27. — Jäderholm 1919: 22, pl. V, fig. 5. — Stechow 1923a: 18. — Rho 1969: 167, pl. I, figs 4, 5, pl. II, fig. 7. — Millard & Bouillon 1973: 87, fig. 11D. — Rho 1977: 282, pl. XCVI, fig. 97. — Hirohito 1995: 280, fig. 96d-e. — Kirkendale & Calder 2003: 167.

Not *Plumularia spiralis* Milstein, 1976: 82, figs. 17, 21, 22, 34, 37 (synonym of *Plumularia milsteinae* n. nom.)

MATERIAL EXAMINED. — **NE Mozambique Channel, NE Geyser Bank.** BENTHEDI, stn CH 13, 12°12.7'S, 46°40.8'E, 2300-2500 m, 20.III.1997: three ramified fragments, 20-25 m high, without gonothecae (MNHN).

DISTRIBUTION. — *Plumularia spiralis* is known from the Seychelles, Indonesia, Korea, Japan (Hirohito 1995), Guam and the Northern Marianas Islands (Kirkendale & Calder 2003) and American Samoa (Coles *et al.* 2003); its bathymetrical range extends from 1 to 400 m depth. Our material comes from a single station in the Mozambique Channel (NE Geyser Bank), located at 2300-2500 m.

DESCRIPTION

Axis monosiphonic, branched, in zigzag (according to Billard 1913: 49); branches originating from zig-zag corners of main axis alternately in different planes; main stem and branches divided into internodes of varied length by oblique nodes.

Apophyses alternately directed right and left with a small mamelon on superior surface and three nematothecae: two axillary and one frontal near of mamelon. Arrangement of apophyses in one plane, but slightly frontally.

Hydrocladia homomerously segmented, hydrocladial internodes separated by oblique nodes. Each thecate internode with one hydrotheca and four nematothecae: one mesial inferior, two laterals and one suprahydrothecal. Hydrotheca cup-shaped, small, adcauline wall completely adnate, abcauline wall straight and slightly higher than adcauline wall; rim smooth, circular and slightly tilted towards adcauline side.

Mesial inferior and suprahydrothecal nematothecae above an elevation. Lateral nematothecae arising from a small apophysis on each side of hydrotheca. All nematothecae bithalamic, movable and conical. Internodes with several perisarcal rings with a variable development.

Gonothecae not observed.

REMARKS

Our material agrees well with the description of this species given by Billard (1913), and we have no doubt about its identification. The locality falls within its geographical distribution but the sampling depth (2300-2500 m) is far away from its known bathymetrical range (1-400 m). The possibility of

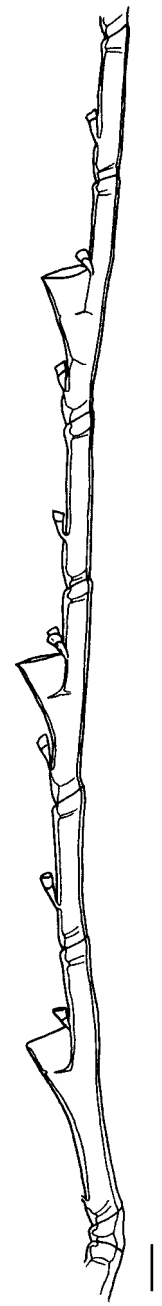

FIG. 22. — *Plumularia setacea* (Linnaeus, 1758), MUSORSTOM 4, stn CC 201, basal part of hydrocladia, lateral view. Scale bar: 0.1 mm.

TABLE 14. — Measurements of *Plumularia spiralis* Billard, 1911 in µm.

	BENTHEDI stn CH 13
Height of colony (in mm)	20-25
Length thecate hydrocladial internodes	490-560
Diameter at node	40-50
Hydrotheca	
Length abcauline wall	55-70
Length adcauline wall	35-40
Diameter at rim	65-80
Mesial nematotheca, length	70-80
Diameter at rim	30-40
Lateral nematotheca, length	80-85
Diameter at rim	30-35

TABLE 15. — Measurements of *Plumularia strobilophora* Billard, 1913 in µm.

	MUSORSTOM 3 stn CP 121
Height of colony (in mm)	21
Stem internode, length	290-380
Diameter at node	45-100
First hydrocladial internode, length	100-150
Length thecate hydrocladial internodes	240-280
Length athecate hydrocladial internodes	225-290
Diameter at node	25-35
Hydrotheca	
Length abcauline wall	40-50
Length adcauline wall	50-70
Diameter at rim	60-75
Mesial nematotheca, length	40-55
Diameter at rim	20-25
Lateral nematotheca, length	60-70
Diameter at rim	30-35

detached colonies subsequently collected by the trawl can not be excluded; in consequence the depth record should be regarded with caution and the presence of *P. spiralis* in the lower bathyal must be confirmed with new data.

Plumularia spiralis Milstein, 1976, described from Uruguay, is a permanently invalid junior primary homonym of *P. spiralis* Billard, 1911, and must be replaced. We propose the name *Plumularia milsteinae* n. nom. for it. The species from South America is quite different in morphology, having (1) erect and straight monosiphonic axes with some lateral ramifications in large colonies, (2) hydrocladia alternately arranged in one plane at the base but in a spiral elsewhere, (3) heteronomous segmentation of hydrocladia, with thecate internodes having one hydrotheca and three nematothecae (one mesial inferior and two laterals) and (4) small athecate internodes without nematothecae.

Plumularia strobilophora Billard, 1913
(Fig. 24; Table 15)

Plumularia strobilophora Billard, 1913: 35, fig. 26. — Vervoort & Vasseur 1977: 79, fig. 33a, b. — Schuchert 2013b: 410, fig. 3.

Plumularia strobilifera – Billard 1933: 23, fig. 9. — Schmidt 1972: 43 (incorrect subsequent spelling).

Plumularia strobilophora – Vannucci Mendes 1951: 87, pl. 3, figs 17, 18. – Grohmann *et al.* 2011: 195, fig. 2h (doubtful records).

Not *Plumularia strobilophora* – Ryland & Gibbons 1991: 536, fig. 8A, B (included in *Plumularia mooreana* Schuchert, 2013).

MATERIAL EXAMINED. — **Philippines.** MUSORSTOM 3, stn CP 121, 12°08.3'N, 121°17.3'E, 73-84 m, 03.VI.1985: one colony 22 mm high without gonothecae (MNHN).

DISTRIBUTION. — *Plumularia strobilophora* is an Indo-Pacific species, known from the Gulf of Suez (Billard, 1933) and Aqaba (Schmidt, 1972), Key Islands (Billard, 1913; Schuchert, 2013b), French Polynesia and the Philippines (Vervoort & Vasseur 1977) and American Samoa (Coles et al, 2003). The bathymetrical distribution extends from the littoral zone to 60 m.
Our material was collected in the Philippines at a depth of 73-84 m.
Brazilian records (Vannucci Mendes 1951; Grohmann *et al.* 2011) are here considered doubtful.

DESCRIPTION
Stem monosiphonic, divided into internodes by straight nodes. Each internode with a distal apophysis and one nematotheca on its basal half, inserting on wall opposite the apophysis. Apophyses alternately directed left and right, each with three nematothecae: two paired axillary and one unpaired above a small and scarcely visible mamelon; one internal septum close to node. First internode of hydrocladium athecate and without nematothecae; remainder of hydrocladium

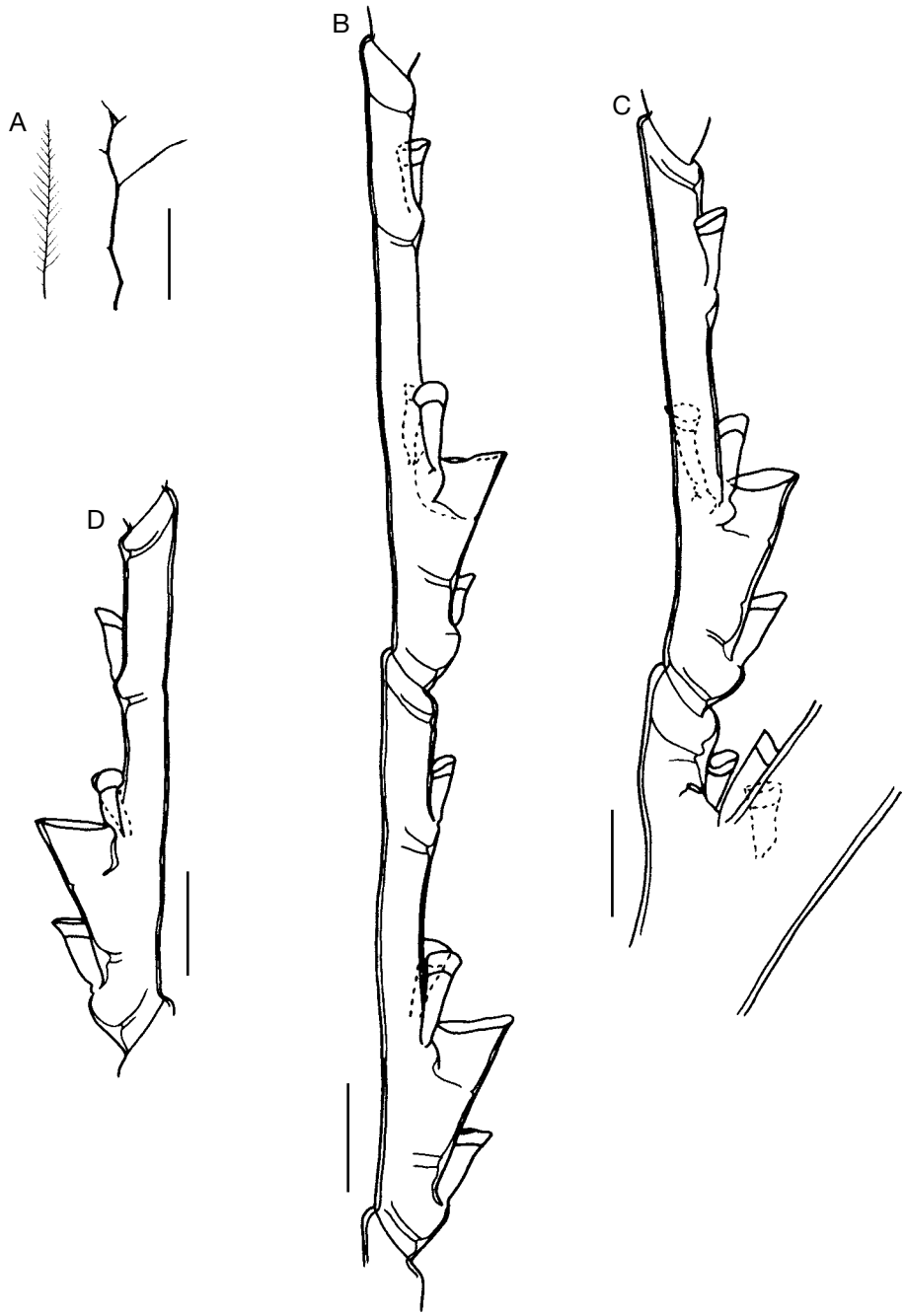

Fig. 23. — *Plumularia spiralis* Billard, 1911, BENTHEDI, stn CH 13: **A**, colony; **B**, internode, lateral view; **C**, apophyses and first internode of hydrocladia; **D**, internode, lateral view. Scale bars: A, 1 cm; B-D, 0.1 mm.

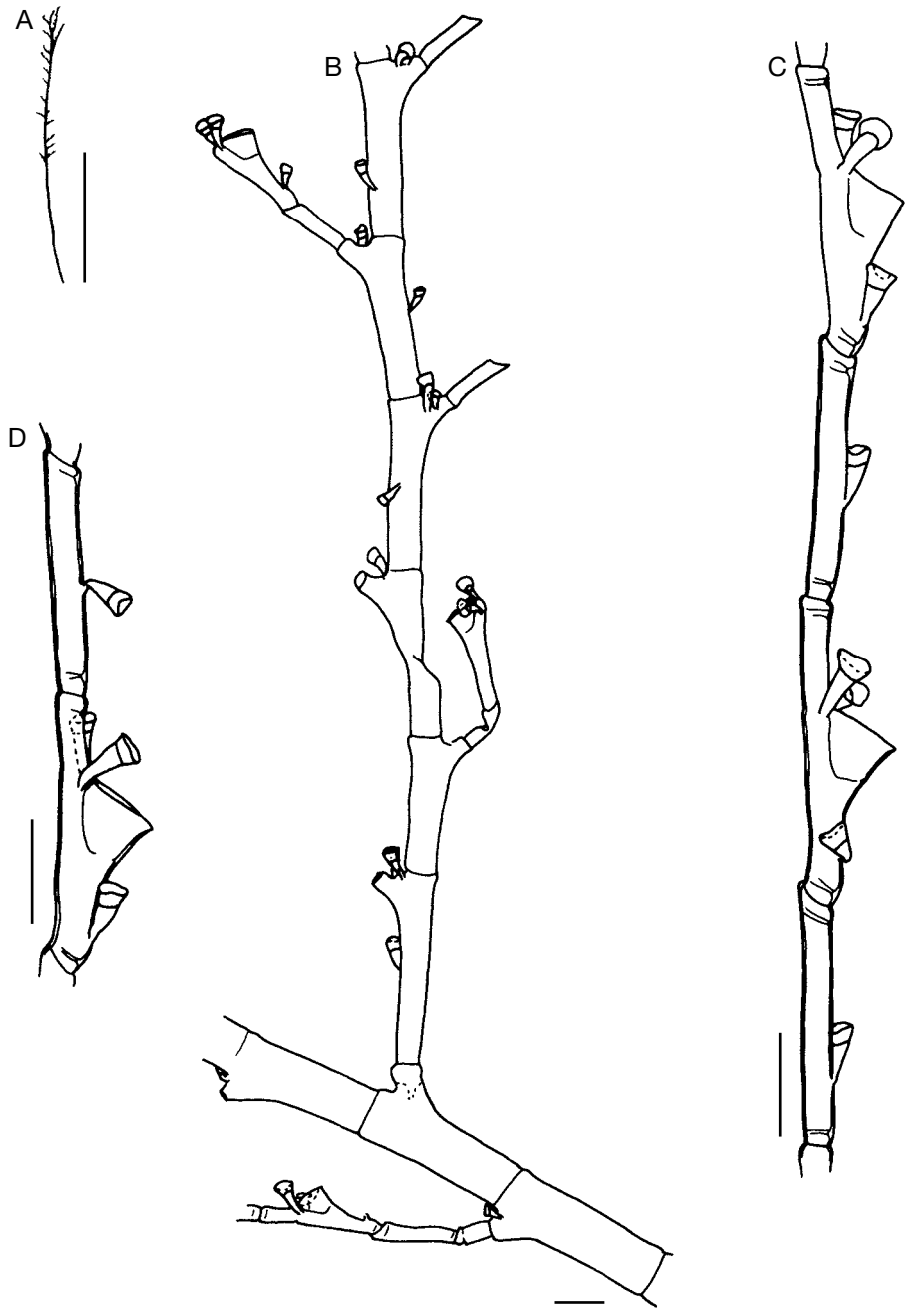

Fig. 24. — *Plumularia strobilophora* Billard, 1913, MUSORSTOM 3, stn CP 121: **A**, colony; **B**, branch arising instead hydrocladia; **C**, internodes from distal part of hydrocladia, lateral view; **D**, internode, lateral view. Scale bars: A, 1 cm; B-D, 0.1 mm.

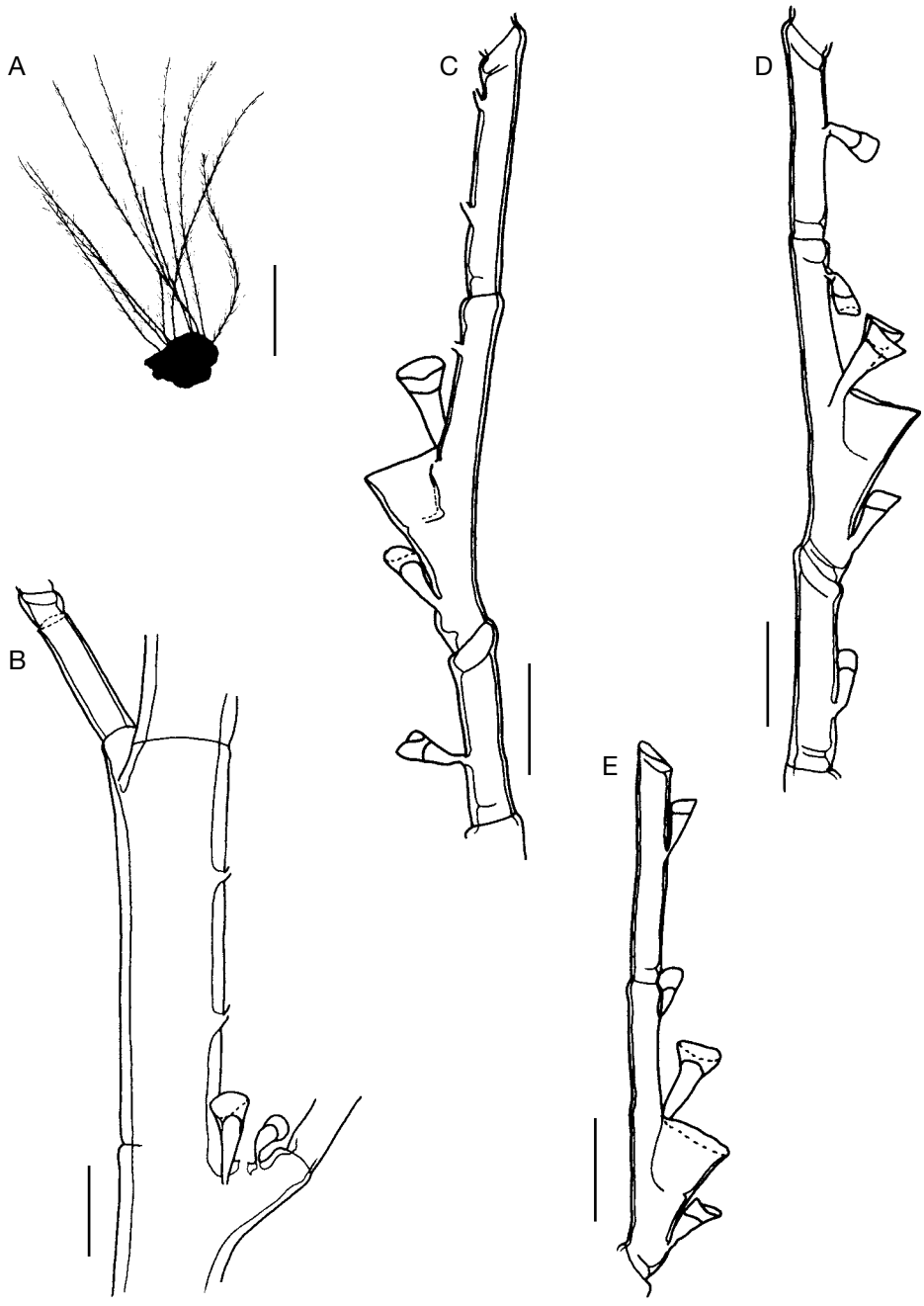

Fig. 25. — *Plumularia* sp. 1, SMIB 5, stn DW 101: **A**, colony; **B**, internode of stem with apophyses; **C**, internodes basal part of hydrocladia; **D**, **E**, internodes apical part of hydrocladia. Scale bars: A, 1 cm; B-E, 0.1 mm.

Table 16. — Measurements of *Plumularia* sp. 1 in µm.

	SMIB 4 stn DW 57	SMIB 5 stn DW 101
Height of colony (in mm)	30	10
Stem internode, length	350-440	320-440
Diameter at node	50-150	45-165
First hydrocladial internode, length	200-210	170-230
Length thecate hydrocladial internodes	260-310	210-310
Length athecate hydrocladial internodes	200-230	210-280
Diameter at node	30-40	25-40
Hydrotheca		
Length abcauline wall	50-60	50-60
Length adcauline wall	65-70	60-70
Diameter at rim	60-70	65-80
Mesial nematotheca, length	60-70	60-65
Diameter at rim	25-35	25-30
Lateral nematotheca, length	70-80	80-85
Diameter at rim	40-50	45-50
Supracalycine nematotheca, length	50-60	55-60
Diameter at rim	25-30	25-30

Table 17. — Measurements of *Plumularia* sp. 2 in µm.

	MUSORSTOM 3 stn DR 117
Height of colony (in mm)	4 (fragment)
Length thecate hydrocladial internodes	580-640
Diameter at node	40-50
Hydrotheca	
Length abcauline wall	35-45
Length adcauline wall	35-40
Diameter at rim	45-50
Mesial nematotheca, length	70-80
Diameter at rim	25-30
Lateral nematotheca, length	75-90
Diameter at rim	30-35
Supracalycine nematotheca, length	70-80
Diameter at rim	25-30

a succession of thecate and athecate internodes separated by oblique and straight nodes; thecate internodes with basal oblique and distal straight node; athecate internodes the reverse; thecate and athecate internodes with a pair of perisarcal rings, with one at each end; thecate internodes with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca in middle of internode, cup-shaped, low, abcauline wall lower than adcauline wall; hydrothecal aperture circular, quite oblique and tilted to abcauline side, rim smooth. Mesial inferior nematotheca conical, with adcauline wall of upper chamber slightly scooped. Lateral nematothecae conical. Athecate internodes each with one nematotheca, located towards the middle; all nematothecae bithalamic and movable.

Gonothecae not observed.

Variability

One branch given off instead of one hydrocladia in basal part of colony.

Remarks

This species is characterized by the morphology of its hydrothecae, which are very shallow and with the plane of its aperture quite oblique (Vervoort & Vasseur 1977). Material described by Vannucci Mendes (1951) and Grohmann *et al.* (2011), the only records of this species in the Atlantic, shows a different hydrothecal morphology and probably belongs to another species.

Plumularia fragilia Watson, 2012 very much resembles this species in morphology, including measurements and height of colonies. The only objective difference is the everted hydrothecal rim in *P. fragilia*. Revision of type material is needed before reaching a conclusion about their relationship.

Plumularia sp. 1
(Fig. 25; Table 16)

Material Examined. — **Norfolk Ridge.** SMIB 4, stn DW 57, 23°21.5'-23°21.0'S, 168°04.6'-168°04.5'E, 210-260 m, 09.III.1989: many *c.* 30 mm high plumes on shell fragments; no gonothecae (MNHN). — SMIB 5, stn DW 101, 23°21.2'S, 168°04.9'E, 270 m, 14.IX.1989: Bunch of *c.* 10 stems, up to 30 mm high, no gonothecae (MNHN).

Distribution. — Known only from Norfolk Ridge, between 210-270 m depth.

Description

Hydrorhiza tubular, attached to sponge, supporting various monosiphonic, unbranched hydrocauli. Hydrocaulus divided into internodes by straight

nodes. Basal part of hydrocaulus, below first apophyses, with two rows of nematothecae. Remainder stem internodes all have one distal apophysis and one to four nematothecae between two consecutive apophyses of the same side. Apophyses alternately directed left and right, with a small opening as a mamelon on superior surface and three nematothecae: two axillary and one above; one perisarcal ring sometimes appears at distal end.

Hydrocladia arranged left and right, slightly frontally in the basal half and gradually put almost frontally in the younger parts. Hydrocladia begin with an athecate internode with one nematotheca in the middle and a perisarcal ring at each extremity. Remainder of hydrocladium a succession of thecate and athecate internodes, separated by oblique nodes; thecate internodes with basal oblique and distal slightly oblique node, athecate internodes reverse. Thecate internodes with one hydrotheca on basal half of internode and four nematothecae: one mesial inferior, two laterals and one supracalycine. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight, hydrothecal aperture slightly tilted downwards, rim smooth. All nematothecae bithalamic, movable and conical. Lateral nematothecae are bigger than mesial. Thecate internodes also with two internal perisarc rings at both extremities. Athecate internodes with one nematotheca approximately halfway their length and two internal thickenings, one basal and one distal.

Gonothecae have not been observed.

Variability

Material from stn DW 57 and stn DW 101 sometimes having thecate internodes without suprahydrothecal nematothecae, and consecutive athecate internodes with two nematothecae; this distribution of nematothecae was always seen after damage and subsequent regeneration.

Remarks

This species approaches *Plumularia setacea* (Linnaeus, 1758), but it differs by the presence of a suprahydrothecal nematotheca.

The absence of gonothecae prevents us from a more precise identification.

Plumularia sp. 2
(Fig. 26; Table 17)

Material Examined. — **Philippines.** MUSORSTOM 3, stn DR 117, 12°31.2'-12°31.3'N, 120°39.3'-120°39.5'E, 92-97 m, 03.VI.1985: 6 mm high top part of colony; no gonothecae (MNHN).

Distribution. — *Plumularia* sp. 2 is recorded only from the Philippines, between 92-97 m depth.

Description

Small fragment 4 mm long, monosiphonic, unbranched and without visible nodes. Axial nematothecae were also not observed.

Apophyses arrangement left and right in one plane. Each apophyses with a well developed mamelon on superior surface and three nematothecae: two axillary and one above the mamelon.

Hydrocladia comprising a succession of thecate internodes separated by oblique nodes, each internode with one hydrotheca and four nematothecae: one mesial inferior, two laterals placed over very low apophyses, and one mesial superior. All nematothecae two-chambered, conical and movable. Hydrotheca small, cup-shaped, adcauline wall fully adnate, abcauline wall straight, rim smooth and circular. Two internal thickenings in each internode next to top and bottom.

Gonothecae not observed.

Variability

The node between apophyses and first thecate internode was not observed in some cases.

Remarks

The material is sterile and consists only of a small apical fragment of a colony, which makes a definitive identification difficult.

Genus *Polyplumaria* G. O. Sars, 1874

Polyplumaria cornuta (Bale, 1884)
(Figs 27, 28; Table 18)

Plumaria cornuta Bale, 1884: 132, pl. XI, figs 1, 2.

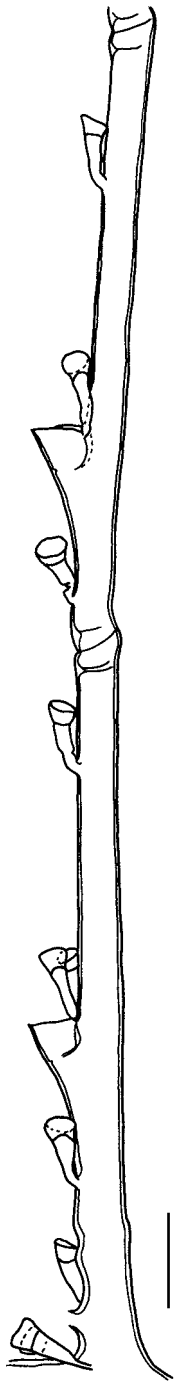

Fig. 26. — *Plumularia* sp. 2, MUSORSTOM 3, stn DR 117, basal internodes of hydrocladia, lateral view. Scale bar: 0.1 mm.

Polyplumaria cornuta – Billard 1913: 53, figs 65, 66, pl. III, fig. 33, pl. IV, figs 35, 36. — Watson 2000: 56, fig. 44A-F. — Schuchert 2003: 213, fig. 62A-E.

Polyplumaria cornuta var. *longispina* Billard, 1913: 56, fig. 67.

Material examined. — **New Caledonia.** LAGON, stn 0615, 22°06.7'S, 166°57.0'E, 56-60 m, 05.VIII.1986: 120 mm high mutilated colony; no gonothecae (MNHN). — LAGON, stn 0745, 22°13.6'S, 167°02.8'E, 78-80 m, 13.VIII.1986: Several fragments of a large colony, no gonothecae (MNHN). — Lagoon, Canal Woodin, 25-40 m, 13.IV.1995, leg. Dr Richer de Forges Noumea. Coelenterate 27624: Fragments with a few hydrocladia and without gonothecae (RMNH).

Distribution. — *Polyplumaria cornuta* has been reported from Australia (Bale 1884, Watson 2000) and Indonesia (Billard 1913, Schuchert 2003), at depths between 6-250 m.
Our material, from New Caledonia, was collected at depths of 25-80 m.

Description

Hydrorhiza composed of a bundle of interwoven tubules adhering to shell sediment, from which rise polysyphonic and ramified hydrocauli. Stem with hydrocladia arranged in two lateral rows in the basal half, and three rows at the top that resembles a verticil. Branches monosiphonic, divided into internodes of varied length by oblique nodes. Apophyses with one mamelon and three nematothecae: two axillary and one above mamelon.

Hydrocladia formed by regular succession of hydrothecate internodes separated by oblique nodes. All internodes with one hydrotheca placed in the middle and three nematothecae: one mesial inferior and two laterals. Hydrotheca cup shaped, widening towards margin, adcauline wall completely adnate, abcauline wall slightly sinuous with distal part concave, margin with two rounded lateral lobes and adcauline side sligthly curved down, rim smooth. Mesial inferior nematotheca large, the margin reaching near half of the abcauline wall of hydrotheca, adcauline wall of upper chamber deeply scooped. Lateral nematotheca conical, movable and placed on small apophyses. Each internode with several perisarcal rings with a variable development; in basal internodes six internal thickenings have been observed: two under, three behind, and one above the hydrotheca.

Many apophyses with one normal hydrocladium and one modified hydrocladium, with a basal hydrotheca, one or two distal nematothecae, and tapering into pointed horn-like process.

Gonothecae not observed.

Variability

In some material from station 615, the top of a secondary hydrocladium developed a normal hydrocladium with several thecate internodes separated by oblique nodes.

Remarks

The presence of horn-like modified secondary hydrocladia affirms the identity of this material as *Polyplumaria cornuta*. *Cladacanthella scabra*, considered a very similar species by Schuchert (2003), lacks such modified hydrocladia.

Polyplumaria kossowskae (Billard, 1911) (Fig. 29; Table 19)

Plumularia kossowskae Billard, 1911: LXIV, fig. 5; 1913: 29, fig. XXVI, pl. I, fig. 19.

Material examined. — **Vanuatu.** MUSORSTOM 8, stn DW 966, 20°19'S, 169°52'E, 128-150 m, 21.IX.1994: one fragment 20 mm high, no gonothecae (MNHN). — Stn CP 1001, 18°49'S, 169°00'E, 150-250 m, 25.IX.1994: three colonies 25-55 mm high with gonothecae (MNHN).

Distribution. — *Plumularia kossowskae* is known only from the type locality in Indonesia: station 166, Siboga Expedition, 2°28.5'S, 131°03.3'E, 118 m depth (Billard 1911, 1913).

Our material, from Vanuatu, was collected between 129-250 m.

Description

Hydrorhiza tubular, attached to substratum, supporting polysiphonic and branched hydrocauli. Branches develop from secondary tubes, arranged in opposite pairs, polysiphonic in lower zones of main axis. Original tube of axis and principal tube of branches divided into internodes of varied length by oblique nodes visible only in apical parts of main stem and branches.

Apophyses directed alternately left and right, each with a well developed mamelon on superior surface and with one axillary nematotheca. One or two nematothecae between two consecutive apophyses.

Hydrocladia begin with an athecate internode having one nematotheca near the base. Remainder of hydrocladium formed by a succession of thecate and athecate internodes separated by oblique nodes. Thecate internodes with a conspicuous, strongly oblique basal node and a scarcely visible slightly oblique superior node; athecate internodes with reverse arrangement.

Each thecate internode with one hydrotheca in the middle and three nematothecae: one mesial inferior and a pair of laterals. Hydrotheca cup-shaped, deep,

Table 18. — Measurements of *Polyplumaria cornuta* (Bale, 1884) in µm.

	Lagoon stn 745
Length thecate hydrocladial internodes	310-350
Diameter at node	90-125
Hydrotheca,	
Length abcauline wall	130-155
Length adcauline wall	125-140
Diameter at rim	110-125
Mesial nematotheca, length	130-150
Diameter at rim	35-40
Lateral nematotheca, length	100-110
Diameter at rim	40-45

Table 19. — Measurements of *Polyplumaria kossowskae* (Billard, 1911) in µm. Symbol: *, one measurement only.

	MUSORSTOM 8 stn CP 1001
Height of colony (in mm)	55
First hydrocladial internode, length	210-280
Length thecate hydrocladial internodes	120-150
Length athecate hydrocladial internodes	320-410
Diameter at node	25-35
Hydrotheca	
Length abcauline wall	110-120
Diameter at rim	120-140
Length free part adcauline wall	50-60
Mesial nematotheca, length	40-50
Diameter at rim	25-30
Lateral nematotheca, length	80-100
Diameter at rim	40-50
Gonotheca, length	260*
Greatest diameter	100*

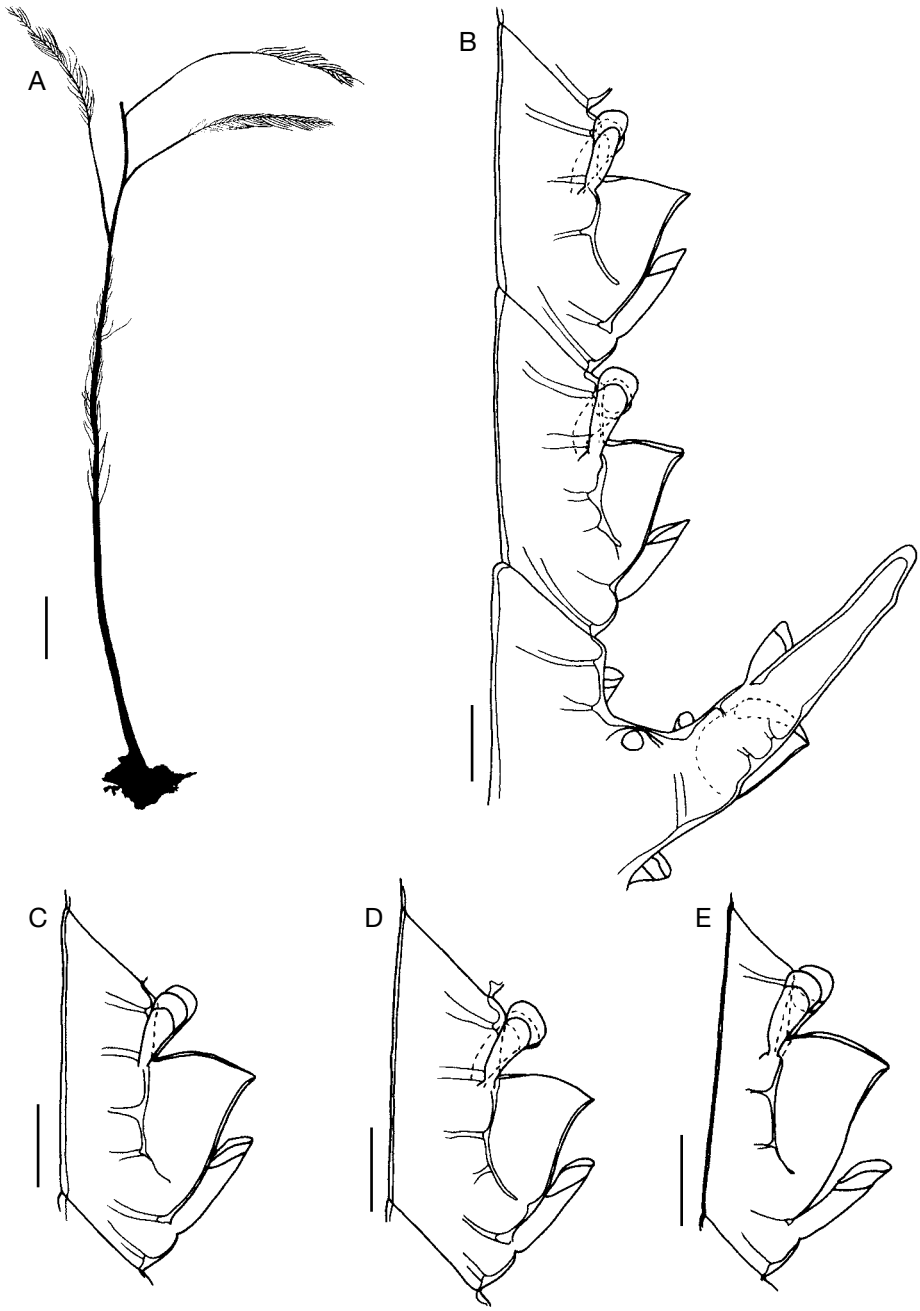

Fig. 27. — *Polyplumaria cornuta* (Bale, 1884): **A**, LAGON, stn 0615, colony; **B**-**E**, LAGON, stn 0745: **B**, first internodes of hydrocladia and one modified hydrocladia on apophyses; **C**-**E**, internodes, lateral view. Scale bars: A, 1 cm; B-E, 0.1 mm.

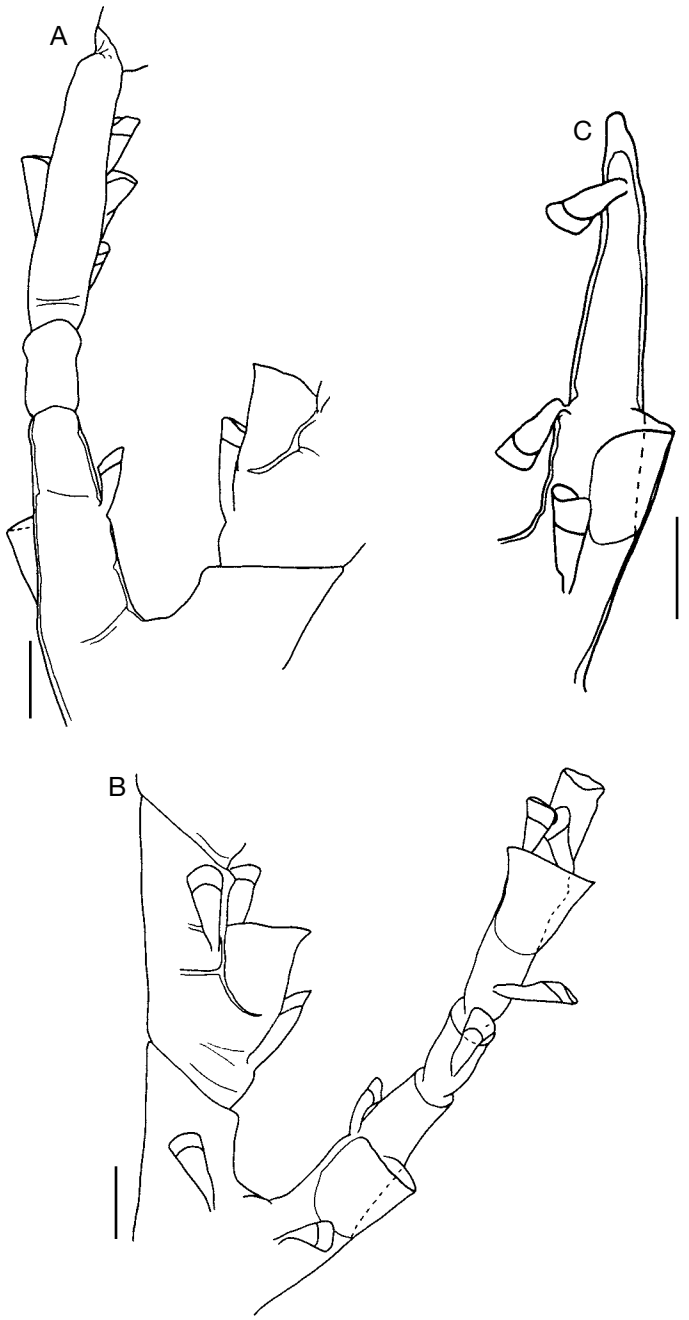

FIG. 28. — *Polyplumaria cornuta* (Bale, 1884), LAGON, stn 0615: **A**, **B**, anomalous spine; **C**, detail spine. Scale bars: 0.1 mm.

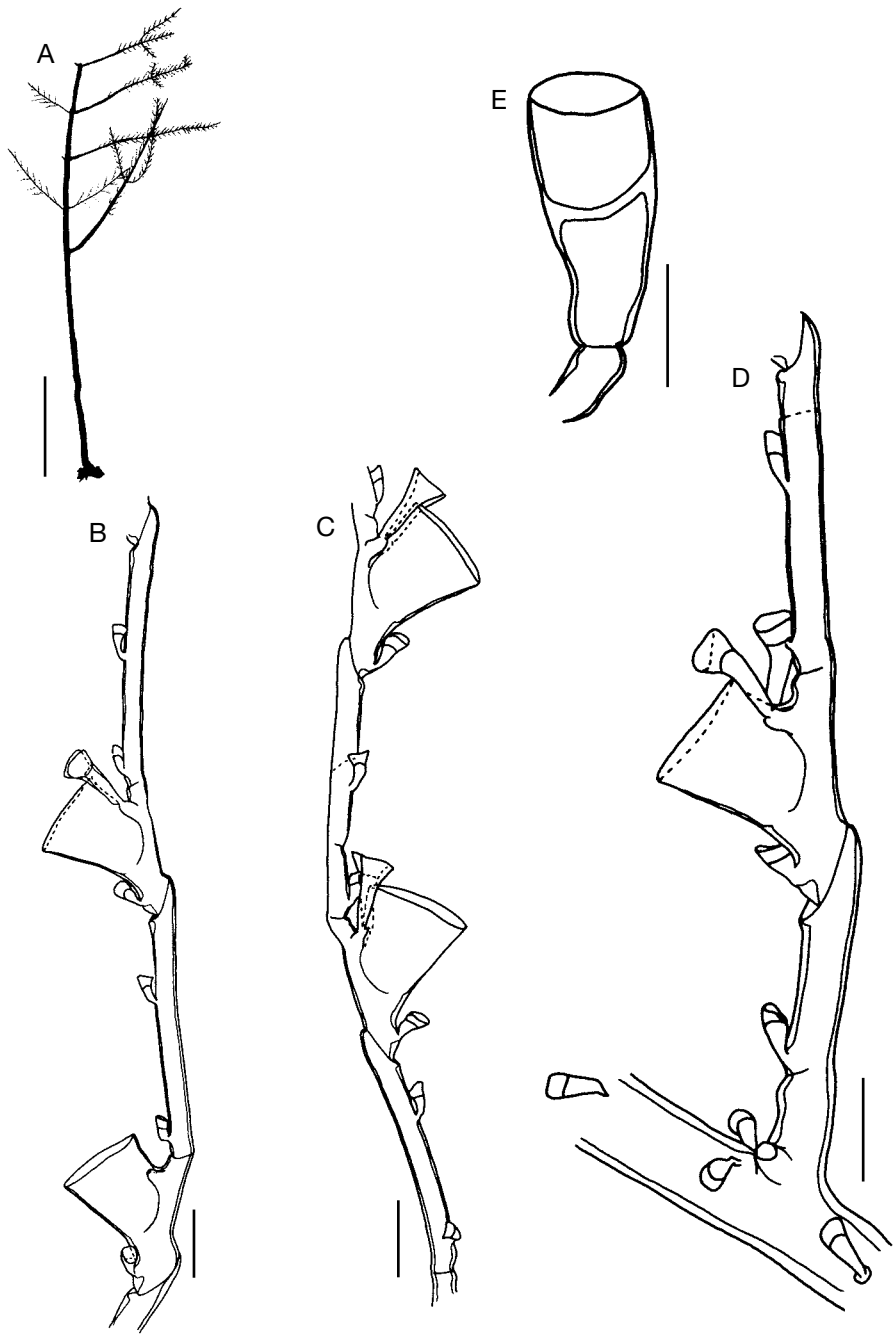

Fig. 29. — *Polyplumaria kossowskae* (Billard, 1911), MUSORSTOM 8, stn CP 1001; **A**, colony; **B**, first internode of hydrocladia; **C**, internodes, lateral view; **D**, apophyses with first internode of hydrocladia; **E**, gonotheca. Scale bars: A, 1 cm; B-E, 0.1 mm.

adcauline wall free about half its length, abcauline wall straight, walls nearly parallel, rim circular and smooth. Hydrothecal aperture forming an angle with hydrocladial axis of approximately 45 degrees. Mesial inferior nematotheca small, not reaching hydrothecal basis and with adcauline wall of superior chamber slightly reduced. Lateral nematothecae arising from well developed apophyses placed on both sides of the hydrotheca, surpassing the hydrothecal margin.

Athecate internodes with two nematothecae, one near the basal and other in the upper third. All nematothecae movable, bithalamic and conical. Lateral nematothecae larger than the others.

One gonotheca was found arising from an apophysis, small, tubular and with one internal thickening well marked, aperture circular and smooth.

Acknowledgements
The authors wish to express their gratitude to Dr A. Crosnier (MNHN) for providing the material for this study. The first author also had financial support from the European Union's PARSYST program to spend two weeks at the MNHN to work on plumulariid material.

We are grateful to Dr Bernhard Ruthensteiner (ZSM) for the loan of type material of *Plumularia habereri* Stechow, 1909 and *Dentitheca hertwigi* Stechow 1909. Our sincere gratitude to Dale R. Calder and Peter Schuchert for providing useful comments and suggestions which helped to improve the quality of this paper. The assistence of D. Calder in the edition of the manuscript was also greatly appreciated.

REFERENCES

Allman G. J. 1877. — Report on the Hydroida collected during the exploration of the Gulf Stream by L. F. de Pourtalès, assistant United States Coast Survey. *Memoirs of the Museum of comparative Zoölogy,* Harvard College 5: 1-66, pls 1-34.

Allman G. J. 1883. — Report on the Hydroida dredged by H. M. S. Challenger during the years 1873-76. Part I. Plumularidae. *Report on the Scientific Results of the Voyage of H. M. S.* Challenger, *Zoology* 7 (20): 1-55, 3 figs, 20 pls.

Ansín Agís J., Ramil F. & Vervoort W. 2001. — Atlantic Leptolida (Hydrozoa, Cnidaria) of the families Aglaopheniidae, Halopteridídae, Kirchenpaueriidae and Plumulariidae collected during the CANCAP and Mauritania-II expeditions of the National Museum of Natural History, Leiden, the Netherlands. *Zoologische Verhandelingen*, Leiden, 333: 1-268, 97 figs.

Ansín Agís J., Ramil F. & Vervoort W. 2004. — *Cladoplumaria anomala* gen. nov., sp. nov., a new genus and species of the family Halopteridídae (Cnidaria: Hydrozoa) from the Chesterfield Islands region (Pacific Ocean). *Cahiers de Biologie marine* 45: 313-324.

Ansín Agís J., Vervoort W. & Ramil F. 2009. — Hydroids of the family Halopteridídae (Cnidaria, Hydrozoa) collected in the western Pacific by various French expeditions. *Zoosystema* 31 (1): 33-61, figs 1-11. http://dx.doi.org/10.5252/z2009n1a3

Bale W. M. 1884. — *Catalogue of the Australian Hydroid Zoophytes*. Australian Museum, Sydney, 198 p.

Bale W. M. 1914. — Report on the Hydroida collected in the Great Australian Bight and other localities. Part 1. *Biological Results of the Fishing Experiments carried on by the F. I. S. "Endeavour"* 1909-1914 2: 1-63, pls 1-7.

Bandel K. & Wedler E. 1987. — Hydroid, amphineuran and gastropod zonation in the littoral of the Caribbean Sea, Colombia. *Senckenbergiana maritima* 19 (1-2): 1-129.

Bedot M. 1921. — Notes systématiques sur les plumularides, 2e partie. *Revue suisse de Zoologie* 29 (1): 1-40.

Bedot M. 1923. — Notes systématiques sur les plumularides, 3e partie. *Revue suisse de Zoologie* 30: 213-243.

Bennitt R. 1922. — Additions to the hydroid fauna of the Bermudas. Contributions from the Bermuda Biological Station for Research, no. 136. *Proceedings of the American Academy of Arts and Sciences* 57 (10): 241-259.

Billard A. 1906. — Hydroïdes. In: *Expéditions scientifiques du Travailleur et du Talisman*, 1906, Paris: 153-243, figs.

Billard A. 1910. — Revision d'une partie de la collection des hydroïdes du British Museum. *Annales des Sciences naturelles Zoologie* (9) 11: 1-67.

Billard A. 1911. — Note préliminaire sur les espèces nouvelles de Plumulariidae de l'expédition du Siboga. *Archives de Zoologie expérimentale et génerale* (5)8, notes et revue 3: LXII-LXXI, figs 1-16.

Billard A. 1913. — Les Hydroïdes de l'expedition du SIBOGA. I. Plumulariidae. *Siboga-Expeditie, Monographie* 7a: 1-114, figs. 1-6.

Billard A. 1930. — Note sur deux espèces d'Hydroïdes de la côte Atlantique du Maroc. *Bulletin Société Scientifique naturelle Maroc* 10: 79-80. fig. 1.

Billard A. 1933. — Les hydroïdes des golfes de Suez et d'Akaba, *in* Mission Robert Ph. Dollfus en Égypte (décembre 1927-mars 1929). *Mémoires de l'Institut d'Égypte,* 21: 1-30, figs. 1-9, pl. 1.

Blanco O. 1994. — Los plumularidos de la Argentina. *Revista del Museo de La Plata, new series 14, Zoología* 162: 217-265.

Boero F. & Bouillon J. 1993. — Zoogeography and life cycle patterns of Mediterranean hydromedusae (Cnidaria). *Biological Journal of the Linnean Society of London* 48: 239-266.

Bonnevie K. 1899. — Hydroida, *in Den Norske Nordhavs-Expedition* 1876-1878. *Zoologi* 7: 1-104, pls 1-8.

Bouillon J., Gravili C., Pagès F., Gili J. M. & Boero F. 2006. — An introduction to Hydrozoa. *Mémoires du Museum national d'Histoire naturelle*, Paris, 194: 1-591

Busk G. 1852. — An account of the Polyzoa and sertularian zoophytes collected in the voyage of the "Rattlesnake" on the coast of Australia and the Louisiade Archipelago, *in* Macgillivray J. (ed.), *Narrative of the voyage of H. M. S. Rattlesnake commanded by the late Captain O. Stanley during the years 1846-1850*, vol. 1. London: 343-402.

Calder D. R. 2013. — Some shallow-water hydroids (Cnidaria: Hydrozoa) from the central east coast of Florida, USA. *Zootaxa* 3648 (1): 1-72

Calder D. R. & Kirkendale L. 2005. — Hydroids (Cnidaria, Hydrozoa) from shallow-water environments along the Caribbean Coast of Panama. *Caribbean Journal of Science* 41: 476-491.

Coles S. L., Reath P. R., Skelton P. A., Bonito V., DeFelice R. C. & Basch L. 2003. — *Introduced Marine Species in Pago Pago Harbor, Fagatele Bay and the National Park Coast, American Samoa*. Bishop Museum Technical Report no. 26, Contribution No 2003-007 to the Pacific Biological Survey, 182 p.

Cornelius P. F. S. 1998. — The hydrozoan work of Prof. Wim Vervoort, *in* den Hartog J. C., van Bruggen A. C., Cornelius P. F. S. & van Ofwegen L. P. (eds), Commemorative volume for the 80th birthday of Willem Vervoort in 1997. *Zoologische Verhandelingen* 323: 17-19.

Defenbaugh R. E. 1974. — Hydroids, *in* Bright T. J. & Pequegnat L. H. (eds), *Biota of the West Flower Garden Bank*: 93-122, figs 1-17.

Di Camillo C. G., Bo M., Puce S. & Bavestrello G. 2010. — Association between *Dentitheca habereri* (Cnidaria: Hydrozoa) and two zoanthids. *Italian Journal of Zoology* 77: 1, 81-91.

Flórez González L. 1983. — Inventario preliminar de la fauna hydroide de la Bahía de Cartagena y áreas adyacentes. *Boletín Museo del Mar, Bogotá* 11: 112-140.

Fraser C.Mclean 1944. — *Hydroids of the Atlantic coast of North America*. The University of Toronto Press, Toronto: 1-451, pls 1-94.

Grohmann P. A., Nogueira C. C. & Abud U. M. 2011. — Hydroids (Cnidaria, Hydrozoa) collected on the inner continental shelf of the state of Rio de Janeiro, Brazil, during the Oceanographic Operations GEOCOSTA RIO I and II. *Biota Neotropica* 11 (2): 193-201.

Hirohito 1983. — Hydroids from Izu Ôshima and Niijima. *Publications of the biological Laboratory, Imperial Household* (6): 1-83, figs 1-41.

Hirohito 1995. — The hydroids of Sagami Bay. II, Thecata. *Publications of the Biological Laboratory, Imperial Household*: i-vii, 1-355, 106 figs, 13 pls.

Hodgson M. 1950. — A revision of the Tasmanian Hydroida. *Proceedings of the Royal Society* Tasmania, 1949: 1- 65, figs 1-92.

Jäderholm E. 1919. — Zur Kenntnis der Hydroidenfauna Japans. *Arkiv för Zoologi* 12 (9): 1-34, pls 1-6.

Kirchenpauer G. H. 1876. — Ueber die Hydroidenfamilie Plumularidae, einzelne Gruppe derselben und ihre Fruchtbehälter. II. *Plumularia* und *Nemertesia*. *Abhandlungen aus dem Gebiete der Naturwissenschaften* 6 (2): 1-59, pls 1-8.

Kirkendale L. & Calder D. R. 2003. — Hydroids (Cnidaria: Hydrozoa) from Guam and the Commonwealth of the Northern Marianas Islands (CNMI). *Micronesica* 35, 36: 159-188.

Lamarck J. B. P. A. 1816. — *Histoire naturelle des animaux sans vertèbres*. Tome 2, Paris: 1-568.

Leloup E. 1947. — Les Coelentérés de la faune Belge. Leur bibliographie et leur distribution. *Mémoires du Musée royal d'Histoire naturelle de Belgique* 107: 1-73, figs 1-40.

Linnaeus C. 1758. — *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species cum characteribus, differentiis, synonymis*, locis. Editio decima, reformata: 1-823. Holmiae (Stockholm).

Millard N. A. H. 1975. — Monograph on the Hydroida of southern Africa. *Annals of the South African Museum* 68: 1-513, colour plate, 143 figs.

Millard N. A. H. & Bouillon J. 1973. — Hydroids from the Seychelles (Coelenterata). *Annales du Musée royal de l'Afrique Centrale,* Serie in 8°, Sciences zoologiques, 206: 1-106, 11 figs, 5 pls.

Milstein A. 1976. — Hydroidea de las costas Uruguayas. *Dusenia* 9 (3): 77-93, figs 1-37.

Moazzam N. & Moazzam M. 2006.—On some hydroids (Cnidaria) from the coast of Pakistan. *Journal of Zoology*, 38 (3): 225-232.

Morris B. F. & Mogelberg D. D. 1973. — Identification manual to the pelagic *Sargassum* fauna. *Special Publication of the Bermuda biological Station for Research* 11: 1-63, figs 1-101.

Mulder J. F. & Trebilcock R. E. 1909. — Notes on Victorian Hydroida, with descriptions of new species. *The Geelong Naturalist* 4: 29-35, pl. 1.

Nutting C. C. 1900. — American hydroids. Part I. The Plumularidae. *Smithsonian Institution, United States National Museum Special Bulletin*, 4 (1): 1-285.

Peña Cantero A. L. 2004. — How rich is deep-sea Antarctic benthic hydroid fauna?. *Polar Biology* 27: 767-774.

Peña Cantero A. L. & Vervoort W. 2010. — Species of *Acryptolaria* Norman, 1875 (Cnidaria, Hydrozoa,

Lafoeidae) collected in the Western Pacific by various French expeditions, with the description of nineteen new species. *Zoosystema* 32 (2): 267-332. http://dx.doi.org/10.5252/z2010n2a5

PICARD J. 1958. — Origines et affinités de la faune d'hydropolypes (Gymnoblastes et Calyptoblastes) et d'hydroméduses (Anthoméduses et Leptoméduses) de la Méditerranée. *Rapports et Procès Verbaux des Réunions. Commission internationale pour l'exploration scientifique de la mer Méditerranée* 14: 187-199.

PICTET C. & BEDOT M. 1900. — Hydraires provenant des campagnes de l' "Hirondelle" (1886-1888). *Résultats des Campagnes Scientifiques par Prince Albert Ier de Monaco* 18: 1-59, pls 1-10.

RALPH P. M. 1961. — New Zealand thecate hydroids. Part IV. The family Plumulariidae. *Transactions of the Royal Society of New Zealand, Zoology* 1 (3): 19-74, 10 figs.

RAMIL F. & VERVOORT W. 1992. — Report on the Hydroida collected by the "BALGIM" expedition in and around the Strait of Gibraltar. *Zoologische Verhandelingen*, Leiden, 277: 1-262, 68 figs, 83 tabs.

REES W. J. & VERVOORT W. 1987. — Hydroids from the John Murray Expedition to the Indian Ocean, with revisory notes on *Hydrodendron, Abietinella, Cryptolaria* and *Zygophylax* (Cnidaria: Hydrozoa). *Zoologische Verhandelingen*, Leiden 237: 1-209.

RHO B. J. 1967. — Marine hydroids from the west and south sea of Korea. *Korean Culture Research Institute* 10: 341-360.

RHO B. J. 1969. — Studies on the marine hydroids in Korea. *Journal of the Korean Research* Institute for better Living, Ewha Womans University 2: 161-172, pls 1-2.

RHO B. J. 1977. — Porifera, Hydrozoa and Ascidiacea. *Illustrated Flora and Fauna of Korea* 20: 1-470.

RUTHENSTEINER B., REINICKE G. B. & STRAUBE N. 2008. — The Type Material of Hydrozoa described by Eberhard Stechow in the Zoologische Staatssammlung München. *Spixiana* 31 (1): 3-27.

RYLAND J. S. & GIBBONS M. J. 1991. — Intertidal and shallow water hydroids from Fiji. II. Plumulariidae and Aglaopheniidae. *Memoirs of the Queensland Museum* 30 (3): 525-560, 24 figs.

SCHMIDT H. E. 1972. — Some new records of hydroids from the Gulf of Aqaba with zoogeographical remarks on the Red Sea area. *Journal of the Marine Biological Association of India* 13: 27-51.

SCHUCHERT P. 2001. — Hydroids of Greenland and Iceland (Cnidaria, Hydrozoa). *Bioscience* 53: 1-184.

SCHUCHERT P. 2003. — Hydroids (Cnidaria, Hydrozoa) of the Danish expedition to the Kei Islands. *Steenstrupia* 27 (2): 137-256.

SCHUCHERT P. 2013a. — The status of Plumularia lagenifera Allman, 1885 (Cnidaria, Hydrozoa) and related species. *Zootaxa* 3613 (2): 101-124, figs 1-14.

SCHUCHERT P. 2013b. — *Plumularia mooreana*, a new marine hydroid from French Polynesia (Hydrozoa, Cnidaria). *Revue Suisse de Zoologie* 120 (3): 405-413, figs 1-3.

SCHUCHERT P. 2014a. — High genetic diversity in the hydroid *Plumularia setacea*: a multitude of cryptic species or extensive population subdivision?. *Molecular Phylogenetics and Evolution* 76: 1-9, figs 1-2.

SCHUCHERT P. 2014b. — *Plumularia asymmetrica* Bale, 1914, *in* SCHUCHERT P. (ed.), World Hydrozoa database. Accessed through: Schuchert P. (2014) World Hydrozoa database at http://www.marinespecies.org/hydrozoa/aphia.php?p=taxdetails&id=292354 on 2014-07-26]

STECHOW E. 1909. — Hydroidpolypen der japanischen Ostküste. I. Teil. Athecata und Plumularidae, *in* DOFLEIN F. (ed.), Beiträge zur Naturgeschichte Ostasiens. *Abhandlungen der Mathematisch-Physikalischen Klasse der Koniglich Bayerischen Akademie der Wissenschaften (Suppl.)* 1 (6): 1-111, pls 1-7.

STECHOW E. 1913. — Hydroidpolypen der japanischen Ostküste. II. Teil: Campanularidae, Halecidae, Lafoeidae, Campanulinidae und Sertularidae, nebst Erganzungen zu den Athecata und Plumularidae, *in* DOFLEIN F. (ed.), Beitrage zur Naturgeschichte Ostasiens. *Abhandlungen der Mathematisch-Physikalischen Klasse der Koniglich Bayerischen Akademie der Wissenschafen (Suppl.)* 3 (2): 1-162, figs 1-135.

STECHOW E. 1923a. — Die Hydroidenfauna der Japanischen region. *Journal of the College of Science* 44 (8): 1-23.

STECHOW E. 1923b. — Zur Kenntnis der Hydroidenfauna des Mittelmeeres, Amerikas und anderer Gebiete. II. Teil. *Zoologische Jahrbücher, Systematik* 47 (1): 29-270, figs 1-35.

STECHOW E. 1925. — Hydroiden von West- und Südwestaustralien nach den Sammlungen von Prof. Dr Michaelsen und Prof. Dr Hartmeyer. *Zoologische Jahrbücher, Abteilung Systematik, Oekologie und Geographie der Tiere* 50 (2): 191-270, figs 1-17.

STECHOW E. & MÜLLER H. C. 1923. — Hydroiden von den Aru-Inseln. *Abhandlungen hrsg. von de Senckenbergischen Naturforschenden Gesellschaft* 35: 459-478.

TORREY H. B. 1902. — The Hydroida of the Pacific coast of North America, with especial reference to the species in the collection of the University of California. *University of California Publications, Zoology* 1: 1-105.

TORREY H. B. 1904. — Contributions from the Laboratory of the Marine Biological Association of San Diego. I. The hydroids of the San Diego region. *University of California Publications, Zoology* 2: 1-43.

TOTTON A. K. 1930. — Coelenterata. Part V.- Hydroida. Natural History Report British Antarctic (Terra Nova) Expedition, 1910. *Zoo*logy 5 (5): 131-252, figs 1-70, pls 1-3.

VAN GEMERDEN-HOOGEVEEN G. C. H. 1965. — Hydroids of the Caribbean: Sertulariidae, Plumulariidae and Aglaopheniidae, *in* Studies on the fauna of Curaçao and other Caribbean Islands 22 (84). *Uitgaven van de*

Natuurwetenschappelijke Studiekring voor Suriname en de Nederlandse Antillen 40: 1-87, 45 figs.

VANNUCCI MENDES M. 1946. — Hydroida Thecaphora do Brasil. *Arquivos de Zoologia do Estado de São Paulo* 4: 535-597.

VANNUCCI MENDES M. 1951. — Hydrozoa e Scyphozoa existente no Instituto Paulista de Oceanografia. *Boletim Instituto Paulista Oceanografia* 2 (1): 69-100, pls 1-4.

VAN PRAËT M. 1979. — Les types de polypes d'Hydraires conservés au Muséum national d'Histoire naturelle de Paris. *Bulletin du Muséum national d'Histoire naturelle* 4e serie, section A, 1 (4): 871-940, 113 figs.

VERVOORT W. 1966. — Bathyal and abyssal hydroids. Galathea Report. *Scientific Results of the Danish Deep-Sea Expedition, 1950-1952*, 8: 97-173, 66 figs.

VERVOORT W. 1993. — Cnidaria, Hydrozoa, Hydroida: hydroids from the western Pacific (Philippines, Indonesia and New Caledonia). I: Sertulariidae (Part 1), *in* CROSNIER A. (ed.), Résultats des campagnes MUSORSTOM. Vol. 11. *Mémoires du Muséum national d'Histoire naturelle* 158: 89-298.

VERVOORT W. & VASSEUR P. 1977. — Hydroids from French Polynesia with notes on distribution and ecology. *Zoologische Verhandelingen*, Leiden, 159: 1-98, 36 figs, 1 tab.

VERVOORT W. & WATSON J. E. 2003. — The marine fauna of New Zealand: Leptothecata (Cnidaria: Hydrozoa) (Thecate Hydroids). *NIWA Biodiversity Memoir* 119: 1-538, 108 figs.

WATSON J. E. 2000. — Hydroids (Hydrozoa: Leptothecatae) from the Beagle Gulf and Darwin Harbour, northern Australia. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory* 16: 1-82.

WATSON J. E. 2012. — Some hydroids (Hydrozoa: Hydroidolina) from Dampier, Western Australia: annotated list with description of two new species. *Memoirs of Museum Victoria* 69: 355-363, figs 1-4.

Submitted on 18 June 2014;
accepted on 31 July 2014;
published on 26 December 2014.