Hydroids (Cnidaria, Hydrozoa) of the Danish expedition to the Kei Islands

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This paper reports upon the marine athecate and thecate hydroids collected by the Danish expedition to the Kei Islands (Indonesia) in 1922. Concomitantly, the historic collection of hydroids from the Moluccas made by C. Pictet and M. Bedot in 1890 was revised. The family Tubidendridae Nutting, 1905 is recognized as valid and its diagnosis emended. Taxonomic problems with the genera *Campalecium* and *Mitrocomium* are discussed. The new species *Cladocarpus keiensis* is described. *Ectopleura pacifica* Thornely, 1900 is considered to be a subjective junior synonym of *Tubularia viridis* Pictet, 1893. *Acryptolaria rectangularis* (Jarvis, 1922) is removed from the synonymy of *Acryptolaria angulata* (Bale, 1914). *Gymnangium unjinense* Watson, 2000 is recognized as a subjective synonym of *Lytocarpia orientalis* (Billard, 1908). The following 15 species are new records for Indonesian waters: *Hydractinia granulata* Hirohito, 1988; *Balella mirabilis* (Nutting, 1905); *Garveia clevelandensis* Pennycuik, 1959; *Eudendrium kirkpatricki* Watson, 1985; *Corydendrium corrugatum* Nutting, 1905; *Cladocoryne haddoni* Kirkpatrick, 1890; *Solanderia secunda* (Inaba, 1892); *Campanulina panicula* G. O. Sars, 1874; *Acryptolaria rectangularis* (Jarvis, 1922); *Acryptolaria angulata* (Bale, 1914); *Lafoea dumosa* (Fleming, 1820); *Zygophylax rufa* (Bale, 1884); *Salacia punctagonangia* Hargitt, 1924; *Synthecium flabellum* Hargitt, 1924; *Antennella campanulaformis* (Mulder & Trebilcock, 1909). A lectotype is designated for *Synthecium samauense* Billard, 1925. *Halecium simplex* Pictet, 1893 is transferred to *Mitrocomium,* as *M. simplex,* n. comb. *Thecocarpus perarmatus* Billard, 1908 is transferred to *Lytocarpia,* as *L. perarmata,* n. comb., and *T. myriophyllum* var. *orientalis,* Billard, 1908 is raised to full species level, as *Lytocarpia orientalis,* n. comb., n. status. *Aglaophenia pluma* var. *sibogae* Billard, 1913 is raised to full species level as *A. sibogae,* n. status.

Keywords: marine Cnidaria, Hydrozoa, Anthoathecata, Leptothecata, taxonomy, revision, new species, new records, Kei Islands, Moluccas, Indonesia

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INTRODUCTION

In 1921, the eminent Danish echinoderm taxonomist Theodor Mortensen set out on an expedition to the islands of Indonesia, in particular the Kei Islands southeast of the Moluccas. The aim of the expedition was to evaluate the feasibility of establishing a tropical marine biological station. For this goal, numerous dredgings were made around the Kei Islands, the Banda Islands, the Moluccas, and in the Sunda Strait. The account of this expedition and most station data were published by Mortensen in 1923. Mortensen's collection also included numerous hydroids in comparatively good condition. This interesting hydroid collection is now kept by the Zoological Museum in Copenhagen and, astonishingly, it has never been worked up and the species remained unidentified. Only Petersen (1990) described the new species *Ralpharia neira* and recorded *Ectopleura pacifica* (Thornely, 1900) based on this collection. The present author therefore gladly accepted an offer to study this collection, moreover as it offered an opportunity to concomitantly revise a collection of hydroids from the Moluccas collected and described by Pictet (1893), a collection now kept by the Natural History Museum of Geneva.

The larger thecate hydroid species of Indonesia are relatively well known, mostly through the studies of Billard (see below). The medusae of the region are also quite well known, except perhaps the smaller forms (Kramp 1968). In contrast, the athecate hydroids and smaller thecate hydroids producing medusae are very poorly known. These forms can often not be identified in dredged material because they require live observation and knowledge of the complete life-cycle. The first study dealing exclusively with Indonesian hydroids was by Pictet (1893). It was based on material collected by M. Bedot and C. Pictet during an expedition to the Moluccas (Bedot 1893–1909). Shortly afterwards, this publication was followed by the studies of von Campenhausen (1896) and Weltner (1900). The Dutch Siboga expedition in 1899–1900 produced a particularly rich collection of hydroids studied thoroughly by Billard (1911a through 1942b). The investigation on the Stylasteridae of the Siboga expedition was published by Hickson & England (1906). Also Stechow & Müller (1923), Leloup (1930), Vervoort (1941), Cairns (1983), and Vervoort (1993) contributed important accounts on Indonesian hydroids (see Appendix 2). For the hydromedusae, the synopsis of Kramp (1965, 1968) remains certainly the most relevant publication. A newer account is provided by van der Spoel & Bleeker (1988). Because the hydrozoan fauna of the tropical Indo-Pacific is rather homogeneous and certainly belongs to one biogeographic unit, systematic studies from waters belonging to other economic zones often contain essential information. The most important of these studies are: Allman (1883, 1888), Bale (1884), Thornely (1900, 1904), Nutting (1905, 1927), Jarvis (1922), Millard & Bouillon (1973), Vervoort & Vasseur (1977), Bouillon (1978a, 1978b, 1980, 1984b, 1985b), Gravier-Bonnet (1979), Watson (1985, 1997, 1999, 2000), Rees & Vervoort (1987), Gibbons & Ryland (1989), and Ryland & Gibbons (1991).

The present account deals with hydrozoan polyps collected by Mortensen's Kei Island Expedition as well as the hydroid material described by Pictet (1893). The numerous new records demonstrate that our knowledge of this region is still far from being complete.

MATERIALS AND METHODS

Materials

The hydroids of the Danish expedition to the Kei Islands are kept by the Zoological Museum, University of Copenhagen. Some slide material of this collection as well as some alcohol material of species collected in great abundance are also in the Natural History Museum of Geneva. The localities are given – if available – as Kei Islands Expedition station numbers. The geographic coordinates and further data of these stations are given in Appendix 1 and in Mortensen (1923). Some material of the Kei Islands Expedition was taken at sites without a station number and therefore the information on the labels is given here.

The specimens were examined with a dissecting microscope or a compound microscope using temporary or permanent preparations on microscope slides (see Gibbons & Ryland 1989). Drawings based on material examined for this study were usually made with the help of a *camera lucida*. The figures given in this publication thus enable calculation of linear dimensions. In cases where a species was recorded from one station only, no locality data are specified in the legends of the illustrations.

Taxonomy and technical terms

Supraspecific taxa are here used as defined in Cornelius (1995a, 1995b), Bouillon (1985a), or Millard (1975), except for the Hydractiniidae and Cordylophoridae, which are delimited as discussed in Schuchert (2001). Additionally, the families Tubidendridae Nutting, 1905 and Hebellidae Fraser, 1912 are here regarded as valid.

Technical terms are generally used as explained in Cornelius (1995a, 1995b), Millard (1975), and Schuchert (1996, 1997).

Abbreviations

MHNG	Muséum d'Histoire Naturelle, Geneva, Switzerland
NMNH	National Museum of Natural History, Smithsonian Institution, Washington D.C., USA
ZMUC	Zoological Museum of the University of Copenhagen, Denmark

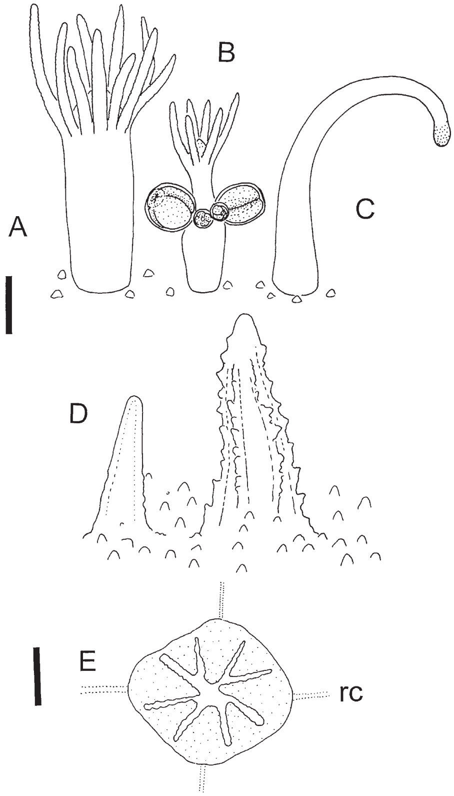

Fig. 1. *Hydractinia granulata* Hirohito, 1988. A. Gastrozooid. B. Gonozooid with medusoids. C. Dactylozooid. D. Spines and prickles. E. View of distal end of medusoid with its rudimentary tentacles and the four radial canals (rc). – Scales: A–C, D = 0.2 mm; E = 50 µm.

ZMA	Zoological Museum Amsterdam, The Netherlands

SYSTEMATIC PART

Order Anthoathecata

Family Hydractiniidae

Hydractinia granulata Hirohito, 1988

Fig. 1.
Hydractinia granulata Hirohito, 1988: 121, fig. 44.

Material examined:
Kei Islands Expedition station 96, 4 gastropod shells (*Nassarius* sp., 2 cm) inhabited by hermit crab *Diogenes custos* (Fabricius, 1798) (kindly identified by Dr Jacques Forest, Paris), shells covered completely by hydroid, fertile males.

Description

Colonies encrusting and covering nearly whole shell, hydrorhiza covered by naked coenosarc, provided with densely set spines and numerous small prickles. Spines simple, up to 2 mm high, smaller ones almost smooth and conical, larger ones with longitudinal ridges set with irregular prickles. Hydranths polymorphic.

Gastrozooids 1 mm high (contracted), hypostome conical, without belt of nematocysts, 6–14 tentacles in one whorl.

Gonozooids smaller and more slender than gastrozooids, shaped like ninepins, 6–8 tentacles, these shorter than in gastrozooids, hypostome with a few larger nematocysts. Gonophores in one whorl in middle of hydranth, 4–6 gonophores per hydranth. Gonophores are medusoids with reduced tentacles, only males observed.

Dactylozooids present along outer lip of shell opening, 1–2 mm, curved, tapering, distal end rounded and densely studded with nematocysts.

Medusoids spherical, diameter about 0.25 mm, with four thin radial canals and a ring canal around the narrow bell-opening, opening surrounded by 8 short tentacle stumps. Male gonads in four interradial, wedge-shaped packets filling the subumbrella completely and hiding the manubrium. Nematocysts: a) microbasic euryteles, 7 x 3 µm, on tentacles; b) heteronemes, (10–12) x (3–4) µm, on hypostome of gonozooids and abundantly on tips of dactylozooids; c) desmonemes, (5–6) x (3) µm, on tentacles.

Remarks

This is the second record of this species and the first record outside Japan. It is apparently also the first record of a *Hydractinia* species for Indonesia. The Indonesian material agrees well with Hirohito’s (1988) description.

Distribution

Japan, Indonesia. Type locality: Hayama, Sagami Bay, Japan.

Family Tubidendridae

Diagnosis (emended)

Anthoathecata Filifera with erect, branched, polysiphonic colonies. Hydranths polymorphic. Gastrozooids with club-shaped body and with two well separated whorls of tentacles. Gonozooids with either one tentacle or none, with one whorl of gonophores. Dactylozooids small, tentacle-like. Gonophores released as immature medusae. Young medusa with four filiform tentacles, manubrium simple.

Remarks

When Nutting (1905) described *Balea mirabilis*, he also created the new family Tubidendridae to accommodate it. Because the name *Balea* is preoccupied for a gastropod, Stechow (1919: 154) renamed the genus *Balella*. Some authors, e.g., Fraser (1938), recognized the family Tubidendridae, while Stechow (1922) referred *Balella* to the new subfamily Balellinae of Clavidae McCrady, 1859. Millard (1975), Bouillon (1985a), and Hirohito (1988) referred the genus to the family Bougainvilliidae. Because the gonophores of *Balella* are produced on the body of hydranths they can be placed neither in the Bougainvilliidae nor the Cordylophoridae (sensu Schuchert 2001, the taxon Clavidae is a synonym of Hydractiniidae). Because of this and its unique tentacle arrangement it is here placed again in the family Tubidendridae. The polymorphic, almost sessile polyps as well as the young medusae suggest close affinities with the Hydractiniidae. Nutting (1905) made cross-sections of the stem and observed naked coenosarc at the surface. This prompted him likewise to associate the Tubidendridae with the Hydractiniidae. The presence of such naked coenosarc could not be seen with sufficient accuracy in the present samples and no cross-sections could be made. Further discussions on the affinities of *Balella mirabilis* must await information on the adult medusa.

***Balella mirabilis* (Nutting, 1905)**

Fig. 2.

Balea mirabilis Nutting, 1905: 940, pl. 2: fig. 3, pl. 7: figs 3–4. – Jäderholm 1919: 4, pl. 1: figs 1–4.

Balella mirabilis. – Hirohito 1988: 91, fig. 32a–c.

Material examined:
Kei Islands Expedition station 81, about 25 colonies, some with medusae buds.

Description

Erect hydroid colonies reaching 6 cm in height, irregularly pinnate, side-branches primarily in one plane. Stem and branches polysiphonic to the tips, component tubes neatly parallel and compactly fused together. Hydrorhiza a large, tangled mass of very fine stolons anchoring the colony in the sediment. Polyps polymorphic, with gastrozooids, gonozooids, and dactylozooids.

Gastrozooids up to 1.2 mm high, sitting preferentially on upper and under side of the side-branches in a wide and shallow perisarc collar; body of gastrozooids with a slender, pedicel-like lower part and a swollen, pear-shaped main body; nipple-shaped hypostome very high, two well separated whorls of filiform tentacles, about ten tentacles per whorl, lower whorl of tentacles at base of swelling, second whorl at base of hypostome, tentacles tapering, evenly covered with nematocysts, gastrodermal cells chordoid. In younger gastrozooids the two tentacle whorls more approximated.

Gonozooids only half the size or less of gastrozooids, very slender and only slightly swollen distally, base in a short, tubular perisarc collar; at distal end a single, thin tentacle, may be absent; at one third from upper end a single whorl with 4–6 medusae buds.

Dactylozooids very numerous and often regularly spaced, finger-like, with no or very low perisarc collar, epidermis of dactylozooids with only few euryteles.

Medusa buds up to 0.25 mm, oldest observed stage with four radial canals, four marginal bulbs, each with thick epidermis and a short tentacle, manubrium simple, without visible gonad tissue. Nematocysts similar to the ones described below.

Nematocysts: desmonemes, four coils when discharged, approx. 4 x 2.5 µm; microbasic euryteles, about 7 x 2.5 µm, almond-shaped, discharged shaft about as long as capsule, only slightly swollen.

Remarks

The present material is the first find of this species in Indonesian waters. The gonozooids and gonophores are here described for the second time only. They were first seen by Jäderholm

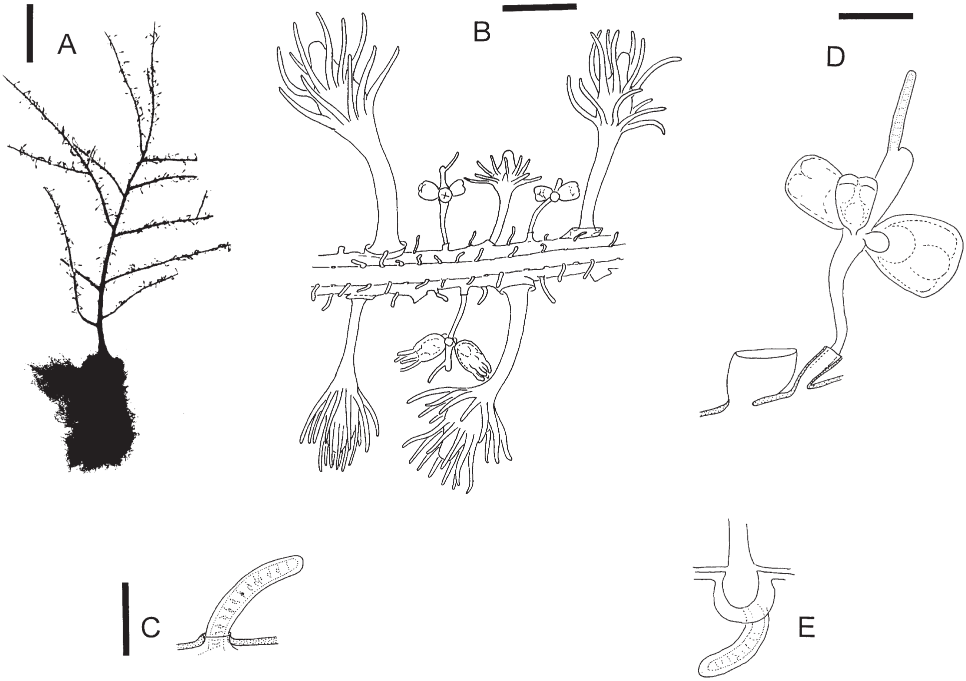

Fig. 2. *Balella mirabilis* (Nutting, 1905). A. Silhouette of colony, note massive hydrorhiza. B. Part of branch with gastrozooids, gonozooids, and dactylozooids. C. Dactylozooid. D. Gonozooid with medusae buds and tentacle; left of the gonozooid an empty perisarc collar of a young gastrozooid. E. Marginal bulb with tentacle of medusa, seen from inside. – Scales: A = 1 cm; B = 0.5 mm; C, E = 0.1 mm; D = 0.2 mm

(1919) in material from Japan and he described the gastrozooids as devoid of tentacles. Contrary to the material of Jäderholm, the gonozooids of the present material usually had a single tentacle (Fig. 2D); some, however, were devoid of such a tentacle (Fig. 2B). Whether this is due to mechanical damage or represents a natural polymorphism could not be determined.

Distribution

Rare species, occurring at the coasts of Japan, Hawaii, and Indonesia; depth range 49–232 m, on sandy or muddy bottoms. Type locality: Hawaiian Archipelago, between Molokai and Maui, 232 m.

Family Stylasteridae

Conopora major **Hickson & England, 1905**

Fig. 3.

Conopora major Hickson & England, 1905: 25, pl. 3: figs 33–35. – ?Broch 1936: 91, fig. 30, pl. 13: fig. 38. – Boschma 1956: F100, fig. 82, 2c. – Boschma 1957: 39, bibliography. – Cairns 1991: 73.

Material examined:
Kei Islands Expedition station 45, 14 colonies, some attached on stones, preserved dry, associated polynoid polychaetes often present.

Description

Colonies forming erect, calcareous skeleton, 1–4 cm high, robust, arborescent, not uniplanar, branches short, with up to 3 cyclosystems, main stem with associated polynoid polychaetes that induce trunk to grow into hollow tube with slit-like openings. Coenosteum white, microscopic texture linear-imbricate, macroscopic texture smooth. Nematopores only present locally, preferentially near base, rare or mostly absent in distal parts of colony, nematopores on shallow mounds. Cyclosystems in region inhabited

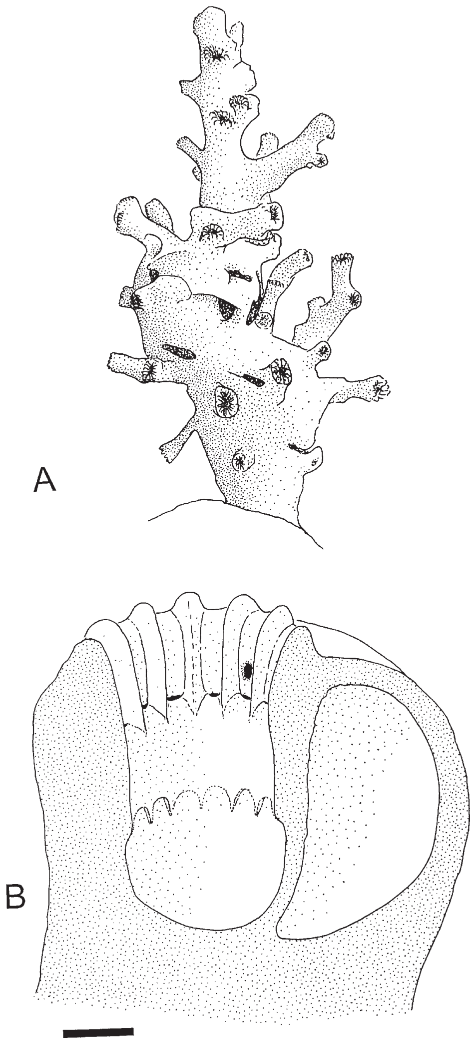

Fig. 3. *Conopora major* Hickson & England, 1905. A. Colony, height 2.5 cm. B. Schematic organization of the cyclosystem, split longitudinally, with ampulla on its side. Note that lower dactylopores are not always as distinct as shown here. – Scale: B = 0.2 mm.

by polychaete irregularly arranged, in distal branches sympodial in arrangements, shifted only slightly to one side of branch, distal ones slightly standing out, proximal ones flush to slightly recessed into branch coenosteum. Cyclosystems circular to slightly irregular in shape, 1 mm in diameter, 9–16 dactylopores per non-diastemate cyclosystem (mean 12.2, S.D. 1.6, n = 47, 10 colonies, most frequent value (mode) 12), one pseudoseptum occasionally thicker than others, adaxial dactylopores of older cyclosystems often filled by coenosteum (diastema). Gastropores, about 0.4 mm in diameter. Gastropore tubes up to 1.2 mm deep, divided into three sections of approximately same height. Upper section cylindrical, bordered by pseudoseptae; below this part a middle section delimited below by the ring of the lower dactylopores; lowest part hemispherical, not delimited by constriction from middle part or constriction very shallow and indistinct. Ring of lower dactylopores can be absent. Ampullae internal, ellipsoidal cavities, only present around cyclosystems; efferent pores on the pseudoseptae or in the gaps between them.

Remarks

The present samples came from a site near the Kei Islands that is only about 40 km away from one of the type localities of *Conopora major*. All colonies showed little variation and matched perfectly the description of *Conopora major* given in Hickson & England (1905), notably also the colony form (Fig. 2A). Broch (1936) assigned material from Mauritius to *C. major*. His colonies were more or less regularly pinnate and had their cyclosystems on the anterior side only. Furthermore, the diameter of the cyclosystems in Broch's samples measured 1.5–1.8 mm in diameter, which is considerably more than the 1 mm observed here, or the 1.2 mm observed by Hickson & England (1905). Thus, the population studied by Broch perhaps belongs to another species, but due to the lack of information on the geographic variability of this species it seems impossible to draw reliable conclusions.

Cairns (1991) re-described the closely similar *Conopora verrucosa* (Studer, 1878) and regarded *Conopora major* as a potential junior synonym. Cairns' (1991) material from New Zealand differs from the present one by having a uniplanar growth versus a bushy and irregular growth; by the abundant nematopores that make the surface warty while in the present material these nematopores are quite rare; by the longer branches with more than 3 cyclosystems; by gastropores that are twice as deep, and by the regular presence of a constriction in the gastropore. These differences, and in particular the difference in colony form, made me hesitate to synonymize *C. verrucosa* and *C. major*.

Distribution

Indonesia, ?Mauritius. Type localities: Kei Islands (5°28.4'S, 132°00.2'E, 204 m) and Sulawesi (1°33.5'N, 124°41'E, 1901 m).

Family Cordylophoridae

Turritopsis cf. *nutricula* McCrady, 1859

Fig. 4.

Turritopsis nutricula McCrady, 1959: 55, pls 4–5. – Russell 1953: 115, figs 54A–C, 55, 56, pl. 5: figs 1–5, pl. 29. – Kramp 1968: 27, fig. 66. – Millard 1975: 76, figs 24F–G. – Calder 1988: 8, figs 5–6, synonymy. – Schuchert 1996: 16, fig. 5a–e, synonymy. – Migotto 1996: 11, fig. 3a–c.

?*Dendroclava Dohrnii* Weismann, 1883: 26. – Pictet 1893: 6, pl. 1: figs 1–2.

?*Corydendrium chevalense* Thorneley, 1904: 109, pl. 1: fig. 4.

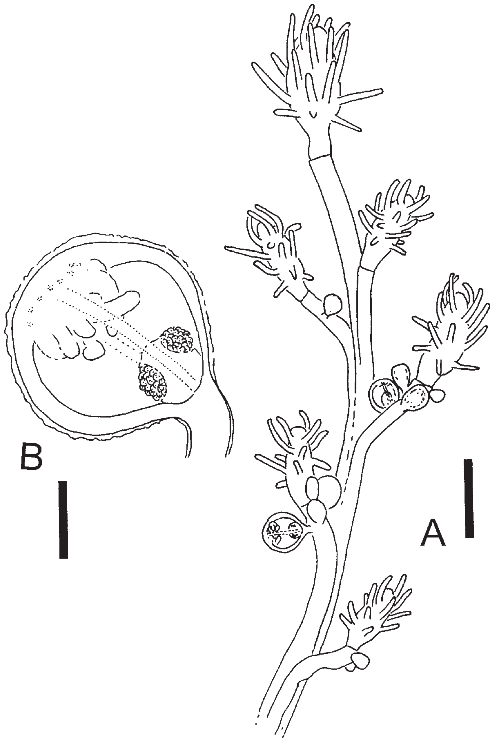

Fig. 4. *Turritopsis nutricula* McCrady, 1859; material from Ambon. A. Shoot with medusae buds. B. Advanced medusa bud, note the coloured interradial patches (stippled). – Scales: A = 0.5 mm; B = 0.1 mm.

Material examined:
Kei Islands Expedition, 28.02.1922, Ambon, harbour pier, 1 m, on *Pennaria disticha* and sponges, with medusae buds. – Kei Islands Expedition station 37, on hydroids and other material, with medusae buds. – MHNG INVE 31269, Bay of Ambon, material of Pictet (1893), labelled *Dendroclava Dohrni*, collected 15.7–12.8.1890, on *Pennaria disticha*, with medusae buds, preserved with $HgCl_2$. – MHNG INVE 32617, Thailand, Andaman Sea, Koh Bi Da Nok, coll. A, Faucci, 6 Apr 2000, 12–18 m, with medusae buds. – MHNG INVE 29753, Mediterranean, Mallorca, Cala Murada, 16.8.2000, 2 m, examined alive, newly released medusae observed. – New Zealand material: see Schuchert (1996).

Description

Hydroid branched, monosiphonic or polysiphonic, 0.5–2 cm in height, arising from creeping, reticulate stolons. Branches and pedicels of hydranths adnate for some distance then curving outwards, diameter of branches 0.1–0.15 mm. Perisarc double layered, outer layer straight, inner layer undulated. Hydranths 0.5–1.0 mm, spindle-shaped, with up to 20 filiform tentacles scattered in distal ¾ of hydranth. Gonophores medusae developing on hydranth pedicels (in perisarc-covered region). Medusa buds spherical. Oldest buds observed with 4 radial canals, several tentacles, 8 eye-spots, manubrium with four interradial pads consisting of large, darkly coloured cells. Nematocysts: desmonemes 3.5 x 2 µm, microbasic euryteles (5.5–6) x (2.5–3) µm.

Remarks

Turritopsis hydroids and young medusae possess some characteristic traits that facilitate their identification: the double-layered perisarc and the interradial patches of coloured cells on the manubrium of the medusa. The first Indonesian record of a hydroid referable to *Turritopsis* was made by Pictet (1893, as *Dendroclava dohrni*). Reexamination of Pictet's original material clearly showed that it belongs to *Turritopsis*. The medusa phase of *Turritopsis* is also known to occur in the region (Kramp 1968, as *T. nutricula*). Although the hydroid phase and young medusa of the specimens from Indonesia, the Andaman Sea, New Zealand, and the Mediterranean appear identical and they agree with the current concept of *T. nutricula* (see Schuchert 1996), there still remains the possibility of sibling hydroid species producing different adult medusae. According to Kramp (1961, 1968), there are only two valid *Turritopsis* medusae, *T. nutricula* and *T. lata* von Lendenfeld, 1885. Results from ongoing research (P. Schuchert, publication in prep.), however, suggest that *Turritopsis* medusae from various populations differ significantly and that *T. nutricula* as presently conceived is very likely a species complex. The Indonesian material was therefore only tentatively assigned to *T. nutricula*, pending further information on the medusa phase of this population. The *Turritopsis* species of the tropical Indo-Pacific might all be referrable to *Turritopsis chevalense* (Thorneley, 1904), a hydroid known from Ceylon. *Turritopsis chevalense* is only known from its polyp phase and at present not distinguishable from other *Turritopsis* hydroids.

Distribution

Circumglobal, mainly in tropical waters but spreading into temperate waters too. Type locality: Charleston Harbour, South Carolina, USA.

***Corydendrium* cf. *corrugatum* Nutting, 1905**

Fig. 5.

Corydendrium corrugatum Nutting, 1905: 941, pl. 2: fig. 2, pl. 7: figs 5–7.

Material examined:
Kei Islands Expedition stations 74. – 107. – For comparison: MHNG INVE 25127, *Corydendrium parasiticum,* Mediterranean, Naples, fertile males.

Description

Colonies up to 4 cm high, arising from tangled, tortuous stolons. Colonies polysiphonic, stout, branching irregularly, diameter of terminal branches (hydranth pedicels) about 0.4 mm. Perisarc thick, not regularly two-layered, slightly and irregularly corrugated or folded, ending abruptly below base of hydranths. Branches adnate for most of their length, then curving outwards, preferentially on one side of branch, free part about 1 mm. Contracted hydranths 1.5 mm long, with about 20 scattered filiform tentacles. Sporosacs not seen.

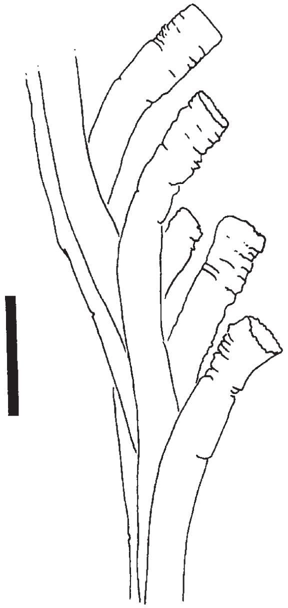

Fig. 5. *Corydendrium* cf. *corrugatum* Nutting, 1905; station 107. Lateral view of part of stem, without hydranths. – Scale: 0.5 mm.

Remarks

Nutting's (1905) Hawaiian material as well as the present material was infertile, thus the genus allocation must remain preliminary only. In view of this lack of knowledge of the gonosome, and also the relatively simple structure of this hydroid offering few reliable distinguishing characters, the identification must considered to be only tentative.

The structure of the trophosome of the Indonesian specimens matched rather well the description and figures given by Nutting (1905) for *C. corrugatum*, except for the annulation of the terminal part of the cauli. These free, terminal parts were longer and had only irregular corrugations and not the broad, regular annulation depicted by Nutting (1905). Because perisarc annulation in hydroids is often highly dependent on environmental conditions, not too much weight should be placed on this difference.

Compared to Mediterranean material of *Corydendrium parasiticum* (Linnaeus, 1767), a species forming similar colonies as *C. corrugatum*, the Indonesian *Corydendrium* is much more robust (thicker), the free terminal branches (hydranth pedicels) are shorter and they are preferentially on one side only, thus creating branches with an anterior and rear side, a trait typical for *C. corrugatum*. In *C. parasiticum*, the hydranths are primarily held sideways.

Distribution

Hawaii, ?Indonesia. Type localities: South of Oahu, 582 m, and northeast coast of Maui, 181 m (Nutting 1905).

Family Bougainvilliidae

***Garveia clevelandensis* Pennycuik, 1959**

Fig. 6.

Garveia clevelandensis Pennycuik, 1959: 166, pl. 2: figs 7–9.

Material examined:
MHNG INVE 31975, harbour of Ambon, collected 1890 by M. Bedot and C. Pictet (see Pictet 1893), on hydroid labelled as *S. vegae* (correct id. is *Dynamena crisioides*, see below).

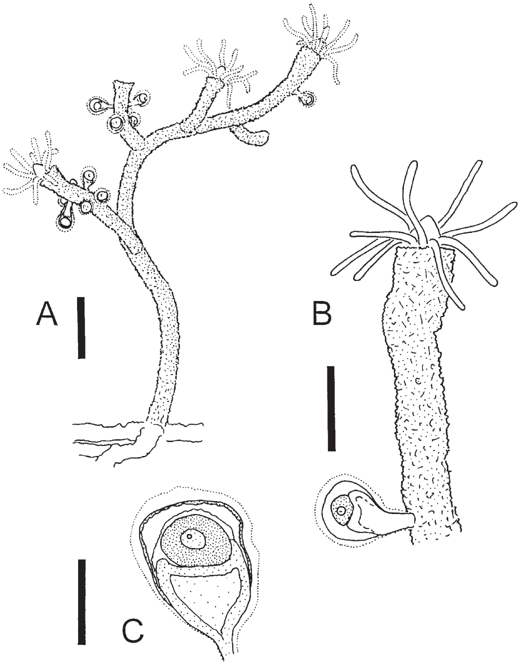

Fig. 6. *Garveia clevelandensis* Pennycuik, 1959. A. Single shoot of a colony. B. Terminal portion with hydranth and sporosac. C. Sporosac with egg. – Scales: A = 0.5 mm; B = 0.2 mm; C = 0.1 mm.

Description

Colonies growing on *Dynamena crisioides*, erect, branched up to second order, height reaching 4 mm. Stolons creeping, ramified. Stems evenly thick, monosiphonic, about 0.15 mm diameter, densely covered by fine silt particles, periderm ends below tentacles of hydranths as pseudohydrotheca, pseudohydrotheca not much dilated and not sheathing base of tentacles. Periderm thin, without regular annulations. Hydranth 0.25 mm long, with 8–14 tentacles (10 or 12 most frequently), tentacles in one whorl; hypostome prominent, conical. Gonophores arise on stem and branches, pear-shaped, up to 0.2 mm. Gonophores are sessile sporosacs without any radial- or circular canals, spadix simple, females bearing a single egg, gonophore covered by thin periderm lamella. Development takes place within sporosac. Male gonophores unknown.

Remarks

The present material corresponds very well with the description and figures of Pennycuik (1959), only the diameter of the stem being greater in the present material. This is the second find of this species and also a new record for Indonesia. *Garveia clevelandensis* closely resembles *Garveia franciscana* (Torrey, 1902) in its finer structure, especially the monosiphonic colony and the sporosacs with one egg only (see Vervoort 1964 or Morri 1982 for a description of *G. franciscana*). *Garveia franciscana* differs only in forming much larger colonies (7–20 cm) and in preferring brackish waters. The dense covering with silt particles found in *Garveia clevelandensis* could be another difference of diagnostic value. *Garveia nutans* Wright, 1859 forms up to 2.5 cm high colonies that are usually polysiphonic, but fertile, monosiphonic colonies are possible (MHNG INVE 31852). Monosiphonic *Garveia nutans* can be distinguished from *G. clevelandensis* by their higher number of eggs per sporosac (6–10).

Distribution

Queensland, Moluccas (new record). Type locality: Cleveland, Queensland, Australia; on *Dynamena crisioides* growing on jetty piles.

Family Eudendriidae

Eudendrium kirkpatricki Watson, 1985

Eudendrium generale. – Kirkpatrick 1890: 607, pl. 15: figs 1–2.
Eudendrium capillare. – Stechow 1925: 202.
Eudendrium kirkpatricki Watson, 1985: 194, figs 35-39. – Watson 1999: 5, fig. 4A–D. – Marques et al. 2000: 98, figs 58–63.

Material examined:
Kei Islands Expedition station 106, infertile. – Kei Islands Expedition, Sulawesi, Ujungpandang, Samalon Island, 25 m, 29 Jun 1922, fertile female, 5-cm shoots, on *Nemertesia indivisa.* – Kei Islands Expedition, Moluccas, Bay of Ambon, 128 m, 25 Feb 1922, fertile female, 2-cm shoots, on organic polychaete tube.

Description

Colonies erect, 2–5 cm high, branched, monosiphonic, often one longer main stem with shorter side-branches, stolons creeping. Stem diameter around 0.2 mm, hydranth-cauli diameter around 0.12 mm. Hydranths relatively small (0.4 mm), 18–20 tentacles in one whorl, hypostome globular. Female sporosacs develop on nearly fully formed hydranth, one whorl of 3–8 sporosacs, spadix simple. During later development spadix reduced and the tentacles of the hydranth shortened to stumps. Eggs are ultimately attached by means of a membrane to the perisarc-covered pedicels of blastostyles. Nematocysts: microbasic euryteles abundant on tentacles, (7–8) x (2.5–3.5) µm; microbasic eurytele, few (< 8) capsules on hydranth body, oblong oval, shaft thick in undischarged and discharged capsule, shaft shorter than capsule, discharged directed sideways, size (22–25) x (11–13) µm in first two samples, (31–35) x (13.5–15) µm in third sample.

Remarks

Eudendrium kirkpatricki is here for the first time recorded for Indonesia. The Indonesian material agrees well with the description given by Watson (1985, 1999) except for the size of the larger microbasic euryteles, which were smaller in two samples. Unfortunately, no male colonies were seen. It is desirable to have information on the male blastostyles in order to assure a full congruence of the Indonesian population with the Australian one. The previous records along northern Australia, however, are rather close to the present ones, which fall within the known range of this species.

There were other *Eudendrium* colonies in the present collection which resembled the ones described here, but had different nematocysts, either isorhizas or egg-shaped microbasic euryteles. Due the lack of gonophores, they were not assigned to a species.

Distribution

Tropical Australia, Red Sea, Indonesia. Type locality: Torres Strait, 09°55'S, 144°08'W.

Family Cladocorynidae

Cladocoryne haddoni Kirkpatrick, 1890

Fig. 7.
Cladocoryne haddoni Kirkpatrick, 1890: 605, pl. 14: fig. 2. – Jäderholm 1903: 263. – Ritchie 1910b: 805. – Bouillon, Boero & Seghers 1987: 281, figs 2–4.

Material examined :
Kei Islands Expedition, Ambon, harbour pier, 1 m, 28 Feb

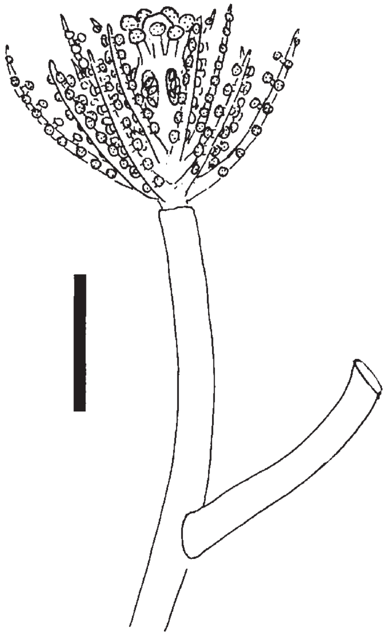

Fig 7. *Cladocoryne haddoni* Kirkpatrick, 1890. – Scale: 0.5 mm.

1922, on *Pennaria disticha* and sponges, infertile. – Kei Islands Expedition, Banda Islands, Lonthoir Channel, 25 m, 11 Jun 1922, on bivalve, infertile.

Description

Colonies stolonal or rarely branched once, reaching heights of about 4–8 mm. Perisarc mostly smooth, thin, ending abruptly below hydranth. Hydranths spindle-shaped, with two aboral whorls of branched tentacles and one whorl of short capitate tentacles around mouth. Aboral tentacles longer than hydranth height, tapering, about 8 per whorl, the two whorls clearly separated, each tentacle with two lateral rows of short capitate side-branchlets, sometimes also a row of such branchlets on upper side of tentacle. Oral tentacles 6–8, short, adnate, with terminal capitae. On hydranth body, halfway between oral and aboral tentacles, five or more oblong pads with large macrobasic euryteles. Gonophores absent.

Additional data

According to Bouillon, Boero & Seghers (1987), the gonophores develop into elongated medusoids with radial canals, marginal bulbs, but without tentacles. Females with 10–20 big, yellowish eggs. Embryos develop in situ.

Remarks

Following Philbert (1936), many subsequent authors regarded *Cladocoryne haddoni* as a synonym of *C. floccosa*. Bouillon, Boero & Seghers (1987) re-described *C. haddoni* based on material from Papua New Guinea and found sufficient differences to *C. floccosa* to permit a reliable identification, even of immature specimens. *Cladocoryne haddoni* differs from *C. floccosa* by having only two instead of three whorls of branched tentacles, by having nematocyst pads in one ring on the hydranth body in the region between the oral and branched tentacles rather than at the bases of the oral and the branched tentacles, and finally by developing oblong gonophores distal to the branched tentacles and not more spherical ones among the tentacles.

The present material of *C. haddoni* – although infertile – agrees well with the account of Bouillon, Boero & Seghers (1987).

Cladocoryne haddoni is here recorded for the first time for waters belonging politically to Indonesia; however, from a biogeographic point of view this species is already known from the region as the type locality in the Torres Strait is very close to the present findings and also the records from Papua New Guinea belong to this geographic region.

Other Indonesian findings of *Cladocoryne* species were reported by Stechow & Müller (1923) and Vervoort (1941). Stechow & Müller (1923) identified their material as *Cladocoryne pelagica* Allman, 1876. Allman's (1876) description of *Cladocoryne pelagica* found on Atlantic *Sargassum* is not precise enough to allow a reliable separation from *C. floccosa*. Allman's figure shows a hydranth which apparently has only one whorl of branched tentacles, but re-examination of the type material must confirm whether this is correct. It was not possible to locate this type material. The material of Stechow & Müller (1923) originating from the Aru Islands was re-examined for this study (the specimens are kept by the "Zoologische Staatssammlung", Munich, Germany). It is a well preserved, typical *Cladocoryne* species growing on the hydroid *Idiellana pristis*. The hydranths have one or two very closely set whorls of aboral tentacles. If two whorls are present, they are closer together as in the material from the Kei Islands. One hydranth had a small, spherical gonophore which developed distal to the aboral tentacles. Despite careful examination, I was unable to see any nematocyst pad on the hydranth body, although discharged macrobasic euryteles could regularly be found in the cauli and on the hydranths. I suspect that this hydroid is not *C. haddoni* and that there exist more *Cladocoryne* species than previously thought. Vervoort's (1941) material identified by him as *C. floccosa* had 3–4 whorls of branched tentacles, each with four tentacles only. Normally both *C. floccosa* and *C. haddoni* have about eight tentacles per whorl and Vervoort's *Cladocoryne* could therefore be another, so far unnamed species.

Distribution

Torres Strait, Papua New Guinea, Moluccas, Banda Islands, Mergui Islands, coast of India.

Type locality: Murray Island, Torres Strait, Australia, 27–37 m.

Pteroclava crassa **(Pictet, 1893)**

Syncoryne crassa Pictet, 1893: 8, pl. 1: figs 3–4. – Boero, Bouillon & Gravier-Bonnet 1995: 71.

Remarks

No new material of this species could be obtained. Examination of the type material of *Syncoryne crassa* Pictet, 1893 (MHNG INVE 25777) showed that it has moniliform tentacles and thus conforms to the genus *Pteroclava* (see Boero, Bouillon & Gravier-Bonnet 1995). Additionally, the few gonophores present revealed that they must develop into medusae with only two tentacle bulbs. The material strongly resembles *Pteroclava krempfi* (Billard, 1919a). However, *Pteroclava krempfi* is only known to occur on Octocorallia while *Pteroclava crassa* was found on the hydrorhiza of the hydroid *Macrorhynchia philippina.* Boero, Bouillon & Gravier-Bonnet (1995) regarded them therefore as separate species.

Family Pennariidae

Pennaria disticha **Goldfuss, 1820**

Pennaria disticha Goldfuss, 1820: 89. – Brinckmann-Voss 1970: 40, text-figs 43, 45–50. – Gibbons & Ryland 1989: 387, fig. 5. – Schuchert 1996: 142, fig. 85a–c. – Migotto 1996: 25.
Pennaria Cavolinii Ehrenberg, 1834: 297. – Pictet 1893: 12, pl. 1: figs 7–9. – von Campenhausen 1896b: 307. – Weltner 1900: 585.
Pennaria australis Bale, 1884: 45.
Halocordyle disticha var. *australis.* – Vervoort 1941: 192.
Halocordyle disticha. – Millard 1975: 41, figs 16C–G. – Garcia-Corrales & Aguirre 1985: 85, figs 1–3, synonymy. – Calder 1988: 57, figs 43–45, synonymy. – Östman et al.1991: 607, figs 1–18. – Hirohito 1988: 28, fig. 9a–d, pl. 1: fig. C.

Material examined:
Kei Islands Expedition stations 11. – 104, fertile. – 116. – Kei Islands Expedition, Moluccas, Ambon, pier of harbour, 1 m, 28.02.1922, well preserved and fertile. – MHNG INVE 31269, Bay of Ambon, material of Pictet (1893), jar labelled *Dendroclava Dohrni*, collected 15 Jul–12 Aug 1890, with mature medusoids. – MHNG INVE 29809, Mediterranean, Mallorca, Cala Murada, 1 m, coll. 24 Aug 2000.

Diagnosis

Anthoathecata Capitata with hydroid phase forming erect, pinnately branched stems, height 10 cm and more, hydranths on upper side of branches, pedicellate, body pear-shaped, one aboral whorl of filiform tentacles and distal to them scattered capitate tentacles. Gonophores oblong medusoids without tentacles, short-lived, released with mature gonads.

Remarks

This characteristic and well known species needs no special comments. Its synonymy is well known and there were no significant differences between the Pacific and Mediterranean material. According to current usage, the genus name *Pennaria* is preferred over *Halocordyle* (see Schuchert 1996).

Distribution

Circumglobal in tropical to warm-temperate waters. Type locality: Gulf of Naples, Mediterranean.

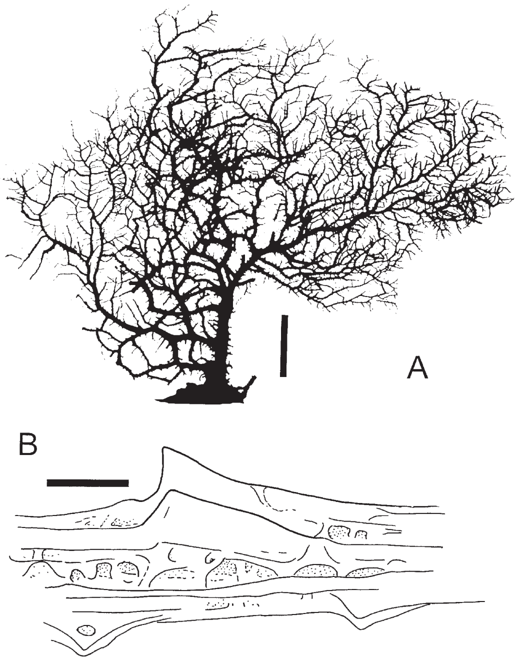

Fig. 8. *Solanderia secunda* (Inaba, 1892). A. Colony silhouette. B. Skeleton of terminal branch with triangular hydrophores. – Scales: A = 3 cm; B = 0.2 cm.

Family Solanderiidae

Solanderia secunda (Inaba, 1892)

Fig. 8.

Dendrocoryne secunda Inaba, 1892: 98, figs 111–113.

Solanderia secunda. – Hirohito 1988: 49, fig. 15. – Bouillon, Wouters & Boero 1992: 12, pls 5–6, 10–12, synonymy. – Watson 1999: 13, fig. 9A–F.

Solanderia minima. – Millard & Bouillon 1973: 16, fig. 2A–B, pl. 1. – Millard 1975: 59, fig. 21C–E.

Material examined:
Kei Islands Expedition, Banda Islands, Neira Island, 25 m, coll. 14 Jun 1922, without gonophores, colony broadly fan-shaped, dimension 22 x 18 cm, stem and thicker branches darkly coloured.

Diagnosis

Solanderiidae with hydranth bases flanked by two parallel, broadly triangular periderm processes (hydrophores).

Remarks

This is the first find of *S. secunda* in Indonesian waters, but it lies well within the known distribution of this species. All *Solanderia* species have recently been revised by Bouillon, Wouters & Boero (1992) and several nominal species were synonymized. For detailed descriptions of this species see Bouillon, Wouters & Boero (1992), Millard (1975, as *S. minima*), or Watson (1999).

Distribution

Tropical and subtropical Pacific and Indian Ocean, reaching from Japan over Australia to South Africa and the Red Sea. Type locality: Misaki, Japan.

Family Tubulariidae

Ectopleura viridis (Pictet, 1893)

Fig. 9.

Tubularia viridis Pictet, 1893: 17, pl. 1: figs 10–11. – Billard 1905: 331, figs 1–3.

Ectopleura pacifica Thornely, 1900: 452, pl. 44: figs 1, 1a. **New synonym.**

Ectopleura pacifica. – Petersen 1990: 165. – Schuchert 1996: 112.

Tubularia pacifica. – Borradaile 1905: 838.

Not *Ectopleura pacifica.* – Mammen 1963: 59, figs 27–29 [= *Ectopleura indica* Petersen, 1990].

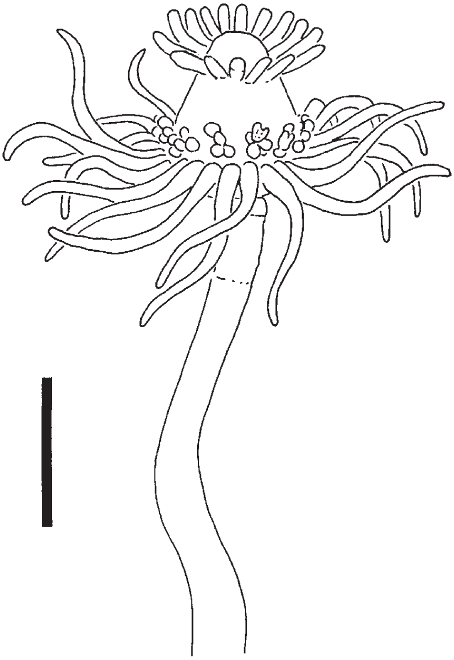

Fig. 9. *Ectopleura viridis* (Pictet, 1893); after type material. Hydranth with part of caulus. – Scale: 1 mm.

Type material examined:
MHNG INVE 31350, coll. Pictet and Bedot, 14 Aug 1890, Port of Ambon, Moluccas, on sponge, depth 1 m, several stems with medusa buds.

Other material examined :
Kei Islands Expedition, labelled as *Ectopleura pacifica*, Banda Islands, off Neira Island, 10 m, on *Melitodes ochracea* (Octocorallia), 1.06.1922, several stems with medusae buds. – ZMUC, as *Ectopleura pacifica*, Laing Island, Papua New Guinea, 40 m, July 1977, coll. J. Bouillon, on crab; solitary, very short hydroids, perhaps does not belong to *E. viridis*.

Description

Hydroid erect, 0.5–1.0 cm, stems not branched, smooth, curved or not, 0.3–0.4 mm diameter, periderm firm, transparent, at distal end of caulus a neck-region, neck-region with filmy perisarc which originates below distal end of stem, with collar formation (see Petersen 1990). Hydranth body ovoid, 1.0–1.2 mm high, one whorl of 16–20 oral tentacles, oral tentacles relatively short and stubby, nematocysts concentrated at tip. At hydranth base on whorl of 18–25 long, filiform tentacles, nematocysts more concentrated on underside.

Gonophores develop in a whorl just above the aboral tentacles, up to about 12 blastostyles bearing 1–6 medusae buds, blastostyles not longer than oral tentacles. Oldest, but still attached, medusa-stage with two tentacle bulbs and eight meridional tracks of nematocysts on exumbrella. Radial canals of equal length. Mature medusa unknown.

Further details (fide Pictet 1893): stolons creeping, hydranth colour: yellowish-green.

Remarks

Re-examination of the type material of *Ectopleura viridis* (Pictet, 1893) permitted extraction of some additional details neither mentioned in Pictet (1893) nor Billard (1905). *Ectopleura viridis* is a small, but typical tubulariid hydroid. The base of the caulus is deeply embedded in the sponge tissue. The oral tentacles are not in two distinct whorls as stated by Pictet, but only one whorl, with an occasional tentacle very slightly displaced. The neck region corresponds to the one for an *Ectopleura* species in the sense of Petersen (1990). The gonophores are medusae with two marginal bulbs and eight meridional tracks of exumbrellar nematocysts. The original fixation with $HgCl_2$ apparently stained the nematocysts brown and thus rendered them visible even under the stereo microscope.

With this additional information, *Ectopleura viridis* becomes indistinguishable from *E. pacifica* Thornely, 1900, except perhaps for the slightly thicker stem in the former species and the difference of substrates. I am convinced that they are conspecific.

Petersen (1990) also reported *Ectopleura pacifica* from Papua New Guinea, growing on a crab. This sample was re-examined and it is somewhat uncertain that it belongs to *E. pacifica* or *E. viridis* because the polyps are solitary and the stems only about 1 mm long. It produces also a two-tentacled medusa.

Distribution

Indonesia, Papua New Guinea, Gambier Islands, Maldives.

Order Leptothecata

Family Campanulinidae

***Campanulina panicula* G. O. Sars, 1874**

Fig. 10.

Campanulina panicula G. O. Sars, 1874: 121, pl. 5: figs 9–13. – Kramp 1941: 1, figs 1–5. – Cornelius 1995a: 190, fig. 43. – Schuchert 2001: 56, fig. 41.
Campanulina denticulata Clarke, 1907: 12, pl. 8.
Opercularella panicula. – Leloup 1974: 4, fig. 3. – Ramil & Vervoort 1992: 25, fig. 3a–d, synonymy. – Hirohito 1995: 91, fig. 25d–e.
Campanulina (?)*indivisa* Fraser, 1948: 216, pl. 24: fig. 7. – Vervoort 1966: 106.
Opercularella denticulata. – Gili, Vervoort & Pagès 1989: 76, fig. 6a.

Material examined:
Kei Islands Expedition station 42, large colony overgrowing axial skeleton of gorgonid octocoral, infertile.

Description

Colonies with erect stems arising from thin, creeping stolons. Stems up to 2 cm high, monosiphonic, 0.15–0.2 mm thick, perisarc smooth. Along stem in more or less regular intervals side-branches formed by pedicellate hydrothecae, all directed towards one side, often roughly in two rows forming an angle smaller than 180°, some hydrothecal pedicels branched. Pedicels of hy-

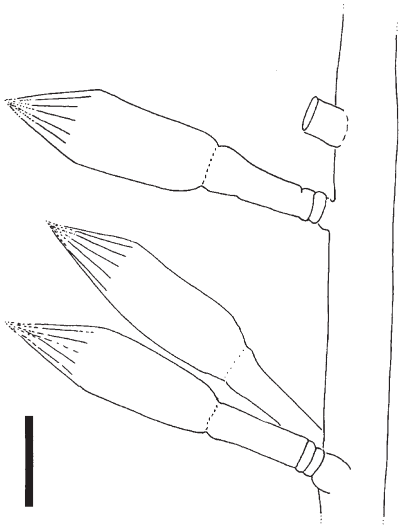

Fig. 10. *Campanulina panicula* G. O. Sars, 1874. Part of stem in side view with hydrothecae. Scale: 0.2 mm.

drothecae 0.3–0.8 mm long, at base with or without annulation. Hydrotheca cylindrical, height without operculum about 0.3 mm, perisarc thin and filmy, hydrotheca at base with slight constriction where hydranth-base is attached and forms a diaphragm-like shelf; operculum conical, formed by about 10 triangular flaps, these not demarcated from hydrotheca by crease line. Gonothecae absent.

Remarks

The present material of *Campanulina panicula* was indistinguishable from similar Atlantic material (Schuchert 2001). This is the first record for Indonesia for this species, but this find fits well into its circumglobal occurrence.

Distribution

Moderately deep to deep waters of the Atlantic, Pacific and Indian Oceans, including the Mediterranean (Ramil & Vervoort 1992). Type locality: Oslo Fjord near Drøbak, Norway, 90–100 m.

Family Haleciidae

Hydrodendron sibogae **(Billard, 1929)**

Fig. 11.

Diplocyathus sibogae Billard, 1929a: 70, fig. A.

Hydrodendron sibogae. – Leloup 1938: 1, fig. 3. – Hirohito 1995: 38, fig. 11a–c, pl. 3: fig. B.

Material examined:
Kei Islands Expedition, Moluccas, Bay of Ambon, 90 m, 2 Mar 1922, on stones and sand.

Description

Colonies up to 10 cm high and broad, irregularly branched, stem and major branches polysiphonic; short and thin monosiphonic branches originating from polysiphonic ones. Monosiphonic branches geniculate and with more or less distinct nodes, nodes alternately oblique, segments about 0.4 mm long, with broad and short apophyses for the attachment of hydrothecae at proximal end of segments, apophyses alternate on lateral sides.

In upper axil of apophysis a tubular nematotheca, length about 0.07 mm, with a tentacle-like nematophore having a swollen distal end.

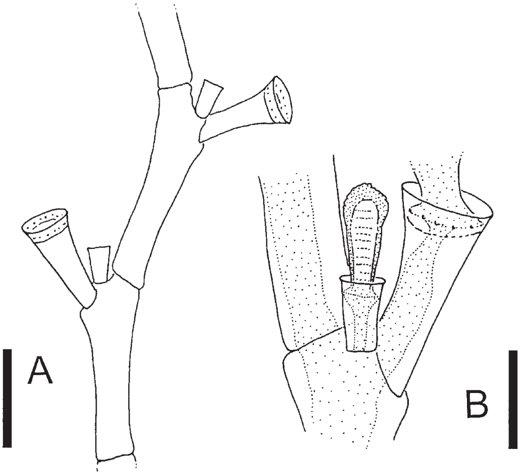

Fig. 11. *Hydrodendron sibogae* (Billard, 1929). A. Monosiphonic part of branch. B. Hydrotheca, hydrophore, and nematotheca with nematophore; soft tissue stippled. – Scales: A = 0.2 mm; B = 0.1 mm.

Hydrotheca movable, on a long (0.2 mm), conical hydrophore. Hydrotheca about 20–30 µm deep, diameter 0.1 mm, walls converging, straight or slightly everted, ring of refringent nodules on inside.

Gonothecae not present.

Remarks

The gonothecae of this species are bell-shaped with a broad, truncated end, about 1 mm high and 0.5–0.7 mm broad, growing on the main stem and branches (Hirohito 1995).

The hydrophores of the present material were about 1/3 shorter than those observed by Billard (1929a) and Hirohito (1995).

In its microscopic structure, especially the present sample with its somewhat shorter hydrophores, *Hydrodendron sibogae* closely resembles *Hydrodendron dichotomum* (Allman, 1888) (see, e.g., Rees & Vervoort 1987, Watson 2000). The polysiphonic stem of the former species seems to be the only reliable character to separate it from *H. dichotomum.*

Distribution

Japan, Indonesia. Type locality: “Indonesia”.

***Halecium halecinum* var. *minor* Pictet, 1893**

Halecium halecinum var. *minor* Pictet, 1893: 20, pl. 1: figs 14–15.

Type material examined:
MHNG INVE 31408, type colony of *H. halecium* var. *minor*, coll 10 Aug 1890 by M. Bedot and C. Pictet, Bay of Ambon, Indonesia.

Description

Colonies 2–4 cm high, branching irregularly, primarily in one plane; main stem and some side-branches polysiphonic from which arise monosiphonic branches. Monosiphonic parts with regular nodes, these transverse to slightly oblique. Hydrothecae on alternating sides of distal ends of internodes, sessile, adcauline wall adnate to internode, hydrothecal wall very short, straight, opening slightly tilted downwards. Gonothecae absent.

Dimensions

Length of internodes about 0.5 mm, diameter of hydrotheca 0.13 mm, depth of hydrotheca 20 µm.

Remarks

Pictet's colonies lack the typical regular and parallel side-branches of *H. halecinum* (Cornelius 1995a, Schuchert 2001). Furthermore, *H. halecinum* is a species mostly known from temperate to cool waters. It is therefore improbable that the present material genetically belongs to *H. halecinum*. The material also conforms with *H. sessile* Norman, 1876, a species which is reportedly cosmopolitan (Millard 1975, Hirohito 1995) and which has been recorded in Indonesian waters by Vervoort (1941). Likewise, Pictet's material could also be identified as *H. beanii*, a species closely resembling *H. sessile.* However, in the absence of information on the gonotheca, Pictet's material cannot be identified with sufficient accuracy.

Distribution

Only known with certainty from type locality: Bay of Ambon, Indonesia.

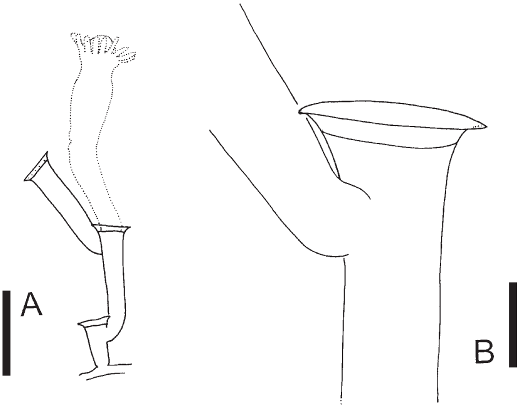

Fig. 12. *Halecium humile* Pictet, 1893; after type material. A. Single shoot. B. Hydrotheca and side-branch. – Scales: A = 0.5 mm; B = 0.1 mm.

***Halecium humile* Pictet, 1893**

Fig. 12.
Halecium humile Pictet, 1893: 23, pl. 1: figs 16–17.

Type material examined:
MHNG INVE 25036, Port of Ambon, Moluccas, slide and alcohol material, 1 mm high shoots with 2–3 hydranths, 20–22 tentacles, internode walls smooth.

Remarks

No new material of this species could be obtained. Its gonothecae are unknown, which makes identification difficult. The hydrothecae are very shallow and much everted (depth 50 µm, diameter at diaphragm 150 µm, at rim 220 µm) and might render the species recognizable. It closely resembles *Halecium pygmeum* Fraser, 1911 (see Fraser 1937, Hirohito 1995). Also *Halecium* sp. 1 depicted in Gibbons & Ryland (1989) might belong to it. A similar Indonesian species is *Halecium scalariformis* Billard, 1929c, which, however, has straight hydrothecal walls. New material from the type locality must be examined to complement the description of *H. humile*.

Distribution

Only known from type locality: Port of Ambon, Moluccas.

Mitrocomium simplex (Pictet, 1893), n. comb.

Halecium simplex Pictet, 1893: 22, pl. 1: figs 16–17. – Ritchie 1910b: 807, pl. 77: figs 10–11.

Campalecium cirratum. – Millard & Bouillon 1975: 7, fig. 2C–E.

Type material examined:
MHNG INVE 25037, as *Halecium simplex* Pictet, 1893, Bay of Ambon.

Remarks

The taxonomic situation of the various species referable to *Campalecium* or *Mitrocomium* is complicated and unresolved (see Calder 1991). The following hydroids referable to the genus *Campalecium* have been described: *C. simplex* (Pictet, 1893); *C. medusiferum* Torrey, 1902; *C. torreyi* (Motz-Kossowska, 1911); *C. microtheca* Hadzi, 1914; and *C. alcoicum* Watson, 1993. Due to their similarity, several authors regarded most of them as conspecific or questionably conspecific (Calder 1991). Brinckmann (1959) – working with Mediterranean material – examined fertile polyps clearly referable to *C. microtheca*. She was able to rear the medusa until the onset of gonad development and she allocated her material to *Mitrocomium cirrata* Haeckel, 1879 (as *Eucheilota cirrata*), an uncommon medusa originally described from the Mediterranean. Brinckmann's medusa agreed reasonably well with Haeckel's medusa, especially in having several lateral cirri. The only serious difference was the tentacle number which was only four in the oldest obtained medusae, while Haeckel's original medusae had 8 tentacles (for a more recent description and figure of *M. cirratum* see Pagès et al. 1992). This difference can, however, easily be attributed to the younger age of Brinckmann's medusae. The medusae observed by Brinckmann were sufficiently old to be allocated to the Lovenellidae (sensu Russell 1953, not Bouillon 1984a). As other medusae of the Lovenellidae have either campanulid or lovenellid hydroid stages, it seems appropriate to keep the genus *Mitrocomium* with its *Halecium*-like hydrotheca until a comprehensive phylogenetic analysis enables recognition of monophyletic groups (see also discussion in Calder 1991).

Because Brinckmann (1959) did not rear her medusae to full maturity, Bouillon (1985a: 149) doubted that *C. microtheca* is the hydroid of *M. cirratum*, although earlier he embraced this view (Millard & Bouillon 1975: 8) and regarded all *Campalecium*-type hydroids known at that time as conspecific with *M. cirratum*. Boero (1981: 188) objected to this because he found a Mediterranean *Campalecium*-like hydroid which reportedly produced a medusa differing from the one described by Brinckmann (1959) and because he found that his polyps had nematocysts that differed from the ones described by Millard & Bouillon (1975). While the umbrellula of the polyps of Millard & Bouillon from the Indian Ocean had large microbasic mastigophores, Boero's were initially identified as macrobasic mastigophores, later corrected to merotrichous isorhizas (Boero & Sarà 1987). Unfortunately, Brinckmann (1959) did not identify the large nematocysts of her polyp. However, I can find no significant difference in the figures of the newly released medusae depicted by Boero (1981: fig. 5, as *Campalecium medusiferum*?) and Brinckmann's medusa (1959: fig. 2e) and I therefore suspect that Boero (1981) in fact had *M. cirratum*. But Boero is correct in that his material differs from Millard & Bouillon's (1975) specimens from the Indian Ocean and that the latter material does not belong to *M. cirratum* because it has different nematocysts. It could belong to *M. medusiferum* or more probably *M. simplex*. Life-cycle studies on Indo-Pacific and Californian material are needed to resolve the problem.

Pictet's material of *H. simplex* was infertile and it was Ritchie (1910b) who described the gonothecae for the first time, this based on material from the Mergui Islands. The true nature of the gonotheca content of Ritchie's material was later described by Millard & Bouillon (1975), who recognized that the gonothecae contained medusa buds.

Unfortunately, no new material of *M. simplex* could be found, but the type material of *Halecium simplex* was re-examined and it proved to have many large microbasic mastigophores identical to the ones depicted in Millard & Bouillon (1975) for their material from the Seychelles. It thus appears very probable that Millard & Bouillon (1975) as well as Ritchie (1910b) had *Mitrocomium simplex* and not *M. cirratum*. Future studies on living material from the type locality of *M. simplex* must substantiate this, however.

As indicated above, the genus *Mitrocomium* (as defined in Brinckmann (1959) based on *Haleciella microtheca*) presents considerable problems not only at the species level, but also at the family level. Its hydroids have a hydrotheca that associates them with the genus *Halecium*, while their medusae belong to the Lovenellidae (sensu Russell). Where known, the hydroids of the family Lovenellidae Russell, 1953 are quite disparate, some like *Eucheilota maculata* being of a campanulid type (Werner 1968), while others are lovenellid with demarcated opercular valves (e.g., *Lovenella clausa*, see Russell 1953 or Cornelius 1995a). To account for this, Bouillon (1984a, 1985a) placed the genera *Eucheilota* and *Lovenella* in families of their own and dismissed the life cycle of *M. cirrata* as insufficiently known. By this, however, the problem is not entirely solved and systems based on the medusa stage and the hydroid stage are still incongruent (see also Cornelius 1995a: 154, who expresses a similar opinion). I consider that *Mitrocomium*, and also the genus *Hydranthea* (see Boero & Sarà 1987), do not belong to the Haleciidae but are more closely related to the genera *Lovenella* and *Eucheilota*, both belonging to the family Lovenellidae Russell, 1953 (not Bouillon). The positive characters of an intratentacular web in the hydroid as well as the lateral cirri of the medusa appear to me as more convincing synapomorphies than the reduced, *Halecium*-like hydrotheca. If one considers that the hydrotheca in *Eucheilota* species can be partially lost, resulting in hydrothecae strongly resembling the ones of *Halecium* (see fig. 14c in Werner 1968), then the usefulness of the shape of the hydrotheca for delimiting families is severely undermined. Such macrotaxonomic problems can only be solved in the framework of a comprehensive phylogenetic analysis and *Mitrocomium* is presently not removed from the Haleciidae as it would cause a major taxonomic instability of this family.

Family Hebellidae

Remarks

As discussed in Schuchert (2001), the members of the genus *Hebella* are here placed in the family Hebellidae Fraser, 1912 and not the Lafoeidae. The species belonging to the Hebellidae have recently been revised by Boero, Bouillon & Kubota (1997). This revision clearly showed that the characters of the hydrotheca alone are mostly insufficient to distinguish species. Many members of this family release immature medusae that must be cultivated to maturity to be identified properly, but this has been done for a few species only. Migotto & de Andrade (2000) succeeded in cultivating the adult medusa of *Hebella furax*. It proved to be a *Toxorchis* sp. (family Laodiceidae). Other Hebellidae release medusae with mature gonads or medusoids with gonads on the manubrium (genus *Anthohebella,* see Boero, Bouillon & Kubota 1997). It is thus evident that Hebellidae species can only be reliably identified if the mature gonophores are known. We have here a similar situation as for the various *Campanulina*- and *Cuspidella*-like hydroids (see also above under *Mitrocomium simplex*).

In the material examined for this study, hebellid hydroids were often present on other hydroids, sometimes even with gonothecae containing immature medusae. For the reasons given above, however, they were not identified to species level.

Family Lafoeidae

***Acryptolaria rectangularis* (Jarvis, 1922)**

Fig. 13.

Cryptolaria rectangularis Jarvis, 1922: 335, pl. 24: fig. 3.
Cryptolaria bulbosa Stechow, 1932: 87.
Acryptolaria rectangularis. – Millard 1975: 171, fig. 57A–D. – Gravier-Bonnet 1979: 17, fig. 4A. – Millard 1980: 138, fig. 4A.
Acryptolaria angulata. – Vervoort 1966: 116, fig. 16. – Hirohito 1995: 102, fig. 29a–b, pl. 6: fig. B.

Material examined:
Kei Islands Expedition station 3, at least two stems and fragments.

Description

Colonies erect, up to 4 cm high, irregularly branched, branching primarily in one plane. Stem and branches polysiphonic through auxiliary tubes covering the hydrotheca-bearing primary tube, polysiphonic parts thinning distally,

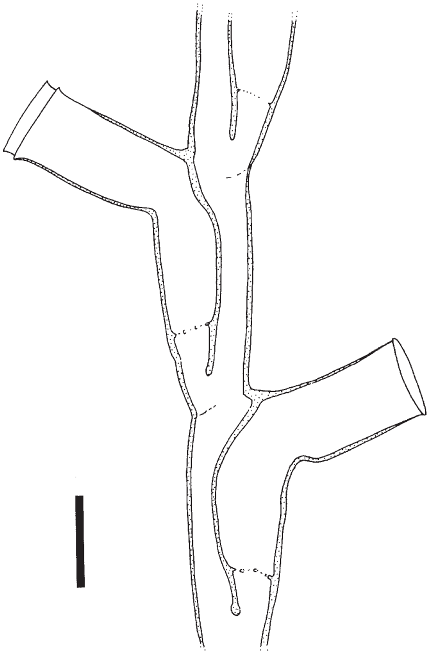

Fig. 13. *Acryptolaria rectangularis* (Jarvis, 1922). Part of hydrocladium with hydrothecae. – Scale: 0.2 mm

but even distal branches with at least one auxiliary tube.

Hydrothecae in two rows, alternate, not much overlapping, tubular, adnate for ½ of length, sharply bent where becoming free, abcauline wall at bend with a more or less distinct notch, free part of hydrotheca straight, about 0.3 mm long, directed slightly upwards or nearly horizontal, diameter not much increasing distally, diameter at opening 0.15–0.18 mm, rim slightly everted, towards base of hydrotheca a ring of nodules or a fine diaphragm; hydrotheca without internal projection at adcauline side. Nematocysts of two sizes: 5 x 3 µm and 23 x 7 µm.

Gonothecae absent (see Millard 1980 for description).

Remarks

Jarvis (1922) distinguished her *Acryptolaria rectangularis* from *A. angulata* Bale, 1914 by the absence of the adcauline projection (dent) into the hydrotheca, but Jarvis considered also the possibility that both are only two forms of the same species. Vervoort (1966) re-examined putative type material of *A. angulata* and allocated also South African material to *A. angulata* even though it did not have the dent ("boss" in his words) described by Bale (1914b). Because this dent represents one of the important diagnostic characters to distinguish it from *A. rectangularis*, it must be assumed that Vervoort (1966) regarded them as possibly conspecific, although he does not explicitly state so in his synonymy. Millard (1975) referred Vervoort's material to *A. rectangularis*. Hirohito's (1985) material also lacked the internal projection and he formally synonymized *A. angulata*, *A. rectangularis,* and *A. bulbosa* Stechow, 1932. Here, both *A. angulata* and *A. rectangularis* are treated as separate species because both morphotypes were found not very far apart. However, I acknowledge the possibility that both could be only forms belonging to the same species.

In the material from the Kei Islands there was one sample which unambiguously matched the descriptions of *A. rectangularis* as given by Jarvis (1922) and Millard (1975) (Fig. 13).

Distribution

Southwest Indian Ocean, South Africa, Japan, Indonesia (new record), below 100 m depth. Type locality: Providence Islands, Indian Ocean, 228 m.

Acryptolaria angulata (Bale, 1914)

Fig. 14.

Cryptolaria angulata Bale, 1914b: 166, pl. 35: fig. 1. – Bale 1915: 251.

Acryptolaria angulata. – Vervoort 1966: fig. 16.

Type material examined:

Syntypes of *Cryptolaria angulata*, Museum of Victoria, Melbourne, F58335, 3 slides.

Other material examined:

Kei Islands Expedition station 7, several shoots, up to 2 cm.

Differential diagnosis

Similar to *A. rectangularis*, but hydrothecae larger, free part up 0.5–0.7 mm long, opening diameter 0.15–0.25 mm, hydrothecae bent nearly at right angle, adcauline side with dent projecting into lumen, abcauline side becoming free with

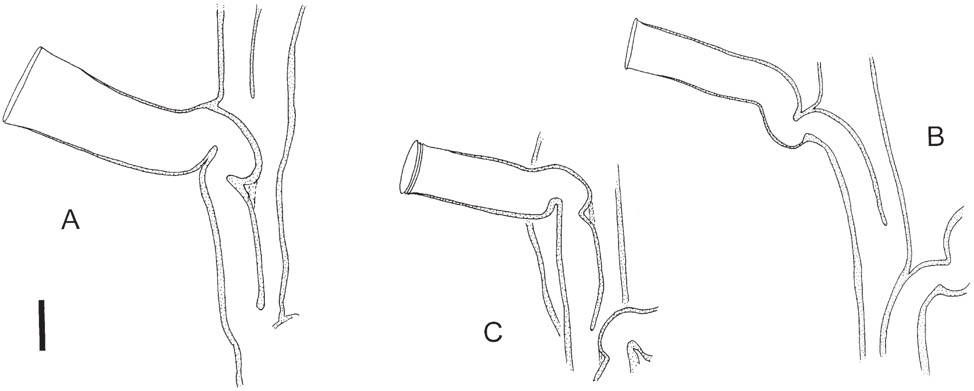

Fig. 14. *Acryptolaria angulata* (Bale, 1914); A–B, station 7; C, type material from Australia. A. Hydrotheca in polysiphonic part, accessory tubules removed. B. Indonesian material, hydrothecae at monosiphonic tip of branch. C. Hydrotheca in polysiphonic part. – Scale: A–C = 0.2 mm.

marked fold projecting into lumen, without refringent nodules at base of hydrotheca. Free adcauline side concave. Hydrothecae at end of branches different, these with an S-shaped curvature (in Indonesian material only, see Fig. 14B).

Remarks

The present sample was allocated to *A. angulata* due to the distinct dent in the adcauline wall of the hydrotheca and the pronounced fold at the bent of the abcauline wall. The Indonesian material matched Bale's type material reasonably well, although its hydrothecae are somewhat larger and longer (up to 1.5 times) and both the adcauline dent and the abcauline fold are more pronounced (cf. Fig. 14A and C). The most distal hydrothecae of the Indonesian colony (Fig. 14B) deviate considerably from the shape of the more proximal ones in that they have an S-shaped curvature at the place where they become free. Such hydrothecae are not present in the type material. More material of this rare species is needed to evaluate the significance of these differences.

The difference from the sample identified here as *A. rectangularis* (Fig. 13) appeared too pronounced to me to place them both into the same species (see above).

Distribution

Southern Australia, Indonesia (new record), depth range 182–328 m. Type locality: Great Australian Bight, 182 m.

***Acryptolaria conferta* (Allman, 1877)**

Fig. 15.

Cryptolaria conferta Allman, 1877: 17, pl. 12: figs 6–10. – von Campenhausen 1896b: 308.

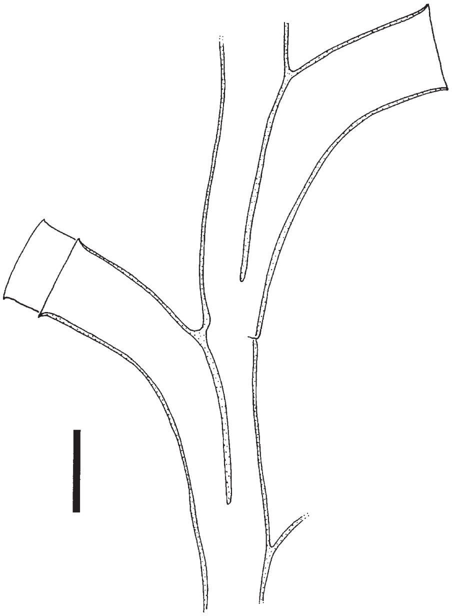

Fig. 15. *Acryptolaria conferta* (Allman, 1877). Monosiphonic part of distal branch. – Scale: 0.2 mm.

Acryptolaria conferta. – Totton 1930: 164, fig. 19a–b. – Ralph 1958: 315, fig. 4a–g. – Millard 1975: 169, fig. 56. – Calder 1991: 33, figs, 19–20, synonymy. – Hirohito 1995: 104, fig. 29c–d, pl. 6: fig. C. – Schuchert 2001: 61, fig. 48A–B.
Acryptolaria conferta var. *australis.* – Totton 1930: 163, figs, 19c–e. – Ralph 1958: 315, fig. 4a–g. – Millard 1964: 9, fig. 1D, F–G.
Acryptolaria conferta conferta. – Ramil & Vervoort 1992: 41, fig. 7a–b.
Acryptolaria conferta minor Ramil & Vervoort, 1992: 43, fig. 8a–c, 9a–c.
Acryptolaria conferta australis. – Vervoort 1966: 115, fig. 15. – Rees & Vervoort 1987: 37, fig. 6e.

Material examined:
Kei Islands Expedition station 7.

Description

Colony erect, up to 5 cm, irregularly branched, stem and main branches polysiphonic through overgrowth of the hydrothecae bearing primary tube with auxiliary tubes, polysiphonic part thinning towards distal, ends of branches monosiphonic. Nodes of primary tube indistinct or absent.

Hydrothecae alternately arranged on opposite sides of primary tube. Hydrothecae tubular, smooth, adnate for about half of their length, curving outward, outer wall not kinked but evenly curved, base of hydrothecae open towards axial tube, no diaphragm, diameter of hydrotheca slightly increasing distally, diameter at opening 0.2 mm, margin slightly everted, often renovated.

Gonothecae absent.

Remarks

Millard (1975) commented on the variability of this species and following her opinion, no subspecies or variants are recognized here. Besides nominal subspecies and variants, there are also similar species like *Acryptolaria pulchella* (Allman, 1888) which are difficult to separate. While it seems plausible that there are actually several species lumped into *A. conferta*, the trophosome of *Acryptolaria* offers too few characters for an objective separation of morphotypes. However, the coppinia of *A. conferta* from the tropical Atlantic and South Africa (see Allman 1877, Millard 1975, Calder 1991) lack modified hydrothecae, but such modified hydrothecae are known to occur in Pacific specimens (Ralph 1958, Hirohito 1995). Hirohito (1995) found both types in Japan. Perhaps this indicates the presence of two species. New investigations must evaluate the significance of these differences.

Acryptolaria conferta has already been recorded in Indonesian waters by von Campenhausen (1896b).

Distribution

Circumglobal, usually below 50 m depth. Type locality: Off Cojima, Cuba, 823 m.

Lafoea dumosa **(Fleming, 1820)**

Fig. 16.
Sertularia dumosa Fleming, 1820: 84.
Lafoea dumosa. – Broch, 1918: 7, fig. 1. – Cornelius 1975b: 385, fig. 4, synonymy. – Millard 1975: 185. – Rees & Vervoort 1987: 40, figs 7–8. – Ramil & Vervoort 1992: 55. – Cornelius 1995a: 261, fig. 60. – Hirohito 1995: 126, fig. 36a–c, pl. 8: fig. A. – Schuchert 2001: 67, figs 54–55.
Lafoea fruticosa. – Millard 1975: 187, fig. 61A–F.

Material examined:
Kei Islands Expedition stations: 7. – 46.

Description

(Based on Indonesian material) Colonies erect, 1–2 cm high, polysiphonic, thinning to monosiphonic, component tubes parallel, each bearing hydrothecae at irregular intervals, arising from all sides of branches.

Hydrothecae tubular, straight, about 0.5 mm

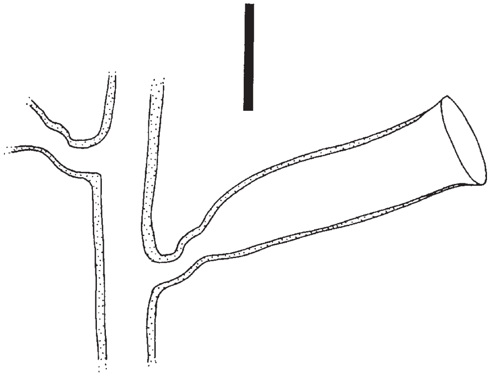

Fig. 16. *Lafoea dumosa* (Fleming, 1820); station 7. Hydrotheca. – Scale: 0.2 mm.

deep, opening diameter 0.18 mm, cylindrical, tapering below into distinct pedicel, pedicel corrugated; rim of opening slightly flared; no diaphragm or operculum.

Gonothecae absent (see Millard 1975 or Cornelius 1995a).

Remarks

Lafoea dumosa is here recorded in Indonesian waters for the first time. This cosmopolitan and extraordinarily variable species has an extensive and complicated synonymy (see Cornelius 1975b, Rees & Vervoort 1987, Schuchert 2001). Contemporary authors mostly do not distinguish anymore between forms having hydrothecae on stalks or sessile ones. However, Schuchert (2001) noted that most colonies with sessile hydrothecae also have significantly smaller isorhiza capsules, suggesting nevertheless the presence of two species. The present material from Indonesia (Fig. 16) had without exception hydrothecae with distinct stalks and the larger nematocyst capsule measured around 25 µm in length, thus conforming with the common Atlantic form.

Distribution

Cosmopolitan, mostly below 100 m. Type locality: Arbroath, Scotland.

***Zygophylax bifurcata* Billard, 1942**

Fig. 17.

Zygophylax bifurcata Billard, 1942a: 34, figs 1–3. – Rees & Vervoort 1987: 79, fig. 13.

Material examined:
Kei Islands Expedition station 52, 3 shoots on small bivalve.

Description

Colonies erect, up to 1 cm, growing on bivalve, stem polysiphonic, hydrocladia monosiphonic. Primary tube of stem bears hydrothecae and hydrocladia.

Hydrocladia unbranched, alternate, in two rows, thin and delicate, nodes indistinct, below distal node apophysis for attachment of hydrotheca. Apophysis occasionally with nematotheca.

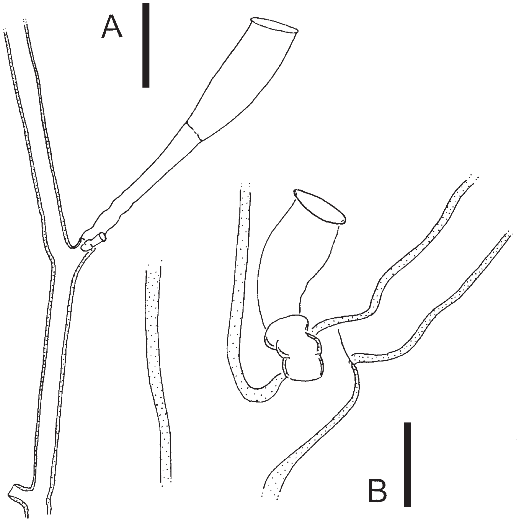

Fig. 17. *Zygophylax bifurcata* Billard, 1942. A. Part of hydrocladium with hydrotheca. B. Apophysis with nematotheca. – Scales: A = 0.2 mm; B = 50 µm.

Hydrothecae alternate, with pedicels longer or as long as hydrotheca, pedicels about 0.4 mm from base to diaphragm, at base some irregular annulation, with distinct node delimiting it from apophysis. Hydrotheca cylindrical, about 0.3 mm from diaphragm to opening, tapering at base continuously into pedicel; opening diameter 0.12 mm, often slightly inclined; diaphragm thin. Nematotheca tubular, often curved, lower end annulated, margin slightly everted. Gonothecae not present.

Remarks

The present material is only tentatively assigned to *Z. bifurcata* because it lacks one of the diagnostic characters: the bifurcated hydrocladia. The colonies appear, however, to be juvenile and as in other hydroids hydrocladia may branch during later development. The identification was based on the long pedicels of the hydrothecae. *Zygophylax bifurcata* seems to be the only species in this genus with non-recurved primary hydrothecae that have pedicels as long or longer than the hydrotheca.

Distribution

Indonesia. Type locality: 8.72°S, 127.28°E, 828 m (Rees & Vervoort 1987).

***Zygophylax rufa* (Bale, 1884)**

Fig. 18.
Campanularia rufa Bale, 1884: 54, pl. 1 fig. 1.
Lictorella rufa. – Vervoort & Vasseur 1977: 15, figs 5–8.
Zygophylax rufa. – Bale, 1914c: 90. – Rees & Vervoort, 1987: 55. – Gibbons & Ryland 1989: 395, fig. 15.

Material examined:
Kei Islands Expedition station 53, 1.5 cm fragment of shoot.

Description

Colonies erect, a few cm high, stem polysiphonic but thin, composed of primary tube and 3 auxiliary tubes.

Hydrocladia strictly pinnate, regularly parallel, thin, monosiphonic, without nodes.

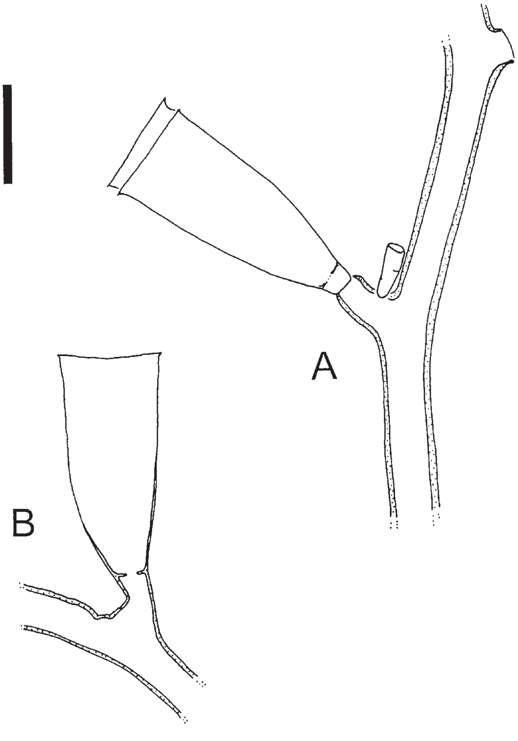

Fig. 18. *Zygophylax rufa* (Bale, 1884). A. Part of hydrocladium with hydrotheca and nematotheca. B. Hydrotheca with short apophysis and no node. – Scale: A–B = 0.2 mm

Hydrothecae alternate, in two rows, the two planes forming an angle of <180°, hydrothecae usually on apophyses of variable length and delimited by node, occasionally not delimited by node and apophysis short. Apophysis occasionally with a single, tubular nematotheca. Hydrotheca campanulate, depth 0.45 mm, sometimes slightly asymmetric, tapering downwards into pedicel, with diaphragm, pedicel below diaphragm short, diameter of calyx opening 0.15–0.2 mm. Gonothecae absent.

Remarks

Despite the review of Rees & Vervoort (1987), many *Zygophylax* species remain difficult to separate, especially in the absence of coppinia. *Zygophylax rufa* (Bale, 1884) and *Z. anthipathes* (Lamarck, 1816) resemble each other closely and Watson (1973: 165) therefore synonymized them. Vervoort & Vasseur (1977) disagreed and kept them distinct based on the following traits. *Zygophylax rufa* differs from *Z. antipathes* by: colonies are smaller (2.5 cm versus 12 cm); hydrocladia are placed in one plane versus around the main stem; hydrothecae are smaller; and the red versus brown colour. In Rees & Vervoort (1987: 56) some of the material formerly identified and depicted by Vervoort & Vasseur (1977) as *Z. rufa* was nevertheless referred to *Z. anthipathes*.

The present material was allocated to *Z. rufa* based on the red colour of the stem and the strictly pinnate colony form. The present material more resembles Bale's (1884) original material in having a node between the apophysis and hydrotheca than the material depicted by Vervoort & Vasseur (1977), which had mostly no apophyses and sessile hydrothecae (compare Fig. 18A and B). The colony also appears more gracile. Vervoort & Vasseur (1977) explained the occurrence of apophyses as due to regeneration. Fertile material must be found to corroborate the presence of *Z. rufa* in Indonesian waters.

Von Campenhausen (1896b, as *Lafoea pinnata*) identified material from Ternate as *Zygophylax pinnata* (G. O. Sars, 1874). *Zygophylax pinnata* is a species occurring only in deeper waters of the north-eastern Atlantic (Cornelius 1995a) and it seems somewhat unlikely that it is present in shallow waters of the tropical Pacific. Although von Campenhausen's material was strictly pinnate, it is also unlikely that it belonged to *Z. rufa* because it was 12 cm high, it had branched stems, and the stems were dark-red to black. The available data are insufficient to identify it unambiguously.

Distribution

Great Barrier Reef, French Polynesia, Fiji Islands, Kei Islands (new record). Type locality: Holborne Island, Great Barrier Reef, Australia.

Zygophylax sibogae **Billard, 1918**

Fig. 19.

Zygophylax sibogae Billard, 1918: 21 fig. 1. – In part Totton 1930: 167, fig. 21. – Ralph 1958: 311, fig. 2e–i. – Millard 1975: 198, fig. 65A–C. – Rees & Vervoort 1987: 72. – Hirohito 1995: 144, fig. 45a–d, pl. 9: fig. D.

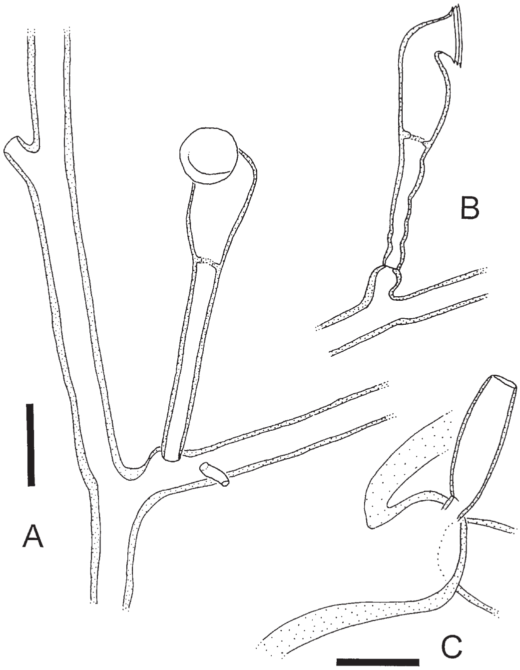

Fig. 19. *Zygophylax sibogae* Billard, 1918; station 33. A. Part of stem and hydrocladium; hydrotheca in frontal view. B. Hydrotheca in side view. C. Nematotheca on apophysis bearing a hydrotheca. – Scales: A–B = 0.2 mm; C = 50 µm.

Material examined:
Kei Islands Expedition stations: 33. – 46. – 48. – 58; all infertile.

Description

Colonies erect, up to several cm high; stem polysiphonic, sometimes branched, composed of a primary tube and auxiliary tubes. Primary tube bears hydrocladia, hydrothecae and nematothecae.

Hydrocladia alternate, monosiphonic, unsegmented, bearing alternate hydrothecae on apophyses. The two rows of hydrothecae not in one plane but borne on anterior surface, with an acute angle between them and with the hydrothecae of one row rotated so that they slightly face away from those of the other row.

Hydrotheca slender and tubular below the diaphragm, then widening and strongly recurved, total height 0.6–0.8 mm, depth from upper margin to diaphragm 0.3–0.35 mm, diameter of opening 0.15 mm. The curved end is trumpet-shaped and held perpendicular to the axis of the lower part of the hydrotheca, resulting in a deep fold on one side. Diaphragm well formed, with central hydropore. Nematothecae tubular, about 80–90 µm long, diameter 20 µm, on axial tube, accessory tubes at base of hydrocladia, and on apophyses of hydrothecae. Not all apophyses bear nematothecae.

Gonothecae not observed (see Billard 1918 for description; figures are given by Hirohito 1995).

Distribution

Indonesia, New Zealand, South Africa, Japan. Type locality: Kei Islands, 5.667°S, 132.433°E, 310 m.

Family Campanulariidae

Clytia linearis **(Thornely, 1900)**

Fig. 20.

Obelia linearis Thornely, 1900: 453, pl. 44: fig. 6.

In part *Obelia bidentata* var. – Pictet 1893: 25, pl. 1: figs 20–21. [Not *Obelia bidentata* Clarke, 1875]

Clytia longicyatha. – Pictet 1893: 28, pl. 2: figs 22–23. [Not *Obelia longicyatha* Allman, 1877]

In part *Clytia serrulata*. – Pictet 1893: 30.

Campanularia gravieri Billard, 1904: 482, fig. 1.

Clytia gravieri. – Billard 1938: 429, figs 1–4. – Millard & Bouillon 1973: 51, fig. 7E–G. – Millard 1975: 215, fig. 71F–H.

Clytia linearis. – Hirohito 1977: 14, fig. 4. – Cornelius 1982: 84, fig. 12, synonymy. – Rees & Vervoort 1987: 94. – Gibbons & Ryland 1989: 404, fig. 22. – Calder 1991: 62, fig. 34, synonymy. – Ramil & Vervoort 1992: 238, fig. 67b. – Hirohito 1995: 65, fig. 18h–i. – Migotto 1996: 85, fig. 16a–b. – Medel & Vervoort 2000: 38, bibliography. – Watson 2000: 73, fig. 57D–E.

Material examined:
Kei Islands Expedition, harbour pier of Ambon, 28 Feb 1922, 1 m, with gonothecae. – Kei Islands Expedition Stations: 40, no gonothecae. – 104, no gonothecae. – MHNG INVE 25045, as *C. longicyatha*, Bay of Ambon, Moluccas, material described by Pictet (1893), fertile, on *Pennaria* and other hydroids, alcohol and slide material. – MHNG INVE 31756, Ambon, coll. Pictet and Bedot 1890, colony with gonothecae. – MHNG INVE 31757, as *Obelia bidentata*, Ambon, on ascidians, several colonies, material described by Pictet (1893), with gonothecae. – MHNG INVE 25040, as *Clytia serrulata*, Ambon, material of Pictet (1893), slide and alcohol material.

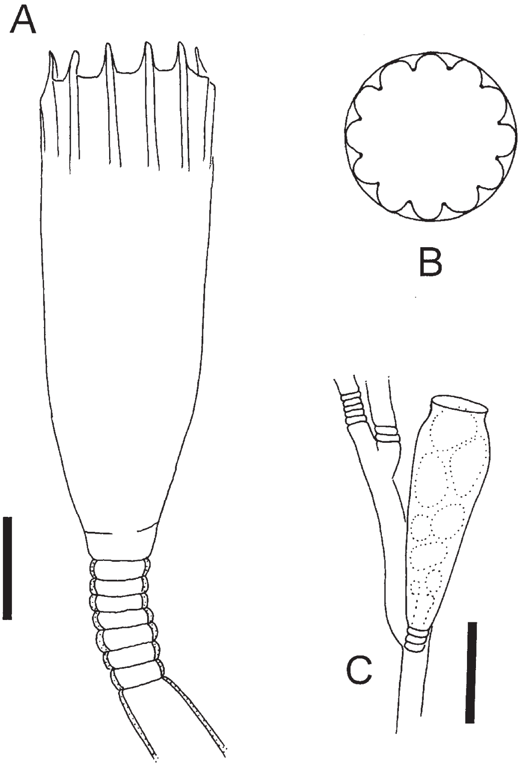

Fig. 20. *Clytia linearis* (Thornely, 1900); A–B, station 104; C, Kei Island Expedition, Ambon harbour. A. Hydrotheca. B. Hydrothecal opening seen from above. C. Gonothecae with medusae buds. – Scales: A–B = 0.2 mm; C = 0.5 mm.

Description

Colonies erect, up to 1 cm high, branched, stem usually monosiphonic or rarely sparingly polysiphonic. Perisarc with short annulated stretches, especially at origin of side-branches or hydrothecal pedicels, otherwise smooth; branches originate at acute angle.

Hydrothecae on pedicels formed by short side-branches, these pedicels usually annulated over larger part. Hydrotheca deep, depth 0.75–1.0 mm, diameter about 0.35 mm, cylindrical, tapering at base, periderm thin and often folded or damaged in preserved material; diaphragm thin. Margin of hydrotheca with 10–12 narrow cusps, between them rounded embayments. Each cusp coincides with a sharp longitudinal inward-fold that is about 4 times as long as the cusp, becoming gradually shallower proximally. The folds are as narrow as the cusps and keel-like, the periderm is slightly thickened. This produces a distinct striation pattern along the hydrotheca (Fig. 20A).

Gonothecae on stem, singly or in pairs, club-shaped, up to 1.2 mm long, maximal diameter 0.4 mm, end truncated, with a more or less distinct neck, pedicel annulated. Blastostyle with one or two rows of medusae buds. Medusae with hemispherical bell and four marginal bulbs.

Remarks

Clytia linearis and its extensive synonymy have been discussed repeatedly, e.g., by Hirohito (1977), Cornelius (1982), and Calder (1991).

Re-examination of material described by Pictet (1893) as *C. longicyatha* clearly showed that it is indistinguishable from *C. linearis* (Thornely, 1900) as it is conceived today (e.g., Cornelius 1982, Calder 1991). *Obelia longicyatha* Allman, 1877 is insufficiently known and Cornelius (1975a) considered it to be conspecific with *O. bidentata*.

Also at least some of the material identified by Pictet as *O. bidentata* clearly belongs to *C. linearis*. Pictet's sample was re-examined for this study and it does not match the figure given by

Pictet (1893: pl. 1 fig. 21), which evidently is *O. bidentata*. Because Pictet reports his colony as growing on ascidians ("sur une *Clavellina*") and these animals are still present in the sample, a later confusion of samples can be excluded with relative certainty. There remains the possibility that Pictet examined a single colony no longer present in the sample. This seems plausible because all remaining colonies on the ascidians are without gonothecae, while Pictet (1893) figured a colony having a gonotheca containing medusae with numerous tentacles. But Pictet mentions longitudinal striae on his hydrothecae, which is rather typical for *C. linearis,* but not *O. bidentata*. All colonies growing on the ascidians are clearly *C. linearis*. The jar also contains one separate colony, which was originally probably not growing on the ascidians. This colony has gonothecae with typical *Clytia* medusae and it is also indistinguishable from *C. linearis*.

The material identified by Pictet (1893) as *Clytia serrulata* (Bale, 1888) evidently contains at least three species. One of them is clearly attributable to *C. linearis*. It has mostly stolonal gonothecae that produce four-tentacled medusae. Some of the shoots growing on the same blade of sea grass belong to a different species; their hydrothecae are only half the size of *C. linearis* and the margin is like in *Obelia bidentata* (see below). A third, separate colony on a brown alga corresponds to Pictet's figure 24. The cusps of the hydrotheca are often – but not always – asymmetric triangles and the colony appears indistinguishable from *Clytia gracilis* (Sars, 1850). *Campanularia serrulata* Bale, 1888 must be regarded as unrecognizable because it was based on infertile material. Cornelius (1982) synonymized it with *C. hemisphaerica*.

Clytia linearis has previously been recorded in Indonesian waters by Billard (1938, as *Clytia gravieri*).

Distribution

Tropical and subtropical waters around the world (Medel & Vervoort 2000). Type locality: Blanche Bay, New Britain, Papua New Guinea.

Clytia trigona **Pictet, 1893**

Fig. 21.

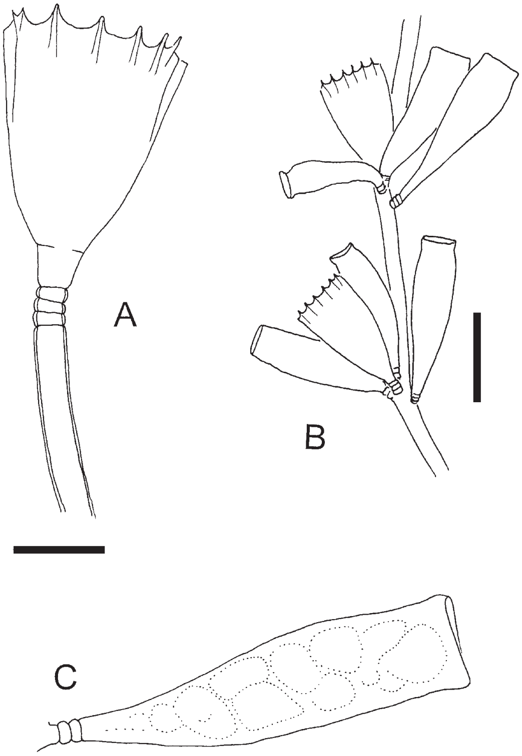

Fig. 21. *Clytia trigona* Pictet, 1893; after slide preparation of type material. A. Hydrotheca; note that the calyx is somewhat compressed. B. Part of stem showing typical arrangement of gonothecae in sets of three. C. Gonothecae with medusae buds. – Scales: A, C = 0.2 mm; B = 0.5 mm.

Clytia trigona Pictet, 1893: 33, pl. 2 figs 28–29.

Type material examined:
MHNG INVE 25043, slide and alcohol material, alcohol material badly preserved.

Diagnosis

Like *Clytia linearis* (Thornely, 1900), but 2–3 gonothecae grouped together, gonothecae 0.8–0.9 mm long, hydrotheca depth 0.5–0.7 mm.

Remarks

Clytia trigona closely resembles *C. linearis* and it is quite possible that they are conspecific. *Clytia trigona* is here kept separate on account of the gonothecae, which develop along the stem in groups of two or three; a few are also solitary. I have never seen *C. linearis* with groups of more than 2 gonothecae. Additionally, the hydrothecae were significantly shorter than in specimens of *C. linearis* of the Bay of Ambon. If new material reveals intermediate forms, so that in *C. linearis* groups of up to three gonothecae can occur besides solitary ones, the younger *C. linearis* (Thornely, 1900) should be synonymized with *Clytia trigona* Pictet, 1893. This would be somewhat awkward, as a widely known and used name would be replaced by a virtually unknown one.

Distribution

Known from its type locality only: Bay of Ambon, Moluccas, Indonesia.

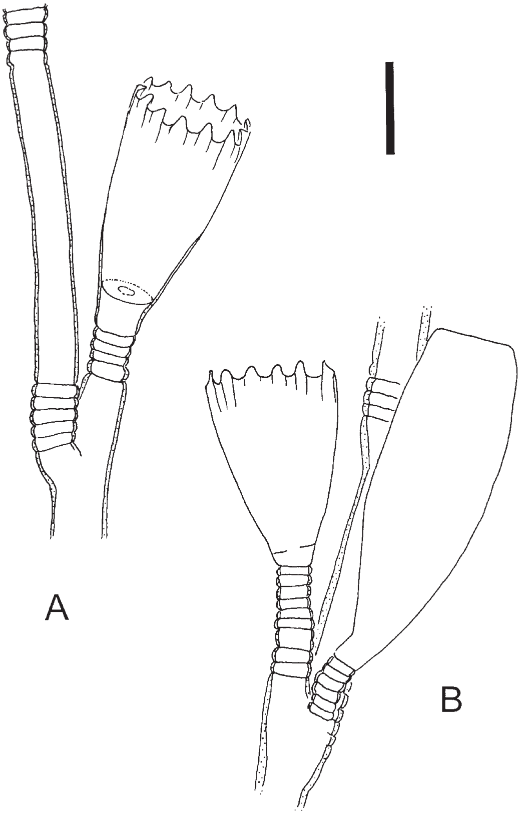

Fig. 22. *Clytia arborescens* Pictet, 1893; after type material. A. Hydrotheca in oblique view. B. Monosiphonic part with gonotheca and hydrotheca. – Scale: 0.2 mm.

***Clytia arborescens* Pictet, 1893**

Fig. 22.

Clytia arborescens Pictet, 1893: 34, pl. 2: figs 30–31. – Billard 1933: 8, fig. 2. – Millard & Bouillon 1973: 50, fig. 7A-D. – Medel & Vervoort 2000: 30, figs 7–8, bibliography.

Laomedea arborescens. – Leloup 1937: 20, fig. 10.

Type material examined:
MHNG INVE 25044, alcohol and slide preparation, growing on stem of tubularid hydroid.

Other material examined:
Kei Islands Expedition station 95, Sunda Strait, one 3 cm colony highly polysiphonic, without gonothecae, identification uncertain.

Description

Colony erect, up to 2 cm high, in same colony monosiphonic or highly polysiphonic stems, up to 20 tubes per polysiphonic stem, stem branching, branches also polysiphonic, thinning to monosiphonic. Perisarc with short annulated stretches, especially at origin of side-branches or hydrothecal pedicels, otherwise smooth, monosiphonic branches originate at acute angles.

Hydrothecae on pedicels formed by short side-branches, these usually almost entirely annulated. Hydrotheca conical, about 0.45–0.55 mm deep, diameter 0.25–0.3 mm, with about 12–14 sinusoid cusps, these about 20 µm high, symmetric, embayments between them rounded. Each cusp coincides with a longitudinal inward-fold that is about 3 times as long as the cusp, becoming gradually shallower downwards. The folds produce a striation pattern originating lateral to the cusps (Fig. 22A–B). A thin diaphragm near base of hydrotheca, slightly oblique or horizontal.

Gonothecae borne singly on stem, usually next to a hydrothecal pedicel. Gonotheca about 0.8–1.2 mm, club-shaped, with flat distal end, without neck, diameter in middle of gonotheca about 0.25 mm, at end 0.18 mm. Blastostyle in gonotheca forming a single row of up to 6 medusae buds. Medusae with hemispherical bell and four bulbs.

Remarks

With its inward folds along the hydrotheca, *Clytia arborescens* somewhat resembles *C. linearis*, but it can be distinguished from the latter by its highly polysiphonic stem (although also monosiphonic ones occur in the same colony), the shorter hydrothecae, and the broad, rounded cusps. *Clytia linearis* typically has pointed cusps and the longitudinal inward-fold are very narrow, giving a much more distinct longitudinal striation (see Fig. 20). Recently, Medel & Vervoort (2000) assigned material from Madeira to this species. Their material closely resembles the Pacific material, but has more pointed cusps which are apparently inclined to one side, and the gonotheca has a slight neck formation and lacks an annulated pedicel. Moreover, Medel & Vervoort do not mention longitudinal folds of the hydrothecae in their material.

Distribution

Indonesia, Vietnam, Seychelles, Gulf of Suez, Gulf of Akaba, Madeira (after Medel & Vervoort 2000). Type locality: Port of Ambon, Moluccas, Indonesia.

***Clytia gracilis* (M. Sars, 1850)**

Fig. 23.

Laomedea gracilis M. Sars, 1850: 138.

Clytia gracilis. – Stechow & Müller 1923: 461. – Cornelius & Östman 1986: 163. – Calder 1991: 54, fig. 31, synonymy. – Ramil & Vervoort 1992: 235, fig. 67a. – Cornelius 1995b: 246, fig. 56. – Hirohito 1995: 63, fig. 18c–g. – Migotto 1996: 81, fig. 15c. – Medel & Vervoort 2000: 32, bibliography.

In part *Clytia serrulata.* – Pictet 1893: 30, pl. 2: figs 24–25.

Material examined :
MHNG INVE 25040, as *Clytia serrulata*, Ambon, material of Pictet (1893), slides and alcohol material.

Description

Colony stolonal or sparingly branched (1–3 times), height up to 5 mm. Perisarc smooth with annulated stretches.

Hydrotheca campanulate, depth 0.6 mm, diameter 0.33 mm, perisarc thin, diaphragm at base thin but distinct, margin with 12 large, pointed teeth, separated by rounded embayments. The teeth are often asymmetric (tilted) with one side almost vertical and the other oblique. The margin in the embayments is slightly everted.

Gonothecae arise on stolons and stems, oblong barrel-shaped, at distal end an indistinct neck formation for the aperture. Blastostyle produces medusae with a hemispherical bell and four bulbs.

Remarks

As discussed under *C. linearis*, part of the material described by Pictet (1893) as *C. serrulata* (Bale, 1888) can be assigned to *C. gracilis*, a fact already suspected by Calder (1991). The material matched rather well material from the North Atlantic (Schuchert 2001), only the hydrothecae are somewhat smaller and apparently not all cusps are asymmetric (tilted).

Clytia gracilis has previously been reported for Indonesian waters by Stechow & Müller (1923).

Distribution

Circumglobal in temperate and tropical waters. Type locality: Lofoten Islands, Norway.

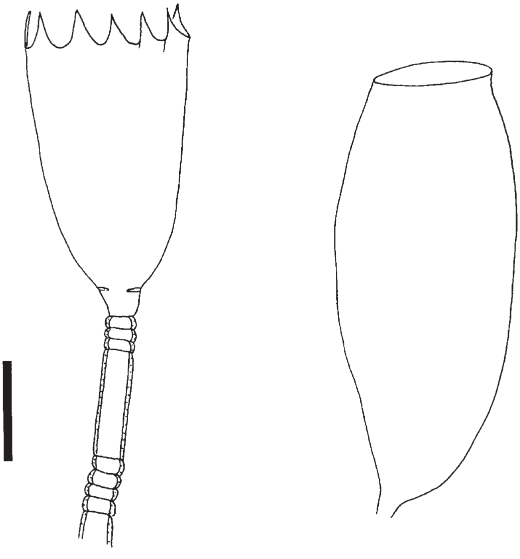

Fig. 23. *Clytia gracilis* (M. Sars, 1850); MHNG INVE 25040. Hydrotheca and gonothecae. – Scale: 0.2 mm.

***Obelia bidentata* Clarke, 1875**

Fig. 24

Obelia bidentata Clarke, 1875: 58, pl. 9: fig. 2. – Cornelius 1975a: 260, fig. 2. – Cornelius 1982: 113, table 4, synonymy. – Gibbons & Ryland 1989: 405, fig. 23. –

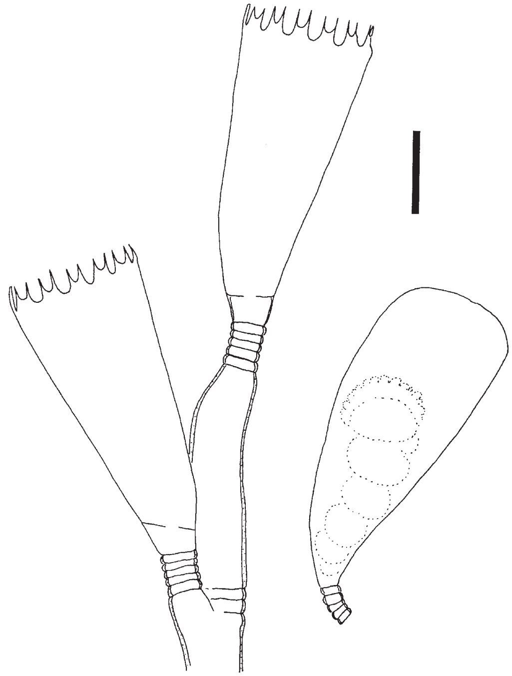

Fig. 24. *Obelia bidentata* Clarke, 1875; hydrothecae and gonotheca. – Scale: 0.2 mm.

Calder 1991: 70, fig. 37, synonymy. – Ramil & Vervoort 1992: 241, fig. 68a–b. – Cornelius 1995b: 292, fig. 68. – Migotto 1996: 87, fig. 16c. – Medel & Vervoort 2000: 46, fig. 12, bibliography.

Obelia bicuspidata Clarke, 1875: 58, pl. 9: fig. 1. – Fraser 1944: 153, fig. 125. – Millard & Bouillon 1973: 56. – Millard 1975: 226, fig. 75C–D. – Hirohito 1995: 71, fig. 21a–b, pl. 5: fig. A.

In part *Obelia bidentata* var. – Pictet 1893: 25, pl. 1: figs 20–21.

Gonothyraea longicyatha Thornely, 1900: 454, pl. 44: fig. 4–4a.

Material examined :
Kei Islands Expedition station 81, with gonothecae.

Description

Colonies erect, up to 4 cm high, arising from a tangled mass of stolons anchoring the colony in the sediment. Main trunk forked several times, polysiphonic, thinning to monosiphonic, branching irregular, primarily in one plane. Short stretches of annulations alternating with long smooth regions of perisarc.

Hydrothecae on short, annulated pedicels; hydrothecae set relatively dense. Hydrotheca deep, conical, often slightly asymmetric in lower region through slightly bulging wall, depth 0.7–0.75 mm, diameter at opening 0.30–0.33 mm, diaphragm thin, may be oblique, calyx margin with about 12 bimucoronate cusps, embayments all U-shaped, embayments not or only slightly everted. Each cusp with two very pointed teeth, separated by a deep embayment, depth of this embayment about 2/3 of the intercusp embayments. There are no longitudinal lines along the hydrotheca.

Gonothecae borne singly along stem, comparatively small, length around 0.8 mm, with annulated pedicel, main body flattened, club-shaped in broad view, end truncated, without neck formation. Blastostyle with medusa buds, most advanced with numerous short tentacles.

Remarks

The gonothecae seen in the present specimen of *O. bidentata* were all flattened. Similarly compressed gonothecae were noted for this species by Hirohito (1995) and Thornely (1900, as *Gonothyraea longicyatha*), although the latter attributed this to the fixation. Although this is a reasonable explanation, living Pacific material should be examined to confirm this. In the present specimen, the regularity of the compression, even in immature gonothecae, led me to suspect that this compression is a natural feature. Perhaps it is confined to some Pacific populations.

The gonothecae of *O. bidentata* are mostly described as having no neck at their end, but Gibbons & Ryland (1989) and Cornelius (1995b) depict and describe specimens having a distinct neck with a much smaller diameter than the main body of the gonothecae, resembling gonothecae found in many other *Obelia* species.

As discussed under *C. linearis*, material described by Pictet (1893) as *O. bidentata* is mostly referable to *C. linearis*, although the figures given by Pictet (1893) are clearly of *O. bidentata*.

Distribution

Circumglobal in temperate to tropical waters (Medel & Vervoort 2000). Type locality: Wharf piles of Greenport, Long Island, New York, USA.

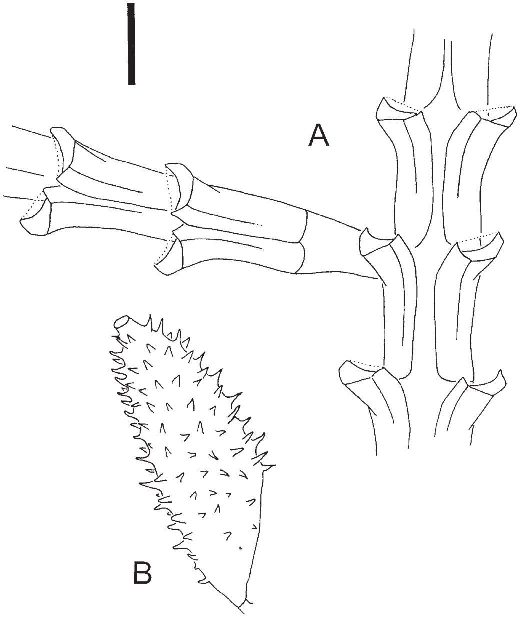

Fig. 25. *Diphasia digitalis* (Busk, 1852); station 72. A. Part of stem and hydrocladium. B. Gonotheca. – Scale: A–B = 0.5 mm.

Family Sertulariidae

Diphasia digitalis (Busk, 1852)

Fig. 25.
Sertularia digitalis Busk, 1852: 393.
Desmoscyphus longitheca Allman, 1877: 26, pl. 14: figs 3–6. – Nutting 1904: 111.
Desmoscyphus acanthocarpus Allman, 1888: 73, pl. 35: fig. 2a–c. – Nutting 1904: 111.
Nigellastrum digitale. – Mammen 1965: 57, fig. 89.
Diphasia digitalis. – Nutting 1904: 110, pl. 30: figs 2–7. – Bale 1884: 101, pl. 9: figs 3–5. – Billard 1925b: 209. – Vervoort 1959: 254, fig. 22. – Vervoort 1968: 37, fig. 17. – Millard & Bouillon 1973: 67, fig. 9A. – Millard 1975: 257, fig. 85E. – Watson 2000: 14, fig. 10A–B.

Material examined:
Kei Islands Expedition stations: 18, fertile. – 67. – 68. – 71, fertile. – 72, fertile. – 90, fertile. – 104. – 107, fertile. – 110.

Description

Colonies erect, pinnate, 3–6 cm high. Main stem mostly unbranched, occasionally branched, with two rows of hydrothecae. Hydrocladia alternate, somewhat irregular in distribution and length.

Hydrothecae in opposite pairs, consecutive pairs mostly overlapping or very close. In lower region of the stem members of a pair of hydrothecae placed on lateral sides and not contiguous with one another; in distal region and on hydrocladia members of a pair placed on anterior surface and contiguous with one another, the two rows forming an angle that is much less than 180°. Hydrotheca about 0.8 mm deep, 0.3 mm broad, adnate for ¾ to entire length, distal part curved slightly away, cross section rounded in basal part, distinctly pentagonal at distal end, with lateral longitudinal crease lines, sometimes also a short median crease line on abcauline wall beginning at margin of hydrotheca, margin untoothed, on adcauline side a broad and deep emargination. No internal cusps or ridges. Operculum single, large, attached to adcauline rim of hydrotheca.

Gonothecae on stem, spindle shaped, 2 mm long, diameter 0.6 mm, with numerous short, stout spines in 10–12 rows, 10–12 spines per row. Hydranths without abcauline blind-sac.

Remarks

Almost all examined colonies had characteristic blackish pigment granules in the epidermis of the coenosarc and the tissue covering the inside of the hydrotheca. Bale (1884) described the colour of the colony as grey to almost black.

Distribution

Circumglobal in tropical and subtropical waters. Type locality: Prince of Wales Channel, Torres Strait, Australia, 16 m.

Diphasia mutulata (Busk, 1852)

Fig. 26.
Sertularia mutulata Busk, 1852: 391.
Diphasia mutulata. – Bale 1884: 101, pl. 9: figs 6–9. – Ritchie 1910a: 12, pl. 4: fig. 3. – Billard 1933: 16, fig. 6, pl. fig. 4. – Watson 2000: 12, fig. 9A–G.
?*Diphasia mutulata*. – Thornely 1904: 118, pl. 2: fig. 6 [? = *Diphasia thornelyi* Ritchie, 1909].
?*Diphasia thornelyi* Ritchie, 1909: 525. – Ritchie 1910a: 13, pl. 4: figs 4–5. – Jäderholm 1919: 16, pl. 4: figs 2–3. – Billard 1925b: 215, fig. 54.
Diphasia thornelyi. – Jäderholm 1919: 16, pl. 4 figs 2–3.
Nigelastrum mutulatum. – Stechow & Müller 1923: 468. – Mammen 1965: 56, fig. 88.

Material examined:
Kei Islands Expedition, Tual, Kei Islands, 1–2 m, 23 Mar

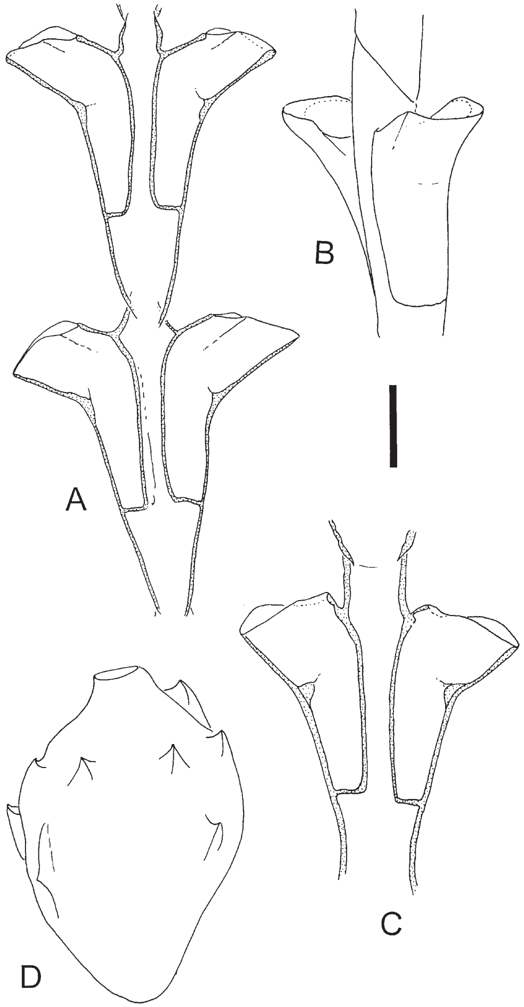

Fig. 26. *Diphasia mutulata* (Busk, 1852); Tual, Kei Islands. A. Part of stem with long hydrothecae, transparent side view. B. Oblique view of part of stem, shown opaque. C. Short form of hydrothecae. D. Female gonotheca. – Scale: A–D = 0.2 mm.

1922, fertile female, on *Aglaophenia cupressina* Lamouroux, 1816. – Kei Islands Expedition, Tual, Kei Islands, 2 m, 21 Mar 1922, infertile, on *Aglaophenia cupressina* Lamouroux, 1816, some stems with opposite and alternate hydrothecae. – Kei Islands Expedition station 67, infertile, on *Monoserius pennarius* (Linnaeus, 1758).

Description

Colonies forming simple stems without hydrocladia, rarely branched once, up to 1 cm high, occasionally with terminal stolonization, nodes occasionally present. Hydrorhiza tubular, creeping on host hydroid.

Hydrothecae normally opposite, occasionally in more distal part alternate, successive hydrothecae not overlapping in present material, the opposite pairs placed on lateral sides of stem and not contiguous, the pair not or only slightly displaced towards one side of stem. Hydrotheca at base somewhat rectangular in cross-section, distal half tubular, outer side rounded, without sharp edges, curved outward, abcauline length 0.45–0.5 mm, diameter at opening 0.16–0.2 mm, adcauline side adnate for ¾ of length, some hydrothecae almost completely adnate. Abcauline wall of hydrotheca in about middle with a transverse intrathecal semicircular ridge, this ridge very variable between hydrothecae, may be absent. Adcauline margin of hydrotheca with a broad emargination; sometimes on each side of hydrotheca near distal end a short, weak crease line. One large adcauline operculum.

Gonothecae near base of stem, two per shoot in present material, egg-shaped, 0.8 mm long, 0.55 mm diameter, aperture on distinct neck, distal half with up to 12 short, broad, spines directed towards distal end of gonotheca.

Remarks

Watson (2000) examined material from northern Australia and found that this population of *Diphasia mutulata* had colonies producing two distinguishable stem forms. Watson named these two forms *mutulata* and *heurteli* morph. The *heurteli* morph had shorter, contiguous hydrothecae. Although there were no intermediate forms, both stem types grew from the same stolons. Watson therefore synonymized *Diphasia mutulata* and *D. heurteli* Billard, 1924. Although I think she might be correct, Billard's (1924) first description of *D. heurteli* shows hydrothecae somewhat different from Watson's *heurteli* morph. Billard's figure (1924, fig. 2A) appears indistinguishable from the hydrothecae observed here (Fig. 26A). Billard (1924) based his description of *D. heurteli* on infertile material and only Millard (1975) found gonothecae in a population from the type locality. Millard's gonothecae were triangular with a wide distal aperture, thus differing from the ones repeatedly observed in *D. mutulata* (Fig. 26D), which are egg-shaped and have their opening on a distinct neck. Watson (2000), assumed that Millard's gonothecae were immature. Although possible, I somewhat doubt this, because Millard could identify the sex of her specimen and she had several gonothecae at hand. New fertile material from the type locality of *D. heurteli* must be examined before further conclusions can be drawn. Therefore, following Millard (1975), *Diphasia heurteli* is here kept separate from *D. mutulata*, although they could prove to be conspecific.

The hydrothecae in the present material also showed some variation within the same stem (Fig. 26A, C), but two distinguishable morphs were not discernible.

Thornely's (1904) material identified as *D. mutulata* had alternate hydrothecae and Ritchie (1909) referred it to *Diphasia thornelyi* Ritchie, 1909. The alternate hydrothecae seem to be the only reliable diagnostic character to distinguish *D. thornelyi* from *D. mutulata*. However, Ritchie (1909) and Billard (1925b) mention that occasionally some hydrothecae can be paired in *D. thornelyi*. Jäderholm (1919) identified material from Japan as *D. thornelyi* despite that it had opposite hydrothecae throughout. In one of the colonies examined for the present study, opposite and alternate arrangements occurred within the same stem. I therefore suspect that *D. thornelyi* is only a form of *D. mutulata*. I refrained from synonymizing them definitively because I have not seen the type material of *D. thornelyi*.

Besides the two mentioned species, there are at least seven more *Diphasia* species known from Indonesia: *D. cauloatheca* Billard, 1920b; *D. cristata* Billard, 1920b; *D. densa* (Stechow, 1923); *D. minuta* Billard, 1920b; *D. orientalis* Billard, 1920b; *Diphasia mutulata*; and *D. scalariformis*. The latter two species were also found in the present material.

Diphasia mutulata is easily distinguishable from *D. scalariformis*. *Diphasia scalariformis* has overlapping, quite straight, rectangular hydrothecae with sharp edges that are distinctly displaced towards one side of the branch surface. *D. mutulata* has its hydrothecae on the lateral sides of the branch, they are mostly not contiguous, they are more curved and their distal end is tubular without sharp edges.

Diphasia digitalis is distinguishable from *D. mutulata* through its pentagonal cross-section of the distal part of the hydrothecae, the much larger hydrothecae, the absence of intrathecal processes, the branched colonies, and the larger gonothecae with numerous spines.

Diphasia cauloatheca forms large, pinnate colonies and has stems without hydrothecae. *Diphasia cristata* is unbranched and has a characteristic pattern of sharp ridges on its hydrothecae and also on the rear side of the stem. *Diphasia orientalis* resembles *D. mutulata*, but its female gonothecae have complicated processes and the hydrotheca has a median ridge flanked by two channel-like concavities of the hydrothecal wall. *Diphasia densa* is not sufficiently well known. *Diphasia minuta* forms small (5 mm) shoots and has smooth gonothecae. Otherwise it closely resembles *D. mutulata* and it may in fact be only a form of this species

Distribution

Northern Australia, Indonesia, Andaman Sea, Red Sea. Type locality: Prince of Wales Channel, Torres Strait, Australia, 16 m.

***Diphasia scalariformis* Kirkpatrick, 1890**

Fig. 27.

Diphasia scalariformis Kirkpatrick, 1890: 609, pl. 15: fig. 3. – Jäderholm 1903: 287. – Billard 1925b: 216, figs 55–56.

Nigellastrum mutulatum. – Stechow & Müller 1823: 468. – Billard 1925b: 216, footnote.

Material examined:
Kei Islands Expedetion stations: 15. – 16. – 18. – 26. – 30. – Kei Island Expedition, Sulawesi, Ujungpandang, Samalon Island, 5 m, 28 Jun 1922; colonies of all stations with gonothecae and growing on *Lytocarpia angulosa* (Lamarck, 1816).

Description

Colonies growing on *Lytocarpia angulosa*, shoots straight, without hydrocladia or with some irregular side-branches, 2–5 cm high.

Hydrothecae in opposite pairs, each pair contiguous on one side of shoot, separate on rear, thus hydrothecae shifted to anterior side of

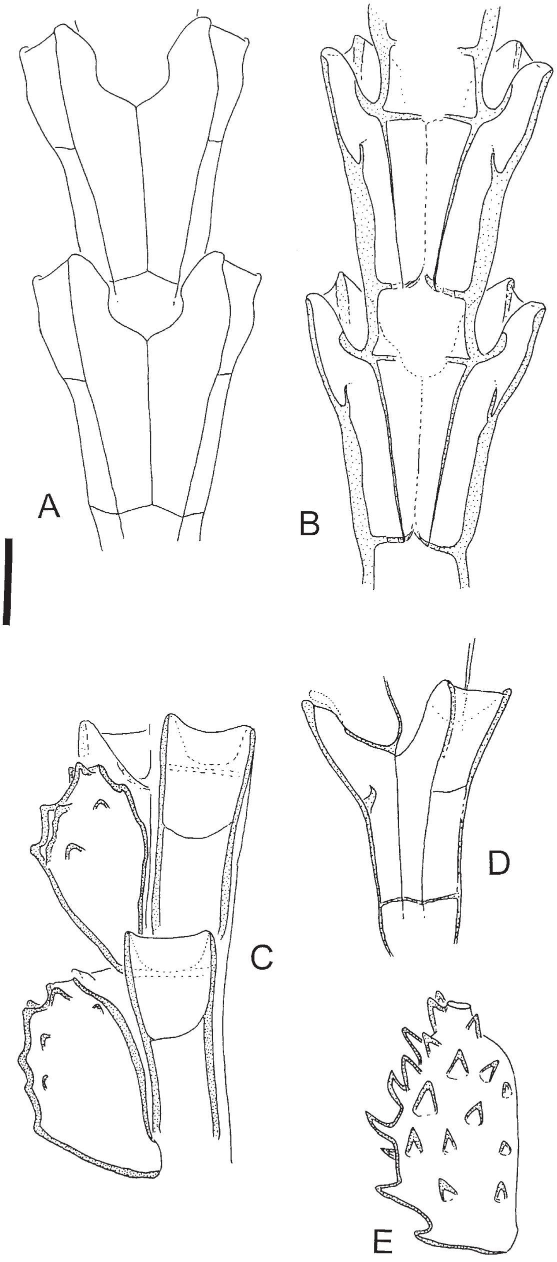

Fig. 27. *Diphasia scalariformis* Kirkpatrick, 1890; A–C, E, station 30; D, station 18. A. Two pairs of hydrothecae in anterior view, shown opaque. B. Hydrothecae in posterior view, shown transparent. C. Hydrocladium with female gonothecae having short spines, side view. D. Variant with longer and more recurved hydrothecae, left hydrotheca in side view. E. Female gonotheca with long spines. – Scale: A–E = 0.2 mm.

hydrocladium, the two rows of hydrothecae forming an angle smaller then 180°. Successive hydrothecae overlapping slightly. Hydrotheca quadrangular with sharp edges, distal half slightly curved outward, basal part straight, anterior and lateral sides of hydrotheca nearly plane, abcauline side 0.5–0.6 mm, adcauline side 0.35–0.45 mm, adcauline side adnate for most of its length, opening of hydrotheca oblique, lateral margin S-shaped, anterior margin slightly depressed and thus forming two lateral marginal cusps, edges of hydrotheca reinforced by perisarc thickenings, on abcauline side slightly above middle an intrathecal shelf or flap projecting upwards into hydrotheca. Stem and branches without nodes.

Gonothecae in a single row along anterior side of stem, very numerous, arising below hydrothecal pairs. Gonotheca egg-shaped, 0.45 mm long, diameter 0.3 mm, lateral and abcauline side with up to 12 spines, some colonies have blunt and shallow spines, some pointed and long ones, aperture of gonotheca at distal end on short neck. Female gonothecae with more than 50 small eggs, diameter of egg about 25 µm. Hydranths small, about 12 tentacles, without abcauline blind-sac.

Remarks

The tightly set quadrangular hydrothecae and the small gonothecae make this species immediately recognizable. Furthermore, in Indonesia this species only grows on the hydroid *Lytocarpia angulosa* (Lamarck, 1816). Jäderholm reported this species from southern Japan, growing on *L. secundus* (Kirchenpauer, 1872), a subjective synonym of *Monoserius pennarius* (Linnaeus, 1758) (see Ritchie 1910a).

Diphasia digitalis is readily distinguishable from *D. scalariformis* through its pentagonal cross-section of the distal part of the hydrothecae, the much larger hydrothecae, the absence of intrathecal processes, the pinnately branched colonies, and the larger gonothecae with numerous spines. The differences from *D. mutulata* are given under the latter species.

Billard (1925b) found that the male gonothecae of *D. scalariformis* has more pointed spines. Perhaps this correlation was due to contingency because of the small number of specimens. In the present material also female gonothecae with very pointed spines could be found (Fig. 27E).

Distribution

Torres Strait, Indonesia, southern Japan. Type locality: Torres Strait, Australia.

***Dynamena crisioides* Lamouroux, 1824**

Fig. 28.

Dynamena crisioides Lamouroux, 1824: 613, pl. 90: figs 11–12. – Billard 1925b: 181, figs 36–37, pl. 7: fig. 21. – Vervoort, 1941: 209. – Vervoort 1959: 260, fig. 27a–b. – Vervoort 1968: 38, fig. 18. – Millard & Bouillon 1974: 32, fig. 6D. – Millard 1975: 263, fig. 87A–F. – Rees & Vervoort 1987: 103. – Gibbons & Ryland 1989: 410, fig. 28. – Calder 1991: 89, figs 47–48, synonymy. – Hirohito 1995: 170, fig. 55a–b. – Migotto 1996: 60, fig. 11e–g. – Medel & Vervoort 1998: 21, synonymy and bibliography.

Dynamena tubuliformis Marktanner-Turneretscher, 1890: 238, pl. 4: fig. 10.

Sertularia Vegae. – Pictet 1893: 44, pl. 2: figs 37–38 [not *Thuiaria vegae* Thompson, 1887].

Not *Sertularia tubuliformis*. – Broch 1918: 132, fig. 71 [= *S. similis* (Clarke, 1876)].

?*Pasythea griffini* Hargitt, 1924: 498, pl. 6 fig. 25.

Sertularia crisioides var. *gigantea* Billard, 1925a: 651. – Billard 1925b: 186, pl. 8: fig. 24. – Leloup 1930b: 7, figs 4–5, pl. 1: fig. 2. – Vervoort 1941: 210, fig. 4.

Sertularia crisioides var. *alternata* Billard, 1925a: 652. – Billard 1925b: 187, fig. 39, pl. 7: fig. 22. – Vervoort, 1941: 213.

Sertularia crisioides var. *peculiaris* Billard, 1925b: 185, fig. 38.

Material examined:

Kei Island Expedition, Banda Islands, Waling, 20 m, 11 Jun 1922 – Kei Islands Expedition, Ujungpandang, Samalon Island 35 m, 28 Jun 1922 – Kei Islands Expedition, Kei Islands, Tual, 1–2 m, 23 Jun 1922, with gonothecae. – MHNG INVE 31974, *Sertularia vegae*, Ambon, material of Pictet (1893).

Description

Colonies erect, monosiphonic, 2–5 cm in present material, pinnate with alternate hydrocladia. Stem unbranched, zigzag, with short basal athecate part terminated by a transverse node. Nodes on stem irregular, mostly indistinct. Stem with two lateral rows of alternate apophyses for the hydrocladia, apophyses long, delimited by node from hydrocladium. Hydrothecae of stem in two lateral rows; one hydrotheca in axil of apophysis and a variable number (2–3) of subopposite hydrothecae between two apophyses.

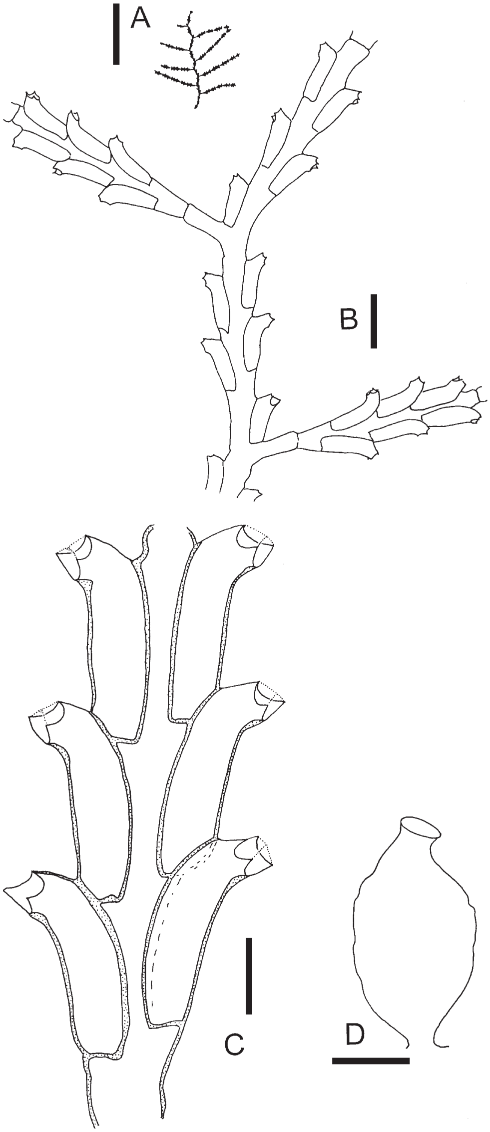

Fig. 28. *Dynamena crisioides* Lamouroux, 1824; Banda Islands. A. Silhouette of a shoot. B. Part of stem and hydrocladia. C. Group of hydrothecae from hydrocladium. D. Gonotheca in side view. – Scales: A = 1 cm; B, D = 0.5 mm; C = 0.2 mm.

Hydrocladia unbranched, divided by straight nodes into internodes which bear a variable number (normally 2–3) of subopposite pairs of hydrothecae. The two rows of hydrothecae in plane of ramification of shoot. Members of hydrothecal pairs not contiguous, consecutive hydrothecae of an internode mostly overlapping and forming groups.

Hydrotheca tubular, adnate for ¾ to 9/10 of adcauline length, then bent outwards, 0.40–0.45 mm in abcauline height and 0.10–0.12 mm in marginal diameter; opening-plane parallel to axis or nearly so, margin with two broad and triangular lateral teeth slightly below middle and one smaller adcauline tooth. Below abcauline margin a perisarc thickening. Operculum composed of two valves, upper valve like a gabled roof. Hydranth with 10–12 tentacles, without abcauline blind-sac.

Gonothecae arise on stem below hydrothecae, ovate, 1.4 mm long, thickest part 0.8 mm diameter, wall irregularly undulated, opening on a slightly curved and flaring neck, neck not in middle and thus rendering gonothecae bilateral-symmetric.

Remarks

This species can show considerable variation. The extent of variation is well described in Millard (1975). Billard (1925a, 1925b) named some of these variants, but later authors, especially Millard (1975), found them to be connected by all possible intermediate forms. The present samples conformed with Billard's normal form. Pictet's (1893) material of *Sertularia vegae* belongs to *S. crisioides*. It is a form with more distant hydrothecae.

Re-examination of the type material of *Pasythea griffini* Hargitt, 1924 (USNM 42656) showed it to closely resemble *D. crisioides*, but the few hydrothecae are apparently arranged in opposite pairs. The gonothecae are identical to the ones described here for *D. crisioides*. Although Hargitt's species likely belongs to *D. crisioides*, the available type material could not provide conclusive evidence.

There exist at least five more *Dynamena* species in Indonesian waters: *Dynamena moluccana* (Pictet, 1893), 1858; *D. fissa* Thornely, 1904; *D. heterodonta* (Jarvis, 1922); *Dynamena mertoni* (Stechow, 1923); and *D. quadridenta* (Ellis & Solander, 1786). *Dynamena crisioides* is readily distinguished from all of them through its subopposite hydrothecae. In the other species they are always strictly opposite. Additional descriptions of the other Indonesian species of *Dynamena* can be found in Billard (1925b), Millard (1975), and Watson (2000).

Distribution

Circumglobal in tropical and subtropical waters. Type locality: Moluccas, Indonesia.

***Dynamena moluccana* (Pictet, 1893)**

Fig. 29.

Sertularia divergens. – Bale, 1884: 81, pl. 5: fig. 3, pl. 19: fig. 16. [Not *Dynamena divergens* Lamouroux, 1816]

Sertularia moluccana Pictet, 1893: 50, pl. 2: figs 42–43. – Billard 1925b: 189.

?*Sertularia complexa.* – Pictet 1893: 47, pl. 2: figs 39–40. – Billard 1925b: 189. [Not *Sertularia complexa* Clarke, 1879, = *Dynamena disticha* (Bosc, 1802)]

Desmoscyphus palkensis Thornely, 1904: 119, pl. 2: fig. 7A–B.

Dynamena cornicina. – Billard 1925b: 188, fig. 40, pl. 7: fig. 23. – Billard 1933: 14, fig. 5, pl. fig. 3. – Vervoort 1941: 206, fig. 3. – Millard & Bouillon 1973: 68. – Cooke 1975: 94, pl. 3: figs 3–4. – Millard 1975: 261, fig. 86A–E. – Gibbons & Ryland 1989: 408, fig. 27. – Vervoort 1993: 108.

Not *Dynamena cornicina* McCrady, 1859: 204. – Genzano 1992: 144, figs 5–6. – Hirohito 1995: 167, fig. 54a–g. [All = *Dynamena disticha* (Bosc, 1802)]

Sertularia cornicina var. *pinnata* Jarvis, 1922: 339.

Dynamena exigua. – Hirohito 1995: 172, fig. 55c–g. [Not *Sertularia exigua* Allman, 1877, = *D. disticha*]

Type material examined:
MHNG INVE 25031, holotype of *Sertularia moluccana*, slides, without gonotheca.

Other material examined:
MNHG INVE 25033, as *Sertularia complexa*, slide and alcohol material of Pictet (1893), with gonothecae. – Kei Islands Expedition, Neira Island, Banda Islands, 1 Jun 1922, 20 m, sand bottom, 5 damaged plumes, no gonothecae. – For comparisons: *Dynamena disticha*, MHNG INVE 29754 and 27132, both from Cala Murada, Mallorca, 1–2 m, coll. 1999 and 2000, with gonothecae. – *Dynamena pumila*, MHNG INVE 29033, Sandgerdi, Iceland (see Schuchert 2001).

Description

Colonies erect, 1–3 cm high (reportedly up to 6 cm), loosely pinnate. Stolons creeping, tubular.

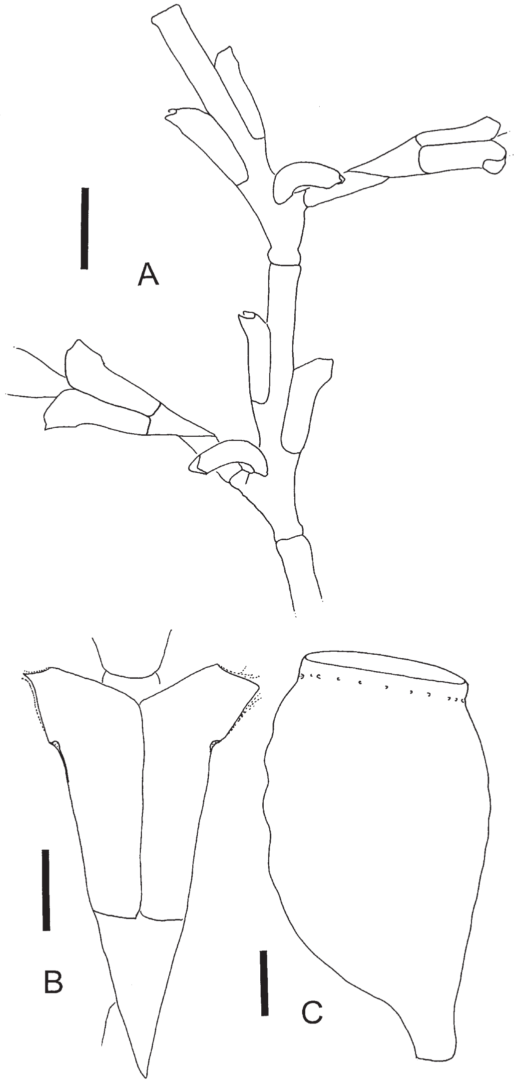

Fig. 29. *Dynamena moluccana* (Pictet, 1893); A–B, after holotype; C, after MHNG INVE 25033, unbranched form. A. Stem segments and basal parts of hydrocladia. B. Pair of hydrothecae from hydrocladium. C. Gonotheca. – Scales: A = 0.5 mm; B–C = 0.2 mm.

Stems zigzag, divided by transverse nodes, segment ends bulging. Each stem segment with three hydrothecae and an apophysis for the hydrocladium; apophysis short, near lower end of segment, in its axil a hydrotheca, this hydrotheca free for most of its length and strongly recurved, the two remaining hydrothecae more distal and subopposite.

Hydrocladia alternate, first segment without hydrotheca, with proximal transverse node and a distal, very oblique hinge-joint node, nodes after first hydrothecal pair transverse or slightly oblique. Hydrothecae in two lateral rows, somewhat displaced to one side of hydrocladium, strictly opposite, each pair contiguous on anterior side, separate on rear side, consecutive hydrothecae of one row well separated.

Hydrotheca tubular, adnate for 2/3 of its length, adcauline side sharply bent where becoming free, abcauline side nearly straight, length 0.4–0.45 mm, adcauline side about 0.7 mm, diameter of opening 0.18–0.2 mm, angle of opening-plane nearly parallel to segment axis or slightly tilted towards above, margin with two lateral cusps. Perisarc of hydrotheca, especially distal end, thin, very delicate and often damaged; lateral cusps frequently not observable. Hydranths relatively large, without abcauline caecum, about 20 tentacles, internal epidermal covering of hydrotheca often with thick patch of larger nematocysts near curvature of abcauline side.

Gonothecae absent in examined material of branched colonies, in unbranched colonies on stem and stolons, ovoid, length 1 mm, width 0.7 mm, walls undulated or smooth, this even in same gonotheca, end truncated, aperture wide and on short neck, on inside of neck a circle of small perisarc pegs.

Variation

Fertile colonies can also be composed of simple stems without hydrocladia. According to Billard (1925b) and Millard (1975), such simple stems can co-occur with pinnate ones. The simple stems are identical to hydrocladia of the branched form, including the oblique hinge joint.

Remarks

Dynamena moluccana Pictet, 1890 is here regarded as valid and distinct from *D. cornicina*, a view already expressed by Calder (1991). Billard (1925b) re-examined the type material of *D. moluccana* and synonymized it with *Dynamena cornicina* McCrady, 1859. Billard also referred unbranched material identified by Pictet as *S. compressa* to *D. cornicina*. However, Calder (1991) showed that *D. cornicina* is not unambiguously identifiable and McCrady's material could have been either *Dynamena disticha* (Bosc, 1802) or *Sertularia distans* (Lamouroux, 1816) (syn. *Dynamena distans* Lamouroux, 1816 or *Tridentata distans*; see Calder 1991). Calder (1991), Migotto (1996), Medel & Vervoort (1998) and others subsequently regarded *D. cornicina* as conspecific with *Dynamena disticha* (Bosc, 1802), a view also shared by the present author. However, comparison of Mediterranean material of *Dynamena disticha* (Fig. 30) with *Dynamena moluccana* (Fig. 29) revealed that both species are distinguishable. The shoots of *Dynamena disticha* (see Calder 1991 for description and synonyms) are usually simple (unbranched). Only rarely, some shoots can be branched once, as was found in material from the Mediterranean (Fig. 30A). This contrasts with *D. moluccana*, which is often pinnately branched, but colonies with unbranched stems also occur. Comparing the stems of both branched forms, it is evident that they are different. The stem of branched *D. disticha* has opposite hydrothecae and it does not differ in structure from the one of the side-branches (Fig. 30A). In *D. moluccana*, the stem differs profoundly from the hydrocladia: there are three hydrothecae per segment, the distal pair is subopposite to almost alternate, and the most proximal hydrotheca is almost completely free and strongly recurved (Fig. 29A). This structure of the stem segments has repeatedly been observed in material coming from different localities (e.g., Thornely 1904 (as *Desmoscyphus palkensis*); Billard 1925b, Vervoort 1941, Cooke 1975, Millard 1975, Gibbons & Ryland 1989 (all as *D. cornicina*); Hirohito 1995 (as *D. exigua*)). The hydrocladia of *D. moluccana* and *D. disticha* resemble each other very closely and it is understandable that both have been synonymized. It seems, however, that *D. moluccana* has slightly larger hydrothecae (abcauline side 0.40–0.45 mm versus 0.25–0.35 mm). The gonothecae are also slightly different. Those of *D. moluccana* are more elongate, those of *D. disticha* characteristically spherical. The gonothecae of *D. disticha* are also often strongly annulated, sometimes even provided with transverse ribs, while the ones of *D. moluccana* are smooth, moderately annulated, or with transverse ribs (Cooke 1975, Millard 1975). The variability of the annulation precludes somewhat that this character can serve as a reliable diagnostic trait. The best characters to positively identify *D. mollucana* are thus the pinnate shoots and the stem morphology. Unbranched colonies of this species are difficult to separate from unbranched *D. disticha*, but a more oblong and smoother gonotheca as well as larger hydrothecae are characteristic for *D. mollucana*. Using these characters to distinguish the species, it is evident that Hirohito (1995) probably found both species in sympatry. Hirohito's *D. exigua* is clearly recognizable as *D. moluccana,* while his *D. cornicina* is obviously referable to *D. disticha.* This sympatric occurrence of both morphotypes strongly argues in favour of two separate species being present and not geographic variants only (subspecies).

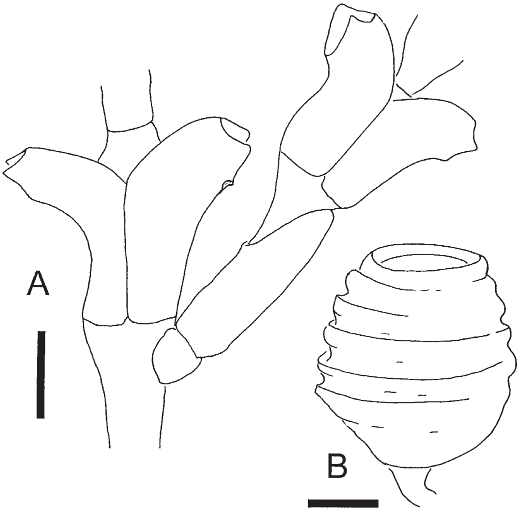

Fig. 30. *Dynamena disticha* (Bosc, 1802); Mediterranean material. A. Stem with rare branching point. B. Gonotheca. – Scales: A–B = 0.2 mm.

It was noted that in the branched shoots of *D. moluccana* there is often a patch of larger nematocysts in the epidermal lining of the hydrotheca. This thickened patch, frequently found in many Sertulariidae (Schuchert 2001), is usually found at the curvature of the abcauline side of the hydrotheca. No such patches were found in *D. disticha*. However, not enough well preserved material could be examined to substantiate this difference.

Both *D. moluccana* and *D. disticha* have a very thin and delicate hydrothecal perisarc. It is often damaged or distorted in preserved samples. Together with the frequent renovations they can look deceptively like hydrothecae of the genus *Salacia*. A careful search for undamaged hydrothecae will, however, reveal the difference (cf. Medel & Vervoort 1998: 31 and Cornelius 1979: 309, note 21). The flimsy perisarc is actually an important trait to distinguish *D. disticha* from *D. pumila.* A further difference is the separation of the hydrothecae: they are not contiguous on either side. *Dynamena pumila* also forms branched and unbranched forms (see Cornelius 1995b or Schuchert 2001 for recent descriptions). *Dynamena pumila* occurs in cooler waters of the North Atlantic, while *D. disticha* is predominantly known from warmer water.

The material identified by Pictet (1893) as *Sertularia gracilis* Hassal, 1848 (MHNG INVE 25032) is clearly a *Dynamena* species and resembles somewhat *D. moluccana*, although it has simple shoots. But the hydrothecae are distinctly smaller (0.2 mm abcauline side) and they are on long internodes. It could thus belong to *Dynamena dalmasi* (Versluys, 1899) (see Calder 1991 and Medel & Vervoort 1998 for recent descriptions).

Distribution

Indonesia (Pictet 1893, Billard 1925b), Papua New Guinea (Thornely 1904), Marshall Islands (Cooke 1975), Australia (Bale 1884, as *S. divergens*), Seychelles (Jarvis 1922 as *S. cornicina* var. *pinnata*), southern Africa (Millard 1975), Japan (Hirohito 1995, as *D. exigua*). Type locality: Bay of Ambon.

***Geminella ceramensis* (Billard, 1925)**

Fig. 31.

Sertularella ceramensis Billard, 1925a: 649. – Billard 1925b: 170, fig. 30, pl. 7: fig. 20.

Geminella ceramensis. – Vervoort 1993: 109, fig. 3a–e.

Not *Geminella ceramensis.* – Vannucci Mendes 1946: 570, pl. 4: figs 40–41.

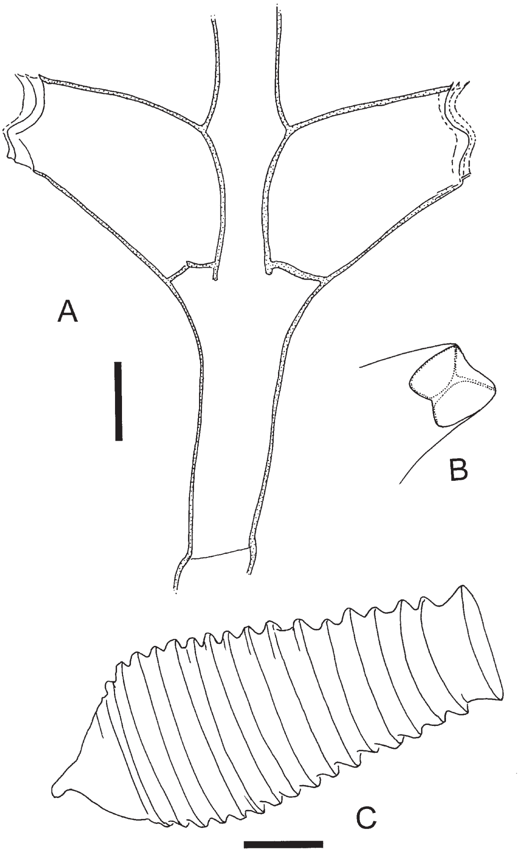

Fig. 31. *Geminella ceramensis* (Billard, 1925). A. Pair of hydrothecae. B. Hydrothecal opening in oblique view showing the three opercular valves. C. Gonotheca. – Scales: A–B = 0.1 mm; C = 0.2 mm.

Material examined:
Kei Islands Expedition station 57, with gonothecae.

Description

Colonies erect, stems irregularly branched, up to 1 cm in height. Stolons tubular, ramified. Stem and branches with identical structure, regularly segmented by more or less distinct transverse nodes. Segments elongate, 0.7–1.1 mm long, each with a pair of opposite to subopposite hydrothecae in its middle. Side-branches originate below a hydrotheca, first segment without hydrotheca, about half as long as other segments.

Hydrotheca conical, adcauline side adnate for half or less of length, abcauline side almost straight, 0.20–0.24 mm long; adcauline side bent where becoming free, free adcauline side straight to somewhat convex, opening-plane directed slightly upwards to nearly parallel to segment axis, diameter 0.13–0.15 mm, margin with three distinct cusps: one on adcauline side, two on lateral sides somewhat below middle; operculum pyramidal and composed of three valves; hydrothecal margin often renovated. Hydranths with abcauline caecum and about 12 tentacles.

Gonothecae develop immediately below a hydrotheca. Gonotheca vase-shaped, 1.2 mm long, max. diameter 0.5 mm, base rounded and with short pedicel, sides quite straight and converging towards distal end; end truncated, walls with 15–18 distinct and sharp transverse ridges, some gonothecae with less distinct ridges and rather undulated only.

Remarks

Most gonothecae observed in this study had rather sharp transverse folds, and were not undulated as described by Vervoort (1993).

Geminella ceramensis is the only known species of its genus. *Geminella* differs from the genus *Symplectoscyphus* only by its opposite hydrothecae, but Vervoort (1993) noted that initial stages of *Geminella ceramensis* have alternate hydrothecae. A future revision might thus synonymize *Geminella* and *Symplectoscyphus.*

Distribution

Indonesia, Philippines, New Caledonia. Type locality: Ceram, Banda Islands, 2.475°S, 131.055°E, 118 m, on coarse sand.

Idiellana pristis **(Lamouroux, 1816)**

Fig. 32.

Idia pristis Lamouroux, 1816: 199, pl. 5: fig. 5. – Allman 1888: 85, pl. 39: figs 1–10. – von Campenhausen 1896b: 311. – Billard 1925b: 219, fig. 58, pl. 7: fig. 33. – Vervoort 1941: 205.

Pasythea philippina Marktanner-Turneretscher, 1890: 234, pl. 4: figs 8 & 8a.

Idiella pristis. – Stechow & Müller 1923: 469. – Vervoort 1959: 252.

Idiellana pristis. – Ralph 1961a: 766, fig. 5c–e. – Mammen 1965: 52, fig. 86. – Millard 1975: 269, fig. 88A–E. – Hirohito 1995: 178, fig. 58a–c. – Vervoort 1993: 188. – Migotto 1996: 64, fig. 12f–g. – Watson 2000: 18, fig. 14A–E.

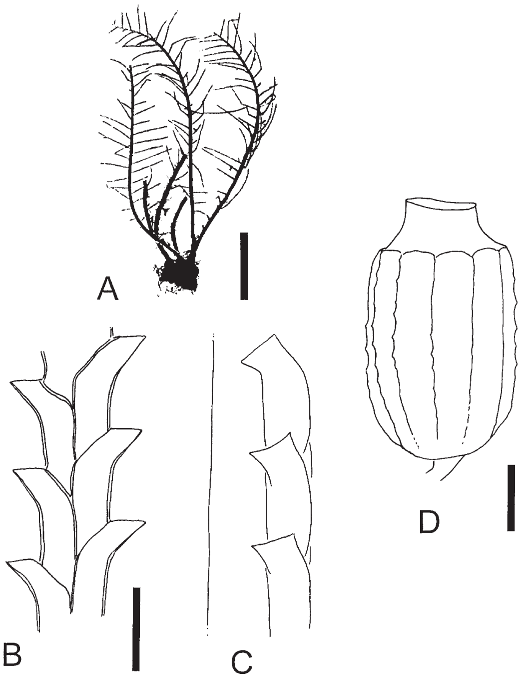

Figure 32. *Idiellana pristis* (Lamouroux, 1816); A, station 71; B–C, station 66; D, station 53. A. Colony silhouette. B. Hydrocladium seen from anterior side. C. Hydrocladium in side view. D. Gonotheca, scale bar 0.5 mm. – Scales: A = 2 cm; B, C = 0.4 mm; D = 0.5 mm.

Material examined:
Kei Islands Expedition, Bay of Ambon, 13 m, 28 Feb 1922, sand bottom, fertile. – Kei Islands Expedition, Bay of Ambon, 90 m, 21 Feb 1922, bottom of stones and sand, fertile. – Kei Islands Expedition, Ujungpandang, Samalon Island, 25 m, 29 Jun 1922, sand bottom. – Kei Islands Expedition, Ujungpandang, Samalon Island, 35 m, 28 Jun 1922, sand bottom. – Kei Islands Expedition, Ambon, harbour pier, 13 m, 27 Feb 1922, sand bottom. – Kei Islands Expedition stations: 11. – 14. – 19, fertile. – 20, fertile. – 21. – 36. – 40. – 53, fertile. – 57. – 61. – 64. – 65. – 66. – 67, fertile. – 68. – 69. – 71, fertile. – 72, fertile. – 73. – 74. – 90. – 103. – 104, fertile. – 106, fertile. – 107. – 110. – 117. – 118, fertile.

Description

Colonies pinnate, up to 7 cm high. Main stem unforked, monosiphonic, with regular nodes, nodes alternate in inclination, each segment with three non-contiguous hydrothecae and an apophysis near lower end.

Hydrocladia alternate, widely spaced, unbranched, unsegmented or only few nodes present, bearing a double row of alternate, overlapping hydrothecae on the frontal face, the two rows contiguous with one another.

Hydrotheca tubular, basal half parallel to hydrocladium, distal half curving away, length of abcauline side 0.6 mm, no internal teeth, rim with two indistinct lateral teeth, operculum composed of an adcauline flap, the base of which is not distinctly demarcated from hydrotheca, margin of hydrotheca often renovated and elongated like duck-bill.

Gonothecae on stem, urn-shaped, 1.6 mm long, diameter 0.8 mm, with 8–10 longitudinal ridges, these partly serrated, distal aperture on conical collar.

Remarks

The alternate hydrothecae on the anterior surface of the hydrocladia, as well as the characteristic hydrothecae, make this species easy to identify. However, it is arguable why this species should be placed in a separate genus *Idiellana* and not in the genus *Diphasia*. The only difference between the two genera is the alternate arrangement of the hydrothecae in *Idiellana*. Hydrothecae on one side of the hydrocladium are also frequently found in *Diphasia* species.

Distribution

Widely distributed in tropical and subtropical regions of the world. Type locality: Australasia (as New Holland in Lamouroux, 1816).

***Salacia hexodon* (Busk, 1852)**

Fig. 33.

Pasythea hexodon Busk, 1852: 395. – Bale 1884: 113, pl. 9: fig. 13. – Bale 1888: 771, pl. 14: figs 8–9. – von Campenhausen 1896b: 311. – Watson 2000: 21, fig. 16A–B.

Salacia hexodon. – Billard 1925b: 207, fig. 49C–D.

Material examined:
Kei Islands Expedition stations: 15. – 18. – 20. – 60. – 61. – 67. – 68. – 71, with gonothecae. – 72, with gonothecae. – 90. – 107.

Description

Colonies erect, simple or irregularly branched, 0.5–2 cm high, monosiphonic, with regular transverse nodes above groups of hydrothecae. Hydrothecae on lateral sides, clustered in groups of 5–7 (range 2–10, reportedly also more), within these clusters consecutive individuals of one row in contact, the two rows not contiguous, long, tubular regions between the groups of hydrothecae. Branching points of side-branches below a hydrotheca.

Hydrotheca tubular, abcauline side 0.4 mm, curved, adnate for half of its adcauline length, opening circular, angle variable, opening-plane parallel to stem or inclined towards below, with single operculum attached to abcauline side. Hydranth without abcauline caecum, one abcauline tentacle longer than others, thick club-shaped with larger nematocysts than in other tentacles.

Gonothecae arising below lowest hydrotheca

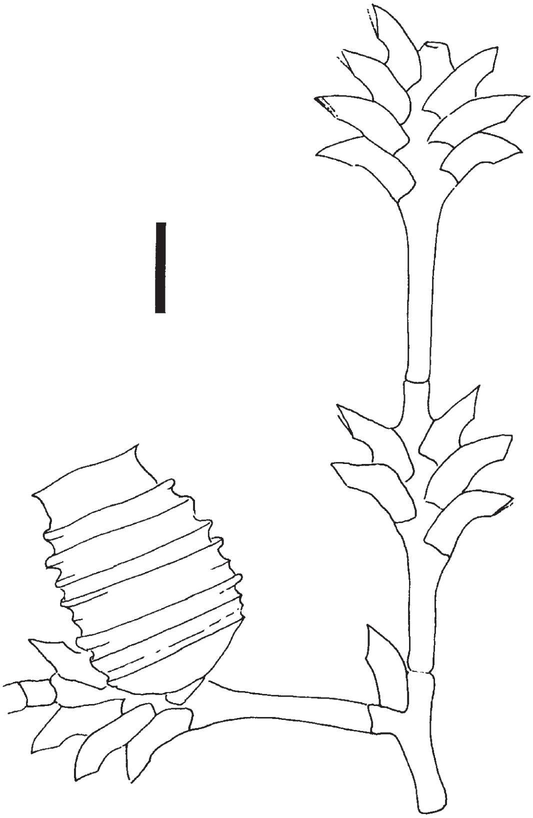

Fig. 33. *Salacia hexodon* (Busk, 1852); station 71. Part of shoot showing typically clustered hydrothecae, a side-branch, and a gonotheca. – Scale: 0.5 mm.

of a cluster, urn-shaped, 1.4 mm long, diameter 1 mm, with 8–10 transverse ridges or ribs.

Distribution

Australia, Indonesia. Type locality: Whitsunday Islands, Queensland, Australia (as Cumberland Islands in Busk, 1852).

Salacia sibogae **Billard, 1924**

Fig. 34.
Salacia sibogae Billard, 1924: 64, fig. 1B–C. – Billard 1925b: 206, fig. 49, pl. 8: fig. 30. – Hirohito 1995: 185, fig. 60f.

Material examined:
Kei Islands Expedition stations: 3. – 12, with gonothecae. – 14, with gonothecae. – 58.

Description

Colonies erect, pinnate. Stem 5–12 cm, monosiphonic, unbranched, zigzag, thicker than hydrocladia, regularly segmented by transverse to slightly oblique nodes, nodes flanked by bulges of the segment ends. Each stem segment with

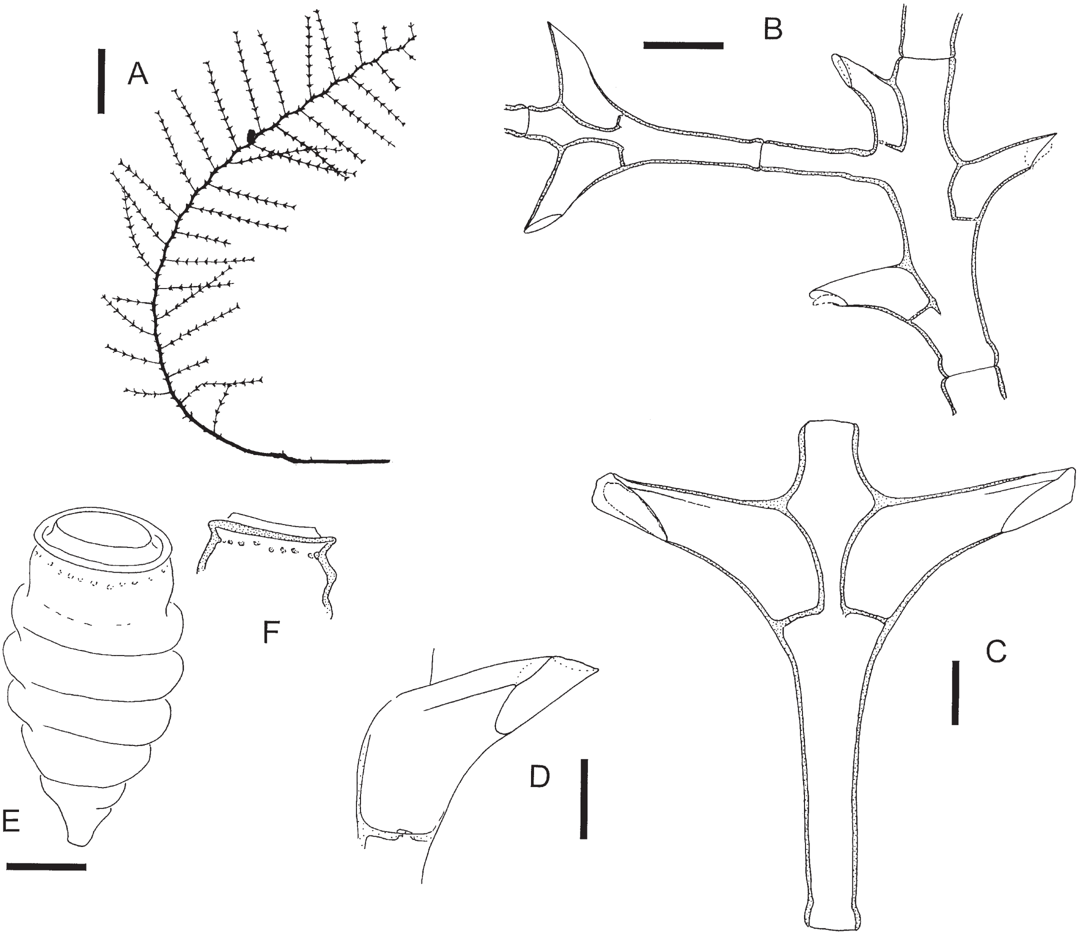

Fig. 34. *Salacia sibogae* Billard, 1924; A, station 12; B–E, station 14. A. Colony silhouette. B. Stem segment with base of hydrocladium. C. Segment from hydrocladium, note faint lateral crease lines originating from hydrothecal margin. D. Oblique view of hydrotheca, note possible upper opercular valve (dotted). E. Gonothecae in oblique view. F. Distal part of gonotheca in side view, shown transparent, same scale as E. – Scales: A = 1 cm; B, E = 0.5 mm; C, D = 0.2 mm.

three alternate hydrothecae in two lateral rows and a long apophysis below the distal-most hydrotheca.

Hydrocladia alternate, straight, with up to 10 segments, nodes transverse and distinct, flanked by swellings of the segment ends, segments long and thin, quite uniform in length (1.5–1.6 mm). Hydrocladial hydrothecae in two lateral rows, in strictly opposite pairs in the distal half of the segment, members of a pair not contiguous on any side, consecutive hydrothecae of one row very far apart.

Hydrotheca curved, free part wedge-shaped in lateral view, duck-billed in oblique view, adcauline side adnate for less than half its length, sharply bent where becoming free, adnate part 0.4 mm long, free adcauline side nearly horizontal, straight to slightly concave, 0.55–0.60 mm long, upper side of hydrotheca shaped like a gabled roof, with lateral crease lines. Periderm of distal part of hydrotheca very thin and flexible. Opening very oblique, with one large, oval adcauline opercular flap, sometimes repeatedly present; perhaps also a small, very indistinct adcauline opercular valve present. Hydranth with about 20 tentacles, without abcauline caecum. Gonothecae on stem, often opposite a hydrocladium.

Gonotheca oblong, about 2 mm long, maximal diameter about 1 mm, distal end truncate, opening on a short neck with wide diameter, lateral wall of gonotheca with about 6 thick annulations; near distal end an interior ring of periderm knobs.

Remarks

With its relatively large, pinnate colonies, and especially the widely spaced hydrothecal pairs with their long wedge-shaped ends, *Salacia sibogae* is quite easily identifiable in the present fauna. All examined samples come from a small area north-east of the Kei Island archipelago, not far from the type locality of the species. Most records lie in deeper waters, with a range of 40–450 m (of the seven known records six are below 245 m, only one is from 40 m).

Although the identity of the present material with Billard's species is quite certain, the allocation of this species to the genus *Salacia* is not entirely secure because there might be more than just one opercular valve and the species appears intermediate between the genera *Dynamena* and *Salacia*. In many hydrothecae, the adcauline (upper) margin is thinner and it looks like a short adcauline opercular valve partitioned by a short median tooth (Fig. 34D). This was only visible in the stereomicroscope and the putative valve is not distinctly demarcated at its base. It was not possible to evaluate whether this is a true, rudimentary operculum or only an illusion. However, the hydrotheca is not entirely typical for the genus *Salacia* and perhaps the genus *Dynamena* might be more appropriate for this species. Millard (1975) mentions that in *Dynamena* the upper valve is usually smaller and it may have a median partition (see *Dynamena crisioides*). However, the distal part of the hydrotheca of *S. sibogae* is so flimsy and difficult to observe that no clear answer seems possible with ordinary light microscopy.

Distribution

Indonesia, Indian Ocean (Hirohito 1995). Type locality: Kei Islands, 5.473°S, 132.000°E, 204 m, on hard coralline sand.

***Salacia punctagonangia* (Hargitt, 1924)**

Fig. 35.
Sertularia punctagonangia Hargitt, 1924: 469, pl. 6: fig. 23.
?*Salacia* spec. – Hirohito 1995: 185, fig. 60d–e.

Type material examined:
Sertularia punctagonangia, NMNH, slide reg. number USNM 42655, part of a plume with male gonothecae.

Other material examined:
Kei Islands Expedition station 4, with female gonothecae.

Differential diagnosis

Similar to *Salacia sibogae* Billard, 1924 (see above), but stem occasionally forked, 7 cm high, nodes on stem absent in proximal region. Hydrocladial hydrothecae smaller, subopposite, some almost alternate, few opposite. Free adcauline wall of hydrotheca convex in side view, cross-section rounded and not roof-shaped, without lateral crease lines. Gonotheca smooth-walled, oblong oval, tapering below into pedicel, termi-

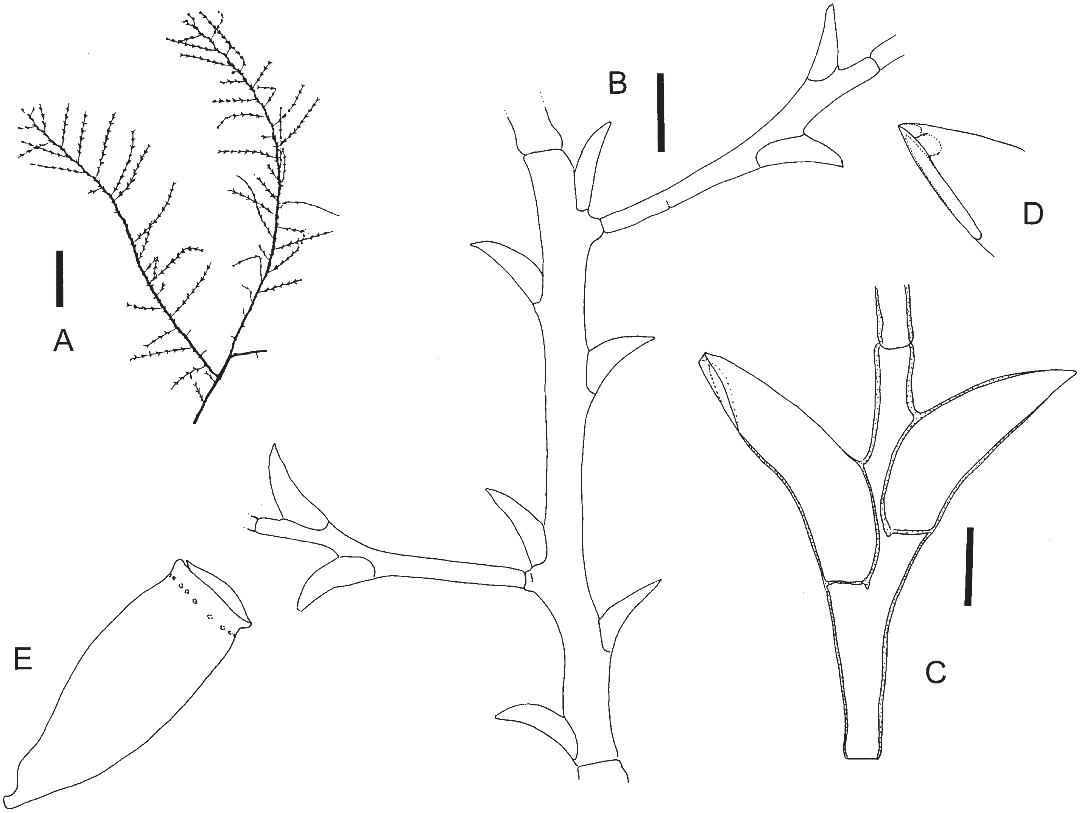

Fig. 35. *Salacia punctagonangia* (Hargitt, 1924); station 4. A. Colony silhouette. B. Part of stem and hydrocladia. C. Side view of typical pair of hydrothecae. D. Oblique view of hydrothecal opening. E. Gonotheca in side view. – Scales: A = 1 cm; B, E = 0.5 mm; C = 0.2 mm.

nal end truncate, with large convex operculum, with slight sub-terminal constriction, at height of constriction a ring of internal wart-like periderm nodules. Measurements: length of free adcauline wall of hydrotheca 0.4–0.5 mm, adnate part 0.3 mm, length of female gonotheca 1.8 mm, male gonotheca 1.3–1.4 mm.

Remarks

Salacia punctagonangia (Hargitt, 1924) is a rare species, so far only recorded from the Philippines (Hargitt 1924). Re-examination of Hargitt's material showed that the present Indonesian material is indistinguishable from it. The only notable difference is the size of the gonothecae, the length of which is 1.3–1.4 mm in the type material, but 1.8 mm in the material from the Kei Islands. The type material is clearly male, while the Indonesian material contains oocytes. The size difference is thus likely to be explained by the different sexes.

Salacia punctagonangia (Hargitt, 1924) so closely resembles *Salacia sibogae* Billard, 1924, especially in the aspect of the colony, hydrothecae and dimensions, that I took it first as a variant of the latter. However, the various small differences are convincing evidence that the two morphotypes belong to different species. Both morphotypes were fortunately found at localities so close together (less than one nautical mile apart), that the respective populations must be considered sympatric. Because both localities are in rather deep waters (245 and 250 m) where environmental conditions can be assumed to be virtually identical, the morphological differences do certainly reflect genetic differences and not phenotypic variations. These presumably genetic differences of sympatric specimens were considered due to two different species being involved. At closer examination, both species are reliably distinguishable using the differences given in the diagnosis above. The most important characters to distinguish *S. punctogonagia* from *S. sibogae* are the subopposite hydrothecae, the curved convex free adcauline wall of the hydrotheca, and the smooth gonotheca.

As for *S. sibogae*, the hydrothecal margin in this species is also very thin and flimsy and it is not entirely clear whether the species belongs to *Salacia* or *Dynamena*.

Salacia punctagonangia is here recorded for the first time for Indonesia. It was previously only known from the Philippines. Hirohito (1995, as *Salacia* sp.) compares a *Salacia* species from Sagami Bay (Japan) with *Salacia sibogae* from the Indian Ocean. This Japanese material, although infertile, shows all characteristics of *S. punctagonagia* and is likely to belong to this species.

Distribution

Philippines, Indonesia, ? Japan. Depths: 120–400 m. Type locality: Batan, Philippines, 120–274 m.

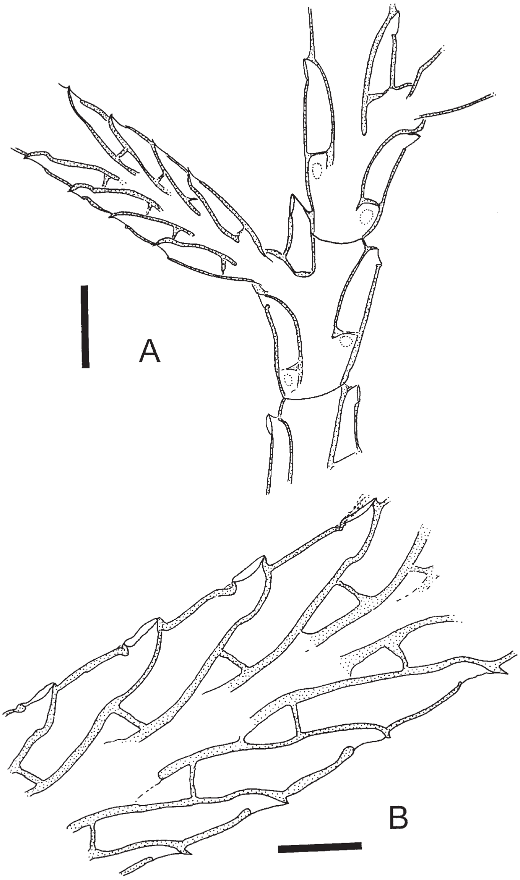

Fig 36. *Salacia sinuosa* (Bale, 1888). A. Teminal part of branch with base of hydrocladium B. Part of hydrocladium seen from broad side. – Scales: A = 0.5 mm; B = 0.2 mm.

Salacia sinuosa **(Bale, 1888)**

Fig. 36.

Thuiaria sinuosa Bale, 1888: 772, pl. 18: figs 9–10. – Ritchie 1911: 844, pl. 85: fig. 4.

Salacia sinuosa. – Billard 1925b: 204, fig. 48, pl. 8: fig. 29. – Watson 2000: 22, fig. 17E.

Material examined:
Kei Islands Expedition station 74, without gonothecae.

Description

Colony large, bush-like, up to 25 cm high, much branched, trunk at base up to 3 mm thick and woody, strongly polysiphonic through overgrowth of stolon-like tubes, only distal-most tips monosiphonic, ultimate branches pinnate, pinnate parts up to 5 cm long, stem of pinnate regions also polysiphonic. Stolons forming a root-like structure which anchors colony in sediment. Monosiphonic distal ends of stem with transverse nodes, segments short, each with three hydrothecae and an apophysis, a single hydrotheca opposite apophysis, two on side of apophysis. Hydrothecae of stem in two lateral rows, alternate, not in contact vertically or horizontally. Apophysis inserted between two successive hydrothecae of a segment, node to hydrocladium twisted.

Hydrocladia stiff, straight, flattened, only occasionally a node present, with two lateral rows of overlapping hydrothecae. Hydrothecae of one row adjacent, oblique, overlapping for about 1/3 of length. Hydrothecae of the two rows not in contact, in opposite to subopposite pairs.

Hydrotheca tubular, narrowing from base to margin; adcauline wall 0.47–0.50 mm, almost completely adnate, only a very short upper rim free; lower half of abcauline side adnate to previous hydrotheca, free abcauline side mostly straight, nearly parallel to hydrocladium axis, 0.18–0.20 mm long, below margin a perisarc thickening and sometimes with a short inward fold; opening in frontal view ovate, opening-plane parallel to hydrocladial axis or somewhat tilted towards below. Operculum a single valve attached to abcauline margin of hydrotheca, often several ones present. Below the side of some hydrothecae a round fenestration.

Gonothecae not observed, according to Watson (2000) oblong, up to 1.5 mm long, width up to 0.54 mm, inserted between the rows of hydrothecae, wall smooth or with faint annulations, aperture on short neck at distal end. Colour of preserved material: stem dark brown, upper branches and hydrocladia light brown.

Distribution

Subtropical Australia, Indonesia. Type locality: Port Molle, Australia.

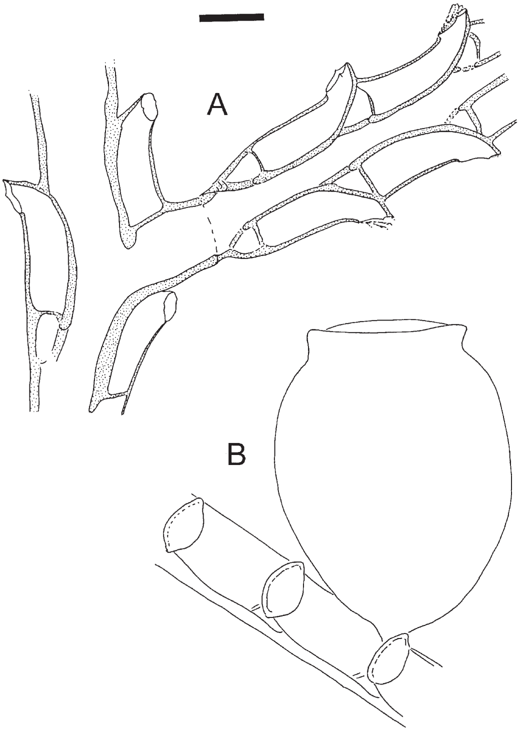

Fig. 37. *Salacia tetracythara* Lamouroux, 1816; station 72. A. Part of stem and base of hydrocladium. B. Hydrocladium in side view and attached gonotheca. – Scale: A–B = 0.2 mm.

***Salacia tetracythara* Lamouroux, 1816**

Fig. 37.

Salacia tetracythara Lamouroux, 1816: 212: pl. 6: fig. 3a–c. – Billard 1925b: 202, fig. 47, pl. 3: figs 27–28. – Mammen 1965: 54, fig. 87. – Rees & Vervoort 1987: 103, fig. 6d. – Gibbons & Ryland 1989: 414, fig. 31. – Hirohito 1995: 183, fig. 60a–c. – Watson 2000: 23, fig. 18A-F.

Thuiaria fenestra Bale, 1884: 116, pl. 7: fig. 7, pl. 9: fig. 14.

Calyptothuiaria opposita von Campenhausen, 1896b: 312, fig. 7.

Material examined:

Kei Islands Expedition stations: 69. – 71. – 72, with gonothecae. – 91. – 104, with gonothecae. – 106. – 107.

Description

Colonies erect, pinnate, up to 6 cm in present material (reportedly up to 10 cm), sometimes neighbouring shoots connected through distal tendrils of hydrocladia. Stems mostly unbranched, monosiphonic or polysiphonic, perisarc thick, nodes only visible in distal regions, two lateral rows of hydrothecae, these not in contact, in subopposite pairs, three between successive hydrocladia of one side, apophyses for hydrocladia short, mostly delimited by node from hydrocladium.

Hydrocladia in one plane, alternating, straight, stiff, length variable, held at approximately 60°–80° to stem, occasionally branching 2–3 three times, with numerous hydrothecae, nodes rare, distal end occasionally transformed into stolon-like tendril. Hydrothecae in two lateral rows, in opposite to subopposite pairs, members of a pair not in contact, successive hydrothecae of a row in contact and overlapping.

Hydrotheca tubular, adnate for 9/10 of their adcauline length, proximal half to 2/3 of adcauline side straight, remaining part curved so that opening slightly tilted downward, abcauline side straight for nearly its entire length, length about 0.3 mm. Hydrothecal opening in frontal view elliptical, margin with three shallow teeth: two lateral ones and one median adcauline, operculum one oval valve attached on abcauline side of hydrothecal rim, often repeated. Hydranth without abcauline caecum, with about 20 tentacles.

Gonothecae on stem and hydrocladia, all on one side, held perpendicular to plane of ramification. Gonothecae globular to urn-shaped, length 1 mm, diameter in middle 0.75 mm, aperture wide, 0.5 mm diameter, on short neck, operculum convex, on inside of neck a ring of perisarc projections.

Distribution

Vietnam, Indonesia, Australia, India, Japan. Type locality: Australia.

***Caminothujaria molukkana* von Campenhausen, 1896**

Fig. 38.

Caminothujaria molukkana von Campenhausen, 1896a: 104. – Vervoort 1993: 102, synonymy.

Caminothujaria moluccana. – von Campenhausen 1896b: 306, pl. 15: fig. 8.

Thuiaria divergens Whitelegge, 1899: 372, pl. 22, figs 1–3. – Billard 1925b: 222.

Sertularia indomalayica Stechow, 1919: 158.

Sertularella singularis Billard, 1920a: 14, fig. 1.

Sertularia sigmagonangia Hargitt, 1924: 495, pl. 5: fig. 20.

Sertularella moluccana. – Billard 1925b: 167, figs 28–29, pl. 7: fig. 19.

Dictyocladium aberrans Nutting, 1927: 214, pl. 41: figs 4–5.

Material examined:
Kei Islands Expedition stations: 21. – 26. – 27. – 53. – 54, with gonothecae. – 68. – 103.

Description

Colonies erect, pinnate, up to 7 cm high. Stolons

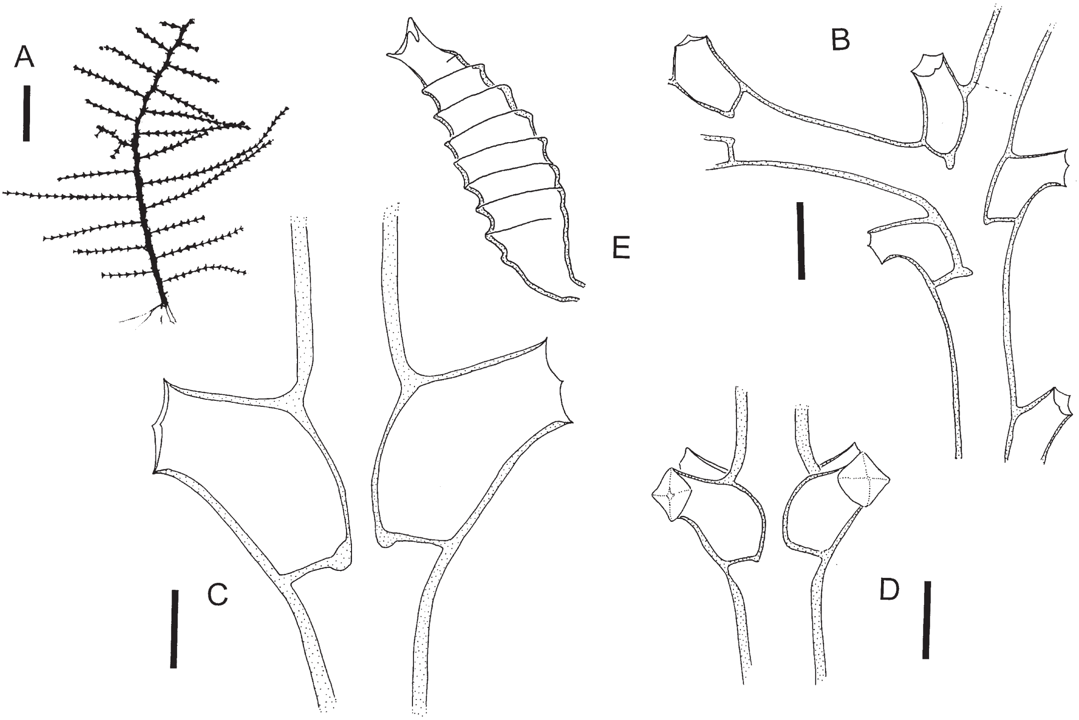

Fig. 38. *Caminothujaria molukkana* von Campenhausen, 1896; A, station 53; B–E, station 26. A. Colony silhouette. B. Part of stem and base of hydrocladium. C. Paired hydrothecae. D. Verticil with four hydrothecae, opercular valves drawn dotted. E. Gonotheca in side view, same scale as B. – Scales: A = 1 cm; B, E = 0.5 mm; C = 0.2 mm; D = 0.4 mm.

root-like or creeping. Stems unforked, monosiphonic in younger colonies, older colonies polysiphonic in lower half; with alternate hydrocladia which are more or less in one plane, nodes along stem absent or very indistinct. Hydrothecae of stem in two lateral rows, in groups of three close to origins of hydrocladia, one hydrotheca opposite hydrocladium, one axillary, one below hydrocladium; end of adcauline wall of stem hydrothecae often with process.

Hydrocladia alternate, straight, occasionally branched secondarily, held at right angle to stem, can be long but length variable, with up to 24 hydrothecal pairs or verticils, nodes rare. Hydrothecae of hydrocladia either in opposite pairs (rarely subopposite), or in verticils of three or four; paired hydrothecae in plane of colony. Verticils with 3–4 hydrothecae more frequent near proximal end of hydrocladium, more distal hydrothecae usually in pairs.

Hydrotheca uniform, curved so that opening-plane is nearly parallel to hydrocladium or somewhat inclined towards above, adcauline wall adnate for half its length or less, abcauline wall about 0.45 mm long, diameter of opening 0.22 mm; rim with four low but acute cusps (two laterals, one adcauline, one abcauline); operculum composed of four valves, pyramid-like; renovations of margin frequent, lower end of adcauline wall often with swelling, this swelling variably present, sometimes this swelling extended like an annular thickening. Hydranths with abcauline caecum.

Gonothecae on hydrocladia, long axis parallel to hydrocladium, shape elongate-fusiform and slightly S-curved, about 2 mm long, maximal diameter 0.6 mm; body with 6–8 sharp transverse crests; opening terminal, rather small, surrounded by three distinct cusps, one adcauline, two laterals; opening covered by operculum divided into four flaps.

Remarks

With its four-cusped hydrothecae in either opposite pairs or verticils of three or four, this species is easily recognizable. Juvenile colonies may have only paired hydrothecae.

Distribution

Indonesia, Philippines, Ellis Islands. Type locality: Ternate, Moluccas, Indonesia.

***Sertularella decipiens* Billard, 1919**

Fig. 39.

Sertularella decipiens Billard, 1919b: 21, fig. 3B. – Billard 1925b: 155, fig. 21, pl. 7: fig. 15, pl. 8: fig. 34. – Watson 2000: 27, fig. 22A–E.

Material examined:
Kei Islands Expedition station 11, with gonothecae.

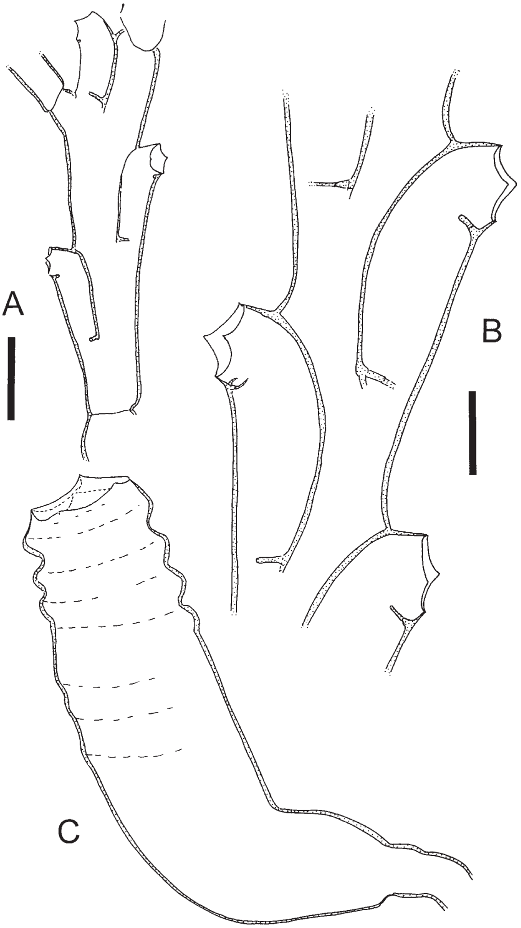

Fig. 39. *Sertularella decipiens* Billard, 1919. A. Stem internode with base of hydrocladium. B. Part of hydrocladium. C. Gonotheca, same scale as A. – Scales: A, C = 0.5 mm; B = 0.2 mm

Description

Colonies erect, pinnate, up to 3 cm high, stems unbranched, monosiphonic, basal part without hydrothecae, delimited by oblique node from distal part; distal part with alternate hydrocladia and hydrothecae in two lateral rows, nodes at least in more distal parts visible, internodes elongate, apophysis for hydrocladium arising below most distal hydrotheca of internode, apophysis rather short, delimited by node from hydrocladium.

Hydrocladia quite long, some with one or two side-branches, with distant nodes and a variable number of hydrothecae per internode. The two rows of hydrothecae on stem and hydrocladia more or less in one plane. Hydrothecae alternate, successive hydrothecae of one row well separated by a gap of about half a hydrothecal length.

Hydrotheca roughly tubular, adnate for 7/8 of length, adcauline side curved, abcauline wall straight for almost entire length and nearly parallel to hydrocladial axis, length of abcauline wall around 0.45 mm, diameter of opening 0.2 mm, opening-plane almost parallel to hydrocladial axis, margin with four pointed cusps, slightly below margin of abcauline side at point of flexure a short intrathecal shelf. Floor of hydrotheca not reaching abcauline side, without distinct process towards interior of internode.

Gonothecae developing in small clusters at very base of stem near junction to stolons. Gonotheca very large, length 3 mm without pedicel, major part cylindrical, tapering and curving below into pedicel, distal part with spiral annulation grading into shallow annulation and smooth part below, distal end truncate, margin with four shallow cusps, operculum pyramidal, composed of four flaps.

Remarks

Stechow & Müller (1923) doubted the validity of this species, suggesting it may be conspecific with *S. quadridens*. This was contested by Watson (2000) who described the gonotheca for the first time. The gonothecae of *S. decipiens* are larger and curved, have a spiral annulation, and develop at the base of the stem. The gonothecae of *S. quadridens* are smaller (up to 2.2 mm), straight, with sharp transverse ridges, and they develop in the hydrocladiate region of the stem.

The examined samples of *S. decipiens* agreed well with Billard's (1925b) description, which was also based on material from the Kei Islands. The Indonesian material shows some minor differences to the material of northern Australia described by Watson (2000): the hydrothecae are notably more widely spaced, the hydrocladia are sometimes branched, and the lower part of the gonotheca is smooth. These differences are here interpreted as intraspecific variation. The characteristic site of gonotheca development at the base of the stem renders this species quite easily identifiable.

Distribution

Indonesia, northern Australia. Type locality: Tual, Kei Islands, Indonesia, 22 m.

***Sertularella diaphana* (Allman, 1886)**

Fig. 40.

Thuiaria diaphana Allman, 1886: 145, pl. 18: figs 1–3.

Sertularella diaphana var. *delicata* Billard, 1919b: 21, fig. 3A. – Billard 1925b: 161, fig. 24, pl. 7: fig. 14.

Sertularella diaphana var. *orthogona* Billard 1925b: 161, fig. 23.

Sertularella diaphana var. *gigantea* Billard, 1925b: 161, pl. 9: fig. 35. – Vervoort 1941: 213.

Sertularella diaphana. – Bale 1919: 337, pl. 16: fig. 5. – Billard 1925b: 157, fig. 22 pl. 7: figs 12–13. – Millard 1975: 285, fig. 93A–D. – Calder 1991: 101, fig. 53, synonymy. – Vervoort 1993: 214, figs 45d–e & 46d, synonymy. – Hirohito 1995: 192, fig. 62b–d, pl. 12: fig. A. – Watson 2000: 31, fig. 24, synonymy.

Material examined:

Kei Islands Expedition station 107, on hydroid, with gonothecae. – Kei Islands Expedition, Neira Island, Banda Islands, 10 m, 5 Jun 1922, on hydroids, sponges and other substrata, numerous colonies, many with gonothecae. – Kei Islands Expedition, Bay of Ambon, 90 m, 2 Mar 1922, bottom of stones and sand, no gonothecae, corresponds to *S. diaphana* var. *orthogona*.

Description

Colonies erect, reaching heights of 12 cm, multipinnate. Stem thick, polysiphonic, forked or not, final branches pinnate with alternate hydrocladia which are more or less in one plane. Stem and branches divided into internodes in distal regions only, nodes oblique, sloping alternately to left and right. Each stem internode bearing three

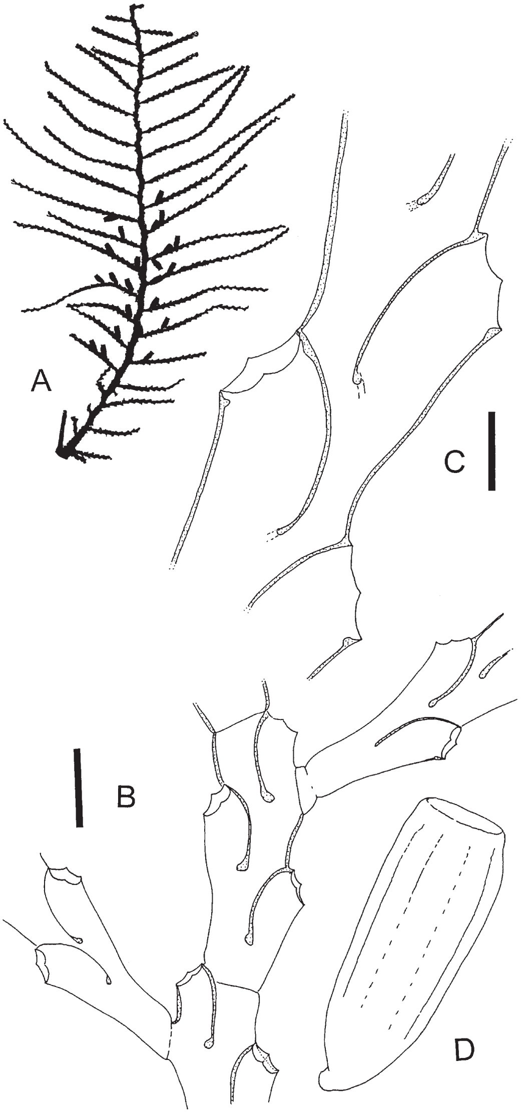

Fig. 40. *Sertularella diaphana* (Allman, 1886); Neira Island. A. Colony silhouette, height about 6 cm. B. Stem internodes with bases of hydrocladia. C. Hydrothecae of hydrocladium. D. Gonotheca. – Scales: B = 0.5 mm; C = 0.2 mm.

hydrothecae in two rows and one hydrocladium, the latter rising just below the most distal hydrotheca.

Hydrocladium straight, unbranched, with distant nodes and a variable number of hydrothecae per internode. The two rows of hydrothecae on stem, branches and hydrocladia shifted somewhat to anterior surface. Hydrothecae alternate, the two rows of hydrothecae on the hydrocladia either in one plane or in two planes of variable obtuse to right angle, both rows well separated.

Hydrotheca completely adnate or very nearly so, without floor, smooth, curved outwards, opening tilted towards abcauline side, adcauline side about 0.5 mm, opening diameter 0.22–0.25 mm. Marginal cusps low but pointed, no internal teeth. Lower end of adcauline hydrothecal wall often ending in a swelling, especially so in the cauline hydrothecae (Fig. 40B).

Gonothecae borne on anterior surface of hydrocladia, elongated, polygonal in cross-section, truncated distally, length 2 mm, diameter 0.7 mm, no marginal spines,

Variation

The variant *Sertularella diaphana* var. *delicata* forms 1 cm high, monosiphonic shoots; variant *S. diaphana* var. *orthogona* has the two rows of hydrothecae set at a right angle; variant *gigantea* forms very large colonies, reaching dimensions of 35 x 28 cm (all after Billard 1925b).

Remarks

Only an abbreviated synonymy of this species is given here because several authors provided one in recent publications (Calder 1991, Vervoort 1993, Watson 2000). The sample from the Bay of Ambon was clearly referable to the variant *orthogona*, although it lacked the thickenings at the lower end of the adcauline hydrothecal wall. Vervoort (1993) also mentions material of this variant lacking the thickening.

Distribution

Widespread in tropical and subtropical waters of the Indo-Pacific and Atlantic. Type locality: Moreton Bay, Queensland, Australia.

***Sertularella quadridens* (Bale, 1884)**

Fig. 41.

Thuiaria quadridens Bale, 1884: 119, pl. 7: figs 5–6. – Weltner 1900: 586, pl. 46: figs 1–3.

Thuiaria vincta Allman, 1888: 68, pl. 32: figs 2 & 2a.

Sertularella quadridens. – Ritchie 1910b: 818, pl. 77: fig.

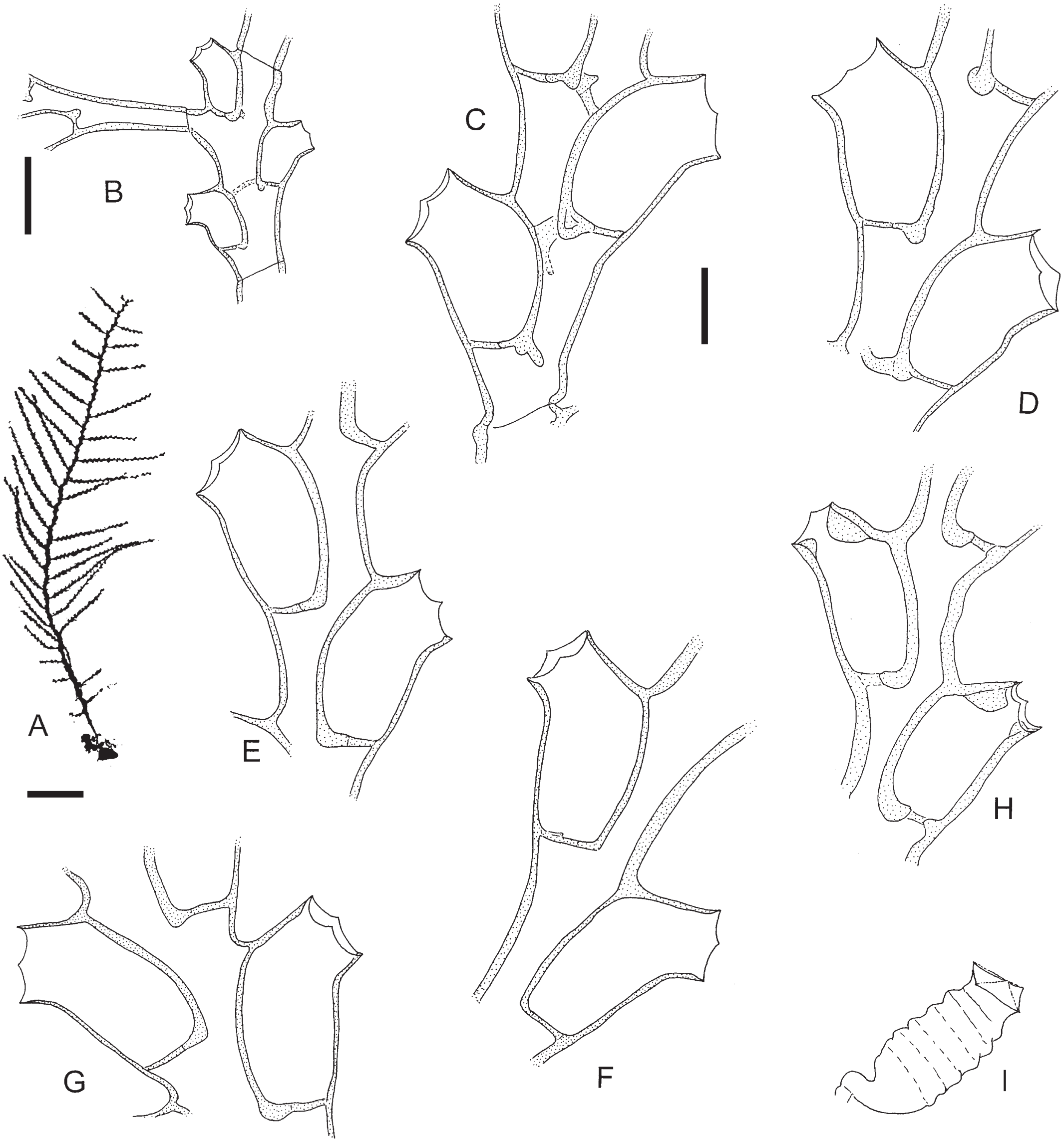

Fig. 41. *Sertularella quadridens* (Bale, 1884); A–E, typical form, station 18; F–G, variant form "*cornuta*", Samalon Island; H–I, variant form "*timorensis*", station 26. A. Colony silhouette. B. Stem internode with base of hydrocladium. C–H. Hydrocladial hydrothecae, note variation of spacing and process at end of adcauline side, all drawn to same scale. I. Gonotheca, same scale as B. – Scales: A = 1 cm; B & I = 0.5 mm; C–H = 0.2 mm.

12a–b. – Stechow & Müller 1923: 471. – Billard 1925b: 150, fig. 19. – Vervoort 1941: 214, fig. 5. – Mammen 1965: 38, fig. 70. – Watson 2000: 28, fig. 23.

Sertularella timorensis Billard, 1919b: 21, fig. 1f–g.

Sertularella polyzonias var. *cornuta* Ritchie, 1909: 525. – Ritchie 1910a: 10, pl. 4: fig. 2.

Sertularella cornuta. – Stechow 1923: 12. – Nutting 1927: 215, pl. 42: figs 1–2.

Sertularella quadridens var. *cornuta.* – Billard 1925b: 151, pl. 7: fig. 9. – Vervoort 1941: 216.

Sertularella quadridens var. *timorensis.* – Billard 1925b: 153, fig. 20, pl. 7: figs 10–11.

Sertularella quadridens forma *quadridens* Ralph, 1961a: 830, fig. 23h.

Sertularella quadridens cornuta. – Vervoort 1993: 232, figs 52b–e, 53a–b.

Material examined:
Normal form
Kei Islands Expedition station 18, several stems, no gonothecae.

Morphotype "*cornuta*"
Kei Islands Expedition stations: 16. – 60. – 63. – 64. – 103. – 104. – 106. – Kei Island Expedition, Samalon Island near Ujungpandang, 35 m, 28 Jun 1922.

Morphotype "*timorensis*"
Kei Islands Expedition station 26, one shoot with gonotheca, much overgrown by Bryozoa and algae.

Description of typical form

Colonies erect, pinnate, reaching heights of 7 cm. Stems monosiphonic, unbranched, with alternate hydrocladia which are more or less in one plane, divided into internodes in distal regions only, nodes oblique, sloping alternately to left and right. Each stem internode bearing three hydrothecae in two rows and one hydrocladium, the latter rising just below the most distal hydrotheca.

Hydrocladia straight, unbranched, with distant nodes and a variable number of hydrothecae per internode.

Hydrothecae alternate, the two rows of hydrothecae on the hydrocladia in one plane, both rows well separated, successive hydrothecae of one row well separated for about somewhat less than the length of one hydrotheca. Hydrotheca tubular, curved outwards, adnate for 2/3 to ¾ of its adcauline length, length of abcauline side 0.30–0.35 mm, diameter of opening 0.20–0.23 mm, length of free adcauline side 0.13–0.18 mm, adcauline side evenly curved, abcauline side straight in lower part and curved in last fourth, opening oblique, margin with four cusps; floor complete, with large pore, lower end of adcauline wall often with an oblique or vertical process, sometimes even connected to opposite hydrotheca (Fig. 41B), size and form of this process very variable within the same shoot (Fig. 41B–D), many hydrothecae even without such a process.

Gonothecae of this form not observed (see Watson 2000, Billard 1925b).

Variant form "cornuta"

Colony 2–5 cm high, hydrothecae slightly larger (abcauline wall 0.35–0.4 mm), hydrotheca more projecting (adnate for 2/3), process at lower end of adcauline wall absent or represented by a slight thickening only (Fig. 41E–G). No gonothecae present.

Variant form "timorensis"

Colony 3 cm high, perisarc much thickened, a large and massive intrathecal tooth on adcauline side, often also smaller on abcauline side, hydrothecae adnate for 2/3 to ¾ of their adcauline side, length abcauline side 0.38–0.40 mm, diameter of opening 0.15–0.16 mm. Gonotheca on hydrocladia, about 1.2 mm long, diameter 0.5 mm, barrel-shaped, with transverse annulation, end truncate, square, with four sharp corners, operculum pyramidal and composed of four triangular flaps.

Remarks

Typical *Sertularella quadridens* have hydrothecae with a characteristic process at the lower end of the adcauline wall (Fig. 41B–D), which renders them relatively easy to identify, even in the absence of the characteristic gonotheca. However, this process is very variable and can be absent in quite a number of hydrothecae. Therefore, also otherwise closely similar colonies lacking this process (variant forms) were here also allocated to this species. One of these variant forms likely corresponds to the form described by Billard (1925b) as *S. quadridens* var. *cornuta*. Billard (1925b) distinguished this variant from the typical form through the more widely spaced and more projecting hydrothecae and smaller gonotheca with longer marginal cusps. The status of this variant is at present unclear. Ritchie (1909, 1910a) suggested it to be a variant of *S. polyzonias*, but Stechow (1923) and Nutting (1927) recognized it as a full species, an opinion also favoured by Watson (2000). Billard (1925b) and Vervoort (1941, 1993) regarded it as a variant of *S. quadridens*. Another variant is *S. quadridens* var. *timorensis*, a morphotype originally described as a separate species by Billard (1919b), but later demoted to a mere variant of *S. qua-*

dridens by Billard (1925b) himself. This characteristic variant has a much thicker perisarc, massive intrathecal teeth, and smaller gonothecae than the normal form. Additionally, it seems to become mature at a smaller size. The thickenings at the lower end of the adcauline hydrothecal walls are somewhat masked by the general thickening of the perisarc. With the available material it was not possible to gain more insight into the status of these morphotypes. More fertile material of all three morphotypes, preferentially from the same locality and accompanied with detailed ecological information, must be examined and compared to re-assess their validity.

Distribution

Indonesia, Philippines, India, northern Australia, New Caledonia. Type locality: Pt. Curtis, Queensland, Australia.

Sertularia loculosa **Busk, 1852**

Fig. 42.

Sertularia loculosa Busk, 1852: 393, pl. 19: fig. 9. – Migotto 1996: 71, fig. 13f–i.

Sertularia ligulata Thornely, 1904: 116, pl. 2: fig. 1–1B. – Billard 1925b: 178, fig. 35. – Millard 1958: 193, figs 8C, 9A–B. – Vervoort 1959: 277, fig. 37. – Millard & Bouillon 1973: 74, fig. 9G. – Millard 1975: 307, fig. 100A–D. – Vervoort & Vasseur 1977: 53, fig. 24. – Gibbons & Ryland 1989: 420. – Hirohito 1995: 213, fig. 71a–g.

Sertularia turbinata. – Ritchie, 1910b: 821. – Bale 1913: 124, pl. 12: fig. 6. – Jäderholm 1919: 14, pl. 3: fig. 8. – Jarvis 1922: 341, pl. 19: fig. 8 (synonyms after Billard 1925b). [Not *Sertularia turbinata* (Lamouroux, 1816)]

Not *Sertularia loculosa*. – Bale 1884: 91. – Thornely 1904: 118. – Warren 1908: 306. – Jarvis 1922: 340 [all *S. turbinata*].

Material examined:
Kei Islands Expedition stations: 67. – 90. – 106.

Description

Colonies forming erect, monosiphonic shoots, up to 3 cm high, usually unbranched but rarely 1–2 short side-branches; basal ahydrothecate part ending in oblique hinge joint, distal part bearing hydrothecae in opposite pairs; nodes mostly absent or indistinct. Members of a pair of hydrothecae contiguous in front, separate on rear side. Branches, when present, with structure identical to stem.

Hydrotheca adnate for 2/3 of its adcauline length, height 0.3 mm, adcauline side bent at 90°, hydrotheca broadest somewhat above middle, opening-plane parallel to stem axis, margin with two very shallow lateral cusps or irregularly undulated, operculum composed of two valves, abcauline one large and circular, covering nearly the whole opening and often tucked into hydrotheca; abcauline valve very small, rudimentary, often not observable. On abcauline side somewhat below opening an oblique, semicircular ridge projecting into lumen of hydrotheca. On adcauline side of hydranth a long process with a terminal, swollen, finger-like region densely studded with large nematocysts (= ligula, nematophore). Hydranth with abcauline caecum.

Gonotheca not observed, according to Migotto (1996) barrel-shaped, annulated, about 1 mm long and 0.6 mm broad.

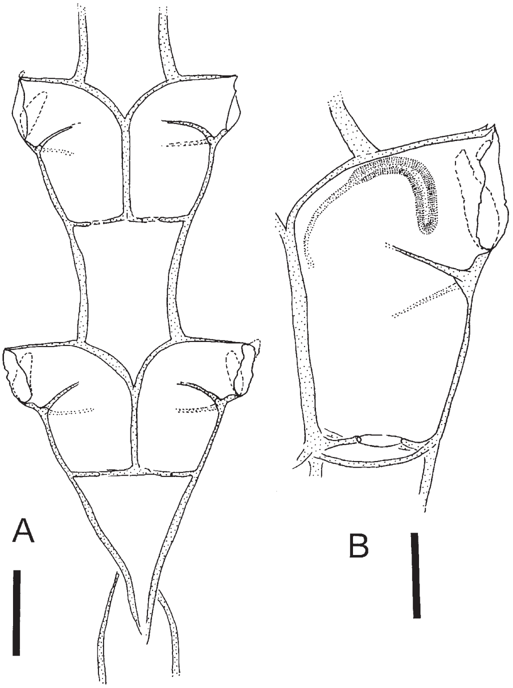

Fig. 42. *Sertularia loculosa* Busk, 1852; station 67. A. Two pairs of hydrotheca just above hinge joint. B. Hydrotheca with ligula (hydranth not shown), operculum shown with broken line. – Scales: A = 0.2 mm; B = 0.1 mm.

Remarks

The characteristic ligula makes this species easily identifiable (Fig. 42B). The lateral cusps of the hydrothecal margin are very shallow and often difficult to observe. They are best seen under a stereomicroscope. The grossly unequal upper and lower valve of the operculum set this species somewhat apart from other *Sertularia* species. In this and the inconspicuous lateral marginal cusps, this species approaches the genus *Thuiaria*. However, the habitus resembles more that of *Salacia*, and only the presence of an abcauline caecum and the ligula may prevent misidentification.

Some authors (e.g., Millard 1975) described this species as having an intrathecal septum. However, there is no true septum but merely a semicircular ridge projecting into the hydrothecal lumen (Fig. 42B). This ridge is moreover not transverse as shown in several figures, but slightly inclined towards the rear. Billard (1925b) made similar observations.

Flattened stolons at the end of the stems as described by Thornely (1904) were not observed in the present material.

Migotto (1996) re-examined the type material of this species and provides a synonymy.

Distribution

Tropical Indo-Pacific, Japan, southern Africa, tropical West Africa, Brazil. Type locality: Bass Strait, Australia.

Sertularia borneensis Billard, 1925

Fig. 43.

?*Sertularia maldivensis* Borradaile, 1905: fig. 6a–b. – Stechow 1919: 97, fig. L1.
Sertularia borneensis Billard, 1925a: 649, fig. 1D. – Billard 1925b: 171, fig. 31. – Vervoort & Vasseur 1977: 60, figs 26b & 27b. – Gibbons & Ryland 1989: 418, fig. 34.
Sertularia west-indica. – Mammen 1965: 40, fig. 71.
Sertularia westindica. – Cooke 1975: 100, pl. 5: fig. 1.
Sertularia turbinata. – Vervoort & Vasseur 1977: 60, figs 26–27. [Not *Sertularia turbinata* (Lamouroux, 1816)].
?*Sertularia tongensis* Stechow, 1919: 101, fig. N1.
?*Sertularia malayensis* var. *sorongensis* Leloup, 1930b: 3, figs 1–3, pl. 1: fig. 1.

Material examined:
Kei Islands Expedition stations: 67, on *Macrorhynchia phoenicea*, with gonothecae. – 107, on concretions, no gonothecae.

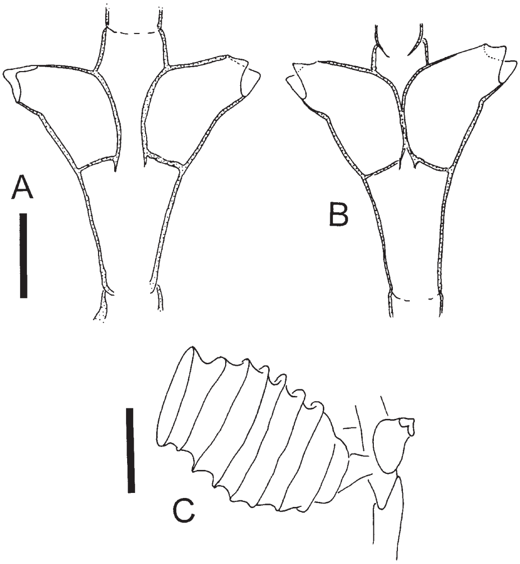

Fig. 43. *Sertularia borneensis* Billard, 1925; station 67. A. Hydrothecal pair in lower region, scale bar 0.2 mm. B. Distal hydrothecae, same scale as A. C. Gonotheca, scale bar 0.5 mm. – Scales: A–B = 0.2 mm; C = 0.5 mm.

Description

Colonies with erect, simple, monosiphonic shoots, never branched. Stolons creeping, tubular, without internal pegs. Shoots reaching heights of 2 cm, at base relatively long ahydrothecate part ending in oblique hinge joint (length of this part equals 2–4 internode lengths of distal part), distal part bearing hydrothecae in opposite pairs, nodes transverse, mostly distinct, hydrothecal pairs in distal half of segment. Hydrothecae on lateral side of stem, proximal pairs not contiguous, most distal pairs contiguous in front, separate on rear side.

Hydrotheca swollen in middle, hydrotheca broadest somewhat above middle, adnate for ½ or more of its adcauline length, adcauline side curved for nearly 90°, free adcauline wall nearly horizontal, abcauline wall oblique with slight double curvature (S-shape). Length of abcauline side 0.21–0.24 mm, diameter of opening (in side view) 0.1–0.11 mm. Hydrothecal opening slightly tilted towards above, margin with two conspicuous lateral cusps, median adcauline cusp not observed, operculum composed of two valves, upper only slightly smaller than lower one. Bottom of hydrotheca oblique, adcauline wall elongated into tapering process. There is no intrathecal ridge. Hydranth with abcauline caecum.

Gonotheca arising perpendicular to stem between lowest pair of hydrothecae, ovoid, 1.2 mm long, diameter 0.8 mm, with flat truncated end, wall with sharp, projecting spiral sculpture in 7–8 loops.

Remarks

There is no doubt that the present material is identical to *S. borneensis* as described and depicted in Billard (1925b) and Vervoort & Vasseur (1977). The fertile colony was also found on the same host as the type material and in nearly the same water depth.

Vervoort & Vasseur (1977) – who also examined the type material of *S. borneensis* – synonymized this species with *S. turbinata,* although their material lacked an intrathecal ridge (see Fig. 43). They explained its absence by the juvenile state of their material. This explanation appears now invalid, as also fertile material examined in this study lacked the ridge. Calder (1991) regarded *S. borneensis* as distinct from *S. turbinata*, but following Leloup (1960) he synonymized it with the Caribbean *S. tumida* Allman, 1877. *Sertularia borneenis* is here kept separate from both *S. turbinata* and *S. tumida*. Similar conclusions were reached by Gibbons & Ryland (1989), who also regarded *S. borneensis* as valid.

One sample from a nearby locality (station 68), and thus sympatric with the other specimens of *S. borneesis*, contained a sertularid clearly referable to *S. turbinata* (see below, Fig. 44). Although I acknowledge the possibility that both could be only variants belonging to the same biological species, they are preferably kept separate because no intermediate forms are known so far. Indonesian morphotypes referable to either *Sertularia borneensis* or *S. turbinata* differ in the following details: *Sertularia borneensis* lacks an intrathecal ridge, has smaller hydrothecae (cf. Figs 43 and 44), the majority of the hydrothecal pairs are not contiguous, the bottom of the hydrotheca is more oblique, the ahydrothecate part below the hinge joint is longer.

Sertularia tumida, a species originally described from the tropical western Atlantic is insufficiently known because the gonothecae have never been described from the original region. *Sertularia borneensis* is therefore preferably kept separate from *S. tumida* (or its synonym *S. westindica*) as long as the gonothecae of *S. tumida* remain unknown from waters of the tropical Atlantic. Perhaps the gonothecae show significant differences and they might resemble more the South African *S. longa*, which has smooth gonotheacae but is otherwise hardly distinguishable. Mammen (1965, as *S. west-indica*) provides the only description and figure of the gonotheca for material attributed to the nominal species *S. tumida*, but for biogeographic reasons and also morphological differences Mammen's material is better referred to *S. borneenis* or *S. maldivensis*.

Sertularia borneensis differs from Atlantic *S. tumida* in the following details (cf. Calder 1991): it apparently lacks the small median tooth on the adcauline rim of the hydrotheca, it is never branched, and the hydrothecal bottom is more oblique. These are admittedly characters prone to variation and of very limited taxonomic value. If Atlantic *S. tumida* should prove to have the same gonothecae as found here for *S. borneensis,* both nominal species would be indistinguishable. Biogeographic arguments might then nevertheless be put forward to regard both species as distinct.

Sertularia maldivensis Borradaile, 1905, an inadequately known species, appears conspecific with *S. borneensis*. Billard (1925b) did not discuss why he considered them distinct. Type material of *Sertularia maldivensis* must be examined before reliable conclusions can be drawn.

Distribution

Indonesia, Polynesia, perhaps also Maldives. Type locality: Indonesia, 2°25'S, 117°43'E, 34 m, on *Macrorhynchia phoenicea*.

Sertularia turbinata **(Lamouroux, 1816)**

Fig. 44
Dynamena turbinata Lamouroux, 1816: 180.
Desmoscyphus brevicyathus Versluys, 1899: 40, figs 9–10.

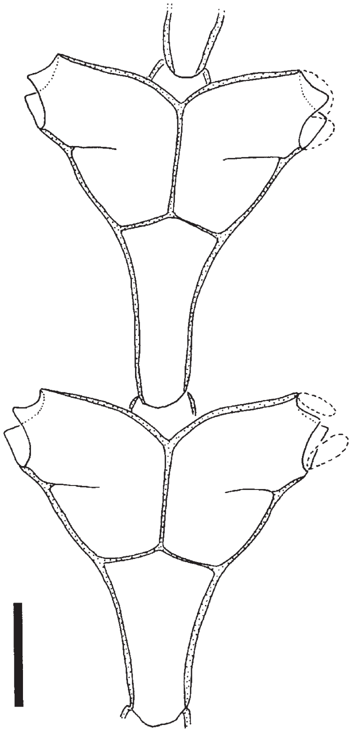

Fig. 44. *Sertularia turbinata* (Lamouroux, 1816). Two pairs of hydrothecae. – Scale: 0.5 mm.

Sertularia loculosa Bale, 1913: 121: pl. 12: figs 7–8, invalid name.
Tridentata acuta Stechow, 1921: 231.
Sertularia balei Briggs, 1922: 150.
Not *Sertularia turbinata.* – Jarvis 1922: 341, pl. 24: fig. 8 [= *Dynamena* spec.].
Sertularia restricta Totton, 1930: 205.
Geminella ceramensis. – Vannucci Mendes 1946: 570, pl. 4: figs 40–41. [Not *Sertularella ceramensis* Billard, 1925]
Sertularia drachi Vannucci, 1949: 247.
Sertularia turbinata. – Billard 1925b: 177, fig. 34. – Millard & Bouillon 1973: 76, fig. 9H. – Millard 1975: 312, fig. 100B–C, E. – Gibbons & Ryland 1989: 425, fig. 39. – Hirohito 1995: 218, fig. 73d–f. – Migotto 1996: 78, figs 14f-g. – Watson 1997: 52. – Medel & Vervoort 1998: 70, fig. 23, synonymy.
Sertularia acuta. – Millard 1958: 19, figs 8A–F.
Not *Sertularia turbinata.* – Garcia, Aguirre, & Gonzalez 1980: 57, fig. 19 [= *Sertularia tumida* Allman, 1877].
Not *Sertularia turbinata.* – Vervoort & Vasseur 1977: 60 figs 26–27 [= *Sertularia borneensis* Billard, 1925].
Tridentata tubinata. – Calder 1991: 110, fig. 60, synonymy.

Material examined:
Kei Islands Expedition station 68, without gonothecae.

Diagnosis

Similar to *D. borneensis* but with a horizontal intrathecal ridge on abcauline side and hydrothecal pairs always contiguous.

Remarks

See discussion under *D. borneensis*

Distribution

Tropical and subtropical waters. Type locality: Australasia.

***Sertularia trigonostoma* Busk, 1852**

Fig. 45.
Sertularia trigonostoma Busk, 1952: 392. – Bale 1884: 84,

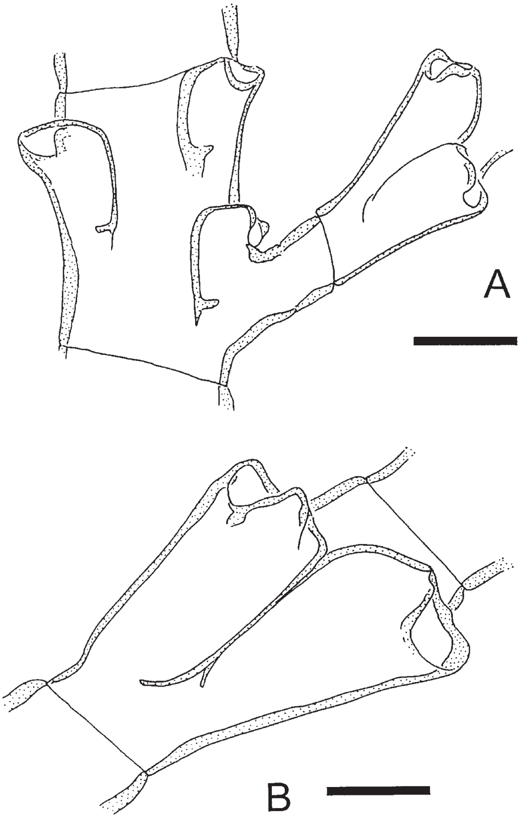

Fig. 45. *Sertularia trigonostoma* Busk, 1852; station 68. A. Stem internode with base of hydrocladium. B. Hydrocladial internode. – Scales: A = 0.2 mm; B = 0.1 mm.

pl. 5: fig. 8. – Billard 1910: 21, fig. 7. – Billard 1925b: 174. – Vervoort 1941: 217. – Watson 2000: 33, fig. 26A–E .

Desmoscyphus obliquus Allman, 1888: 72, pl. 34: fig. 3–3a.

Sertularia trigonostoma var. *alternata* Vervoort, 1959: 284, fig. 42.

Material examined:
Kei Islands Expedition stations: 68. – 71; both colonies without gonothecae.

Description

Colonies erect, pinnate, up to 7 cm high. Stems monosiphonic, rather thick near base (0.7 mm), tapering distally, bearing alternate hydrocladia and two lateral rows of alternate hydrothecae, nodes distinct to indistinct, if present, alternately slanted and delimiting internodes. Stem internodes with three hydrothecae and an apophysis for hydrocladium, two hydrothecae on side of apophysis, one on opposite side, apophysis below lower hydrotheca.

Hydrocladia straight, parallel, regular, arising at an angle of about 45° to axis, unbranched, longest ones in lower region of shoot, well demarcated from apophysis by transverse node, nodes more or less distinct, nodes inclined towards one side, two subopposite hydrothecae per internode; hydrothecae shifted to anterior side of internode, adnate on anterior side, separate on rear side.

Hydrotheca adnate for most of its length, sac-shaped, walls thick, abcauline side about 0.2 mm long, straight; opening directed upwards, margin with two blunt lateral teeth and sometimes a small adcauline median tooth. Opening elliptical, margin reinforced by thickened perisarc, operculum composed of two valves, difficult to observe. Connection of hydrotheca to internode very wide, thus hydrotheca without true floor.

Gonothecae not present (see Watson 2000 for description).

Remarks

The hydranths in the present samples were not ideally preserved and it was not possible to decide reliably whether an abcauline caecum is present or not. Watson (2000) states that there is no caecum, although she also had badly preserved hydranths. If the absence of an abcauline caecum can be corroborated, this species should be referred to the genus *Dynamena*.

Distribution

Tropical Indo-Pacific, Red Sea, tropical western Africa. Type locality: Torres Strait, Australia.

***Sertularia malayensis* Billard, 1925**

Fig. 46.

Sertularia malayensis Billard, 1925a: 649. – Billard 1925b: 173, fig. 32. – Vervoort & Vasseur 1977: 57, fig. 25. – Hirohito 1983: 49, fig. 21. – Gibbons & Ryland 1989: 421, fig. 37. – Hirohito 1995: 215, fig. 72a–c.

Material examined:
Kei Islands Expedition station 26, several shoots without gonotheca on *S. quadridens* var. *timorensis*.

Description

Colonies forming erect unbranched shoots without hydrocladia, height 2–4 mm. Stolons creeping, ramified. Stem thin (about 0.1 mm), with occasional oblique or transverse nodes. Hydrothecae strictly opposite, each pair contiguous on frontal side, separated at rear.

Hydrotheca tubular, upper and underside converging and end thus duck-bill shaped, adcau-

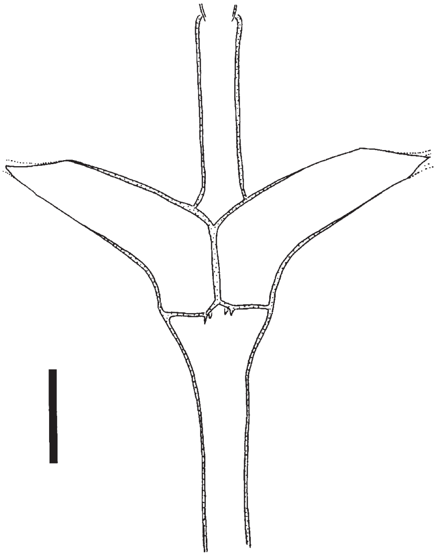

Fig. 46. *Sertularia malayensis* Billard, 1925. Pair of hydrothecae. – Scale: 0.1 mm.

line wall adnate for 1/3 of its length, abcauline curved, about 0.18 mm long, adcauline wall quite sharply bent where becoming free, margin with two long, pointed lateral teeth, operculum formed by two valves, upper one much larger, lower valve not distinctly delimited from hydrotheca, distal end of hydrotheca very soft and often distorted; floor of hydrotheca complete, lower end of adcauline wall forming short, pointed process. Hydranth with about 8 tentacles, with small abcauline caecum.

Gonothecae not observed (according to Hirohito 1983: pear-shaped, smooth walls, with truncate end and opening on short collar).

Remarks

The hydrothecal margin of this small and delicate species is rather flimsy and the generic characters are very difficult to see.

Leloup (1930b) described a variant of this species from New Guinea as *Sertularia malayensis* var. *sorongensis*. Leloup's material was juvenile and not reliably identifiable. It resembles much more *S. borneensis*, to which it most probably belongs. Leloup (1930b: 6) also discusses the differences of his variant to *S. borneensis*, but all tabulated characters are of very limited value in discriminating *Sertularia* species.

Distribution

Indonesia, Japan, French Polynesia, Fiji. Type locality: Borneo, 2°25'S, 117°43'E, 40–50 m, on hydroids.

***Symplectoscyphus macrocarpa* (Billard, 1918)**

Fig. 47.

Sertularella macrocarpa Billard, 1918: 23, fig. 3A–B. – Billard 1925b: 162, fig. 25, pl. 7: figs 16–17.

Material examined:
Kei Islands Expedition station 1, with gonothecae.

Description

Colonies erect, up to 2 cm high, pinnate. Stem and hydrocladia zigzag, both with identical structure, stem with about 2–3 hydrothecae between successive hydrocladia of one side.

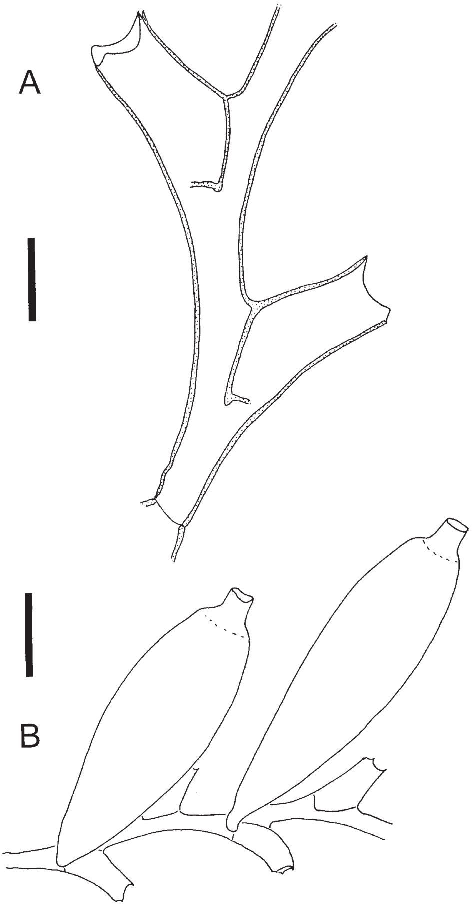

Fig. 47. *Symplectoscyphus macrocarpa* (Billard, 1918). A. Two hydrothecae. B. Gonothecae. – Scales: A = 0.2 mm; B = 0.5 mm.

Hydrocladia long, may reach the same length as stem, inserting below hydrothecae of stem, nodes oblique, often indistinct or absent.

Hydrotheca cylindrical, adnate for 2/5 of its adcauline length, free part held at about 60° to internode, abcauline wall almost straight to slightly concave, 0.35–0.4 mm, abcauline side sharply curved where becoming free; opening diameter 0.14–0.16 mm, margin with three cusps, one median adcauline and two latero-abcauline; operculum composed of three flaps, hydrothecal floor not complete, reaching mostly only to middle. Gonothecae numerous, on hydrocladia.

Gonotheca elongate amphora-shaped, walls smooth, length 2–2.2 mm, maximal diameter above middle 0.5–0.6 mm, terminal opening on a narrow tubular neck, length 0.2 mm.

Distribution

Moluccas, Kei Islands. Type locality: Moluccas, 3.450°S, 131.008°E, 567 m, on fine grey-yellow mud. So far only known from deeper waters (370–567 m).

Family Thyroscyphidae

Thyroscyphus bedoti **Splettstösser, 1929**

Fig. 4.

Lytoscyphus junceus. – Pictet 1893: 37, pl. 2: figs 32–33. [Not *Thyroscyphus junceus* (Allman, 1876)]

Thyroscyphus bedoti Splettstösser, 1929: 42, figs 36–38, new name.

?*Thyroscypus macrocytharus*. – Watson 2000: 37, fig. 29A.

Type material examined:

MHNG INVE 25030, as *Lytoscyphus junceus*, material described in Pictet (1893), type material of *Thyroscyphus bedoti* Splettstösser, 1929.

Description

Colony erect, up to 4 cm high, unbranched, without hydrocladia, with alternately oblique nodes, internodes smooth, of variable length, with subterminal apophysis for hydrothecae, apophysis demarcated from hydrotheca by node. Hydrothecae alternating, in two rows, in one plane. Pedicel of hydrotheca annulated or not. Mature shoots with numerous gonothecae of different developmental stages, almost every hydrotheca with one gonotheca below it

Hydrotheca campanulate, radially symmetric to bilaterally symmetric, straight abcauline side and convex adcauline side, depth 1.1–1.2 mm, diameter at opening 0.6 mm, walls smooth; margin with 4 shallow cusps or almost even; operculum pyramidal with four flaps, mostly lost; diaphragm an oblique perisarcal ring, more developed on adcauline side. Hydranth with about 25 tentacles.

Gonotheca 1.4 mm long, diameter 0.7 mm, cylindrical, tapering into pedicel below, distal half of gonotheca slightly undulated.

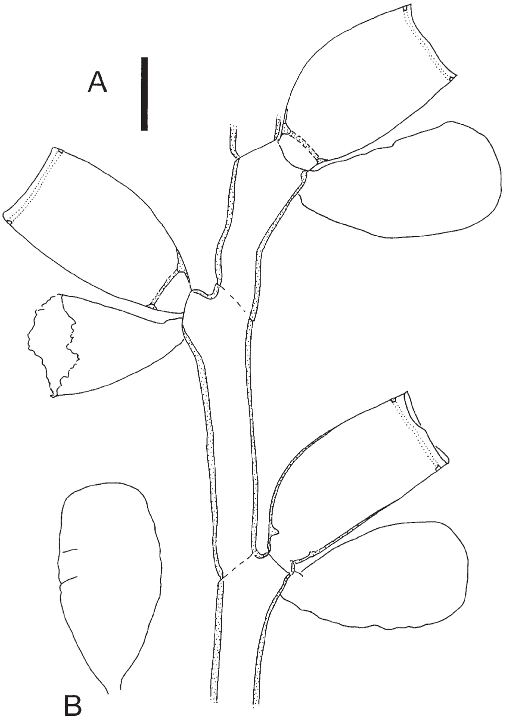

Fig. 48. *Thyroscyphus bedoti* Splettstösser, 1929; after type material. A. Part of stem with hydrothecae and gonothecae of various developmental stages. B. Mature gonotheca, same scale as A. – Scale: A–B = 0.5 mm.

Remarks

Pictet (1893) allocated unbranched but mature colonies of a *Thyroscyphus* species to *Lytoscyphus junceaus* (Allman, 1876). *Thyroscyphus junceus* (Allman, 1874), an obvious synonym of *T. fruticosus*, forms large and branched plumes and it is unlikely that Pictet's material belongs this species. In his detailed study of the Thyroscyphidae, Splettstösser (1929) therefore proposed a new name for Pictet's species: *Thyroscyphus bedoti*.

Thyroscyphus bedoti shows some resemblance to *T. macrocyttarus* (Lamouroux, 1824). This species has recently been re-described (Watson 1994) and synonymized with *T. marginatus* (Bale, 1884) (= *T. balei* Calder, 1983). *Thyroscyphus macrocyttarus* had been reported until recently only from temperate waters of southern and south-western Australia. Its colonies are characterized as occurring either as stolonal forms or as unbranched stems that have all their hydrothecae on one side only. The perisarc of its internodes are usually undulated. These characteristics separate it clearly from *T. bedoti*, which is a species of warm waters and which has two rows of hydrothecae. Watson (2000) allocated material from tropical waters near Darwin to *T. macrocyttarus* (as *T. macrocytharus*), although it had two rows of alternate hydrothecae and rather smooth internodes. Her material was growing on sponges. Due to these morphological, substrate, and biogeographic differences, I think that Watson's material from Darwin could also belong to *T. bedoti*, although it has more pointed cusps and the hydrothecae are considerably smaller.

Distribution

Eastern Indonesia, ? northern Australia. Type locality: Batumera, Bay of Ambon, Moluccas, Indonesia; littoral zone, on coarse sand.

***Thyroscyphus fruticosus* (Esper, 1793)**

Fig. 49.

Spongia fruticosa Esper, 1793: 188.

Thyroscyphus vitiensis Marktanner-Turneretscher, 1890: 210, pl. 3: fig. 10. – Gibbons & Ryland 1989: 427.

Campanularia thyroscyphiformis Marktanner-Turneretscher, 1890: 206, pl. 3: fig. 4. – Rees & Vervoort 1987: 67.

?*Campanularia juncea* Allman, 1876: 260, pl. 11: figs 3–4.

Campanularia juncea. – Thornely 1904: 113, text. figs 1–3, pl. 1: fig. 1a–b.

Not *Lytoscyphus junceus.* – Pictet 1893: 37, pl. 2: figs 32–33 [= *Thyroscyphus bedoti* Splettstösser, 1929]

Lytoscyphus fruticosus. – Stechow & Müller 1923: 465, pl. 27: fig. 6.

Thyroscyphus fruticosus. – Splettstösser 1929: 7, figs 1–11, 13–27. – Vervoort 1941: 202. – Ralph 1961a: 754, fig. 1a. – ? Millard 1975: 323, fig. 104. – Gibbons & Ryland 1989: 425, fig. 40. – Watson 2000: 38, fig. 29D.

Thyroscyphus ramosus. – Mammen 1965: 30, fig. 63. [Not *T. ramosus* Allman, 1877]

Material examined:
Kei Islands Expedition stations: 11, with gonothecae. – 19, with gonothecae. – 43. – 67, with gonothecae. – 86. – Kei Islands Expedition, Banda Islands, Lonthoir, 07 Jun 1922, with gonothecae.

Description

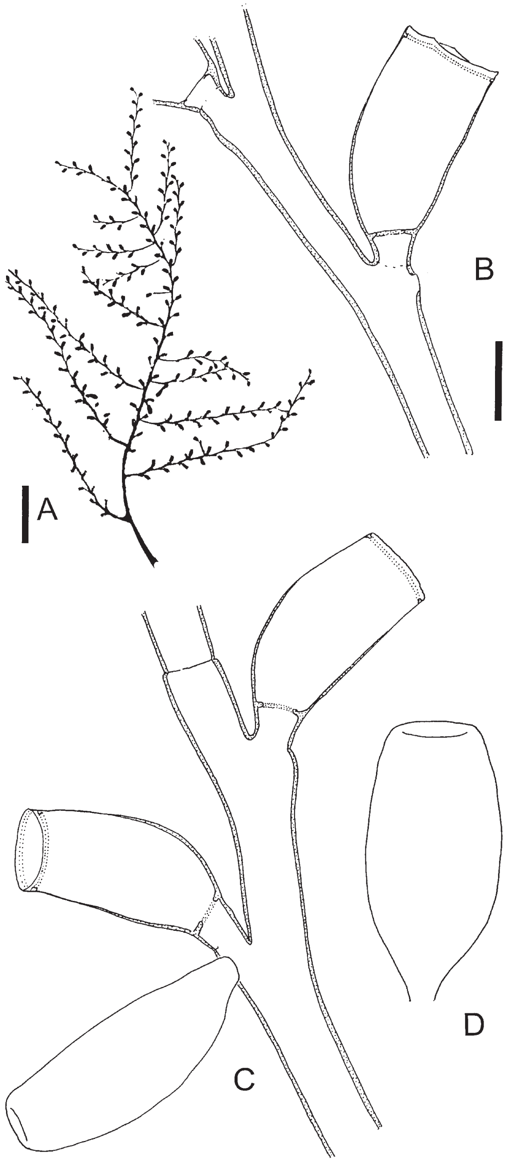

Fig. 49. *Thyroscyphus fruticosus* (Esper, 1793); A & C–D, station 19; B, station 11. A. Colony silhouette. B. Hydrotheca variant with marginal cusps and operculum. C. Two hydrothecae with smooth margin and a male gonotheca, same scale as B. D. Presumed female gonotheca, same scale as B. – Scales: A = 1 cm; B–D = 0.5 mm.

Colony erect, pinnate, 5–20 cm, stems often in dense clusters. Stem thick, stiff, monosiphonic, without nodes, with two lateral rows of hydrothecae, hydrothecae alternate and in one plane.

Hydrocladia alternate, in one plane, long and quite straight, usually unbranched, only rarely branched, nodes indistinct or absent, hydrothecae on a broad and short apophysis. Hydrotheca with short pedicel, without distinct node demarcating it from apophysis.

Hydrotheca campanulate, 1–1.2 mm deep, diameter at opening 0.5–0.6 mm, slightly bilateral symmetric through bulging upper side and almost straight underside, at base a distinct diaphragm, margin either smooth or with four indistinct, broad cusps; below rim an internal annular ridge, operculum pyramidal and composed of four flaps, operculum frequently lost. Inside of hydrotheca covered by thin tissue layer with few large nematocysts. Hydranth with about 30 tentacles.

Gonothecae on stem and hydrocladia, developing below hydrothecae on their apophyses, 1.8–2.4 mm, oblong oval, basal part tapering, end truncated, wall smooth. Male more slender, female thicker and end wider.

Remarks

See comments under *T. torresii*. The hydrothecae in living colonies have a characteristic rose-pink colour, which is lost in preserved material (Millard 1975, Watson 2000).

Distribution

Tropical Indo-West Pacific, New Zealand, southern Africa, western Africa, Mediterranean. Type locality: Unknown.

***Thyroscyphus torresii* (Busk, 1852)**

Fig. 50.

Laomedea torresii Busk, 1852: 402.

Campanularia Torresii. – Bale 1884: 52, pl. 11: fig. 3.

Tyroscyphus simplex Allman, 1888: 25, pl. 13: figs 1–2.

Tyroscyphus regularis Jäderholm, 1896: 9, pl. 1: fig. 8.

Cnidoscyphus torresii. – Splettstösser 1929: 70, figs 68–77, map 2. – Vervoort 1941: 204, fig. 1. – Vervoort 1993: 104.

Thyroscyphus torresi. – Jäderholm 1903: 273, pl. 12: fig. 6. – Stechow & Müller 1923: 466. – Watson 2000: 37, fig. 29B–C.

Thyroscyphus fruticosus. – Mammen 1965: 31, fig. 64. [Not *T. fruticosus* (Esper, 1793)]

Material examined:
Kei Islands Expedition stations: 15. – 18. – 20. – 40. – 64. – 65, with gonothecae. – 68. – 71. – 74. – 90. – 102. – 103. – 104. – 106.

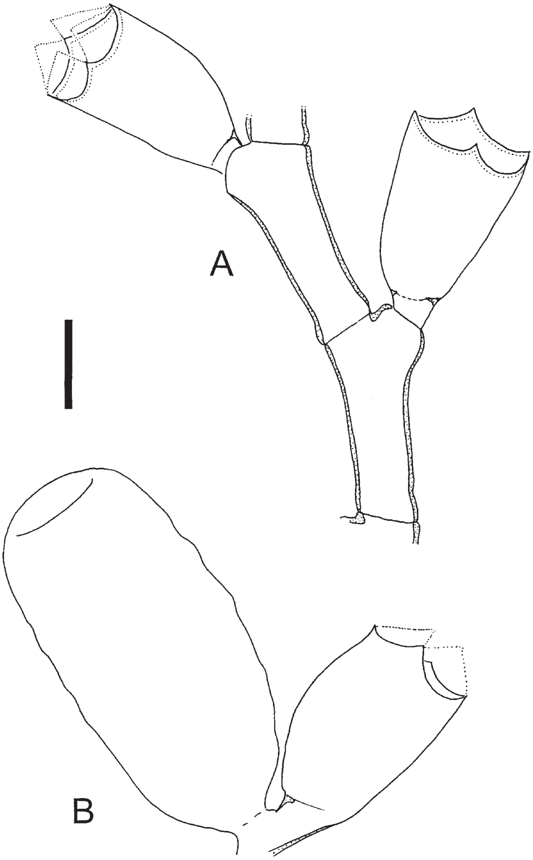

Fig. 50. *Thyroscyphus torresii* (Busk, 1852); station 65. A. Two internodes with hydrothecae. B. Hydrotheca and gonotheca, same scale as A. – Scale: A–B = 0.5 mm.

Differential diagnosis

Similar to *Thyroscyphus fruticosus*, but epidermal lining of hydrotheca with a pad containing a dense cluster of large nematocysts; stems shorter (up to 10 cm); hydrocladia with distinct nodes, nodes alternately inclined left and right; hydrotheca demarcated by distinct node from apophysis, rim of hydrotheca with four distinct cusps, operculum regularly present. Diaphragm of hydrotheca more unequally developed. Gonotheca more barrel-shaped, 1.1 mm, lateral wall undulated in distal half.

Remarks

Thyroscyphus fruticosus and *T. torresii* share many characters, particularly in size of colony, habit and choice of habitat (Watson 2000). Their morphological similarity has probably led to some past confusion of the species. In the present Indonesian material, just as in the Australian one described by Watson (2000), *T. torresii* is relatively easy to distinguish from *T. fruticosus* through the distinct nodes of the hydrocladia and the distinct marginal cusps of the hydrotheca. Other populations may show intermediate characters. The figure of *T. fruticosus* in Millard (1975, fig. 104) resembles more *T. torresii*. The colour of the African material, however, matches *T. fruticosus*. Living colonies of *T. fruticosus* are rose-pink, while *T. torresii* are golden-yellow to golden-brown (Watson 2000). Using this colour information and his figures, it is evident that Mammen (1965) confounded the two species. His material identified as *T. ramosus* is actually *T. fruticosus,* while his *T. fruticosus* material belongs to *T. torresii*. A good character to distinguish both species are the large nematocyst batteries in the interior lining of the hydrothecae of *T. torresii* (Splettstösser 1929). However, these nematocyst clusters are often lost in dredged material. Splettstösser (1929) used this character to establish the new genus *Cnidoscyphus*. The validity of this genus was emphasized by Vervoort (1993), but other recent authors, e.g., Bouillon (1985a), Calder (1983), and Watson (2000), did not use it. Such thick nematocyst pads are also found in many species of the Sertulariidae, the closest relatives of the Thyroscyphidae, and thus likely represent a plesiomorphy. Because plesiomorphic traits are not suitable for detecting monophyletic groups, the genus *Cnidoscyphus* is not used here either.

Mature gonothecae of this species have been described by Jäderholm (1903) and Splettstösser (1929). The gonothecae observed in the present material confirmed Jäderholm’s findings in that their distal half has an undulated wall. The male gonothecae may be more slender and smooth as Splettstösser’s (1929) figures suggest.

Distribution

Indonesia, northern and western Australia, Queensland, China Sea, Mergui Archipelago. Type locality: Prince of Wales Channel, Torres Strait, Australia.

***Thyroscyphus sibogae* Billard, 1930**

Fig. 51.

Thyroscyphus sibogae Billard, 1930: 230, fig. 1. – Pennycuik 1959: 198. – Gibbons & Ryland 1989: 427, fig. 41.

Material examined:
Kei Islands Expedition station 60, without gonothecae, few shoots on a synascidian.

Description

Colony forming erect shoots, up to 1 cm high, unbranched, without hydrocladia, with indistinct alternately oblique nodes, internodes smooth or slightly undulated, with subterminal apophysis for hydrothecae, apophysis demarcated from hydrotheca by node. Hydrothecae alternating, in one plane.

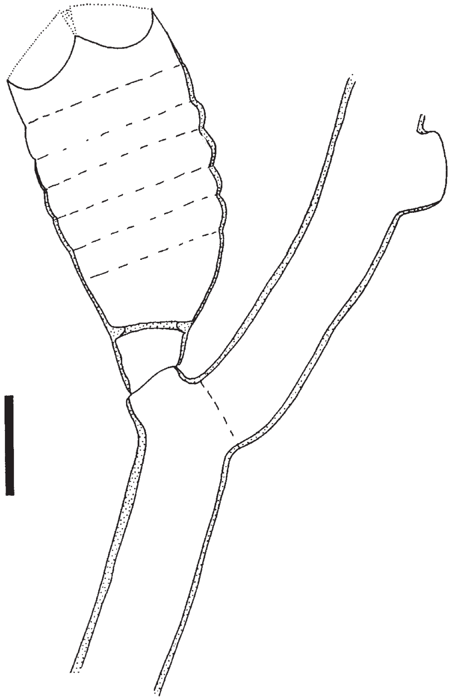

Fig. 51. *Thyroscyphus sibogae* Billard, 1930. Hydrotheca. – Scale: 0.2 mm

Hydrotheca campanulate, bilaterally symmetric, straight abcauline side and convex adcauline side, depth 0.5–0.6 mm, diameter at opening 0.33 mm, lateral wall with distinct transverse corrugation (about 6 bulges), margin with 4 pointed cusps and deep, round embayments between them, operculum pyramidal with four flaps, diaphragm an oblique perisarcal ring, more developed on adcauline side. Pedicel of hydrotheca annulated or not.

Gonothecae absent, according to Gibbons & Ryland (1989) arising from hydrothecal apophyses, pedicellate, annulated, usually directed horizontally and down, not in the same plane as the remainder hydrothecae; obovoid, truncated distally; aperture with four cusps and operculum of four flaps.

Remarks

The corrugated, small hydrothecae distinguish this species from all other congeners in the Indonesian region.

Distribution

Eastern Indonesia, Great Barrier Reef, Fiji. Type locality: Timor.

Family Syntheciidae

***Synthecium flabellum* Hargitt, 1924**

Fig. 52.

Synthecium flabellum Hargitt, 1924: 497, pl. 6: fig: 24. – Gravier-Bonnet 1979: 41.

Synthecium samauense in part Billard, 1925a: 646, fig. 1A (not others). – Billard 1925b: 132, fig. 7C–E, pl. 7: fig. 3 (not others).

Sertularia tubitheca. – Pictet 1893: 51–52, pl. 2: figs 44–45. – von Campenhausen 1896b: 309. [Not *Synthecium tubithecum* (Allman, 1877)]

?*Synthecium megathecum* Billard, 1925a: 648. – Billard 1925b: 130, fig. 6, pl. 7: fig. 2.

Type material examined:
Synthecium flabellum Hargitt, 1924, NMNH reg. number USNM 42514, in formaldehyde, overgrown by *Hebella* spec. – *Synthecium samauense* Billard, 1925, ZMA number Coel 3835, Siboga station 60, tube labelled by Billard as female type, only colonies with gonothecae belong to *S. flabellum*, infertile ones are *S. samauense*.

Other material examined:
ZMA no. Coel 3833, Siboga station 274, identified as *S. samauense* by Billard, fertile female colonies. – Kei Islands Expedition, Neira Island, Banda Islands, Indonesia, 10 m, coll. 5 Jun 1922, few stems on black sponge and hydroids, with female gonothecae, overgrown by *Hebella* sp. – MHNG INVE 32194, as *Sertularia tubitheca*, Ambon, 16 Aug 1890, material of Pictet (1893), overgrown by *Hebella* sp.

Description

Colonies pinnate, 2–4 cm in height. Stolons tubular, thick. Stems flexible, with opposite pairs of hydrocladia, 4–6 per side, stem without nodes, hydrocladia without distinct apophysis, with 2 or more pairs of opposite hydrothecae between successive hydrocladia.

Hydrocladia straight, unbranched, some with terminal tendrils, up to 2.5 cm long, nodes rare, with two rows of opposite hydrothecae, the pairs of hydrothecae not contiguous, successive hydrothecae of one row not in contact and quite distant, the median planes of the two rows form an angle < 180°.

Hydrotheca tubular, recurved 60–75°, opening inclined upwards, abcauline side adnate for 3/5–2/3 of its length, opening diameter 0.25–0.30 mm (mean 0.27, S.D. 0.017, n = 6, 3 colonies), length free part of adcauline side 0.25–0.40 mm, length adnate part 0.57–0.67 mm. Margin of opening planar or sinuous, slightly everted, often renovated several times, without operculum.

Only female gonothecae seen, developing from within stem hydrothecae, 0.9–1.1 mm long, diameter 0.7–0.8 mm, egg-shaped, with distal nipple-shaped process, not flattened, walls smooth; terminal opening small; containing one egg of 0.5–0.6 mm diameter.

Nematocysts: I, abundant tentacular capsule, almond-shaped, 5.5 x 1.5 µm, probably a mastigophore. II, large isorhiza, (40–43) x (10–11) µm. III, smaller isorhiza 17 x 5 µm.

Remarks

Synthecium flabellum Hargitt, 1924 is a little known species and Gravier-Bonnet (1979) suggested that it could be conspecific with *S. samauense* Billard, 1925. Re-examination of the type material of *Synthecium flabellum* and *S. samauense* showed that part of Billard's type material of *S. samauense* indeed belongs to *S. flabellum*, while the remainder of the type mate-

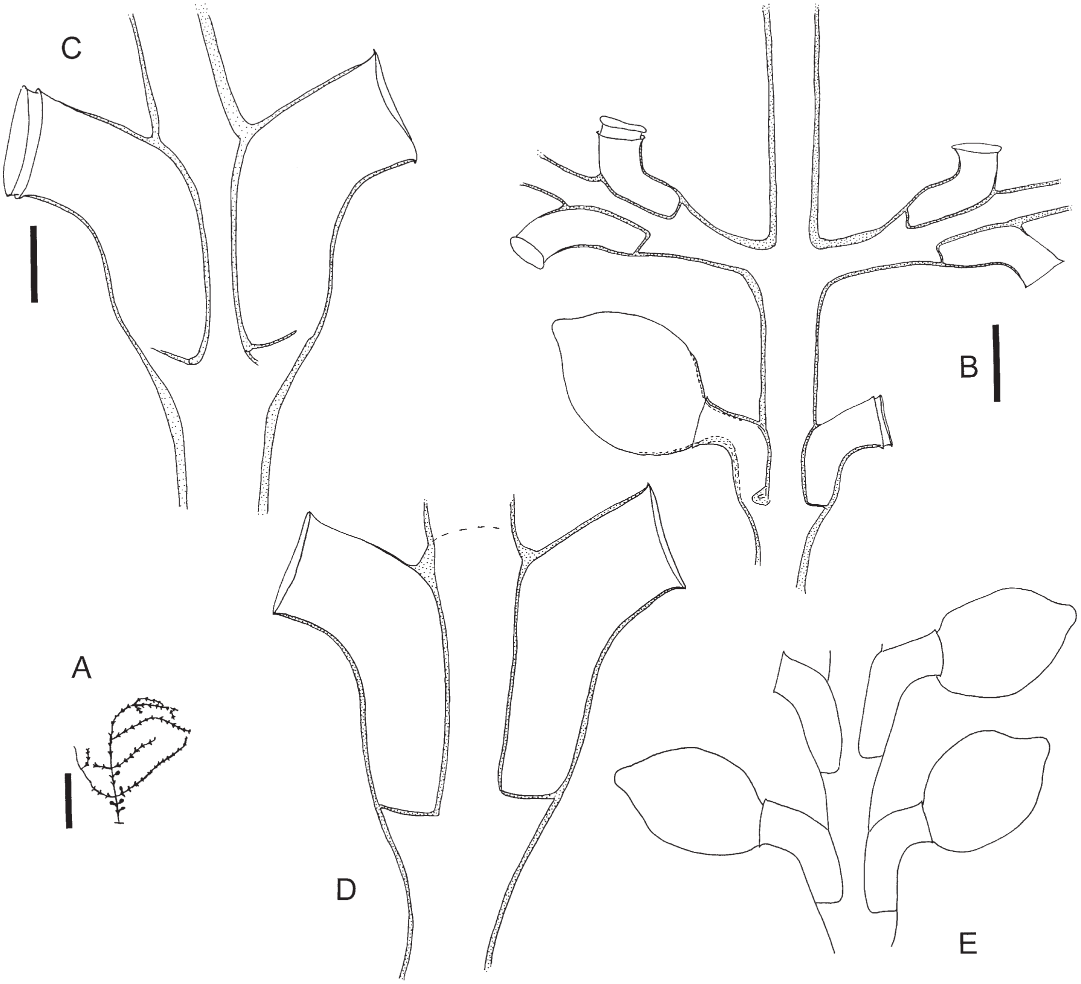

Fig. 52. *Synthecium flabellum* Hargitt, 1924; A–C, Banda Islands; D–E, type material. A. Colony silhouette. B. Part of stem, hydrocladia, and female gonotheca. C. Pair of hydrothecae. D. Pair of hydrothecae, same scale as C. E. Part of stem with female gonothecae. – Scales: A = 1 cm; B & E = 0.5 mm; C = 0.2 mm

rial belongs to *S. samauense sensu lato*. For more details see under *S. samauense*.

Especially the characteristic female gonothecae resembling a lemon was important for recognizing the species (Fig. 52B). The male gonothecae of this species are so far unknown, but it is very probable that *Synthecium megathecum* Billard, 1925b is nothing but the male of *S. flabellum*. Billard kept *Synthecium megathecum* separate from other congeners on account of its large hydrothecae. Billard (1925b) gives for *Synthecium megathecum* a hydrotheca diameter of 0.28–0.33 mm, which largely overlaps with the here observed values for female *Synthecium flabellum* (0.25–0.30 mm).

Distribution

Philippines, Indonesia. Type locality: Philippine Islands.

Synthecium samauense Billard, 1925

Fig. 53.

Synthecium samauense in part Billard, 1925a: 646, fig. 1B. – in part Billard 1925b: 132, fig. 7A-B. – Vervoort & Vasseur 1977: 24, figs 10–13. – Gibbons & Ryland 1989: 398, fig. 16.

Type material examined:
Synthecium samauense Billard, 1925, ZMA no Coel 3835, Siboga station 60, Haingsisi; comprises two tubes: one tube labelled by Billard as male type containing several male colonies as depicted in Billard (1925b: fig. 7A–B), but also one colony with female gonothecae; this female colony placed in new tube and designed here as lectotype. The tube labelled by Billard as female type contains several colonies: some fertile females with distinctly larger hydrothecae and some distinctly more gracile ones without gonothecae. The latter are presumably also *S. samauense*, while the fertile colonies are clearly *S. flabellum* Hargitt, 1924.

Other material examined:
ZMA Coel 3835, Siboga station 282, as *Synthecium samauense*, with gonotheca, soft tissue not well preserved but shape and dimensions conforms with lectotype. – Kei Islands Expedition, Waling, Banda Island, Indonesia, 20 m, coll. 11 Jun 1922, on sponge, several stems with female gonothecae, some empty.

Differential diagnosis

Like *Synthecium flabellum*, but colonies 1–2 cm, hydrotheca distinctly narrower, diameter of opening 0.16–0.20 mm (mean 0.175, S.D. 0.017, n = 15, 4 colonies), length of free adcauline wall 0.15–0.31 mm, length adnate part 0.48– 0.55 mm, occasionally some hydrothecal pairs contiguous. Female gonotheca ovoid-lenticular, broader side horizontal, smooth walled or slightly undulated, length 1.1 mm, thickness 0.65 mm, without nipple-shaped distal process, opening sometimes with indistinct collar, one egg of 0.5–0.6 mm. Male gonothecae elongated pod-shaped, 1.6 mm long, somewhat flattened, broader side held horizontally, wall with or without gentle undulation, terminal opening, pedicel within hydrotheca and not at right angle to body of gonotheca.

Remarks

When describing *Synthecium samauense*, Billard (1925b) noted that the dimensions of the hydrothecae in his material permitted the distinction of two separate morphotypes, this even within the specimens from the type locality. Billard interpreted this as sexual dimorphism as his obvious female colonies belonged to the morphotypes with larger hydrothecae. Vervoort & Vasseur (1977) re-examined Billard's type material from Siboga station 60 and found no female gonothecae and all dimensions of the investigated material were rather homogeneous. The female gonothecae observed by Vervoort & Vasseur (1977) in material from Moorea deviated clearly from the one depicted in Billard (1925b) as they lacked the nipple-shaped process and they were flattened. Identical material from Fiji was later described by Gibbons & Ryland (1989). Because the material of *Synthecium* species from the Kei Islands expedition presented considerable difficulties for identification, and because there were also two sets of colonies with distinctly different dimensions and gonothecae, I compared it to Billard's type material, the non-type material from the Siboga collection and the holotype of *Synthecium flabellum* Hargitt, 1924 as well.

Re-examination of the type material of *Synthecium samauense* convinced me that it is composed of two species. The type material from Siboga station 60 is separated into two tubes with labels made by Billard: one labelled as female, one as male. The tube labelled as female contains several stems, some of them with gonothecae. The infertile stems in this tube are clearly distinct as they have narrower hydrothecae. It seems thus, that Vervoort & Vasseur (1977) did not have the complete type series at hand. In fertile female stems, the eggs are clearly visible in the gonothecae, and these specimens are identical to the holotype of *Synthecium flabellum* Hargitt, 1924. The infertile stems are here regarded as belonging to *S. samauense*. The sample labelled as containing male colonies contains also several stems, most of them with male gonothecae as figured in Billard (1925b). The dimensions of the hydrothecae do not vary significantly and the specimes are distinguishable from the larger *S. flabellum*. One of the fertile colonies in the tube reportedly containing male *S. samaunese*, however, has short gonothecae and closer inspection (temporary clearing in 50% lactic acid) revealed it to be female (Fig. 53F). Because it is evident that Billard's type material of *S. samauense* contains two species, this female stem was chosen as lectotype and placed in a separate tube. The remainder of the tubes are the stems with male

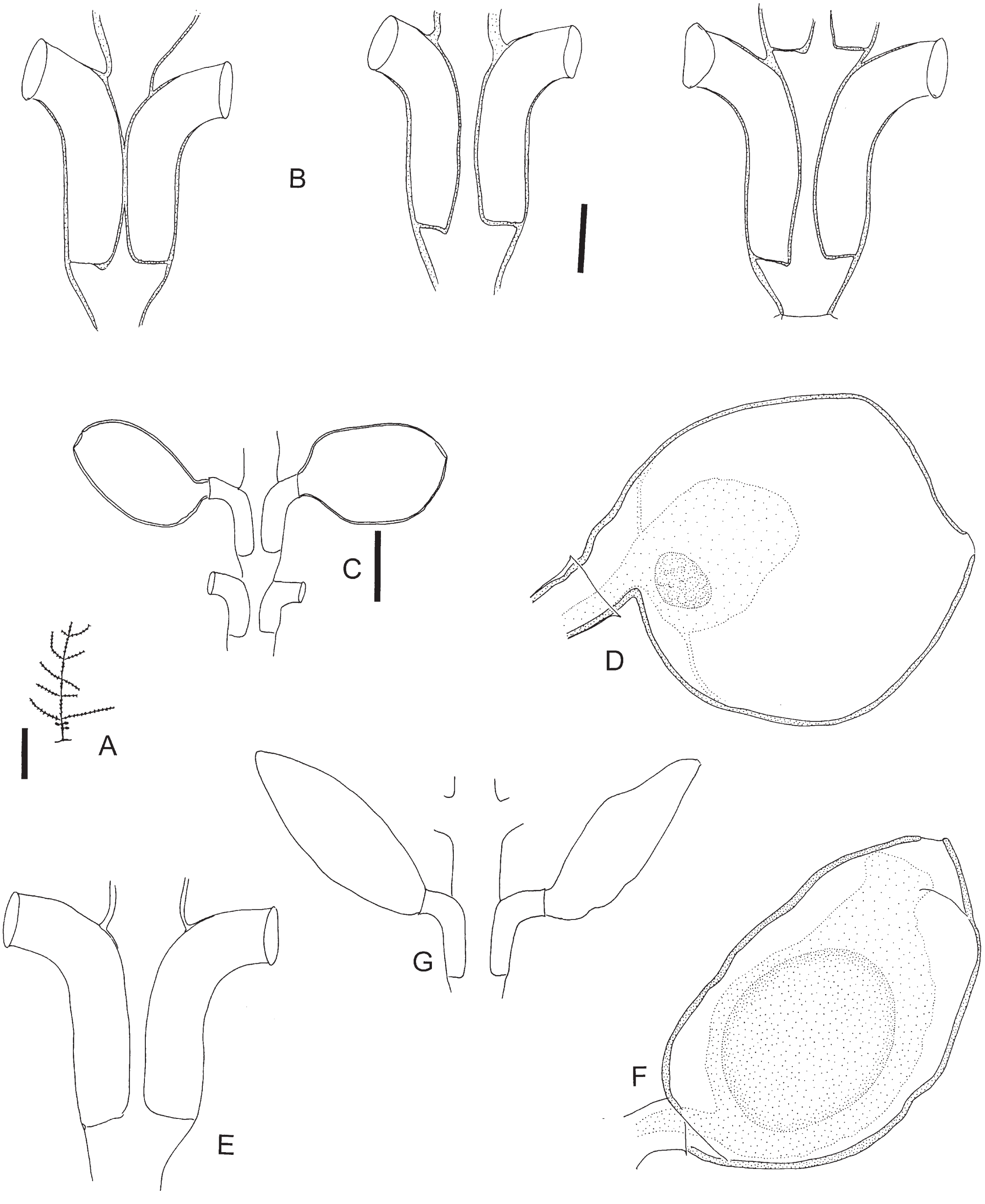

Fig. 53. *Synthecium samauense* Billard, 1925; A–D, from Banda Islands; E–F, lectotype; G, male type colony. A. Colony silhouette. B. Three pairs of hydrothecae, note variation of separation and length of free part. C. Female gonothecae. D. Female gonotheca seen from broad (upper) side with tissue inside (incipient egg stippled dark), same scale as B. E. Pair of hydrothecae, same scale as B. F. Female gonotheca in side view, egg stippled dark, same scale as B. G. Pair of male gonothecae in side view, same scale as C. – Scales: A = 1 cm; B, D–F = 0.2 mm; C, G = 0.5 mm.

gonothecae. By choosing the female colony with the smaller dimensions as lectotype, Billard's species remains valid and does not become a subjective synonym of *S. flabellum*. Furthermore, Vervoort & Vasseur's (1977) and Gibbons & Ryland's (1989) identifications remain correct by this procedure.

The validity of both *S. samauense* and *S. flabellum* is underlined by the sympatric occurrence of their respective morphotypes (Siboga station 60, Banda Islands). *Synthecium samauense* and *S. flabellum* can be distinguished on account of the differently shaped female gonothecae and the dimension of the hydrotheca. *Synthecium samauense* has a lenticular female gonothecae, while *S. flabellum* has a spherical one with a nipple-shaped process. The hydrothecal diameter of *S. samauense* is like most of the congeners of the region (0.16–0.20 mm), while *S. flabellum* has a diameter of 0.25–0.30 mm. The diameters are more obviously different than other dimensions of the hydrotheca.

With its new, restricted scope, *Synthecium samauense* is not easy to separate from *S. orthogonium* or *S. campylocarpum*, at least for the material encountered in this study. The regular corrugation of the gonothecae of *S. orthogonium* is the only reliable character to separate it from *S. samauense*. *Synthecium campylocarpum* forms larger colonies (6 cm versus 1–2 cm) and has male gonothecae with a pedicel inserting at a right angle.

More material of all morphotypes must be examined to consolidate the validity of all *Synthecium* species discussed here. As shown by Watson (2000), life observation of colour and ecology might provide additional and more reliable characters to separate them.

Distribution

Indonesia, Polynesia, New Caledonia. Type locality: Hainsisi, Indonesia.

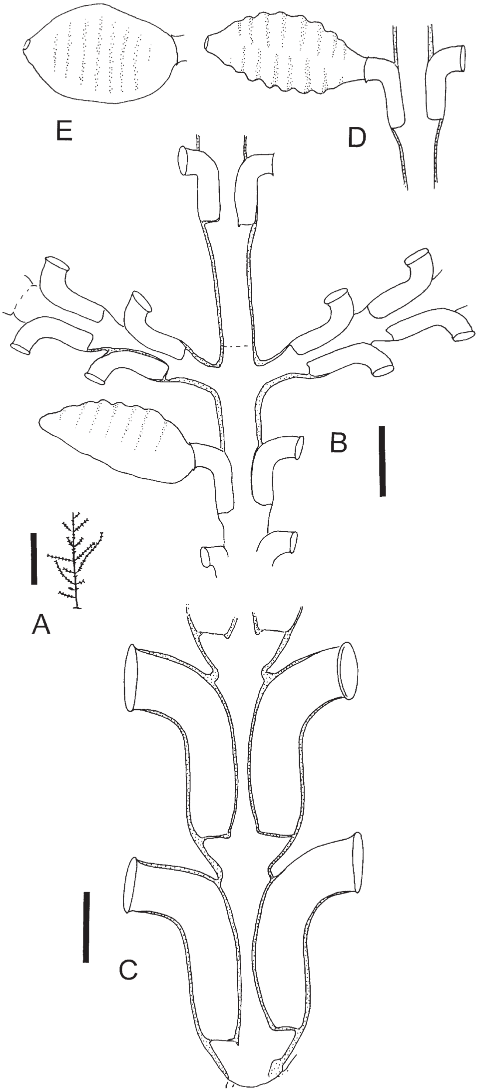

Fig. 54. *Synthecium orthogonium* (Busk, 1852). A. Colony silhouette. B. Part of stem with two hydrocladia and gonotheca with smooth underside. C. Hydrothecae of hydrocladium. D. Gonotheca in side view, upper and underside are corrugated, same scale as B. E. Gonotheca seen from broad side, same scale as B. – Scales: A = 1 cm; B, D–E = 0.5 mm; C = 0.2 mm.

***Synthecium orthogonium* (Busk, 1852)**

Fig. 54.

Sertularia orthogonia Busk, 1852: 390.

Synthecium orthogonium. – Stechow & Müller 1923: 465. – Watson 2000: 41, fig. 32A–F, table 4.

Not *Synthecium orthogonium*. – Bale 1888: 767. – Bale 1924: 250. [= *S. campylocarpum*]

Synthecium patulum. – Billard 1925b: 125, figs 2–3. – Vervoort 1941: 199, fig. 2.

Synthecium patulum var. *elongatum* Billard, 1925b: 128, fig. 4. [Not *Synthecium patulum* (Busk, 1852)]

Material examined:
Kei Islands Expedition station 67, on *Idiellana pristis*, several fertile plumes.

Description

Colonies pinnate, up to 3 cm. Stolons tubular, thick. Stems with opposite hydrocladia, 6–8 per side, stem with indistinct transverse nodes, hydrocladia at distal end of internodes, without distinct apophysis, 1–3 pairs of opposite hydrothecae per stem internode bearing hydrocladia.

Hydrocladia straight, unbranched, up to 1 cm long, nodes rare, with two rows of opposite hydrothecae, the pairs of hydrothecae not contiguous, successive hydrothecae of one row not in contact but rather close, the median planes of the two rows form an angle < 180°.

Hydrotheca tubular, recurved 90°, opening-plane parallel to hydrocladial axis, abcauline side adnate for 2/3, opening diameter 0.14–0.15 mm, length free part of adcauline side 0.20–0.25 mm, length adnate part 0.45 mm. Margin of opening planar and not sinuous, slightly everted, often renovated several times, without operculum.

Gonothecae arise from within stem hydrothecae, 1.2 mm long, oblong ovoid, somewhat flattened, broader sides horizontal, either both sides corrugated or upper side corrugated and underside smooth, corrugations fading out towards periphery, if both sides corrugated, the crests do not meet at the narrow sides, the crests of both sides are out of phase; opening terminal, small.

Nematocysts: I, abundant tentacular capsule, almond-shaped, 5.5 x 1.5 µm, probably a mastigophore. II, large isorhiza, holotrichous, (40–43) x (10) µm, on hydranth body, thread well visible in un-discharged capsule. III, smaller isorhiza, (19–23) x (5–6) µm, on hydranth body.

Remarks

The sample identified here as *S. orthogonium* agreed well with the figures and dimensions given in Watson (2000) and there can be little doubt that they belong to the same species.

Because Busk (1852) himself somewhat doubted the validity of *Synthecium orthogonium* (Busk, 1852), most authors referred this species to *S. patulum* (Busk, 1852) (e.g., Billard 1925b, Rees & Vervoort 1987). Watson (2000) showed that both are distinct species, although separating the two is not trivial. *Synthecium patulum* is restricted to temperate waters of southern and south-eastern Australia, while *S. orthogonium* is a species occurring in tropical waters. Living colonies of *S. patulum* have a characteristic reddish-purple colour, which is, however, lost in preserved material.

Synthecium campylocarpum Allman, 1888 has likewise been synonymized by many authors with *S. patulum* and *S. orthogonium* (e.g., Billard 1925b, Rees & Vervoort 1987). Watson (2000) re-examined type material and provided evidence that it can be distinguished from both of them, although the differences are minimal (see remarks under *S. campylocarpum*).

There is little, except for biogeographic arguments, to distinguish *Synthecium orthogonium* (Busk, 1852) from *S. tubithecum* (Allman, 1877), a species of the warm Atlantic Ocean (see Calder 1991 for description). The two could be indistinguishable, but not necessarily belong to the same biological species.

Distribution

Indonesia, northern Australia, ?Queensland, ?Papua New Guinea. Depth range: usually less than 100 m, one record of 400 m (Billard 1925b). Type locality: Torres Strait, Australia.

***Synthecium campylocarpum* Allman, 1888**

Fig. 55.

Synthecium campylocarpum Allman, 1888: 78, pl. 37: figs 1 & 1a–c. – von Campenhausen 1896b: 310, fig. 6. – Billard 1910: 26, fig. 10. – Ralph 1958: 347, fig. 15c–g. – Watson 2000: 40, figs 30A–G, 31A–C.

Synthecium orthogonium. – Bale 1888: 767. – Bale 1924: 250.

Synthecium patulum. – Millard & Bouillon 1973: 64, fig. 8J. – Millard & Bouillon 1975: 12, fig. 3C–E. [Not *Synthecium patulum* (Busk, 1852)]

Material examined:
Kei Islands Expedition, Samalon Island, Sulawesi, Ujungpandang, Indonesia, 25 m, sandy bottom, coll. 29 Jun 1922, one plume 6 cm and hydrocladium with male gonothecae.

Differential diagnosis

Like *Synthecium orthogonium*, but stems larger (6 cm), stem thick, lower half of stem without hydrothecae between successive hydrocladia,

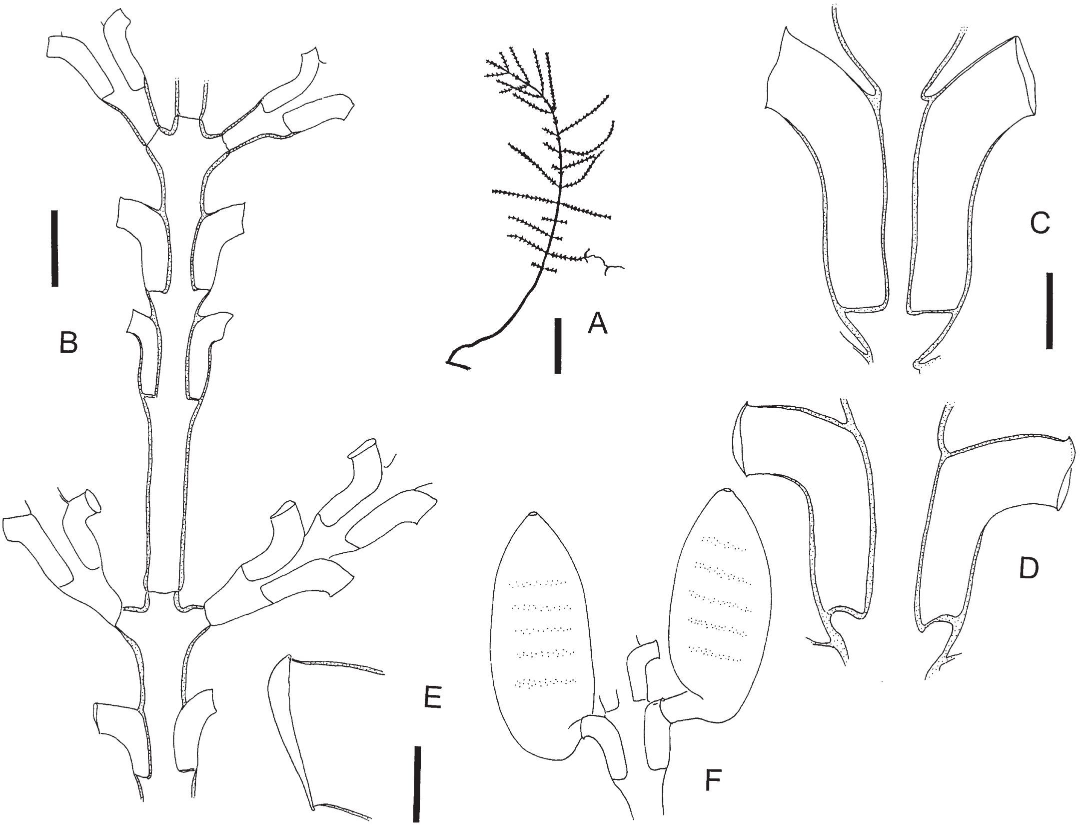

Fig. 55. *Synthecium campylocarpum* Allman, 1888. A. Colony silhouette, note apical tendril on second hydrocladium on right. B. Internodes of distal part of stem. C. Typical hydrothecae. D. More rare hydrothecae with sharper bend; from same colony and scale as shown in C. E. Hydrothecal margin with typical sinuous outline. F. Pair of male gonothecae, twisted so that broad sides are in plane of view, same scale as B. – Scales: A = 1 cm; B & F = 0.5 mm; C-D = 0.2 mm; E = 0.1 mm.

apophyses demarcated by node; hydrotheca usually less curved (60°) with opening inclined towards above, margin usually sinuous. Measurements: hydrothecal opening diameter 0.18–0.21 mm, free adcauline part 0.28–0.31 mm, adnate part 0.50–0.55 mm. Large isorhiza (49) x (12–13) µm, smaller isorhiza 24 x 6 µm.

Description of gonotheca

Only male gonothecae seen, develop inside hydrocladial hydrothecae, pod-shaped, flattened, 1.7 mm long, diameter in middle 0.7 mm, pedicel inserted at right angle slightly above lower end, broad sides gently undulated, upper end pointed with small opening.

Female gonothecae not seen, according to Ralph (1958) and Watson (2000) resembling the one of *S. orthogonium*.

Remarks

The identification of this material as *Synthecium campylocarpum* was largely influenced by Watson (2000), but I am not sure whether the differences from *S. orthogonium* are significant or represent intraspecific variation due to larger grown colonies. The material strongly resembles *S. orthogonium* and the traits of the trophosome used to distinguish it from the latter species are given in the section "*Differential diagnosis*". The most important differences are the larger stem, the less curved hydrothecae, and the sinuous hydrothecal margin. Although these traits generally agree with Watson's material of *S. campylocarpum*, they also show variation within the same plume that approached the characteristics of *S. orthogonium*. Some few hydrothecae are longer and curved for 90° (Fig. 55D), while other hydrothecae quite frequently lack the sinuous margin. A quite distinct difference to the material identified here as *S. orthogonium* is the paucity of cauline hydrothecae, even in internodes bearing hydrocladia. Only more distal stem internodes have hydrothecae (Fig. 55A–B). The figures by Allman (1888) show a similar situation. However, Watson (2000) indicates that also the basal internodes of *S. orthogonium* may lack hydrothecae. One dimension did not agree with Watson's measurements: the length of the free adcauline side of the hydrotheca. While Watson measured 0.1–0.17 mm, here 0.28–0.31 mm were found. It seems that new material of both species from different localities is needed to evaluate their status.

Distribution

Eastern Australia, northern Australia, Indonesia, Japan, ?New Zealand. Type locality: Off Sydney, Australia, 55–64 m.

Family Halopterididae

***Antennella campanulaformis* (Mulder & Trebilcock, 1909)**

Fig. 56.

Plumularia campanulaformis Mulder & Trebilcock, 1909: 31, pl. 1: figs 6, 9, 10.
Plumularia campanulaformis var. *dubia* Mulder & Trebilcock 1911: 115, pl. 2: fig. 6.
Antennella campanuliformis. – Watson 1973: 182, figs 43–44.
Halopteris diaphana. – Millard & Bouillon 1973: 82, fig. 10L–M.
Antennella campanulaformis. – Schuchert 1997: 24, fig. 7.

Material examined:
Kei Islands Expedition, Banda Islands, Kombir, 70–90 m, 6 Jun 1922, numerous shoots with gonothecae, on sponge and presumable polychaete tubes made of sand grains.

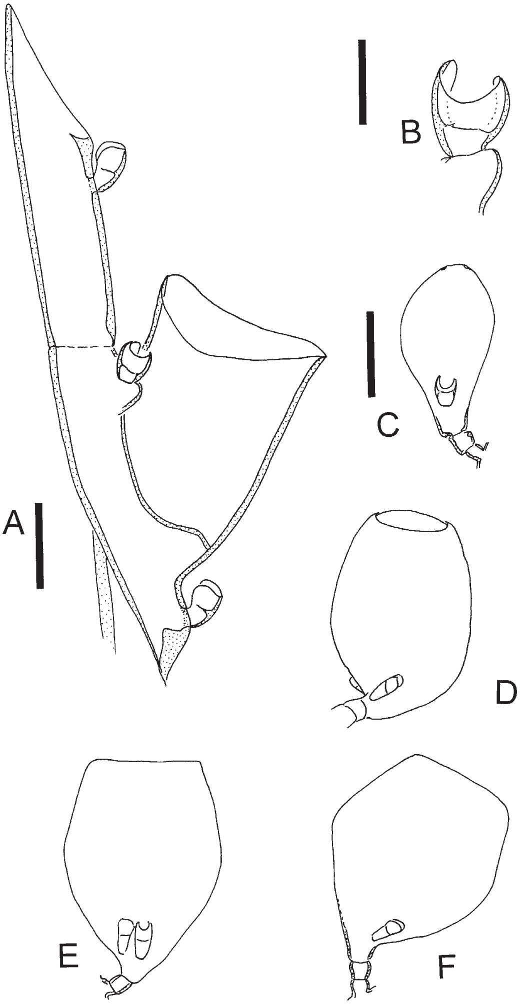

Fig. 56. *Antennella campanulaformis* (Mulder & Trebilcock, 1909). A. Part of stem with main- and intersegment. B. Lateral nematothecae and apophysis seen from outer side. C. Male gonotheca. D–F. Female gonothecae, same scale as C. – Scales: A = 0.1 mm; B = 50 µm; C–F = 0.2 mm.

Description

Colonies erect, shoots thread-like, not branching, lacking hydrocladia, 1–1.5 cm high. Stolons creeping, tubular, ramified. Stems heteromerously segmented by alternating, distinct, oblique nodes and less distinct transverse nodes, delimiting main segments bearing a hydrotheca and intersegments without hydrotheca. First node oblique, in stem region below first node 1–3 median nematothecae, sometimes on a separate segment flanked by two oblique nodes. Main segment 0.8 mm long, with central hydrotheca and three nematothecae: one median inferior and two laterals. Intersegment of variable length, 0.4–0.6 mm, with a single nematotheca near its distal end.

Hydrotheca cylindrical to campanulate, held at an angle of 30–40° to segment axis, length abcauline side 0.25–0.27 mm, diameter of opening 0.20–0.21 mm, margin sinuous, sometimes somewhat everted.

Nematothecae movable. Lateral nematothecae on short, rounded apophysis. Nematothecae about 50 µm high, egg-shaped, two-chambered, upper chamber larger, walls incurved, abcauline and adcauline side with round emarginations, adcauline notch deeper and broader, reaching bottom of upper chamber. Hydranth small, fits into hydrotheca, about 16 tentacles.

Male and female gonothecae present in same colony, often on same stem; if so, female gonothecae distal to male ones. Female gonotheca 0.5 mm long, egg-shaped, flattened, end truncated, when mature with large convex operculum, two nematothecae near base of gonotheca, pedicel of gonotheca with one separate segment attached to an apophysis originating below hydrothecae. Female gonothecae contain one egg only. Male gonotheca 0.4 mm, egg-shaped to oblong, distal end more pointed, operculum small, one nematotheca near base.

Nematocysts: I, small tentacular capsule, 6 x 2 µm. – II, microbasic mastigophore in nematophores, (16–18) x (5) µm, almond-shaped, discharged shaft 0.7 times the capsule length.

Remarks

Antennella campanulaformis has recently been reported to occur in the north-eastern Atlantic (Ansín Agís, Ramil & Vervoort 2001), but Peña Cantero & Garcìa Carrascosa (2002) referred this population to a new species, *Antennella ansini*. The main character to distinguish *A. ansini* from *A. campanulaformis* is the occurrence of male and female gonothecae on separate stems.

Distribution

Australia, Seychelles, Indonesia (new record). Depth range 1–90 m. Type locality: Barwon Heads, Victoria, Australia.

Antennella secundaria (Gmelin, 1791)

Fig. 57.

Sertularia secundaria Gmelin, 1791: 3856.

Plumularia secundaria. – Pictet 1893: 53, pl. 2: fig. 26.

Antennella secundaria. – Billard 1913: 8, fig. 1, pl. 1: figs 1–3. – Stechow & Müller 1923: 473. – Mammen 1967: 296, fig. 93. – Millard & Bouillon 1973: 77, fig. 10E. – Millard 1975: 332, fig. 107F–L. – Vervoort & Vasseur 1977: 64, fig. 28. – Calder 1997: 29, fig. 7, synonymy. – Ryland & Gibbons 1991: 525, fig. 1. – Cornelius 1995b: 121, fig. 28 A–C, E–G, not D. – Hirohito 1995: 236, fig. 79a–c. – Schuchert 1997: 14, figs 3–4, synonymy. – Watson 1997: 522, fig. 6A–B. – Watson 2000: 45, fig. 34A–D. – Ansín Agís, Ramil & Vervoort 2001: 140, fig. 63, bib-liography.

Material examined:

Kei Islands Expedition stations: 65, male and female gonothecae present. – 67, on *Diphasia digitalis*, no gonothecae. – 68, on hydroids, no gonothecae. – 71, on sponge and stolons of other hydroids, no gonothecae. – 90, on hydroids, with female and male gonothecae, two samples. – 104, on hydroids, male and female gonothecae present. – 106, on hydroids, no gonothecae. – 107, on Bryozoa, no gonothecae. – 110, on hydroids, no gonothecae. – 111, only female gonothecae present. – Kei Islands Expedition, 5.12°S, 119.34°W, Ujungpandang, Samalon Island, 35 m, 28 Jun 1922, on Bivalvia, no gonothecae. – MNHG INVE 25024, Bay of Ambon, Moluccas, material of Pictet (1893, as *Plumularia secundaria*), no gonothecae. – MHNG INVE 32969, Banyuls-sur-Mer, France, Mediterranean, 15 May 2002, 62 m, on *Protula* sp., female gonothecae distal to male ones, living colony yellow-greenish.

Description

Colonies erect, shoots thread-like, lacking hydrocladia, mostly unbranched, fertile stems 0.8–2 cm high. Stolons tubular, ramified. Basal part of stem without hydrothecae, stem above basal part heteromerously segmented by alternating oblique and transverse nodes. Main segments with hydrotheca and four nematothecae: one median inferior, two lateral of hydrotheca, and one axillary behind hydrotheca. Main segment quite short, hydrotheca project beyond transverse node. Intersegments mostly with two nematothecae, rarely some segments with three, length variable within and between stems.

Hydrotheca cup-shaped, walls in side view rather straight, converging towards below, margin sinuous, opening forming an angle of 45 to 55° with the main axis, adcauline side adnate for half of its length or less, length of abcauline side 0.19–0.26 mm, opening diameter 0.20–0.23 mm.

Nematothecae all two-chambered. Median inferior nematothecae with adcauline wall of upper

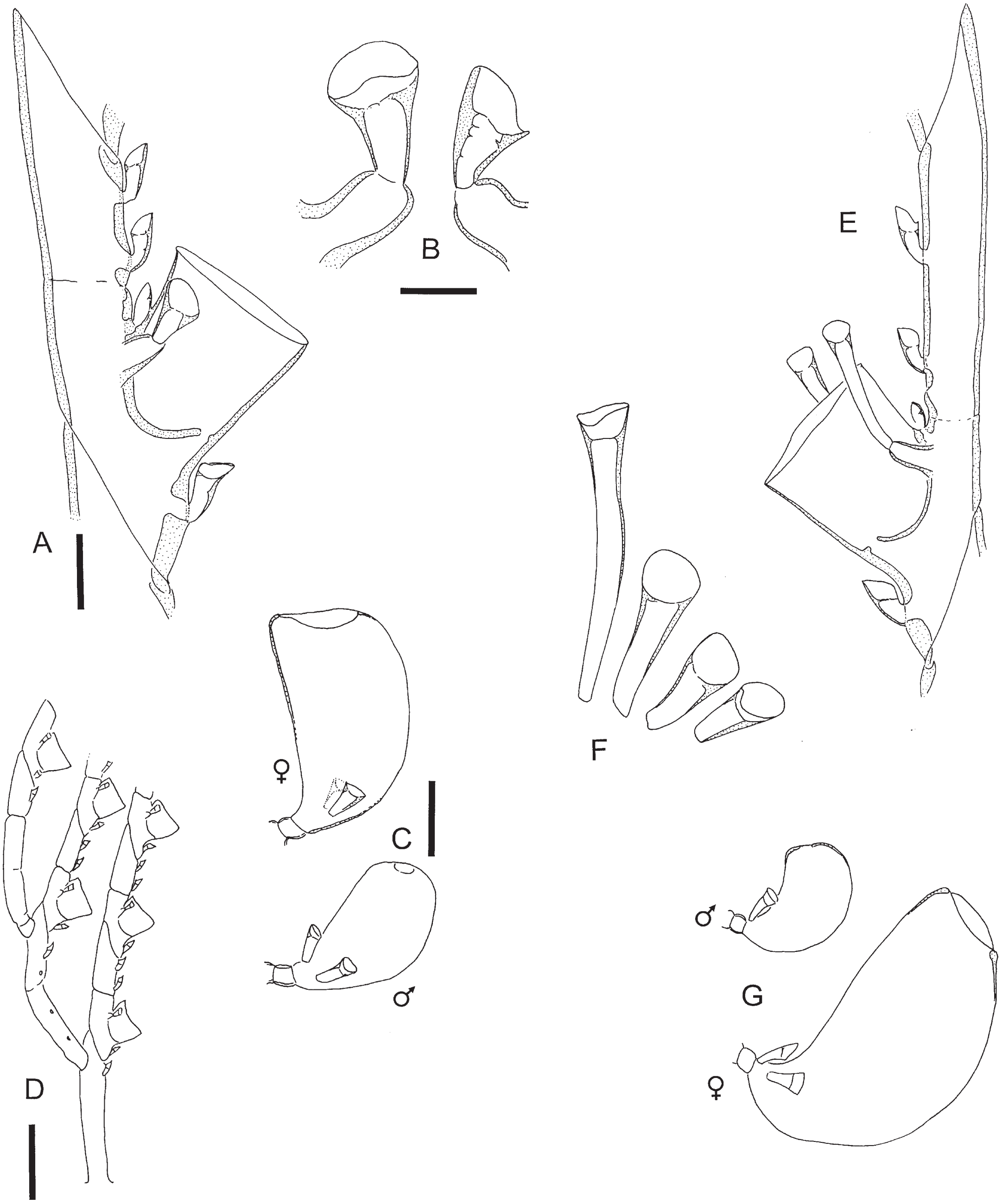

Fig. 57. *Antennella secundaria* (Gmelin, 1791); A-D, station 104, colonies having short lateral nematothecae only; E–G, colonies with long lateral nematothecae, E & G, station 90, F, station 67. A. Part of stem with main- and intersegment. B. Two lateral nematothecae and apophysis, left one seen from inner side, right one in side view. C. Female and male gonothecae. D. Basal part of a branched stem. E. Part of stem, main- and intersegment, same scale as A. F. Size variation of lateral nematothecae of single stem, same scale as B. G. Gonothecae, same scale as C. – Scales: A, E = 0.1 mm; B, F = 50 µm; C, G = 0.2 mm; D = 0.5 mm.

chamber much lowered. Lateral nematothecae on long apophysis, conical, walls straight and not incurved, adcauline wall of upper chamber lowered, sometimes bilabiate; length of laterals very variable even within the same stem, usually 0.07 mm and not reaching beyond hydrothecal rim but in Indonesian material frequently longer, sometimes up 0.3 mm long. Axillary nematotheca rather variably developed, one side reduced.

Gonothecae of both sexes can occur on the same stem, developing below hydrothecae, male gonothecae either below female ones, above them, or mixed. Female gonotheca 0.6–0.8 mm long, diameter 0.4 mm, end truncate with large convex lid, pedicel segmented, near bas of gonotheca 2 nematothecae. Male gonotheca 0.3–0.4 mm, distal end more rounded and with small aperture, at base 1–2 nematothecae.

Nematocysts: I, small tentacular capsule. II, larger mastigophore in nematophores, (16–20) x (5.5–7) µm.

Remarks

Antennella secundaria is a well known, almost cosmopolitan species, and its taxonomy has been treated recently by several authors (see synonymy list above).

The study of the specimen here assigned to *Antennella secundaria*, however, brought up several problems. While some colonies have only short lateral nematothecae as seen in European populations (Fig. 57A–B), others have numerous very long lateral nematothecae that reach far beyond the rim of the hydrotheca (Fig. 57E–F). The same stems bearing these extremely long nematothecae invariably also have short nematothecae and all intermediate lengths. Sometimes there is even a long and a short nematotheca flanking the same hydrotheca. Such long lateral nematothecae have also been observed by Billard (1913, Indonesia), Millard (1975, South Africa), Rees & Vervoort (1987, Zanzibar). All these authors regarded them as variants of one species only. Billard (1913) thought that the long nematothecae could be regenerated ones. Mammen (1967) thought that Billard's material with long nematothecae belonged to a different species and he tentatively allocated them to *A. allmani* Armstrong, 1879.

I was unable to find any other significant character that co-varied reliably with the presence of long lateral nematothecae and thus prefer the hypothesis that only one species is present. The stems having long nematothecae never showed any branching, while those with short nematothecae occasionally have branched stems (see below). This correlation could, however, be purely coincidental.

The respective position of the male and female gonothecae is another problem. In Mediterranean (type locality) and South African populations, the male gonothecae are below the female ones. These observations are based on very few observations and it is not clear how variable this arrangement is. Watson (2000) found in an otherwise typical specimen from northern Australia a reversed order. A mixed arrangement was reported by Ryland & Gibbons (1991) in material from Fiji and by Hirohito (1995, fig. 79c) in a Japanese specimen. In the material examined here, colonies with short nematothecae had either the male gonothecae below the female ones, or they were mixed. In one colony having long lateral nematothecae the male gonothecae were distal to the female ones. It seems thus that at least Pacific populations of *A. secundaria* have a variable the arrangement of the male and female gonothecae in monoecious stems.

Some stems examined in this study were branched 2–3 times (Fig. 57D). The observed branching pattern is characteristic for the genus *Monostaechas* (see Schuchert 1997). Identical branched stems have also been described by Billard (1913), Millard & Bouillon (1973), Watson (1975), Vervoort & Vasseur (1977), Ryland & Gibbons (1991), and Calder (1997). The "*Monostaechas*"-like branching seems thus to be a characteristic trait of most populations of *A. secundaria*. Billard (1913) noted that the branching of *A. secundaria* and *Monostaechas* are different in that in the latter species a new axis is formed by the successive basal stem segments. I think this is not really tenable and that there is no fundamental difference. This renders *Monostaechas quadridens* (McCrady, 1859) only gradually different from *A. secundaria*. While it is absolutely justified to regard *M. quadridens* as a distinct species, the validity of the genus *Monostaechas,* however, is clearly undermined. The same problem exists for the genus *Halopteris* and a new discussion on generic limits in the family Halopterididae is needed. As a further difference it was found that the Indonesian specimen had mastigophores that are nearly twice as long as the ones found in specimens from Europe (cf. Schuchert 1997).

Distribution

Cosmopolitan species with a distinct preference for temperate and tropical waters, occurring from the subtidal zone down to 1250 m. Type locality: Mediterranean.

Halopteris plagiocampa **(Pictet, 1893)**

Fig. 58.

Plumularia plagiocampa Pictet, 1893: 56, pl. 3: fig. 50. – Billard 1913: 31, fig. 23. – Jäderholm, 1919: 21.

Halopteris plagiocampa. – Schuchert 1997: 117, fig. 42. – Watson 2000: 47, fig. 36A–C.

Type material examined:
MHNG INVE 25021, holotype of *Plumularia plagiocampa*, slide preparation.

Material examined:
Kei Islands Expedition station 11, infertile, on sponge. – Kei Islands Expedition Samalon Island, Ujungpandang, Sulawesi, 28 Jun 1922, 35 m, infertile, on polychaete tube.

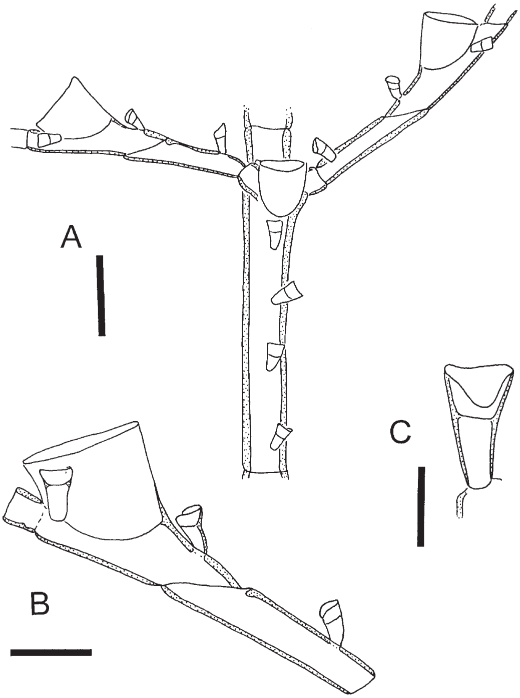

Fig. 58. *Halopteris plagiocampa* (Pictet, 1893); station 11. A. Stem segment and proximal parts of hydrocladia. B. Repeated unit of hydrocladium (main- and intersegment). C. Lateral nematotheca seen from inner side. – Scales: A = 0.2 mm; B = 0.1 mm; C = 50 µm.

Description

Colonies erect, pinnate, hydrocladia in opposite pairs, stems 1–2 cm high. Stem monosiphonic, straight, unbranched, with basal part devoid of hydrothecae and hydrocladia and a longer distal part. This distal part homomerously segmented by transverse nodes, in terminal region sometimes heteromerously segmented through an oblique node below hydrotheca. Each cauline segment with a hydrotheca at its distal end, hydrotheca flanked by two opposite apophyses for the hydrocladia; three nematothecae in association with the hydrotheca: two lateral and one median inferior; below cauline hydrotheca on the fused intersegment 3–4 median nematothecae.

Up to 16 hydrocladia per side. Apophysis followed by a short, quadrangular segment, both lacking a nematotheca. Remaining part of hydrocladium heteromerously segmented by alternating oblique and transverse nodes, often with a quadrangular segment without nematothecae intercalating between main- and intersegments. Intersegments proximal to main segment, with a single median nematotheca. Main segments with three nematothecae: one median inferior and a pair of laterals.

Hydrotheca cup-shaped, placed in middle of main segment, margin reaches to distal end of segment, rear- and frontal wall quite straight and roughly parallel in side view. Hydrotheca adnate for about half its length, rim smooth and flat, opening forming an angle of about 40 to 50° with hydrocladial axis. Depth of hydrotheca 0.12 mm, diameter 0.15 mm.

Nematothecae of stem and hydrocladia all two-chambered and movable. Median inferior nematotheca of main segments conical, adcauline wall of upper chamber lowered. Lateral nematothecae on very short pedicel or pedicel lacking, conical, walls straight, rim deeply emarginated on inner side. Nematothecae of intersegments similar to median inferior but with longer lower chamber.

Gonothecae absent in present material, see Schuchert (1997) for a description and figures.

Remarks

The type material of *Halopteris plagiocampa* (Pictet, 1893) was recently located (see Schuchert 1997) and was re-examined for this study. The new material from the Kei Islands Expedition was indistinguishable from the type material.

My previous description of the stem segmentation (Schuchert 1997) is not entirely correct. Nearly the whole stem is segmented by transverse nodes only, except for the most distal part where an oblique node below the hydrotheca can delimit an intersegment. In the homomerously segmented part of the stem, the intersegments are thus fused to the lower end of the main segments. Contrary to the previously examined material, the lateral nematothecae in the present material and the type specimen had deep emarginations on the adcauline side. Such a variation, however, is quite usual in this family.

Distribution

Indonesia, Japan, northern Australia. Type locality: Bay of Ambon, Moluccas, Indonesia, zone of corals (Pictet 1893).

Family Plumulariidae

Plumularia badia Kirchenpauer, 1876

Fig. 59.

Plumularia badia Kirchenpauer, 1876: 34, 45, pl. 1: figs 3–4, pl. 4: fig. 3. – Bale 1884: 128, pl. 18: figs 1–2. – Stechow & Müller 1923: 473. – Vervoort 1941: 221. – Watson 2000: 51, fig. 39A–E.

Plumularia ramsayi Bale, 1884: 131, pl. 11: figs 3–4. – Billard 1913: 52. – Vervoort 1941: 221.

Plumularia gracilis von Lendenfeld, 1885: 476, pl. 14: fig. 17, pl. 17: figs 28–29.

Material examined:
Kei Islands Expedition stations: 71, several stems, without gonothecae. – 104, with gonothecae. – Kei Islands Expedition, Samalon Island near Ujungpandang, Sulawesi, 35 m, 28 Jun 1922, with gonothecae, on shell fragment.

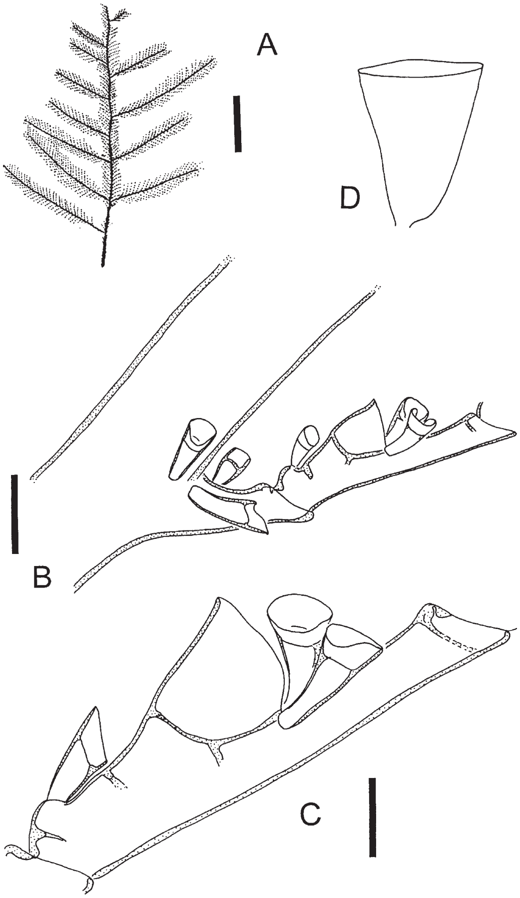

Fig. 59. *Plumularia badia* Kirchenpauer, 1876; A–B station 71; D station 104. A. Part of colony. B. Branch with apophysis and part of hydrocladium. C. Internode of hydrocladium. D. Gonotheca, perhaps not fully grown yet, same scale as B. – Scales: A = 1 cm; B = 0.1 mm; C = 50 µm.

Description

Colonies up to 8 cm high, multi-pinnate, stems monosiphonic, stiff, branches opposite or alternate, in one plane. Stem and branches bear alternate hydrocladia. Stem and branches without nodes, without hydrothecae, with long apophyses for hydrocladia (0.18 mm). Three nematothecae associated with each apophysis: two on apophysis, one close to base.

Hydrocladia relatively short and very thin, all in plane of branches and stem, length quite uniform, with up to 10 hydrothecae, homomerously segmented by oblique nodes, segments about 0.3 mm long, all segments with a hydrotheca and three nematothecae: one below and two lateral to hydrotheca. Internode with internal ribs, variably developed: one at each end, one below median nematotheca, one at base of hydrotheca.

Hydrotheca cup-shaped, depth 64–80 µm, placed centrally on internode, adcauline side adnate, abcauline wall at an angle of about 30° to internode axis, straight or with slight curvature, hydrothecal margin sinuate, distinctly lowered towards internode.

All nematothecae two-chambered and movable, conical, walls straight, rim not incurved, adcauline wall of upper chamber emarginated. Median inferior nematotheca not reaching to hydrotheca, on prominence of internode. Lateral nematothecae almost as big as depth of hydrotheca.

Gonothecae inserted without pedicel in upper axil of apophyses, small (0.2 mm), conical, distally truncated, terminal orifice oval, perisarc thin.

Colour: Stem and branches deep brown, hydrocladia white.

Distribution

Indonesia, tropical and subtropical coast of Australia (Watson 2000). Type localities: Brisbane and Singapore.

Plumularia habereri **Stechow, 1909**

Fig. 60

Plumularia habereri Stechow, 1909: 77, pl. 6: fig. 4. – Stechow 1913: 91, figs 59–60. – van Gemerden-Hoogeeven 1965: 60, figs 34–36. – Ryland & Gibbons 1991: 532: fig. 5.

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

Plumularia habereri var. *elongta* 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. 3: fig. 31.

Plumularia habereri var. *mucronata* Billard, 1913: 46, fig. 40, pl. 2: fig. 24.

Dentitheca habereri. – Hirohito 1995: 259, fig. 87a–c.

Material examined:
Kei Islands Expedition, Waling, Banda Islands, 10 m, 15 Jun 1922, fragmented plume with gonothecae. – Kei Islands Expedition, Samalon Island near Ujungpandang, Sulawesi, 35 m, 28 Jun 1922, juvenile colony, together with *P. badia*.

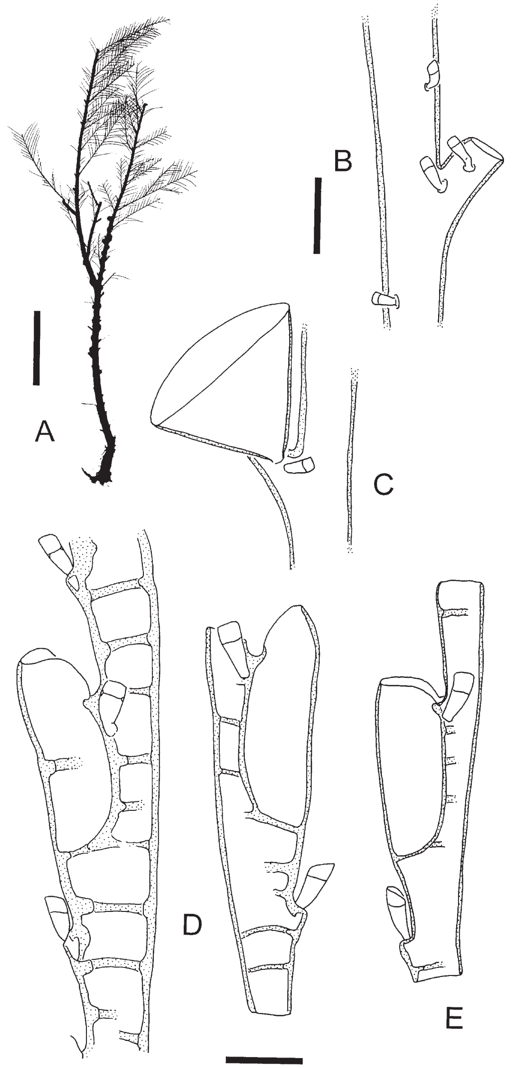

Fig. 60. *Plumularia habereri* Stechow, 1909; A–D, Banda Islands; E, Samalon Island. A. Colony silhouette (damaged). B. Part of branch with apophysis. C. Branch with gonotheca, same scale as B. D. Two hydrothecae from same hydrocladium; note variability. E. Hydrocladial internode of juvenile colony, same scale as D. – Scales: A = 2 cm; B, C = 0.2 mm; D, E = 0.1 mm.

Description

Colonies 5–25 cm high, multi-pinnate, up to fourth order branching, roughly in one plane, stem and branches polysiphonic, thinning to monosiphonic in distal regions. Stem and branches in polysiphonic parts composed of an embedded main tube and auxiliary tubes. Main tube originally with alternate hydrocladia, but these often broken off in older parts. Branches originating from auxiliary tubes, auxiliary tubes bearing nematothecae. Stem and branches without nodes in large colonies, homomerously segmented in juveniles, with alternate apophyses for hydrocladia, without hydrothecae. In segmented stems two hydrocladia per internode. Two nematothecae associated with each apophysis, additional nematothecae present on stem and branches.

Hydrocladia with up to 15 hydrothecae, nodes either mostly absent or homomerously segmented by transverse nodes, each hydrotheca and associated with three nematothecae: one below and two lateral to hydrotheca. Hydrocladium often with numerous, evenly spaced, thick internal ribs formed by annular thickenings, some regions with no or only weakly developed ribs.

Hydrotheca tubular, abcauline wall 0.25–0.3 mm, straight and parallel to hydrocladial axis, adcauline side completely adnate, shorter than abcauline side, margin therefore much lowered on adcauline side, lateral rim with two broad and shallow lobes, on inside of abcauline wall frequently a transverse semicircular perisarc thickening, rim on adcauline side with thickened perisarc.

All nematothecae two-chambered and movable, conical, walls straight, rim not incurved, adcauline wall of upper chamber emarginated, lower chamber longer than upper one. Median inferior nematotheca far below hydrotheca, not reaching hydrotheca, on distinct prominence of internode. Lateral nematothecae inserted near rim of hydrotheca, about 70 µm high.

Female gonotheca inserted in upper axil of apophyses, 0.3 high mm, top-shaped (turbinate), end flat, wall straight, no pedicel. Male gonothecae not seen

Remarks

The Indonesian population of *Plumularia habereri* is very variable and Billard (1913) proposed a number of nominal variants. Because they are sympatric, these variants are not subspecies, but represent phenotypic or genotypic variability. Most of them are quite unlike the form from the original location in Japan (Stechow 1909, Hirohito 1995), from the Caribbean (van Gemerden-Hogeveen 1965), or from Fiji (Ryland & Gibbons 1991). The material examined here clearly matched *Plumularia habereri* var. *mediolineata* Billard, 1913 as most hydrothecae had an internal perisarc thickening (Fig. 60D). Some hydrothecae of the same stem or even hydrocladium, however, lacked this thickening and more approached the variant *elongata*. The more juvenile colony also corresponded to the form *elongata* (Fig. 60E). Only few specimens of all these variants are known and more material is needed to further evaluate the validity of all of them. Some, especially the form described above, could prove to be separate species.

Distribution

Japan, Indonesia, Caribbean Sea. Type locality: Between Ito and Hatsushima Islands, Sagami Bay, Japan.

Plumularia scabra Lamarck, 1816

Fig. 61.

Plumularia scabra Lamarck, 1816; 127. – Billard 1907: 322. – Billard 1913: 47. – Watson 2000: 52, fig. 40A–E.

Plumularia effusa Busk, 1852: 400. – Kirchenpauer 1876: 46, pl. 1: fig. 4, pl. 5: fig. 4. – Bale 1884: 129, pl. 18: fig. 5.

Acanthella effusa. – Allman 1883: 27, pl. 6: figs 1–4. – von Campenhausen 1896b: 315. – Stechow & Müller 1923: 474.

Material examined:
Kei Islands Expedition stations: 67, with gonothecae. – 72, large cluster of 25 cm high stems. – 106, with gonothecae. – 107.

Description

Colonies 5–25 cm high, comprising many stems, multi-pinnate, up to third-order branching, side-branches in verticels and not in one plane, stem and branches monosiphonic, quite rigid, all bearing alternate hydrocladia, hydrocladia in older parts usually lost, branches of lower part of stem usually broken off. Stem and branches without nodes, with long apophyses for hydrocladia (0.12

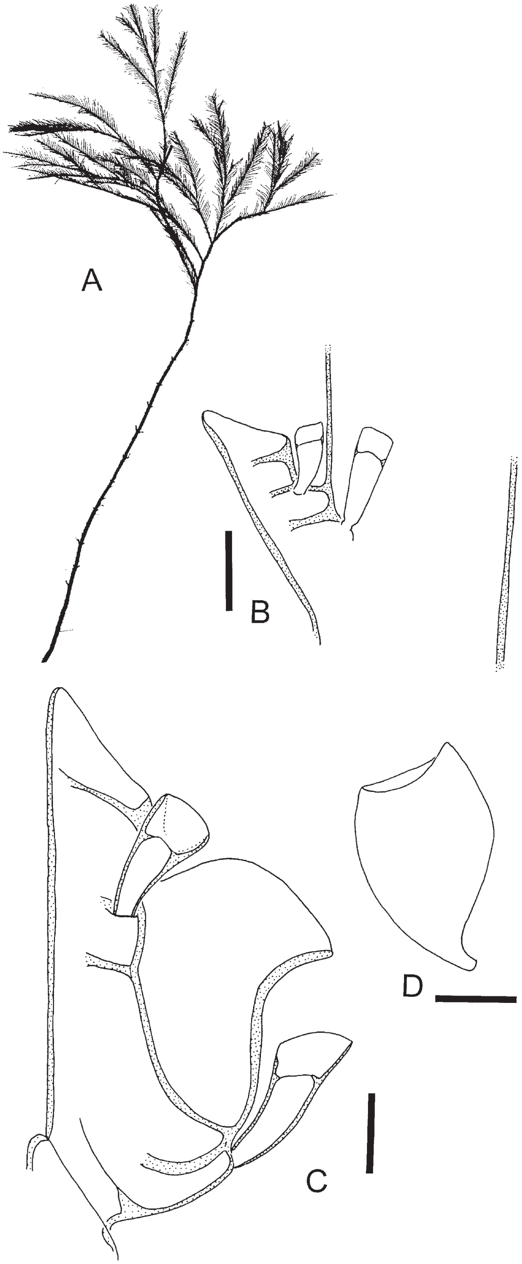

Fig. 61. *Plumularia scabra* (Lamarck, 1816); A, station 72; B–D, station 106. A. Colony silhouette, height 13 cm. B. Part of hydrocaulus (branch) with apophysis, scale bar 0.1 mm. C. Segment of hydrocladium. D. Gonothecae. – Scales: B = 0.1 mm; C = 50 µm; D = 0.2 mm.

mm), only in most distal portions with oblique nodes, each segment with two apophyses, without hydrothecae. Two to three nematothecae associated with each apophysis: one or two on apophysis, one close to base.

Hydrocladia with up to 15 hydrothecae, homomerously segmented by oblique nodes, segments about 0.25 mm long, all segments with hydrotheca and three nematothecae: one below and two lateral to hydrotheca. Internode with internal ribs, variably developed: one at each end, one at rear wall of hydrotheca, one curved between hydrotheca and median inferior nematotheca. Several terminal hydrocladia of some branches often replaced by thorn-like growth of the apophysis bearing a nematotheca.

Hydrotheca cup-shaped, depth 0.13 mm, centrally placed on internode, adcauline side adnate, abcauline wall strongly S-shaped, adcauline wall convex, hydrothecal margin with two broad, rounded lateral lobes.

All nematothecae two-chambered and movable, conical, walls straight, rim not incurved, adcauline wall of upper chamber emarginated, lower chamber longer than upper one. Median inferior nematotheca immediately below hydrotheca, reaching beyond middle of hydrotheca, not on distinct prominence of internode. Lateral nematothecae inserted near rim of hydrotheca, about 70 µm high.

Gonotheca inserted in upper axil of apophyses, 0.5 mm, ovoid, flattened, distal end truncated and oblique, orifice slit-like.

Remarks

See under *Polyplumaria cornuta*.

Distribution

Northern Australia, Singapore, Philippines, Indonesia. Type locality: “South Seas” (Lamarck, 1816).

***Polyplumaria cornuta* (Bale, 1884)**

Fig. 62.

Plumularia cornuta Bale, 1884: 132, pl. 11: figs 1–2.

Polyplumaria cornuta. – Billard 1913: 53, figs 65–66, pl. 3: fig. 33, pl. 4: 35–36. – Watson 2000: 56, fig. 44A–F.

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

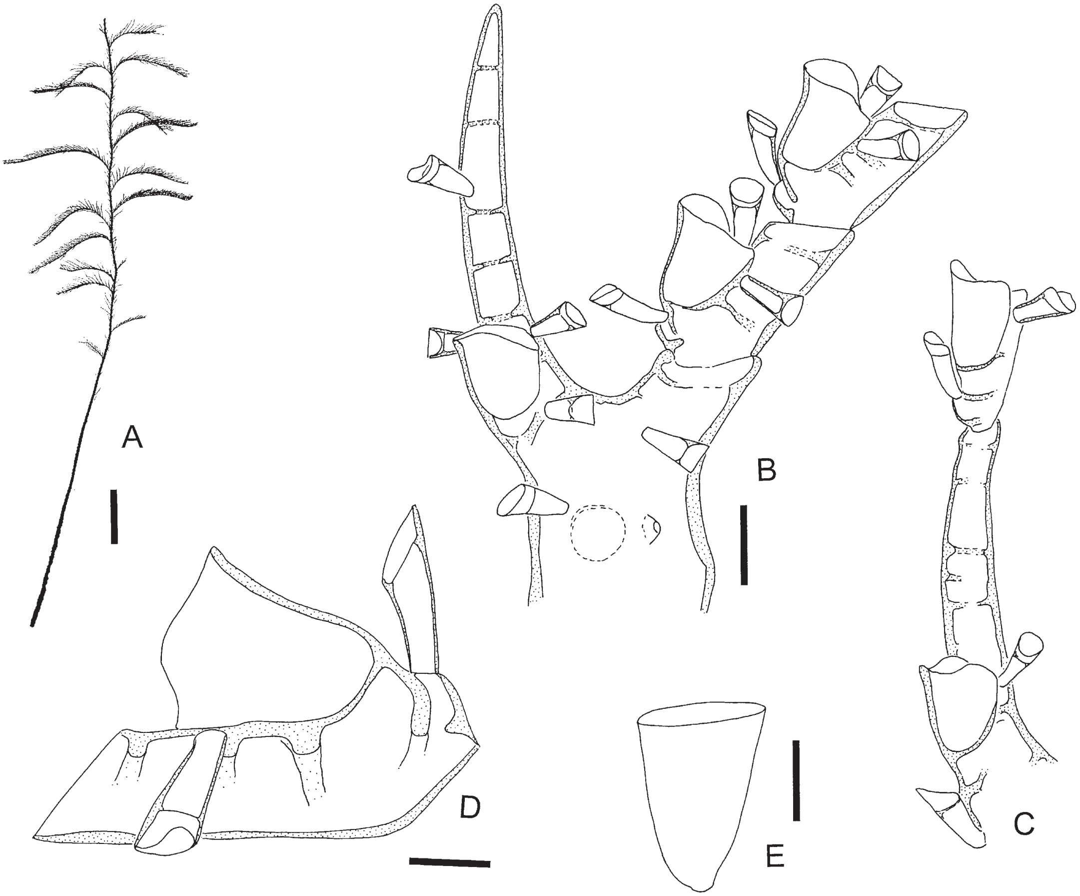

Fig 62. *Polyplumaria cornuta* (Bale, 1884); A, station 66; B–D, station 72; E, station 53. A. Colony silhouette. B. Oblique view of apophysis, base of hydrocladium and modified secondary hydrocladium, circle on apophysis is scar from broken-off gonotheca. C. Modified secondary hydrocladium with additional hydrothecate segment at end, same scale as B. D. Hydrocladial internode in side view. E. Gonotheca. – Scales: A = 1 cm; B, C = 0.1 mm; D = 50 µm; E = 0.2 mm.

Material examined:
Kei Islands Expedition stations: 53, with gonothecae. – 63, with long hydrocladia. – 65. – 66. – 67, with gonothecae. – 69. – 72. – 83. – 90. – 102. – 103. – 112.

Description

Colonies forming solitary stems, stems very slender and limp, monosiphonic, reaching heights of 20 cm and more, branched, multi-pinnate, stems with relatively short branches, these branches not branched again, thus branching order being first degree only, branches arranged helically around stem in upper half. Stem with hydrocladia, either in two lateral rows or in verticels, often broken off. Stolons root-like, anchored in mobile substrata. Terminal apophyses never modified into thorn-like process.

Hydrocladia on branches in two rows, origin shifted to upper side, with up to 10 hydrothecae, homomerously segmented by oblique nodes, segments about 0.2 mm long, all segments with hydrotheca and three nematothecae: one below and two lateral to hydrotheca. Proximal part of hydrocladium often strongly modified, fused to apophysis, bifurcated, one normal hydrocladium and one branch with a basal hydrotheca and then tapering into pointed horn-like process with a nematotheca, sometimes on top of this secondary hydrocladium an additional terminal segment bearing a hydrotheca and nematothecae (Fig. 62C).

Internodes with internal ribs, variably developed: one at each end, two at rear wall of hydrotheca, one curved between hydrotheca and median inferior nematotheca.

Hydrotheca cup-shaped, depth 0.13 mm, centrally placed on internode, adcauline side adnate, abcauline wall weakly s-shaped, adcauline wall straight, hydrothecal margin with two broad, rounded lateral lobes.

All nematothecae two-chambered and movable, conical, walls straight, rim not incurved, adcauline wall of upper chamber lowered, lower chamber longer than upper one. Median inferior nematotheca immediately below hydrotheca, reaching beyond middle of hydrotheca, sometimes on indistinct prominence of internode. Lateral nematothecae inserted near rim of hydrotheca, about 80 µm high.

Gonotheca inserted in upper axil of apophyses, 0.45 mm, diameter 0.3 mm, conical, walls quite straight, distal end planar, circular.

Remarks

If present, the characteristically modified secondary hydrocladium (Fig. 62B) renders *Polyplumaria cornuta* (Bale, 1884) easy to recognize. Unfortunately, these horn-like processes can be quite rare and some younger colonies may lack them entirely. Because the microscopic structure of the hydrocladia of *Polyplumaria cornuta* and *Plumularia scabra* are virtually indistinguishable (cf. Figs 61C and 62D), other characteristics must be used to identify such material. The important differences are summarized in Table 1. The easiest way to distinguish them is by comparing the colony form. While *P. scabra* has colonies comprising usually several stems that are branched up to the third order, *P. cornuta* colonies form very elongate, solitary stems with simple, short branches. The hydrocladia are also generally shorter, but the length is quite variable (cf. Figs 61A and 62A). The longest hydrocladia were observed in a sample from deeper waters (250 m). This sample also regularly had secondary hydrocladia, while in colonies with shorter hydrocladia they can be scarce or absent.

The hydrocladia of the stem of *Polyplumaria cornuta* can be arranged in verticels and the coenosarc of the stem can be canaliculated, both characteristic for the genus *Nemertesia*, a fact already noted by Billard (1913). The limits of the genera *Plumularia*, *Polyplumaria* and *Nemertesia* are thus somewhat diffuse.

Distribution

Indonesia, tropical coasts of Australia. Type locality: Holborn Island, Queensland, Australia.

***Nemertesia indivisa* (Allman, 1883)**

Fig. 63.

Sciurella indivisa Allman, 1883: 26, pl. 5: figs 1–4. – Kirkpatrick 1890: 609.
Antennularia cylindricala Bale, 1884: 146, pl. 10: fig. 7.
Nemertesia indivisa. – Billard 1910: 38. – Billard 1913: 60, fig. 50.

Material examined:
Kei Islands Expedition stations: 67. – 71. – Kei Islands Expedition, Samalon Island, Ujungpandang, Sulawesi, 25 m, 29 Jun 1922.

Table 1. Differences between *Polyplumaria cornuta* and *Plumularia scabra.*

Character	*Polyplumaria cornuta*	*Plumularia scabra*
Hydrocladia	may be branched, secondary branch modified	never branched
Terminal apophyses	never modified	some drawn into horn-like process
Branching (exclusive hydrocladia)	1st order	up to 3rd order
Stem	soft	stiff
Hydrocladia on stem	two rows or in verticels	two rows
Hydrocladia	often recurved towards branch end	mostly straight
Gonotheca	conical, circular cross-section	ovoid, flattened, distal end truncated
Hydrotheca, abcauline wall	shallow double-curvature	strong double-curvature

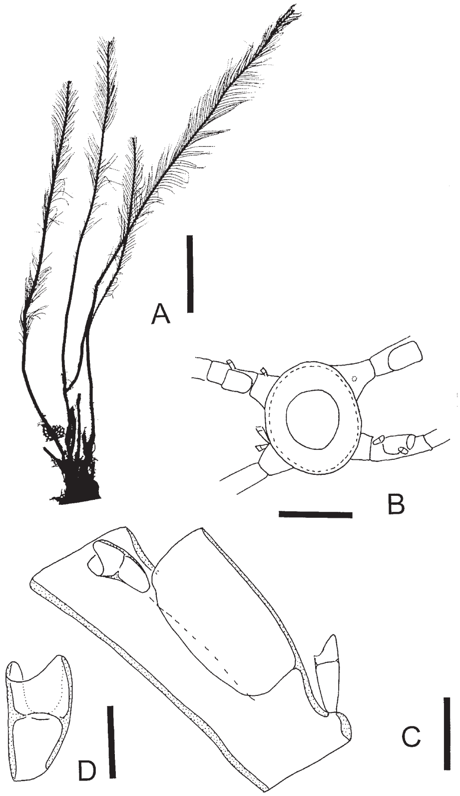

Fig. 63. *Nemertesia indivisa* (Allman, 1883); Samalon Island. A. Colony silhouette. B. One stem internode seen from above, showing arrangement of hydrocladia in four lateral rows. C. Hydrocladial segment. D. Lateral nematotheca. – Scales: A = 2 cm; B = 0.5 mm; C = 0.1 mm; D = 50 µm.

Description

Colonies with several unbranched or occasionally branched stems, 5–15 cm high, stems clustered, with laterally held hydrocladia all along most of the stem length giving impression of stems being pinnate. Stems thick, usually with distinct nodes but nodes may be indistinct in some regions, majority of internodes with four hydrocladia, less frequently two, six, or more. Hydrocladia originating on relatively short apophyses, each apophysis associated with up to four nematothecae and 1–2 or more close to apophysis. Coenosarc of stem canaliculated.

Hydrocladia short in comparison to stem length, in four longitudinal rows but directed towards sides, in opposite pairs. Basal parts of younger stems may have only two lateral rows of hydrocladia, being thus truly pinnate, in distal parts the hydrocladia can be arranged around the stem in whorls comprising three hydrocladia each. Hydrocladia homomerously segmented by slightly oblique nodes, internodes quite short (0.4–0.5 mm), each with one hydrotheca and three nematothecae: one median inferior, tow laterals. Internal ribs absent. Median inferior nematotheca on slight elevation or not so.

Hydrotheca cylindrical, depth 0.2–0.26 mm, diameter about 0.1 mm, adcauline wall completely adnate, adcauline and abcauline wall quite straight and nearly parallel, opening-plane perpendicular to internode axis, rim somewhat lowered on adcauline side.

Lateral nematothecae 60 µm high, close to hydrothecal margin, ovoid to conical, upper and lower chamber nearly of same height, wall of upper chamber slightly incurved, rim emarginated on outer and inner side, emarginations on inner side much deeper, reaching bottom of upper chamber. Median inferior nematothecae longer, conical, rim not incurved, rim lowered on adcauline side only.

Gonothecae not observed, according to Billard (1913) about 1 mm, irregularly lobed, flattened, with numerous nematothecae.

Remarks

The arrangement of the hydrocladia of *Nemertesia indivisa* (Allman, 1883) shows quite some variation. The majority of them are in four longitudinal rows and they are directed sideways. But also truly pinnate sections and sections with verticillate arrangement occur. *Nemertesia indivisa* with its mostly laterally held hydrocladia, the deep hydrothecae, and the lobed gonothecae furnished with nematothecae is somewhat unusual among it congeners. The peculiar gonotheca induced Allman (1883) to place this species in the new genus *Sciurella*, which has, however, not found general acceptance.

Distribution

Northern Australia, Indonesia. Type locality: Somerset Island, Cape York, Torres Strait, Australia, 9–18 m.

Sibogella erecta Billard, 1911

Fig. 64.

Sibogella erecta Billard, 1911a: 108. – Billard 1913: 61, fig. 51, pl. 3: fig. 32. – Billard 1929b: 72. – Vervoort 1941: 222. – Hirohito 1969: 27, fig. 18. – Hirohito 1995: 282, fig. 97g.

Stechowia armata Nutting, 1927: 230, pl. 44: figs 1–2.

Material examined:
Kei Islands Expedition station 18.

Description

Colony comprising several erect stems, up to 10 cm high. Stem monosiphonic, composed of a trunk with spirally arranged side-branches, branches bearing hydrocladia. Main stems unsegmented, with numerous nematothecae in three rows. Side-branches homomerously segmented by transverse nodes, segments without hydrotheca, with a subterminal apophysis for hydrocladium, apophysis with a nematotheca and a mamelon, in middle of segment a further nematotheca.

Hydrocladia alternate, segmented by transverse nodes, only one hydrotheca per hydrocladium, distal part modified into flexible process. First segment of hydrocladium simple (intersegment), with one nematotheca. Second segment long, bearing at distal end hydrotheca and three nematothecae: one median inferior far below hydrotheca, two laterals near margin of hydrotheca. Distal to hydrothecate segment several simple segments, each with one or two nematothecae thin, jointed flexibly and forming a tendril-like appendage.

Hydrotheca cup-shaped, shallow, abcauline side 50 µm, diameter 70 µm, adcauline side adnate, rim even.

Nematothecae all movable and two-chambered, conical, lower chamber longer than upper chamber, wall of upper chamber lower on one side.

Gonothecae not observed, according to Billard (1913) pyriform, 0.3–0.34 mm long, in upper axil of apophyses of hydrocladia

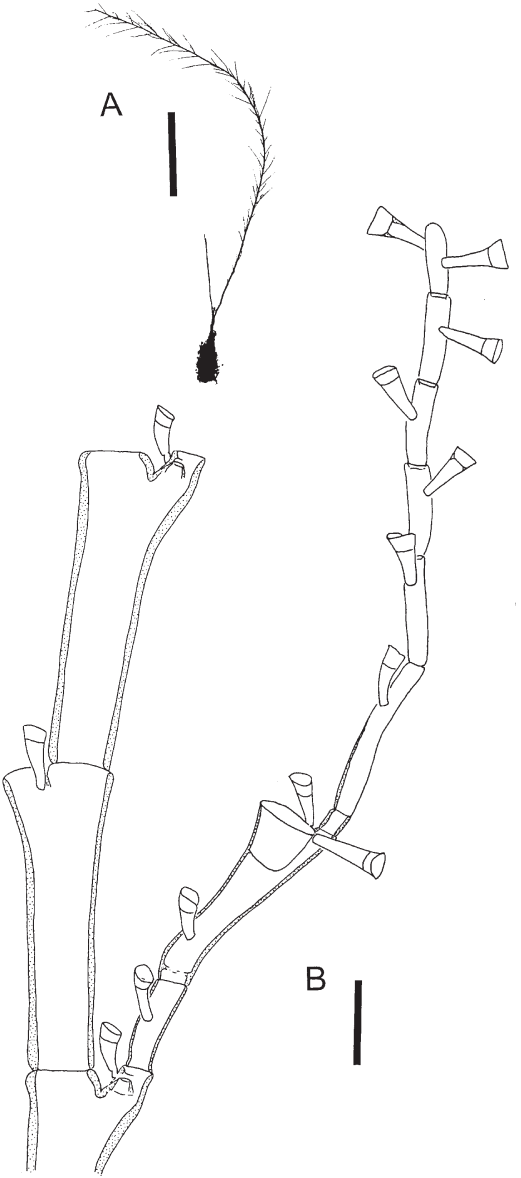

Fig. 64. *Sibogella erecta* Billard, 1911. A. Colony silhouette. B. Part of side-branch with one hydrocladium. – Scales: A = 2 cm; B = 0.1 mm.

Remarks

The flexible, modified distal hydrocladia with up to 12 segments (Billard 1913) make this species quite unique and immediately recognizable. It would be interesting to learn more about its function, which is presumably defensive. Billard (1927) described the arrangement of side-branches as in three longitudinal rows. In the present material, this arrangement is better described as spiral. Occasionally it is also pinnate.

Distribution

Indonesia, Philippines, Japan. Type locality: Indonesia, 1°42.5'S, 130°47.5'E, 32 m.

Family Aglaopheniidae

***Gymnangium longicorne* (Busk, 1852)**

Fig. 65.
Plumularia longicornis Busk, 1852: 399.
Aglaophenia longicornis. – Bale 1884: 157, pl. 14: figs 7–8, pl. 17: fig. 5.
Lytocarpus longicornis. – Allman 1883: 45, pl. 19: figs 4–6.
Macrorhynchia (?) *longicornis*. – Stechow & Müller 1923: 474.
Halicornaria longicornis var. *sibogae* Billard, 1913: 67, fig. 54, pl. 4: fig. 38.
Halicornaria intermedia Billard, 1913: 65, fig. 53, pl. 4: fig. 37.
Gymnangium longicorne. – Watson 2000: 60, fig. 48A–F.

Material examined:
Kei Islands Expedition stations: 67. – 68, 30 m and 50 m depth. – 71. – 73, with gonothecae. – 104.

Description

Colonies up to 20 cm high, multi-pinnate, branching in one plane; composed of a polysiphonic main trunk and pinnately arranged side-branches bearing themselves pinnately arranged hydrocladia. Main trunk either unbranched or forked, strongly polysiphonic up to distal end, composed of a superficial primary tube and numerous auxiliary tubes. Primary tube with alternate hydrocladia, these short (2–3 hydrothecae) and often lost. No nematothecae on auxiliary tubes. From auxiliary tubes of main trunk issue pinnately arranged side-branches, these always monosiphonic, 1.5–2 cm long, at base a deeply cut, oblique hinge-joint rendering branch easily movable, other nodes only visible in more distal parts, each internode with an apophysis bearing a hydrocladium. Below hinge-joint no hydrocladia, only median nematothecae. Apophysis of hydrocladia associated with two nematothecae, one on abcauline end and one in upper axil, both nematothecae with two apertures, one aperture much larger than the other.

Hydrocladia thin and dense, curved, not in one plane, planes forming an angle < 90°, hydrothecae facing towards above, hydrocladia relatively short, with up to 7 hydrothecae, with distinct oblique nodes, internode length about 0.2 mm. Each segment with two well developed internal ribs.

First or second hydrocladium of side-branch often modified into long, very flexible pseudophylactocarp; proximal 2–5 segments like in normal hydrocladia, then up to 12 modified segments with without hydrotheca but with three long nematothecae.

Hydrotheca about 0.22 mm in total length, 1/5 of its upper end curved for nearly 90°, lower part straight or slightly curved, slightly inclined towards above, adcauline side adnate for ¾ of its length, opening-plane tilted towards above or parallel to internode axis, margin with two broad, rounded cusps, one on each lateral side and one frontal, the latter cusp shallow and appearing as frontal tooth in side view. Distal part of abcauline hydrothecal wall sharply bent, at site of bend an abcauline perisarc thickening projecting into hydrotheca, on adcauline side near base of hydrothecae a second, horizontal intrathecal ridge, length and thickness very variable, opening for hydranth below this ridge, axis of extended hydranth thus S-shaped within hydrotheca. Hydranth with about 10 tentacles.

Median inferior nematotheca tubular, distal end sometimes slightly swollen, mostly very long, as long or longer as height of hydrotheca, the first hydrothecae of a hydrocladium may have much shorter median nematothecae. Median nematotheca adnate up to the middle of the hydrotheca, with three openings: one at distal end, one on upper side where becoming free from hydrotheca, and one leading into the lumen of the hydrotheca. Lateral nematothecae thin and tubular, straight, following free upper wall of hydrotheca, reaching beyond margin of hydrotheca.

Gonothecae on upper axil of apophyses for hydrocladia, 0.4 mm long, leaf-shaped, flattened, rounded distal end without opening, aperture on side, slit-like, short pedicel near base.

Remarks

With its feather-like side-branches, pivoting at the slightest movement, the long nematothecae, and the lash-like modified hydrocladia, *Gymnangium longicorne* (Busk, 1852) is a very characteristic species. The very flexible hinge joint

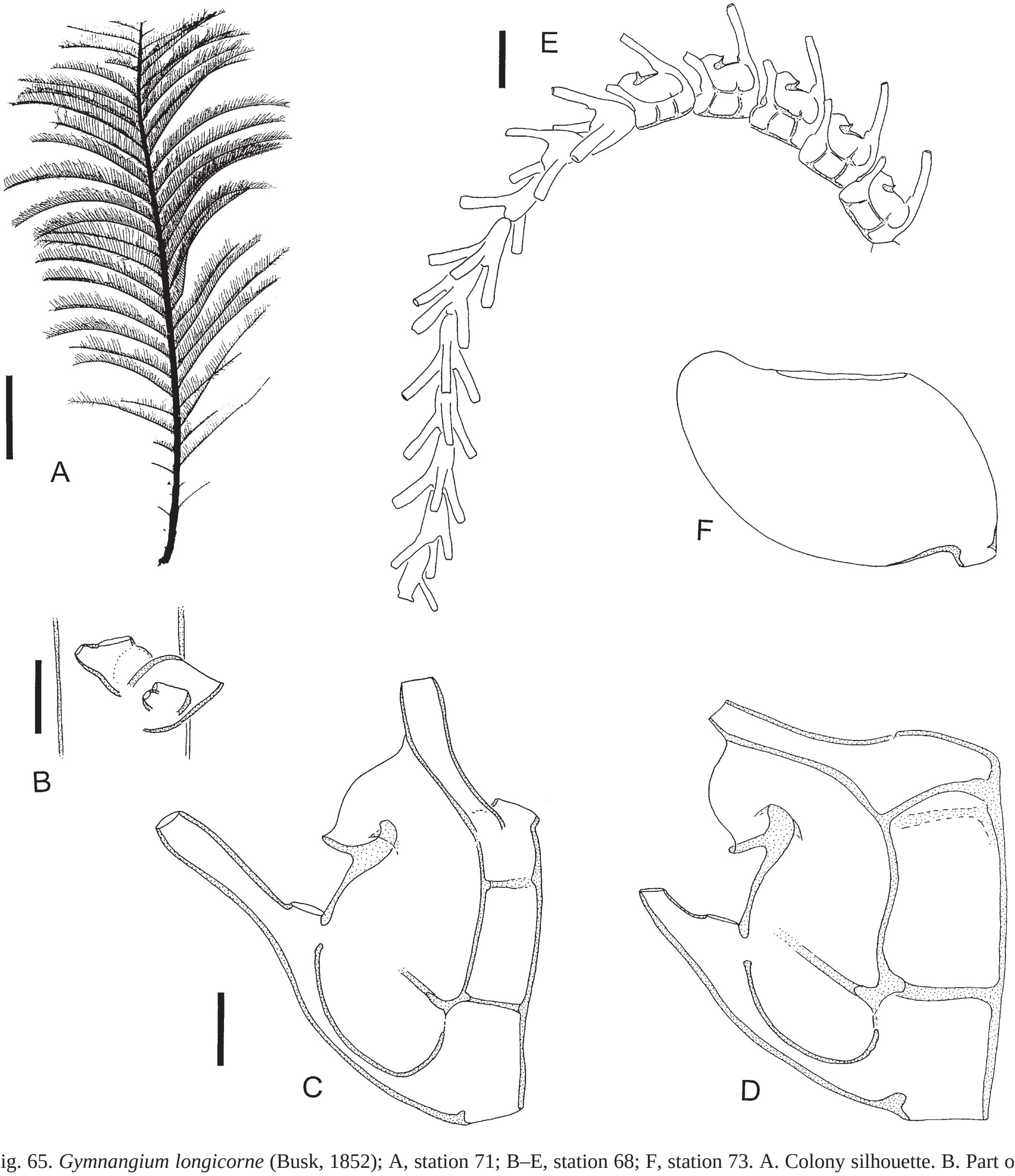

Fig. 65. *Gymnangium longicorne* (Busk, 1852); A, station 71; B–E, station 68; F, station 73. A. Colony silhouette. B. Part of sidebranch with apophysis (pointing towards right) and two nematothecae. C. Hydrocladial segment with common form of long median nematotheca. D. Segment of proximal region of hydrocladium with less common, short median nematotheca, same scale as C. E. Modified hydrocladium (pseudophylactocarp). F. Gonotheca, same scale as B. – Scales: A = 1 cm; B, F = 0.1 mm; C–D = 50 µm; E = 0.2 mm.

of the side-branches, well described by Allman (1883), renders the side-branches very movable. The modified hydrocladia, named pseudophylactocarps by Watson (2000), are normally regularly present, but some colonies have only few of them. Watson (2000) argued that these structures are not homologous to phylactocarps because they neither bear gonothecae nor protect them. The correlation of the occurrence of these pseudophylactocarps and absence of epibionts led Watson (2000) assume that they have a defensive function.

Halicornaria intermedia Billard, 1913 was regarded by Rees & Vervoort (1987) as a synonym of *G. eximium* (Allman, 1874). I agree with Watson (2000), that *Halicornaria intermedia* more probably belongs to *Gymnangium longicorne*. Billard (1913) mentioned that the type colony of *H. intermedia* has modified hydrocladia (pseudophylactocarps), a structure not known to occur in *G. eximium*.

Rees & Vervoort (1987) regarded the record of Allman (1883) of *L. longicornis* as a misidentification and referred it to *G. eximium*. Allman's material had monosiphonic side-branches with hinge-joints and the median inferior nematothecae were very long. Allman's figure of the colony (1883, pl. 19: fig. 4) is also very characteristic. Although Allman did not mention modified hydrocladia, his identification seems correct beyond any doubt. *Gymnangium eximium* can be distinguished from *G. longicornis* by the shorter median inferior nematotheca, the polysiphonic side-branches without hinge-joint, and absence of modified hydrocladia (based on the description by Rees & Vervoort 1987).

Distribution

Tropical Australia, Indonesia, Philippines. Type locality: Prince of Wales Channel, Torres Strait, Australia.

Gymnangium cf. *gracilicaule* (Jäderholm, 1903)

Fig. 66.

Lytocarpus gracilicaulis Jäderholm, 1903: 299, pl. 14: figs 3–4.
Halicornaria gracilicaulis. – Billard 1913: 63. – Billard 1933: 25, pl. fig. 5. – Vervoort 1967: 47, figs 14–15.
?*Halicornaria gracilicaulis* var. *armata* Billard, 1913: 65, fig. 52.
Halicetta gracicaulis. – Hirohito 1995: 293, fig. 103b–d.
Gymnangium gracilicaule gracilicaule Millard, 1968: 282. – Millard 1975: 443, fig. 136A & D.
Gymnangium gracilicaule. – Rees & Vervoort 1987: 168, fig. 40, synonymy. – Watson, 1997: 539, fig. 8G–H.
Lytocarpus philippinus. – Rho 1969: 165, figs 5–6, pl. 1: fig. 6, pl. 2: fig. 8.

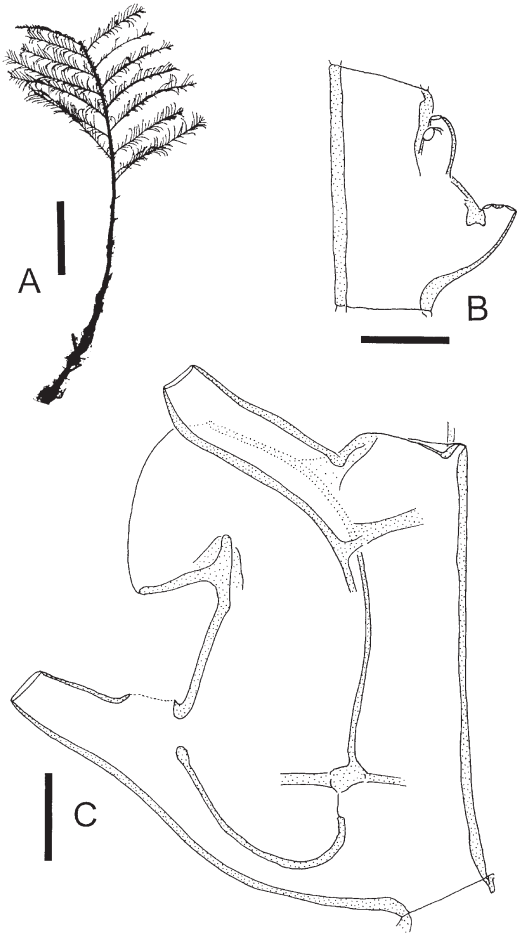

Fig. 66. *Gymnangium* cf. *gracilicaule* (Jäderholm, 1903). A. Silhouette of damaged colony, lower part of main trunk overgrown with other organisms. B. Side view of side-branch segment with apophysis and two nematothecae. C. Hydrocladial segment. – Scales: A = 1 cm; B = 0.1 mm; C = 50 µm.

Material examined:
Kei Islands Expedition station 107, no gonothecae.

Description

Colonies up to 6 cm high, multi-pinnate, branching in one plane; composed of a polysiphonic main trunk and pinnately arranged lateral branches bearing themselves pinnately arranged hydrocladia. Main stem weakly polysiphonic up to distal end, composed of a superficial primary tube and 2–3 auxiliary tubes bearing side-branches, no nematothecae on auxiliary tubes. Primary tube with alternate hydrocladia. Side-branches always monosiphonic, about 1.5 cm long, at base a deeply cut, oblique hinge-joint rendering branch very movable, other nodes only visible in more distal parts, each internode with an apophysis bearing a hydrocladium. Below hinge-joint no hydrocladia, only median nematothecae. Apophysis of hydrocladia associated with two nematothecae, one on abcauline end and one in upper axil, both nematothecae with two apertures.

Hydrocladia alternate, curved, relatively short, with up to 7 hydrothecae, with distinct nodes, internode length about 0.25 mm. Each segment with two internal ribs, not much developed.

Hydrotheca about 0.25 mm in total length, distal third curved for nearly 90°, lower 2/3 straight and inclined towards hydrocladial axis, adcauline side adnate for ¾ of its length, opening tilted slightly towards above, margin smooth, without lateral cusps or median tooth, distal part of abcauline wall sharply bent, at site of bend an abcauline perisarc thickening projecting into hydrotheca. On adcauline side near base of hydrothecae a second, horizontal intrathecal ridge, length and thickness very variable.

Median inferior nematotheca tubular, not longer than about 2/3 the depth of the hydrotheca, end reaching to level of upper curvature of hydrotheca, with three openings: one at distal end, one on upper side where becoming free from hydrotheca, and one leading into the lumen of the hydrotheca. Lateral nematothecae thin and tubular, straight, following free upper wall of hydrotheca, reaching beyond margin of hydrotheca.

Gonothecae not observed, according to Vervoort (1967) horn-shaped, 0.4–0.45 mm long, end truncated, flattened, aperture slit-like, females with one egg only.

Remarks

The present Indonesian material was only hesitatingly assigned to *Gymnangium gracilicaule* because it does not agree entirely with the description of the type material given by Rees & Vervoort (1987): the abcauline wall is not curved but rather bent, the total length of the hydrotheca is smaller (0.25 versus 0.29–38 mm), and the abcauline wall of the hydrotheca at the curvature is quite thickened and forms a short septum projecting into the hydrotheca. Such a thickening is also known from *G. eximium* and it can be very variably expressed (Rees & Vervoort 1987). Although the observed variations are within the variation observed for other similar hydroids, it is nevertheless possible that the present material belongs to another species.

Gymnangium gracilicaule and *Gymnangium eximium* (Allman, 1874) resemble each other and need careful examination to be distinguished. Rees & Vervoort (1987) re-examined the type material of *G. graciliaule* and worked out the differences to *G. eximium*. The latter species differs from *G. graciliaule*: in having polysiphonic side-branches instead of strictly monosiphonic ones, its hydrotheca is less sinuous and has a margin with lateral lobes, the axillary nematotheca above the cauline apophysis has one aperture. Very likely correlated with the polysiphonic side-branches, the strong, oblique hinge joint found in *G. graciliaule* is apparently absent in *G. eximium*.

The likewise similar *G. longicorne* (see above) has much denser hydrocladia (two times), thicker stems, the median inferior nematothecae are usually longer, the hydrothecal margin is distinctly lobed, and modified hydrocladia are usually present (cf. Figs 65 and 66). Comparing colonies of both species side by side, the differing habits are very evident (cf. Fig. 65A and 66A), but it could be that it is only an extreme variant of *G. longicorne*.

Distribution

Japan, Indonesia, Indian Ocean, South Africa, Red Sea, Western Australia. Type locality: Southern Japan, 90 m.

***Macrorhynchia philippina* Kirchenpauer, 1872**

Fig. 67.

Macrorhynchia philippina Kirchenpauer, 1872: 19. – Stechow & Müller 1923: 475. – ?Not Hirohito 1983: 78, fig. 41. – ?Not Rees & Vervoort 1987: 177, fig. 43. – Ryland & Gibbons 1991: 553, fig. 22. – ?Not Hirohito 1995: 297, fig. 105d–g. – Migotto 1996: 40, fig. 8e–f. – Calder

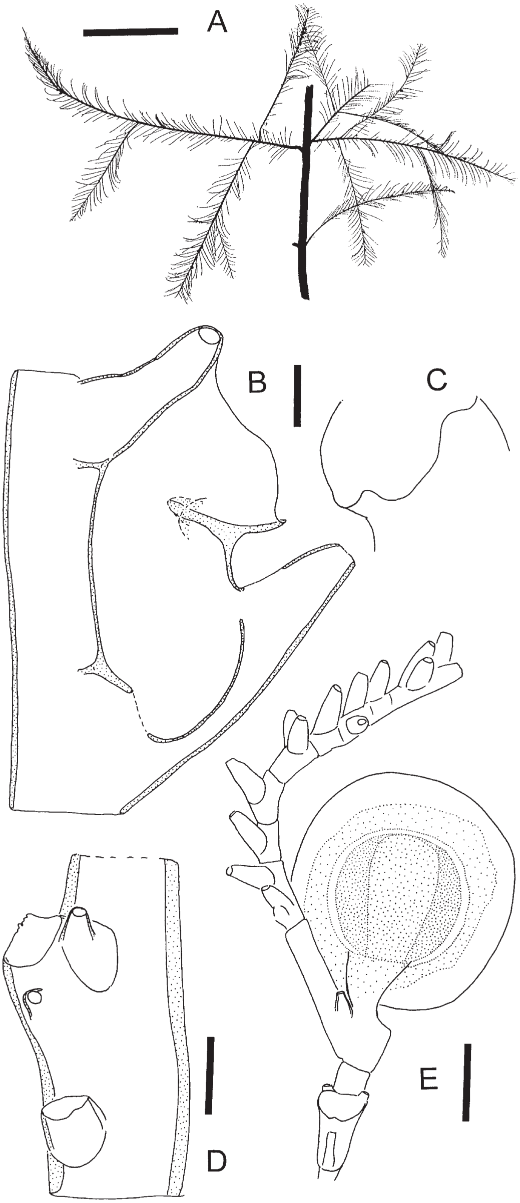

Fig. 67. *Macrorhynchia philippina* Kirchenpauer, 1872; A, Indonesia; B–E, Kei Island Expedition, Ambon harbour. A. Silhouette of colony fragment. B. Hydrocladial segment. C. Rim of hydrotheca in oblique view, note abcauline tooth, same scale as B. D. Oblique view of segment of primary tube, with apophysis (pointing towards left), nematothecae, and mamelon (on apophysis). E. Phylactocarp with gonotheca containing a male medusoid, tissue stippled. – Scales: A = 2 cm; B–C = 50 µm; D = 0.1 mm; E = 0.2 mm.

1997: 66, fig. 21. – Watson 1997: 538, fig. 8F. – Watson 2000: 67, fig. 53A–D. – Ansín Agís, Ramil & Vervoort 2001: 46, fig. 46, bibliography, synonymy.

Lytocarpus philippinus. – Pictet 1893: 60, pl. 3: fig. 53. – Nutting 1900: 122, pl. 31: figs 4–7. – Weltner 1900: 587. – Billard 1913: 78, fig. 63. – Vervoort 1941: 225. – Fraser 1944: 419, pl. 93: fig. 410. – Vervoort 1968: 88, fig. 41. – Millard & Bouillon 1973: 93. – Millard 1975: 449, fig. 138A–C.

?*Lytocarpus balei.* – Leloup 1930b: 8, fig. 6, pl. 1: fig. 3. [Not *Macrorhynchia balei* (Nutting, 1905)]

Lytocarpus crosslandi Ritchie, 1907: 511, pl. 24: fig. 11, pl. 26: figs 2–4.

Material examined :
Kei Islands Expedition stations: 11, with gonothecae. – 31. – 107. – Kei Islands Expedition, Ambon, harbour pier, 4 Mar 1922, with gonothecae. – Kei Islands Expedition, Lonthoir Channel, Banda Islands, 25 m, 11 Jun 1922. – Kei Islands Expedition, Bay of Ambon, Feb 1922. – MHNG INVE 32228, as *Lytocarpus philippinus*, material of Pictet (1893), Ambon Harbour.

Description

Colonies 5–40 cm high, much branched, multipinnate, stem and branches polysiphonic, thinning in distal ramifications, only short terminal portions monosiphonic. Stem and branches composed of a superficial primary tube and a bundle of auxiliary tubes, primary tube of side-branches originating from auxiliary tubes of sister branch. Primary tube with hydrocladia, nodes may be present in distal regions, each segment with a hydrocladial apophysis, a broad median inferior nematotheca, a nematotheca on side of apophysis, and a mamelon on apophysis.

Hydrocladia alternate, soft, shifted to anterior side of primary tube, regularly segmented by transverse to slightly oblique nodes, each segment with two internal ribs, these variably developed, up to 18 hydrothecae per hydrocladium.

Hydrotheca sac-shaped, total height 0.32 mm, diameter in middle 0.11 mm, upper third curving away, opening oblique, margin with two rounded lateral cusps and a median abcauline tooth, the latter variably developed, between margin and median inferior nematotheca a thick shelf projecting halfway into hydrotheca, shelf in side view triangular. Hydranth with 8–10 tentacles.

Nematothecae with very large mastigophores (80 µm long). Median inferior nematotheca conical in side view, free part tubular (not gutter-shaped), about 90 mm long, reaching beyond margin of hydrotheca, with three openings: one terminal, one on upper surface where becoming free, one just below the latter leading into hydrothecal cavity (foramen). Lateral nematothecae tubular, inclined forward, overtopping somewhat hydrothecal margin, one or two openings: one terminal and one near base on upper surface, the latter not always visible.

Gonothecae on modified hydrocladia (phylactocarps), one or two per phylactocarp. Phylactocarps composed of one hydrocladial segment with hydrotheca as in normal hydrocladia, followed by cylindrical segments with one or two nematothecae. Gonotheca attached to segment following hydrothecate segment, lens-shaped, diameter 0.6 mm; gonophore medusoid, with spadix, bell margin with granules.

Remarks

Hirohito's (1983, 1995) material allocated to this species had rather thin intrathecal septae, had several gonothecae per phylactocarp, and was apparently larviparous. I therefore doubt that Hirohito's samples belonged to *M. philippina*. The increased number of gonothecae and the lamellar intrathecal septae match better *M. balei* (Nutting, 1905). Contrary to this, Leloup's (1930b) specimen identified as *M. balei* appears indistinguishable from *M. philippina*.

Distribution

Circumglobal in tropical and subtropical waters. Type locality: Manila, Philippines.

***Macrorhynchia phoenicea* (Busk, 1852)**

Figs 68–69.
Plumularia aurita Busk, 1852: 397.
Plumularia phoenicea Busk, 1852: 398.
Aglaophenia rostrata Kirchenpauer, 1872: 45, pl. 1: fig. 25, pl. 6: fig. 25. – Weltner 1900: 588.
Lytocarpus spectabilis Allman, 1883: 43, fig. 2, pl. 15: figs 1–5.
Aglaophenia phoenicea. – Bale 1884: 159, pl. 15: figs 1–5, pl. 17: figs 1–4, pl. 19: fig. 31.
?*Aglaophenia disjuncta* Pictet, 1893: 59, pl. 3: figs 51–52.
Lytocarpus phoeniceus. – Billard 1910: 48, fig. 22. – Billard 1913: 74, figs 60–61. – Weltner 1900: 588. – Leloup 1930b: 10, fig. 7, pl. 2: fig. 1. – Millard & Bouillon 1973: 94. – Millard 1975: 451, fig. 137D.
Macrorhynchia phoenicea. – Mammen 1967: 313, figs 108–109. – Rho 1967: 348, fig. 8. – Ryland & Gibbons 1991: 555, fig. 23. – Hirohito 1995: 299, fig. 106a–e.
Macrorhynchia phoenicia.– Watson 2000: 68, fig. 54A–E.

Material examined:
Kei Islands Expedition stations: 18. – 19, with gonothecae. – 24. – 26, with gonothecae. – 57. – 67. – 69. – 71, with gonothecae. – 72. – 106. – 107. – Kei Islands Expedition, Kei Islands, Tual, 2 m, 28 Mar 1922, with gonothecae. – Kei Islands Expedition, Kei Islands, Tual, 22 Mar 1922, with gonothecae. – Kei Islands Expedition, Banda Islands, Neira Island, 25 m, 14 Jun 1922.

Differential diagnosis

Somewhat similar to *Macrorhynchia philippina*, but branching more regular, hydrocladia more bristly, denser, lengths quite homogenous, about 12 hydrothecae per hydrocladium; abcauline horizontal shelf in hydrotheca thin and not triangular, height of hydrotheca smaller (0.22–0.25 mm), free abcauline wall short, margin without abcauline tooth, lateral margin with two irregular cusps; majority of lateral nematotheca directed towards above; both nematothecae of hydrocaulus with two openings of different size. Gonotheca lens-shaped, less flattened but also with sharp edge along circumference. Nematothecae of phylactocarps in three rows.

Description

See Millard (1975), Ryland & Gibbons (1991), and Watson (2000).

Remarks

The bristly, neatly regular hydrocladia of equal length (Fig. 68) make large and fully grown *Macrorhynchia phoenicea* (Busk, 1852) to some degree recognizable even without the aid of a microscope. The hydrothecae and the internodes are quite variable (Fig. 68C–E). Especially the outline of the lateral rim of the hydrotheca is very variable. Bale (1884) discussed the variability of this species.

The gonophores seen in the present material are likely sessile sporosacs, female ones containing 10–16 eggs.

The samples from stations 24, 26, and 57 deviate somewhat from the others (Fig. 69). The colonies are smaller (6 cm), more gracile, they have longer internodes (0.30–0.34 mm), thinner hydrocladia, the lateral nematothecae of the proximal hydrothecae are directed in the direc-

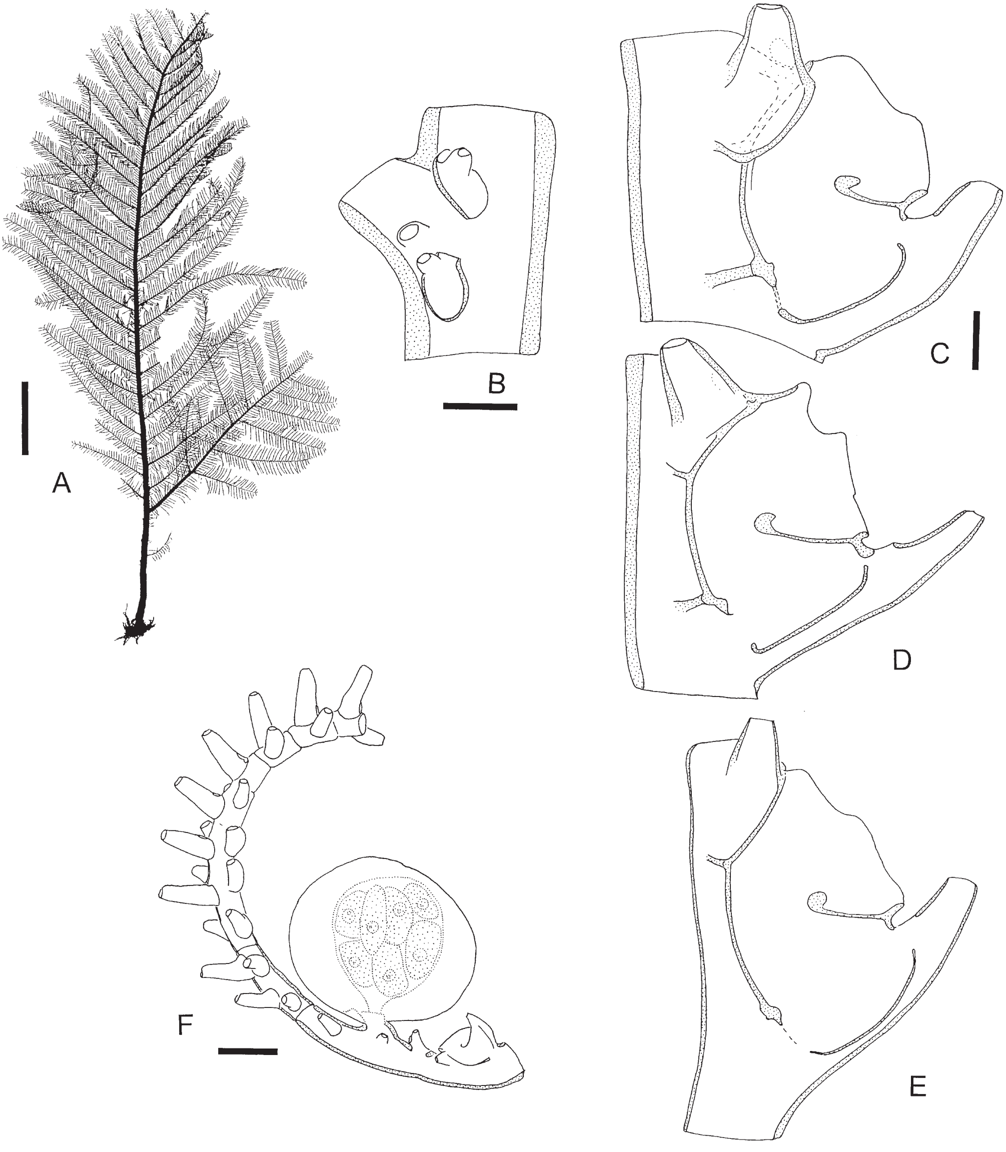

Fig. 68. *Macrorhynchia phoenicea* (Busk, 1852); A, station 71; B & F, station 19; C–D, Tual; E, Neira Island. A. Colony silhouette. B. Frontal view of segment of primary tube, with apophysis (pointing towards left), nematothecae, and mamelon (on apophysis). C–E. Hydrocladial segments of different colonies, note variation of rim, length of median nematotheca, and length of segment. F. Phylactocarp with gonotheca containing eggs (stippled). – Scales: A = 2 cm; B = 0.1 mm; C–E = 50 µm; F = 0.2 mm.

tion of the hydrothecal opening and not towards above, and the phylactocarps have only two rows of nematothecae instead of three as observed in the other samples. These samples came from deeper waters (90–200 m), which could perhaps explain the differences, but they could as well also belong to a different species. This material resembles *M. phoenicea* described by Ryland &

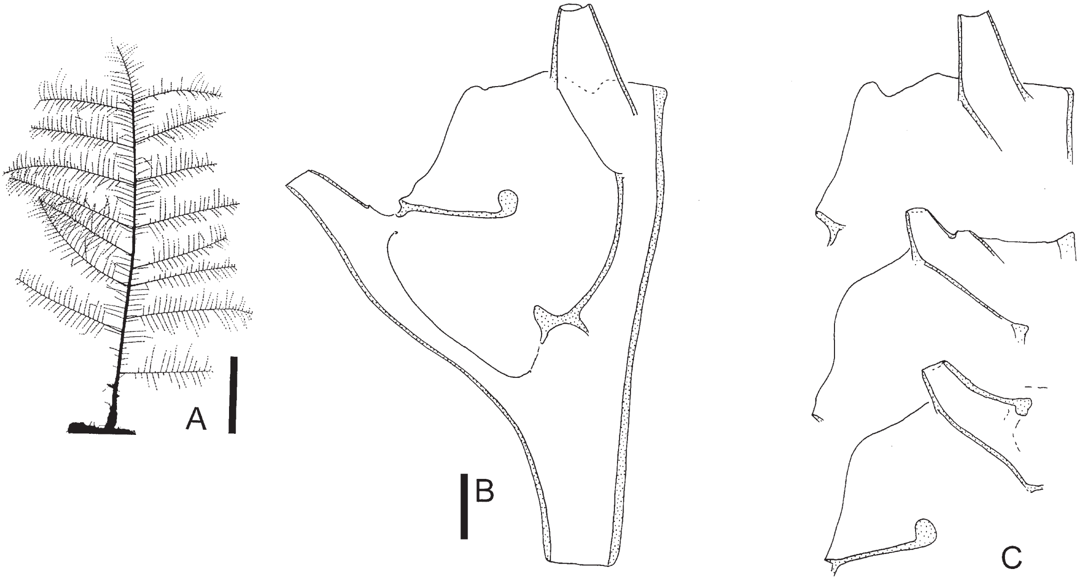

Fig. 69. *Macrorhynchia phoenicea* (Busk, 1852); variant morphotype from station 24. A. Colony silhouette. B. Hydrocladial segment, note elongated shape (compare Fig. 68C–E). C. Variation of lateral nematotheca and hydrothecal margin within one hydrocladium, proximal hydrotheca below, distal one at top, note second opening in lateral nematotheca of middle region, same scale as B. – Scales: A = 1 cm; B–C = 50 µm.

Gibbons (1989). The morphology approaches also the one of material described by Pictet (1893) as *Aglaophenia disjuncta*, but the internodes and hydrothecae are less elongated. Bedot (1926) considered *Aglaophenia disjuncta* Pictet, 1893 as a synonym of *M. phoenicea* and a reexamination of the type material of *A. disjuncta* (MHNG INVE 25025, Bay of Ambon, Moluccas, 80 m) indeed confirmed the close resemblance. *Aglaophenia disjuncta*, however, is characterized by very long hydrocladial internodes (Fig. 70), while the hydrothecae appear not distinguishable from *M. phoenicea*. The observed internode length (0.35–0.40 mm), however, is perhaps beyond the variation observed for *M. phoenicea* (0.27–0.34 mm, cf. also Figs 68C–E and 69B). Because the gonosome of *Aglaophenia disjuncta* remains also unknown, I prefer to regard it as only questionably conspecific with *M. phoenicea*.

Distribution

Australia, Indonesia, Malay Peninsula, New Guinea, Philippines, South China Sea, Japan,

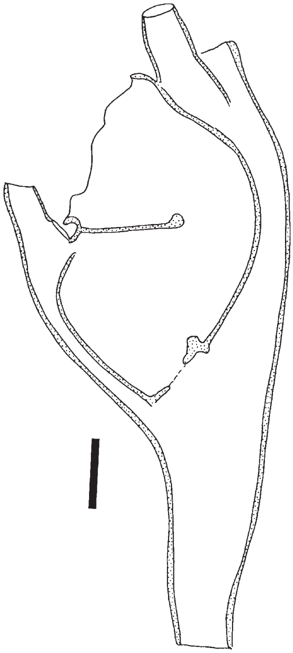

Fig. 70. *Aglaophenia disjuncta* Pictet, 1893; type material. Hydrocladial segment. – Scale: 50 µm.

Polynesia, tropical Indian Ocean, southern Africa. Type locality: Torres Strait, Australia.

Macrorhynchia balei (Nutting, 1905)

Fig. 71.

Lytocarpus balei Nutting, 1905: 954, pl. 6: fig. 1, pl. 13: figs 7–8. – in part Stechow 1909: 99, pl. 6: figs 12–13. – Billard 1913: 81, fig. 66. – Stechow 1919: 134. – Nutting 1927: 236. – Vervoort 1941: 226, fig. 9. – Hirohito 1995: 297, fig. 105a–c. [Not *Lytocarpia balei* (Nutting, 1927)]

Not *Lytocarpus balei*. – Leloup 1930b: 8, fig. 6, pl. 1: fig. 3. [= *M. philippina*]

?*Macrorhynchia philippina*. – Hirohito 1983: 78, fig. 41. – Hirohito 1995: 297, fig. 105d–g. [Not *Macrorhynchia philippina* Kirchenpauer, 1872]

Type material examined:
USNM 22220, Albatross Station 3852, South of Molokai, 47–115 fathoms (86–210 m), fragmented colony, with numerous phylactocarps, not labelled as type material, but locality and collector clearly identifies it as such.

Material examined:
Kei Islands Expedition station 57. – Kei Islands Expedition, Bay of Ambon, 90 m, 2 Mar 1922, with 4 gonothecae on young phylactocarps. – Kei Islands Expedition, Bay of Ambon, 45–90 m, 2 Mar 1922. – Kei Islands Expedition, Bay of Ambon, 13–18 m, 28 Feb 1922. – USNM 68534, loc. Philippines, material described in Nutting (1927).

Differential diagnosis

Similar to *Macrorhynchia philippina*, but differs in forming smaller sized colonies, thicker hydrocladia with up to 17 hydrothecae; hydrotheca with lamellar adcauline septum, hydrothecal rim with or without abcauline tooth; lateral nematothecae either parallel to upper wall of hydrotheca or pointing towards above (varies from proximal to distal of hydrocladium, Fig. 71D), rim of opening of median inferior nematotheca often curved; lateral rim of hydrothecae with two rather variably shaped cusps, lateral rim can also be almost smooth. On rear wall of hydrocladia, auxiliary tubes, and primary tubes numerous small pores (nematopores) plugged with clusters of nematocysts (isorhizas) (Fig. 71B). Phylactocarps 2/3 as long as hydrocladia, with up to 8 lenticular gonothecae, these alternately shifted to the right and left.

Differs from *M. phoenicea* by its more irregular colonies, longer hydrocladia, forward directed lateral nematothecae, rear nematopores, and the number of gonothecae per phylactocarp.

Measurements: colony height 4–10 cm, total height of hydrotheca 0.25–0.32 mm, larger isorhiza about 85 µm long (in median inferior nematotheca), smaller isorhiza about 40 µm long (in rear nematopores). Female gonothecae contain 4–6 eggs. Gonotheca diameter 0.6 mm.

Remarks

The numerous nematopores on the rear side of the hydrocladia, primary tubes, and auxiliary tubes make *Macrorhynchia balei* recognizable even in the absence of phylactocarps. These nematophores are funnel-shaped holes in the periderm that are plugged by a bundle of elongated nematocysts (see Fig. 71B). If the capsules are lost in preserved material, the nematopores are not conspicuous. However, if these isorhizas are discharged so that the bundle of shafts protrude trough the pore, the pores are easy to see and very characteristic. The number of pores per hydrocladial segments varies from zero to two, mostly they are at the level of the internal ribs. The pores are usually absent in the distal segments of the hydrocladium. The auxiliary tubes also have these pores, usually in several rows (Fig. 71D). As in the hydrocladia, also here the density of the pores is variable between colonies.

No such nematopores were reported in any of the available descriptions of this species (see synonymy). The type material of *Macrorhynchia balei* was therefore re-examined for this study. Although the soft tissue of the type material is is not well preserved, perhaps due to mechanical damage during the collecting procedure, some hydrocladia with intact soft tissue clearly possess identical nematopores and tufts of isorhiza capsules just like in the Indonesian material. The dimensions and morphology of hydrotheca and nematothecae were also indistinguishable from the Indonesian material, which is thus almost certainly conspecific with Nutting's original material. Nutting (1927) also attributed material from the Philippines to the present species. Also this material could be re-examined. It is more robust than the type colony, infertile, and the soft tissue is almost completely lost. There are, however, distinct pores on the rear side of the hydrocladia, which renders this identification quite secure.

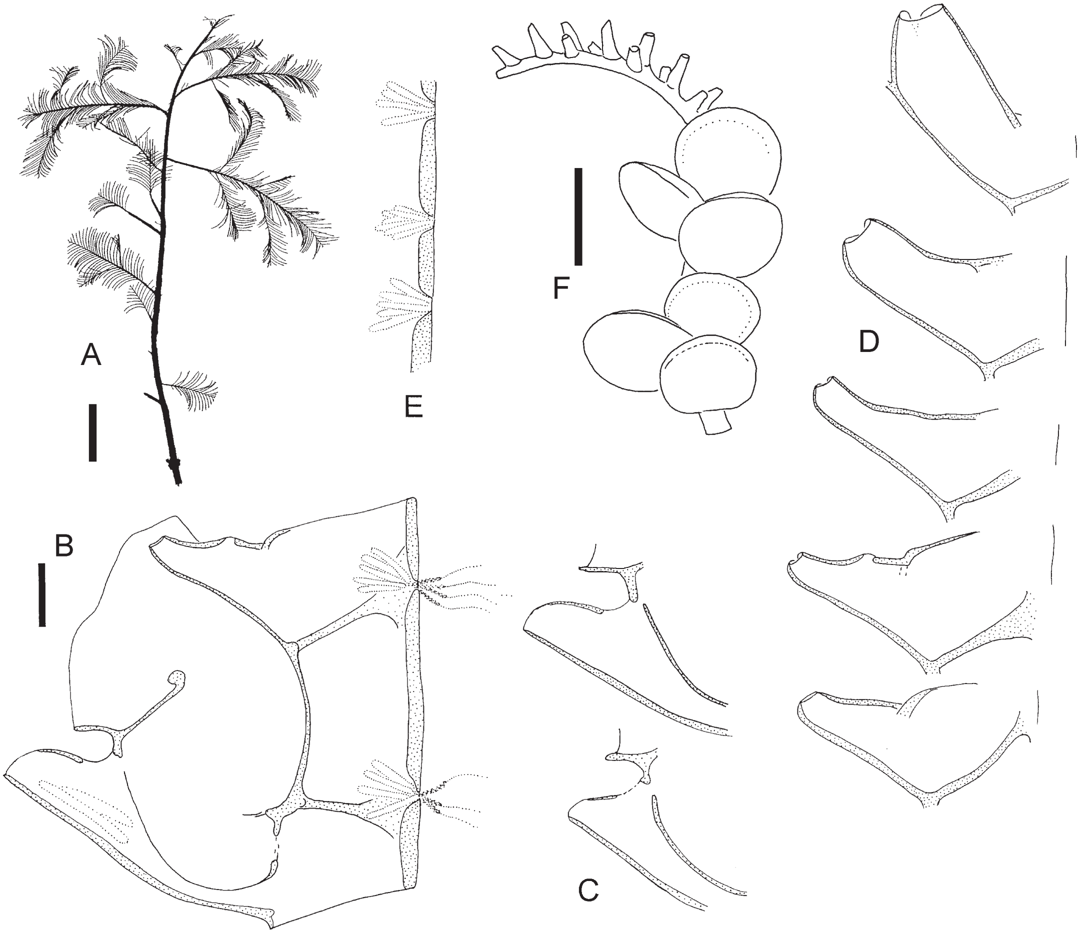

Fig. 71. *Macrorhynchia balei* (Nutting, 1905); A–B & D, Bay of Ambon; C, station 57; F after type material. A. Colony silhouette. B. Hydrocladial segment, note clusters of nematocysts at rear side. C. Variation of median inferior nematotheca and abcauline tooth, same scale as B. D. Variation of lateral nematotheca from proximal (bottom) to distal (top) part of hydrocladium, same scale as B. E. Side view of auxiliary tube wall with nematopores and nematocyst clusters, same scale as B. F. Phylactocarp with gonothecae, note that the hydrotheca at the base of the phylactocarp is not visible in this figure. – Scales: A = 1 cm; B–E = 50 µm; F = 0.5 mm.

The curved margin of the distal opening of the median nematotheca is also quite characteristic (Fig. 71B), although not all nematothecae have it (Fig. 71C).

Macrorhynchia balei was originally described by Nutting based on material from Hawaii. Subsequently, Stechow (1909) reported it from Japan. Later, however, Stechow (1919: 134) referred part of this material to *Macrorhynchia singularis* (Billard, 1913). Billard (1913) identified infertile material from Indonesia as *M. balei*. Stechow (1919: 129) thought that Billard's material did not belong to *M. balei* and he referred it to *Lytocarpia*(?) *graeffei* (Kirchenpauer, 1876), a problematic species. Kirchenpauer (1876) provided only the name *Aglaophenia graeffii*, this without any diagnosis or illustration. This nominal species must therefore be seen as invalid, a *nomen nudum*. It appears, however, that Stechow (1919) based his description and figure on Kirchenpauer's original material, so Stechow thus becomes the author of this species. Stechow based his description of *Lytocarpia graffei* on a small, juvenile colony. The colony was monosiphonic and had no gonothecae. It must be considered as unrecognizable. Stechow (1919) distinguished it from *M. balei* on account of the shape of the bottom of the hydrotheca: rounded in *M. balei*, with a step in *Lytocarpia graffei*. This character is of little use, as usually all intermediates can be found in *Macrorhynchia* colonies. Leloup (1930b) also contested Stechow's view, however, Leloup's (1930b: fig. 6) material of *M. balei* appears indistinguishable from *M. philippina* because his figures show a thick, triangular intrathecal septum. Hirohito (1983, 1995) again described Japanese material of *M. balei*. Hirohito distinguished his material from *M. philippina* solely on account of the length and thickness of the intrathecal septum. However, the figures of *M. philippina* given by Hirohito (1983, 1995), are more typical for *M. balei*: the upright lateral nematotheca and the numerous gonothecae on the phylactocarps. Because Hirohito (1983) also described female gonothecae containing planulae, thus being larviparous and not releasing medusoids as seen in typical *M. philippina*, it seems more likely that this material was also *M. balei*. Hirohoto's material should be re-examined for the presence of nematopores.

Distribution

Hawaii, Indonesia, Philippines, Japan. Type locality: Off south coast of Molokai, Hawaiian archipelago, 86–210 m.

Macrorhynchia singularis (Billard, 1908)

Fig. 72.

Plumulariidae spec. IV von Campenhausen 1896b: 317, pl. 15 fig. 5.

Lytocarpus philippinus var. *singularis* Billard, 1908b: 112, figs A–B.

Lytocarpus singularis Billard, 1913: 79, figs 64–65.

Lytocarpus balei. – In part Stechow 1909: 99, pl. 6: fig. 12. – Stechow 1919: 134.

Material examined:
Kei Islands Expedition stations: 18. – 40. – Kei Islands Expedition, Bay of Ambon, 45–90 m, 2 Mar 1922. – Kei Islands Expedition, Bay of Ambon, 90 m, 2 Mar 1922.

Differential diagnosis

Similar to *Macrorhynchia philippina*, but colonies smaller (up to 10 cm), one lateral nematotheca of first hydrocladial segment much enlarged and directed towards rear, opposite nematotheca of same segment small, free part of median nematotheca very short; median nematotheca of segments distal to first one mostly much enlarged and thick, lateral nematothecae usually small. Some lateral nematothecae of more distal segments can also be enlarged on one side, as well as some median inferior nemat-

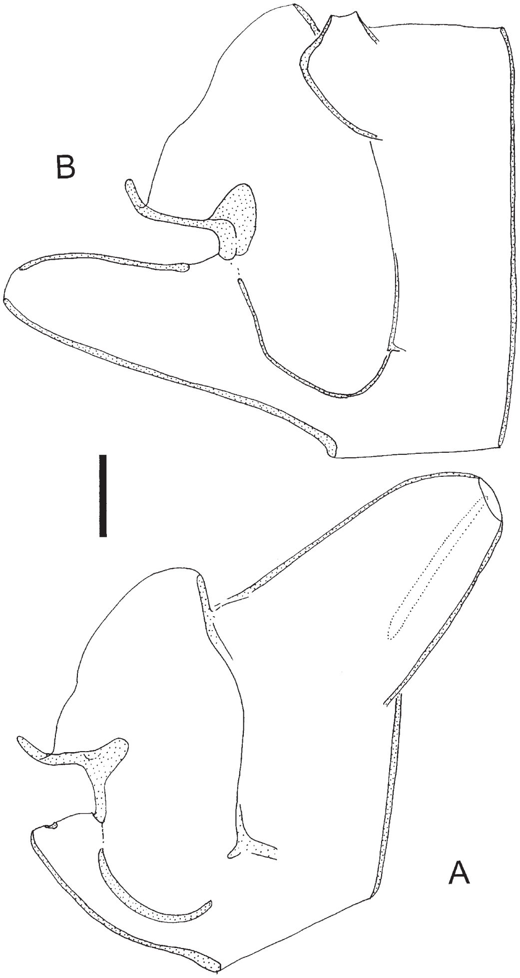

Fig. 72. *Macrorhynchia singularis* (Billard, 1908); station 40. A. First internode of hydrocladium, note enlarged lateral nematotheca (dotted: nematocyst). B. Second segment of hydrocladium with characteristic thick median inferior nematotheca. – Scale: A–B 50 µm.

othecae can be short. Hydrothecal margin with two broad lateral lobes or irregular, abcauline side with pointed tooth.

Remarks

Billard (1908b) first regarded *M. singularis* as a variety of *M. philippina*, but in his 1913 publication he raised its status to the species level. *Macrorhynchia singularis* indeed resembles *M. philippina*, but the unilaterally hypertrophied lateral nematothecae as well as the alternately extremely short or very thick median inferior nematothecae make this morphotype rather distinct and easy to recognize (Fig. 72A–B). Stechow (1919) found Japanese material from Sagami Bay that only partially matched Billard's description. It had one enlarged lateral nematotheca on the first segment, but the median inferior ones were normal. Stechow (1919) made some comments that let one suspect that he doubted somewhat the validity of *M. singularis*. In his survey of the thecate hydroids of Sagami Bay, Hirohito (1995) did not include *M. singularis*.

Distribution

Indonesia, ?Japan. Type locality: Salawati Island, NW New Guinea, 1.701°S, 130.785°E, 32 m.

***Monoserius pennarius* (Linnaeus, 1758)**

Fig. 73.

Sertularia pennaria Linnaeus, 1758: 813.

Aglaophenia spicata Lamouroux, 1816: 166. – Billard 1909: 329.

Plumularia Banksii Gray, 1843: 294. – Billard 1910: 48.

Aglaophenia secunda Kirchenpauer 1872: 35, pl. 1: fig. 15, pl. 2: fig. 15, pl. 3: fig. 15. – Marktanner-Turneretscher 1890: 273. – Billard 1909: 329.

Aglaophenia crispata Kirchenpauer, 1872: 36, pl. 1: fig. 16, pl. 2: fig. 16, pl. 3: fig. 17. – Billard 1909: 329.

Not *Aglaophenia spicata*. – Kirchenpauer 1872; 27, pl. 1: fig. 12, pl. 2: fig. 11, pl. 4: fig. 11, [= *A. cupressina* Lamouroux, 1816].

Lytocarpus secundus. – Allman, 1883: 42, pl. 14. – Jäderholm 1903: 298. – Billard 1908c: 940.

Lytocarpus fasciculatus Thornely, 1904: 123, pl. 3: figs 3, 3A, 3B.

Lytocarpus pennarius. – Billard 1909: 329. – Ritchie 1910a: 19, pl. 4: fig. 2.

Hemicarpus fasciculatus. – Billard 1913: 83, figs 68–69, pl. 5: figs 41–42.

Hemicarpus banksi. – Bale 1924: 263, fig. 17a.

Monoserius fasciculatus. – Leloup 1932: 165, fig. 28. – Vervoort 1941: 228.

Monoserius banksii. – Ralph 1961b: 56, fig. 8h

Monoserius pennarius. – Mammen 1967: 307, figs 108–109.

Monoserius fasciculatus. – Mammen 1967: 310.

Material examined:
Kei Islands Expedition stations: 65, incipient gonocladium present. – 67, with male gonothecae. – 69. – 70. – 83. – 102. – 103. – 105. – 110. – 114. – Kei Islands Expedition, Samalon Island, Ujungpandang, Sulawesi, 35 m, 28 Jun 1922. – Kei Islands Expedition, Taka Bako, Ujungpandang, Sulawesi, 25 m, 27 Jun 1922.

Description

Colonies forming single stems, rooted in sediment by a tangled mass of fibre-like stolons, stem height reaching 100 cm and more, flexible, limp when out of water. Stem polysiphonic, with regularly spaced pinnate side-branches. Basal part of stem in younger colonies pinnate through alternate hydrocladia, hydrocladia arise from superficial primary tube; in more distal part where there are pinnate side-branches and in larger colonies without pinnate base there is no primary tube, stem thus formed by auxiliary tubes only. Side-branches originate from auxiliary tubes of main stem, feather-like through dense hydrocladia, side-branches alternate, in two rows, the two rows forming an angle of 90° or less, side-branches thus directed towards one side (depending on view). Axis of side-branches polysiphonic but thinning to monosiphonic, with superficial primary tube bearing alternate hydrocladia. Primary tube with short apophyses for hydrocladia, each apophysis associated with three nematothecae: one on apophysis, one on side, one below.

Hydrocladia straight, stiff, dense, inclined towards hydrocaulus at an angle of about 40°, with or without transverse nodes delimiting segments, spacing of hydrothecae variable: hydrothecae either slightly overlapping (Fig. 73C) or well separated (Fig. 73D). Internal ribs not much developed, usually two originating from rear wall of hydrotheca.

Hydrotheca campanulate, nearly parallel to hydrocladial axis, 0.27–0.35 mm high, diameter at rim 0.15–0.17 mm, adcauline side completely adnate, opening-plane perpendicular to hydrocladial axis, rim with a large abcauline tooth and 4–5 triangular cusps on both lateral sides. Marginal abcauline tooth rectangular in frontal view,

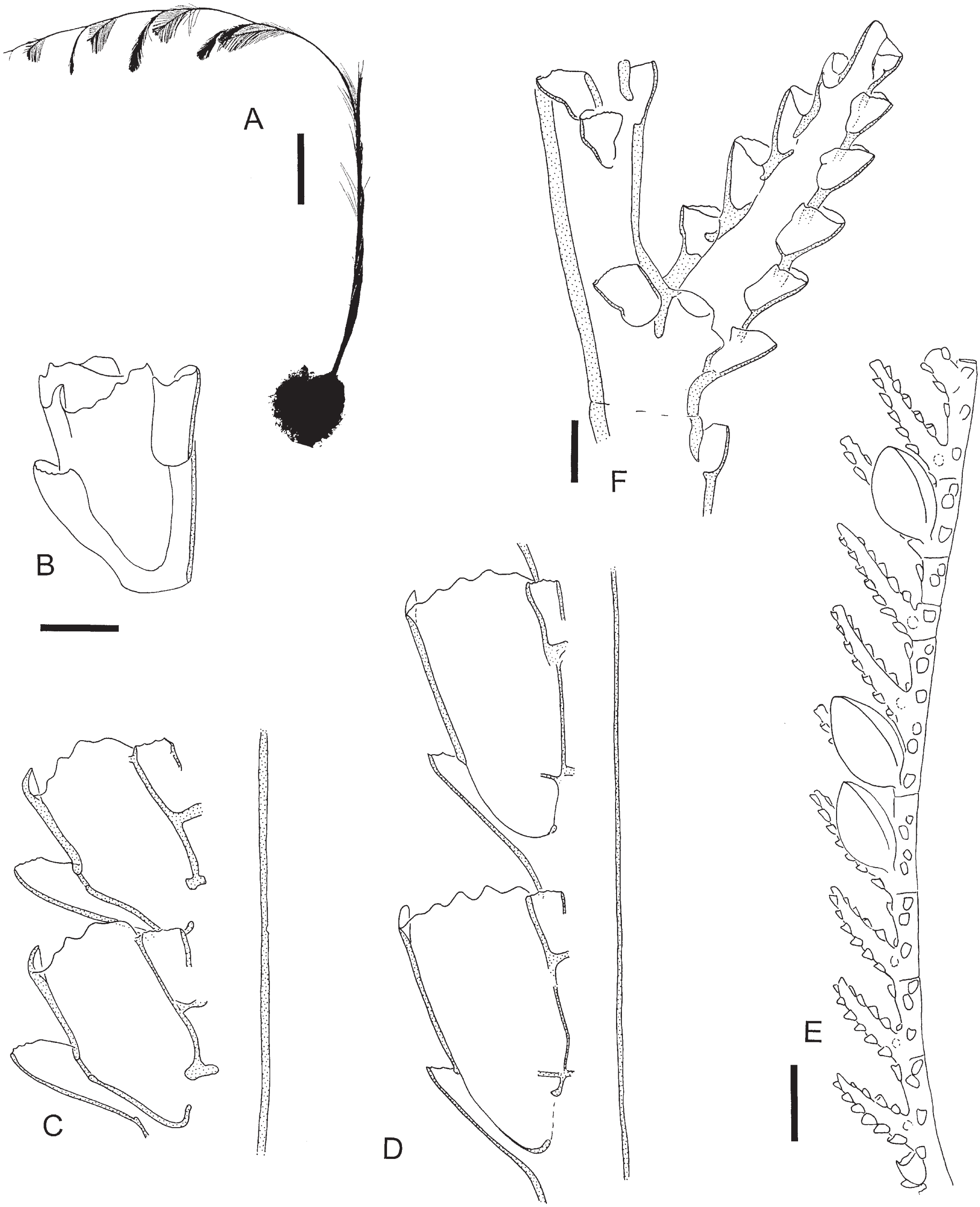

Fig. 73. *Monoserius pennarius* (Linnaeus, 1758); A, station 70; B–C, E–F, station 67; D, station 102. A. Silhouette of young colony. B. Hydrotheca in oblique view, note abcauline gutter-shaped tooth. C. Two hydrothecae in side view, from colony with narrow spacing, same scale as B. D. Two hydrothecae from colony with widely spaced hydrothecae, same scale as B. E. Gonocladium with three gonothecae, note that there is only one row of nematocladia. F. Part of gonocladium with nematocladium. Scales: A = 2 cm; B–D = 0.1 mm; E = 0.5 mm; F = 0.1 mm.

curved in side view, with longitudinal gutter-like depression along its entire length, gutter also somewhat continued on abcauline wall of hydrotheca. Lateral cusps of variable height, the two in the middle more prominent.

Nematothecae all with finely crenulated rims. Median inferior nematotheca reaching to middle or up to 2/3 of hydrotheca, free part of variable length, top side open and thus gutter-like, opening into hydrotheca (foramen) present, often difficult to see, perhaps also obliterated. Lateral nematothecae cup-shaped, small, 0.1–0.12 mm long, opening facing towards above.

Gonothecae borne on modified hydrocladia, (gonocladia), about every third to fifth hydrocladium may be modified into a gonocladium. Gonocladia straight, fully mature ones reach the same length as other hydrocladia. First segment as in normal hydrocladia, thus with a hydrotheca, along rest of gonocladium no hydrothecae, but with one row of spine-like processes (nematocladia) bearing two rows of nematothecae along their sides. Gonocladial axis also with nematothecae. Nematothecae adnate on one side. Gonothecae arise at base of nematocladia, lens-shaped but not much flattened, diameter 0.7 mm.

Remarks

The genus *Monoserius* Marktanner-Turneretscher, 1890 is here used for this species and *Hemicarpus* Billard, 1913 is regarded as a synonym of it. With its gonocladia having a single row of side-branches (nematocladia), this is quite a distinct genus.

Mammen (1967) is here followed in regarding *M. pennarius* (L.) and *M. fasciculatus* (Thornely, 1904) as conspecific. Billard (1909, 1910) examined the type material of *Sertularia pennaria* Linnaeus, 1758; *Aglaophenia spicata* Lamouroux, 1816; and *Plumularia Banksii* Gray, 1843 and he concluded that they are conspecific. He also included *Aglaophenia secunda* Kirchenpauer 1872 and *Aglaophenia crispata* Kirchenpauer, 1872 in this synonymy. It is therefore somewhat surprising that Billard (1913) regarded *M. fasciculatus* (Thornely, 1904) as valid and did not discuss the differences to *M. pennarius*.

In the present material two variants are discernible: a variant with more robust, thick stems and long branches and a gracile variant with thin stems and short side-branches. These differences are here seen as age related.

Distribution

India, Ceylon, Indonesia, Philippines, Taiwan, Southern Japan, Palau, New Zealand. Type locality: Unknown.

***Cladocarpus keiensis* new species**

Fig. 74.

Type material:
Holotype: ZMUC, Kei Islands Expedition station 24, Kei Islands, 15 Apr 1922, hard bottom, colony fragmented; part of this colony as schizotype slides in MHNG, collection no. INVE 32487. Type locality: Kei Islands Expedition station 24, 5.62°S, 132.93°E, 100 m.

Description

Colony 6 cm high, stem with a few side-branches, stem polysiphonic, composed of one superficial primary tube bearing hydrocladia (lost in lower part) and bundle of about 8 auxiliary tubes, number of auxiliary tubes reduced towards distal, terminal part of stem monosiphonic; few side-branches present, structured like stem, lower ones slightly polysiphonic, distal ones monosiphonic, primary tube of side-branches originates from primary tube of stem. Auxiliary tubes with a row of nematothecae in groove separating two adnate tubes, nematothecae of auxiliary tube similar to those of primary tube. Primary tube segmented in more distal parts, internodes long (0.9 mm); in distal third of internode an apophysis for the hydrocladium, with three nematothecae: one axillary and two median in lower half of segment. Nematothecae oval, free end gutter-like.

Hydrocladia on stem and side-branches in two rows, alternate, stiff, thin, up to 2 cm long, the two rows not in one plane but at variable angle, angle may be smaller than 90°. Hydrocladium homomerously segmented by slightly oblique nodes, segments 0.65–0.75 mm long, diameter at nodes 0.15–0.2 mm, each segment with one hydrotheca and three nematothecae: two laterals and one median inferior; internodes with regular

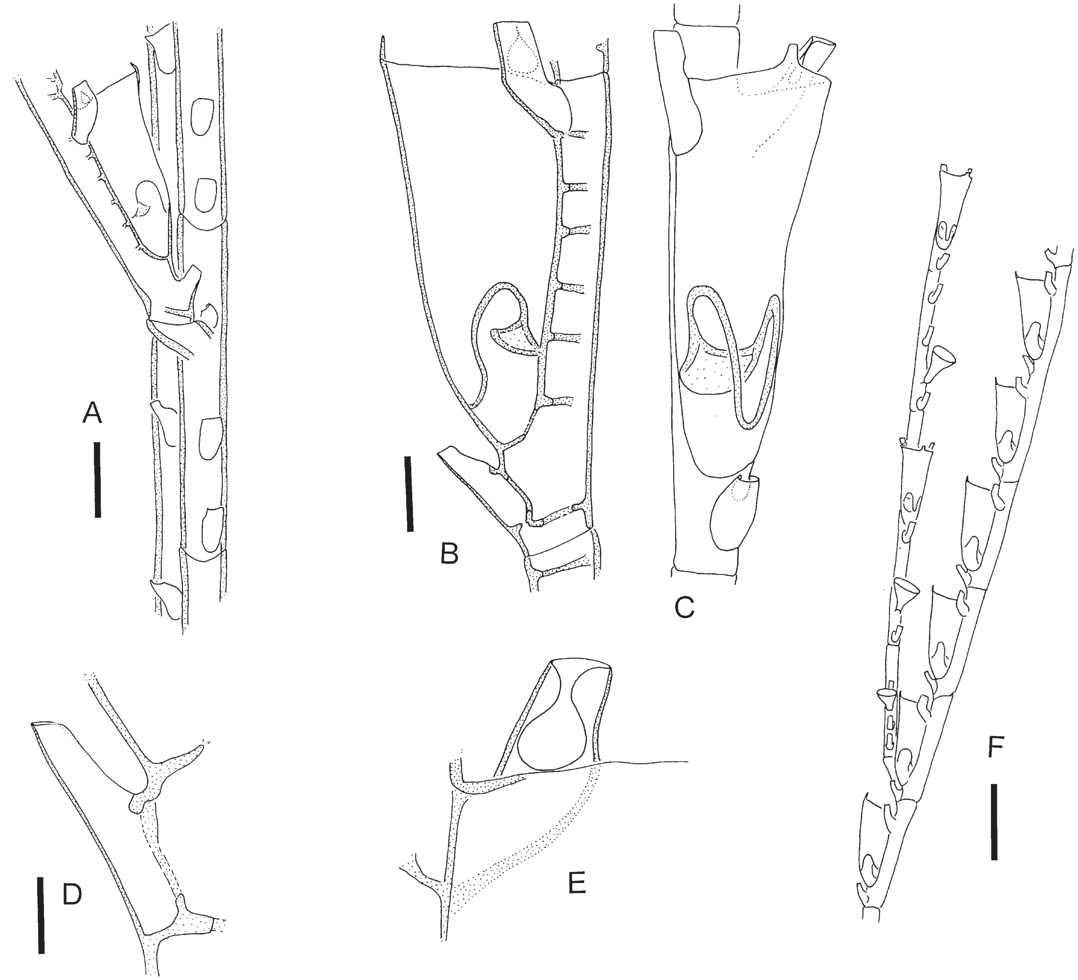

Fig. 74. *Cladocarpus keiensis* new species. A. Part of stem in polysiphonic region, with base of hydrocladium; note presence of nematothecae on auxiliary tube (left). B. Hydrocladial segment in lateral, transparent view. C. Hydrocladial segment in oblique view, note intrathecal septum and ridge (stippled). D. Median inferior nematotheca. E. Lateral nematotheca seen from inner side, note that two lobes formed by drop-shaped emargination can also be fused, same scale as D. F. Hydrocladium with gonocladium bearing three juvenile gonothecae, note presence of hydrothecae on gonocladium as well as single row of nematothecae. – Scales: A = 0.2 mm; B–C = 0.1 mm; D–E = 50 µm; F = 0.5 mm.

internal thickenings (ribs): 7–8 semicircular ones along adcauline wall of hydrotheca, one circular at base of median inferior nematotheca.

Hydrotheca elongate, conical, depth 0.5 mm, opening diameter 0.2 mm, adcauline wall completely adnate, abcauline wall mostly straight or very slightly S-shaped, opening-plane perpendicular to internode axis, margin smooth except for a sharp rectangular abcauline cusp, cusp not gutter-like. Hydropore near base of adcauline side. At lower fourth of hydrotheca an internal adcauline septum spanning half the hydrothecal diameter, scoop-shaped, directed obliquely upward, lateral sides attached to hydrotheca and continued as a looped ridge to abcauline wall where both ends meet (Fig. 74B–C). Septum and ridge very conspicuous, present in all hydrothecae.

Lateral nematothecae tubular, distal half extending beyond hydrotheca, bent at level of hydrothecal margin, upper part upright, lower, adnate part oblique, one circular terminal opening, inner wall with either a deep, drop-shaped emargination or a similarly shaped hole (Fig. 74E). Median inferior nematotheca below hydrotheca and just reaching somewhat beyond its bottom, tubular, straight, lower half adnate, free part gutter-like.

Gonothecae borne on modified hydrocladia (gonocladia) branching off from ordinary hydrocladia, branching point near base of a hydrotheca. Gonocladia unpaired, straight, closely resembling ordinary hydrocladia, with a few segments bearing a hydrotheca and nematothecae, these segments thus identical to the ones of ordinary hydrocladia, intercalated between them 2–3 internodes bearing a gonotheca, each internode with 2–3 nematothecae, nematothecae these internodes in one median row, thus not paired, resembling median inferior nematothecae. Gonocladium with regular internal ribs.

Observed gonothecae all at beginning of development only, funnel-shaped, circular cross-section.

Etymology

The name *keiensis* refers to the type locality in the channel between the two main islands of the Kei Archipelago.

Remarks

Cladocarpus keiensis resembles *Cladocarpus sibogae*, the type locality of which is only 8–9 nautical miles distant. They differ, however, in a number of independent details. *Cladocarpus sibogae* has median inferior and lateral nematothecae with slit-like openings which are not gutter-shaped or tubular (see Ramil & Vervoort 1992: fig. 27f), the hydrothecal margin is undulated, it lacks the large intrathecal septum and the looped ridge, the gonocladium has no interspersed segments with hydrothecae, and the nematothecae of the gonocladium are in two rows. Further differences are found in the unbranched stem and the generally larger dimensions of internode length and hydrotheca size. *Cladocarpus multiseptata* Bale, 1915, is also similar but this species has gonocladia with nematothecae in two rows and without hydrothecae. There are more such similar species and their differences are discussed in Vervoort (1966), Rees & Vervoort (1987), Ramil & Vervoort (1992), and Ansín Agís et al. (2001). *Cladocarpus keiensis* differs from all of them by its peculiar gonocladium and the intrathecal septum continued as a looped ridge.

The gonocladium (phylactocarp) of *Cladocarpus keiensis* with its interspersed hydrothecate elements immediately suggests its origin from an ordinary hydrocladium and could represent the least derived phylactocarp morphology found in this genus. The gonothecae of the type specimen were all juvenile, but clearly recognizable as incipient gonothecae (Fig. 74F).

Distribution

Only known from the type locality: Kei Islands Expedition station 24, 5.62°S, 132.93°E, 100 m.

Lytocarpia angulosa **(Lamarck, 1816)**

Fig. 75.

Plumularia angulosa Lamarck, 1816: 126.

Aglaophenia angulosa Lamouroux, 1816: 166.

Plumularia Huxleyi Busk, 1852: 395.

Acanthocladium Huxleyi. – Allman 1883: 33, pls 9 & 20: figs 1–3.

Aglaophenia Huxleyi. – Bale 1884: 161, pl. 15: fig. 6, pl. 17: fig. 8.

Thecocarpus angulosus. – Billard 1907: 326, fig. 2, revision. – Billard 1913: 85, figs 70–74.

Acanthocladium studeri Weltner, 1900: 588, pl. 46: figs 4–7.

Acanthocladium angulosum. – Stechow & Müller 1923: 478.

Lytocarpia angulosa. – Watson 2000: 64, fig. 51A–G.

Material examined:
Kei Islands Expedition stations: 15, with gonothecae. – 16. – 18. – 21. – 24. – 26. – 30, with gonothecae. – 37. – 53.

Description

Colonies forming single stems, rooted in sediment by tangled mass of fibre-like stolons, stem height reaching 60 cm and more, flexible, limp when out of water, polysiphonic, furnished all around with helically arranged pinnate side-branches. Stem only occasionally with hydrocladia arising from a primary tube, hydrocladia

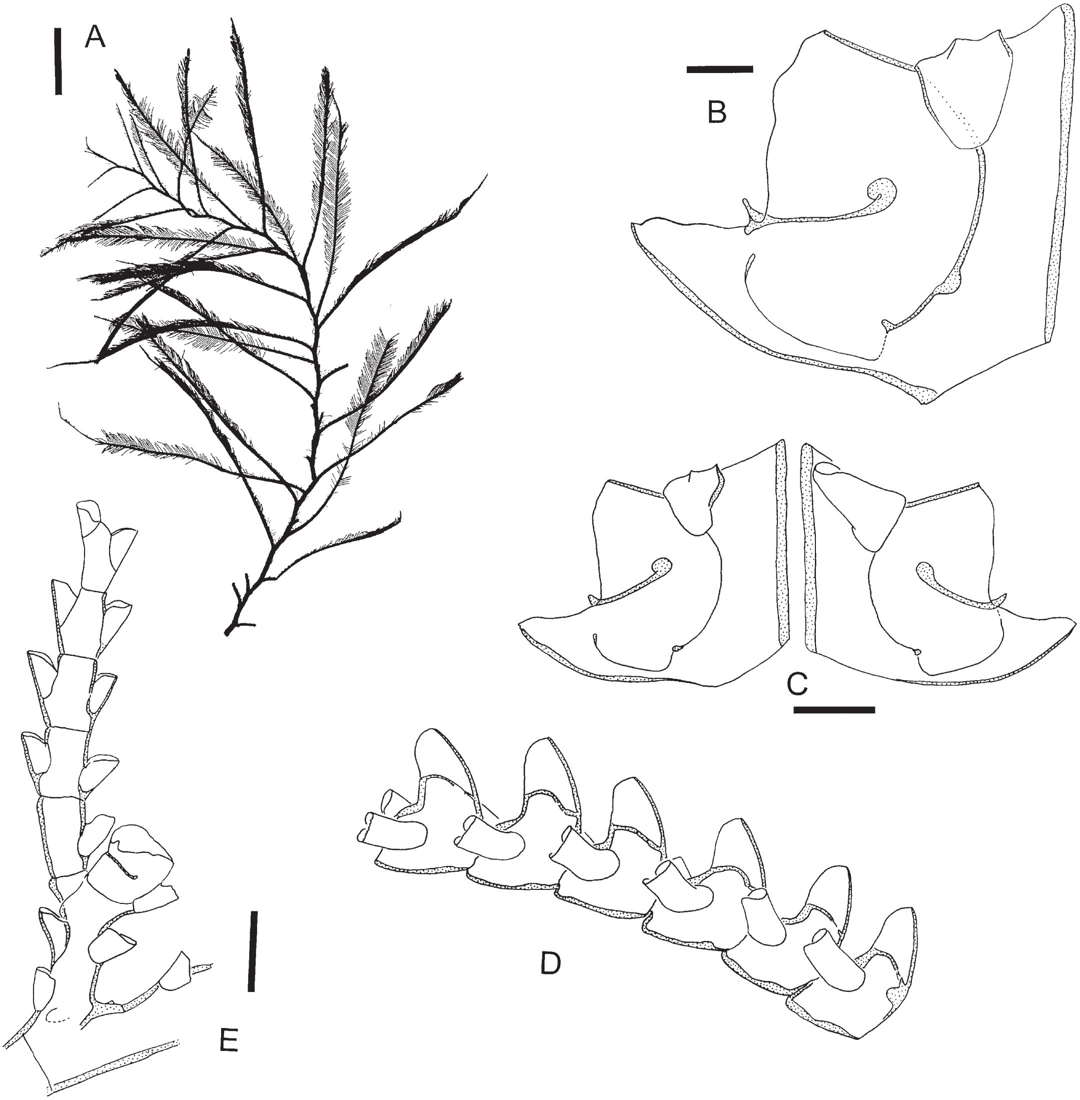

Fig. 75. *Lytocarpia angulosa* (Lamarck, 1816); A, Indonesia, Kei Islands collection; B–D, station 18; E, station 15. A. Distal fourth of a colony. B. Hydrocladial segment, note abcauline marginal tooth. C. Same hydrocladial segment seen from left and right, note differently shaped lateral nematothecae. D. Modified hydrocladium (pseudophylactocarp) from stem, same scale as C. E. One costa of a corbula seen from inner side. – Scales: A = 2 cm; B = 50 µm; C–D = 0.1 mm; E = 0.2 mm.

often lost, some replaced by pseudophylactocarps. Auxiliary tubes can also bear pseudophylactocarps; they can also be present on side-branches, sometimes they are rare or absent.

Pseudophylactocarps are modified hydrocladia without hydrothecae, highly flexible, composed of short segments, each segment with three nematothecae, these resembling to a pair of laterals and one median inferior nematotheca of normal hydrocladia.

Axis of side-branches polysiphonic, monosiphonic at very ends only, with superficial primary tube bearing alternate hydrocladia, base of side-branches without oblique pinching (hinge-joint).

Hydrocladia straight, stiff, dense, inclined towards hydrocaulus at an angle of about 60°, up to 5 mm long, with oblique nodes delimiting segments. The distal-most hydrocladia of a side-branch can be transformed into spine-like processes bearing nematothecae.

Hydrotheca semi-circular in side view, 0.21–0.25 mm high, adcauline side 2/3 adnate, opening-plane parallel to hydrocladial axis, almost no free abcauline side, rim with a large abcauline tooth, lateral margin undulated, with a horizontal, thin abcauline septum projecting into lumen of hydrotheca, free end of septum in-rolled.

Median inferior nematotheca adnate along entire length of abcauline hydrothecal wall, total length less than height of hydrotheca, free part of variable length, top side of free part open and thus gutter-like, opening into hydrotheca (foramen) present. Lateral nematothecae cup-shaped, broad, opening facing upward; the two lateral nematothecae of on hydrothecae are often unequally developed, especially in more proximal hydrothecae (Fig. 75C).

Gonothecae borne on hydrocladium modified into corbula. Corbula as long as hydrocladia, axis without hydrothecae, with two rows of alternate costae. Costae solitary and not fused, up to 1.3 mm long, each with a hydrotheca in lower part, distal part tapering, segmented, on lateral side of each segment two opposite, adnate nematothecae. Gonothecae attached below hydrotheca, lenticular to sac-shaped, 0.6 mm diameter; gonophore medusoid, bell margin with granules.

Remarks

The hydrotheca of *Lytocarpia angulosa* (Lamarck, 1816) resembles somewhat the one of *Macrorhynchia phoenicea*, but its abcauline tooth, the gutter-shaped median inferior nematotheca, and the frequently unequal development of the lateral nematothecae of *L. angulosa* are sufficient to distinguish them. The colony form of the two species is quite different and so they are easily separable macroscopically (cf. Figs 68A and 75A).

Some of the examined gonothecae contain gonophores that are clearly similar to the ones found in *M. philippina*, thus presumably liberable medusoids. The medusoids even have a ring of refringent granules along the bell margin. These medusoids are now known for quite a number of thecate hydroids (see Boero & Bouillon 1989, Gravier-Bonnet & Migotto 2000). Likewise, the pseudophylactocarps are found in various species of tropical aglaophenids belonging to different genera (see also *L. perarmata* below).

Distribution

Northern Australia, Indonesia. Type locality: Australia.

Lytocarpia delicatula **(Busk, 1852)**

Fig. 76.

Plumularia delicatula Busk, 1852: 396.

Aglaophenia delicatula Bale, 1884: 167, pl. 14: fig. 4, pl. 17: fig. 11. – Borradaile 1905: 843, pl. 69: fig. 7. – Billard 1913: 106, fig. 95. – Jäderholm 1920: 8, pl. 2: fig. 7. – Jarvis 1922: 350. – Pennycuik 1959: 185. – Watson 2000: 57, fig. 46A–E.

Thecocarpus delicatulus. – Millard & Bouillon 1973: 94, fig. 11J–K. – Millard 1975: 455, 139D–E.

Material examined:
Kei Islands Expedition stations: 37, on sponge and stone. – 67, part of plume. – 85, with gonothecae. – Kei Islands Expedition, Banda Islands, Neira Island, 20 m, 1 Jun 1922, on sponge.

Description

Colony pinnate, 3–12 cm, stem not branched, monosiphonic, bearing alternate hydrocladia, with prosegments, with one or two hinge-joints, part above hinge-joint segmented through slightly oblique nodes, each segment bearing a hydrocladial apophysis with a mamelon and three nematothecae: one inferior anterior and one on each side of the apophysis.

Hydrocladia up to 8 mm long, held obliquely to caulus, bearing anterior hydrothecae, homomerously segmented by transverse nodes, segments with weakly developed internal ribs.

Hydrotheca campanulate, depth 0.21–0.23 mm, covering nearly complete segment, adcauline side adnate; opening forming an angle of about 55° with segment, inclined towards below, margin with five cusps: one distinct abcauline

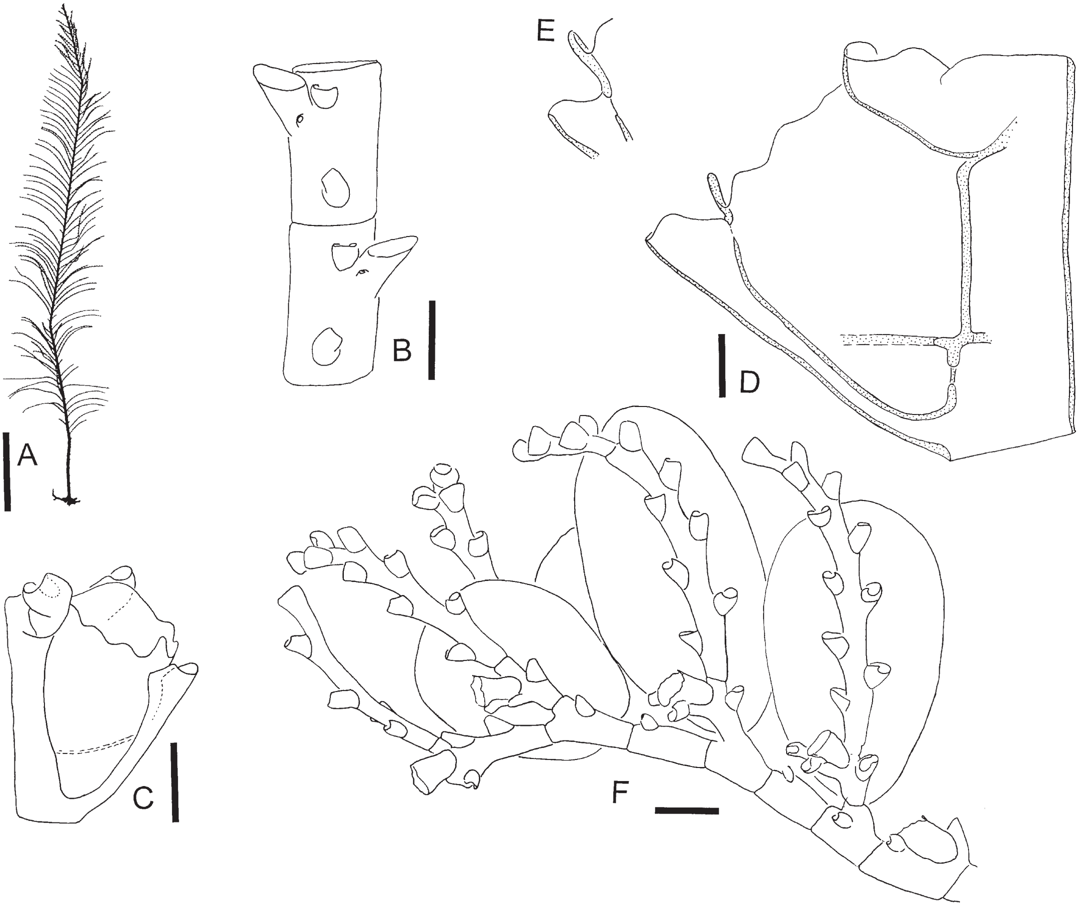

Fig. 76. *Lytocarpia delicatula* (Busk, 1852); A, Indonesia, Kei Islands collection; B–F, station 85. A. Colony silhouette. B. Two stem segments. C. Hydrotheca in oblique view. D. Hydrocladial segment from side. E. Hydrothecal tooth and median inferior nematotheca from hydrotheca on same hydrocladium as that shown in D, note the variability. F. Corbula containing gonothecae. – Scales: A = 1 cm; B, F = 0.2 mm; C = 0.1 mm; D, E = 50 µm.

tooth and on each lateral side two broader triangular cusps. On inside of lower part of hydrotheca a short adcauline shelf, shelf continued as ridge along hydrothecal wall towards front.

Median inferior nematotheca adnate to abcauline hydrothecal wall to just below origin of abcauline tooth, free end rather short, gutter-shaped, reaching approximately to level of the tips of the marginal cusps; foramen into hydrotheca present but inconspicuous and small, may be obliterated. Lateral nematothecae curved, opening directed towards above, reaching beyond margin of hydrotheca.

Corbula open, replacing a hydrocladium, first segment like in a normal hydrocladium with hydrotheca, followed by 6–7 segments bearing alternate ribs (costae). Costae thin, not flattened, not fused, near base a hydrotheca with associated lateral nematothecae; part of costa distal to hydrotheca with two rows of alternate nematothecae. Gonotheca attached on costal apophysis of corbula axis (rachis), oblong, flattened, 0.8–1.0 mm long

Remarks

The corbulae of *Lytocarpia delicatula* (Busk,

1852) are relatively small. In the present material (Fig. 76F), the simultaneous presence of gonothecae with soft tissue and others that are already empty nevertheless suggests that the corbulae are mature. See also below for the distinction from the similar *Lytocarpia phyteuma*.

Distribution

Northern Australia, Great Barrier Reef, Indonesia, Seychelles, Maldives, Mozambique. Type locality: Torres Strait, Australia, 16 m.

***Lytocarpia phyteuma* (Kirchenpauer, 1876)**

Fig. 77.

Agalophenia phyteuma Kirchenpauer, 1876: 23.

Agalophenia elongata var. *sibogae* Billard, 1913: 103, figs 92–93.

Thecocarpus phyteuma. – Stechow 1919: 139, figs C2–D2. – Pennycuik 1959: 187. – Millard & Bouillon 1973: 95, fig. 11E–F. – ?Vervoort & Vasseur, 1977: 86, fig. 36.

Lytocarpia phyteuma. – Ryland & Gibbons 1991: 548, figs 18–19. – Watson 2000: 65, fig. 52A–G.

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

Thecocarpus leopoldi Leloup, 1930a: 1, fig. 1. – Leloup 1930b: 11, figs 8–9, pl. 2: figs 2–3. – Vervoort & Vasseur, 1977: 86, revision.

Material examined:

Kei Islands Expedition station 69. – Kei Islands Expedition, Banda Islands, Neira Island, 20 m, 1 Jun 1922, incipient corbulae with hydrothecae present. – Kei Islands Expedition, Banda Island, village of Waling, 20 m, 11 Jun 1922. – MHNG INVE 32597, Thailand, Andaman Sea, Koh Pee Pee, 10–15 m, 15 Apr 2000, coll. A. Faucci, with corbulae

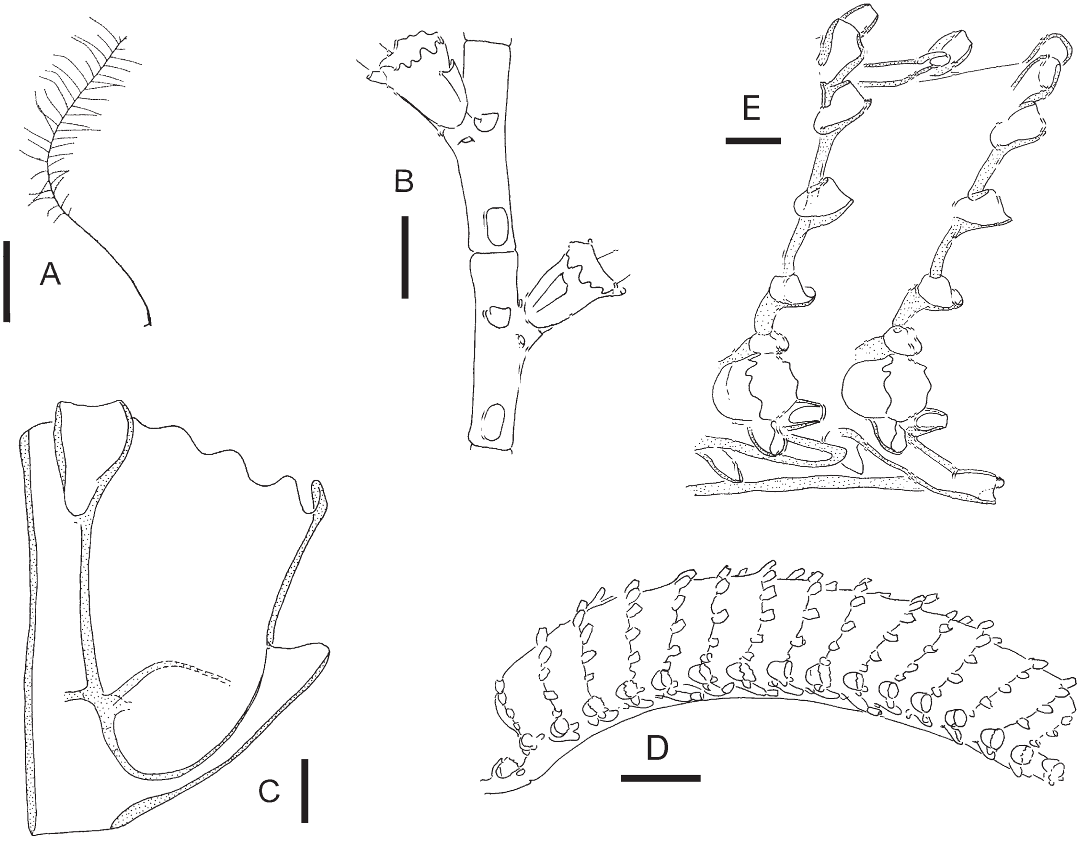

Fig. 77. *Lytocarpia phyteuma* (Kirchenpauer, 1876); A–C, Banda Islands; D–E, Andaman Sea. A. colony silhouette. B. Two stem segments. C. Hydrocladial segment from side. D. Corbula. E. Two costae of corbula. – Scales: A = 1 cm; B = 0.2 mm; C = 50 µm; D = 0.5 mm.

Differential diagnosis

Similar to *L. delicatula*, differing in: stems only up to 4 cm, hydrocladia wider spaced, stem without hinge-joints, prosegments not visible but with solitary nematothecae on proximal stem-region; hydrotheca deeper (0.26 mm), opening less inclined, lateral margin with three cusps, median inferior nematotheca reaches only to middle of hydrotheca; mature corbula long (2/3 of hydrocladia), with fused broad ribs bearing only one row of nematothecae.

Description of gonotheca

Corbulae closed, length variable but may reach almost the length of a hydrocladium. First segment hydrothecate and identical to normal hydrocladium, then axis with two alternate rows of costae. Costae leaf-like, at base a hydrotheca on a lobe, distal rim of costa with a row of nematotheca, costae fused to form a tube, distal end mostly open, this even in corbulae with mature gonothecae. Lobe bearing hydrotheca can be elongated like a spur and may bear a terminal nematotheca.

Description of trophosome

See Stechow (1919) or Ryland & Gibbons (1991).

Remarks

The Indonesian material assigned here to *Lytocarpia phyteuma* (Kirchenpauer, 1876) had only one immature corbula. The hydrotheca on the corbula made it clear that it belonged to *Lytocarpia*. The trophosome matched quite well fertile material from the Andaman Sea as well as the description of Millard & Bouillon (1973), or Ryland & Gibbons (1991). It matched also Stechow's (1919) re-description of the type specimen, although the median nematothecae of the type material are tubular and not gutter-shaped as observed here. All other authors describing material of *L. phyteuma* reported gutter-like median nematothecae. Millard & Bouillon (1973) interpreted this as an interspecific variation because such a variation is also known in from other aglaophenids. The material of Vervoort & Vasseur (1977) differs in that the lateral nematothecae extend much towards the rear side of the internode. Watson (2000) had therefore some doubts on the identity of this material. The Australian material of Watson (2000), however, also differs slightly from the Indonesian one in that the median nematotheca reaches much higher up, thus approaching the condition of *L. delicatula*. The size of the hydrotheca is apparently also smaller.

The material of the present investigation is obviously identical to Billard's (1913) *Aglaophenia elongata* var. *sibogae* from various Indonesian localities. Billard had apparently only infertile material at hand and his variant is therefore here regarded as a synonym of *L. phyteuma*. *Aglaophenia elongata* Meneghini, 1845 is a Mediterranean species (Svoboda & Cornelius 1991).

Lytocarpia leopoldi (Leloup, 1930) from New Guinea is very similar to *L. phyteuma*. The main distinguishing characters are the gutter-shaped median nematotheca, two nematothecae per cauline segment, and some aspects of the corbula. Vervoort & Vasseur (1977) found that the differences of the corbula are not significant and they synonymized the two names. As mentioned above, tubular or gutter-shaped median nematotheca is likely only representing intra-specific variation. The cauline nematothecae are sometimes not easy to observe, especially in slide preparations, and Leloup might have overlooked one. *Lytocarpia leopoldi* is therfore very likely a synonym of *L. phyteuma*, although for a final decision the type material of *L. leopoldi* should be re-examined.

Distribution

Polynesia, Great Barrier Reef, northern Australia, Indonesia, Seychelles. Type locality: Tonga Islands.

***Lytocarpia perarmata* (Billard, 1908), n. comb.**

Fig. 78.

Thecocarpus myriophyllum perarmatus Billard, 1908a: 74, fig. 3.

Thecocarpus perarmatus. – Billard 1913: 95, figs 81–86.

Material examined:

Kei Islands Expedition stations: 53, with corbulae. – 54, with corbulae.

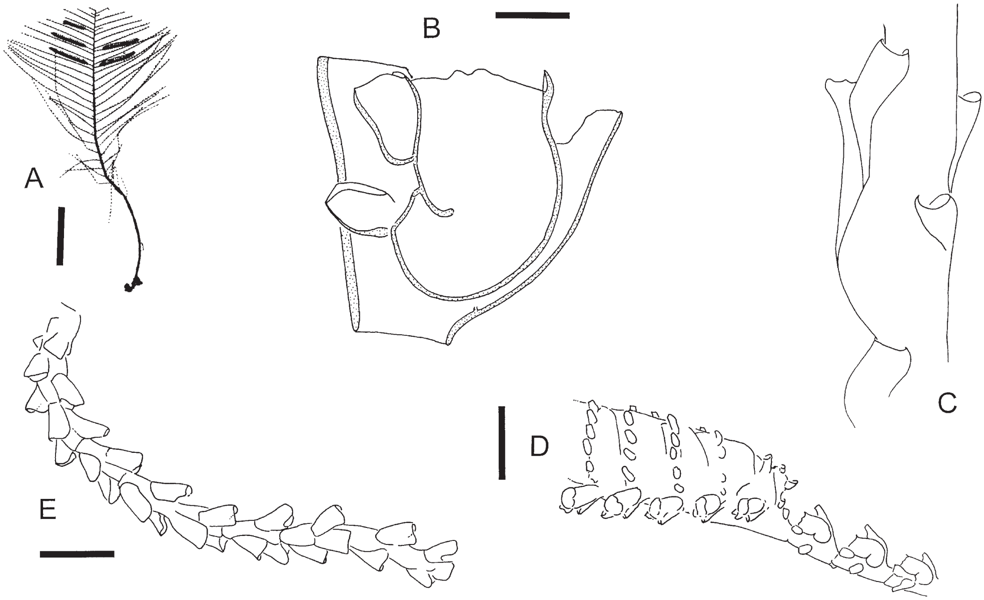

Fig. 78. *Lytocarpia perarmata* (Billard, 1908); station 53. A. Colony silhouette. B. Hydrotheca in side view. C. Hydrocladium seen from behind, note asymmetric pair of lateral nematothecae (top), and additional nematotheca on rear side (below), same scale as B. D. Part of corbula. E. Appendage at base of hydrocladium. – Scales: A = 1 cm; B–C = 0.1 mm; D = 0.5 mm; E = 0.2 mm.

Description

Colonies pinnate, 4–6 cm high, planar, stem not forking, lightly polysiphonic but becoming monosiphonic towards distal, composed of a superficial primary tube and a few auxiliary tubes. Primary tube with nematothecae and apophyses for the hydrocladia. Hydrorhiza a tangled mass of stolons anchoring colony in soft substrate.

Hydrocladia, alternate, long (up to 2.5 cm), straight, with oblique nodes, nodes can be indistinct.

Hydrotheca cup-shaped, depth 0.3 mm, slightly curved, opening-plane perpendicular to hydrocladial axis, abcauline wall rounded, short intrathecal shelf on adcauline side, hydrothecal rim with one median, rectangular tooth, this tooth slightly gutter-shaped, lateral rim of hydrotheca with two or more shallow teeth.

Median inferior nematotheca gutter-shaped, attached up to middle of hydrotheca and more, without foramen leading into hydrotheca. Lateral pair of nematothecae unequal, one nematotheca taller and displaced towards rear side. On rear side at the level of lower third of hydrotheca an additional nematotheca, displaced from median line towards side with smaller lateral nematotheca.

Hydrocladial apophysis of primary tube often bearing a flexible appendage consisting of a row of segments with nematothecae, each segment with three nematothecae (Fig. 78E).

Gonothecae protected in corbulae. Corbula replacing a hydrocladium, long and thin, tubular, about 1/3 of hydrocladial length, beginning with a few (3) segments having a structure identical to normal hydrocladia (Fig. 78D), then with two rows of costae forming a closed corbula. Costae flattened, fused at distal end with opposite costae, one row of tubular nematothecae along distal rim of each costa, each costa at its base with a lobe bearing a fully formed hydrotheca.

Remarks

Because *Lytocarpia* Kirchenpauer, 1872 has priority over its synonym *Thecocarpus* Nutting, 1900 (Rees & Vervoort 1987), *Thecocarpus perarmatus* is here used in the new combination *Lytocarpia perarmata.*

With its additional nematotheca placed almost behind the hydrotheca and the asymmetric lateral nematothecae, this species is very distinct and easy to recognize, but see also the discussion under *L. orientalis*.

The apophyses of the primary tube that bear the hydrocladia often also possess an appendage resembling the pseudophylactocarps described for *Gymnangium longicorne*, *Lytocarpia angulosa* and other aglaophenids (Fig. 78E). Although it is likely a modified hydrocladium, it is probably not strictly homologous to the pseudophylactocarps of *Gymnangium longicorne,* because it does not replace a hydrocladium.

Distribution

Indonesia. Type localities: 2.475°S, 131.058°E, 188 m and 2.592°S, 131.437°E, 95 m.

Lytocarpia orientalis **(Billard, 1908) n. comb., n. status**

Fig. 79.

Thecocarpus myriophyllum var. *orientalis* Billard, 1908a: 73, fig. 1. – Billard 1913: 91, fig. 76–78, pl. 5: fig. 43. – Jäderholm 1919: 25, pl. 6: fig. 5. – Billard 1922: 347, fig. 2. – Vervoort 1941: 23. – Vervoort 1972: 221, fig. 76.

Thecocarpus myriophyllum var. *angulatus* Billard, 1913: 94, figs 79–80. – Billard 1922: 347, fig. 3.

Thecocarpus myriophyllum var. *elongatus* Billard, 1910: 51. – Billard 1922: 348, fig. 4.

Gymnangium unjinense Watson, 2000: 62, fig. 50A–E, **new synonym.**

Material examined:
Kei Islands Expedition stations: 67. – 72, with corbulae. – 90, with corbulae. – 106.

Description

Colonies pinnate, stems never forked, up to 12 cm high, outline of plume with blunt top. Hydrorhiza a tangled mass of stolons anchoring colony in sediment. Stem polysiphonic, becoming monosiphonic in distal-most part, in basal part pinched obliquely one or more times; stem composed of a superficial primary tube on a bundle of auxiliary tubes. Auxiliary tubes with rows of small, ovoid nematothecae along the grooves where two tubes meet. Primary tube with more or less distinct nodes, each segment with one hydrocladial apophysis and two nematothecae: one on lower part, one axillary; mamelon on apophysis present. Pseudophylactocarps absent.

Hydrocladia dense, straight, stiff, up to 2 cm long, regularly segmented by slightly oblique nodes, each segment with hydrotheca covering about ¾ of segment and three nematothecae, internal ribs weakly developed or absent.

Hydrotheca 0.21–0.28 mm deep, opening diameter 0.2 mm, cup-shaped, abcauline wall gently convex, adcauline wall completely adnate, opening-plane nearly perpendicular to hydrocladium or inclined towards below, hydropore in about middle of adcauline wall, covered by a downward pointing intrathecal septum attached at adcauline wall, septum margin thickened, septum makes completely contracted hydranth to face downward. Abcauline margin with a distinct median cusp, cusp depressed longitudinally and thus gutter-shaped; lateral margin with 2–3 shallow, variable teeth.

Median inferior nematotheca almost completely adnate, attached along 6/7 of abcauline wall of hydrotheca, free end short, gutter-shaped, reaching to rim of hydrotheca, without foramen into hydrotheca. Lateral nematothecae cup-shaped, opening facing towards above.

Gonothecae in corbulae, corbula replaces hydrocladium. Corbula thin, closed, about 7 mm long, diameter 0.7 mm; first three segments identical to hydrothecate segments of normal hydrocladia, then axis furnished with two rows of costae, costae fused together to form an almost closed tube; near base of each costa a nematotheca and a free hydrotheca with its lateral nematothecae; instead of median inferior nematotheca grows the leaf-like main body of the costa with one row of about 4 nematothecae along edge facing away from stem. Tip of corbula axis (rachis) with short process bearing nematothecae. The pair of lateral nematothecae of the costal hydrotheca can be replaced by a process bearing 4–7 nematothecae, rarely this process developed as a free costa. The most proximal costae can be free.

Remarks

Lytocarpia orientalis (Billard, 1908) was first described as a variant *orientalis* of the Atlantic *L. myriophyllum* (Linnaeus, 1758). Billard also described several other variants of this species and

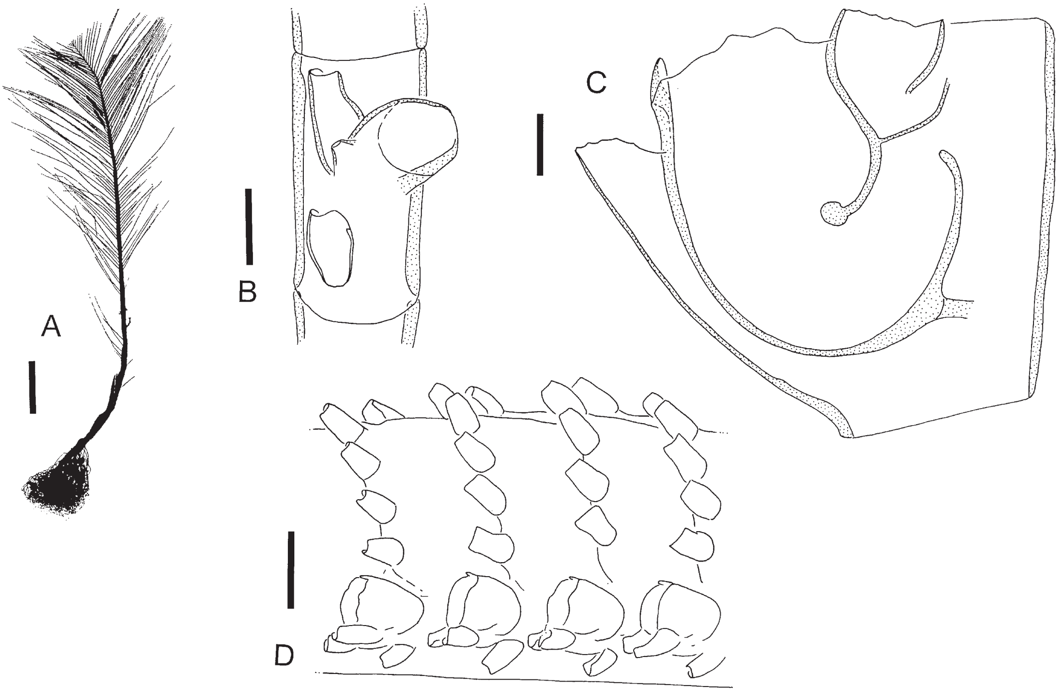

Fig. 79. *Lytocarpia orientalis* (Billard, 1908); station 72. A. Colony silhouette. B. Segment of primary tube. C. Hydrocladial segment from side. D. Middle part of corbula. – Scales: A = 1 cm; B = 0.1 mm; C = 50 µm; D = 0.2 mm.

he reviewed their features (Billard 1922). *Lytocarpus myriophyllum* (Linnaeus, 1758) is indeed a very variable species as far as the hydrotheca and the colony form are concerned. Ramil & Vervoort (1992) and also Ansìn Agìs, Ramil & Vervoort (2001) documented thoroughly the variation of the hydrotheca of a population from the north-eastern Atlantic. Atlantic and Mediterranean colonies can be either simple or branched, reaching heights of up to 1 m. The variation of the hydrothecal morphology and colony form observed in the Atlantic populations also encompass the variant *orientalis*, and both morphotypes cannot objectively be separated using this character set alone. Constant differences between the Atlantic and Pacific populations were, however, observed in the morphology of the corbulae. While Atlantic morphotypes have open corbulae with isolated, thin costae, the ones from the Pacific have closed, tubiform corbulae formed by the fusion of leaf-like costae (compare Figs 79D and 80, note different scaling factor). There is also a considerable size difference. Whether these differences are due to inter- or intra specific variation is not immediately apparent, and whether the Pacific morphotype corresponds to a true geographic subspecies of *L. myriophyllum* or whether it represents a separate species can only be answered based on genetic information (note that the category subspecies is only used in some species concepts, while others do not accept them, see Wheeler & Meier 2000). In other aglaophenids, however, such a difference in corbula morphology is seen as a good indicator for two species being involved (cf. *L. delicatula* and *L. phyteuma*). Additionally, the wide geographic separation – Northern Atlantic Ocean versus Pacific Ocean – argues in favour of treating the two morphotypes as representatives of separate species. Therefore, and out of a preference for species concepts not accepting the category of subspecies, Billard's variety *orientalis* is raised to full species level as *Lytocarpia orientalis (Lytocarpia* has priority over *Thecocarpus,* see

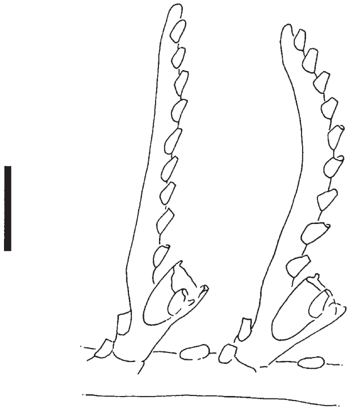

Fig. 80. *Lytocarpia myriophyllum* (Linnaeus, 1758); Azores, Atlantic Ocean (MHNG collection). Part of corbula with two costae. – Scale: 0.5 mm.

above). Contrary to Billard (1913), the present Indonesian material was very homogeneous and showed only little variation. This material thus differed also from Atlantic *L. myriophyllum* (see Cornelius 1995b, Schuchert 2001) in having unbranched colonies only, having a median nematothecae reaching higher up the abcauline wall of the hydrotheca, having much smaller hydrothecae, and lacking intra-segmental ribs.

Thecocarpus myriophyllum var. *angulatus* Billard, 1913 differs from the variety *orientalis* mainly in having more inclined hydrothecal openings. This difference and others mentioned by Billard (1913) appear insignificant and this form is here regarded as a synonym only.

Likewise, *Thecocarpus myriophyllum* var. *elongatus* Billard, 1910 is also seen as a synonym of *L. orientalis* (see Billard 1922).

According to Ansìn Agìs, Ramil, & Vervoort (2001: 98), *Thecocarpus myriophyllum vervoorti* Stepanjants, 1979 from the south tip of South America also belongs to the *orientalis* group. The spine-like processes of the corbula depicted in Stepanjants (1979) set this species somewhat apart. Because of this, the wide geographic separation and its occurrence in colder waters it is here not included in the synonymy, pending closer examination of material.

Lytocarpia annandalei (Ritchie, 1910a) also resembles *L. orientalis*, but the former has pseudophylactocarps (Ritchie interpreted them as phylactocarps). Pseudophylactocarps have so far never been observed in *L. orientalis*, but they occur in *L. perarmata*. The latter species is – apart from the pseudophylactocarps and the additional nematotheca behind the hydrotheca – strikingly similar to *L. orientalis*, notably in colony habit and hydrothecal morphology.

Gymnangium unjinense Watson, 2000 appears identical to the present material and this name is here regarded as a subjective synonym of *L. orientalis*. Watson (2000) based her description on infertile material and acknowledged the similarity to *M. orientalis*. The differences given by Watson are here considered as not significant

Distribution

Indonesia (Billard 1913), Philippines (Billard 1910, as *L. myriophyllum* var. *elongata*), Japan (Jäderholm 1919), Chile (Vervoort 1972), northern Australia (Watson 2000, as *Gymnangium unjinense*). Perhaps also China Sea (Leloup 1937, cited in Ansìn Agìs, Ramil, & Vervoort 2001). Type localities: Borneo Bank, SW Celebes, 5.058°S, 119.000°E, 450 m and Waigeu Island, NW New Guinea, 0.063°N, 130.405°E, 141 m.

Aglaophenia cupressina **Lamouroux, 1816**

Fig. 81.

Aglaophenia cupressina Lamouroux, 1816: 169. – Kirchenpauer 1872: 27, pl. 1: fig. 11. – Billard 1907: 331, fig. 5. – Billard 1909: 330. – Billard 1913: 107, fig. 96; pl. 6. – Bale 1915: 319, pl. 47: figs 6–8. – Leloup 1930b: 15, figs 10–11, pl. 2: fig. 4. – Leloup 1932: 1–3. – Vervoort 1941: 233, fig. 11. – Millard & Bouillon 1974: 36, fig. 8E–F. – Millard 1975: 408, fig. 128A–C.

Plumularia bipinnata Lamarck, 1816: 126. – Billard 1907: 331.

Aglaophenia macgillivrayi Busk, 1852: 400. – Allman 1883: 34, pl. 10, pl. 20: figs. 4–6. – von Campenhausen 1896b: 315. – Billard 1909: 331.

Aglaophenia spicata. – Kirchenpauer 1872; 27, pl. 1: fig. 12, pl. 2: fig. 11, pl. 4: fig. 11. [Not *Aglaophenia spicata* Lamouroux, 1816 = *Monoserius pennarius* (Linnaeus, 1758)]

Corbulifera macgillivrayi. – Naumov 1969: 530, figs 380–381.

Material examined:
Kei Islands Expedition, Kei Islands, Tual, 2 m, 21 Mar 1922, numerous stems, with corbulae. – Kei Islands Expedition, Moluccas, Bay of Ambon, 1 m, 8 Feb 1922, with corbulae. – Kei Islands Expedition, Banda Islands, Neira Island, 10 m, 5

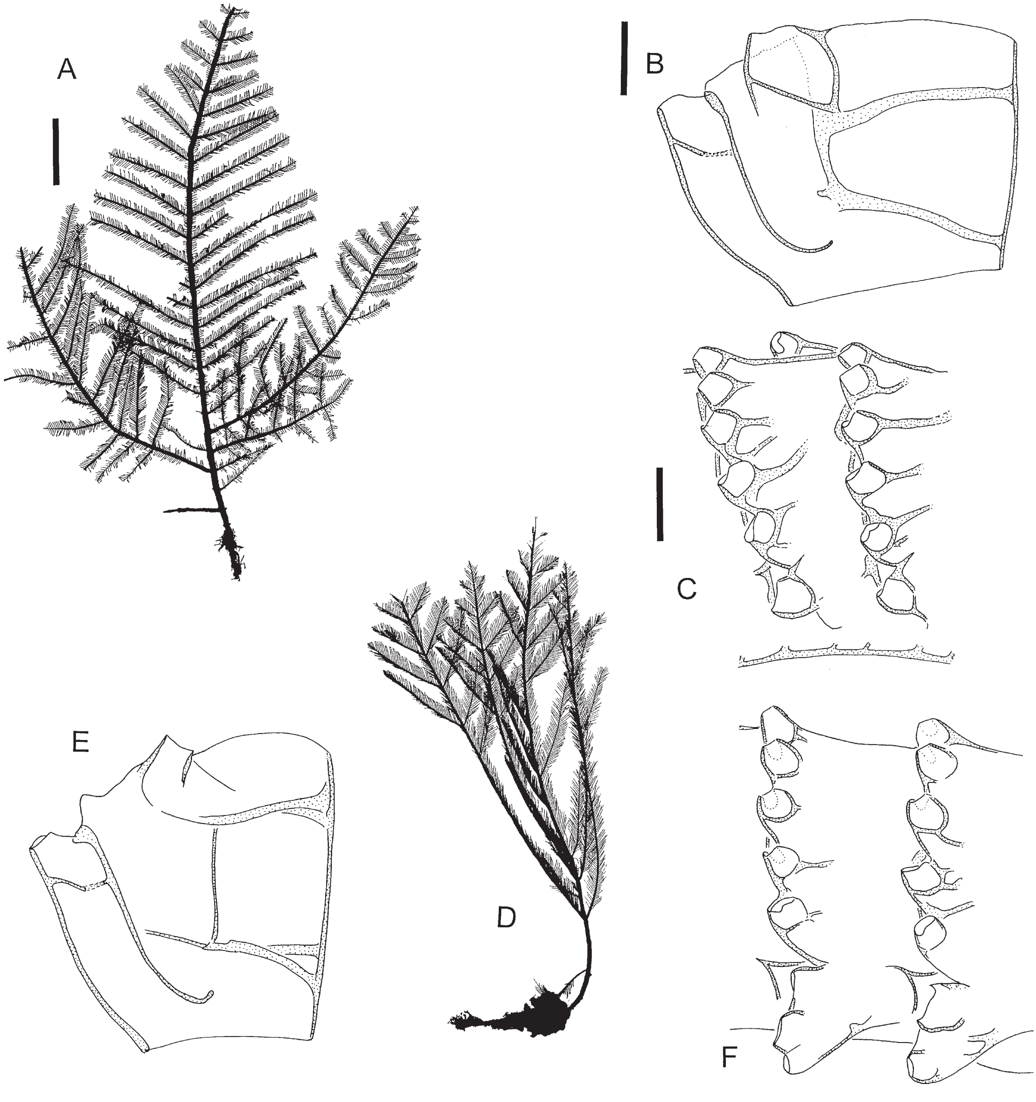

Fig. 81. *Aglaophenia cupressina* Lamouroux, 1816; A–C, Bay of Ambon, 1 m depth; D–F, Neira Island, 10 m depth. A. Colony silhouette. B. Hydrocladial segment. C. Two costae of a male corbula. D. Colony silhouette, same scale as A. E. Hydrocladial segment, same scale as B. F. Two costae of a female corbula, same scale as C. – Scales: A, D = 2 cm; B, E = 0.1 mm; C, F = 0.2 mm.

Jun 1922, numerous stems, with corbulae. – Kei Islands Expedition, Kei Islands, Tual, 1–2 m, 23 Mar 1922, with corbulae.

Description

Colonies large, 7–20 cm, branched up to fourth order, branching often in one plane, usually a thick central primary axis (stem) with two lateral rows of side-branches, side-branches nearly opposite, regularly spaced, some side-branches branched again similar to main axis. Main stem and all branches thickly polysiphonic, only very short stretches at distal ends monosiphonic, polysiphonic parts composed of a superficial primary tube and a bundle of auxiliary tubes. Primary tube of side-branches originate from primary tube of stem, branching points of primary tubes often overgrown by few auxiliary tube. Primary tubes segmented in terminal parts, each segment with an apophysis for hydrocladium and two nematothecae at side of apophysis. Primary tubes usually with hydrocladia, but these may be broken off in proximal part of stem. Stolons tangled, creeping, anchoring colony on solid substrata. Inside of periderm of whole colony densely covered by a lining of spherical zooxanthellae, size 7–9 µm.

Hydrocladia alternate, thick and bristly, making colony resemble a fir twig, hydrocladia 3–5 mm, 6–11 hydrothecae, length within one colony similar, flattened laterally, rear side keeled, regularly segmented by transverse nodes, each segment with one hydrotheca, with two strong internal ribs (ridges, thickenings) at the level of the hydrotheca, these ribs irregularly curved, fused to a longitudinal ridge running along rear side, rear wall otherwise remarkably thin.

Hydrotheca relatively narrow, depth 0.25–0.28 mm, diameter 0.13–0.15 mm, campanulate, not curved, adcauline side completely adnate, opening slightly inclined towards below (approx. 30°), lateral margin slightly undulated or with a distinct antero-lateral cusp, hydropore at base of rear wall, above hydropore a very short adcauline shelf which is continued as a transverse internal ridge, presence variable.

Median inferior nematotheca very stout, breadth in lateral view 2/3 or more of hydrothecal diameter, completely adnate, reaching to the level of hydrotheca, margin with two broad lateral cusps (or free end gutter-shaped), on inside near upper third an oblique septum with a pore on adcauline side; no foramen into hydrotheca. Lateral nematotheca overtop hydrotheca, ovoid to cup shaped, about half as high as hydrotheca, opening directed towards above or inclined towards rear.

Gonothecae in closed corbula which replaces a hydrocladium. Corbula 1.7–2.5 mm long, tubular, first segment like in ordinary hydrocladia, then with leaf-like costae, 5–8 per side, fused to form a cylinder but with slit-like lateral openings, costae with one row of nematothecae, basal 2–3 may be on a raised lobe.

Remarks

The samples from 1 m and 10 m water depth showed very obvious differences that are very likely attributable to their different environment (cf. Fig. 81A–C and 81D–F). The colonies from 10 m depth were dark brown, while those from 1 m were bright amber coloured. Furthermore, the colonies from 10 m were more branched, more flexible, less bristly, had longer and thinner hydrocladia. There was also a difference in the corbulae. This difference, however, could be either due to depth or sexual dimorphism. The limited number of independent colonies did not make it possible to draw a reliable conclusion. The difference was mainly confined to the presence or absence of a raised lobe near the base of each costa. This lobe had 2–3 nematothecae. The opening behind this lobe was also larger than the usual slits. In the examined material this type of corbula contained gonothecae with eggs, while the other type of corbula was quite certainly male. Both type of corbulae have been described by other authors. Billard (1913) depicts the form without lobe, while Millard & Bouillon (1974) depict a corbula with a basal lobe. Bale (1915) also described such a lobe and he also thought of a possible sexual dimorphism.

Aglaophenia cupressina is a very characteristic species and especially the microscopic structure make its identification easy (see Fig. 81B and 81E). The colonies often occur in very shallow waters and are thus easily encountered. They are very notorious for their painful stings.

Naumov (1969, as *Corbulifera macgillivrayi*) reported this otherwise tropical shallow water species from the arctic sea of Okhotsk and from deep waters near the Kuriles. His material was sterile. For biogeographic reasons I doubt somewhat that Naumov’s specimen belonged to *A. cupressina*, although his figures look identical to the present material. Although *A. cupressina* is widespread in the tropical Indo-Pacific, interestingly, it is not known to occur on smaller islands of the tropical Pacific (Polynesia).

Distribution

From Zanzibar and Mozambique to Great Barrier Reef, Indonesia, New Guinea, Philippines, Japan. ?Sea of Okhotsk. Occurs even in very shallow water (1 m), but Billard (1913) found it down to 564 m. Type locality: East Indies (Lamouroux, 1816).

Aglaophenia sibogae Billard, 1913, n. status

Fig. 82.
Aglaophenia pluma var. *sibogae* Billard, 1913: 101, figs 90–91.

Material examined:
Kei Islands Expedition station 65, one plume, with corbulae.

Description

Colony pinnate, 3 cm high; stolons creeping; stem with prosegment, monosiphonic, with oblique hinge-joint, with regular nodes, segments with hydrocladial apophysis bearing a mamelon and three nematothecae: two on each side of the apophysis and one below.

Hydrocladia alternate, thin and flexible, up to 4 mm, regularly segmented by slightly oblique nodes, segments without internal ribs.

Hydrothecal walls U-shaped in side view, depth 0.30–0.35 mm, adcauline wall not entirely adnate, free for about 1/7 of total abcauline length, hydropore close to base, diameter of opening 0.15–0.17 mm, opening slightly inclined towards below, margin with 9–10 sinusoid cusps: one median abcauline (largest), four laterals, and sometimes a shallow and broad adcauline one (the latter can be absent).

Median inferior nematotheca nearly completely adnate, tip reaching to base of abcauline cusp, free part about 1/7 of length, gutter-shaped, with foramen leading into hydrotheca, perisarc of outer wall thickened where nematotheca joins internode. Lateral nematothecae ovoid to cup-shaped, reaching just below tips of marginal cusps, height relatively small (60 µm high), inner wall reduced.

Gonothecae protected in corbulae. Corbula open, replacing a hydrocladium, shorter than hydrocladium, first segment identical to the ones of normal hydrocladia, followed by rachis bearing two rows of alternate costae, about 8 per side; costae rod-shaped, free, with two rows of lateral nematothecae and an additional one in axil to rachis. Gonothecae oblong, about 0.6 mm.

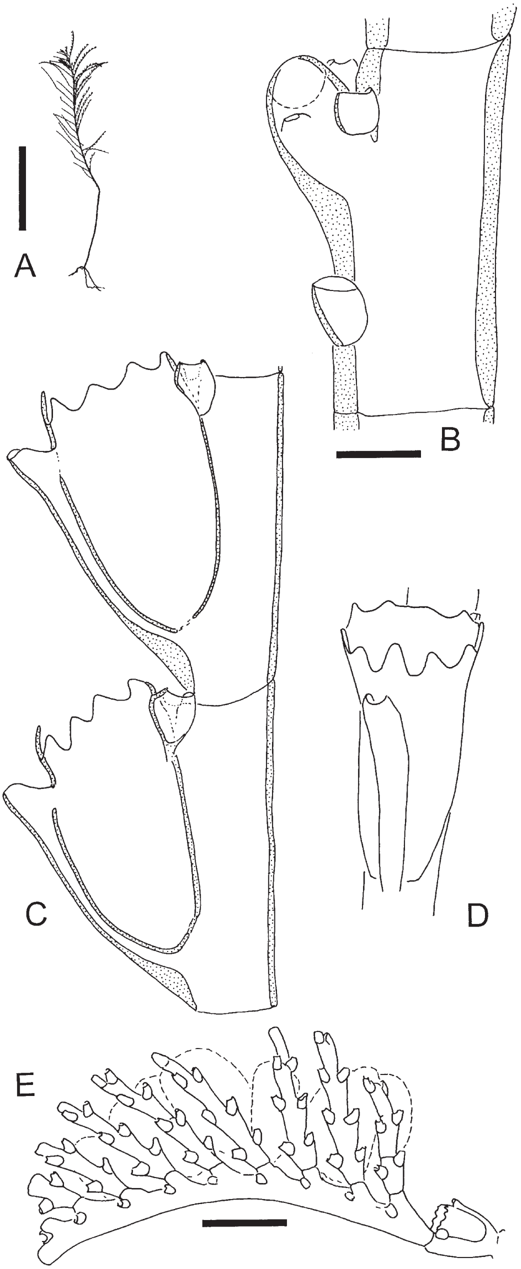

Fig. 82. *Aglaophenia sibogae* Billard, 1913. A. Colony silhouette. B. Stem segment. C. Two hydrocladial segments. D. Hydrotheca seen from abcauline side, same scale as B. E. Corbula in side view, only one row of costae shown. – Scales: A = 1 cm; B, C = 0.1 mm; E = 0.4 mm

Remarks

Aglaophenia sibogae Billard, 1913 was first described as a variety of *A. pluma* (Linnaeus, 1758). *Aglaophenia pluma* is a species of the temperate north-eastern Atlantic, but it also penetrates into the western Mediterranean (Svoboda & Cornelius 1991). It always has closed corbulae and can also form branched colonies. Billard's Indonesian variant has open corbulae and referring to the same arguments as given for *Lytocarpia orientalis* (see above) it is here raised to full species level.

Aglaophenia sibogae resembles closely *A. postdentata* Billard, 1913 (for description see also Millard & Bouillon 1973, Ryland & Gibbons 1991, Watson 1994). Billard (1913) distinguished *A. postdentata* on account of the smaller hydrothecae (depth 0.22–0.24 mm) and the presence of a distinct cusp on the adcauline side of the hydrothecal opening. The colony size of *A. postdentata* does also not surpass 1 cm, while the stems of *Aglaophenia sibogae* are more than two times as high. There seem to be no significant differences in the morphology of the corbulae. Perhaps when more material of both species becomes available, intermediate forms might link the two morphotypes and *A. sibogae* could be prove to be conspecific with *A. postdentata*.

Distribution

Indonesia. Type localities: 3°27'S, 117°36'E, 59 m; 1°42.5'S, 130°47.5'E, 32 m (Indonesia).

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Appendix 1

Station data of the Kei Island Expedition, after Mortensen (1923); only those stations which yielded identifiable hydroids are included. Data given as follows: station number; locality; decimal coordinates (if available); depth; collection date; bottom type. Mortensen (1923) provides more details and also maps.

1. Kei Islands; 5.57°S, 132.83°E; 370 m; 30 Mar 1922; mud
3. Kei Islands; 5.53°S, 132.6°E; 245 m; 31 Mar 1922; sand
4. Kei Islands; 5.53°S, 132.63°E; 250 m; 3 May 1922; sand
7. Kei Islands; 5.64°S, 132.43°E; 196 m; 5 Apr 1922; sandy mud, small stones
11. Kei Islands, off Tual; 20 m; 9 Apr 1922; sand, shells, corals
12. Kei Islands; 5.5°S, 132.58°E; 320 m; 9 Apr 1922; sand, shells, coral
14. Kei Islands, south of Doe Roa; 40 m; 10 Apr 1922; sand
15. Kei Islands, South of Doe Roa; 5 m; 10 Apr 1922; sand
16. Kei Islands; 5.54°S, 132.62°E; 50 m; 12 Apr 1922; sand, *Lithothamnion*
18. Kei Islands, Doe Roa Strait; 40 m; 12 Apr 1922; sand, corals
19. Kei Islands off Tual; 20 m; 14 Apr 1922; sand
20. Kei Islands, Doe Roe Bassin; 50 m; 14 Apr 1922; sand
21. Kei Islands; 5.5°S, 132.78°E; 50 m; 14 Apr 1922; hard bottom, corals
24. Kei Islands; 5.62°S, 132.93°E; 100 m; 15 Apr 1922; hard bottom
26. Kei Islands; 5.63°S, 132.92°E; 20 m; 16 Apr 1922; sand
27. Kei Islands, 2 miles N of Elat; 60 m; 17 Apr 1922; fine sand
30. Kei Islands, between Doe Roa and Kei Doelah; 40 m; 18 Apr 1922; sand, shells
31. Kei Islands, Doe Roe Bassin; 50 m; 18 Apr 1922; sand
33. Kei Islands; 5.517°S, 132.567°E; 285 m; 22 Apr 1922; sand
36. Kei Islands, bay North of Noehoe-Roa; 35 m; 23 Apr 1922; sand
37. Kei Islands, Doe Roa Strait; 40 m; 23 Apr 1922; sand
40. Kei Islands, North of Doe Roa; 20 m; 25 Apr 1922; sand
42. Kei Islands; 5.58°S, 132.48°E; 225 m; 26 Apr 1922; mud
43. Kei Islands; 5.5°S, 132.75°E; 35 m; 7 Apr 1922; sand, coral
45. Kei Islands; 5.81°S, 132.23°E; 270 m; 1 May 1922; sand
46. Kei Islands; 5.79°S, 132.43°E; 250 m; 2 May 1922; clay, mud
48. Kei Islands; 5.67°S, 132.35°E; 263 m; 3 May 1922; sandy mud
52. Kei Islands; 5.77°S, 132.83°E; 352 m; 7 May 1922; mud
53. Kei Islands; 5.6°S, 132.92°E; 85 m; 9 May 1922; sand
54. Kei Islands; 5.57°S, 132.92°E; 85 m; 9 May 1922; sand
57. Kei Islands; 5.53°S, 132.82°E; 200 m; 10 May 1922; shells
58. Kei Islands; 5.48°S, 132.74°E; 290 m; 12 May 1922; mud
60. Kei Islands, South of Doe Roa; 25 m; 14 May 1922; gravel, shells, lithothamnion
61. Kei Islands, between Doe Roa and Kei Doelah; 50 m; 15 May 1922; Bryozoans
63. Kei Islands; 5.53°S, 132.61°E; 250 m; 16 May 1922; sand
64. Sunda Strait; 5.85°S, 106.37°E; 35 m; 26 Jul 1922; sandy mud, shells
65. Sunda Strait; 5.87°S, 106.28°E; 25 m; 27 Jul 1922; sand
66. Sunda Strait; 5.9°S, 106.2°E; 24 m; 27 Jul 1922; sandy mud, shells
67. Sunda Strait; 5.8°S, 106.2°E; 38 m; 27 Jul 1922; sand
68. Sunda Strait; 5.78°S, 106.28°E; 50 m; 27 Jul 1922; stones
69. Sunda Strait; 5.78°S, 106.28°E; 50 m; 27 Jul 1922; sand
70. Kei Islands; 5.67°S, 106.35°E; 35 m; 28 Aug 1922; mud, shells
71. Sunda Strait; 5.67°S, 106.13°E; 54 m; 28 Jul 1922; sand, stones
72. Sunda Strait; 5.68°S, 105.95°E; 35 m; 28 Jul 1922; stones
73. Sunda Strait; 5.95°S, 105.95°E; 30 m; 28 Jul 1922; sand, shells
74. Sunda Strait; 6.05°S, 105.9°E; 30 m; 29 Jul 1922; mud
81. Sunda Strait; 6.62°S, 105.45°E; 49 m; 29 Jul 1922; mud
83. Sunda Strait; 6.7°S, 105.57°E; 42 m; 30 Jul 1922; sandy mud
85. Sunda Strait; 5.88°S, 105.52°E; 25 m; 31 Jul 1922; sandy mud, pumice
86. Sunda Strait; 5.9°S, 105.617°E; 31 m; 31 Jul 1922; mud, pumice
90. Sunda Strait; 5.92°S, 105.5°E; 36 m; 1 Aug 1922; hard bottom
91. Sunda Strait; 5.88°S, 105.45°E; 42 m; 1 Aug 1922; mud
95. Sunda Strait; 5.73°S, 105.33°E; 25 m; 1 Aug 1922; mud
96. Sunda Strait; 5.7°S, 105.28°E; 29 m; 1 Aug 1922; mud
102. Krakotoa; 6.15°S, 105.47°E; 75 m; 3 Aug 1922; mud, pumice
103. Sunda Strait; 6.08°S, 105.7°E; 52 m; 4 Aug 1922; sand, shells
104. Sunda Strait; 5.87°S, 106.07°E; 38 m; 4 Aug 1922; stones
105. Sunda Strait; 5.93°S, 106.12°E; 13 m; 5 Aug 1922; mud
106. Sunda Strait; 5.83°S, 106.27°E; 32 m; 5 Aug 1922; sand
107. Sunda Strait; 5.78°S, 106.12°E; 49 m; 5 Aug 1922; sand, stones
110. Sunda Strait; 5.42°S, 105.88°E; 12 m; 5 Aug 1922; sandy mud
111. Sunda Strait; 5.47°S, 106.05°E; 22 m; 6 Aug 1922; sandy mud
112. Sunda Strait; 5.6°S, 106.22°E; 52 m; 6 Aug 1922; mud
114. Sunda Strait; 5.85°S, 106.45°E; 60 m; 7 Aug 1922; mud
116. Sunda Strait; 5.95°S, 106.57°E; 22 m; 7 Aug 1922; sand, shells
117. Sunda Strait; 5.85°S, 106.45°E; 60 m; 7 Aug 1922; mud
118. Sunda Strait; 5.9°S, 106.67°E; 27 m; 7 Aug 1922; sand, shells

Appendix 2

List of marine hydoids recorded in Indonesian waters. The list is not necessarily complete. The numerous Stylasteridae are not included. For this taxon, see Boschma (1953, 1957), Cairns (1983), and Cairns & Hoeksema (1998).

Some nominal species listed here are problematic and their inclusion does not mean that they are valid records or species.

Species encountered in the collection of the Kei Island Expediton and described and discussed in this study are marked by a *. For the other species, one suitable reference is given, although the species may have been recorded by other authors too.

Family Hydractiniidae

Hydractinia granulata	* new record

Family Tubidendridae

Balella mirabilis	* new record

Family Cordylophoridae

Turritopsis nutricula	this study
Corydendrium corrugatum	* new record
Corydendrium parasiticum	Vervoort 1941

Family Bougainvilliidae

Bougainvillia muscus	Pictet 1893
Garveia clevelandensis	new record

Family Eudendriidae

Eudendrium capillare	Vervoort 1941
Eudendrium kirkpatricki	* new record
Eudendrium ramosum	Stechow & Müller 1923
Myrionema amboinense	Pictet 1893

Family Sphaerocorynidae

Sphaerocoryne bedoti	Pictet 1893

Family Cladocorynidae

Cladocoryne haddoni	* new record
Pteroclava crassa	Pictet 1893

Family Pennariidae

Pennaria disticha	*

Family Solanderiidae

Solanderia secunda	* new record

Family Tubulariidae

Ralpharia neira	Petersen 1990
Ectopleura viridis	* this study

Family Campanulinidae

Campanulina maduraensis	Billard 1940b
Campanulina panicula	* new record
Campanulina paucilaminosa	Billard 1940b
Egmundella sibogae	Billard 1940a
Modeeria rotunda	Vervoort 1941

Family Haleciidae

Halecium dyssymmetrum	Billard 1929b
Halecium humile	this study
Halecium halecinum var. *minor*	this study
Halecium scalariformis	Billard 1929b
Halecium sessile	Vervoort 1941
Halecium sibogae	Billard 1929b
Hydrodendron dichotomum	Billard 1929a
Halecium spatulum	Watson 2000
Hydrodendron sibogae	*
Mitrocomium simplex	this study

Family Hebellidae

Hebella contorta	Campenhausen 1896b
Hebella corrugata	Stechow & Müller 1923
Hebella costata	Stechow & Müller 1923
Hebella dyssymetra	Billard 1942b
Hebella hartmeyeri	Stechow & Müller 1923
Hebella lata	Pictet 1893
Hebella laterocaudata	Billard 1942b
Hebella scandens	Weltner 1900
Hebella cylindrica	Pictet 1893

Family Lafoeidae

Acryptolaria rectangularis	* new record
Acryptolaria angulata	* new record
Acryptolaria conferta	*
Cryptolarella abyssicola	Campenhausen 1896b
Lafoea dumosa	* new record
Zygophylax bifurcata	Billard 1942a
Zygophylax bifurcata	*
Zygophylax pinnata	Campenhausen 1896b
Zygophylax rufa	* new record
Zygophylax sibogae	*

Family Campanulariidae

Clytia arborescens	this study
Clytia gracilis	this study
Campanularia raridenta	Stechow & Müller 1923
Clytia linearis	*
Clytia noliformis	Pictet 1893
Clytia sibogae	Billard 1917
Clytia trigona	this study
Obelia bidentata	*
Obelia geniculata	Pictet 1893

Family Sertulariidae

Caminothujaria molukkana	*
Diphasia cauloatheca	Billard 1925b
Diphasia cristata	Billard 1925b
Diphasia densa	Stechow & Müller 1923
Diphasia digitalis	*
Diphasia minuta	Billard 1925b
Diphasia mutulata	*
Diphasia orientalis	Billard 1925b
Diphasia scalariformis	*
Diphasia thornelyi	Billard 1925b
Dynamena crisioides	*
Dynamena fissa	Billard 1925b
Dynamena heterodonta	Billard 1925b
Dynamena mertoni	Stechow & Müller 1923
Dynamena moluccana	*
Dynamena quadridenta	Billard 1925b

Geminella ceramensis	*
Hincksella cylindrica	Billard 1925b
Hincksella sibogae	Billard 1925b
Idiellana pristis	*
Salacia hexodon	*
Salacia punctagonangia	* new record
Salacia sibogae	*
Salacia sinuosa	*
Salacia tetracythara	*
Sertularella acutidentata	Billard 1925b
Sertularella catena	Billard 1925b
Sertularella crassa	Billard 1925b
Sertularella decipiens	*
Sertularella diaphana	*
Sertularella parva	Billard 1925b
Sertularella inconstans	Billard 1925b
Sertularella intricata	Billard 1925b
Sertularella keiensis	Billard 1925b
Sertularella minuscula	Billard 1925b
Sertularella quadridens	*
Sertularella robusta	Billard 1925b
Sertularia borneensis	*
Sertularia elongata	Stechow & Müller 1923
Sertularia loculosa	*
Sertularia malayensis	*
Sertularia trigonostoma	*
Sertularia turbinata	*
Symplectoscyphus clarkii	Campenhausen 1896b
Symplectoscyphus macrocarpa	*
Symplectoscyphus pedunculatus	Billard 1925b
Symplectoscyphus sibogae	Billard 1925b
Symplectoscyphus tropicus	Billard 1925b
Thuiaria abyssicola	Billard 1925b
Thuiaria articulata	Stechow & Müller 1923

Family Thyroscyphidae

Thyroscyphus bedoti	this study
Thyroscyphus fruticosus	*
Thyroscyphus sibogae	*
Thyroscyphus torresii	*

Family Syntheciidae

Synthecium flabellum	* new record
Synthecium elegans	Billard 1925b
Synthecium megathecum	Billard 1925b
Synthecium dentigerum	Billard 1925b
Synthecium orthogonium	*
Synthecium campylocarpum	*
Synthecium samauense	*

Family Halopterididae

Antennella campanulaformis	* new record
Antennella secundaria	*
Antennella sibogae	Billard 1913
Antennella varians	Billard 1913
Halopteris alternata	Billard 1913
Halopteris campanula	Billard 1913
Halopteris concava	Billard 1913
Halopteris crassa	Billard 1913
Halopteris diaphragmata	Billard 1913
Halopteris jedani	Billard 1913
Halopteris peculiaris	Billard 1913
Halopteris plagiocampa	*
Halopteris polymorpha	Billard 1913
Monostaechas simplex	Billard 1913
Monostaechas sibogae	Billard 1913

Family Plumulariidae

Nemertesia indivisa	*
Nemertesia ramosa	Billard 1913
Nemertesia singularis	Vervoort 1941
Plumularia badia	*
Plumularia campanuloides	Billard 1913
Plumularia crater	Billard 1913
Plumularia habereri	*
Plumularia insignis	Billard 1913
Plumularia orientalis	Billard 1913
Plumularia scabra	*
Plumularia setacea	Billard 1913
Plumularia spiralis	Billard 1913
Plumularia strictocarpa	Pictet 1893
Plumularia strobilophora	Billard 1913
Plumularia stylifera	Stechow & Müller 1923
Polyplumaria cornuta	*
Polyplumaria kossowskae	Billard 1913
Polyplumaria sibogae	Billard 1913
Polyplumularia bedoti	Billard 1913
Sibogella erecta	*

Family Kirchenpaueriidae

Kirchenpaueria halecioides	Pictet 1893
Kirchenpaueria ventruosa	Billard 1913

Family Aglaopheniidae

Aglaophenia cupressina	*
Aglaophenia laxa	Billard 1913
Aglaophenia postdentata	Billard 1913
Aglaophenia sibogae	*
*Cladocarpus keiensis**	new species
Cladocarpus multiapertus	Billard 1913
Cladocarpus siboga	Billard 1913
Gymnangium allmani	Billard 1913
Gymnangium gracilicaule	*
Gymnangium haswellii	Billard 1913
Gymnangium hians	Billard 1913
Gymnangium longicorne	*
Lytocarpia angulosa	*
Lytocarpia brevirostris	Billard 1913
Lytocarpia delicatula	*
Lytocarpia furcata	Vervoort 1941
Lytocarpia orientalis	*
Lytocarpia perarmata	*
Lytocarpia phyteuma	*
Macrorhynchia balei	*
Macrorhynchia philippina	*
Macrorhynchia phoenicea	*
Macrorhynchia sibogae	Billard 1913
Macrorhynchia singularis	*
Monoserius pennarius	*