# Report on the Hydroida collected by the "BALGIM" expedition in and around the Strait of Gibraltar

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Key words: Cnidaria; Hydrozoa; Hydroida; genera; relationship; new species; bathyal-abyssal fauna of Ibero-Moroccan Bay; Strait of Gibraltar; Alboran Sea; water movements.

A total of 102 species and varieties of hydroids and three unidentifiable species are described or mentioned in the present report, which deals principally with hydroids collected in the Ibero-Moroccan Bay (and adjacent Atlantic), the Strait of Gibraltar, and the Alboran Sea; for revisionary purposes some additional, mainly Atlantic, material had to be included. The material described has been assigned to four families of athecate and 14 families of thecate hydroids. Nearly all species have been illustrated and a permanent slide collection has been made. Where necessary the material described has been compared with type material; ten new (sub)species are described, of which eight from the BALGIM material. Holotypes, and where necessary and/or possible paratypes have been indicated for *Stegopoma giganteum* spec. nov., *Acryptolaria conferta minor* subspec. nov., *Zygophylax elongata* spec. nov., *Zygophylax leloupi* spec. nov., *Cladocarpus boucheti* spec. nov., *C. corneliusi* spec. nov., *C. paraventricosus* spec. nov., and *Plumularia falcicula* spec. nov. and their deposition recorded. Generally holotypes have been deposited in the Muséum National d'Histoire Naturelle, Paris. Paratypes and slides are in the collections of the National Museum of Natural History (Nationaal Natuurhistorisch Museum, former Rijksmuseum van Natuurlijke Historie), Leiden, The Netherlands. Some additional paratypes are now in The Natural History Museum [former British Museum (Natural History)], London. A representative slide collection is in the Departamento de Recursos Naturales y Medio Ambiente, Orense.

A survey of the geographical distribution over the BALGIM stations shows that, generally speaking, practically all littoral and benthic species occur in the Alboran Sea as well as in the Ibero-Moroccan Bay, the few exceptions being bathyal-abyssal species for which the sill in the Strait of Gibraltar apparently forms a major obstacle in penetrating the Mediterranean. Furthermore a distinct influence of the outflowing Mediterranean Water on the bathyal hydroid fauna in the north-eastern part of the Ibero-Moroccan Bay could not be demonstrated. *Synthecium evansii* (Ellis & Solander, 1786), so far considered a characteristic Mediterranean hydroid, has been observed to occur on the Atlantic side of the Straits; the species moreover has recently been recorded from the Canary Islands region. These observation contrast with the results obtained by Grasshoff (1989) during his study of other groups of benthic Cnidaria (Gorgonaria, Pennatularia and Antipatharia).

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## Resumen

Estudio de los hidroideos recolectados por la expedición BALGIM en la zona del Estrecho de Gibraltar.

Palabras clave: Cnidaria; Hydrozoa; Hydroida; géneros; afinidades; especies nuevas; fauna batial-abisal del Golfo Ibero-Marroquí; Estrecho de Gibraltar; Mar de Alborán; movimientos de agua.

En el presente estudio se describen o mencionan un total de ciento dos especies y variedades de

hidroideos y tres especies no identificadas, la mayor parte de las cuales han sido recolectadas en el Golfo Ibero-Marroquí (y aguas adyacentes del Atlántico), en el Estrecho de Gibraltar, y en el Mar de Alborán; asimismo, y con fines revisionistas se ha incluido material adicional procedente en su mayor parte del Atlántico. El material descrito ha sido asignado a cuatro familias de hidroideos atecados y 14 familias de hidroideos tecados. Casi todas las especies han sido ilustradas, y se ha realizado una colección de preparaciones microscópicas permanentes. En los casos necesarios se ha comparado el material descrito con el material tipo; se describen diez (sub)especies nuevas para la ciencia de las cuales ocho proceden del material recolectado por la expedición BALGIM. Se designan los holotipos, y cuando era necesario y/o posible también los paratipos de *Stegopoma giganteum* spec. nov., *Acryptolaria conferta minor* subspec. nov., *Zygophylax elongata* spec. nov., *Zygophylax leloupi* spec. nov., *Cladocarpus boucheti* spec. nov., *Cladocarpus corneliusi* spec. nov., *Cladocarpus paraventricosus* spec. nov. y *Plumularia falcicula* spec. nov., y se indica además, el lugar donde han sido depositados. Generalmente los holotipos se han depositado en el Muséum National d'Histoire Naturelle de París. Los paratipos y las preperaciones microscópicas están en las colecciones del National Museum of Natural History) (Nationaal Natuurhisotirsch Museum/Rijksmuseum van Natuurlijke Historie) de Leiden, Holanda. Algunos paratipos adicionales han sido depositados en el Natural History Museum [British Museum (Natural History)] de Londres. Una colección representativa de preparaciones microscópicas se encuentra en el Departamento de Recursos Naturales y Medio Ambiente (Universidad de Vigo), en Orense.

Un examen de la distribución geográfica de las especies en las estaciones de la expedición BALGIM muestra que, en general, prácticamente todas las especies se encuentran tanto en el Mar de Alborán como en el Golfo Ibero-Marroquí, y las pocas excepciones encontradas son especies batial-abisales para las cuales la menor profundidad existente en el Estrecho de Gibraltar parece formar un importante obstáculo para su penetración en el Mediterráneo. Además, no se ha demostrado una influencia clara del agua procedente del Mediterráneo sobre la fauna hidroide batial en la parte noreste del Golfo Ibero-Marroquí. *Synthecium evansii* (Ellis & Solander, 1786), considerada hasta ahora como una especie típica del Mediterráneo, ha sido recolectada en la parte atlántica del Estrecho; esta especie ha sido citada recientemente además, en la región de las Islas Canarias. Estas observaciones contrastan con los resultados obtenidos por Grasshoff (1989) durante su estudio de otros grupos de Cnidarios bentónicos (Gorgonaria, Pennatularia y Antipatharia).

## Contents

## Introduction

The hydroid collections on which the present report is based originate from explorations of the Strait of Gibraltar and adjacent areas in both the Mediterranean Sea and the Atlantic Ocean, carried out during the BALGIM 84 campaign of the 'Centre National de la Recherche Scientifique (PIROCEAN)' on board of the Research vessel Cryos (25 May - 22 June 1984, 'chef de mission' Dr Philippe Bouchet, Muséum National d'Histoire Naturelle, Paris). In addition some samples from the campaign EPI ('Environnement profonds: impacts') have been studied. The samples were sorted at the 'Centre National de Tri d'Océanographie Biologique, CENTOB', Brest; they were placed at the disposal of the second author for scientific study by Dr Michel Segonzac, director of 'CENTOB'. A happy series of circumstances made it possible for Dr Fran Ramil, who had been interested in Atlantic hydroids for some time, to join the second author in his endeavour to study this large and interesting collection and to prepare a full report. The study of the BALGIM material has largely been done in the National Museum of Natural History (Nationaal Natuurhistorisch Museum, now comprising the Rijksmuseum van Natuurlijke History), Leiden, The Netherlands and to a minor degree in the 'Departamento de Recursos Naturales y Medio Ambiente, Facultad de Ciencias de Orense', at Orense, Galicia, Spain. The holotypes of the new species are deposited in the collections of the Muséum National d'Histoire Naturelle, Paris; the remaining material is now in the collections of the National Museum of Natural History, Leiden, The Netherlands. A representative slide collection is with Dr Fran Ramil, Orense.

The aims of the BALGIM cruise were twofold, viz.

1. The study of a faunistic transit between the Atlantic and Mediterranean faunae, and

2. The study of the correlation between the composition of the benthic fauna and the origin of water masses.

Though the results obtained with the benthic hydroid fauna with respect to these considerations are not impressive, some general observations and tentative conclusions are presented in the section dealing with biogeography at the end of this report.

The EPI cruises aimed at a study of the impact of marine pollution (mining activities at great depth, dumping of radioactive waste, oil spils, etc.) on biological, sedimentological and physical conditions in the marine environment.

All well preserved material has been fully described, but no effort has been made to give synonymy of and references to the various species as completely as possible; this has only been done where a full discussion of the taxonomic position of the species concerned was necessary. Generally only those references are given that relate to the region investigated, viz. the Ibero-Moroccan Gulf, the Strait of Gibraltar and the Alboran Sea.

## List of abbreviations

BALGIM — Benthos Alboran Golfe Ibéro-Marocain.
BMNH — British Museum (Natural History) [The Natural History Museum], London, U.K.
CENTOB — Centre National de Tri d'Océanographie biologique, Brest, France.
CP — 'Chalut à perche'; Beam trawl.
DR — 'Drague à roches'; Rocky bottom dredge.
DW — 'Drague Waren'; Waren dredge.
EPI — Program: 'Environnement profond: impacts' of IFREMER.
KG — 'Carotier Usnel grande surface'; Usnel box-corer.
IFREMER — Institut Français de Recherche pour l'Exploration de la Mer, Brest, France.
IRSN — Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium.
ITZ — Instituut voor Taxonomische Zoologie (Zoologisch Museum), University of Amsterdam, The Netherlands.
MCZ — Museum of Comparative Zoology (The Agassiz Museum), Harvard University, Cambridge, Massachusetts, U.S.A.
MNHN — Muséum National d'Histoire Naturelle, Paris, France.
MOM — Musée Océanographique, Institut Océanographique, Monaco.
RMNH — Rijksmuseum van Natuurlijke Historie, now Nationaal Natuurhistorisch Museum (National Museum of Natural History), Leiden, The Netherlands.
SAM — South African Museum, Cape Town, Republic of South Africa.
ZSM — Zoologische Staatssammlung München, Munich, Federal Republic of Germany.

## List of stations and species collected

EPI I, Stn CP 38, 47°33.75'N-08°42.15'W, 29.iii.1974, 2100 m: *Garveia arborea* (Browne, 1907); *Cryptolarella abyssicola* (Allman, 1888).

EPI I, Stn CP 39, 47°32.00'N-08°38.4'W, 30.iii.1974, 2100 m: *Garveia arborea* (Browne, 1907); *Opercularella panicula* (G.O. Sars, 1874); *Cryptolarella abyssicola* (Allman, 1888).

EPI IV, Stn KG 221, 47°34'N-08°41.7'W, 05.ix.1975, 2100 m: unidentifiable athecate hydroid.

BALGIM Stn DR 01, 36°52.9'N-09°15.7' W, 28.v.1984, 720 m: unidentifiable hydroid.

BALGIM Stn DW 02, 36°55'N-09°16'W, 28.v.1984, 893 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 03, 36°50.4'N-09°14.9'W, 28.v.1984, 681 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Cladocarpus pectiniferus* Allman, 1883; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Obelia bidentata* Clarke, 1875.

BALGIM Stn DW 07, 36°46.1'N-09°27'W, 29.v.1984, 1141 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 09, 36°47.6'N-09°28'W, 29.v.1984, 1163 m: *Cladocarpus corneliusi* spec. nov.; *Cladocarpus paraventricosus* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1785); *Diphasia margareta* (Hassall, 1841).

BALGIM Stn CP 10, 36°45.3'N-09°43'W, 29.v.1984, 1592 m: *Stegopoma bathyale* Vervoort, 1966; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DW 11, 36°44.2' N 09°31.4'W, 29.v.1984, 1523 m: *Stegopoma giganteum* spec. nov.; *Acryptolaria conferta minor* subspec. nov.; *Cladocarpus pectiniferus* Allman, 1883; *Cladocarpus* spec.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: *Opercularella panicula* (G.O. Sars, 1874);

*Cladocarpus corneliusi* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Plumularia filicula* (Allman, 1877); *Plumularia marocana* Billard, 1930; *Diphasia margareta* (Hassall, 1841): *Clytia* spec.

BALGIM Stn KR 15, 36°46.4'N-09°30.1'W, 30.v.1984, 1305 m: *Diphasia margareta* (Hassall, 1841).

BALGIM Stn DW 16, 36°45.8'N-09°29.4'W, 30.v.1984, 1283 m: *Cladocarpus boucheti* spec. nov.; *Cladocarpus corneliusi* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 17, 36°45.3'N-09°30.8'W, 30.v.1984, 1470 m: *Cladocarpus corneliusi* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DW 20, 36°35.9'N-07°34.5'W, 31.v.1984, 452 m: *Cladocarpus boucheti* spec. nov.

BALGIM Stn CP 21, 36°36.5'N-07°24'W, 31.v.1984, 485 m: *Opercularella panicula* (G.O. Sars, 1874); *Acryptolaria conferta minor* subspec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DR 22, 36°35.4'N-07°23.6'W, 31.v.1984, 466 m: *Cladocarpus pectiniferus* Allman, 1883.

BALGIM Stn DR 23, 36°38.8'N-07°19.5'W, 31.v.1984, 556 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn DW 24, 36°41.1'N-07°19'W, 31.v.1984, 545 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: *Cladocarpus pectiniferus* Allman, 1883; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Halopteris catharina* (Johnston, 1833); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia margareta* (Hassall, 1841); *Clytia gracilis* (M. Sars, 1850).

BALGIM Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: *Stegopoma bathyale* Vervoort, 1966; *Acryptolaria conferta minor* subspec. nov.; *Acryptolaria crassicaulis* (Allman, 1888); *Zygophylax biarmata* Billard, 1905; *Aglaophenia* cf. *lophocarpa* Allman, 1877; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791); *Halopteris catharina* (Johnston, 1833); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia margareta* (Hassall, 1841); *Clytia gracilis* (M. Sars, 1850).

BALGIM Stn DW 27, 36°46.3'N-07°07.3'W, 31.v.1984, 370 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn DW 28, 36°45.8'N-07°07.7'W, 31.v.1984, 398 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Clytia gracilis* (M. Sars, 1850).

BALGIM Stn DW 32, 36°47.2'N-07°04.4'W, 01.vi.1984, 250 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 33, 36°46.9'N-07°04'W, 01.vi.1984, 256 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia margareta* (Hassall, 1841).

BALGIM Stn CP 34, 36°48.8'N-07°04.9'W, 01.vi.1984, 180 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Laomedea pseudodichotoma* Vervoort, 1959.

BALGIM Stn CP 36, 36°16.6'N-07°13.7'W, 01.vi.1984, 990 m: *Filellum* cf. *serratum* (Clarke, 1879); *Nemertesia antennina* (Linnaeus, 1758); *Sertularella gayi gayi* (Lamouroux, 1821).

BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Acryptolaria conferta minor* subspec. nov.; *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820): *Halecium* spec. 1; *Antennella secundaria* (Gmelin, 1791); *Halopteris catharina* (Johnston, 1833); *Schizotricha frutescens* (Ellis & Solander, 1786); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia pinastrum* (Cuvier, 1830); *Hydrallmania falcata* (Linnaeus, 1758); *Sertularella gayi gayi* (Lamouroux, 1821); *Synthecium evansii* (Ellis & Solander, 1786); *Campanularia hincksii* Alder, 1856; *Clytia* spec.

BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: *Turritopsis nutricula* McCrady, 1859; *Eudendrium capillare* Alder, 1856; *Eudendrium ramosum* (Linnaeus, 1758); *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Filellum* cf. *serratum* (Clarke, 1879); *Zygophylax biarmata* Billard, 1905; *Halecium delicatulum* Coughtrey, 1876; *Halecium* spec. 2; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Halopteris catharina* (Johnston, 1833); *Kirchenpaueria bonnevieae simplex* Billard, 1930; *Nemertesia ramosa* Lamarck, 1816; *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia attenuata* (Hincks, 1866) var. *robusta* Billard, 1924; *Diphasia margareta* (Hassall, 1841); *Diphasia pinastrum* (Cuvier, 1830).

BALGIM Stn DW 43, 35°54.1'N-06°14.5'W, 02.vi.1984, 150 m: *Lytocarpia myriophyllum* (Linnaeus, 1758);

*Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Zygophylax biarmata* Billard, 1905; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia pinastrum* (Cuvier, 1830).

BALGIM Stn DW 47, 35°43.5'N-06°18.2'W, 02.vi.1984, 281 m: *Eudendrium ramosum* (Linnaeus, 1758); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Bedotella armata* (Pictet & Bedot, 1900); *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Halecium sibogae marocanum* Billard, 1914; *Halecium tenellum* Hincks, 1861; *Halecium* spec. 2; *Aglaophenia tubulifera* (Hincks, 1861); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791); *Halopteris catharina* (Johnston, 1833); *Kirchenpaueria bonnevieae simplex* Billard, 1930; *Nemertesia antennina* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia margareta* (Hassall, 1841); *Diphasia pinastrum* (Cuvier, 1830); *Diphasia rosacea* (Linnaeus, 1758); *Hydrallmania falcata* (Linnaeus, 1758); *Sertularella gayi gayi* (Lamouroux, 1821); *Campanularia hincksii* Alder, 1856; *Clytia* spec.; *Obelia dichotoma* (Linnaeus, 1758).

BALGIM Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Acryptolaria conferta minor* subspec. nov.; *Bedotella armata* (Pictet & Bedot, 1900); *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Halecium delicatulum* Coughtrey, 1876; *Halecium sibogae marocanum* Billard, 1914; *Halecium tenellum* Hincks, 1861; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Halopteris catharina* (Johnston, 1833); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia pinastrum* (Cuvier, 1830); *Diphasia* spec.; *Sertularella gayi gayi* (Lamouroux, 1821); *Synthecium evansii* (Ellis & Solander, 1786); *Campanularia hincksii* Alder, 1856; *Clytia gracilis* (M. Sars, 1850); *Clytia* spec.

BALGIM Stn DR 51, 35°41.2'N-06°29.5'W, 03.vi.1984, 362 m: *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia pinastrum* (Cuvier, 1830).

BALGIM Stn DW 53, 35°41'N-06°30.5'W, 03.vi.1984, 364 m: *Acryptolaria conferta minor* subspec. nov.; *Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn CP 54, 35°41.3'N-06°29.7'W, 03.vi.1984, 356 m: *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890); *Plumularia marocana* Billard, 1930; *Clytia gracilis* (M. Sars, 1850).

BALGIM Stn DR 56, 35°41.4'N-06°35.8'W, 03.vi.1984, 481 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn DW 57, 35°41.7'N-06°35.2'W, 03.vi.1984, 548 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DW 58, 35°39.4'N-06°45.6'W, 03.vi.1984, 826 m: *Sertularia distans* Lamouroux, 1816.

BALGIM Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: unidentifiable athecate hydroid; *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Lafoea dumosa* (Fleming, 1820); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia delagei* Billard, 1912.

BALGIM Stn CP 68, 35°11.9'N-07°52.6'W, 05.vi.1984, 2035 m: *Halecium delicatulum* Coughtrey, 1876.

BALGIM Stn DR 72, 35°52'N-08°11.6'W, 06.vi.1984, 173 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Sertularella gayi gayi* (Lamouroux, 1821).

BALGIM Stn DR 73, 33°52.1'N-08°12.8'W, 06.vi.1984, 181 m: *Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn DW 74, 33°52.1'N-08°12.8'W, 06.vi.1984, 181 m: *Diphasia margareta* (Hassall, 1841); *Sertularella gayi gayi* (Lamouroux, 1821).

BALGIM Stn DR 75, 33°52.7'N-08°15.2'W, 06.vi.1984, 252 m: *Aglaophenia* cf. *lophocarpa* Allman, 1877; *Cladocarpus pectiniferus* Allman, 1883; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn DR 79, 33°49.3'N-08°23.6'W, 06.vi.1984, 260 m: *Cladocarpus pectiniferus* Allman, 1883; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758).

BALGIM Stn DR 81, 33°45.9'N-08°29.9'W, 06.vi.1984, 309 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DR 82, 33°45.5'N, 08°32'W, 06.vi.1984, 355 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 84, 33°45.4'N-08°31.'9W, 06.vi.1984, 345 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Sertularella gayi gayi* (Lamouroux, 1821); *Sertularella polyzonias* (Linnaeus, 1758).

BALGIM Stn DR 85, 34°14.1'N-07°23.7'W, 07.vi.1984, 497 m: *Lytocarpia myriophyllum* (Linnaeus, 1758);

*Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890).

BALGIM Stn CP 86, 34°15.1'N-07°21'W, 07.vi.1984, 512 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DW 87, 34°15.6'N-07°17.9'W, 07.vi.1984, 500 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 89, 34°20.3'N-07°18.4'W, 07.vi.1984, 722 m: *Acryptolaria conferta minor* subspec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: *Egmundella amirantensis* Millard & Bouillon, 1973; *Stegopoma bathyale* Vervoort, 1966; *Acryptolaria conferta minor* subspec. nov.; *Zygophylax leloupi* spec. nov.; *Halecium sessile* Norman, 1867; *Cladocarpus corneliusi* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia ramosa* Lamarck, 1816; *Plumularia filicula* (Allman, 1877); *Polyplumaria flabellata* G.O. Sars, 1874; *Sertularella gayi robusta* Allman, 1873.

BALGIM Stn CP 91, 34°22.3'N-07°25.1'W, 07.vi.1984, 948 m: *Opercularella panicula* (G.O. Sars, 1874); *Stegopoma bathyale* Vervoort, 1966; *Acryptolaria conferta minor* subspec. nov.; *Zygophylax levinseni* (Saemundsson, 1911); *Plumularia filicula* (Allman, 1877).

BALGIM Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: *Stegopoma bathyale* Vervoort, 1966; *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Kirchenpaueria bonnevieae simplex* Billard, 1930; *Nemertesia ramosa* Lamarck, 1816; *Plumularia marocana* Billard, 1930; *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn DW 94, 34°24.9'N-07°28.5'W, 08.vi.1984, 1175 m: *Cladocarpus sigma* (Allman, 1877) var. *elongata* Bedot, 1921; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Diphasia margareta* (Hassall, 1841).

BALGIM Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: *Stegolaria geniculata* (Allman, 1888); *Stegopoma bathyale* Vervoort, 1966; *Zygophylax leloupi* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Plumularia marocana* Billard, 1930; *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn DW 96, 34°23.5'N-07°40.3'W, 08.vi.1984, 1255 m: *Stegolaria geniculata* (Allman, 1888); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Kirchenpaueria bonnevieae* (Billard, 1906); *Diphasia margareta* (Hassall, 1841).

BALGIM Stn CP 99, 34°28.2'N-07°43.3'W, 09.vi.1984, 1870 m: *Eudendrium ramosum* (Linnaeus, 1758).

BALGIM Stn DW 100, 34°28'N-07°42'W, 09.vi.1984, 1691 m: *Cladocarpus boucheti* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DR 101, 34°10.9'N-07°29.8'W, 09.vi.1984, 353 m: *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: *Modeeria rotunda* (Quoy & Gaimard, 1827); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia ramosa* Lamarck, 1816; *Diphasia margareta* (Hassall, 1841); *Sertularella gayi gayi* (Lamouroux, 1821).

BALGIM Stn CP 108, 36°10.8'N-08°06.2'W, 10.vi.1984, 1527 m: corymorphid or tubularioid hydroid.

BALGIM Stn CP 109, 36°14.5'N-07°56.4'W, 10.vi.1984, 1200 m: *Aglaophenia tubulifera* (Hincks, 1861); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia margareta* (Hassall, 1841); *Sertularella gayi gayi* (Lamouroux, 1821).

BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: *Bimeria vestita* Wright, 1859; *Eudendrium capillare* Alder, 1856; *Eudendrium ramosum* (Linnaeus, 1758); *Eudendrium* spec.; *Egmundella amirantensis* Millard & Bouillon, 1973; *Laodicea undulata* (Forbes & Goodsir, 1853); *Modeeria rotunda* (Quoy & Gaimard, 1827); *Mitrocomella polydiademata* (Romanes, 1876); *Acryptolaria conferta minor* subspec. nov.; *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Halecium delicatulum* Coughtrey, 1876; *Halecium tenellum* Hincks, 1861; *Aglaophenia tubulifera* (Hincks, 1861); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Halopteris diaphana* (Heller, 1868) f. *siliquosa* (Hincks, 1871); *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ramosa* Lamarck, 1816; *Diphasia attenuata* (Hincks, 1866) var. *robusta* Billard, 1924; *Diphasia margareta* (Hassall, 1841); *Diphasia* spec.; *Sertularella cylindritheca* (Allman, 1888); *Sertularella gayi gayi* (Lamouroux, 1821); *Synthecium evansii* (Ellis & Solander, 1786); *Campanularia hincksii* Alder, 1856; *Clytia gracilis* (M. Sars, 1850); *Clytia paulensis* (Vanhöffen, 1910); *Clytia* spec.

BALGIM Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: *Bimeria vestita* Wright, 1859; *Corydendrium parasiticum* (Linnaeus, 1767); *Eudendrium capillare* Alder, 1856; *Eudendrium* spec.; *Egmundella amirantensis* Millard & Bouillon, 1973; *Laodicea undulata* (Forbes & Goodsir, 1853); *Modeeria rotunda* (Quoy & Gaimard, 1827); *Mitrocomella polydiademata* (Romanes, 1876); *Acryptolaria conferta minor* subspec. nov.; *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Halecium sibogae marocanum* Billard, 1914;

*Halecium tenellum* Hincks, 1861; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Halopteris diaphana* (Heller, 1868) f. *siliquosa* (Hincks, 1871); *Nemertesia irregularis* (Quelch, 1885); *Nemertesia ramosa* Lamarck, 1816; *Diphasia delagei* Billard, 1912; *Diphasia* spec.; *Sertularella cylindritheca* (Allman, 1888); *Sertularella gayi gayi* (Lamouroux, 1821); *Sertularia distans* Lamouroux, 1816; *Synthecium evansii* (Ellis & Solander, 1786); *Campanularia hincksii* Alder, 1856; *Clytia gracilis* (M. Sars, 1850); *Clytia linearis* (Thornely, 1899); *Clytia paulensis* (Vanhöffen, 1910); *Clytia* spec.; *Obelia dichotoma* (Linnaeus, 1758).

BALGIM Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: *Mitrocomella polydiademata* (Romanes, 1876); *Aglaophenia tubulifera* (Hincks, 1861); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia* spec.

BALGIM Stn DW 116, 35°48.6'N-06°04.2'W, 11.vi.1984, 340 m: *Diphasia attenuata* (Hincks, 1866) var. *robusta* Billard, 1924; *Hydrallmania falcata* (Linnaeus, 1758).

BALGIM Stn CP 119, 35°49.7'N-05°13'W, 13.vi.1984, 517 m: *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn DW 120, 35°51.2'N-05°10.4'W, 13.vi.1984, 425 m: *Cladocarpus pectiniferus* Allman, 1883; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Lafoea dumosa* (Fleming, 1820): *Zygophylax biarmata* Billard, 1905; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890); *Plumularia falcicula* spec. nov.; *Campanularia hincksii* Alder, 1856.

BALGIM Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: *Turritopsis nutricula* McCrady, 1859; *Eudendrium ramosum* (Linnaeus, 1758); *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Filellum* cf. *serratum* (Clarke, 1879); *Halecium delicatulum* Coughtrey, 1876; *Halecium sibogae marocanum* Billard, 1914; *Halecium tenellum* Hincks, 1861; *Halecium* spec. 1; *Aglaophenia tubulifera* (Hincks, 1861); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Kirchenpaueria pinnata* (Linnaeus, 1758); *Sertularella cylindritheca* (Allman, 1888); *Sertularella gayi gayi* (Lamouroux, 1821); *Campanularia hincksii* Alder, 1856.

BALGIM Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: *Bimeria vestita* Wright, 1859; *Turritopsis nutricula* McCrady, 1859; *Eudendrium capillare* Alder, 1856; *Eudendrium ramosum* (Linnaeus, 1758); *Leuckartiara octona* (Fleming, 1823); *Opercularella panicula* (G.O. Sars, 1874); *Laodicea undulata* (Forbes & Goodsir, 1853); *Modeeria rotunda* (Quoy & Gaimard, 1827); *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Halecium sibogae marocanum* Billard, 1914; *Halecium tenellum* Hincks, 1861; *Aglaophenia tubulifera* (Hincks, 1861); *Aglaophenia* spec. A; *Antennella secundaria* (Gmelin, 1791); *Sertularella cylindritheca* (Allman, 1888); *Sertularella gayi gayi* (Lamouroux, 1821); *Thuiaria* spec.; *Campanularia hincksii* Alder, 1856; *Clytia gracilis* (M. Sars, 1850); *Clytia linearis* (Thornely, 1899); *Clytia paulensis* (Vanhöffen, 1910).

BALGIM Stn DR 133, 35°25.8'N-04°17.4'W, 15.vi.1984, 195 m: *Turritopsis nutricula* McCrady, 1859; *Eudendrium* spec.; *Bedotella armata* (Pictet & Bedot, 1900); *Lafoea dumosa* (Fleming, 1820); *Halopteris catharina* (Johnston, 1833).

BALGIM Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: *Eudendrium* spec.; *Modeeria rotunda* (Quoy & Gaimard, 1827); *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Halecium sibogae marocanum* Billard, 1914; *Halecium tenellum* Hincks, 1861; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Sertularella gayi gayi* (Lamouroux, 1821); *Campanularia hincksii* Alder, 1856; *Clytia* spec.; *Obelia dichotoma* (Linnaeus, 1758).

BALGIM Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: *Opercularella panicula* (G.O. Sars, 1874); *Modeeria rotunda* (Quoy & Gaimard, 1827); *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Cladocarpus* cf. *multiseptatus* (Bale, 1915); *Cladocarpus pectiniferus* Allman, 1883; *Cladocarpus sinuosus* Vervoort, 1966; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Halopteris catharina* (Johnston, 1833); *Schizotricha frutescens* (Ellis & Solander, 1786); *Kirchenpaueria bonnevieae* (Billard, 1906); *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ramosa* Lamarck, 1816; *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia pinastrum* (Cuvier, 1830); *Campanularia hincksii* Alder, 1856.

BALGIM Stn DW 136, 35°26.5'N-04°18.5'W, 15.vi.1984, 298 m: *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890).

BALGIM Stn CP 137, 35°33.2'N-04°23'W, 15.vi.1984, 1005 m: *Acryptolaria conferta minor* subspec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758).

BALGIM Stn CP 145, 35°56.6'N-03°07.9'W, 16.vi.1984, 373 m: *Opercularella panicula* (G.O. Sars, 1874); *Aglaophenia kirchenpaueri* (Heller, 1868); *Antennella secundaria* (Gmelin, 1791); *Sertularella gayi gayi* (Lamouroux, 1821).

BALGIM Stn DW 146, 35°56.5'N-03°08.6'W, 16.vi.1984, 555 m: *Opercularella panicula* (G.O. Sars, 1874); *Lafoea dumosa* (Fleming, 1820).

BALGIM Stn CP 148, 35°51.8'N-04°59'W, 17.vi.1984, 508 m: *Nemertesia ramosa* Lamarck, 1816.

BALGIM Stn CP 149, 35°47.5'N-05°11' W, 17.vi.1984, 377 m; *Opercularella panicula* (G.O. Sars, 1874); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

BALGIM Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Halopteris catharina* (Johnston, 1833); *Schizotricha frutescens* (Ellis & Solander, 1786); *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ramosa* Lamarck, 1816; *Sertularella cylindritheca* (Allman, 1888); *Campanularia hincksii* Alder, 1856.

BALGIM Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia pinastrum* (Cuvier, 1830); *Clytia paulensis* (Vanhöffen, 1910).

BALGIM Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: *Eudendrium capillare* Alder, 1856; *Eudendrium ramosum* (Linnaeus, 1758); *Modeeria rotunda* (Quoy & Gaimard, 1827); *Acryptolaria conferta minor* subspec. nov.; *Cryptolaria pectinata* (Allman, 1888); *Zygophylax biarmata* Billard, 1905; *Halecium* spec. 2; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Nemertesia antennina* (Linnaeus, 1758); *Plumularia falcicula* spec. nov.; *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia margareta* (Hassall, 1841); *Diphasia pinastrum* (Cuvier, 1830); *Sertularella gayi robusta* Allman, 1873.

BALGIM Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: *Garveia nutans* Wright, 1859; *Turritopsis nutricula* McCrady, 1859; *Eudendrium ramosum* (Linnaeus, 1758); *Acryptolaria conferta conferta* (Allman, 1877); *Acryptolaria conferta minor* subspec. nov.; *Bedotella armata* (Pictet & Bedot, 1900); *Cryptolaria pectinata* (Allman, 1888); *Filellum* cf. *serratum* (Clarke, 1879); *Lafoea dumosa* (Fleming, 1820); *Zygophylax biarmata* Billard, 1905; *Halecium sibogae marocanum* Billard, 1914; *Halecium* spec. 2; *Aglaophenia* cf. *lophocarpa* Allman, 1877; *Aglaophenia picardi* Svoboda, 1979; *Aglaophenia tubulifera* (Hincks, 1861); *Schizotricha frutescens* (Ellis & Solander, 1786); *Kirchenpaueria bonnevieae simplex* Billard, 1930; *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890); *Plumularia falcicula* spec. nov.; *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874; *Diphasia attenuata* (Hincks, 1866); *Diphasia margareta* (Hassall, 1841); *Diphasia pinastrum* (Cuvier, 1830); *Sertularella gayi robusta* Allman, 1873; *Campanularia hincksii* Alder, 1856.

BALGIM Stn CP 155, 36°19.8'N-07°40.6'W, 18.vi.1984, 903 m: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874.

BALGIM Stn DW 157, 36°21'N-07°55.8'W, 18.vi.1984, 1108 m: *Cladocarpus pectiniferus* Allman, 1883; *Polyplumaria flabellata* G.O. Sars, 1874.

## Taxonomic report

### Unidentifiable athecate hydroid

Material.— EPI IV, Stn KG 221, 47°34'N-08°41.7'W, 05.ix.1975, 2100 m: single hydranth of athecate hydroid with disc-shaped proboscis, filiform tentacles and long, thin pedicel.

BALGIM Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: five erect colonies up to 50 mm high on

stone. Axis polysiphonic and irregularly branched. No well preserved hydranths or gonophores.

### Corymorphid or tubularioid hydroid

Material.— BALGIM Stn CP 108, 36°10.8'N-08°06.2'W, 10.vi.1984, 1527 m: two specimens rising from detached fibres. No gonophores. Probably dislodged from solid substratum.

## Family **Bougainvilliidae** Lütken, 1850
## Genus **Bimeria** Wright, 1859

### **Bimeria vestita** Wright, 1859

*Bimeria vestita* Wright, 1859: 109, pl. 8 fig. 4; Hincks, 1868: 103-104, pl. 15 fig. 2; Billard, 1931a: 245; Leloup, 1934: 5; Philbert, 1935c: 25; Philbert, 1935d: 19; Leloup, 1937a: 93, 116; Moore, 1937: 39; Fraser, 1938a: 7, 17; Fraser, 1938c: 131; Leloup, 1940b: 5; Leloup, 1947: 15, fig. 7; Picard, 1951a: 109; Picard, 1951b: 260; Leloup, 1952: 120-121, fig. 58: Buchanan, 1957: 356, fig. 5; Hamond, 1957: 295, 297, fig. 3; Picard, 1958: 190; Mammen, 1963: 42, fig. 8; Millard, 1966: 449, fig. 5A-F; Cabioch, 1968: 704; Fey, 1970: 391; Patriti, 1970: 15, fig. 8; Blanco, 1974: 43, fig. 1; Millard., 1975: 95, fig. 32C-H; Millard, 1978: 189; Marinopoulos, 1981: 176; Castric & Michel, 1982: 81, fig; Boero, 1985: 136; Calder, 1988: 21, figs. 17, 18; Hirohito, 1988: 92, 94-96, figs. 33d-f, 34a.
*Perigonimus vestitus* - Stechow, 1912: 348; Rees, 1938: 18; Rees, 1956: 343, 347; Caspers, 1950: 133.
*Cytaeis vestita* - Stechow, 1919: 21, 24.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: one large colony 35 mm high, possibly supported by other hydroid. Also creeping colonies on *Diphasia attenuata* var. *robusta* (with *Lafoea dumosa* and *Campanularia hincksii*), on *Sertularella gayi gayi* and on other hydroids. No gonophores.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: small, branched colonies on old hydroid stems and on worm-tube, with many other epizootic hydroids; no gonophores. Also several small colonies 2-3 mm high on worm-tube with many other epizootic hydroids.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: two monosiphonic stems 8-10 mm high with a few well kept hydranths; no gonophores. Also profusely branched c. 12 mm high colonies, smaller colonies on worm-tubes and fragments; no gonophores.

Description.— Species present either as pediculate hydranths rising from a creeping stolon or as gracefully built 5-15 mm high stems. These stems also emerge from creeping stolons and may give rise to a monopodially built colony with erect, monosiphonic axis bearing at regular intervals, usually alternate secondary pedicels that rebranch only quite occasionally. Axis may at times create impression of being polysiphonic by development of epizootic colonies of same or other species; the stolon may completely invest axis and/or branches of host species and create the impression of a much larger, more strongly built and more profusely ramified species. Axis basally with a few indistinct rings or a spiral groove; such corrugations of perisarc also occur occasionally on axis between pedicels or branches. Identical rings or spiral twisting is also observed at the base of pedicels.

Hydranths small, 260-335 µm long, when expanded elongate spindle-shaped with fairly long, dome-shaped proboscis, at base of which there is one whorl of 12-16 amphi-coronate, filiform tentacles. In stained slides the disc-shaped structure of the entodermal cells is quite evident.

Periderm thin but firm, generally smooth between above mentioned corrugations, terminating some distance under hydranth and there represented by hyaline sheath investing basis of hydranth and basal part of tentacles (i.e. continuing over the basal part of each tentacle as a short tube from which filiform end of tentacle protrudes). Only few silt particles adhere to hyaline collar that even in contracted hydranths is relatively transparent.

No gonophores have been observed.

Distribution.— *Bimeria vestita* is a cosmopolitan species with a wide distribution in eastern and western Atlantic (cf. Calder, 1988), occurring in shallow as well as deeper waters. The present records are from the western, Atlantic side of the Strait of Gibraltar (DR 113, DW 114) and from the Alboran Sea (DW 132). The species has previously been recorded from the Mediterranean by Picard (1958) and Marinopoulos (1981), the latter giving 20-200 m as the depth distribution. The present depth records are 144-170 m.

Discussion.— For the synonymy of this species we refer to Hirohito (1988) and Calder (1988).

## Genus **Garveia** Wright, 1859

### **Garveia arborea** (Browne, 1907)

*Bimeria arborea* Browne, 1907: 15, 16, 18, 20, pl. 1 figs. 1-3, pl. 2; Hirohito, 1988: 94, fig. 33a-c.
*Garveia arborea* - Vervoort, 1985: 273-277, pl. 2.

Material.— EPI I Stn CP 38, 47°33.75'N-08°42.15'W, 29.iii.1974, 2100 m: remnants of one or several large colonies with thick, polysiphonic axis; hydranths badly preserved, no gonophores.— Stn CP 39, 47°32.00'N-08°38.4'W, 30.iii.1974, 2100 m: five fragmentary colonies c.70 mm high; badly preserved hydranths, no gonophores.

Distribution.— This species is apparently well distributed over soft bottoms in the deeper parts of the Bay of Biscay (Browne, 1907; Vervoort, 1985), the depth records varying between 753 m (Browne, 1907) and 1920-3100 m (Vervoort, 1985). The present records (EPI CP 38 and CP 39) are from deep water of the northern entrance of the Bay of Biscay at 2100 m depth. There is only one record from outside Bay of Biscay waters: off Arasaki, Sagami Bay, depth 420 m (Hirohito, 1988).

Discussion.— We have little to add to the comprehensive redescription of the species by Vervoort (1985), the present colonies being also in poor condition. The colonies are fragile and are easily damaged when hauled in the trawl bag from the ocean bottom. The preserved material has a characteristic yellowish grey colour; the basal portions of the axes are recognized by the dense tuft of fine hydrorhiza fibres anchoring the colonies in soft mud.

### **Garveia nutans** Wright, 1859

*Garveia nutans* Wright, 1859: 109, pl. 8 fig. 5; Hincks, 1868: 102-103, pl. 14 fig. 4; Fraser, 1911: 23; Fraser, 1937: 36, pl. 5 fig. 22; Hamond, 1957: 295, 297; Paul, 1958: 535; Cabioch, 1968: 704.
*Bimeria (Garveia) nutans* - Moore, 1937: 39; Williams, 1954: 47.

*Bimeria nutans* - Stechow, 1919: 30; Leloup, 1934: 5; Philbert, 1935c: 19; Leloup, 1947: 15, fig. 7; Leloup, 1952: 19-20, fig. 57; Lewis, 1953: 529.
*Perigonimus (?) nutans* - Rees, 1956: 342.

Material.— BALGIM Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: two fragment 5 and 6 mm high of slightly polysiphonic, sterile colonies with a few contracted hydranths, taken from unidentifiable hydroid.

Description.— Short axis rising from more or less reticulate fibres attached to hydroid stem, branching to form hydroid pedicels that are not again re-branched but bear a terminal hydranth, often bent abruptly downward.

Hydranths contracted in BALGIM specimens, spindle-shaped, with single whorl of c. 12 thick, filiform tentacles in single whorl around dome-shaped proboscis.

Perisarc on axis and pedicels quite irregularly wrinkled but thin, visible until some distance under hydranth where it becomes transparent and forms a cup-shaped 'pseudohydrotheca' around proximal portion of hydranth; it does not continue around base of tentacles. Visibility of 'pseudohydrotheca' usually increased by adherence of silt particles.

Gonophores absent.

Distribution.— *Garveia nutans* has a world wide distribution in boreal and temperate seas, living mainly in the deeper littoral zone. The present record (DR 153) is from the Strait of Gibraltar proper, depth 580 m.

Discussion.— In absence of gonophores the identification of the (few) BALGIM colonies must remain slightly doubtful.

## Family **Clavidae** McCrady, 1859
## Genus **Corydendrium** P.J. van Beneden, 1844

### **Corydendrium parasiticum** (Linnaeus, 1767)
(fig. 1a)

*Sertularia parasitica* Linnaeus, 1767: 1315.
*Corydendrium parasiticum* - Millard, 1975: 72, fig. 24B-D: Hirohito, 1988: 66, fig. 21a-c, pl. 2 fig. B.

Material.— BALGIM Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: small fragment c. 5 mm high with a single fully expanded hydranth, and some gonophores inside tube. In addition several small colonies without gonophores on various hydroids, amongst which *Sertularella gayi gayi*.

Description.— Material available consists of perisarcal tubes, usually covered by epizootic hydroids, i.a. *Filellum* cf. *serratum*, bearing some dispersed cornucopia-shaped structures (siphons), gradually becoming hyaline terminally, some containing completely or partially withdrawn hydranths. One of these tubes has a partly contracted hydranth and a fully withdrawn gonophore (fig. 1a).

Hydranth, as far as can be observed elongated ovoid with 10-12 contracted, filiform tentacles dispersed over body of hydranth; hypostome could not be observed. Body of hydranth tappers proximally to form a narrow band of tissue with a sudden widening that blocks the basal portion of the siphon. Lateral to basal portion of hydranth a sac-shaped gonophore can be observed, just reaching the siphonal rim

Table 1. Measurements of *Corydendrium parasiticum* in µm.

| | BALGIM Stn DW 114 |
|---|---|
| Perisarcal tube, length | 665 |
| diameter at base | 90 |
| diameter at rim | 220 |
| Contracted hydranth, length | 260 |
| maximal diameter | 150 |
| Gonophore, length | 260 |
| maximal diameter | 110 |

and containing c. seven developing eggs. Tissue strand basally of tissue plug communicating with coenosarc of tube. Perisarc of tube firm but without the obvious, two-layered structure observed in *Turritopsis nutricula*. Along wall of siphon thickness of perisarc gradually diminishes to become almost hyaline in apical part, where some silt particles adhere to its exterior surface.

Distribution.— *Corydendrium parasiticum* is widely distributed throughout the temperate and tropical parts of Atlantic, Indian and Pacific Oceans, including also the whole of the Mediterranean. The present material originates from the Atlantic off the Strait of Gibraltar (DW 114), depth 150 m.

Discussion.— The BALGIM material comes quite near to *Corydendrium brevicaulis* Hirohito, 1988 but for the fact that the hydrorhiza in the latter is a reticulate, anastomosing structure. The BALGIM material agrees with the general concept of *Corydendrium parasiticum* with the exception of the colony structure: the present specimens are solitary polyps arranged along a length of tube; no hydrorhiza has been found in the material. Usually *C. parasiticum* forms distinct colonies with a fascicled stem and hydranth-bearing siphons that are adnate over at least part of their length.

## Genus Turritopsis McCrady, 1859

### Turritopsis nutricula McCrady, 1859

*Oceania (Turritopsis) nutricula* McCrady, 1859a: 55, pls. 4-7; McCrady, 1859b: 105, 127-129, pl. 8 fig. 1.
*Turritopsis nutricula* - Millard, 1975: 76, fig. 24F-G; Hirohito, 1988: 71-72, fig. 23c-d.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: stem fragment 4 mm high without hydranths and gonophores; structure of perisarc reticulate.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: two fragments of slightly polysiphonic stems c. 15 mm high; no polyps present. Reticulate structures of axis and branches.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: two stem fragments 8 and 12 mm high with reticulate structure of axis and branches, polyps in bad condition; no gonophores. In addition two branched fragments 15 and 18 mm high with a few contracted hydranths; no gonophores.— Stn DR 133, 35°25.8'N-04°17.4'W, 15.vi.1984, 195 m: single branch 10 mm high with a few hydranths; no gonophores.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: single 8 mm high, basally polysiphonic colony with well preserved polyps. No gonophores.

Description.— Colony small, 10-25 mm high, erect; axis composed of number of adhering tubes, branching of colony and tubes irregular. Tubes after point of branching running parallel for some distance, basally adnate, then curving abruptly away from original tubule under angle of c. 60°, slightly increasing in diameter apically.

Hydranths in BALGIM specimens spindle-shaped, 300-400 µm high, free from perisarc of tubules, with 12-16 filiform tentacles mainly distributed over distal part of

hydranth. Proboscis cylindrical to weakly conical, firmly closed.

Perisarc strong, composed of two layers of which internal is thickest and distinctly wrinkled within thinner and smooth external sheath that may accumulate particles of grit and mud. Perisarc ending some distance under hydranth; coenosarc continuing until base of hydranth, not constricted; hydranths not retractable.

There are no gonophores.

Distribution.— The distribution of this species is almost cosmopolitan, though it is mainly restricted to temperate, subtropical and tropical waters and occurs mainly in the littoral zone. The present records are from the Atlantic off the Strait of Gibraltar (DR 42), from the Strait proper (DR 153) and from the Alboran Sea off Morocco (DR 130, DR 132, DW 133); depth distribution 135-580 m. The species has previously been recorded from the Mediterranean as *Dendroclava dohrni* Weismann, 1883.

Discussion.— The two-layered structure of the perisarc is quite characteristic in the BALGIM specimens and may serve to distinguish fragments of the species in which the structure of the hydranths is obscure. We have followed the general concept of this species in considering *Turritopsis nutricula* and *Dendroclava dohrni* to be synonymous, a point of view not shared by Calder (1988: 8-10). The material of both 'species' which so far came to our attention is too scanty to allow of any additional conclusions. For the synonymy of *Turritopsis nutricula* as conceived here we refer to Hirohito (1988).

## Family **Eudendriidae** L. Agassiz, 1862
## Genus **Eudendrium** Ehrenberg, 1834

### **Eudendrium capillare** Alder, 1856
(fig. 1b, c)

*Eudendrium capillare* Alder, 1856: 355, pl. 12 figs. 9-12; Hincks, 1868: 84-86, pl. 14 fig. 2; Picard, 1958: 189; Millard & Bouillon, 1974: 17, fig. 3E-H; Millard, 1975: 82, fig. 27E-J; Hirohito, 1988: 77-80, figs. 24g-h, 25.

*Eudendrium ? capillare* - Watson, 1985: 186-189, figs. 17-19.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: five fragments 5-8 mm high, all monosiphonic, one with a few deteriorated hydranths and without gonophores may belong here.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: a few well preserved hydranths rising from stolon creeping on *Sertularella gayi gayi*; no gonophores. Also tangled tuft c. 10 mm high with distinct hydranths; no gonophores.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: a few hydranths rising from stolon creeping on *Sertularella gayi gayi*; some of pedicels branched; together with many other epizootic hydroids. One hydranth with female gonophores.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: small colonies on *Zygophylax* spec.; no gonophores. In addition 10-20 mm high colonies, no gonophores observed.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: several detached colonies; no gonophores. Also four stems up to 15 mm high with a few hydranths.

Description.— Colony composed of usually straggling, unbranched pedicels rising from a stolon creeping on other hydroid, usually together with many other epizootic hydroids. Pedicels thin, with irregularly wrinkled or ringed perisarc, with a few more or less distinct rings basally, occasionally giving the impressions of spiral twisting. Pedicels occasionally branched, resulting branches (secondary pedicels) short, basally

with a few indistinct rings. Sometimes branching slightly more profuse and pinnate, resulting in short, monosiphonic stems with a limited number of lateral ramifications.

Hydranths small, in preserved condition c. 250 µm long, with a single whorl of 12-16 filiform tentacles around globular to trumpet-shaped proboscis (fig. 1b).

Only young, female gonophores are present. These are composed of one (hyaline) egg surrounded by an unbranched spadix and occur on the body of normal to slightly reduced (in tentacle number and size of proboscis) hydranths (fig. 1c). They measure 50-60 µm in diameter.

No nematocysts have been studied.

Distribution.— The geographical distribution of this species, generally considered cosmopolitan, is uncertain because of its frequent confusion with other small species of *Eudendrium*, from which it can only be separated with sufficient certainty by inspection of the nematocysts and/or the gonophores. Its occurrence in the temperate eastern Atlantic and Mediterranean, however, is beyond reasonable doubt. The present records are from the Atlantic off the Strait of Gibraltar (DR 42, DR 113, DW 114), from the Strait proper (DR 152) and from the Alboran Sea (DW 132), depths 135-550 m. Its presence in the Mediterranean has previously been confirmed by Picard (1958).

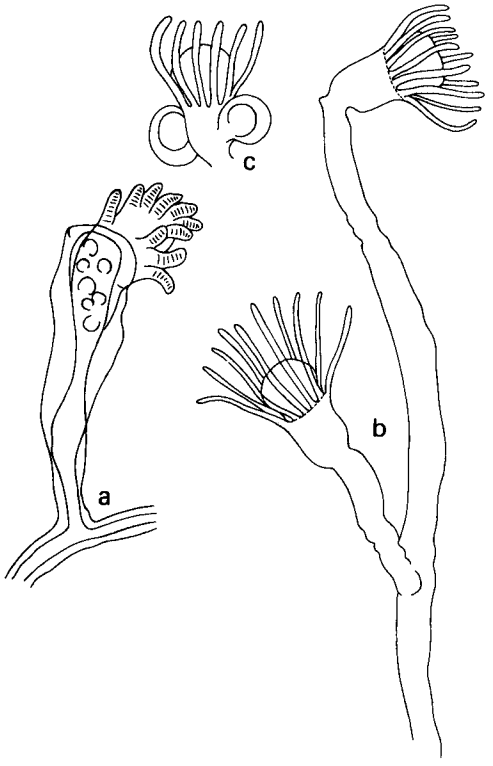


Fig. 1. a, *Corydendrium parasiticum* (Linnaeus, 1767), from DW 114, contracted hydranth and fully withdrawn gonophore. b, c, *Eudendrium capillare* Alder, 1856, from DW 132. b, part of colony with 2 hydranths; c, young, female gonophores on slightly reduced hydranth. a-c, × 90.

Discussion.— The species of *Eudendrium* in the BALGIM collection fall into two groups, one of which has been tentatively identified as *Eudendrium capillare* Alder, 1857, the other as *Eudendrium ramosum* (Linnaeus, 1758). The identifications must be considered tentative because study of the nematocysts in the alcohol preserved material proved to be impossible. Recent studies by i.a. Millard & Bouillon (1973, 1974) and Watson (1985) have indicated that the study of nematocysts is imperative to distinguish the two forenamed species from their congeners. However, considering the relatively restricted Atlantic and Mediterranean areas from which the BALGIM material originates we feel fairly confident that the identifications of the *Eudendrium* material presented here are dependable. Though no satisfactory nematocyst preparation of *E. capillare* could be obtained, the superficial inspection of nematocysts of *E. ramosum* that we have been able to pursue affords no points contradictory to its identification as such (vide infra).

## Eudendrium ramosum (Linnaeus, 1758)

*Tubularia ramosa* Linnaeus, 1758: 804.
*Eudendrium ramosum* - Hincks, 1868: 82-83, pl. 13; Picard, 1958: 189; Millard & Bouillon, 1973: 32-33, fig. 4F; Millard & Bouillon, 1974: 19-20, fig. 3A-D; Millard, 1975: 85-87, fig. 31A-D; Hirohito, 1988: 87-88, figs. 30d-e, 31a-c, pl. 2 fig. C.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: one 5 mm high fragment with single hydranth may belong here. No gonophores.— Stn DW 47, 35°43.5'N-06°18.2'W, 02.vi.1984, 281 m: fragment of colony 15x18 mm with some hydranths and ripe, male gonophores.— Stn CP 99, 34°28.2'N-07°43.3'W, 09.vi.1984, 1870 m: c. 80 mm high colony in two parts; hydranths present but in bad condition, no gonophores. Axis basally polysiphonic. May belong here.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: two fragments 15 and 20 mm high without hydranths or gonophores may belong here; partly covered with *Bimeria vestita* and other hydroids.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: single 10 mm high stem fragment with *Turritopsis nutricula*. Five fragments 20-35 mm high, basally weakly polysiphonic; partly covered with smaller species of *Eudendrium*, possibly *E. capillare*. No hydranths; no gonophores.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: three fragments 10 and 15 mm high with well preserved hydranths, one with developing male gonophores. Also two stems 15 and 25 mm high with well preserved hydranths and many female gonophores; with *Antennella secundaria* and other epizootic hydroids. In addition 35 mm high profusely branched specimens with well preserved hydranths and male and female gonophores.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: three fragments, largest 8 mm high, with several hydranths; no gonophores. May belong here. Also several fragments of polysiphonic stems c. 35 mm high with developing and mature female gonophores and a 3 mm high fragment with single hydrotheca of *Clytia* (?) spec.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: four monosiphonic fragments 5-8 mm high with some hydranths, one with developing male gonophores. Also 5 mm high fragment with a few hydranths; no gonophores.

Description.— Adult colonies tall, with erect, straight axis, slightly to moderately polysiphonic basally and bearing regular, at times more or less alternate side-branches, supporting short pedicels. Side-branches leaving axis under angles varying between 90 and 60 degrees. Perisarc smooth, with a few rings under the branches; side-branches ringed at origin; pedicels short, at times almost completely ringed. Some of colonies from DR 152 more strongly polysiphonic and fairly irregularly branched; ultimate ramifications, pedicels, hydranths and gonophores as in previous type. Young colonies occur on various hydroids and adult stems of same species, resembling primarily *E. capillare* in mode of growth, but with smooth periderm, distinct rings and bigger hydranths.

Perisarc terminates fairly abruptly under hydranth, body of polyp there with slight constriction.

Hydranths, compared to those of *E. capillare*, large, with conspicuous, usually trumped-shaped proboscis and a whorl of 12-18 filiform tentacles. Gonophores occur abundantly in the BALGIM material. Female gonophores occur in a whorl at the basal part of the hydranths, at times as many as eight in one whorl and are composed of a large egg surrounded by an undivided spadix. Male gonophores in various stages of development are present; the smaller are indistinctly two-chambered, the apical chamber forming a crescent-shaped dome on a globular basal chamber. The adult male gonophore is a fairly voluminous ovoid body; two or three per hydranth have been observed. Both female and male gonophores occur on hydranths that are in various, usually slight, degrees of atrophication, involving size of body and proboscis as well as number and length of tentacles.

There are two types of nematocysts, both presumably euryteles. The larger type is

ovoid and c. 25 μm long; the smaller also ovoid and 7-8 μm long. Internal structure could not be observed and no exploded nematocysts have been found. The smaller type is common on tentacles and body; the larger type has not been observed in the tentacles but seems to be restricted to the body of the hydranth.

Distribution.— *Eudendrium ramosum* is generally considered to be a cosmopolitan species, but this conception is largely based on records that have ignored information on the nematocysts. Its presence in abundance in the temperate and boreal eastern Atlantic and in the Mediterranean is beyond doubt.

The BALGIM records are from the Atlantic off Kenitra, Morocco (CP 99), from the Atlantic off the Strait of Gibraltar (DR 42, DW 47, DR 113), from the Strait proper (DR 152, DR 153) and from the Alboran Sea (DR 130, DW 132). The presence of the species in the Mediterranean has previously been established by Picard (1958). The depth records of the BALGIM material are from between 135 and 1870 m.

Discussion.— We refer to the discussion of *Eudendrium capillare* for comment on both species. Though external morphology of the colonies and gross morphology of the nematocysts does not contradict identification of the present material as *E. ramosum*, detailed inspection of the nematocysts in the alcohol preserved material was unsuccessful.

### **Eudendrium** spec.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: small damaged colony on *Sertularella gayi gayi*; no gonophores.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: many colonies without gonophores on various hydroids.— Stn DR 133, 35°25.8'N-04°17.4'W, 15.vi.1984, 195 m: fragment 5 mm high without gonophores; lost while handling.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: damaged colony 15 mm high with a few contracted hydranths; no gonophores.

## Family **Pandeidae** Haeckel, 1879
## Genus **Leuckartiara** Hartlaub, 1914

### **Leuckartiara octona** (Fleming, 1823)

*Geryonia octona* Fleming, 1823: 299. (Medusa).
*Leuckartiara octona* - Russell, 1953: 188-195, figs. 91-96, pl. 11 figs. 5-6, pl. 12 fig. 3, pl. 31 figs. 91-92, 93A-B, 94-96; Leloup, 1952: 210, fig. 125.
*Eudendrium pusillum* Wright, 1857: 84, 90, pl. 2 figs. 8-9. (Polyp).
*Eudendrium repens* Wright, 1858: 448.
*Atractylus repens* - Wright, 1858: 450, pl. 22 figs. 4-5.
*Perigonimus repens* - Hincks, 1868: 90-93, pl. 16 fig. 2; Vervoort, 1946b: 141-144, figs. 54-55; Leloup, 1952: 116-117, fig. 55.

Material.— BALGIM Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: single fragment 8 mm high with one hydranth. Also 8 mm high, profusely branched colonies on *Sertularella gayi gayi*, with *Eudendrium* cf. *capillare*, *Campanularia hincksii* and *Clytia paulensis*; gonophores present. In addition irregularly branched colonies 5-10 mm high with a single gonophore from stolon on worm-tubes as well as fragments.

Description.— Small colonies composed of irregularly branched axes rising from

one or several hydrorhiza fibres creeping on worm-tubes, other hydroids, etc., occasionally hydrorhiza forming reticulum. Axes largely monosiphonic, in larger colonies basally with a few secondary tubules, irregularly branched, branches diverging from axis at an angle of 60° or less, basally with a few irregular rings or with wrinkled perisarc, usually re-branching, occasionally repeatedly so.

Hydranths in expanded condition elongate fusiform, c. 185-225 µm long, with eight to twelve long, filiform tentacles in single whorl around dome-shaped proboscis.

Perisarc firm, irregularly wrinkled over whole of colony, ending some distance under hydranth to form hyaline, gelatinous covering of basal portion of polyp, that after contraction may form a distinct, cup-shaped 'pseudohydrotheca'. Visibility of hyaline covering of 'pseudohydrotheca' increased by adherence of particles of silt.

Gonophores abundantly present as rounded bodies attached by means of short, hyaline stalk to hydrothecal pedicel some distance under polyp. Gonophores c. 165x225 µm, rounded, the oldest apically flattened, completely invested by hyaline sheath; development of medusa with two thick marginal tentacles visible through sheath.

Distribution.— Cosmopolitan, including Mediterranean, in littoral to deeper littoral zone. The present specimens originate from the Alboran Sea off Morocco (DW 132), depth 170 m.

Discussion.— The small size of the colonies probably accounts for the scarcity of material of this widely distributed species in the BALGIM collection. For the synonymy of this species we refer to Russell (1953).

## Family **Campanulinidae** Hincks, 1868
## Genus **Egmundella** Stechow, 1921

### **Egmundella amirantensis** Millard & Bouillon, 1973
(fig.2a-d)

*Egmundella amirantensis* Millard & Bouillon, 1973: 40-42, fig. 5A-D; Millard, 1975: 133, fig. 43G; García-Corrales, Arcas & De Diego, 1979: 27-28, fig. 14; Roca, 1986: 9.
*Lafoeina amirantensis* - Calder, 1991: 10, fig. 3.

Material.— BALGIM Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: many colonies composed of hydrothecae and nematothecae springing from stolon on *Halecium sessile*; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: colony composed of various hydrothecae and one nematotheca on axis of *Diphasia attenuata* var. *robusta*; no gonothecae. Additional colonies on *Sertularella gayi gayi*, *S. cylindritheca* and *Synthecium evansi*; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: several colonies on *Sertularella gayi gayi* and *Eudendrium capillare*; no gonothecae.

Description.— Colony stolonal, composed of fine stolonal tube creeping on axis of *Diphasia attenuata* var. *robusta* and other hydroids, no anastomoses have been observed. From that stolon rise hydrothecae and nematothecae in protected areas, as for instance the angle between axis and free adcauline hydrothecal wall. Hydrothecae tubular and completely free from stolon and substratum, erect or slightly twisted, narrowly rounded basally to from an extremely short c.q. almost

invisible pedicel. At the hydrothecal rim theca is slightly everted and runs almost imperceptibly into the opercular apparatus, composed of 10-12 triangular flaps, closed in all hydrothecae studied to form a fairly high triangular roof. No demarkation between hydrothecal rim and opercular plates has been observed and as opercular apparatus could not be studied in opened condition it can not unambiguously be stated whether or not the opercular plates are free or connected by means of a membranous sheath. When closed the plates fit rather tightly, so if a connecting membrane is present it must be quite thin (fig. 2a-c).

Nematotheca club-shaped, apical portion ovoid with small, circular opening, basally narrowing to form a slender shaft attached directly to stolon. The nematothecae contain a small number of large, elongated nematocysts with their long axis parallel to the nematothecal length axis (fig. 2d).

All hydrothecae contain remnants of polyps; no gonothecae have been observed.

Table 2. Measurements of *Egmundella amirantensis* in µm.

| | BALGIM Stn DR 113 | Seychelles (Millard & Bouillon, 1973) |
|---|---|---|
| Stolon, diameter | 30-40 | |
| Hydrotheca, length from insertion on stolon | | |
| up to opercular origin | 140-95 | 140-340 |
| idem, including operculum | 160-230 | |
| diameter at rim | 60-65 | 60-90 |
| Nematotheca, length | 75 | 40-120 |
| maximal diameter | 20 | |
| diameter of pedicel | 11 | |
| Nematocyst inside nematotheca, length | 16 | 15 |
| diameter | 2.5 | |

Distribution.— Originally described from the Seychelles (Amirante, Praslin & Mahé), depth c. 15 m (Millard & Bouillon, 1973). Later records are from Mozambique (Inhaca to Santa Carolina), depth not stated (Millard, 1975), from the Mediterranean and Cantabrian seas (García-Corrales, Arcas & De Diego, 1979; Roca, 1986) and from Bermuda (Calder, 1991). The present material is from the Atlantic off Cape Spartel (DR 113, DW 114) and off Casablanca (CP 90), depth 144-890 m.

Discussion.— Though sterile the present material is so much in agreements with descriptions and measurements in Millard & Bouillon (1974) and Millard (1975) that there can be no reasonable doubt concerning their conspecificity. The occurrence of this species in the temperate Atlantic is quite a surprise. It should be noted, nevertheless, that the hydro- and gonothecae are quite small and transparent, while the hydranths, though greatly extensile, are inconspicuous. The species, therefore, may have frequently been overlooked. It produces a so far unknown hydromedusa. It was recently transferred to *Lafoeina* M. Sars, 1874, by Calder (1991: 10). We agree with Calder (1991: 5, 8) that the inclusion of the genera *Egmundella* Stechow, 1921, and *Lafoeina* M. Sars, 1874, in the family Campanulinidae is disputable.

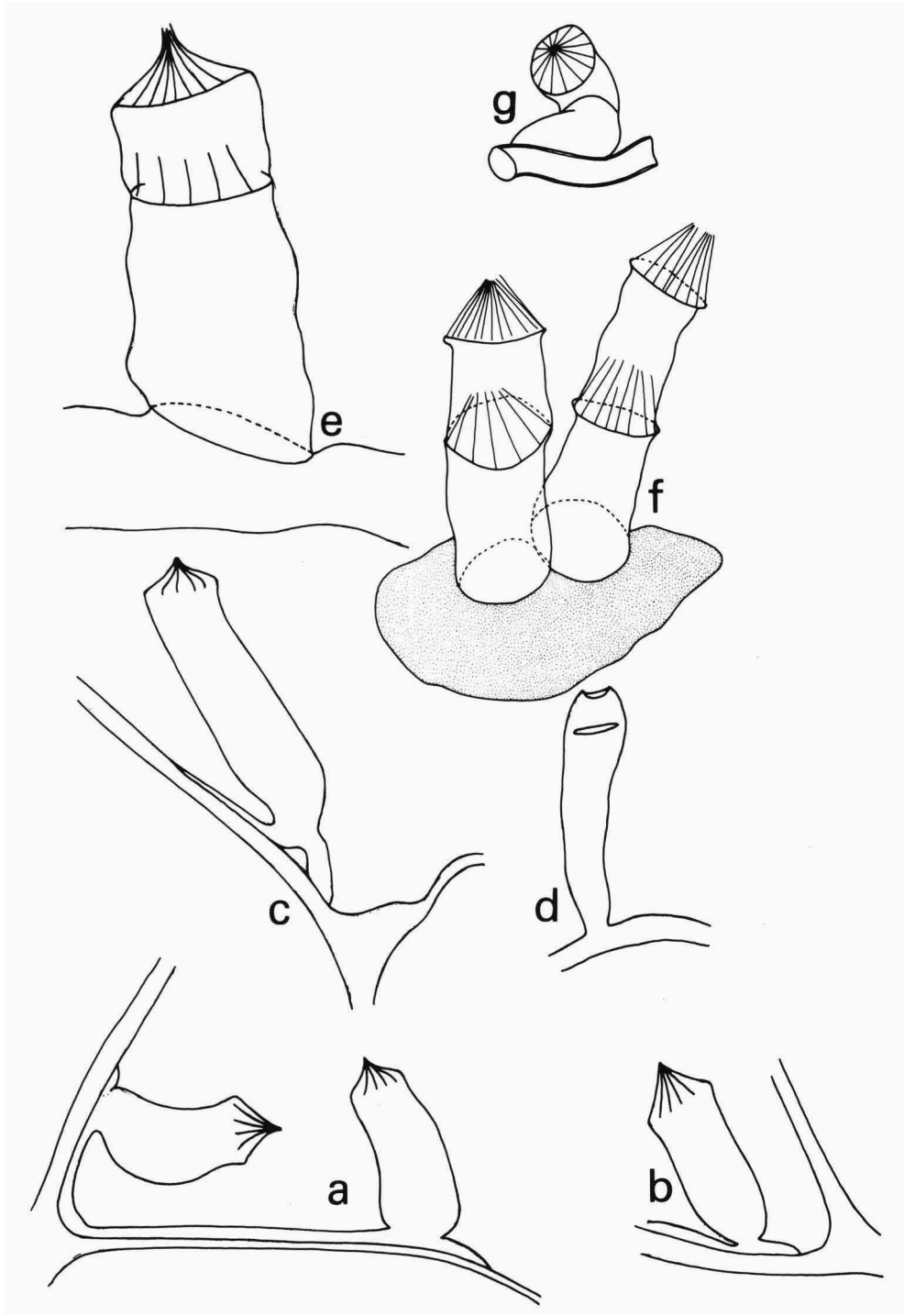


Fig. 2. a-d, *Egmundella amirantensis* Millard & Bouillon, 1973, from DR 113. a-c, various hydrothecae; d, nematotheca with single nematocyst. e-g, *Laodicea undulata* (Forbes & Goodsir, 1853). e, single hydrotheca from DW 132; f, g, hydrothecae from DR 113. a-c, × 175; d, × 440; e, × 265; f-g, × 110.

## Family **Phialellidae** Russell, 1953
## Genus **Opercularella** Hincks, 1868

### **Opercularella panicula** (G.O. Sars, 1874)
(fig. 3a-d)

*Campanulina panicula* G.O. Sars, 1874: 95, 121, 134, 140, pl. 5 figs. 9-13; Storm, 1882: 16, 28, 30; Duerden, 1895: 325, 332, pl. 14 figs. 7-8; Storm, 1897: 413; Bonnevie, 1899: 10, 75; Bonnevie, 1901: 10; Rioja, 1905: 278; Jäderholm, 1909: 23, 81; Broch, 1910: 212; Rees, 1939: 436, 438, 444; Kramp, 1941: 1-11, figs. 1-5; Rossi, 1958: 4, 8, 9; Pérès & Picard, 1964: 103; Rees & Rowe, 1969: 17; Jägerskiöld, 1971: 61.

*Opercularella panicula* - Christiansen, 1972: 291; Leloup, 1974: 4, fig. 3; Ramil & Iglesias, 1988b: 79-81, figs. 1-2.

*Lovenella (?) paniculata* - Picard, 1955: 185.

*Campanulina denticulata* Clarke, 1907: 12, pl. 8; Stechow, 1913a: 144; Stechow, 1913b: 122, fig. 92; Stechow, 1923b: 8; Rees, 1939: 443, 445; Kramp, 1951: 123; Yamada, 1959: 43.

*?Opercularella denticulata* - Vervoort, 1966: 104-106, 109, figs. 4-5; 1972: 40-42, fig. 11a; 1985; 278, 279, fig. 2b.

*Opercularella denticulata* - Gili, Vervoort & Pagès, 1989: 76, 77, fig. 6A.

*Campanulina (?) indivisa* Fraser, 1948: 216, pl. 24 fig. 7; Vervoort, 1966: 106.

*Campanulina indivisa* - Ljubenkov, 1980: 48.

*Opercularella* spec. Vervoort, 1972: 42, fig. 11b-c.

Material.— EPI I Stn CP 39, 47°32.00'N-08°38.4'W, 30.iii.1974, 2100 m: four stems up to 15 mm high from stolon on unidentifiable substrate; no gonothecae.
BALGIM Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: damaged colony composed of five axes 5-10 mm high on *Lytocarpia myriophyllum*; no gonothecae.— Stn CP 21, 36°36.5'N-07°24'W, 31.v.1984, 485 m: three stems 10-12 mm high with fair hydrothecae springing from stolon creeping on small coral; no gonothecae.— Stn CP 91, 34°22.3'N-07°25.1'W, 07.vi.1984, 948 m: two mutilated stems 10 and 15 mm high; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: single detached stem 10 mm high with fair hydrothecae; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: several stems 10-15 mm high on empty worm-tubes, old hydroids stems, etc.; one empty gonotheca present. In addition colony 8 mm high on *Kirchenpaueria bonnevieae*; no gonothecae.— Stn CP 145, 35°56.6'N-03°07.9'W, 16.vi.1984, 373 m: several 5-8 mm high stems on axis of *Sertularella gayi gayi*; one empty gonotheca.— Stn DW 146, 35°56.5'N-03°08.6'W, 16.vi.1984, 555 m: several stems 8 mm high and many damaged stems on empty worm-tube; hydrothecae in good condition, three empty gonothecae.— Stn CP 149, 35°47.5'N-05°11' W, 17.vi.1984, 377 m: 12 mm high, detached stem; no gonothecae.

Description.— Axes stiff and erect, springing singly from thin, creeping stolon, tightly attached to substrate; perisarc of axis thick, hyaline and smooth, basally sometimes with a few (indistinct) rings. Hydrothecae spring directly from all sides of axis at irregular intervals, pointing obliquely upwards and laterally, usually bearing two opposite secondary hydrothecae some distance from origin on axis (fig. 3a). Pedicels of varied length, as long as or c. twice as long as hydrotheca, basally with some indistinct rings or with wrinkled perisarc, apically gradually widening and running imperceptibly into basal part of lantern-shaped hydrotheca. Wall of hydrotheca either gradually widening towards rim (hydrotheca lantern-shaped) or body of hydrotheca slightly swollen in basal third. Rim of hydrotheca gradually merging with opercular apparatus, in some hydrothecae rim slightly everted. There is no distinct demarcation between walls of hydrotheca and opercular apparatus, which is composed of collapsible part of hydrotheca reinforced with triangular

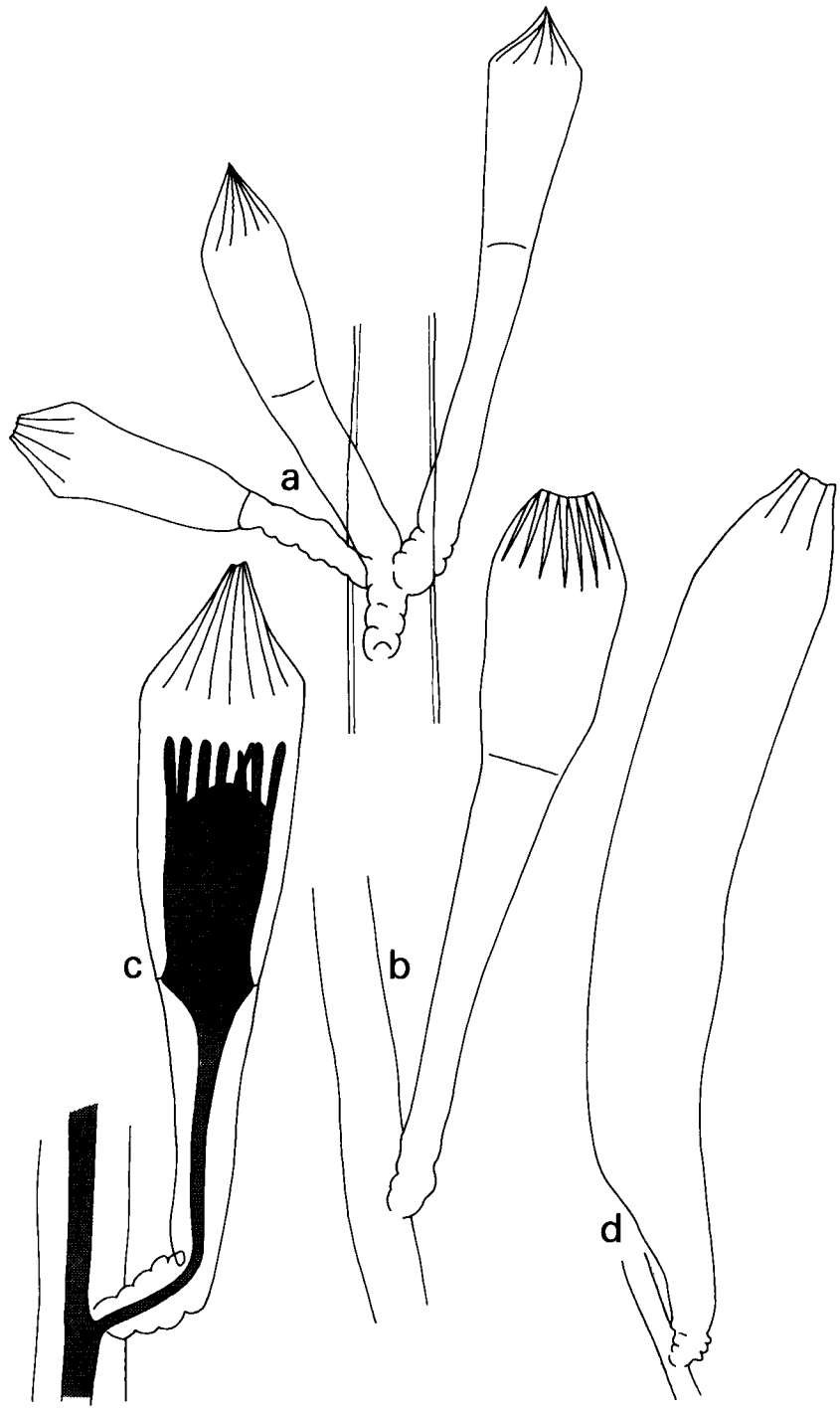


Fig. 3. *Opercularella panicula* (G.O. Sars, 1874). a, b, part of colony and hydrothecae from DW 132; c, hydrotheca with contracted hydranth from CP 149; d, gonotheca from CP 145. a, b, × 85; c, × 135; d, × 47.

strips. In half opened position connecting membrane between thickened strips visible (in stained preparations, fig. 3b); when closed the strips form a rather irregularly folded, high triangular roof. Specimens from DW 132 and CP 149 with well preserved though fully retracted hydranths, attached inside hydrotheca by means of circular, hyaline, membranous collar, that may persist after disappearance of hydranth and form a thin operculum, here considered to be demarkation between hydrotheca and pedicel. Hydranths with 16-18 thin tentacles around globular proboscis (fig. 3c). Perisarc of pedicel thin though firm, gradually thinning out along hydrothecal wall; hydrothecae easily collapsible.

Gonothecae occur at CP 135, CP 145 and DW 146, originating from axis as do hydrothecae, elongated banana- to sac-shaped, narrowing basally into short, ringed or wrinkled pedicel; apex of all gonothecae frayed, probably closing by means of folded membrane as do hydrothecae (fig. 3d). Perisarc of gonothecae hyaline and thin.

Table 3. Measurements of *Opercularella panicula* in µm.

| | BALGIM Stn DW 132 | BALGIM Stns CP 145 & DW 146 | Indian Ocean (Vervoort, 1966) |
|---|---|---|---|
| Axis, diameter at base | 170-250 | | 100-120 |
| Hydrotheca, length pedicel from insertion to 'diaphragm' | 335-705 | | 335-410 |
| diameter at base | 60-85 | | |
| Hydrotheca, length 'diaphragm'-rim, excl. operculum | 260-295 | | |
| idem, including operculum | 335-370 | | 440-540 |
| diameter at rim | 155-170 | | 160-240 |
| Gonotheca, approximate length | | 2060-2175 | 2200-2320 |
| maximal diameter | | 280-365 | 160-175 |

Distribution.— The geographical distribution of this species has recently been reviewed by Ramil & Iglesias (1988); it occurs in moderately deep to deep waters of Atlantic, Pacific and Indian Oceans, including the Mediterranean. The material from EPI 1 originates from deep water of the north-eastern part of the Bay of Biscay (CP 39); the BALGIM material is from the Atlantic off Cape São Vicente (CP 14), the Atlantic off Cádiz (CP 21), the Atlantic off Casablanca, Morocco (CP 91), the Alboran Sea off Morocco (DW 132 and CP 135), the Alboran Sea near Alboran Island (CP 145, DW 146) and the Mediterranean off the Strait of Gibraltar (CP 149). The depth records are from between 170 and 2100 m depth.

Discussion.— We have accepted the view previously expressed by Leloup (1974) concerning the synonymy of *Campanulina panicula* G.O. Sars, 1874 and *Campanulina denticulata* Clarke, 1907, a point of view also accepted by Ramil & Iglesias (1988). *Campanulina (?) indivisa* Fraser, 1948, has already been synonymised with *Campanulina denticulata* by Vervoort, 1966, and *Opercularella* spec. described by Vervoort (1972) has been included by Ramil & Iglesias (1988).

## Family Laodiceidae Browne, 1907
## Genus Laodicea Lesson, 1843

### Laodicea undulata (Forbes & Goodsir, 1853)
(fig. 2e-g)

*Thaumantias undulata* Forbes & Goodsir, 1853: 313, pl. 10 fig. 7. (Medusa).
*Laodicea undulata* - Russell, 1936: 581-587, figs. 1-7; Russell, 1953: 230-239, figs. 123-131, pl. 14 figs. 1-3.
*Cuspidella costata* Hincks, 1868: 210-211, pl. 40 fig. 5 (polyp); Vervoort, 1946b: 205-206, fig. 86; Leloup, 1952: 132, fig. 67.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: separate hydrothecae and small colonies on *Sertularella gayi gayi*; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: separate hydrothecae and several colonies on various hydroids, i.a. *Sertularella gayi gayi* and on worm-tubes; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: single hydrotheca on stem of *Eudendrium ramosum*; no gonothecae.

Description (of the DR 113 specimens).— Material composed of three hydrothecae of which two are small, cylindrical and without pedicel. Hydrothecal walls smooth; halfway length of hydrothecal wall with circular ring indicating growth or regeneration of hydrotheca and shaped like a low, transversal costa to which opercular plates (of the preceding hydrothecal aperture) are attached. Hydrothecal rim circular, smooth, slightly everted; aperture closed by means of pyramidal operculum composed of thin, triangular plates (fig. 2f). Third hydrotheca differs from two previously described by the fact that part of its proximal wall is adnate to the substrate, rest of hydrotheca curved upwards and free from substrate. The closing apparatus is as in the other hydrothecae (fig. 2g).

The hydrotheca from DW 132 is slightly smaller but for the rest exactly fits the above description. It occurs on a heavily overgrown stem of *Eudendrium ramosum* to which it is apparently directly attached; no stolon could be observed (fig. 2e).

Table 4. Measurements of *Laodicea undulata* (polyp) in µm.

| | BALGIM Stn DR 113 | BALGIM Stn DW 132 | reared in aquarium (Russell, 1936) |
|---|---|---|---|
| Length of hydrotheca without operculum | 390-440 | 240 | 280-950 |
| idem, with operculum | 450-590 | 285 | |
| diameter at rim | 130-150 | 85 | 90-110 |

Distribution.— The confusion concerning the taxonomic position of the various species of *'Cuspidella'* makes it difficult to state accurately the geographical distribution of *Laodicea undulata*. Hydroids that agree with the description of *L. undulata* given above have been recorded from the eastern Atlantic as far north as the Skagerak (Vervoort, 1946b, as *Cuspidella costata*) and as far south as the coast of Sierra Leone (Vervoort, 1959, as *C. costata*). Both hydromedusa and polyp are recorded from the Mediterranean by Picard (1958) and listed as a cosmopolitan species. The hydroid has furthermore been recorded from Sagami Bay by Stechow (1923b, as *Cuspidella*

*gigantea*) and from the Atlantic coast of Canada by Fraser (1918; 1921; 1944, as *Cuspidella costata*).

The record of *Cuspidella costata* from the Mergui Archipelago, Indian Ocean, by Ritchie (1910b) has been questioned by Rees & Thursfield (1965) as the hydromedusa of the genus *Laodicea* present in the Indian Ocean, *L. indica* Browne, 1905, is a species different from the Atlantic and Mediterranean *L. undulata*. Rees & Thursfield therefore propose the name *Laodicea brownei* for the hydroid described by Ritchie, at least until its relationship with *Laodicea indica* has been established.

The BALGIM material originates from the Atlantic off the Strait of Gibraltar (DR 113, DW 114, off Cape Spartel, Morocco) and from the Alboran Sea (DW 132, off Morocco), depths 144-170 m.

Discussion.— The present material, characterized by the presence of transversal costae representing growth or regeneration, agrees perfectly with the available descriptions of *Cuspidella costata* Hincks, 1868, which polyp, according to Russell (1936, 1953), represents the hydroid phase of the hydromedusa *Laodicea undulata*, which name has priority over *Cuspidella costata*. In spite of agreement in morphological characters of the BALGIM material with existing descriptions of *Cuspidella costata* our identification must be considered with some reserve. Russell (1936, 1953) has pointed out that *Cuspidella*-like polyps occur in the life history of quite a number of hydromedusae and the allocation of a *Cuspidella*-like form to a certain species can only been done with sufficient certainty when the life histories of such species have been fully worked out.

## Family **Tiarannidae** Russell, 1940
## Genus **Modeeria** Forbes, 1848

### **Modeeria rotunda** (Quoy & Gaimard, 1827)
(fig. 4a-b)

*Dianaea rotunda* Quoy & Gaimard, 1827: 181, pl. 6A figs. 1, 2. (Medusa).

*Modeeria rotunda* - Millard, 1975: 137, fig. 45A; Edwards, 1973a: 573-590, figs. 1-3; Millard, 1977b: 106; Gili, Vervoort & Pagès, 1989: 74, fig. 3c.

*Campanularia fastigiata* Alder, 1860: 73-74, pl. 5 fig. 1. (Polyp).

*Stegopoma fastigiatum* - Jäderholm, 1919: 13, pl. 3 fig. 5; Stechow, 1919: 72; Totton, 1930: 155, fig. 11; Billard, 1931a: 246; Leloup, 1940b: 8; Vervoort, 1942: 285; Fraser, 1944: 178-179, pl. 32 fig. 153; Vervoort, 1946b: 219, fig. 14; Fraser, 1948: 219; Picard, 1951b: 261; Buchanan, 1957: 362; Millard, 1958: 175; Picard, 1958: 191; Millard, 1967: 172; Rossi, 1958: 4; Vervoort, 1959: 234, fig. 10; Yamada, 1959: 44; Vervoort, 1966: 115; Vervoort, 1968: 99; Hirohito, 1969: 13, fig. 10; Patriti, 1970: 31, fig. 37; Jägerskiöld, 1971: 64; Vervoort, 1972: 42; Leloup, 1974: 7, fig. 5; Marinopoulos, 1981: 176.

*Calycella fastigiata* - Redier, 1971a: 506.

Material.— BALGIM Stn CP 03, 36°50,4'N-09°14.9'W, 28.v.1984, 681 m: five hydrothecae rising from stolon on old hydrocaulus, probably of *Eudendrium* spec.— Stn DW 28, 36°45.8'N-07°07.7'W, 31.v.1984, 398 m: three hydrothecae rising from stolon on unrecognizable hydroid.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: isolated hydrothecae from stolons on *Polyplumaria flabellata* and *Sertularella gayi gayi*.— Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: several hydrothecae on various hydroids; no gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: separate hydrothecae rising from stolon on *Eudendrium* spec., *Polyplumaria flabellata*, *Hydrallmania falcata* and *Sertularella gayi gayi*.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: single hydrotheca from stolon on stem

of *Polyplumaria flabellata*, together with *Halopteris catharina*.— Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: two hydrothecae from stolon on *Sertularella gayi gayi*.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: many hydrothecae from stolon on *Lafoea dumosa*, *Diphasia attenuata* var. *robusta* and *Sertularella gayi gayi*. Also isolated hydrothecae from stolon on *Bimeria vestita*.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: isolated hydrothecae from stolon on *Sertularella gayi gayi* with many other epizootic hydroids.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: hydrothecae rising from stolons on *Acryptolaria conferta minor*, *Zygophylax biarmata*, *Halecium sibogae marocanum* and *H. tenellum*, one gonotheca.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: hydrothecae from stolons on *Halecium sibogae marocanum* and *Sertularella gayi gayi*.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: many hydrothecae springing from stolon on *Lafoea dumosa*.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: single hydrotheca on fragment of *Cryptolaria pectinata*. Also separate hydrotheca on 3 mm high pedicel. With the exception of DW 132 none of the samples has gonothecae.

Description.— Colony composed of hydrothecae springing from creeping stolon by means of pedicels of varied length. Stolonal tube strongly attached to substrate, usually other hydroids; pedicels springing from stolon at irregular intervals, gradually widening into tubiform hydrotheca of characteristic shape, that is either straight or slightly curved. Walls of hydrotheca gradually widen towards apical portion; two opposite, semi-circular sections of hydrothecal wall form closing apparatus suspended between the two stiff sides, when closed forming a triangular roof. Thickened strips in semi-circular plates visible as fine lines running downwards from top of 'roof'. Closing apparatus damaged in many hydrothecae and closing plates folded irregularly. Colonies from DR 49 have well preserved hydranths with 12 (contracted) tentacles; the proboscis, in contracted condition, is rounded with tentacles arranged around it in single whorl. Hydranth attached inside hydrotheca by means of circular, membranous ring (often visible in hydrothecae from which hydranths have vanished), here taken to be demarkation between hydrotheca and pedicel (fig. 4b).

Perisarc of hydrotheca thin and hyaline; many hydrotheca are collapsed.

A single gonotheca occurs at DW 132; it has the same general shape as the hydrotheca but it is more elongated and slightly contorted basally, where it springs from the stolon as do the hydrothecae. It closes in the same fashion as do the hydrothecae. The gonophore contained in the gonotheca evidently produces medusae: there are three medusae-buds in various stages of development and one medusa has apparently just been released (fig. 4a).

Table 5. Measurements of *Modeeria rotunda* (polyp) in μm.

| | BALGIM Stn DR 49 | BALGIM Stn DW 132 | Firth of Clyde (Edwards, 1973) |
|---|---|---|---|
| Hydrotheca, length 'diaphragm'-rim | 935-975 | 1260-1365 | 900-1760 |
| maximal diameter | 215-345 | 345-390 | 250-380 |
| Pedicel, length | 215-240 | 435-605 | 200-234 |
| diameter | 65-85 | 65-75 | 80-110 |
| Gonotheca, length | | 2170 | 2070-2340 |
| diameter | | 435 | 400-430 |
| Number of tentacles | 12 | | 10-16 (14) |


Fig. 4. a, b, *Modeeria rotunda* (Quoy & Gaimard, 1827). a, gonotheca and gonophore from DW 132; b, hydrotheca with contracted hydranth from DR 49. c-e, *Stegolaria geniculata* (Allman, 1888) from CP 95. c, top part of colony; d, e, hydrothecae. a, b, d, e, × 60; c, × 20.

Distribution.— *Modeeria rotunda*, both hydroid phase and medusa, are known from boreal, temperate, subtropical and tropical parts of Atlantic, Indian and Pacific Oceans, where the hydroid inhabits moderately deep water near land, it does not occurs at bathyal or abyssal depths. The hydroid also penetrates Arctic and Antarctic regions. Its presence in the Mediterranean has previously been established by Broch (1912), Picard (1951b, 1958), Monniot (1965) and Marinopoulos (1981). The BALGIM records are from the Atlantic off Cape São Vicente (CP 03), the Atlantic off Cádiz (DW 28), the Atlantic off the Strait of Gibraltar (DR 40, DR 45, DR 49, DW 50, DR 113, DW 114), the Atlantic off Casablanca, Morocco (CP 103), from the Strait of Gibraltar proper (DR 152) and from the Alboran Sea (DW 132, DW 134, CP 135). The depths distribution is between 144 and 681 m.

Discussion.— The life history of the hydromedusa *Modeeria rotunda* (Quoy & Gaimard, 1827) and its hydroid *Stegopoma fastigiatum* (Alder, 1860) is discussed at length by Edwards (1973a), who also gives a review of the genera *Stegopoma* Levinsen, 1893 and *Stegolaria* Stechow, 1913. Especially in *Stegopoma* the distinction between the various species brought to this genus is far from clear, particularly because of the considerable and so far indistinctly defined variability in length of the hydrotheca proper, of its pedicel and of the gonothecae. A scrutiny of the available literature suggests that in the hydroid of *Modeeria rotunda*, formerly in *Stegopoma* as *S. fastigiatum*, combined length of hydrotheca and pedicel rarely exceeds 4 mm (4000 µm); the gonotheca is usually slightly larger than the hydrotheca proper but has a very short to almost absent pedicel. In the BALGIM material the combined length of hydrotheca and pedicel rarely exceeds 1.95 mm (1950 µm).

## Genus **Stegolaria** Stechow, 1913

### **Stegolaria geniculata** (Allman, 1888)
(fig. 4c-e)

*Cryptolaria geniculata* Allman, 1888: 41-42, pl. 20 figs. 1, 1a-b.
*Lafoea geniculata* - Billard, 1910: 5.
*Stegolaria geniculata* - Stechow, 1913a: 137-138; Stechow, 1913b: 29; Stechow, 1923d: 147; Vervoort, 1946c: 299-303, figs. 2-3; Ralph, 1957: 849; Edwards, 1973a: 593-594; Millard, 1977b: 106, 112, fig. 3; Millard, 1978: 198; Gravier-Bonnet, 1979: 16; Millard, 1980: 130; Vervoort, 1985: 281-282.
?*Cryptolaria operculata* Nutting, 1905: 947-948, pl. 3 fig. 4, pl. 10 figs. 12-14; Ritchie, 1910a: 9-10.
*Stegolaria operculata* - Stechow, 1913a: 137-138; Stechow, 1913b: 29; Rees & Thursfield, 1965: 88; Edwards, 1973a: 594; Gravier-Bonnet, 1979: 14-17, fig. 3B-F.
*Stegopoma operculatum* - Billard, 1941: 16-17, fig. 1.

Material.— BALGIM Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: ten colonies up to 80 mm high with thick, strongly polysiphonic axis, diameter basally 5 mm; numerous fragments. No gonothecae.— Stn DW 96, 34°23.5'N-07°40.3'W, 08.vi.1984, 1255 m: fragmentary colony 50 mm high, hydrothecae in bad condition; no gonothecae.

Description.— Flabellate colonies with thick, erect, occasionally forked axis, bearing side-branches at irregular intervals but mainly in one plane. Axis, ramifications and principal side-branches strongly polysiphonic; basal part of axis widened to form small disk composed of fibres attaching colony to fixed substrate. Distal parts

of colony and side-branches monosiphonic and slightly geniculate (fig. 4c); geniculation lost in older parts of colony because of strong development of secondary tubules. Structure of axis and branches sympodial, axis as a result slightly to distinctly geniculate, with two rows of hydrotheca in plane of ramification, alternately directed left or right. Hydrothecae tubular, gradually widening from base onwards, outwardly curved, basal half of adcauline wall adnate to axis (fig. 4d, e), curvature in some hydrothecae fairly sudden at level where hydrotheca becomes free from axis; such hydrothecae have the distal portion bent outward rather than being smoothly curved. Closing apparatus of hydrotheca as in *Modeeria rotunda*: semicircular part of ad- and abcauline hydrothecal wall thin and provided with thickened, transversal strips; semicircular portions suspended between lateral, triangular portions of hydrothecal wall; opercular structure thus forming a triangular roof over mouth of hydrotheca. Original structure of monosiphonic parts becomes rapidly obscured by development of secondary tubules that cover axis and part of hydrothecae, communicating with the primary tube by means of circular holes. Side-branches develop under axial hydrothecae that becomes axillary because of fusion of its abcauline wall with side-branch. Axial and axillary hydrothecae rapidly invested by secondary tubules, distal part only remaining free.

Perisarc firm on axis and tubules, rapidly thinning out along hydrothecal wall, on distal portion of hydrotheca relatively thin; many hydrothecae are collapsed.

Many hydrothecae with remnants of hydranths; no complete hydranths having been observed. Hydranths attached deep inside hydrotheca by means of circular, thin lamella, sometimes visible in hydrotheca from which hydranth has almost completely disappeared as a thin 'diaphragm'.

No gonothecae have been observed; these have been described by Vervoort (1946a: 302, fig. 3).

Variability.— The mode of geniculation in the colonies is varied, being fairly distinct in the younger, monosiphonic parts, to become obscured in the older parts because of the development of many secondary tubules. The youngest hydrotheca on a branch is always a completely free hydrotheca, strongly reminiscent of that of *Modeeria rotunda*, though more distinctly curved. The next hydrotheca develops from a budding zone at the basal, adcauline side of that hydrotheca, first forming a section of axis adnate to part of the adcauline wall of that hydrotheca; at about halfway the length of the abcauline wall the growing axis begins the development of a hydrotheca, initially completely free from the preceding hydrotheca.

Table 6. Measurements of *Stegolaria geniculata* in μm*.

| | BALGIM Stn CP 95 |
|---|---|
| Axis, diameter at base | 1500-2500 |
| Hydrotheca, total depth | 1300-1670 |
| length adnate part adcauline wall | 865-1085 |
| length free part adcauline wall | 435-565 |
| diameter at 'diaphragm' | 110-150 |
| diameter at rim | 260-305 |

* all measurements are approximate!

Distribution.— *Stegolaria geniculata*, considered here to include *S. operculata* Nutting, 1905, has been recorded from deep water of all great oceans, though mainly from the tropical, subtropical and temperate zones, living in the deeper zones and penetrating bathyal depths (Vervoort, 1946a, 1985). The present records are from deep water of the Atlantic off Casablanca, Morocco (CP 95, DW 96), depth 1255-1378 m.

Discussion.— We have included *Cryptolaria operculata* Nutting 1905 [= *Stegolaria operculata* (Nutting, 1905)] in the synonymy of *Cryptolaria geniculata* Allman, 1888 [= *Stegolaria geniculata* (Allman, 1888)]. The principal point of difference between both 'species' is the geniculate appearance of the (ultimate) branches in *S. geniculata* and the absence of distinct geniculation in *S. operculata*; there are no other distinct differences though the gonothecae of the latter are still unknown. *S. geniculata* has been recorded from both Atlantic and Pacific Oceans (Allman, 1888; Vervoort, 1946a, 1985), while *S. operculata* was described from the Pacific (Nutting, 1905) and later on also recorded from the Indian Ocean (Ritchie, 1910a; Gravier-Bonnet, 1979).

## Genus **Stegopoma** Levinsen, 1893

### **Stegopoma bathyale** Vervoort, 1966
(fig. 5a-d)

*Stegopoma bathyale* Vervoort, 1966: 114-115, fig. 14; Edwards, 1973a: 593.

Material.— BALGIM Stn CP 10, 36°45.3'N-09°32'W, 29.v.1984, 1592 m: three colonies c. 40x40 mm; no gonothecae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: two fragments 5 mm high; no gonothecae.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: three large colonies up to 80x80 mm with repeatedly forked axis and some fragments; no gonothecae. — Stn CP 91, 34°22.3'N-07°25.1'W, 07.vi.1984, 948 m: three large, flabellate colonies c. 100x100 mm with repeatedly forked axis, basally c. 5 mm diameter; many gonothecae on younger branches (hydrocladia). Also several fragments.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: six colonies c. 40x80 mm and some fragments; no gonothecae.— Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: single large flabellate colony 80x100 mm; axis basally repeatedly forked, 3 mm diameter; also many fragments. Many gonothecae on young branches (hydrocladia).

Description.— Big, flabellate colonies with strongly polysiphonic, thick, usually forked axis, giving off side-branches at irregular intervals but in same plane; distal parts of colony monosiphonic. Colony of sympodial structure; in monosiphonic parts axis composed of series of nodes, each topped by a pediculate hydrotheca, next node springing from budding zone at base of hydrothecal pedicel, axis consequently weakly geniculate or slightly undulated (fig. 5a). Monosiphony only to be observed at extreme end of branches as primary axis becomes rapidly covered by secondary tubules; on terminal part of branches there are two of such secondary tubes, one frontal, one dorsal, but in more basal parts there is a series of secondary tubules on all sides, also bearing hydrothecae and complicating the originally biserial structure of the axis.

Hydrothecae almost as in *Modeeria rotunda* but a trifle more bulky, slightly curved outwards, with adcauline wall convex and abcauline wall straight to slightly convex (fig. 5b, c). All hydrothecae free from axis and secondary tubules, placed on short wrinkled or indistinctly ringed pedicel. Closing apparatus of hydrothecae as in *Modeeria rotunda*; semicircular, pleated parts of hydrothecal wall found on ad- and abcauline sides (fig. 5c).

Side-branches develop directly under axial hydrothecae and become rapidly covered by secondary tubules, axillary hydrotheca remaining free; branch rebranching repeatedly.

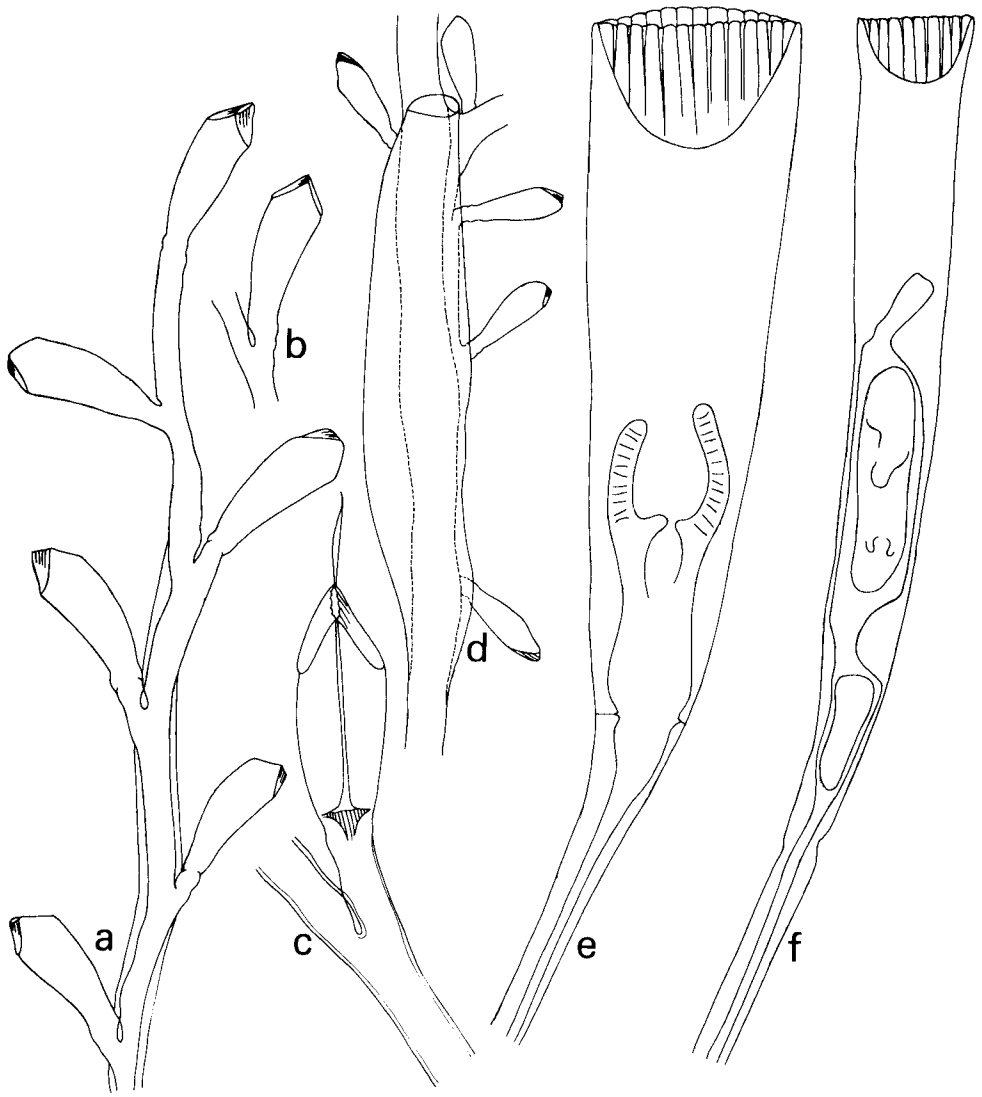


Fig. 5. a-d, *Stegopoma bathyale* Vervoort, 1966 from CP 91. a, distal portion of colony; b, hydrotheca; c, hydrotheca with remnant of hydranth; d, gonotheca. e, f, *Stegopoma giganteum* sp. nov. from DW 11. e, hydrotheca with contracted hydranth; f, gonotheca. a, b, × 36; c, × 68; d-f, × 23.

Perisarc fairly thick on axis and in nodes, but fairly abruptly thinning out on pedicel; walls of hydrothecae thin and as a consequence frequently collapsed.

None of colonies with well preserved hydranths, but remnants of hydranth attached inside hydrotheca by means of circular, hyaline collar, disappearing upon disintegration of hydranth. Place of attachment of collar taken to be demarkation between hydrotheca and its pedicel (fig. 5c)

Some colonies have gonothecae of which sex could not be ascertained, found

along stem and principal branches. Gonothecae elongated tube-shaped, apparently produced by one of secondary tubules, completely adnate with branch or axis and covered by net of anastomosing tubules. It opens apically by means of circular hole. They were seen to contain one to three developing gonophores, apparently not forming free medusae (this could not be put beyond proof!); contents obscured by net of secondary tubules overlying gonotheca (fig. 5d).

Table 7. Measurements of *Stegopoma bathyale* in μm.

| | BALGIM Stn CP 91 | Bay of Bengal (Vervoort, 1966) |
|---|---|---|
| Hydrotheca, total length | 465-520 | 375-450 |
| maximal diameter | 155-170 | 110-150 |
| Pedicel, length | 135-170 | 65-200 |
| diameter | 75-90 | 80-100 |
| Gonotheca, approximate length | 3055-3470 | |
| maximal diameter | 540-605 | |

Distribution.— Originally described from deep water (1180 m) of the Bay of Bengal (Vervoort, 1966) and now discovered at a number of deep water Atlantic localities: off Cape São Vicente (CP 10), off Cádiz (CP 26), and off Casablanca, Morocco (CP 90, CP 91, CP 92, CP 95). The depths records are between 394 and 1592 m; at the shallowest record (CP 26, 394-390 m) the species is represented by two mutilated fragments only; from all other localities there are fair colonies, some with gonothecae.

Discussion.— In the structure of its colony this species resembles its congener *Stegopoma plicatile* (M. Sars, 1853), though in the latter the colonies are more rugged. It is at once distinguished by the total absence of coalesced hydrothecae, all hydrothecae being pediculate. The gonotheca in *S. plicatile*, though also an elongated, almost tubiform affair, is always free from the axis; it has coalesced with axis or branch in *S. bathyale* and is covered by anastomosing secondary tubules. The occurrence of *S. bathyale* in deep Atlantic waters is unexpected but it may have been confused with *S. plicatile*.

## **Stegopoma giganteum** spec. nov.
(fig. 5e, f)

Material.— BALGIM Stn DW 11, 36°44.2'N-09°31.4'W, 29.v.1984, 1523 m (type locality): ten hydrothecae 4.0-4.2 mm high on 20-26 mm high pedicels from stolon creeping on worm-tube; five much shorter gonothecae present. Eight hydrothecae and four gonothecae on the worm-tube form the (alcohol preserved) holotype; two hydrotheca and a gonotheca (in a stained slide) form the paratype.

Description.— Colony attached to worm-tube externally reinforced with long sponge spicules; stolon fine, tubiform, winding between sponge spicules and firmly attached to exterior of worm-tube, producing pediculate hydrothecae and shortly stalked gonothecae at irregular intervals; anastomoses of stolonal tube have not been observed.

Hydrothecae large, strongly resembling those of *Modeeria rotunda* but fully four times as large, placed on long, fairly stiff and erect pedicels of uniform diameter, gradually widening towards hydrothecal base and smoothly merging with wall of hydrotheca. Walls of hydrotheca smooth or slightly undulated, hydrotheca almost symmetrical, imperceptibly widening towards rim or being cylindrical over larger part of its length. Tip of hydrotheca provided with closing mechanism entirely comparable to that of *Modeeria rotunda*: two opposite, semicircular sections of hydrothecal wall thin, with reinforced longitudinal strips that give those portions a pleated structure; strips suspended between two triangular parts of hydrothecal wall, number of strips per semicircular section c. 12. Structure of opercular apparatus best observed in intact colony; in stained slides apical portion of hydrotheca collapses because of pressure of cover glass. In such preparations some of hydrothecae show signs of renovation by development of secondary hydrotheca inside damaged theca. One of hydrotheca with complete, large polyp attached by means of hyaline membranous ring inside hydrotheca; this place of attachment is taken to be demarkation between hydrotheca and its pedicel. Hydranth with c. 12 strongly contracted, thick tentacles around a flat proboscis of which the 'lips', surrounding the oral aperture, stain strongly and stand out clearly (fig. 5e).

Perisarc of pedicel strong and fairly thick, hyaline, gradually thinning out along hydrothecal walls. Some pedicels have transversal ring-shaped cicatrise probably indicating renovation of a broken pedicel.

Gonothecae, including short pedicel, c. 7 mm long, slenderer than hydrothecae though with same general shape and closing apparatus; number of strips per segment nine or ten. Gonophore inside gonotheca evidently produces free medusae; in the stained specimen there is one almost 'ripe' bud vaguely showing peduncle and tentacles (fig. 5f). In addition there is one much younger developing medusa while the top part of the gonophore shows signs of having previously released a medusa.

Table 8. Measurements of *Stegopoma giganteum* in µm.

| | BALGIM Stn DW 11 |
|---|---|
| Hydrotheca, length 'diaphragm'-rim | 4000-4200 |
| Pedicel, length | 15000-26000 |
| diameter | 185-200 |
| Gonotheca, length including pedicel | 7000-7500 |
| maximal diameter | 520-650 |

Distribution.— The type locality (and only records of the species) is in the Atlantic off Cape São Vicente (DW 11), depth 1523 m.

Discussion.— In spite of the difficulties encountered with the definition of species in the genus *Stegopoma* Levinsen, 1893, that are largely caused by the considerable variability in length of hydrotheca and its pedicel, we believe the above described material to represent a new species. The size of the hydrotheca is fully four times as large as the largest '*Stegopoma fastigiatum*' (= *Modeeria rotunda*) so far recorded while the pedicel is more than ten times the so far recorded length. There are additional differences in length and structure of the gonotheca and its gonophore. It approaches *Stegopoma gilberti* Nutting, 1905, in certain respects and the main reasons for separating the two species are listed below.

1. There are no exact measurements known for *Stegopoma gilberti*: no size details are given in Nutting's account, the species has never since been (reliably) recorded nor has the holotype been redescribed. Nutting's plate 3 gives some information con-

cerning the size, considering the remark in the explanation of the plate that all magnification are fivefold also to apply to fig. 1 of the plate, representing (a portion of) the colony. The hydrothecae must have had a length of 2.0-2.4 mm, the pedicels a length of 4-5 mm and the gonothecae an overall length of 2.4-3.0 mm. The hydrotheca of *S. giganteum* would than be about twice as large, the pedicel c. four times as long and the gonotheca two or three times longer.

2. *Stegopoma gilberti* is described as a colony 6 inches (= 15 cm) or more high, with fascicled stem and branches, the branches being irregularly alternate and "themselves often giving off irregularly disposed branchlets". Inspection of pl. 3 fig. 1 reveals that the likelihood of a stolonal colony growing on another hydroid can not altogether be neglected; this, however, should be checked in the holotype.

3. The gonothecae, judged from pl. 3 fig. 1 are decidedly swollen in comparison to the hydrothecae; all gonothecae in *Stegopoma giganteum* are long and slender.

4. There is a considerable gap in the distributional records: *S. gilberti* so far is exclusively known from the Hawaiian region (between the islands Maui and Molokai), depth 122 fathoms (= 223 m); *S. giganteum* has been found in the Atlantic at a considerable depth (c. 1500 m).

We do not concur with Edward's remark (1973a: 591) that Nutting's drawing of the gonotheca suggests that *S. gilberti* does not produces medusae. Though the best proof of the phenomenon of medusa liberation is observation *in vivo*, there is little in Nutting's drawing that contradicts such a phenomenon: there are three developing medusa-buds that have not been drawn in such detail that they can unambiguously be recognized as developing medusae but the production of free medusae by the type of gonophore figured by Nutting does appear quite likely.

Stechow (1913b: 122) records *Stegopoma gilberti* from Sagami Bay, Japan, but perusal of his description distinctly shows that he was dealing with *Modeeria rotunda*, as has already been surmised by Yamada (1959: 44).

## Family **Mitrocomidea** Torrey, 1909
## Genus **Mitrocomella** Haeckel, 1879

### **Mitrocomella polydiademata** (Romanes, 1876)
(fig. 6a-i)

*Tiaropsis polydiademata* Romanes, 1876: 274. (Medusa).
*Mitrocomella polydiademata* - Russell, 1953: 257-261, figs. 147-149; Edwards, 1973b: 601-606, figs. 1-2.
*Cosmetira polydiademata* - Leloup, 1952: 213, fig. 128.
*Cuspidella polydiademata* - Naumov, 1960: 302-303, fig. 194.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: several hydrothecae on small stone, no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: c. 20 hydrothecae rising from stolon creeping on Bryozoa; three gonothecae.— Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: numerous hydrothecae on stem and hydrocladia of *Diphasia attenuata* var. *robusta*. No gonothecae.

Description (of the DW 114 material).— Colony formed by hydro- and some gonothecae rising from anastomosing, tubiform stolonal fibres on a cylindrical Bryozoon. Stolonal tubes with conspicuous perisarc, bearing cylindrical hydrothecae,

that either are erect and directly free from substratum or curved in proximal portion and adnate to substrate for a small part of their length (fig. 6a, c-e). Walls of hydrothecae generally smooth, occasionally with a few indistinct undulations, particularly in basal part, where a minor constriction just above insertion on stolon may be present. Hydrothecae have almost same diameter throughout their length, running almost imperceptibly into part of hydrothecal wall forming operculum. Operculum in closed condition roof-shaped, apical part of hydrotheca pleated because of presence of strengthened strips or triangles held together by not strengthened hydrothecal wall, folding fairly roughly to form the triangular roof (fig 6 f, g). When seen from above hydrothecal rim is seen to be almost imperceptibly everted (fig. 6c); some hydrothecae also shows signs of renovation or growth (fig.6a). This phenomenon can be observed when hydrotheca is seen from above and opercular apparatus is opened: a second operculum may be observed below first; it may also occasionally be seen by the presence of fine vertical lines on the hydrothecal exterior suggesting that the existing opercular apparatus has been pushed aside by developing hydrothecal wall. Perisarc of hydrothecae thin and hyaline.

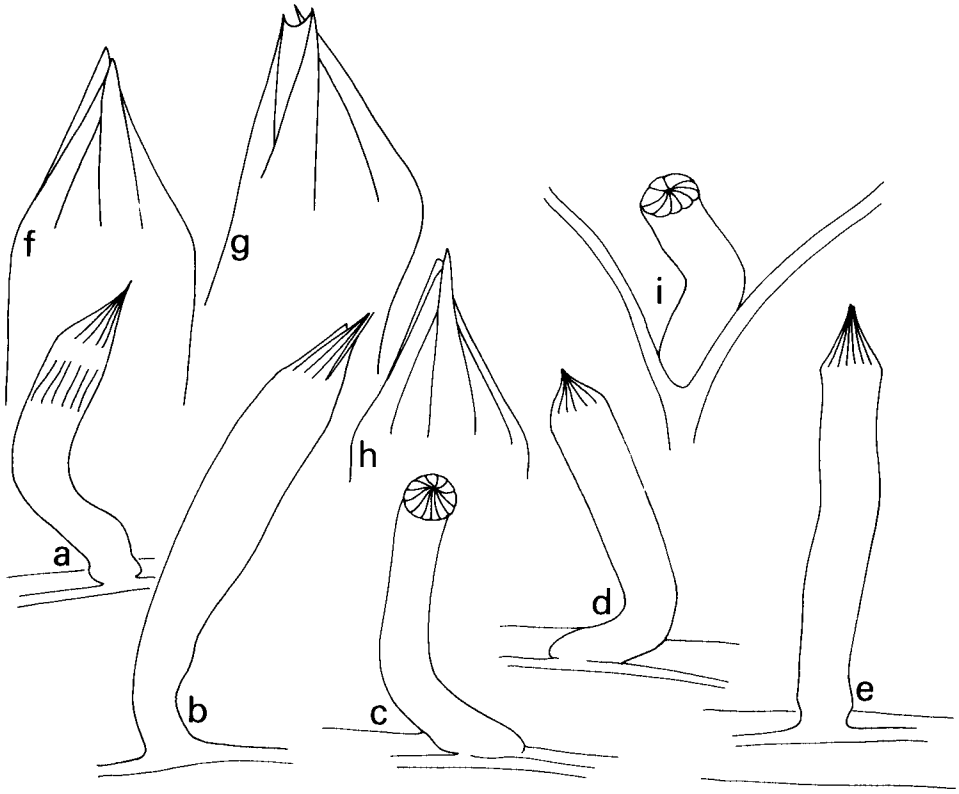


Fig. 6. *Mitrocomella polydiademata* (Romanes, 1876); a-h, from DW 114; i, from DR 115. a, hydrotheca showing signs of renovation; b, supposed gonotheca; c-e, various hydrothecae; f-h, closing apparatus of three different hydrothecae; i, hydrotheca in angle of hydrotheca and stem of *Diphasia attenuata* var. *robusta*. a-e, i, × 80; f-h, × 190.

Amongst the c. 20 hydrothecae there are three that are larger and rather more ellipsoid than tubular; the basal portion is distinctly narrowed (fig. 6b). Closing apparatus as in remaining hydrothecae; perisarc thin and transparent. They probably represent (empty) gonothecae.

The material from DR 115 occurs on a stem fragment of *Diphasia attenuata* var. *robusta* bearing four hydrocladia; the stolon can distinctly be followed on both stem and hydrocladia and produces hydrothecae at protected spots, for instance in the axil between free adcauline hydrothecal wall and hydrocladium or axis. The specimen is fairly strongly abraded and only some hydrothecae are undamaged. It differs from the DW 114 material by the fact that the basal part of the majority of hydrothecae is adnate to the substratum, consequently nearly all hydrothecae curve upwards or outwards distally; some of the broken hydrothecae greatly resembling *Filellum serpens* (Hassall, 1848). One of the hydrothecae, because of its favourable position could be seen from above; the opercular apparatus is seen to be separated from the rest of the hydrotheca by a weak, undulating line, the opercular plates fit together to form an imperfectly closed triangular roof the apical part of which appears to be slightly twisted (fig. 6i). Some of the broken hydrothecae have a larger diameter than the others and may have been gonothecae.

Table 9. Measurements of *Mitrocomella polydiademata* (polyp) in µm.

| | BALGIM Stn DW 114 |
|---|---|
| Diameter of stolon | 30-50 |
| Hydrotheca, length | 590-665 |
| diameter at base | 65-75 |
| diameter at rim | 80-90 |
| Gonotheca, length | 815-890 |
| maximum diameter | 110-125 |

Distribution.— The hydromedusa *Mitrocomella polydiademata* is characterized by Russell (1953: 258) as a "somewhat northerly species". It has been recorded from the northern part of the North Sea, from Skagerak and Kattegat, Kara Sea and Barents Sea, but has also been found off the Belgium coast. Its hydroid phase has been reared by Edwards (1973b) from medusae collected in the Firth of Clyde.

The present specimens are from the Atlantic off the Strait of Gibraltar, viz. off Cape Spartel, Morocco (DR 113, DW 114 and DR 115), depth 144-332 m.

Discussion.— We find our specimens to agree best with Edward's (1973b) description of the hydroids stage of *Mitrocomella polydiademata*, though Edwards' specimens were reared in the laboratory and produced no gonophores. The colonies described by Edwards were reared on a glass substrate which may explain the generally erect nature of the hydrothecae. There is also a slight difference in the mode of development between two of the BALGIM specimens, which may also be explained by differences in substrate: the Bryozoon at DW 114 affording minimal protection for the hydrothecae; those on the hydroid at DR 115 using the protection of the axil between hydrotheca and hydrocladium or axis. We have to stress again that this polyp belongs to the group of *Cuspidella*-like hydroids of which the life history has only been partly worked out and that are notoriously difficult to identify from preserved material. Our identification, therefore, should be taken with some reserve. For the synonymy of *Mitrocomella polydiademata* we refer to Russell (1953).

## Family **Lafoeidae** A. Agassiz, 1865
## Genus **Acryptolaria** Norman, 1875

### **Acryptolaria conferta conferta** (Allman, 1877)
(fig. 7a, b)

*Cryptolaria conferta* Allman, 1877: 17-19, pl. 12 figs. 6-10; Stechow, 1913b: 30.
*Grammaria conferta* - Broch, 1918: 17-18.
*Oswaldaria conferta* - Leloup, 1940b: 15; Picard, 1958: 193; Marinopoulos, 1981: 176.
*Acryptolaria conferta* - Totton, 1930: 164, fig. 19a-b; Fraser, 1944: 210-211, pl. 40 fig. 189; Kramp, 1947: 8; Fraser, 1948: 228; Millard, 1964: 7, fig. 1A-C, E; Rees & White, 1966: 273; Vervoort, 1968: 99; Patriti, 1970: 30, fig. 33; Vervoort, 1972: 41, fig. 12a; Millard, 1975: 169-171, fig. 56; Millard, 1977b: 106; Millard, 1978: 188; 1980: 131; Templado et al., 1986: 98; Calder, 1991: 33-35, figs. 19, 20.
*Acryptolaria conferta conferta* - Vervoort, 1985: 282-283.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: two colonies 15 and 30 mm high, smaller on coral fragment; no coppiniae.— Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: two colonies 40 and 65 mm high, larger with spread of 45 mm and some coppiniae. With *Lafoea dumosa*.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: two colonies 60 and 80 mm high attached to small stones; no coppiniae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: ten colonies and large fragments up to 35 mm high, partly attached to coral fragments; one coppinia on branch.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: single 15 mm high colony; no coppiniae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: single forked fragment 8 mm high; no coppiniae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: single 40 mm high colony and three fragments 5-10 mm high; no coppiniae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: five unbranched, erect colonies 8-15 mm high, attached to shell fragments; no coppiniae. In addition three larger colonies 30 mm high without coppiniae, one of which attached to coral fragment.

Description.— Flabellate colonies of irregular shape, but usually composed of erect, polysiphonic, forked axis bearing side-branches and hydrocladia roughly in one plane and with occasional anastomoses between ultimate branches or hydrocladia. Polysiphony of axis brought about by multitude of longitudinally arranged secondary tubules that anastomose with each other and with primary axis and also cover side-branches and majority of hydrocladia of which only apical parts still possess original, monosiphonic structure. As a result colony stiff, with branches and hydrocladia erect when taken out of fluid. Ultimate branches show original sympodial structure with axis either straight or weakly geniculate between two rows of laterally disposed hydrothecae. Hydrothecae biseriate, alternately directed left or right and in plane of ramification; side-branches, resulting from further development of hydrocladia, slightly above and laterally of (axial) hydrotheca, that is slightly displaced (fig. 7a). Hydrothecae smoothly tubular, basally slightly narrowing, with abcauline wall forming a perfect quarter circle. Free part of adcauline wall usually shorter than fused portion but lengthened by repeated renovations of hydrothecal rim (fig. 7b); such renovations may lengthen hydrotheca in its original circular shape or turn into some other direction; at times renovations of considerable length. Hydrothecal rim circular, almost imperceptibly everted, perpendicular to general length axis of hydrotheca, which in primary hydrotheca means also parallel to axis.

Perisarc of axis and hydrocladia firm, particularly on fused portion of adcauline hydrothecal wall, which has basal thickening, but periderm thins out along hydrothecal walls and is quite thin at hydrothecal rim. Collapsed hydrothecae are frequent.

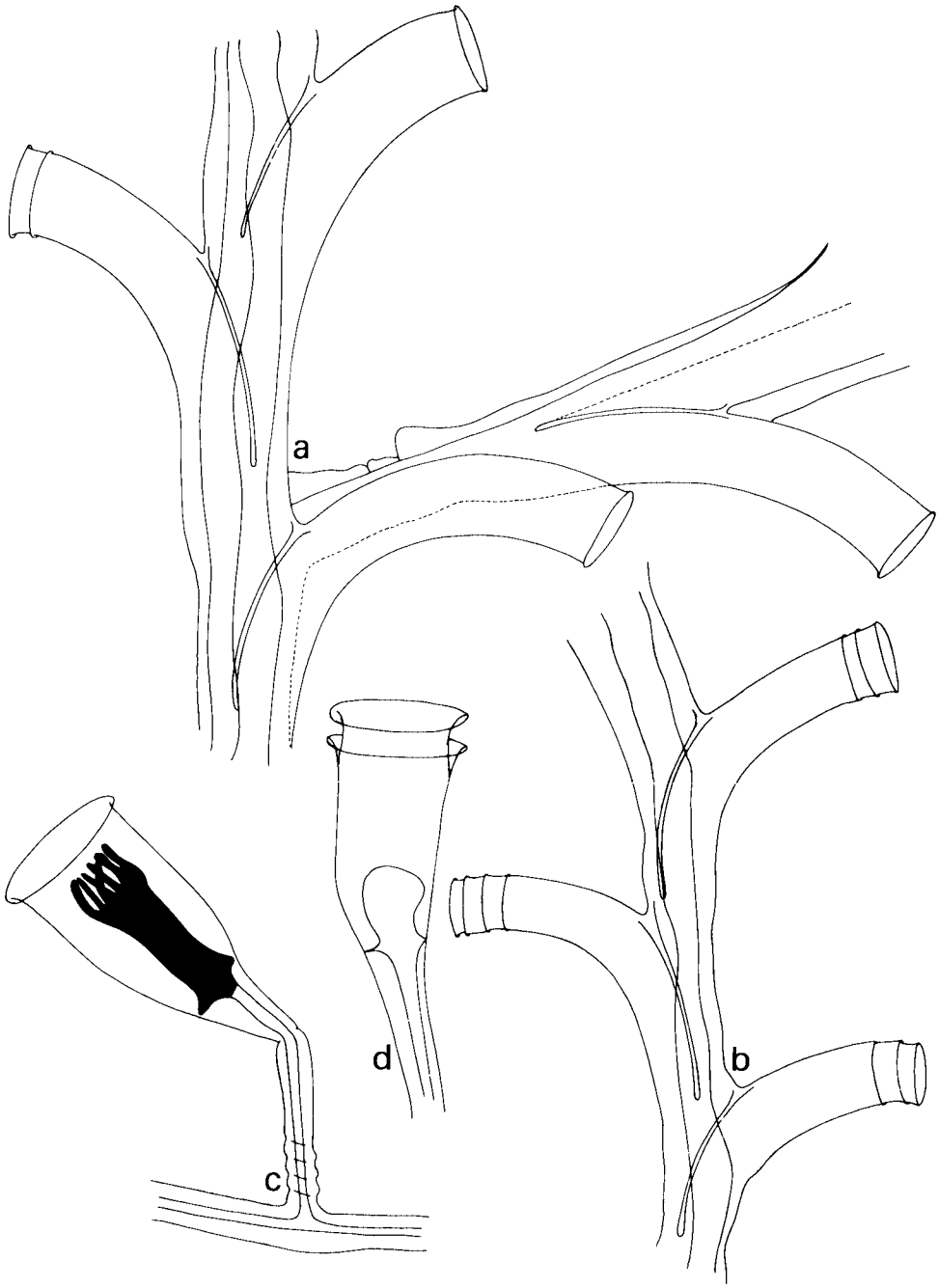


Fig. 7. a, b, *Acryptolaria conferta conferta* (Allman, 1877), from DW 132. a, part of stem with side-brach; b, part of side-branch. c, d, *Bedotella armata* (Pictet & Bedot, 1900), from DR 153. c, stolonal hydrotheca with partly contracted hydranth; d, renovated hydrotheca with fully contracted hydranth. a, c, d, × 56; b, × 47.

Some of colonies with well preserved hydranths attached deep inside hydrotheca by means of scarcely visible circular ligamentum.

Gonothecae aggregated to form ovoid coppiniae on stem or branches, composed of closely packed, adnate, amphora-shaped gonothecae. Structure of coppinia in frontal section shows hexagonal shape of compressed body of gonotheca. There are no protective structures or elongated tubules between the gonothecae but occasionally the aperture of a (normal) hydrotheca is visible between the mass of gonothecae. Female gonothecae with acrocyst.

Table 10. Measurements of *Acryptolaria conferta conferta* in μm.

| | BALGIM Stn DW 132 | South-Western Atlantic (Vervoort, 1972) |
|---|---|---|
| Axial and hydrocladial hydrothecae, total depth* | 1085-1195 | |
| length adnate part adcauline wall | 695-715 | 475-540 |
| length free part adcauline wall* | 540-715 | 285-335 |
| length free part adcauline wall without renovations | 475-500 | |
| diameter at base | 150-175 | 110-120 |
| diameter at margin | 215-240 | 185-200 |

* = including renovations.

Distribution.— *Acryptolaria conferta conferta* is generally considered to be a cosmopolitan species, living in the deeper to deep water strata. The BALGIM specimens originate from the Strait of Gibraltar proper (DR 153), from the Atlantic off the Strait (DR 42), from the Atlantic off Cape Spartel (CP 62), from the Atlantic off Rabat (CP 92), and from the Alboran Sea (DW 128, DR 130, DW 132, CP 135). The depth records vary between 135 and 1250 m.

Discussion.— The bulk of the *Acryptolaria* material in the BALGIM collection is of rather uniform structure but on closer examination it can be divided into two groups, differing mainly in size. We have brought this BALGIM material to *Acryptolaria conferta* s.l. but as it falls into two distinctly separate size groups we have recorded the large form as *Acryptolaria conferta conferta* (Allman, 1877) and we have described the small form as a new subspecies, *A. conferta minor* subspec. nov. The form described above as *A. conferta conferta* agrees best with the North Atlantic material so far described as *Acryptolaria conferta conferta*.

## **Acryptolaria conferta minor** subspec. nov.
(figs. 8a-c, 9a-c)

*Acryptolaria gracilis* - Billard, 1906d: 178; Patriti, 1970: 30, fig. 34. (Not *Acryptolaria gracilis* - Totton, 1930: 162; Ralph, 1958: 314-315, fig. 3b-d = *Cryptolaria gracilis* Allman, 1888: 42, pl. 20 figs. 2, 2a).

Material.— BALGIM Stn DW 11, 36°44.2'N-09°31.4'W, 29.v.1984, 1523 m: single 20 mm high colony with long basal filaments; no coppiniae.— Stn CP 21, 36°36.5'N-07°24'W, 31.v.1984, 485 m: tangled mass of at least four colonies on shell fragments, up to 50 mm high, and some fragments; no coppiniae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: four fragments 5-8 mm high; no coppiniae.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: single 8 mm high stem attached to shell fragment

also supporting colony of *Sertularella gayi gayi*; no coppiniae.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: four separate, forked colonies up to 25 mm high; also small erect stems 10 mm high on worm-tube and old hydroid stem; no coppiniae. Fragment from larger colony 8 mm high; no coppiniae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: single small, monosiphonic colony from unrecognizable hydroid, 6 mm high; no coppiniae.— Stn DW 53, 35°41'N-06°30.5'W, 03.vi.1984, 364 m: large colony 40x30 mm, basally with fibres anchoring colony in sediment and some fragments; coppinia on branch.— Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: single branched colony 40x25 mm, four colonies up to 35 m high and some fragments; no coppiniae.— Stn CP 89, 34°20.3'N-07°18.4'W, 07.vi.1984, 722 m: three colonies 50-80 mm high, largest (80x80 mm) a mass of several colonies with contiguous branches and many coppiniae.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: several colonies up to 70 mm high, tangled and with coalesced branches; some coppiniae present on stems and branches. Also many fragments.— Stn CP 91, 34°22.3'N-07°25.1'W, 07.vi.1984, 948 m: two small stems c. 8 mm high on empty worm-tube also supporting *Plumularia filicula;* in addition tangled mass of c. 50 mm high colonies with some fused branches on rock fragment; no coppiniae.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: seven stems 30-40 mm high springing from or growing on old hydroid stem and on stones; no coppiniae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: two colonies 10x20 and 25x30 mm; no coppiniae. Smaller colony with *Campanularia hincksii*.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: single branched colony 20 mm high; no coppiniae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: numerous colonies up to 35 mm high on coral fragments, one coppiniae . With *Campanularia hincksii*.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: six colonies partly on worm-tube c. 15 mm high, spread 10 mm; no coppiniae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: five colonies up to 30 mm high, with *Modeeria rotunda;* no coppiniae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: numerous tangled colonies 10-40 mm high, some on stem *Polyplumaria flabellata*, some with fused branches and a coppinia; also some fragments. Some colonies with basal tuft of fibres.— Stn CP 137, 35°33.2'N-04°23'W, 15.vi.1984, 1005 m: two branched colonies 15 and 30 mm high on worm-tube; no coppiniae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: numerous colonies 10-15 mm high on coral fragments; no coppiniae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m (type locality): 25 regularly pinnate colonies up to 20 mm high, spread 15 mm, partly on coral fragments; no coppiniae. One of colonies is holotype of subspecies; remaining colonies are paratypes.

Description.— Flabellate colonies maximally several cm high with erect, polysiphonic, usually forked axis bearing side-branches (hydrocladia) at irregular intervals and occasionally with anastomoses between ultimate ramifications. Axis and principal branches polysiphonic by development of secondary tubules; diameter of axis at base 1-2 mm, often with flattened disc attaching colony to firm substratum or with fibres attaching colony to small stones in sediment. Development of secondary tubules on the ultimate branches (hydrocladia) variable, as a result ultimate branches occasionally slender and weak; branches of such colonies limp when colony is taken from fluid (in contradistinction to condition found in *A. conferta conferta* where these branches are always supported by secondary tubules and remain stiff when colony is taken from fluid). Though built of colony is sympodial, monosiphonic hydrocladia are straight; hydrothecae biseriate in plane of ramification of colony, well spaced: bottom of succeeding hydrotheca at level of axil between free part adcauline hydrothecal wall and axis. Hydrocladia (and after development of secondary tubules also side-branches) develop immediately above and laterally of (cauline) hydrotheca of which free part adcauline wall is attached to base of hydrocladium (figs. 8a, 9a). This hydrotheca may be slightly pushed frontally or backwards. Hydrotheca tubular, smoothly curved outwards; basal part of abcauline wall usually with slight bulge opposite end of adcauline wall, then for some distance parallel with internode and then fairly suddenly curving outwards (fig. 8a, b) or, in older colonies, with smooth-

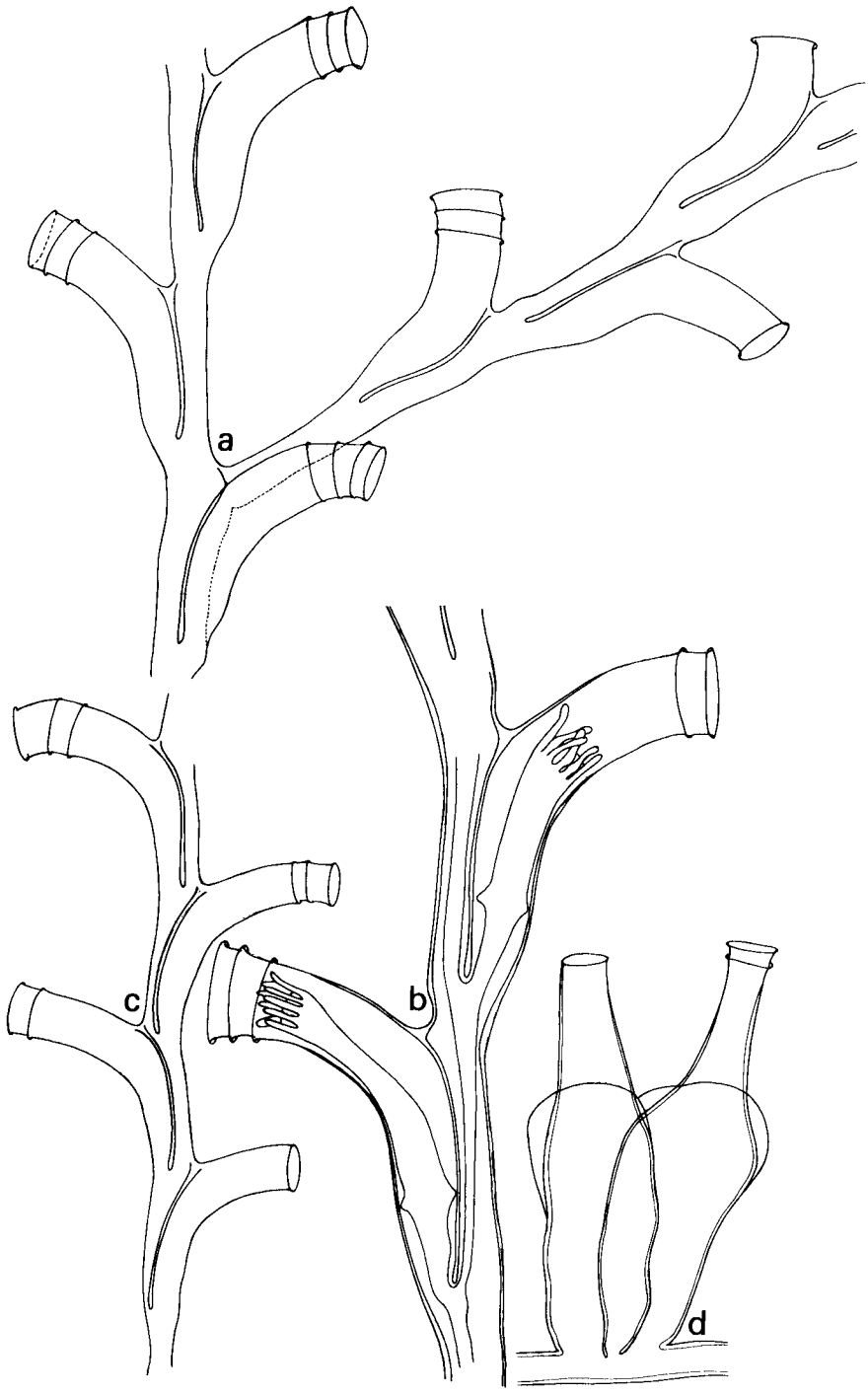


Fig. 8. *Acryptolaria conferta minor* subspec. nov. a, b, from DR 130; a, part of stem with side-branch; b, part of hydrocladium, hydrothecae with contracted hydranths. c, from DR 153, part of hydrocladium; d, from DW 53, two gonothecae isolated from coppinia. a, × 45; b, × 65; c, × 30; d, × 88.

ly curved abcauline hydrothecal wall (figs. 8c, 9a). Adnate part adcauline wall basally thickened; free part smoothly convex; axil between free part and axis 30-45 degrees. Length of free portion of hydrotheca varied in same colony and amongst different colonies, usually comparatively longer in young colonies. Hydrothecal rim circular, slightly but distinctly everted, renovations three to five. Many hydrothecae with large polyp attached deep inside hydrotheca by means of a circular, membranaceous sheath (fig. 8b); no desmocytes have been observed.

Perisarc firm, thinning out along hydrothecal wall; collapsed hydrothecae common.

Gonothecae aggregated to form coppiniae on axis and principal branches, entirely comparable to those of *A. conferta conferta*, being ovoid bodies surrounding stem or branch, enclosing some hydrothecae, still visible amongst gonothecae, but without protective structures or tubules projecting between gonothecae (fig. 8d). Base of coppinia formed by tissue of secondary tubules on which gonothecae are inserted; each gonotheca more or less amphora-shaped, slightly widening from base onwards towards upper third, where it is constricted to form a short neck. Gonothecae strongly aggregated and compressed, their walls adnate, in section more or less hexagonal (dependent upon position of gonotheca). Gonophore produces acrocyst that can be brought outside gonotheca through terminal funnel.

Table 11. Measurements of *Acryptolaria conferta minor* in μm.

| | BALGIM Stn DR 130 | BALGIM Stn DR 153 | Atlantic off Morocco (Talisman) |
|---|---|---|---|
| Axial and hydrocladial hydrothecae, total depth* | 705-740 | 815-850 | 685-740 |
| length free part adcauline wall* | 345-405 | 445-665 | 300-350 |
| length free part adcauline wall, without renovation | 245-275 | 370-420 | |
| length adnate part adcauline wall | 445-480 | 520-540 | 525-645 |
| diameter at base | 65-80 | 65-105 | 95-110 |
| diameter at rim | 160-170 | 185-205 | 185-205 |
| Gonotheca (from DW 53), total length | 520-530 | | |
| maximal diameter | 170-185 | | |

* = including renovations.

Distribution.— The BALGIM material has been collected in the Atlantic off Cape São Vicente (DW 11), off Cádiz (CP 21, CP 26), off the Strait of Gibraltar (DW 40, DR 42, DW 50, DW 53, DW 113, DW 114), off Cape Spartel (CP 62) and off Rabat (CP 89, CP 90, CP 91, CP 92). Further records are from the Alboran Sea (DW 128, CP 135, CP 139) and from the Strait proper (DR 152, DR 153). The depth records are from between 135 and 1523 m.

Discussion.— As pointed out under the description of the nominate subspecies the material of *Acryptolaria conferta* s.l. in the BALGIM collections falls into two groups that are different only in size. There are no structural differences but the two groups are not bridged by intermediary specimens, at least not in the present collection. *Acryptolaria conferta minor* has smaller hydrothecae, i.e. less deep and with smaller diameter basally and at the rim, that are not so widely spaced as those of the

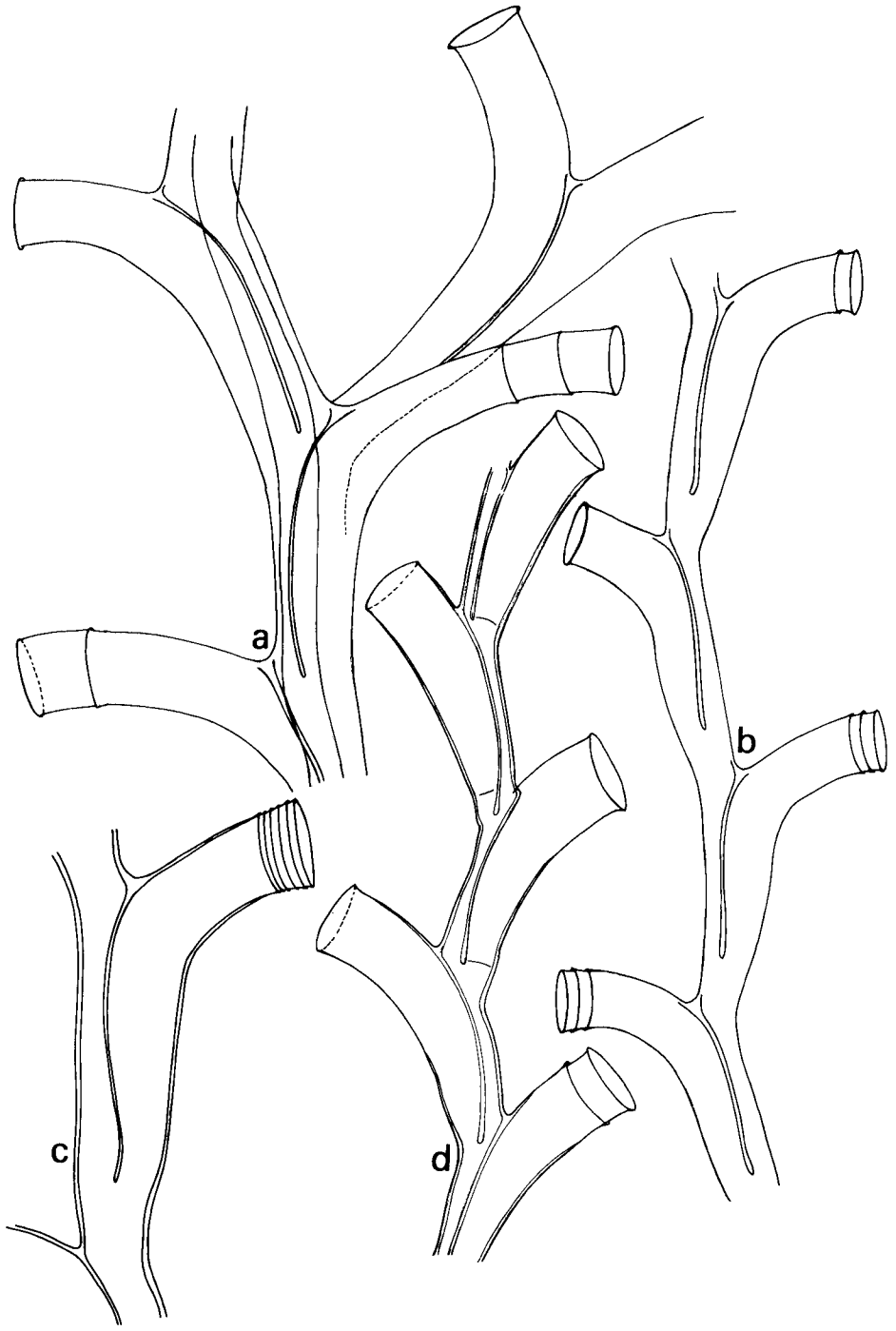


Fig. 9. a-c, *Acryptolaria conferta minor* subspec. nov. a, from DR 153, part of stem with side-branch; b, c, from Billard's slide no. 169 of "*Acryptolaria gracilis*" in MNHN, Talisman Exped. b, part of hydrocladium; c, renovated hydrotheca. d, *Acryptolaria crassicaulis* (Allman, 1888) from CP 26, top part of colony. a, c, × 60; b, × 50; d, × 26.

nominate subspecies, of which the colonies subsequently are coarser.

There are no differences in size and structure of the coppiniae or the gonothecae. The coppiniae are aggregates of amphora-shaped bodies, closely pressed together and consequently more or less hexagonal on cross section. On isolation gonothecae appear to be adnate, the narrowed 'neck' being free. Gonothecal aperture circular, with slightly everted rim, occasionally with a renovation. The gonophore produces an globular acrocyst containing the larvae and on many instances projecting out of the gonothecal aperture.

The reasons for describing part of the *Acryptolaria conferta* material as a separate subspecies have been pointed out above. Though in the present material the size differences between both subspecies are not bridged by intermediary specimens it does not appear unlikely that intermediate colonies occur in material from a wider area. Comparison of figures, descriptions and measurements of *A. conferta* s.l. over the whole of its (considerable) distributional range suggests that we are either dealing with a single polymorphic species or with a complex of closely allied species.

Young colonies occur at various stations. At DW 132 young colonies develop from stolons creeping on a calcareous worm-tube and bearing many solitary hydrothecae, that can easily be confused with the hydrothecae of *Lafoea dumosa*. The further development of the axis takes place from the stolon immediately besides the insertion of the primary hydrotheca that becomes adnate to the base of the axis and maintains its straight appearance, though curving by renovation. The primary colony has slightly more widely spaced hydrothecae of which the proximal half of the abcauline wall is more or less straight; they curve fairly sharply away from the axial internode. Distal abcauline half and free adcauline hydrothecal walls may be practically straight or only slightly curved. This type of hydrothecal development (fig. 8a) is characteristic for young colonies and can be maintained even in polysiphonic colonies. Colonies with smoothly curved hydrothecae and those (usually young) with the 'kinked' type of hydrothecae have occasionally been seen to originate from the same stolon; they have consequently been considered conspecific.

*Acryptolaria gracilis* (Allman, 1888) is a rare Pacific species, shortly and perfunctory described by Allman (1888: 42, pl. 20 figs. 2, 2a); the description has been supplemented by Ralph (1958: 314-315, fig. 3b-d) from Pacific material of uncertain origin. The Atlantic records of this species by Billard (1906d) and subsequently Patriti (1970) are quite suspicious. We have had the opportunity to study two of Billard's slides labelled "*Acryptolaria graclis*" in the slide collection of MNHN (slides L 169 and 170); both are undoubtedly identical with the subspecies described above and differ considerably from Ralph's re-description of *Acryptolaria gracilis* Allman, 1888. Billard's material originates from the Talisman Expedition [off El Jadida (= Mazaghan), Atlantic coast of Morocco, 33°N-11°19'W, depth 550 m, 14.vi.1883], the same locality is quoted by Patriti (1970). Part of Billard's material is figured here (fig. 9b, c).

### **Acryptolaria crassicaulis** (Allman, 1888)
(fig. 9d)

*Cryptolaria crassicaulis* Allman, 1888: 41, pl. 19 figs. 3, 3a; Ritchie, 1911: 833, pl. 87 fig. 4; Stechow, 1913b: 11, 113, figs. 86-87; Jäderholm, 1919: 8, pl. 2 fig. 2.

*Acryptolaria crassicaulis* - Yamada, 1959: 49; Rees & White, 1966: 273; Millard, 1967: 172, fig. 2A; Leloup, 1974: 8; Millard, 1978: 188; Gravier-Bonnet, 1979: 18-22, fig. 34B-C; Vervoort, 1985: 283-285, fig. 1.

Material.— BALGIM Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: single fragment 8 mm high; no coppiniae.

Description.— Species represented by top part of colony only being composed of seven hydrothecate nodes, basally with a single secondary tubule. Structure of fragment sympodial: next internode with its hydrotheca developing from budding zone at base of free part adcauline hydrothecal wall; axis of fragment slightly geniculate. Hydrothecae elongated 'cornucopia'-shaped, i.e. gradually widening from base onward and smoothly curved outwards; abcauline wall smoothly concave and adcauline wall (adnate and free parts) smoothly convex. Free part adcauline wall about half length of adnate part, 'axil' c. 60 degrees. Hydrothecal rim slightly though distinctly everted, rim circular, smooth, perpendicular to length axis of hydrotheca; some renovations do occur (fig. 9d). Only remnants of hydranths present, these are attached deep inside hydrotheca by means of circular sheath, visible in hydrotheca from which polyp has almost completely disappeared as membranaceous 'diaphragm'; there are no desmocytes visible.

Perisarc firm and fairly thick on nodes, thinning out along walls of hydrotheca but still quite resistant as no collapsed hydrothecae have been observed.

Table 12. Measurements of *Acryptolaria crassicaulis* in µm.

| | BALGIM Stn CP 26 | off Madagascar (Gravier-Bonnet, 1979) |
|---|---|---|
| Axial hydrotheca, total depth* | 1475-1690 | |
| length adnate part adcauline wall | 1000-1215 | 1220-1270 |
| length free part adcauline wall* | 475-650 | 1000-1050 |
| diameter at rim | 410-455 | 520-550 |
| diameter at base | 150-195 | 200 |

* = including renovations.

Distribution.— *Acryptolaria crassicaulis* has been recorded from deeper waters (100-2640 m) of the Atlantic, Pacific and Indian Oceans, penetrating into the Antarctic region (summary in Gravier-Bonnet, 1979). The present specimen is from the Atlantic off Cádiz, Spain (CP 26), depth 392 m.

Discussion.— Though the distinction between *A. crassicaulis*, originally an Indo-Pacific deep water species, and the Atlantic *Acryptolaria longitheca* (Allman, 1877) is far from clear (Vervoort, 1972: 47) we have referred the BALGIM specimen to *A. crassicaulis* because of its general agreement with descriptions and particularly measurements given in the literature. An extensive list of measurements is given by Gravier-Bonnet (1979: 21) and our specimens are fully in the ranges given there. Gravier-Bonnet's Madagascar colonies generally are slightly larger than those listed in her table 2 and also slightly larger than those of the BALGIM specimen, the latter being based, however, on some ten hydrothecae. For the synonymy we refer to Gravier-Bonnet (1979) and Vervoort (1985).

## Genus **Bedotella** Stechow, 1913

### **Bedotella armata** (Pictet & Bedot, 1900) (figs. 7c, d; 10a-c)

*Campanularia armata* Pictet & Bedot, 1900: 9-10, pl. 1 figs. 3-6; Billard, 1906d: 171; Stechow, 1913b: 27; Marinopoulos, 1981: 176; Aguirrezabalaga et al., 1984: 89, 91, fig. 4.
*Bedotella armata* - Stechow, 1913a: 137; Stechow, 1913b: 27; Leloup, 1940b: 9; Rees & White, 1966: 273; Aguirrezabalaga et al., 1986: 138-139.

Material.— BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: twisted and anastomosing bundle of stolonal fibres with three hydrothecae and some nematophores; no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: separate hydrothecae rising from anastomosing stolon on worm-tube; no nematophores; no gonothecae.— Stn DR 133, 35°25.8'N-04°17.4'W, 15.vi.1984, 195 m: four colonies 5-12 mm high; two are fragments from 'rhizocaulomic' colonies, two are from stolon on hyaline (worm?) tube. Many nematophores; no gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: several 8 mm high colonies, some fragments and isolated hydrothecae from stolon on *Aglaophenia tubulifera* and other hydroids. Some fragments with distinct nematophores. No gonothecae.

Description.— Species represented in BALGIM collection as stolonal colonies and small, erect, 'rhizocaulomic' colonies, occasionally as a combination of both. The stolonal colonies consist of solitary, creeping tubes (usually on other hydroids) or an anastomosing, irregular network of stolonal tubes (usually on worm-tubes). Rhizocaulomic colonies 5-7 mm high, composed of a number of adnate stolons, basally attached by means of creeping stolons that in some colonies may bear hydro- and nematothecae (fig. 10a, b).

Hydrotheca campanulate, middle portion with parallel walls, proximally gradually narrowing into pedicel of varied length, distally curving outwards into everted, circular hydrothecal rim (fig. 7c). Renovations of hydrotheca common (figs. 7d, 10a); as many as eight renovations may be observed, but number usually smaller. Some hydrothecae slightly asymmetric in proximal third. Hydrothecal pedicel of uniform diameter, with a few rings or undulations of perisarc near insertion on stolon. Some hydrothecae have strongly contracted hydranth, attached inside narrowed portion of hydrotheca by means of hyaline, circular lamella (fig. 7c, d); perisarc of hydrotheca shows no thickening at place of attachment.

Table 13. Measurements of *Bedotella armata* in μm.

| | BALGIM Stn DR 133 | BALGIM Stn DW 153 |
|---|---|---|
| Hydrothecal pedicel, length | 620-1000 | 1445-1555 |
| diameter | 65-80 | 60-85 |
| Hydrotheca, length from attachment of polyp onwards, including renovations | 590-665 | 465-555 |
| diameter at rim | 265-390 | 230-320 |
| Nematotheca, length pedicel | 35-40 | |
| length nematotheca | 95-105 | |
| maximal diameter | 70-75 | |
| Nematocyst, length | 45-50 | |

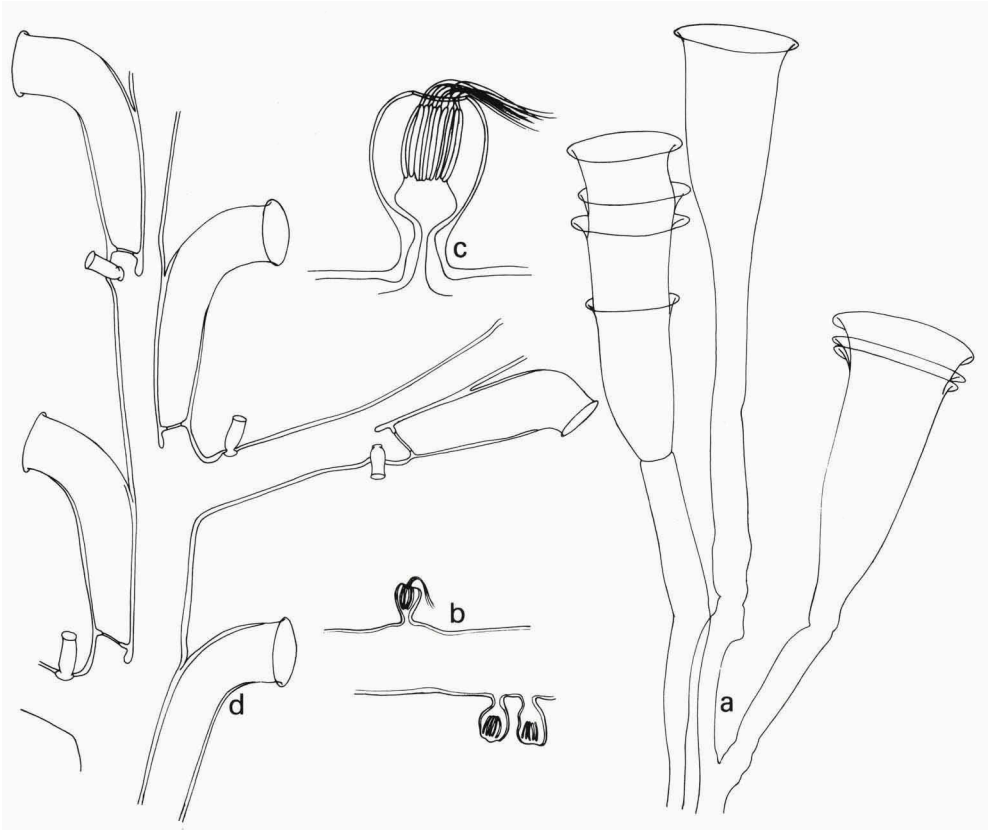


Fig. 10. a-c, *Bedotella armata* (Pictet & Bedot, 1900), from DR 133. a, part of rhizocaulomic colony with two renovated hydrothecae; b, nematothecae from stolon; c, stolonal nematotheca, strongly magnified. d, *Cryptolaria pectinata* (Allman, 1888), from DR 153, part of stem with hydrocladium. a, b, d, × 45; c, × 175.

Shortly stalked, more or less globular nematothecae occur on stolonal tubes (fig. 10b); arrangement irregular, sometimes aggregated into small groups, occasionally widely dispersed. Nematotheca proper globular to cup-shaped, slightly longer than wide, with flattened, open apical portion, containing a bundle of slightly curved, long and thin nematocysts (fig. 10c). In some nematothecae nematocysts exploded and threads visible as fibrous bundle trailing from top of nematotheca (fig. 10c). Exact nature of nematocysts could not be ascertained.

Perisarc thin and hyaline over whole colony, including hydrotheca, where it thins out gradually along hydrothecal wall; only few hydrothecae collapsed. Base of nematotheca and insertion of nematothecal pedicel with slightly thickened perisarc.

Distribution.— The chief area of distribution of *Bedotella armata* is the deeper water of the Bay of Biscay (Pictet & Bedot, 1900; Billard, 1906). The species has also been recorded from the Azores area by Leloup (1940b). There is one Mediterranean record (Marinopoulos, 1981): deep water off the French Mediterranean coast. The present records are from the Atlantic off the Strait of Gibraltar (DR 49, DW 50), the Strait of Gibraltar proper (DR 153) and the Alboran Sea (DR 133). The depth records vary

between 195 and 580 m. The depth records so far are between 134 and 880 m.

Discussion.— The gonotheca of this species still remains to be described. Fertile colonies are mentioned by Aguirrezabalaga et al., 1986: 138-139. We have recently seen a gonotheca from material collected by and to be described by Dr Chelo Alvarez Claudio, Zoological Laboratory, University of Oviedo, Spain, and originating from the Cantabrian Sea. The gonotheca has affinities with that met with in the genus *Halisiphonia* Allman, 1888.

## Genus **Cryptolarella** Stechow, 1913

### **Cryptolarella abyssicola** (Allman, 1888)

*Cryptolaria abyssicola* Allman, 1888: 40, pl. 18 figs. 2, 2a.
*Cryptolarella abyssicola* - Stechow, 1913a: 137; Stechow, 1913b: 29; Stechow, 1923d: 147; Kramp, 1951: 121, pl. 1 figs. 1-3; Vervoort, 1966: 118-120, figs. 18-20; Millard, 1975: 172-174, fig. 57E-G; Millard, 1978: 191; Millard, 1980: 131; Vervoort, 1985: 285-286.
*Cryptolaria diffusa* Allman, 1888: 42-43, pl. 21 figs. 1, 1a.
?*Cryptolaria humilis* Allman, 1888: 39-40, pl. 18 figs. 1, 1a-b; Brown, 1907: 29.

Material.— EPI I Stn CP 38, 47°33.75'N-08°42.15'W, 29.iii.1974, 2100 m: two colonies 20 and 60 mm high with forked axes and a fragment; larger colony with two (empty) gonothecae.— Stn CP 39, 47°32.00'N-08°38.4'W, 30.iii.1974, 2100 m: two colonies 20 and 40 mm high, the larger with remnants of gonothecae on stem. Also separate top part and some fragments.

Distribution.— Widely distributed in deep water of the Atlantic, Indian and Pacific Oceans (Vervoort, 1966, 1985; Millard, 1975). The present records (EPI CP 38 and CP 39) are from deep water of the north-western entrance of the Bay of Biscay, depth 2100 m.

Discussion.— *Cryptolarella abyssicola* has recently been completely redescribed by Vervoort (1966, 1985) and Millard (1975). It seems unnecessary to redescribe the EPI material; it is in complete conformity with those descriptions. On the older branches the hydrothecae are present on all sides of the axis; in the youngest parts they have a more or less distichous arrangement. Young hydrothecae of the type found on young colonies (Vervoort, 1966, fig. 19b) occur at the base of the larger colony from EPI Stn CP 38 and are also found on a separate stolon of the colony. The gonothecae are of the type previously figured by Vervoort (1966, fig. 18b) and are heavily invested by peripheral tubules; they have no contents.

## Genus **Cryptolaria** Busk, 1857

### **Cryptolaria pectinata** (Allman, 1888)
(fig. 10d)

*Perisiphonia pectinata* Allman, 1888: 45-46, pl. 21 figs. 2, 2a-b; Ritchie, 1911: 835, pl. 87 fig. 2; Kramp, 1947: 8.
*Acryptolaria pectinata* - Stechow, 1923d: 146; Leloup, 1940b: 9.
*Cryptolaria pectinata* - Ralph, 1958: 320-322, figs. 5g-j, 6g-j; Rees & Thursfield, 1965: 84, 196; Rees &

White, 1966: 273; Millard, 1975: 174-175, fig. 58A-F; Millard, 1978: 191; Millard, 1980: 131; Rees & Vervoort, 1987: 49-50; Gili, Vervoort & Pagès, 1989: 71, fig. 2.

Material.— BALGIM Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: c. 25 colonies 3-18 mm high attached to coral fragments, some detached; no coppiniae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: fifteen colonies on coral fragments and detached, 5-20 mm high, together with *Zygophylax biarmata*. No coppiniae.

Description.— Colony up to 20 mm high, with strongly polysiphonic, erect, occasionally forked axis, basally with small disk formed by stolonal fibres attaching colony to fixed substratum (small stones, shells, corals, other hydroids). Axis bearing alternate hydrothecae and subalternate hydrocladia (side-branches), both axis and hydrocladia monosiphonic in upper (youngest) parts of colony, rapidly covered by secondary tubules that obscure arrangement of hydrothecae on axis and hydrocladia. All hydrothecae biserially arranged, those of axis and hydrocladia (side-branches) in one plane. Neither axis nor hydrocladia show division into segments or internodes. Hydrocladia (side-branches) springing from axis at base of every third and fourth axial hydrotheca; irregularities do occur.

Hydrothecae born on slight apophysis, indicated by bulge of periderm, tubular, basally slightly narrowed, apical portion smoothly curving away from axis or hydrocladium. Proximal part of adcauline wall adnate to perisarc of axis or hydrocladium for slightly more than half total adcauline length; free part smoothly rounded. Abcauline hydrothecal wall broadly concave in upper third; hydrothecal rim smooth, circular and slightly everted, primarily more or less parallel to length axis of stem or hydrocladium. Renovations of hydrothecal margin occur frequently and may change direction of hydrothecal rim, that may become tilted downwards. Diaphragm at hydrothecal base thick, oblique, abcauline part higher than adcauline portion, with wide, circular opening for passage of coenosarc; end of adcauline wall slightly swollen (fig. 10d).

Nematothecae occur singly on frontal part of hydrothecal apophyses; when shed place of attachment indicated by large circular hole or thin spot in perisarc. Nematotheca deep tumbler-shaped, rounded basally, practically without pedicel or which short pedicel; rim circular, not everted. Nematotheca of axillar hydrotheca placed at base of hydrocladium (side-branch).

Table 14. Measurements of *Cryptolaria pectinata* in µm.

| | BALGIM Stn DW 153 |
|---|---|
| Axial and hydrocladial hydrothecae, total depth* | 350-385 |
| length adnate part adcauline wall | 220-230 |
| length free part adcauline wall* | 200-210 |
| length abcauline wall* | 300-310 |
| diameter at rim | 95-105 |
| Nematotheca, length | 60-75 |
| diameter at rim | 20-30 |

* = renovations excluded.

Secondary tubules run parallel to axis and hydrocladia, investing basal portion of hydrothecae, leaving free exteriorly directed, curved part of hydrothecae and usually bearing many, irregularly distributed nematothecae.

Perisarc strong and thick, thinning out along ad- and abcauline hydrothecal walls.

The gonosome, a coppinia, has not been observed.

Variability.— The number

of nematothecae on the secondary tubules varies considerably, some colonies bristling with nematothecae, others having few. The length of the free part of the hydrotheca also varies considerably, primarily by the varied degree of renovation but also because in some colonies the fused part of the adcauline hydrothecal wall is reduced in length, the axillary hydrothecae being occasionally completely free.

Distribution.— The geographical distribution of *Cryptolaria pectinata* has recently been reviewed by Gili, Vervoort and Pagès (1989), the species occurring in deep water of the Atlantic and Pacific Oceans. The present records are from the Strait of Gibraltar proper (DW 152, DW 153), depth 534-604 m.

Discussion.— The above described material is in full agreement with South African material described by Millard (1975).

## Genus **Filellum** Hincks, 1868

### **Filellum** cf. **serratum** (Clarke, 1879)

*Lafoëa serrata* Clarke, 1879: 242, pl. 4 fig. 25; Ritchie, 1911: 818.
*Reticularia serrata* - Ralph, 1958: 312, figs. 2j, 3a; Rees & Thursfield, 1965: 87.
*Filellum serratum* - Stechow, 1913a: 144; Stechow, 1913b: 30, 111, fig. 85; Jäderholm, 1919: 7; Stechow, 1923b: 11; Stechow, 1923d: 145; Leloup, 1940b: 15; Fraser, 1944: 216, pl. 44 fig. 199; Picard, 1955: 193; Picard, 1958: 193; Yamada, 1959: 51; Millard, 1967: 175, fig. 2D; Vervoort, 1968: 100; Hirohito, 1969: 14; Patriti, 1970: 29, fig. 32; Vervoort, 1972: 51, fig. 14a-b; Millard & Bouillon, 1973: 8, 57; Leloup, 1974: 8, fig. 9; Millard, 1975: 178, fig. 59A-C; García-Corrales, Arcas & De Diego, 1979: 10, fig. 3; Gravier-Bonnet, 1979: 22-24, fig. 4D; Marinopoulos, 1979: 120; Millard, 1980: 131; Izquierdo, García-Corrales & Bacallado, 1986: 84, fig. 2; Templado et al., 1986: 98; Rees & Vervoort, 1987: 39-40; Calder, 1991: 36, fig. 21.

Material.— BALGIM Stn CP 36, 36°16.6'N-07°13.7'W, 01.vi.1984, 990 m: small colony on stems of *Sertularella gayi gayi*.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: colony composed of 36 hydrothecae on stem of *Polyplumaria flabellata*, together with *Antennella secundaria, Lafoea dumosa* and *Modeeria rotunda*; also small colony on *Sertularella gayi gayi*.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: small number of hydrothecae on various hydroids, i.a. *Polyplumaria flabellata*.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: separate hydrothecae from stolon on worm-tube and *Sertularella gayi gayi*.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: separate hydrothecae from stolon on *Polyplumaria flabellata* and on worm-tube.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: some hydrothecae from stolon on fragment of *Sertularella gayi gayi* and on worm-tube.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: some hydrothecae from stolon on unidentifiable athecate hydroid on worm-tube, with many epizootic hydroids. In addition some hydrothecae on hydrocladium of *Sertularella* spec., on various other hydroids and on worm-tube with many other epizootic hydroids.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: isolated hydrothecae from stolon on *Lytocarpia myriophyllum* and old hydroid stem, with *Campanularia hincksii*.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: several colonies on *Halecium sibogae marocanum* and on calcareous worm-tube.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: two colonies on *Halecium sibogae marocanum*.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: isolated hydrothecae from stolon on stem of *Polyplumaria flabellata*, with many other epizootic hydroids.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: separate hydrothecae from stolon on worm-tube. None of the colonies has coppiniae.

Distribution.— Records of *Filellum serratum* are worldwide; the species is probably as cosmopolitan as *F. serpens* (Hassall, 1848) (see also discussion). The BALGIM

records are from the Atlantic off Cádiz (CP 36), the Atlantic off the Strait (DR 40, DR 42, DR 49, DW 50, DR 113, DW 114), from the Strait proper (DR 151, DR 153) and from the Alboran Sea (DR 130, DW 132, DW 134). The depth records are between 135 and 990 m.

Discussion.— All hydrothecae inspected have the upper surface of the adnate part more or less striated, the number of striae varying between three and c. 50. In hydrothecae with many striae these are closely approximated, resulting in de accumulation of small particles between the striae. As no coppiniae have been found we are not certain about its specific identity and have consequently recorded it as being doubtfully *Filellum serratum* (Clarke, 1879); we have also refrained from a complete description. The BALGIM material is in full agreement with Millard's (1975) description of *F. serratum* based on fertile material and shows the same (considerable) variability in size of the hydrothecae. In view of the great variability in striation of the proximal part of the hydrotheca it does not appear unlikely that in *F. serratum* the striation may occasionally be fully absent, in which case distinction from *F. serpens* (Hassall, 1848) would only be possible in the presence of the gonosome. Nor does it appear unlikely that in *F. serpens* the hydrotheca is occasionally slightly striated, resulting in the same problem. The distinction between the coppiniae of both species is not impressive: those in *F. serpens* having straight accessory tubules, while those in *F. serratum* are more or less strongly curved. The differences between both species need a closer study with a larger, fertile material.

## Genus **Lafoea** Lamouroux, 1821

### **Lafoea dumosa** (Fleming, 1820)

*Sertularia dumosa* Fleming, 1820: 83.
*Lafoea dumosa* - Cornelius, 1975b: 385-390, fig. 4; Rees & Vervoort, 1987: 40- 44, figs. 7-8.

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: single stem 5 mm high on coral fragment, together with *Halopteris catharina* and *Sertularella gayi gayi*. Also 5 mm high branched stem from stolon with isolated hydrothecae on *Sertularella gayi gayi*, together with *Synthecium evansi*. In addition stolonal colony on *Polyplumaria flabellata*, together with *Modeeria rotunda*, *Filellum* cf. *serratum* and *Antennella secundaria*. No coppiniae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: many colonies 5-20 mm high, mono- and polysiphonic on axis of *Polyplumaria flabellata* and on algae. Also isolated hydrothecae rising from stolon on shell fragment on which also 25 mm high colony of *Diphasia pinastrum*. No coppiniae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: six rhizocaulomic colonies rising from stolon on old hydroid stem; no coppiniae.— Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: some separate hydrothecae rising from stolon on *Acryptolaria conferta conferta*.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: six polysiphonic colonies up to 30 mm high, no coppiniae. On colonies *Eudendrium* spec., *Modeeria rotunda* and *Campanularia hincksii*. Also colonies on *Diphasia attenuata* var. *robusta* and stolonal colonies on *Diphasia margareta*, giving occasionally rise to c. 8 mm high, erect, rhizocaulomic stems. With *Campanularia hincksii*. No coppiniae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: stolonal colony on *Sertularella gayi gayi*, no coppiniae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: four monosiphonic colonies 8 mm high on worm-tube.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: eight colonies up to 35 mm high rising from stolon with isolated hydrothecae on calcareous debris, together with *Eudendrium* spec. and *Campanularia* or *Clytia* spec.; also some fragments and isolated hydrothecae from stolon on *Acryptolaria conferta minor*. No coppiniae.— Stn DR 133, 35°25.8'N-04°17.4'W, 15.vi.1984, 195 m:

detached colony 20 mm high with branched polysiphonic stem and some fragments. No coppiniae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: many colonies up to 10 mm high at base of other hydroids and on shell fragments; also some larger, independently growing, forked colonies up to 35 x 30 mm and some fragments. No coppiniae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: eight colonies 10-35 mm high, largest with coppinia 8 mm long, and some fragments. Also stolonal colonies on old hydroid stems, occasionally giving rise to monosiphonic, erect stems 8 mm high. Also developing on axis of *Acryptolaria conferta conferta, Diphasia pinastrum* and *Polyplumaria flabellata*. Some colonies with *Modeeria rotunda*.— Stn CP 137, 35°33.2'N-04°23'W, 15.vi.1984, 1005 m: single colony 25x13 mm with forked, polysiphonic stem; no coppiniae.— Stn DW 146, 35°56.5'N-03°08.6'W, 16.vi.1984, 555 m: fragment of larger colony; no coppiniae.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: stolonal colonies c. 30 mm high on axis of *Polyplumaria flabellata* and small, monosiphonic, erect stems c. 8 mm high. Also some rhizocaulomic colonies c. 15 mm high. No coppiniae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: forked, polysiphonic colony 23 mm high, spread 15 mm and a fragment; no coppiniae.

Distribution.— *Lafoea dumosa* in its present concept has a nearly worldwide distribution in shallow to deep waters. The BALGIM specimens originate from the Atlantic off the Strait of Gibraltar (DR 40, DR 49, DW 50, CP 62, DR 113, DW 114), from the Strait proper (DR 151, DR 153), from the Alboran Sea off Morocco (DW 128, DW 132, DR 133, DW 134, CP 135, CP 137) and from the Alboran Sea off Alboran Island (DW 146). The depth range is between 115 and 1250 m.

Discussion.— For a discussion of the synonymy, present concept and variability of this species we refer to Vervoort, 1972, Cornelius, 1975, and Rees & Vervoort, 1987. We have little to add to the considerable range of variability in this species, covering the shape of the hydrotheca, the shape and development of the hydrothecal pedicel and the development of the colony. In the BALGIM material it is quite common to observe the stolonal type of colony, with isolated hydrothecae springing from the reptant tube, giving rise to mono- or polysiphonic colonies, the latter being of the rhizocaulomic type, the axis being composed of a series of adnate tubes bearing hydrothecae. Hydrothecae may occur dispersed as well as pseudo-verticillate. Nearly all the material has well-preserved hydranths, these being attached near the bottom of hydrothecal cavity by means of a series of desmocytes, that leave hyaline puncta on the hydrothecal bottom after disappearance of the hydranth. In spite of the abundance of material coppiniae are scarce: only one was observed (CP 135), being composed of closely adnate hexagonal male and female gonothecae and a number of elongated but fairly straight tubular hydrothecae protruding between the gonothecae. The coppinia evidently is young; no gonothecal apertures have (yet) been developed.

## Genus **Zygophylax** Quelch, 1885

### **Zygophylax bathyphila** Leloup, 1940
(fig. 11a-d)

*Zygophylax bathyphila* Leloup, 1940b: 10-11, 33, pl. 1 fig. 5, 5a; Rees & Vervoort, 1987: 78.

**Material.— Northern Atlantic Ocean.** François Arago, 22.vii.1910, no. 1632-11, 47°51'55"N-41°51'50"W, from covering of cable resting at 4630 m depth, leg. Glattard, 21.iii.1911, MOM no. 11

0504: remnants of a colony (holotype) of which only four hydrothecae are recognizable. The principal label in the vial reads: "Collection de S.A.S. le Prince de Monaco. Station François ARAGO 22-7-1920. *Zygophylax bathyphyla* n. sp. sur garniture extér.re de câble à 4.630 m. Leloup dét. No. 1632-11". In addition four slides from the collections of IRSN, from the same source and numbered 12.981 and I.G. 12.981, bearing the indication "type".

Description.— The present condition of the Monaco holotype only permits the description of the (damaged) hydrothecae. Hydrotheca large, basally gradually merging into fairly long pedicel with slightly wrinkled perisarc; adcauline wall of hydrotheca distinctly convex in basal third or in middle; abcauline wall almost straight; hydrotheca consequently asymmetric. At bottom of hydrotheca there is a distinct though not particularly thick diaphragm, slightly oblique and with thickened ring at attachment to internal wall of hydrotheca. Hydrothecal rim damaged in all four hydrothecae, but presumed to be circular and lightly everted; one of hydrothecae with four renovations. Perisarc fairly strong though not particularly thick (fig. 11a-c). Interior of hydrothecae filled with debris.

The slides in IRSN also contain remnants only of colonies (hydrocladia, fragments of axis and hydrorhiza, and separate hydrothecae). Only one of the hydrothecae is in good shape and has a length (diaphragm-margin) of 660 µm, the diameter at the rim is 375 µm. The pedicel is fairly long, only slightly shorter than the hydrothecal length: 575 µm (fig. 11d). The only nematothecae in the slides are two stolonal nematothecae, figured also by Leloup (1940b, pl. 1 fig. 5a).

Table 15. Measurements of *Zygophylax bathyphila* in µm.

| | Northern Atlantic Ocean, MOM no. 11 0504 | |
|---|---|---|
| | own observations | Leloup, 1940 |
| Internode, length | | 1000-1500 |
| Hydrotheca, length adcauline wall | 600-740 | 1100* |
| length abcauline wall | 510-615 | 900* |
| diameter at base | 130-150 | 100 |
| diameter at rim | 310-345 | 350 |
| length pedicel | 280-315 | 200 |
| diameter | 110-120 | 60-100 |
| Nematotheca, length | | 60 |
| diameter | | 40 |
| Apophysis, length | | 20 |

* = presumably including renovations and/or part below diaphragm.

Distribution.— This species is exclusively known from the type locality in the northern Atlantic Ocean: 47°51'55"N-41°51'50"W, depth 4630 m.

Discussion.— The holotype material in MOM and the slides in IRSN are too scanty to allow of any definite conclusion. The exact length of the hydrothecal pedicel is not to be determined and no nematothecae have been rediscovered. The hydrothecae are much larger than either *Zygophylax brownei* or *Z. levinseni*. Comparison with the species described here as *Zygophylax elongata* spec. nov. shows that in the latter the hydrothecae have the same overall length but are much slenderer and the hydrothecal pedicel is apparently longer. So far no comparable species has

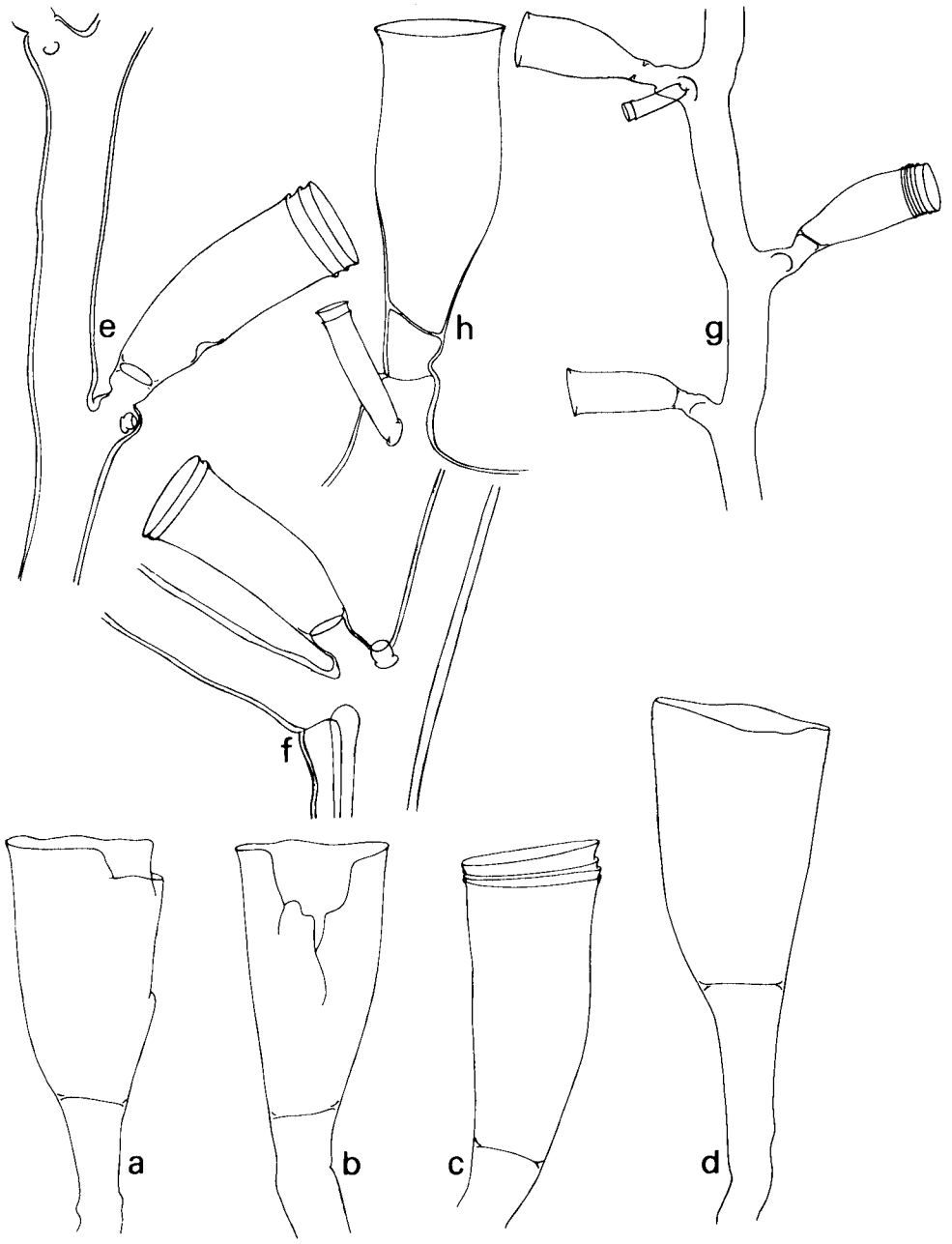


Fig. 11. a-d, *Zygophylax bathyphila* Leloup, 1940. a-c, hydrothecae from MOM no. 11 0504; d, hydrotheca from IRSN, no. 12.981. e-h, *Zygophylax biarmata* Billard, 1905. e, f, from MOM no. 11 0352; g, h, from Billard's type slide no. 215 in MNHN, Travailleur Exped., Dr. VIII. e, hydrotheca with internal, adcauline swelling; f, part of axis with base of hydrocladium; g, monosiphonic fragment of colony; h, hydro- and nematotheca. a-d, g, × 55; e, f, × 88; h, × 135.

been described; *Z. bathyphila* may possibly be recognized by the size of the (large), slightly asymmetric hydrothecae, the length of the hydrothecal pedicel and by the fact that the hydrocladia are broken up into internodes separated by straight septa, the internodal wall bearing on both sides a ring-shaped thickening. There are one to three hydrothecae per internode that are frontally directed.

## **Zygophylax biarmata** Billard, 1905
(figs. 11e-h, 12a-i, 13e, f)

*Zygophylax biarmata* Billard, 1905a: 97-98, fig. 2; Billard, 1906a: 330; Billard, 1906d: 180-181, fig. 8; Leloup, 1940b: 11, pl. 1 fig. 6; Rees & White, 1966: 274; Patriti, 1970: 28, fig. 29; Van Praët, 1979: 883, fig. 2.

?*Zygophylax biarmata* - Stechow, 1925b: 447-448; Kramp, 1938: 28; Kramp, 1947: 10; Millard, 1968: 263.

?*Zygophylax ?biarmata* - Millard, 1958: 176-177, fig. 4A; Millard, 1975: 193, fig. 63C.

Not *Zygophylax biarmata* - Stechow, 1913a: 114; Stechow, 1913b: 11, 14-15 (= *Zygophylax stechowi* Jäderholm, 1919); Broch, 1918: 24-25 [= *Zygophylax levinseni* (Saemundsson, 1911)]; Jäderholm, 1919: 8-9, pl. 2 fig. 3; Jarvis, 1922: 335 (= *Zygophylax millardae* Rees & Vervoort, 1987); Stechow, 1923b: 10; Leloup, 1938: 9-10, fig. 6; Yamada, 1959: 47; Rho & Chang, 1974: 135, 139, pl. 4 figs. 1-3; Rho, 1977: 255-256, 415-416, pl. 47 fig. 67; Hirohito, 1983: 26-27, fig. 8; Izquierdo, García-Corrales & Bacallado, 1986: 87-89, fig. 5.

*Lictorella halecioides* var. *annellata* Pictet & Bedot, 1900: 17, 53, pl. 3 fig. 6.

*Zygophylax profunda* p.p. - Totton, 1930: 165 (not *Zygophylax profunda* Quelch, 1885)

*Zygophylax profunda* p.p. - Millard, 1977a: 17-19, fig. 6 (not fig. 6A = *Zygophylax profunda* Quelch, 1885).

*Zygophylax profunda* p.p. - Rees & Vervoort, 1987: 56-62, figs. 9-10 (not fig. 10c = *Zygophylax profunda* Quelch, 1885).

*Zygophylax inconstans* Millard, 1977b: 117-119, fig. 5; Millard, 1978: 200; Millard, 1979: 140; Millard, 1980: 143, fig. 4B; Izquierdo, García-Corrales & Bacallado, 1986: 89, fig. 6; Rees & Vervoort, 1987: 61, 85.

*Zygophylax ?armata* - Gravier-Bonnet, 1979: 24-31, fig. 5 [not *Zygophylax armata* (Ritchie, 1907)]

Material.— BALGIM Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: single juvenile colony 5 mm high epizootic on *Polyplumaria flabellata*; no coppiniae.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: twenty-two fragments 5-30 mm high, one with coppiniae. Single colony composed of several axes up to 10 mm high growing on polychaete tube; no coppiniae.— Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: detached polysiphonic stem 15 mm high with a few hydrocladia and hydrothecae; no coppiniae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: single stem 33 mm high from stolon on axis of *Polyplumaria flabellata*; also separate hydrothecae on stolon creeping on *Polyplumaria flabellata* and *Diphasia pinastrum*. No coppiniae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: single fragment 7 mm high; no coppiniae. — Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: several colonies up to 15 mm high epizootic on *Sertularella gayi gayi* and on worm-tubes; no coppiniae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: six fragments 5-12 mm high; no coppiniae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: c. 20 fragments 7-20 mm high, one with single hydrotheca of *Campanularia hincksii*; no coppiniae. In addition colony 5 mm high on *Thuiaria* spec., no coppiniae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: single fragment 15 mm high; no coppiniae. — Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: monosiphonic colonies 5 mm high on axis of *Polyplumaria flabellata*; no coppiniae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: thirteen fragments 3-7 mm high; no coppiniae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: twenty colonies and fragments 3-10 mm high, some on coral fragments; no coppiniae. Four colonies up to 10 mm high on *Polyplumaria flabellata*; no coppiniae.

Additional material.— **Bay of Biscay**. Campagne Océanographique Prince Albert I de Monaco, Campagne 1866, Stn 60, 43°57'N-09°27'W, 300 m, 09.viii.1886: one carmine stained slide of four fragments labelled "*Lictorella halecioides* var. *annellata*" and numbered no. 11 005 (MOM).— **Eastern**

**Atlantic Ocean.** Campagne 1897, Stn 889, 37°57'30"N-29°15'10"W, 208 m, 10.viii.1897: fragments of strongly mutilated colony without coppiniae, mixed with *Acryptolaria* (= *Cryptolaria*) *pectinata* and *Diphasia alata* (= *D. pinastrum*) (MOM no. 11 0352). Also slide from collections of IRSN numbered I.G. 12.981, containing a colony 4 mm high.

Description.— Axis erect, polysiphonic, basally occasionally forked and with numerous side-branches (hydrocladia) pointing left and right and in same plane as axis, with a tendency towards pinnate arrangement, though with numerous irregularities. Younger (distal) parts of colony monosiphonic, slightly geniculate, without division into segments or internodes, bearing alternately arranged apophyses, separated by a variable length of axis and all in same plane with rest of colony; hydrotheca inserting on apophysis (fig. 12a). Hydrothecae occasionally slightly turned in frontal direction, tubular, slightly asymmetric as adcauline wall is distinctly convex and abcauline wall either straight or slightly concave. Hydrotheca narrowing basally towards short peduncle, separated from hydrotheca by slightly oblique diaphragm (fig. 12b). Hydrothecal rim smooth, circular, slightly everted. Renovations of hydrothecal border common and usually multiple, also occasionally including renovation of diaphragm (fig. 12c).

Nematothecae inserting on apophysis, generally one on each side of hydrotheca. However, one or both nematothecae may become detached in which case place of attachment may still be observed as slight circular depression on apophysis (fig. 12a-c). Nematotheca cylindrical, with short, spherical pedicel; rim smooth, circular, slightly everted and frequently renovated. Nematothecae of identical shape may also be found on secondary tubules.

Side-branches (hydrocladia) inserting directly below hydrotheca on axial apophyses; hydrotheca consequently becoming axillar. Structure of branches as described for main axis; occasionally with secondary branches or hydrocladia.

Only one coppinia observed on basal part of one of colonies (DR 42), surrounding axis and composed of mass of adnate globular gonothecae. Each gonotheca with short tubular neck with terminal aperture of which rim is strongly everted and with diaphragm just below everted part (fig. 12d, e). Coppinia provided with numerous nematophorous ramules pointing in all directions; nematothecae as described above (fig. 12d, e). Occasionally ramules terminating in a small hydrotheca (fig. 12f).

Variability.— Renovations of both hydrothecal and nematothecal rim occasion a considerable variability in size of hydrothecae and nematothecae in the same colony.

Part of the material from DR 153 is characterized by many fractures of pedicels and hydrothecae followed by renovation; the hydrothecal pedicels after such renovations are much longer and may give the impression of being composed of various articles. Such hydrothecae occur on colonies with otherwise normal, non-renovated hydrothecae.

Part of the material from DR 49 is composed of hydrothecae rising directly from creeping stolon also bearing nematothecae. The shape of the hydrothecae is as in colonial specimens; renovations of the margin are common. The presence of a diaphragm distinguishes such hydrothecae from those of *Lafoea dumosa* that are quite similar.

Distribution.— Considering the confusion of species characters in the genus *Zygophylax* it is at this moment difficult to give a clear picture of the distribution of

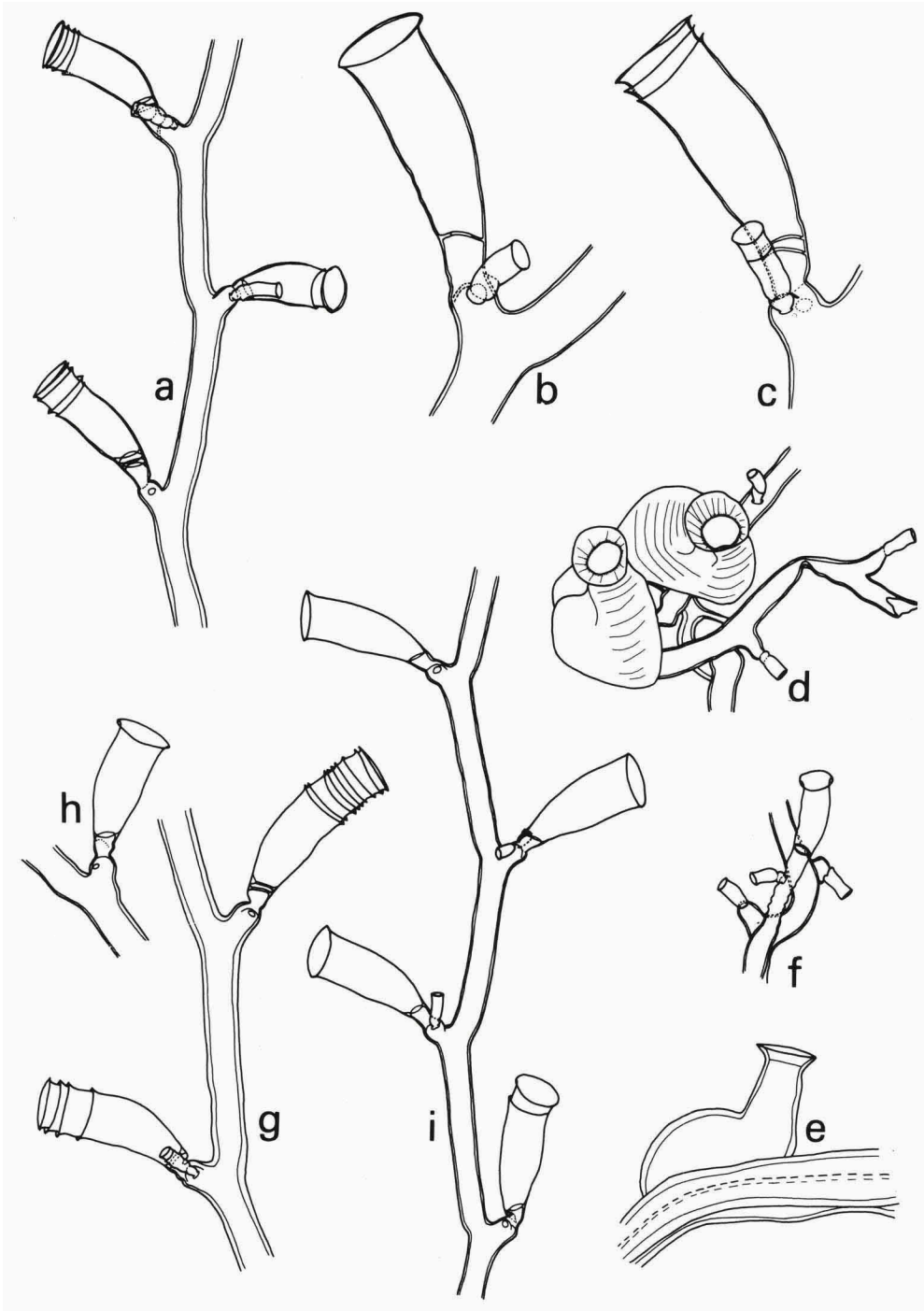


Fig. 12. a-f, *Zygophylax biarmata* Billard, 1905, from DR 42. a, monosiphonic part of stem; b, c, hydro- and nematothecae; d, two gonothecae and some nematophorous tubules isolated from coppinia; e, gonotheca, lateral view; f, part of nematophorous tubule with 3 nematothecae and a (small) hydrotheca. g, h, '*Zygophylax profunda*' (= *Zygophylax biarmata* Billard, 1905) from Camera de Lobos, Madeira. g, part of hydrocladium; h, hydrotheca. i, *Zygophylax inconstans* Millard, 1977 (= *Zygophylax biarmata* Billard, 1905) from La Réunion, part of hydrocladium. a, d-i, × 57; b, c, × 115.

Table 16A. Measurements of *Zygophylax biarmata*, *Z. profunda* and *Z. inconstans* in µm.

For the sake of comparison measurements are given of a normally developed colony (DR 42), of a colony in BMNH labelled *Zygophylax profunda*, Camera de Lobos, Madeira, coll. R. Kirkpatrick (BMNH no. 19.8.15.2) and of a colony labelled *Zygophylax inconstans* Millard, 1977, originating from La Réunion (RMNH Coel. no. 25689). Some other measurements are also given.

| | BALGIM Stn DR 42 | *Zygophylax profunda* Camera de Lobos | *Zygophylax inconstans* La Réunion |
|---|---|---|---|
| Axis, distance between two consecutive hydrothecae | 300-440 | 360-500 | 250-420 |
| diameter at 'node' | 60-80 | 75-100 | 45-60 |
| Hydrothecal pedicel, length of adcauline wall | 40-60 | 30-50 | 30-50 |
| Hydrotheca, length adcauline wall from diaphragm onwards, without renovations | 210-270 | 250-290 | 220-290 |
| length adcauline wall from diaphragm onwards, with renovations | 290-370 | 360-450 | 280-320 |
| diameter at rim | 120-140 | 130-140 | 110-120 |
| Nematotheca, length without renovations | 80-110 | 75-100 | 80-110 |
| length with renovations | 110-175 | 95-160 | 90-190 |
| diameter at rim | 35-45 | 40-45 | 35-45 |
| Coppinia, diameter of gonotheca at end of neck | 120-160 | 140-160 | |
| diameter at diaphragm | 70-110 | 100-120 | |
| diameter of nematophorous ramules | 45-70 | 40-55 | |
| length nematotheca | 80-100 | 85-130 | |
| diameter of nematotheca at rim | 30-40 | 30-40 | |

Table 16B. Measurements of *Zygophylax biarmata*, *Z. inconstans* and *Z. profunda* in µm.

| | *Zygophylax biarmata* (Billard's-type) | *Zygophylax inconstans* (Millard, 1977) | *Zygophylax profunda* (Rees & Vervoort, 1987) |
|---|---|---|---|
| Axis, distance between two consecutive hydrothecae | 355-510 | | 320-390 |
| diameter at 'node' | 65-90 | | 65-80 |
| Hydrothecal pedicel, length of adcauline wall | | 30-60 | 20-35 |
| Hydrotheca, length adcauline wall from diaphragm onwards, without renovations | 275-335 | 220-300* | 310-335 |
| length adcauline wall from diaphragm onwards, with renovations | | | 355-365 |
| diameter at rim | 120-140 | 100-120 | 105-120 |
| Nematotheca, length without renovations | | | 80-85 |
| length with renovations | 100-105 | | 105-120 |
| diameter at rim | 40-45 | | 30-40 |
| Coppinia, diameter of gonotheca at end of neck | | | 105-130 |
| diameter at diaphragm | | | 85-90 |
| diameter of nematophorous ramules | | | 55-60 |
| length nematotheca | | | 65-70 |
| diameter of nematotheca at rim | | | 30-35 |

* = mean length.

each species. *Zygophylax biarmata* is known with certainty from a locality northwest of Spain (Billard, 1905a, 1906a, d), from the Azores (Leloup, 1940b; Rees & White, 1966), from various localities off the Atlantic coast of Morocco (Billard, 1905a, 1906a, d; Patriti, 1970), from Madeira (Totton, 1930, as *Z. profunda*), from the Canary Islands (Izquierdo, García-Corrales & Bacallado, 1986, as *Z. inconstans*), from the east coast of South Africa (Millard, 1977b, 1980, as *Z. inconstans*), from the Madagascar area (Gravier-Bonnet, 1979, as *Z. ?armata*) and from the Zanzibar area (Rees & Vervoort, 1987, as *Z. profunda*). Kramp (1938) mentions *Z. biarmata* from off the coast of Iceland; this record, however, needs confirmation as Kramp considers *Z. levinseni* a synonym of *Z. biarmata*: his 1938 paper contains neither figure nor description of the Icelandic material. The species is included by Picard (1958) in a list of Mediterranean hydroids while Templado et al. (1986) record the species from the Alboran Sea.

The BALGIM material originates from six localities on the Atlantic side of the Strait of Gibraltar (CP 26, DR 42, DR 45, DR 49, DR 113, DW 114), from three localities in the Strait (DR 151, DR 152, DR 153) and from three localities in the Alboran Sea off the coast of Morocco (DW 128, DW 132, CP 135); the depths records are from 135-580 m. Additional material studied comes from Cámera de Lobos, Madeira and from La Réunion, 20°59.0'S-55°43.3'E, 180-525 m.

Discussion.— *Zygophylax biarmata* is characterized by the alternate disposition of the apophyses in one plane, as do also the hydrothecae, that may occasionally be slightly inclined towards the front of the colony, the hydrothecal pedicel is short. These characters distinguish it from *Zygophylax levinseni* (Saemundsson, 1911), with distinctly frontally directed hydrothecae that show a tendency towards unilateral disposition and with longer hydrothecal pedicels. There are also quite distinct differences in the shape and arrangement of the gonothecae (see description of *Z. levinseni*). Our material described above as *Z. biarmata* agrees with Billard's (1905a, 1906d) descriptions, though the gonosome was left undescribed by that author as his material was sterile. The coppinia found at DR 42 agrees with that described for *Zygophylax profunda* Quelch, 1885, by Totton (1930) from material originating from Cámera de Lobos, Madeira. This coppinia was later on also described by Millard (1977) and Rees & Vervoort (1987). The Madeira material has been re-studied and found to be identical with the BALGIM colonies (fig. 12g, h). This prompted us to compare the BALGIM and Cámera de Lobos material with Quelch's (1885) original description and later descriptions by Millard (1977) and Rees & Vervoort (1987). We have also compared this material with drawings made after the holotype. All this leads to the conclusion that we were dealing with two separate species, one of which (*Z. profunda* Quelch, 1885) has short and fairly strongly curved hydrothecae and comes near to *Zygophylax armata* (Ritchie, 1907); the material from Cámera de Lobos, Madeira, in reality belongs to *Zygophylax biarmata* Billard, 1905. It should be pointed out that Quelch's holotype is now in poor state and moreover it is sterile; inspection of topotypic material might lead to the synonymization of *Z. armata* with Quelch's species. Millard (1977), after the inspection of Quelch's type material, reached the conclusion that it differs from *Zygophylax inconstans* (= *Z. biarmata*, fig. 12i), but she points out that the Madeira material included by Totton (1930) in *Z. profunda* is very similar to *Z. inconstans*, differing however by the absence of nematophorous ramules (with small hydrothecae) in the latter. In 1980 Millard described such ramules for the coppinia of *Z. inconstans*, removing the principal difference with *Z. biarmata*, with

which is has now been synonymized. The records of *Z. biarmata* by Stechow (1925b) and Kramp (1938, 1947) have doubtfully been included in the synonymy of that species as neither figures nor descriptions are given that could enable us to differentiate between *Z. biarmata* and *Z. levinseni*, so far considered synonymous.

The colonies described by Millard (1958, 1968, 1975) as *Zygophylax ?biarmata* might concern another species; the measurements given by Millard (1958) on comparison with those of undubitable *Z. biarmata* show a species with much larger hydrothecae on a much longer pedicel; this material was not included in *Zygophylax inconstans* by Millard (1975) which points towards distinct differences between the two species.

Rho & Chang (1974) describe and figure as *Zygophylax biarmata* a species from Korean waters with larger hydrothecae; probably it concerns another species, as does also Rho's (1977) record of *Z. biarmata*.

Japanese records of *Zygophylax biarmata* (Jäderholm, 1919; Stechow, 1923b; Leloup, 1938; Yamada, 1959; Hirohito, 1983) definitely concern another species as appears from the description of the coppinia by Hirohito (1983). We have also excluded the record by Izquierdo, García-Corrales & Bacallado (1986), who figure hydrothecae of which the rim has two lateral cusps.

The Atlantic species *Zygophylax pinnata* (G.O. Sars, 1874) and *Zygophylax brownei* Billard, 1924, have almost identical trophosomes as *Z. biarmata* but show distinct differences in the size of the hydrothecae and the shape of the coppiniae and gonothecae (cf. Bonnevie, 1899; Broch, 1909).

We have compared the BALGIM material with Billard's type material in MNHN. There are three alcohol preserved lots (nos 98, 99 and 100) that we have been unable to study, and two slides, L 215 and 216; part of slide 215, here indicated as the lectotype, has been figured (fig.11g, h) and used for description and measurements. Both slides are labelled: "*Zygophylax biarmata* Billard fec. 1905. Travailleur Dr. VIII (G. de Gascogne), Pr. 400, sur *Polyplumaria flabellata* Sars". The locality, in the Bay of Biscay, is at 44°04'30"N 09°27'30"W, depth 411 m. The lectotype slide contains a single, c. 8 mm high branch, carmine stained, basally slightly polysiphonic. There is one side-branch, springing from the apophysis supporting a hydrotheca. Division of axis into internodes indistinct, occasionally marked by weak perisarcal constrictions (fig. 11g). Hydrothecae supported by well marked lateral apophyses at end of 'internode', cicatrices on both sides of apophyses indicate that originally two nematothecae, one on each side, must have been present but only few are preserved. Hydrotheca asymmetric, with abcauline wall straight to slightly convex; adcauline wall distinctly convex in lower third to lower half. Hydrothecal margin circular, perpendicular to hydrothecal length axis, slightly everted, usually with several renovations; diaphragm oblique, tilted downwards, present as ring in basal part of hydrotheca. Hydrothecal pedicel short, with single or a few indistinct undulations (fig. 12h). Nematothecae tubular, narrowed basally, with short, globular pedicel; rim circular, non-everted, with occasional renovation. Perisarc strong on internodes, thinning out along hydrothecal walls, but only few hydrothecae collapsed. Perisarc of nematothecae thin.

We have also inspected a slide of *Lictorella halecioides* var. *annellata* Pictet & Bedot, 1900, from MOM, numbered no. 11 0053, containing several 5-7 mm high fragments (and a 15 mm high stem of *Kirchenpaueria bonnevieae* Billard, 1906). There is a note on the slide reading: "N. Var. décrite dans Pictet & Bedot, 1900 (Van Praët 1985)". There is an indication to station number 63b on the label of the slide, though this number is

Table 17. Measurements of *'Lictorella halecioides* var. *annellata'* and *Zygophylax biarmata* in µm.

| | *L. halecioides* var. *annellata* B. of Biscay Camp. 1886, Stn 60 | *Zygophylax biarmata* Subtr. Atlantic Camp. 1897, Stn 889 |
|---|---|---|
| Hydrocladia, distance between consecutive apophyses | | 300-440 |
| Hydrothecae, mean length, excl. renovations | 235-265 | 275-320 |
| mean length including renovations | 310-475 | 310-345 |
| diameter at rim | 110-125 | 120-135 |
| Pedicel, length | 50-135 | 40-60 |
| diameter under hydrotheca | 35-60 | |
| Nematotheca, mean length, including renovations | 75-105 | |
| diameter at rim | 35-40 | |

given as 60 by Pictet & Bedot; this last number is here considered to be the correct station number.

Inspection of the slide reveals that var. *annellata* is based on a strongly renovating specimen of *Zygophylax biarmata* Billard, 1905. Though it was considered by its authors to be a variety of *Lictorella halecioides* (here considered to represent *Zygophylax brownei*) the hydrothecae are much smaller and much more slender than in that species; the hydrothecal pedicel, though lengthened in some cases, may be wrinkled but it is never kinked. The fragments are much slenderer than those of *Z. brownei*: the hydrocladial internodes being proportionately longer and thinner, with fairly thin perisarc. There are, in the slide, quite normal hydrothecae that can not be distinguished from those of specimens here described as *Zygophylax biarmata* (fig. 13e), and many strongly renovated hydrothecae, in which the number or renovations of the hydrothecal rim amounts to c. ten and those of the diaphragm to three and that are provided with strong perisarcal rings (fig. 13f). Though in the slide the number of nematothecae is reduced there are circular hyaline depressions on both sides of the apophyses close to the insertion of the pedicel indicating that many more have originally been present. Though the structure of the colony can not very well be described after the specimens in the slide it can be seen that the hydrocladia originate from apophyses on a slightly polysiphonic fragment of the axis, usually bearing an axillary hydrotheca. Nematothecae also occur on the secondary tubules. The material originates from the Bay of Biscay off the NW corner of Spain, depth 300 m.

The material in MOM identified and reported upon by Leloup (1940b: 11; Campagne 1897, Stn 889) as *Zygophylax biarmata* has also been studied and we have found it to be identical with the Balgim material. There are only hydrocladia with a few hydrothecae, two hydrothecae in good condition have been figured (fig. 11e, f). The measurements of the specimen are given below.

## **Zygophylax brownei** Billard, 1924
(figs. 13a-d, 14a-c)

*Lafoea pinnata* - Browne, 1907: 16, 18, 25-28, 29; Billard, 1923: 14-16, fig. 1A [not *Lafoea pinnata* G.O.Sars, 1874 = *Zygophylax pinnata* (G.O. Sars, 1874)]

*Zygophylax Brownei* Billard, 1924: 64; Billard, 1927: 331-332.
*Zygophylax brownei* - Leloup, 1940b: 11, pl. 1 fig. 7.
?*Zygophylax brownei (?)* - Patriti, 1970: 28-29, fig. 30.
Not *Zygophylax brownei* - Millard, 1977b: 106, 114-116, fig. 4; Millard, 1978: 200.
*Lictorella halecioides* - Pictet & Bedot, 1900: 4, 16, 53, pl. 3 figs. 4-5.

Material.— **Bay of Biscay.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1886, Stn 58, 43°40'N-08°55'W, 134 m, 07.viii.1886: two carmin stained slides of c. 15 mm high colonies without coppinia labelled *Lictorella Halecioides* and numbered no. 11 0041 (MOM).

Description.— Axis slightly polysiphonic basally, in the monosiphonic upper region weakly geniculate, without distinct division into nodes, with alternate apophyses pointing strictly left or right and supporting hydrocladia leaving axis under almost right angle; arrangement of hydrocladia in present specimens consequently strictly pinnate. Apophysis supporting hydrocladium conspicuous, invariably with axial hydrotheca and circular hyaline spot indicating insertion of nematotheca; hydrocladium separated from apophysis by distinct perisarcal constriction, no complete septum being present (fig. 13a).

Hydrocladia with occasional perisarcal constriction indicating subdivision into internodes bearing one to five alternate apophyses supporting hydrothecae (fig. 13a, c). Apophyses in slides give impression of being slightly frontally directed. Hydrothecae fairly large, more or less cylindrical but asymmetric as adcauline wall usually is more convex than abcauline wall, that may occasionally be almost straight. Hydrotheca narrowing basally almost imperceptibly into pedicel c. two-thirds hydrothecal length; at border of pedicel and hydrotheca there is a distinct, slightly concave but perpendicular diaphragm attached inside hydrotheca by means of thickened perisarcal ring (fig. 13c). Pedicel always irregularly wrinkled, occasionally kinked (fig. 13b, c). Hydrothecal rim circular, slightly but distinctly everted. Renovations of hydrothecal border frequent, usually two or three, occasionally more. Renovation of diaphragm occasionally observed (fig. 13b).

Nematothecae scarce, only one found in three slides, cup-shaped with cylindrical walls and rounded basally, attached by means of almost imperceptible pedicel; rim circular, renovated (fig. 13d). This nematotheca was observed on hydrocladial apophysis near insertion of hydrothecal pedicel. In spite of careful inspection no other nematothecae (or hyaline spots indicating their former presence) could be observed.

Perisarc firm on axis and hydrocladia, rapidly thinning out along apophysis, thin but quite firm along walls of hydrotheca; number of collapsed hydrothecae small.

Distribution.— So far only with certainty known from the Bay of Biscay, viz. 48°07'N-08°13'W, 412 fms (= 753 m) (Browne, 1907, as *Lafoea pinnata*), 47°20'N-06°10'W, 186 m (Billard, 1923, as *Zygophylax pinnata*; 1924, 1927), 47°02'N-05°18'W (Billard, 1927) and 43°40'N-08°55'W, 134 m (Pictet & Bedot, 1900, as *Lictorella halecioides*; Leloup, 1940b). Patriti's (1970) record of this species from off Rabat-Fédala, Morocco, is here considered doubtful; Patriti, according to his description, was in doubt concerning the identity of his material and the drawing (fig. 30) is too vague to give certainty.

We have recently seen colonies from the Mediterranean (Canyon de la Cassidaigne, off Cassis, 20 km E of Marseille, France, depth unknown) sent by Dr H. Zibrowius, Centre d'Océanologie de Marseille and previously identified by Dr J. Picard as *Acryptolaria conferta conferta*.

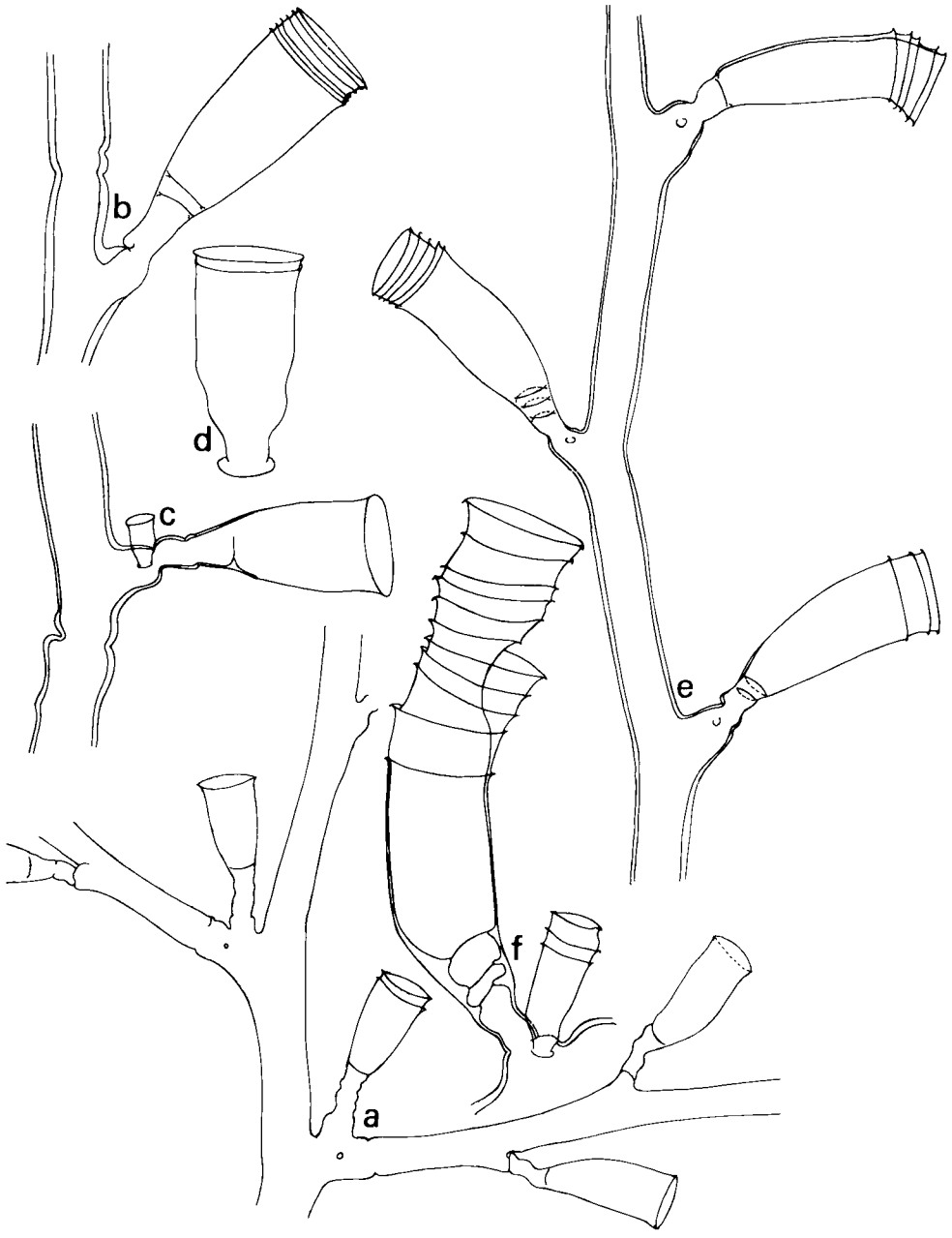


Fig. 13. a-d, *'Lictorella halecioides'* (= *Zygophylax brownei* Billard, 1924), from MOM no. 11 0041. a, monosiphonic part of stem with two hydrocladia; b, renovated hydrotheca; c, hydro- and nematotheca; d, nematotheca. e, f, *Lictorella halecioides* var. *annellata* Pictet & Bedot, 1900 (= *Zygophylax biarmata* Billard, 1905), from MOM no. 11 0053. e, monosiphonic part of stem with 3 hydrothecae; f, strongly renovated hydrotheca and renovated nematotheca. a, × 27; b, c, × 50; d, × 200; e, × 80; f, × 120.

Table 18. Measurements of *'Lictorella halecioides'* (= *Zygophylax brownei*) in µm.

| | Camp. 1886, Stn 58 |
|---|---|
| Hydrotheca, length diaphragm-rim, incl. renovations | 335-525 |
| diameter at rim | 185-230 |
| Pedicel, length | 155-220 |
| Nematotheca, length, incl. renovations | 105 |
| diameter at rim | 62 |

Discussion.— The actual size of the colonies is not given in Pictet & Bedot's paper, but judging from the figure of a colony at actual size (1900, pl. 3 fig. 4) they must have been c. 30 mm high. The slides probably contain side-branches or top parts. The specimens had already been recognized as representing *Zygophylax brownei* by Leloup, 1940b, though the station number (78) given in Leloup's paper (and also given on the slide!) is incorrect. One of the slides bears the remark: "correspond à la Pl.II fig. 5, Pictet & Bedot (Van Praët, 1985)".

We have also inspected Billard's type material in MNHN comprising both alcohol preserved material and slides. The alcohol preserved material, unfortunately was not available during our visit to Paris (07/08.1991); it is still entered in the catalogue as "*Halecium pinnatum* Sars" but on the two slides (L 218 and 219) Billard changed that name into *Zygophylax brownei* n. nom. One of the slides (L 218), containing carmine stained branches or top-parts is here indicated as the lectotype, originating from 'Tanche' Stn 294, Bay of Biscay, 47°20'N-06°10'W. The colony from which the slides were made must have been polysiphonic, with branches (hydrocladia) sub-opposite, in same plane as axis. Between each pair of sub-opposite hydrocladia there are three hydrothecae (fig. 14a): one axillary, one on opposite side and superior, and one still higher on same side. Axis and hydrocladia indistinctly divided into segments separated by distinct to weak perisarcal constrictions and occasionally a complete septum, bearing one to three hydrothecae. The septa (or internodes) each have a subapical, lateral apophysis, slightly turned towards front of colony, as do the inserted hydrothecae; nematothecae reduced in number, usually a single nematotheca per apophysis. Hydrocladia originating from internode directly under apophysis, with strong basal constriction, pointing obliquely upward. Hydrothecae large, subcylindrical, slowly widening from base onwards, slightly asymmetric as abcauline wall is convex and adcauline wall is almost straight to slightly convex. Hydrotheca basally narrowing into short, usually wrinkled or undulated pedicel. Exact shape of hydrotheca can best be judged from drawings (fig. 14b, c). Hydrothecal rim circular, smooth, slightly everted, perpendicular to hydrothecal length axis. Renovations of hydrothecal rim common, numbering two to four, some thecae show signs of repair after sustained damage. Hydrothecal bottom with perisarcal ring and thin, membranous diaphragm perpendicular to length axis: renovations of diaphragm and ring common. No well preserved hydranths observed. Nematothecae rare, tubular to elongated cup-shaped, thin and hyaline, supported by short, spherical pedicel, inserting on frontal aspect of apophyses. No renovations of nematothecae observed. Secondary tubules develop parallel to axis and hydrocladia, though not in profusion.

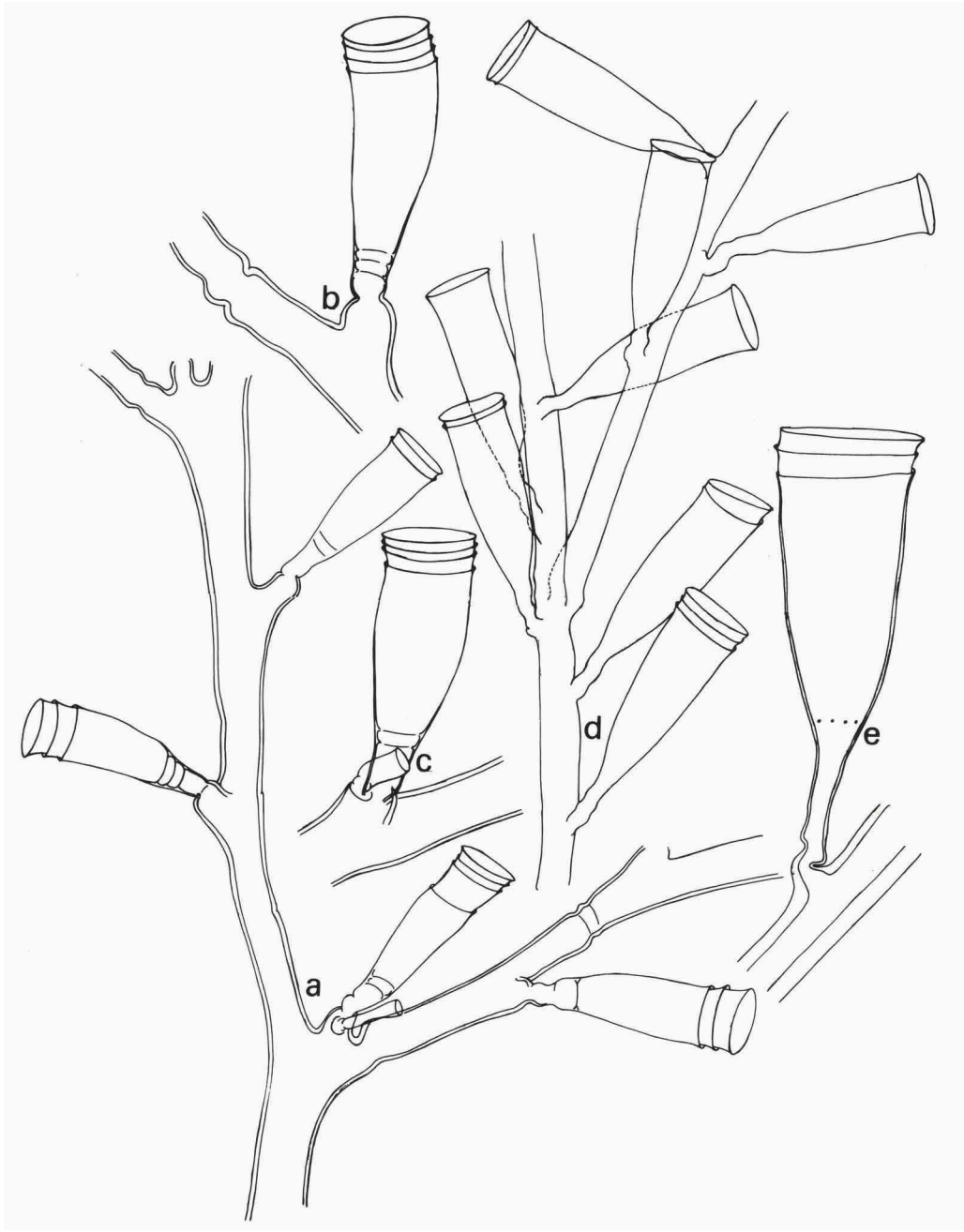


Fig. 14. a-c, *Zygophylax brownei* Billard, 1924, from Billard's slide no. 218 in MNHN, Tanche Exped., Stn 294. a, monosiphonic part of stem between two hydrocladia; b, c, hydrothecae, one of apophyses with nematotheca. d, e, *Lictorella flexilis* Pictet & Bedot, 1900 [= *Lafoea dumosa* (Fleming, 1820)], from MOM no. 11 0094. d, monosiphonic part of stem; e, hydrotheca with distinct desmocytes. a, × 37; b, c, e, × 50; d, × 27.

Table 19. Measurements of *Zygophylax brownei* in µm.

| | Bay of Biscay 'Tanche', Stn 294 |
|---|---|
| Segments of axis and hydrocladia, length | 830-1940 |
| diameter | 370-405 |
| Hydrotheca, total depth* | 1480-1630 |
| length abcauline wall (diaphragm-rim)* | 1015-1090 |
| length adcauline wall (diaphragm-rim)* | 1075-1165 |
| diameter at rim | 480-555 |
| Nematotheca, length | 370-555 |
| diameter at rim | 90-150 |

* = including renovations.

They communicate with the primary axis and hydrocladia by means of circular holes, particularly noticeable on the apophyses. Development of perisarc on axis, branches and hydrocladia fairly strong, thinning out along hydrothecal walls; no collapsed hydrothecae observed.

We believe that Millard's *Zygophylax brownei* from the Indian Ocean off southern Africa (1977b: 114-116, fig. 4; 1978: 200) represent another, probably new species of *Zygophylax*. The hydrothecae are slenderer and smaller than those of the Atlantic *Z. brownei*, the pedicel is not kinked and the diaphragm usually oblique.

## **Zygophylax elongata** spec. nov.
(fig. 15a-g)

Material.— **Tropical Atlantic S. of Cape Verde Islands.** No station data, 07°51'N-21°39'W, 1670 fms (= 3055 m), c. 1927: three colonies 30-40 mm high and some fragments. No coppiniae . Very brittle. BMNH no. 1927.2.13.4; slides in RMNH under Coel. no. 16581.— Monarch, 06°05'N-28°30'W, 2200 fms (= 4025 m), c. 1949 (type locality): ten colonies 60-100 mm high, some forked, one with a large coppinia surrounding stem like a muff over length of 60 mm. Fragments and some smaller coppinia. Specimen with large coppinia holotype; remaining colonies from this station paratypes. BMNH no. 1949.2.2.9; one paratype and some slides in RMNH under Coel. no. 25711.

Description.— Colony with erect, polysiphonic, occasionally bifurcate, slightly geniculate axis. Axis bearing numerous pinnately arranged side-branches (hydrocladia), alternately directed left and right and in same plane as axis. Monosiphonic (younger) parts of colony show division of axis and hydrocladia into internodes of varied lengths, separated by well marked, transverse nodes (fig. 15a). Internodes with one or two hydrothecae; internodes with three hydrothecae have also occasionally been observed. Internodes with one hydrotheca have that hydrotheca on distal part (fig. 15b). Hydrothecae inserting on apophyses arranged along axis and hydrocladia at varied distances and alternately pointing obliquely left or right and frontally. Hydrothecae also directed frontally, tubular, placed on pedicel of considerable length and separated from that pedicel by thin diaphragm. Adcauline hydrothecal wall distinctly convex and abcauline wall concave, giving hydrotheca a characteristic, curved appearance (fig. 15a, b). Hydrothecal rim circular, smooth, slightly everted. Renovations of hydrothecal border frequent and repeated (fig. 15a, b); renovation of the diaphragm has once been observed.

Nematothecae, probably as a result of damage, few in number, cylindrical, with short spherical peduncle; rim smooth, circular and slightly everted (fig. 15c-e). Renovations of nematotheca frequent. Nematothecae inserting on apophyses, one on

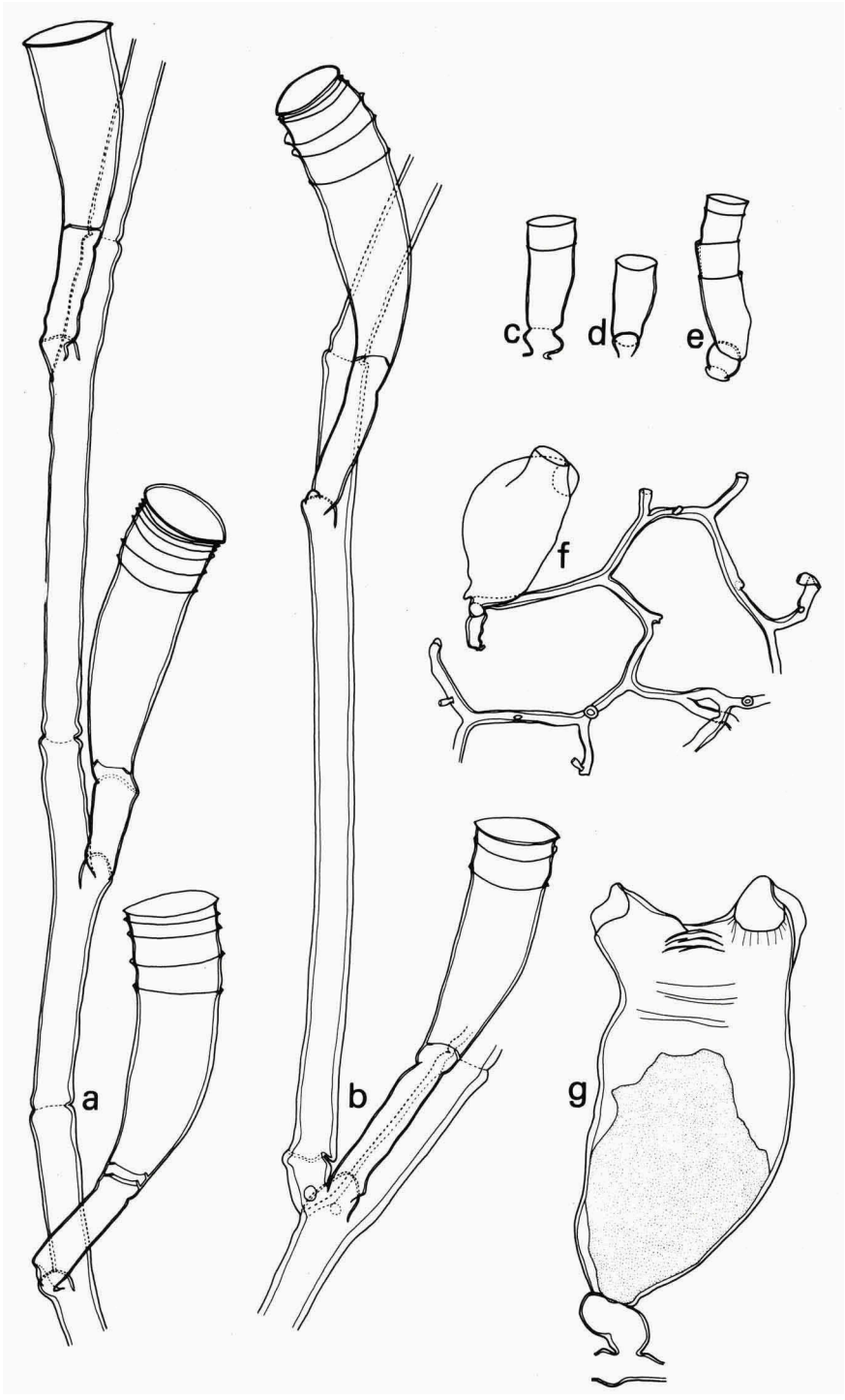


Fig. 15. a-g, *Zygophylax elongata* nov. spec., from Monarch Exped., BMNH no. 1949.2.2.9. a, monosiphonic part of axis; b, part of axis and hydrocladium; c-e, nematothecae; f, some ramules from coppinia and a gonotheca; g, isolated gonotheca. a, b, g, × 45; c-e, × 90; f, × 18.

each side of hydrotheca, on base of side-branches (hydrocladia) and dispersed on axis and secondary tubules.

Side-branches (hydrocladia) in structure identical to axis, basally with perisarcal constriction.

Coppinia formed by a mass of gonothecae and nematophorous ramules surrounding the axis; the ramules are repeatedly dichotomously branched (fig. 15f) and form a dense cover for the gonothecae, obscuring their presence. Gonothecae separate, without adnate walls, ovoid, apically with bifurcate process, bifurcations ending in gonothecal apertures, two for each gonotheca (fig. 15g). Occasionally three gonothecal apertures were observed. Ramules with comparatively few nematothecae, structure as described above but generally smaller.

Variability.— Hydro- and nematothecae within the same colonies are varied in length as a result of renovations. The length of the hydrothecal pedicel is also variable in the same colony.

Table 20. Measurements of *Zygophylax elongata* in µm.

| | BMNH 1949.2.2.9 |
|---|---|
| Axis, distance between two consecutive hydrothecae | 1140-1450 |
| diameter at node | 100-160 |
| Hydrotheca, length of pedicel along adcauline wall | 400-620 |
| length of adcauline wall, from diaphragm onwards,without renovations | 550-670 |
| length adcauline wall, from diaphragm onwards,with renovations | 700-900 |
| diameter at rim | 230-300 |
| Nematotheca, length without renovations | 120-160 |
| length with renovations | 180-250 |
| diameter at rim | 60-70 |
| Coppinia, maximal length gonotheca | 1250-1620 |
| maximal diameter of gonotheca | 650-700 |
| diameter of (nematophorous) ramules | 70-100 |
| length of nematotheca | 90-160 |
| diameter of nematotheca at rim | 40-60 |

Distribution.— The material examined is from two localities south the of Cape Verde Islands, depths 3055-4025 m.

Discussion.— The above described colonies resemble *Zygophylax levinseni* (Seamundsson, 1911) in the arrangement of the ramifications in one plane, the frontal disposition of the hydrothecae and the long hydrothecal pedicels but differ in the considerably larger and more strongly curved hydrothecae and the longer hydrothecal pedicels. There are considerable differences in the structure of the coppinia, that in *Z. elongata* is characterized by the dense cover of dichotomously branched ramules, that are fully absent in *Z. levinseni*. There are also very distinct differences in the shape of the apical portion of the gonotheca.

*Zygophylax elongata* also resembles *Zygophylax leloupi* spec. nov., but here the hydrothecae are much shorter and wider; it has a coppinia without nematophorous ramules. The gonothecae of both species are similar.

Etymology.— The specific name *'elongata'* has been coined because of the elongated condition of the hydrothecae.

## Zygophylax flexilis (Pictet & Bedot, 1900)
(fig. 14d, e)

*Lictorella flexilis* Pictet & Bedot, 1900: 4, 15-16, 55, pl. 3 figs. 1-3; Rees & White, 1966: 274.
*Zygophylax flexilis* - Rees & Vervoort, 1987: 68-69.

**Material.— Eastern Atlantic Ocean.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1888: Stn 247, off Pico, Azores, 38°24'N-30°21'40"W, 318 m (type locality). Three carmine stained schizoholotype slides of c. 10 mm high fragments, numbered no. 11 0094 (MOM).

Description.— Fragments with erect axis, basally overlaid by some secondary tubules, distally monosiphonic, irregularly branched, branches leaving axis under an angle of 45-60 degrees (fig. 14d). Hydrothecae inserting on all sides of axis and secondary tubules, fairly closely approximated, with distinct, often kinked pedicel rising from minor apophysis on axis or secondary tubule, cylindrical, gradually narrowing into pedicel, slightly but distinctly everted at circular rim, usually with a few renovations (fig. 14d, e). There is no diaphragm at base of hydrotheca though decaying tissue inside hydrotheca at times gives that impression. However, there is a transverse row of hyaline punctae at the hydrothecal base indicating that hydranth is internally attached by means of desmocytes (fig. 14e). Perisarc thick and conspicuous along axis and secondary tubules, fairly suddenly thinning out at base of pedicel; wall of pedicel and hydrotheca thin.

Table 21. Measurements of *'Lictorella flexilis'* and *Lafoea fruticosa* (= *L. dumosa*) in µm.

| | *'Lictorella' 'flexilis'* | | *Lafoea fruticosa* |
|---|---|---|---|
| | Azores (own measurements) | Azores (Pictet & Bedot, 1900) | NW Atlantic (Vervoort, 1972) |
| Hydrotheca, length puncta-rim, incl. renovations | 555-665 | 600-700 | 500-610 |
| diameter at rim | 220-370 | 200-300 | 150-200 |
| Pedicel, length | 245-275 | 300 | 135-190 |

Discussion.— Though Pictet & Bedot (1900) refer to a 50 mm high colony the three slides mentioned above is all left of this species. One of the slides is labelled: M. 155, *Lictorella flexilis*, Type, 11 0094; the specimen on the slide is here indicated as the lectotype. The slides have previously been studied by Dr M. Van Praët, MNHN, who wrote on the lectotype slide: "Correspond au type. Pl. III fig. 2, Pictet et Bedot 1900 (Van Praët 1985)". Study of the specimens leads to the conclusion that it cannot possibly be separated from some of the material described by Vervoort (1972) as *Lafoea fruticosa* (M. Sars, 1851) (for synonymy see Vervoort, 1972). First of all there are certainly no nematothecae in *'Zygophylax flexilis'*, a careful inspection of the three slides failed to reveal their presence and hyaline, circular spots indicating the presence of dislodged nematothecae on the apophyses and at the base of the side-branched are totally absent. None of the species of *Zygophylax* so far described has a strongly kinked hydrothecal pedicel; in the presence of this character the present material fully agrees with the present concept of species of *Lafoea* with strongly kinked

hydrothecal pedicel. The colony structure of *'Zygophylax flexilis'*, finally does not differ in any respect from that met with in the Atlantic material of *Lafoea fruticosa* described by Vervoort (1972): there is an irregularly branched, erect primary axis that becomes rapidly covered by secondary tubules; both primary and secondary tubes bear irregularly distributed hydrothecae on all side. *Lafoea fruticosa* (M. Sars, 1851) has been placed in the synonymy of *Lafoea dumosa* (Fleming, 1820) by Cornelius (1975b).

## **Zygophylax leloupi** spec. nov.
(figs. 16a-c, 17a-d)

*Zygophylax geniculata* - Leloup, 1940: 13-14, pl. 1 fig. 9 (not *Zygophylax geniculata* Clarke, 1893).

Material.— BALGIM Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m (type locality): thirteen colonies up to 140 mm high and many fragments. One colony with coppinia on stem (holotype), remaining colonies from this station paratypes.— Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: three fragments 20-35 mm high, without coppiniae.
Additional material.— **Eastern Atlantic Ocean.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1895, Stn 584, near Azores, 38°31'N-26°49'W, 845 m, 16.vii.1895: two vials, one containing debris, the other with a number of fragments from a larger colony, generally in bad condition. Label in this vial runs: "Collection de S.A.S. le Prince de Monaco. Station 584 16 juillet 1895 *Zygophylax geniculata* (Clark) photographié et reprod. s. planche. Barre à fauberts. Leloup det. 845 m". (MOM no. 11 0309). In addition one slide with part of a colony and some alcohol preserved colonies from IRSN, numbered I.G. 12.981.— Campagne 1897, Stn 838, near Azores, 37°55'N-25°23'W, 880 m, 22.vii.1897: debris of a colony; hydrothecae largely detached (MOM no. 11 0328). Also one slide numbered I.G. 12.981 from IRSN, containing a colony fragments.— Campagne 1902, Stn 1344, near Azores, 38°45.5'N-28°07°45'W, 1095 m, 18.viii.1902: several colonies, largest c. 60 mm; many hydrothecae detached (MOM no. 11 0429). In addition three slides with parts of colonies and some alcohol preserved colonies, all with the number I.G. 12.981, from the collections of IRSN. All material from MOM and IRSN as *Zygophylax geniculata* (Clark); no coppiniae present.

Description (of the material from BALGIM Stn CP 90).— Colony with strong, erect, polysiphonic, repeatedly bifurcated axis, bearing pinnately arranged side-branches (hydrocladia), alternately pointing left and right and in same plane with axis. Both axis and hydrocladia without segmentation, straight. Front of axis and hydrocladia with series of apophyses, alternately pointing left and right and obliquely forwards; apophyses consequently not in same plane with axis. Hydrothecae, inserting on apophyses, directed frontally, tubular, with fairly long pedicels, separated from hydrotheca proper by means of slightly oblique diaphragm (fig. 16a, b). Adcauline wall of hydrotheca convex over greater part of its length but just under rim with slight concavity giving hydrotheca characteristic appearance (fig. 16b); abcauline wall convex and slightly longer than adcauline wall. Hydrothecal rim smooth, circular and slightly everted; renovations frequent.

Nematothecae largely dislodged, cylindrical; rim smooth, circular, non-everted. Nematothecal pedicel short (fig. 16b). No renovations have been observed. Nematothecae inserting on apophyses, one on each side of hydrothecal pedicel. Small circular depressions on axis and secondary tubules indicate places of insertion of additional nematothecae that have become dislodged. Such depressions are occasionally present

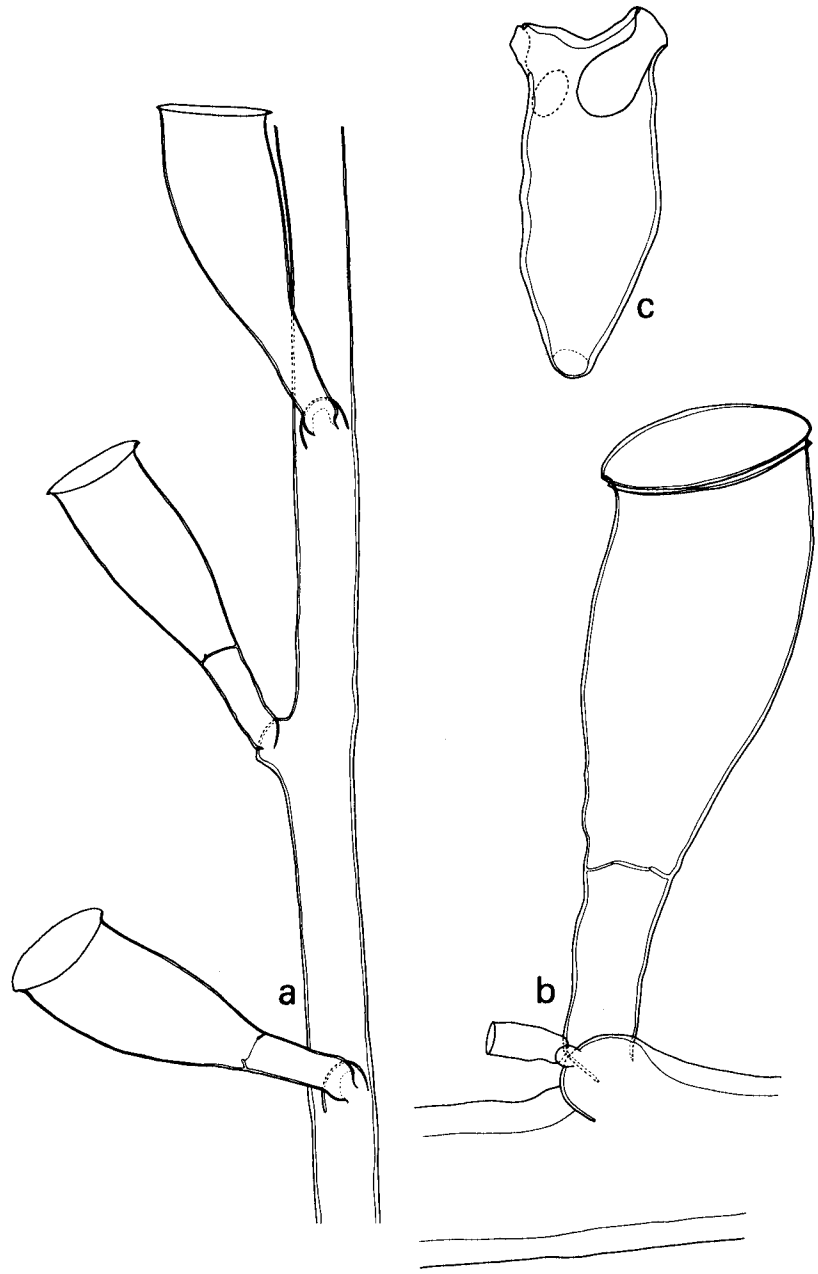


Fig. 16. a-c, *Zygophylax leloupi* nov. spec., holotype, from CP 90. a, monosiphonic part of axis; b, hydro- and gonotheca; c, isolated gonotheca. a, c, × 50; b, × 90.

at the base of side-branches or hydrocladia. Such branches spring from axis directly under axial apophysis, the axial hydrotheca becoming axillary, and have a characteristic perisarcal constriction basally; structure identical with that of axis.

The only coppinia observed is in advanced stage of development and much damaged, so that a complete description is impossible. Apparently there are no nematophorous ramuli, the coppinia being composed of a dense aggregation of gonothecae surrounding the basal part of the axis. Gonothecae ovoid, aggregated though not adnate, at distal extremity with two or three short, tubular processes, pointing obliquely upwards, each with one terminal aperture. In some cases one of gonothecal apertures elongated downwards along gonothecal wall to become more or less slit-shaped (fig. 16c).

Table 22. Measurements of *Zygophylax leloupi* in µm.

| | BALGIM Stn CP 90 | NW Atlantic (Leloup, 1940b) |
|---|---|---|
| Axis, distance between two consecutive hydrothecae | 700-1000 | |
| Hydrothecal pedicel, length adcauline wall | 270-350 | |
| Hydrotheca, length adcauline wall from diaphragm onwards, no renovation | 500-640 | |
| length adcauline wall from diaphragm onwards, with renovations | 570-690 | 600-800* |
| diameter at rim | 280-340 | 250-350 |
| Nematotheca, length | 100-130 | 150-200 |
| diameter at rim | 35-45 | 30-40 |
| Coppinia, maximal length gonotheca | 1000-1400 | |
| maximal diameter gonotheca | 480-700 | |

* = mean length.

Distribution.— Leloup (1940b, as *Zygophylax geniculata*) records the presence of this species at three localities near the Azores, the depths varying between 845 and 1095 m. The BALGIM material is from the coast off Rabat, Morocco, depths 890-1378 m.

Discussion.— We have convinced ourselves that the material described by Leloup (1940b) as *Zygophylax geniculata* (Clarke, 1894) is identical with the above mentioned BALGIM material. Leloup was of the opinion that the size differences of his material with that described by Clarke (1894: length hydrotheca from diaphragm onwards 350-400 µm, diameter of hydrotheca at rim 175-200 µm, mean length of hydrothecal pedicel 200 µm) were insufficient to separate his material specifically from that described by the latter. In our opinion, however, the size differences between Clarke's Pacific material and the Atlantic colonies are such that the Atlantic material must have a separate specific standing; Clarke's species, which is of Pacific origin, has never been recorded since its original record. Though the Monaco material on which Leloup based his conclusions is now generally in bad condition we have nevertheless been able to find some colony fragments with the hydrothecae attached. Leloup's material is characterized by strong renovations in some of its parts, those regenerations also affecting the length and condition of the pedicels, some of which appear to be composed of several internodes (fig. 17a-d). Such hydrothecae are characterized by duplications of the diaphragm and the hydrothecal rim. The (few) 'primary' hydrothecae in the Monaco material are identical with those described above, including

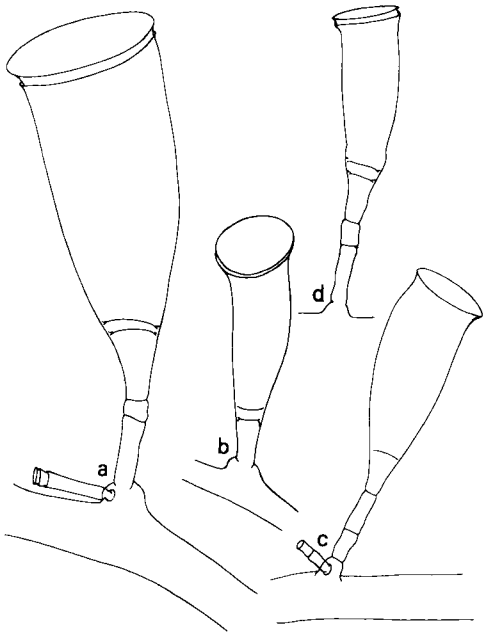


Fig. 17. a-d, *'Zygophylax geniculata'* (= *Zygophylax leloupi* nov. spec.), from MOM no. 11 0309. a, part of hydrocladium with apophysis and hydro- and nematotheca; b-d, hydrothecae. a, × 50; b-d, × 28.

the characteristic concavity of the adcauline hydrothecal wall (fig. 17b). The measurements of the Monaco material are slightly superior to those of the BALGIM colonies. The nematothecae in this species appear to be firmly attached; the hydrothecae usually still have one tubular and fairly long nematotheca on the apophysis supporting the hydrothecal pedicel.

The present material demonstrates certain affinities with *Zygophylax levinseni* (Saemundsson, 1911) and with *Zygophylax elongata* spec. nov.in the general structure of the colony, the frontal direction of the hydrothecae and the long hydrothecal pedicel. However, the concavity of the adcauline wall just under the hydrothecal rim is characteristic for the material here described as *Zygophylax leloupi* spec. nov.; in both *Z. levinseni* and *Z. elongata* the whole of the adcauline hydrothecal wall is convex. The present material also has larger hydrothecae than *Z. levinseni* and the gonothecae are quite different. Though the differences between the gonothecae of *Z. leloupi* and those of *Zygophylax elongata* are slight, there are numerous nematophorous ramules in the coppinia of the latter that are absent here.

The species described by Millard (1968, 1975) as *Zygophylax ?geniculata* is considered by Rees & Vervoort (1987) as a species different from *Z. geniculata* Clarke, 1894; the authors indicate that Millard's material should probably be included in *Zygophylax bifurcata* Billard, 1942. The hydrothecae in Millard's material are smaller than those recorded here (length hydrotheca 400-500 μm, diameter at rim 110-150 μm); the hydrothecae are arranged in the same plane and may be directed towards the front of the colony; there is also occasional bifurcation of hydrocladia in Millard's specimens, the hydrothecae "of the anterior limb of the forked hydrocladium (being) shifted towards the posterior surface" (Millard, 1975: 197).

*Zygophylax abyssicola* (Stechow, 1926) has never been figured but from the description it appears to be a species allied to *Z. levinseni*, *Z. leloupi* and *Z. elongata*. The hydrothecae are not in the same plane as axis and branches, have a relatively long pedicel (290 μm) and 'T-shaped' gonothecae with two large apertures at the end of laterally directed, tubular processes. The presence of a dense mass of nematophorous ramules in the coppinia seems to separate this species from *Z. levinseni* and *Z. leloupi*. The type of Stechow's species is badly in need of a critical redescription and the publication of some figures.

Etymology.— The specific name has been chosen to commemorate the late Dr E.

Leloup, Institut Royal des Sciences naturelles de Belgique, Brussels, in recognition of his important studies on Hydroida.

## **Zygophylax levinseni** (Saemundsson, 1911)
(figs.18a-d, 19a-f)

*Lictorella Levinseni* Saemundsson, 1911: 86-88, fig. 2.
*Zygophylax levinseni* - Rees & Vervoort, 1987: 72.
*Zygophylax biarmata* - Broch, 1918: 24-25 (not *Zygophylax biarmata* Billard, 1905).
*Zygophylax elegantula* Leloup, 1940b: 11-12, pl. 1 fig. 8; Rees & White, 1966: 274; Rees & Vervoort, 1987: 78.

Material.— BALGIM Stn CP 91, 34°22.3'N-07°25.1'W, 07.vi.1984, 948 m: single colony and some fragments 25-60 mm high. No coppiniae.
Additional material.— **Bay of Biscay**. Monarch, 48°02'N-09°25'W, 930 fms (= 1700 m), 1950: large colony 90x70 mm with repeatedly forked stem, one of forks with large coppinia (13x2 mm). BMNH no. 1950.2.10.4, one separate branch in RMNH (Coel. no. 16577).— Monarch, 48°02'N-09°27'W, 900 fms (= 1646 m), 1950: c. 30 colonies 60-120 mm high with many coppiniae on stem and branches. BMNH no. 1950.2.10.5, part in RNNH as Coel. no. 16578.— **Eastern Atlantic Ocean**. Campagne Océanographique Prince Albert I de Monaco, Campagne 1902, Stn 1349, near Azores, 38°35'30"N-28°05'45"W, 1250 m, 19.viii.1902: fragments of a larger colony with few hydro- and nematothecae; no coppiniae (MOM no. 11 0434; a 10 mm high fragment preserved as a stained slide is here indicated as lectotype, see below). Also two slides from IRSN, containing 8-15 mm long parts of colonies; numbered I.G. 12.981, "type".— Musée Océanographique, Monaco. On telegraph cable near Azores, leg. F.A. Chaves, 1160 m, 26.iii.1093: strongly fragmented remains of colony, few hydrothecae left (no. 11 0503). In addition one slide from IRSN with a 12 mm high part of a colony and numbered I.G. 12.981, "type". All material from MOM and IRSN as *Zygophylax elegantula* Leloup, 1940.— **Tropical Atlantic S. of Cape Verde Islands.** No station data, leg. T. Westfall Anderston, E & Assoc. Tel. Cy, south of Cape Verde Islands, 07°57.5'N-21°49.5'W, 2000 fms (= 3657 m), xii.1922: c. 20 colonies up to 100 mm high and some fragments. One of colonies with coppinia on stem. BMNH no. 1936.6.9.1; slides in RMNH under Coel. no. 15582.

Description.— Colony with strongly polysiphonic, usually repeatedly bifurcated axis bearing numerous pinnately arranged side-branches (hydrocladia) pointing left and right in same plane as axis. Upper (younger) parts of colony with straight monosiphonic axis and with regularly arranged, straight hydrocladia, divided into internodes of varied length by means of transverse nodes. Along axis and hydrocladia there is a series of apophyses alternately directed obliquely left and right and frontally, on which insert the hydrothecae that consequently are also frontally directed and are not placed in the same plane (fig. 18a, c). Hydrotheca on fairly long pedicel that gradually widens towards hydrothecal base, being separated from hydrotheca proper by a (usually slightly oblique) diaphragm. Hydrotheca tubular, slightly asymmetric as adcauline wall is slightly convex and abcauline wall slightly concave. Hydrothecal rim circular, smooth, somewhat everted (fig. 18b, d). Renovations frequent, many hydrothecae with repeated renovations; those of diaphragm not observed (fig. 18a)

Nematotheca cylindrical, with short, spherical pedicel; rim smooth, circular and somewhat everted; renovations frequent. Nematothecae inserting on apophyses, usually one on each side of hydrothecal pedicel (fig. 18b); side-branches (hydrocladia)

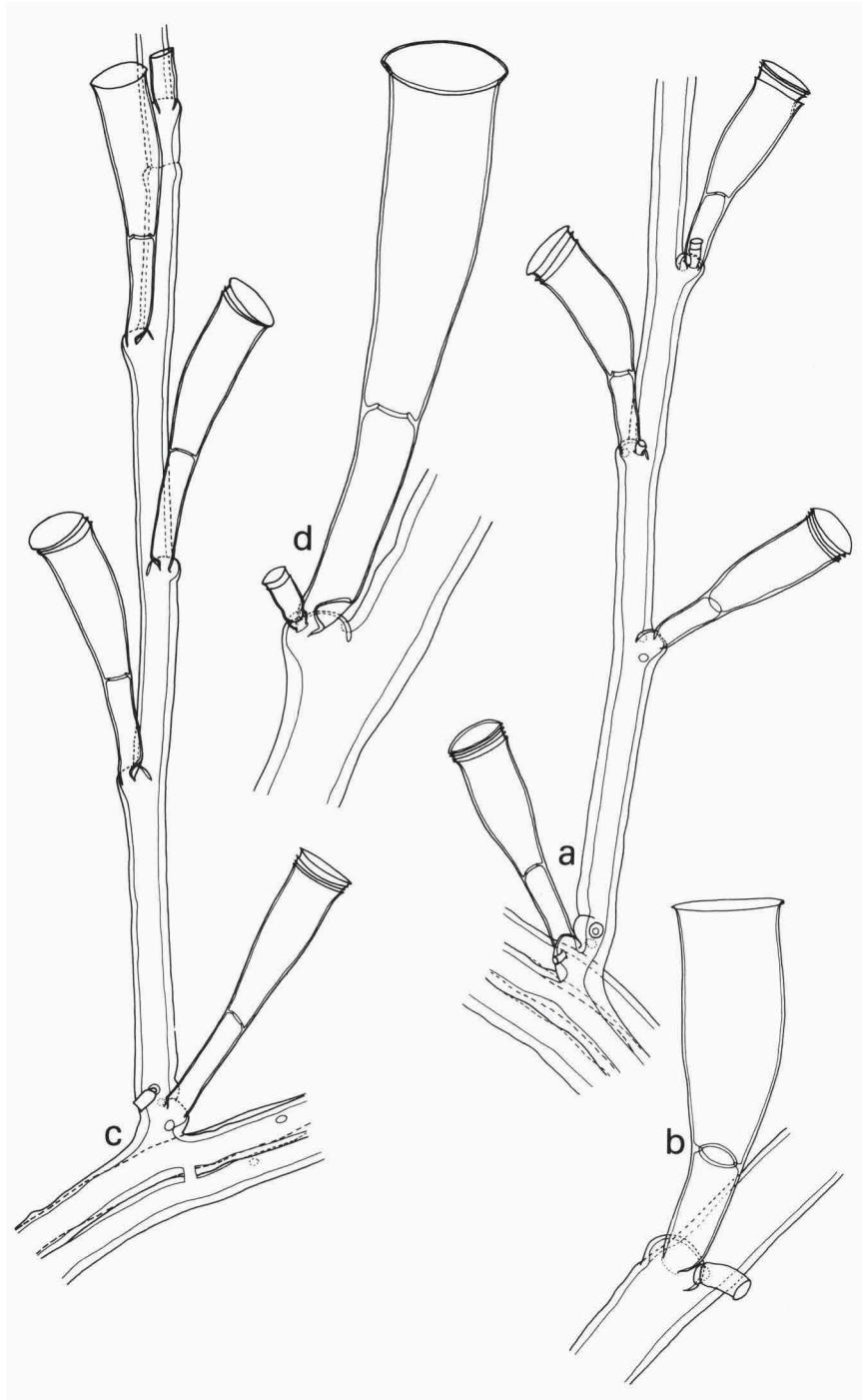


Fig. 18. a-d, *Zygophylax levinseni* (Saemundsson, 1911). a, b, from CP 91. a, part of polysiphonic axis and a hydrocladium; b, hydro- and nematotheca. c, d, from Monarch Exped., BMNH no. 1950.2.10.4. c, part of axis with hydrocladium; d, hydro- and nematotheca. a, c, d × 45; b, × 90.

Table 23. Measurements of *Zygophylax levinseni* and *Z. elegantula* in µm.

| | *Zygophylax levinseni* | | *Zygophylax elegantula* |
|---|---|---|---|
| | BALGIM Stn CP 91 | Bay of Biscay BMNH 1950.2.10.4 | Azores region (Leloup, 1940b)* |
| Axis, distance between two consecutive hydrothecae | 400-800 | 500-900 | 650-975 |
| diameter at node | 85-120 | 90-130 | 95-110 |
| Hydrotheca, length of pedicel along adcauline wall | 180-290 | 260-345 | 215-225 |
| length of adcauline wall, from diaphragm onwards, without renovations | 340-440 | 400-475 | 325-435 |
| length of abcauline wall, from diaphragm onwards, incl. renovations | 380-460 | 440-530 | |
| diameter at rim | 155-175 | 155-180 | 140-170 |
| Nematotheca, length without renovations | 90-140 | 70-120 | 80 |
| length with renovations | 105-230 | 120-160 | |
| diameter at rim | 35-50 | 35-40 | 35 |
| Coppinia, maximal length gonotheca | | 980-1220 | |
| greatest width at distal extremity | | 520-750 | |
| length nematotheca | | 90-190 | |
| diameter nematotheca at rim | | 35-50 | |

* = our own measurements of lectotype, see below.

basally with pair of nematothecae (fig. 18a, c). Dispersed nematothecae also occur on axis and secondary tubules. Nematothecae easily dislodged, in which case place of insertion is still visible as circular perisarcal hole or depression. Side-branches (hydrocladia) in structure identical with distal parts of axis, basally with more or less marked perisarcal constriction; secondary side-branches (hydrocladia) occasionally present.

Coppiniae only observed in additional material, borne on axis or ramifications, composed of dense aggregation of individual, non-adnate gonothecae. Each gonotheca ovoid, slightly laterally compressed, distally produced into a pair of laterally curved tubes; the two apertures of gonotheca each at end of this curved tube and directed basally (fig. 19e, f). Numerous nematothecae dispersed between gonothecae, identical to those described above but generally better developed (fig. 19e). No nematophorous tubules have been observed. Occasionally perisarcal tubules have been observed between the gonothecae, bearing a terminal hydrotheca. Such tubules do not form part of the coppinia but must be considered as auto-epizootic structures originating from a basal disc formed by a larva settling on a gonotheca.

Variability.— The additional material differs from the BALGIM material (CP 91) by slightly longer hydrothecae and pedicels, which gives the colonies a graceful appearance, though there is identity in all other respects. The frequent renovations of borders of hydro- and nematothecae leads towards a considerable variability in length of these structures; the length of the hydrothecal pedicel is also variable in the same colony.

Distribution.— *Zygophylax levinseni* is known with certainty from a locality south of Iceland, depth 510 m (Seamundsson, 1911; Broch, 1918), though as indicated above (p. 63) some of the Atlantic records of *Zygophylax biarmata* Billard, 1905, may refer to

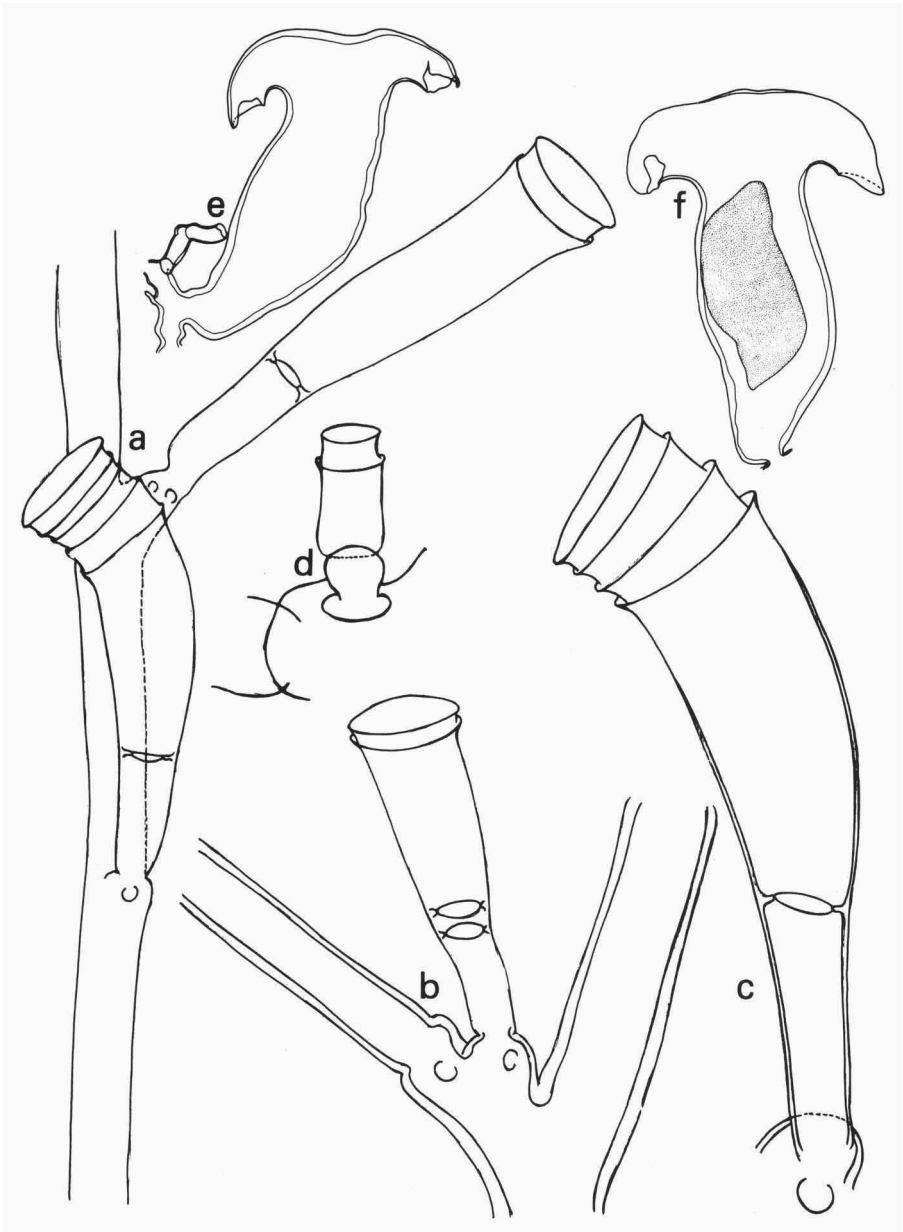


Fig. 19. a-d, *Zygophylax elegantula* Leloup, 1940 [= *Zygophylax levinseni* (Seamundsson, 1911)], from lectotype, MOM no. 11 0434. a, monosiphonic part of axis; b, part of axis and hydrocladium, with axillary hydrotheca; c, hydrotheca; d, nematotheca. e, f, *Zygophylax levinseni* (Seamundsson, 1911), from Monarch Exped., BMNH no. 1950.2.10.4, isolated gonothecae. a, b, × 80; c, × 125; d, × 190; e, f, × 47.

*Z. levinseni*. *Zygophylax elegantula* originates from the Azores region, depth 1250 m (Leloup, 1940). The BALGIM material comes from one locality near the coast of Rabat, Morocco, depth 948 m (CP 91). The additional, BMNH material originates from two Bay of Biscay localities and from one tropical Atlantic locality south of the Cape Verde

Islands. The depth records of this additional material vary between 1646 and 3657 m.

Discussion.— Broch (1918) redescribed *Lictorella Levinseni* Saemundsson, 1911 and placed it in the synonymy of *Zygophylax biarmata* Billard, 1905. *Zygophylax levinseni* nevertheless differs from *Z. biarmata* because axis and ramifications are straight, not geniculate and present an irregular segmentation by means of transverse nodes. Apophyses and hydrothecae are distinctly directed frontally; the hydrothecae have a much longer pedicel. These characters suffice to distinguish the trophosomes of both species, while in the structure of the coppiniae and gonothecae there are even more distinct differences. In *Z. levinseni* the gonothecae, forming a dense collar around axis or ramifications, remain separate, are ovoid and flattened, with a distinctive apical portion bearing the two gonothecal apertures at the end of basally curved funnels. In *Z. biarmata* the gonothecae are globular and adnate, and have a single aperture at the end of a strongly everted, short neck. The coppinia of *Z. levinseni* has no nematophorous ramules as are present in profusion in the coppinia of *Z. biarmata.*

*Zygophylax elegantula* was described by Leloup (1940) after sterile material from the Azores region; the gonosome remained undescribed. We have been able to evaluate Leloup's species from the type lot in MOM. The species was founded on material from two lots, no distinct holotype being indicated. The material from Stn 1349 is the best preserved, a colony fragment from this lot, now mounted as a stained slide in MOM and also under no. II 0434 is here indicated as the lectotype; it contains only few hydrothecae and a single nematotheca (fig. 19a-d). *Zygophylax elegantula,* as a study of the type lot distinctly shows, agrees perfectly with the description of *Z. levinseni* given above and should be included in the synonymy of that species. Measurements taken from the lectotype of *Z. elegantula* are given above; they fit the measurements of the BALGIM material particularly well. The label on the vial containing the remainder of the lectotype reads: "Collection de S.A.S. le Prince de Monaco. Station 1349 19 août 1902 *Zygophylax elegantula* n. sp. photographié et reproduit s. pl. Chalut (,) Leloup det. 1250 m".

The size differences between the BALGIM material and the BMNH material in our opinion do not justify a specific separation bearing in mind the conformity in morphology. It should be pointed out, however, that the BALGIM material was sterile so that the gonosomes could not be compared.

## Family **Haleciidae** Hincks, 1868
## Genus **Halecium** Oken, 1815

### **Halecium delicatulum** Coughtrey, 1876
(fig. 20a-c)

*Halecium delicatulum* Coughtrey, 1876a: 26, pl. 3 figs. 4, 5; Coughtrey, 1876b: 299; Ralph, 1958: 334-338, figs. 11e, h-n, 12a-p.
*Halecium parvulum* - Vervoort, 1959: 227-229, fig. 7.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: single fragment 7 mm high; no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: single colony 5 mm high on *Polyplumaria flabellata* and single colony 3 mm high on worm-tube; no gonothecae.— Stn CP 68, 35°11.9'N-07°52.6'W, 05.vi.1984, 2035 m: mutilated colony 60 mm high with many female gonothe-

cae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: single colony 5 mm high on *Sertularella gayi gayi*; no gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: various colonies up to 15 mm high on *Sertularella gayi gayi*; no gonothecae. In addition fragment 5 mm high without gonothecae.

Description.— Colony with erect, polysiphonic, irregularly branched axis rising from stolon attached to substratum. Monosiphonic parts of colony slightly geniculate, composed of regular succession of internodes separated by oblique nodes, marked by constriction of perisarc. Each internode with well developed distal hydranthophore, alternately pointing obliquely left or right and upwards and surpassing level of node, as well as an apophysis supporting next internode (fig. 20a). Primary hydrotheca with basal diaphragm, gradually widening towards aperture and with everted rim perpendicular to length axis of hydranthophore. Wall of hydrotheca above diaphragm occasionally with row of desmocytes, characteristic of Haleciidae and serving the attachment of the hydranth. Hydranthophore some distance below diaphragm with annular perisarcal thickening forming a 'pseudodiaphragm'. Secondary, tertiary and further hydranthophores originate from diaphragm of previous hydrotheca and have smooth walls without undulations or constrictions (fig. 20a). Secondary hydranthophores occasionally with perisarcal thickening, but only present on adcauline side. Secondary, tertiary and further hydrothecae as primaries, rim occasionally slightly tilted upwards.

Ramifications originating from primary hydranthophores, occasionally polysiphonic and in structure identical with axis.

The female gonothecae, the only sex observed, insert on primary hydranthophores, their shape is more or less ovoid, slightly compressed laterally; apex truncate or broadly rounded. Interior of gonotheca with varied number (2-7) of developing eggs (fig. 20b, c); contents of gonotheca apparently emptied through apical slit, but condition of gonothecae such that detailed structure could not be observed.

Distribution.— The geographical distribution of *Halecium delicatulum* has recently been reviewed by Rees & Vervoort (1987); the species is there considered to be circumglobal in tropical and subtropical waters, penetrating Pacific waters as far north as Japan and Queen Charlotte Island (Canada) and going in the Atlantic as far north as Morocco. Southwards its distribution extends into the Antarctic. However, the distribution of *H. delicatulum* in the Atlantic and particularly along the European coasts seems to be more extended; the species has been recorded from the White Sea and the Barents Sea (Leloup, 1960), from a locality SW of the Glénan Archipelago, France (Leloup, 1940b, as *Halecium flexile*), from the littoral of the Basque coast of Spain (Aguirrezabalaga et al., 1984), from the coasts of Galicia (N.W. Spain) (Ramil & Iglesias, 1988a) and from the Azores (Leloup, 1940b; Rees & White, 1966, both as *H. flexile*). Furthermore *H. delicatulum* has been described from numerous Mediterranean localities along the Spanish coasts (García-Corrales, Aguirre & Gonzalez, 1978, as *H. tenellum*;

Table 24. Measurements of *Halecium delicatulum* in µm.

| | BALGIM Stn CP 68 |
|---|---|
| Internodes of axis, length | 950-1200 |
| diameter at node | 100-140 |
| Hydrotheca, distance diaphragm-rim | 30-45 |
| diameter at rim | 160-180 |
| Female gonotheca, maximal height | 970-1370 |
| maximal width | 450-640 |

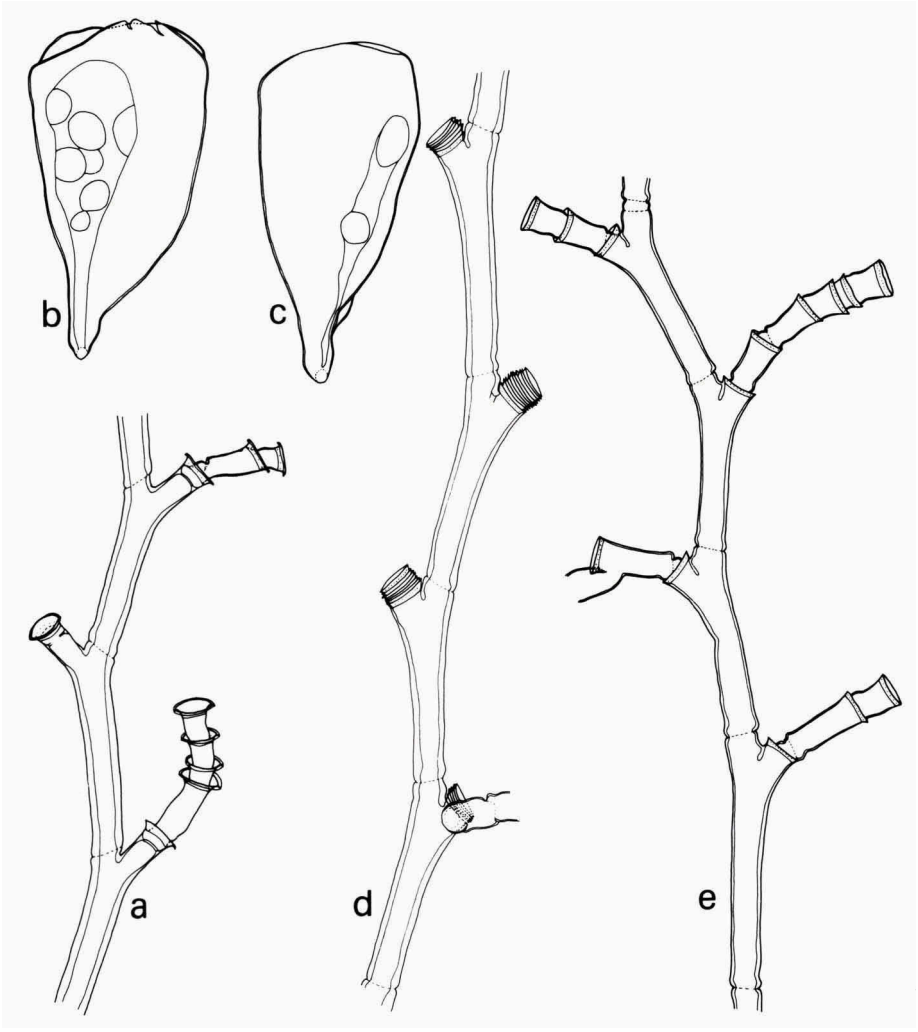


Fig. 20. a-c, *Halecium delicatulum* Coughtrey, 1876. a, from DR 42, part of stem. b, c, from CP 68, female gonothecae. d, *Halecium sessile* Norman, from CP 90, part of stem with repeatedly renovated hydrothecae. e, *Halecium* spec. 2, from DR 152, monosiphonic stem with base of side-branch springing from secondary hydranthophore. a-e, × 36.

García-Carrascosa, 1981), from the French Mediterranean littoral (Motz-Kossowska, 1911, as *H. gracile*; Stechow, 1919, as *H. mediterraneum*; Leloup, 1934, as *H. mediterraneum*), from the Italian coasts (Neppi, 1921, as *H. gracile*; Stechow, 1923d, as *H. mediterraneum*; Boero, 1981, as *H. mediterraneum*; Boero & Fresi, 1986, as *H. mediterraneum*), and from the Adriatic (Broch, 1933, as *H. mediterraneum*).

The BALGIM material originates from a locality off the Atlantic coast of Morocco (CP 68), from three localities west of the Strait of Gibraltar (DR 42, DW 50, DR 133), and from a locality in the Alboran Sea (DR 130). The depth records are between 135 and 2035 m.

Discussion.— Variability and synonymy of *Halecium delicatulum* have been discussed by Ralph (1958); in this report we have followed her views, particularly when establishing the geographical distribution. García-Corrales, Aguirre & González (1978) expressed the opinion that *H. delicatulum* should be included in *Halecium tenellum* Hincks, 1861, this specific name having priority. As Ramil & Iglisias (1988a) have done previously we have here followed García-Carrascosa (1981) in considering *H. delicatulum* to be clearly differentiated from *H. tenellum*; the specimens recorded by García-Corrales, Aguirre & González (1981) as *H. tenellum* should be included in the synonymy of *H. delicatulum*.

## **Halecium sessile** Norman, 1867
(fig. 20d)

*Halecium sessile* Norman, 1867: 196, 199, 205, 206; Hincks, 1868: 229-230, pl. 44 fig. 2; Billard, 1904a: 157-160, pl. 6 figs. 1-14; Ritchie, 1911: 812-813, pl. 87 figs. 8-9; Vervoort, 1966: 100-102, fig. 1; Cornelius, 1975b: 406-409, fig. 11.

Material.— BALGIM Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: a few colonies c. 45 mm high from stolon on *Acryptolaria conferta minor*; no gonothecae.

Description.— Hydrocaulus polysiphonic, though in its basal part axis is formed also by axis of a colony of *Acryptolaria conferta minor* on which *H. sessile* is growing. Axis ramified, branches disposed pinnately to left or right, though irregularities do occur and some branches are not in the plane of ramification. In monosiphonic parts of colony axis is seen to be composed of segments separated by slightly oblique nodes, each segment bearing at its distal part a sessile hydrotheca and a lateral apophysis surpassing the hydrothecal rim and supporting the next segment. Primary hydrothecae alternately directed left and right, fully sessile, low and with smooth rim, plane of aperture oblique, with basal diaphragm and a row of desmocytes typical of Haleciidae just above diaphragm. Majority of primary hydrothecae with numerous (5-10) renovations, none with distinct hydranthophore, each renovation being short and inserting at diaphragm of previous hydrotheca, closely packed (fig. 20d). Exact number of renovations can only be established after careful study of the slide. Renovated hydrothecae as primaries, though with slightly widening walls as diameter at diaphragm is less than that at hydrothecal rim; margin not everted.

Ramifications always originating directly under a primary hydrotheca and placed on small apophysis, forming annulation at base of branch. Communication

Table 25. Measurements of *Halecium sessile* in μm.

| | BALGIM Stn CP 90 | Bay of Biscay (Cornelius, 1975) |
|---|---|---|
| Axial segments, length | 500-900 | 550-700 |
| diameter at node | 100-130 | 90-130 |
| Hydrotheca, length diaphragm-rim | 15-25 | 25-35 |
| diameter at rim | 130-140 | 130-170 |

between apophysis and axis by means of transparent circular hole; morphology of branch as that of axis. Secondary ramifications of identical structure have also been observed.

Distribution.— Ralph (1958) considers *Halecium sessile* to be a cosmopolitan species; the worldwide distribution has been discussed by Vervoort (1966). In the eastern Atlantic it occurs from the Norwegian coasts southward until the Atlantic off Senegal (Vervoort, 1966). The BALGIM material originates from an Atlantic locality near Rabat, Morocco (CP 90), depth 890 m.

Discussion.— The BALGIM material agrees with eastern Atlantic material previously described by Billard (1904) and Cornelius (1975) and is characterized by a succession of extremely short renovated hydrothecae without proper hydranthophores. Differences between Atlantic and Indo-Pacific material described as *Halecium sessile* have been indicated by Vervoort (1966). There are also distinct differences between female gonothecae from the northern coasts of France described by Billard (1904) and those from New Zealand waters described by Ralph (1958). There are additional differences in the renovated hydrothecae between Atlantic material, where a hydranthophore is absent, and the Indo-Pacific material, that usually develops distinct hydranthophores, also occurring in colonies described by Millard (1975) from the east coast of South Africa (Durban region). The sterile BALGIM colony is not in good shape and does not permit any definite conclusions.

### **Halecium sibogae marocanum** Billard, 1934
(figs. 21a-e, 22a-b)

*Halecium Sibogae marocanum* Billard, 1934: 229, fig. 2; Van Praët, 1979: 880.
*Halecium sibogae* var. *marocanum* - Patriti, 1970: 25, fig. 23.

Material.— BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: five fragmented colonies 5-40 mm high of which two with gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: two damaged fragments 10 and 25 mm high with a gonotheca and a small colony 5 mm high on *Polyplumaria flabellata*, no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: single colony 5 mm high on *Sertularella gayi gayi* and 15 mm high colony on worm-tube; no gonothecae. Also fragment 3 mm high without gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: eleven fragments 5-12 mm high, without gonothecae, on tube of polychaete. Also colony composed of various 15 mm high hydrocauli on worm-tube; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: two colonies and six fragments 7-30 mm high, without gonothecae, on calcareous tube. Single colony composed of various 5-10 mm high hydrocauli on fragment of *Turritopsis nutricula*. Also two fragments 5 and 10 mm high, no gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: two colonies 13 and 25 mm high, no gonothecae, one growing on worm-tube. Single damaged fragment with gonothecae 12 mm high.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: three fragments 10-15 mm high one of which with gonotheca in bad condition.

Description.— Axis polysiphonic, branched and erect, rising from stolonal fibres (hydrorhiza) firmly attached to substratum (other hydroids, worm-tubes, etc.). Ultimate parts of colony monosiphonic, composed of succession of geniculate internodes that give axis distinct zig-zag appearance; internodes separated by means of oblique nodes only visible in youngest parts of colony. In older parts nodes obscured by strong development of perisarc and only indicated by perisarcal constrictions or

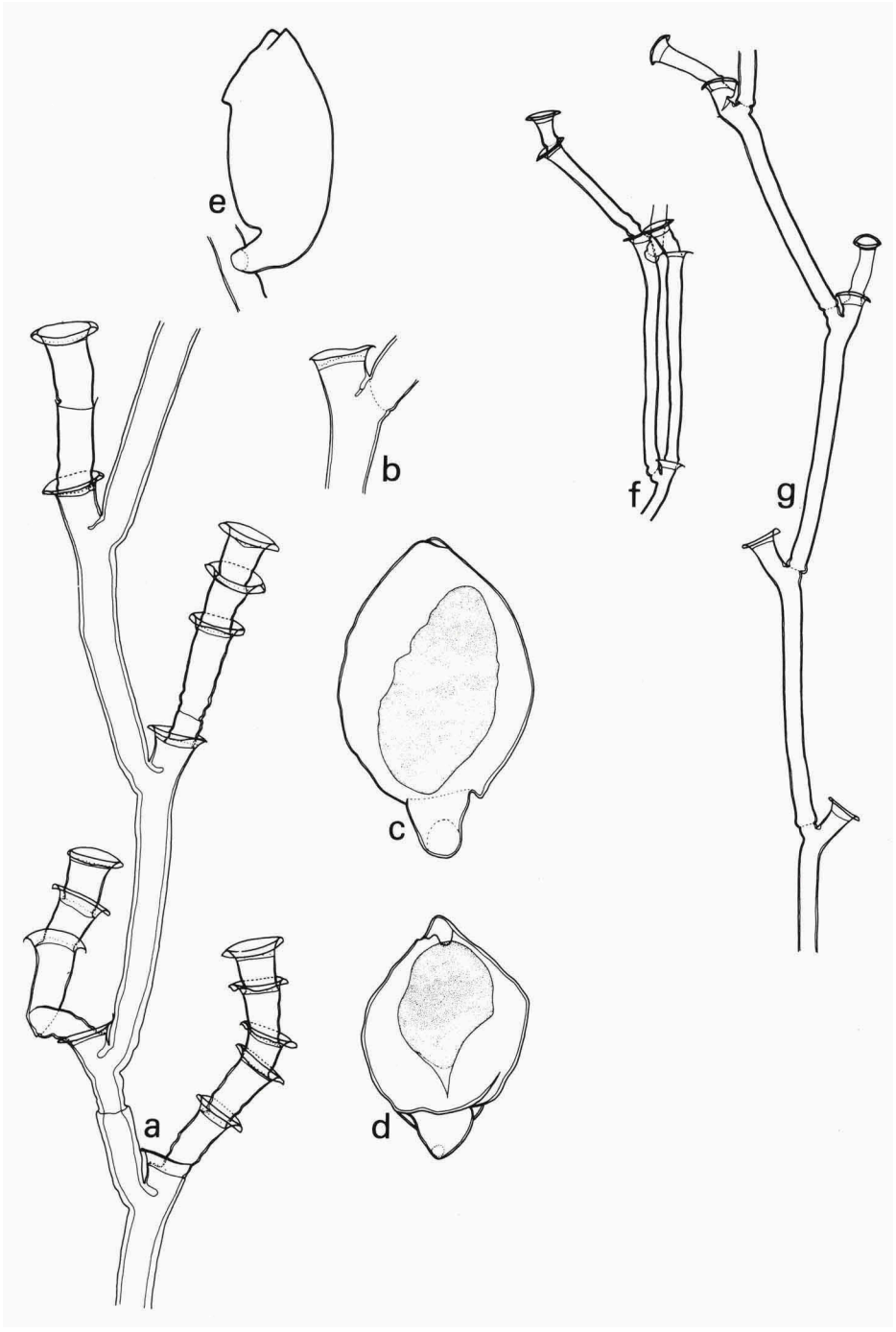


Fig. 21. a-e, *Halecium sibogae maroccanum* Billard, 1934. a, from DW 130, part of stem; b-d, from DW 50, b, distal part of internode with hydrotheca and apophysis supporting next internode; c, d, (?)male gonothecae; e, from DW 134, male (?) gonotheca. f, g, *Halecium tenellum* Hincks, 1861, from DW 132. f, development of renovated hydrothecae; g, part of small colony. a-g, × 36.

totally absent (fig. 21a). Each internode distally with well developed primary hydranthophore; the next internode rises laterally of that hydranthophore and at its base without distinct apophysis (fig. 21b). Adcauline wall of primary hydranthophore at place of fusion with wall of internode with characteristic, internally directed, comma-shaped perisarcal fold (fig. 21a, b). Length of primary hydranthophore varied; primary hydrotheca with distinct basal diaphragm and widening apically; rim distinctly everted. Secondary, tertiary and following hydranthophores originating from diaphragm of previous hydrotheca, usually smooth-walled but occasionally with one or two basal annulations; length varied. Secondary, etc. hydrothecae as primaries, with everted rim; as many as six renovated hydrothecae have been observed (fig. 21a). Line of desmocytes just above diaphragm usually visible in all hydrothecae.

Side-branches develop from axis directly under primary hydranthophore and are alternately directed left and right in pinnate fashion and in same plane with axis. In structure side-branches agree with axis.

Gonothecae inserting at base of primary hydranthophores (fig. 21e), globular, apically with two more or less developed elevations, between which is situated the gonophoral aperture at the end of a short cone (fig. 21c, d). Inside of gonothecae in stained slides formed by strongly coloured, uniform mass; their sex is probably male.

Table 26. Measurements of *Halecium sibogae* and *H. sibogae marocanum* in µm.

| | *H. sibogae* BALGIM Stn DW 130 | *marocanum* own measurements | *H. sibogae* Billard, 1934 |
|---|---|---|---|
| Internode, length | 730-1070 | 850-925 | |
| diameter | 120-140 | 125-140 | |
| Primary hydranthophore plus hydrotheca, height | 105-180 | | 55-110 |
| Primary hydrotheca, length diaphragm-rim | 40-55 | 45-50 | |
| diameter at diaphragm | 140-160 | 140-170 | 165-180 |
| diameter at rim | 220-250 | 220-265 | 210-230 |
| Gonotheca (sex unknown), maximal height | | 815 | |
| maximal diameter | | 445 | |
| Gonotheca (probably male), maximal height (BALGIM DW 50) | 910-1170 | | |
| maximal diameter | 640-760 | | |

Distribution.— *Halecium sibogae marocanum* so far has only been obtained at Cape Cantin on the Atlantic coast of Morocco, depth 110 m (Billard, 1934). The nominate subspecies, *H. sibogae sibogae* was described by Billard (1929) after material collected by the Siboga Expedition in the eastern part of the Malay Archipelago and was redescribed by Gibbons & Ryland (1989) from the Fiji islands.

The BALGIM material originates from three localities in the Atlantic off Cape Spartel, Morocco (DR 49, DW 50, DW 114), from one locality in the Strait of Gibraltar proper (DR 153), and from three localities in the Alboran Sea, off the coast of Morocco (DR 130, DW 132, DW 134). The depths records are between 145 and 580 m. This is the first record of the species from the Mediterranean.

Discussion.— *Halecium sibogae marocanum* is characterized by the presence of a

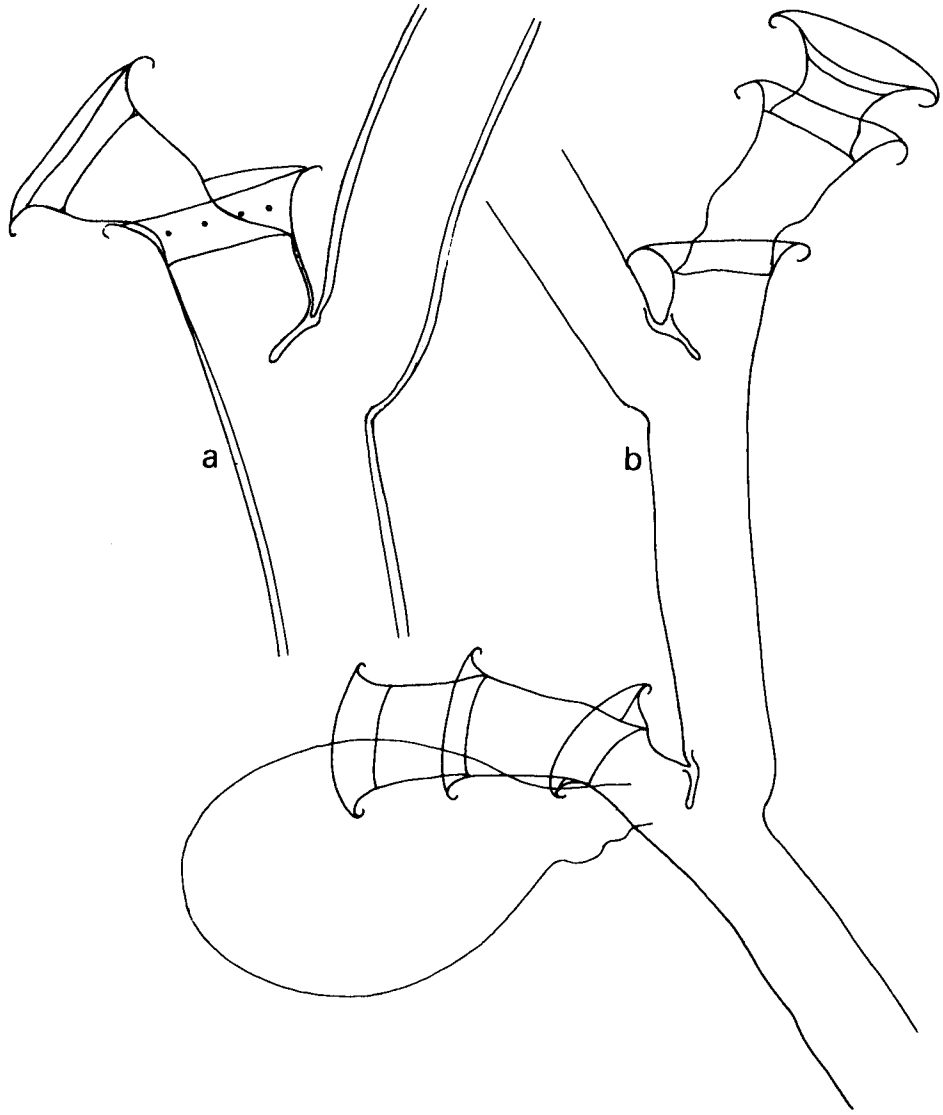


Fig. 22. a, b, *Halecium sibogae maroccanum* Billard, 1934, from Billard's slide no. 147 in MNHN, Vanneau Exped., Stn XI. a, renovated hydrotheca; b, monosiphonic part of colony with repeatedly renovated hydrothecae and a gonotheca. a, × 110; b, × 75.

perisarcal fold at the base of the adcauline wall of the hydranthophore and the widening hydrothecae with strongly everted rim. The fore-mentioned perisarcal fold separates this species from *Halecium tenellum* Hincks, 1861. In the latter there may be a slight perisarcal thickening at the base of the primary hydranthophore, but it never takes the shape of a strong fold. *H. sibogae marocanum* may have polysiphonic colonies (never in *H. tenellum*) and the hydrothecae are much larger. The perisarcal fold also separates *H. sibogae marocanum* from *H. delicatulum* Coughtrey, 1876, where such fold is

absent; the latter has a pseudodiaphragm under the primary hydrotheca (and sometimes also the secondary hydrotheca) which is always lacking in *H. sibogae marocanum*. In *Halecium liouvillei* Billard, 1934, also described from the Moroccan coasts, the primary hydrotheca is always sessile: a primary hydranthophore is totally absent in that species. The nominate subspecies differs from *H. sibogae marocanum* by the bigger colony, shorter primary hydranthophores, less widening hydrothecae with less everted rim that have a larger diameter at the level of the diaphragm.

Comparison of the measurements shows that the size differences are slight but we have though it wise to keep both subspecies separate until a more abundant material, particularly of the nominate subspecies, has become available. The measurements of *Halecium sibogae marocanum* presented above are based on the inspection of Billard's holotype slide (alcohol preserved material is not available) in Billard's slide collection in MNHN. This slide, L 147, bears the label: "*Halecium Sibogae marocanum* n. var. Billard fec. 6.v.1936, "Vanneau" Stat. XI". The locality is off Cape Cantin, Morocco, 110 m depth; the slide contains three carmine stained branches 5-7 mm high, one of which has a gonotheca (fig. 22b). All branches are monosiphonic and do not rebranch. The primary hydrothecae have strongly everted margins, as have the secondaries and tertiaries that are occasionally present. The perisarcal fold at the base of the primary hydranthophore is distinct (fig. 22a, b). Desmocytes are also occasionally visible. The gonotheca is attached to an apophysis supporting a primary hydranthophore; basal portion (pedicel?) indistinctly ringed or ribbed (fig. 22b). No hydranths could be seen on the gonotheca; its sex could not be ascertained.

## Halecium tenellum Hincks, 1861
(fig. 21f, g)

*Halecium tenellum* Hincks, 1861: 252, pl. 6 figs. 1-4; Hincks, 1868: 226-227, pl. 45 fig. 1; Vervoort, 1946b: 164-165, fig. 68; Vervoort, 1959: 229-231, fig. 8; Vervoort, 1966: 102, fig. 2; Cornelius, 1975b: 409-411, fig. 12; Millard, 1975: 156-157, fig. 50F-L; Calder, 1991: 22-24, fig. 14.

Material.— BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: three colonies composed of numerous unbranched hydranthophores with renovations, no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: small colony 5 mm high with unbranched, renovated hydranthophores on *Polyplumaria flabellata*; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: four colonies composed of various erect axes 5-10 mm high on *Sertularella cylindritheca* and *S. gayi gayi*; no gonothecae. Single 1 mm high colony on *Sertularella gayi gayi*; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: colonies 5-10 mm high on *Sertularella gayi gayi* and worm-tubes; no gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: several colonies 5-10 mm high on *Halecium delicatulum* and *Sertularella gayi gayi*; no gonothecae. Single 10 mm high colony on *Kirchenpaueria pinnata*; no gonothecae. One colony of six hydrocauli up to 4 mm high on Bryozoa; no gonothecae. Three colonies up to 10 mm high on *Lytocarpia myriophyllum*; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: two colonies up to 10 mm high, no gonothecae. Colony composed of c. 15 hydrocauli 5-15 mm high on *Thuiaria* spec.; no gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: Several up to 15 mm high, monosiphonic stems may belong here; no gonothecae.

Description.— Hydrocaulus erect, monosiphonic and usually unbranched, rising from small apophysis on hydrorhiza attached to substratum. Axis of sympodial built, composed of a number of geniculate internodes. Each internode basally with

Table 27. Measurements of *Halecium tenellum* in μm.

| | BALGIM Stn DW 132 |
|---|---|
| Axial internodes, length | 560-1060 |
| diameter at node | 40-65 |
| Hydrotheca, distance diaphragm-margin | 25-40 |
| diameter at rim | 125-150 |

characteristic annulation just above insertion on previous apophysis; distal part with well developed hydranthophore, alternately directed left or right, at the base of which there is a small lateral apophysis supporting next internode (fig. 21f, g). Hydrotheca shallow and widening considerably; rim strongly everted; diaphragm distinct. Secondary, tertiary and succeeding hydranthophores inserting on diaphragm of preceding hydrotheca, of varied length and with basal annulation (fig. 21f). Secondary, tertiary, etc. hydrothecae also with basal diaphragm and strongly everted margin. Ramifications have occasionally been observed; they originate from the secondary hydranthophores and insert on a short apophysis just under secondary hydrotheca; ramification basally with annular constriction, in structure identical to main axis.

Distribution.— Millard (1975) considers *Halecium tenellum* a cosmopolitan species. Cornelius (1975b), in his revision of British species of *Halecium* cites Hamond (1957) who considers many of the records of this species doubtful because of confusion with related species such as *H. undulatum* Billard, 1921. This prompted Cornelius (1975b) to consider the geographical distribution of *H. tenellum* to be imperfectly known. *H. undulatum* is included by Cornelius (1975b) in the synonymy of *Halecium labrosum* Alder, 1859, an opinion which we share. However, we consider *H. labrosum* and *H. tenellum* to be two distinctly separate species, separable by characters of colony structure and details of the hydrothecae and gonothecae and we have reservations concerning the confusion existing around *H. tenellum* that we think is properly characterized.

The BALGIM material originates from the Atlantic west of the Strait of Gibraltar (DR 49, DW 50), from two Atlantic localities west of Cape Spartel, Morocco (DR 113, DW 114) and from two localities in the Alboran Sea off the coast of Morocco (DR 130, DW 132). The depths records are from between 144 and 523 m.

Discussion.— This is a well known species that needs no further comment.

## Halecium spec. 1

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: single mutilated colony 5 mm high on *Sertularella gayi gayi*; no gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: single colony 5 mm high on *Kirchenpaueria pinnata*; no gonothecae.

Discussion.— The material recorded above is young; it consists of a single hydranthophore with a few renovations. The hydrotheca widens apically and has a strongly everted rim. The material may represent young colonies of either *Halecium delicatulum* Coughtrey, 1876, or *H. sibogae marocanum* Billard, 1934, that are both present in the BALGIM collection. The colonies are insufficiently developed and thus can not be properly identified.

## **Halecium** spec. 2
(fig. 20e)

**Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: three fragments 5-20 mm high, without gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: two fragments 10 and 20 mm high, without gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: two colonies 5 and 15 mm high on stone; no gonothecae. In addition two fragments 5 and 17 mm high, without gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: six fragments of a larger colony, 5-25 mm high, without gonothecae.**

Description.— Colonies composed of erect, polysiphonic axis attached to substrate by means of perisarcal tubes (hydrorhiza); axis occasionally bifurcated at basal part, bearing pinnately arranged side-branches, pointing alternately left and right and in same plane with axis. Monosiphonic parts of axis divided into segments by oblique nodes, each segment with sessile, distal hydrotheca and a lateral apophysis, supporting next segment. Hydrothecae alternately directed left and right, with basal diaphragm, neither widening nor with everted rim, usually with numerous renovations; secondary, tertiary and following hydranthophores with basal constriction or annulation and smooth walls (fig. 20e). Length of additional hydranthophores varied, those of higher order (4th or 5th) usually shorter, with less distinct annular constriction at base. Hydrothecae of second, third or superior order identical with primaries. All hydrothecae have a row of hyaline desmocytes above diaphragm as is characteristic of the Haleciidae.

Side-branches originating from base of axial hydrothecae or occasionally from primary hydranthophore (fig. 20e). Secondary ramifications developing in same fashion. All ramifications in structure similar to axis.

Distribution.— The BALGIM material described above originates from two Atlantic localities west of the Strait of Gibraltar (DR 42, DR 49) and from two localities in the Strait (DR 152, DR 153), depth 135-580 m.

Discussion.— The present sterile material matches both the description of *Halecium beanii* (Johnston, 1838) and *H. halecinum* (Linnaeus, 1758). Though well developed sterile specimens of both species can usually be distinguished the principal differences between both species concern the structure of the female gonotheca. Consequently it is usually impossible to discriminate between small, sterile specimens of the two species, though several authors (e.g., Vervoort, 1959) have drawn attention to the fact that in *H. halecinum* the basal chamber of the second, third and further hydranthophores have a tendency towards asymmetry in contradistinction to the condition in *H. beanii*, where the said chamber is usually symmetrical. This character, nevertheless, is subjected to considerable variability. Judged by the shape of the basal chamber of the additional hydranthophores the BALGIM material approaches *H. beanii*; they also greatly resemble the (sterile) material described under that name by Vervoort (1972) and as well as that of *Halecium* cf. *beanii* mentioned by Vervoort & Rees (1987), the latter being also sterile.

Table 28. Measurements of *Halecium* spec. 2 in µm.

| | BALGIM Stn DR 152 |
|---|---|
| Axial segments, length | 570-1010 |
| diameter at node | 90-140 |
| Hydrotheca, length diaphragm-rim | 15-35 |
| diameter at rim | 120-140 |

## Family **Aglaopheniidae** Broch, 1918
## Genus **Aglaophenia** Linnaeus, 1758

### **Aglaophenia kirchenpaueri** (Heller, 1868)
(fig. 23a)

*Plumularia kirchenpaueri* Heller, 1868: 40, pl. 2 fig. 4.
*Aglaophenia kirchenpaueri* - Marktanner-Turneretscher, 1890: 263, pl. 7 figs. 9, 22; Svoboda, 1979: 87-90, figs. 12g, 13g, 14c, 15g. 16g, pl. 5 figs. d-f; Templado et al., 1986: 98.
*Aglaophenia septifera* Broch, 1913: 6-7, fig. 8.

Material.— BALGIM Stn CP 145, 35°56.6'N-03°07.9'W, 16.vi.1984, 373 m: five mm long hydrocladium.

Description.— Hydrocladium composed of 13 internodes, each with one hydrotheca and three nematothecae in the location characteristic of *Aglaophenia*. There is an intrathecal septum in each hydrotheca which enables exact identification of the fragment (fig. 23a).

Table 29. Measurements of *Aglaophenia kirchenpaueri* in µm.

| | BALGIM Stn CP 145 |
|---|---|
| Hydrocladial internode, length | 410-460 |
| Hydrotheca, diameter at rim | 240-260 |
| total depth | 290-310 |
| length free part abcauline wall | 130-150 |

Distribution.— *Aglaophenia kirchenpaueri* is a Mediterranean and Lusitanian species; the distribution in the Atlantic reaches from the Isle of Lundy in the north to the Cape Verdian Islands in the south (Svoboda, 1979). The BALGIM specimen originates from the Alboran Sea (CP 145), depth 373 m.

Discussion.— The maximal known depths for the species so far were 90 m (Straits of Messina, Svoboda, 1979) and between 70 and 120 m (vicinity of Alboran Island, Templado et al., 1986). The present record extends the depth distribution rather considerably.

### **Aglaophenia cf. lophocarpa** Allman, 1877
(fig. 23b, c)

*Aglaophenia lophocarpa* Allman, 1877: 41, pl. 24 figs. 1-4; Svoboda, 1979: 82-86, figs. 12e, 13e, 15e, 16e; Gili, Vervoort & Pagès, 1989: 92-94, fig. 20A.
*Aglaophenia apocarpa* Allman, 1877: 41-42, pl. 24 figs. 5-9.

Material.— BALGIM Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: single 15 mm high colony; no corbulae.— Stn DR 75, 33°52.7'N-08°15.2'W, 06.vi.1984, 252 m: single colony 20 mm high, no corbulae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: single colony 5 mm high without corbulae.

Description (of the material from CP 26).— Colony with erect, unbranched axis, of which basal part is formed by an undivided segment followed by a prosegment with a single nematotheca. Rest of axis formed by regular succession of segments each bearing an apophysis and three nematothecae: one under the apophysis and two axillary; apophyses alternately directed left and right. Hydrocladia composed of regular succession of hydrothecate internodes separated by transverse nodes; each

internode bearing one hydrotheca and three nematothecae: one median fused with the hydrothecal base and two laterals. Hydrotheca elongated, deep, with poorly developed internal septum at adcauline bottom. Hydrothecal rim with four pairs of lateral cusps and one median abcauline cusp, all well developed. Median nematotheca covering basal third of abcauline hydrothecal wall; free part pointing away from hydrotheca almost perpendicularly to hydrothecal length axis; terminal aperture gutter-shaped. Laterals slightly projecting above hydrothecal rim; terminal aperture also gutter-shaped. Each hydrothecate internode with distinct septum (internal ridge) basally at level of internal hydrothecal septum (fig. 23c). In some hydrocladia the first hydrotheca has a membrane closing the communication between interior of hydrotheca and median nematotheca.

In the material from DR 75 the septum (internal ring) in the hydrocladial internodes is scarcely developed (fig. 23b).

Table 29. Measurements of *Aglaophenia lophocarpa* in µm.

| | *Aglaophenia* cf. *lophocarpa* BALGIM Stn CP 26 | BALGIM Stn DR 75 | *Aglaophenia lophocarpa* Guinea Bissau (Gili, Vervoort & Pagès, 1989) |
|---|---|---|---|
| Axial segment, length | 365-430 | 340-460 | 500-1100 |
| diameter at node | 80-95 | 55-70 | 450-650 |
| Hydrocladial internode, length | 540-560 | 550-625 | 550-580 |
| diameter at node | 50-60 | 40-45 | |
| Hydrotheca, total depth | 450-480 | 430-490 | 480-500 |
| diameter at rim | 160-180 | 155-160 | 180-195 |
| length free part abcauline wall | 285-320 | 310-315 | |

Distribution.— *Aglaophenia lophocarpa* is known from the Mediterranean, from the Azores and from the Caribbean (Svoboda, 1979). Recently the species has also been recorded from the coasts of Guinea Bissau (Gili, Vervoort & Pagès, 1989). The BALGIM material comes from one locality in the Gulf of Cádiz (CP 26); from one locality near Casablanca, Morocco (DR 75) and from one locality in the Strait of Gibraltar (DR 153); the depths records vary between 252 and 580 m.

Discussion.— The material inspected, consisting of small, juvenile colonies, can not possibly be identified with certainty. The shape of the hydrothecae and its measurements conform with the material described by Gili, Vervoort & Pagès from the coasts of Guinea Bissau as *Aglaophenia lophocarpa*, for which reason is here doubtfully mentioned under that name.

## Aglaophenia picardi Svoboda, 1979
(fig. 23d)

*Aglaophenia picardi* Svoboda, 1979: 70-74, figs. 12b, 13b, 15b, 16b, pl. 1 fig. a, pl. 7 fig. b.

Material.— BALGIM Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: single fragment five mm high composed of piece of stolon with one axis bearing a total of seven hydrocladia in bad condition of which the largest has three hydrothecae. No corbulae.

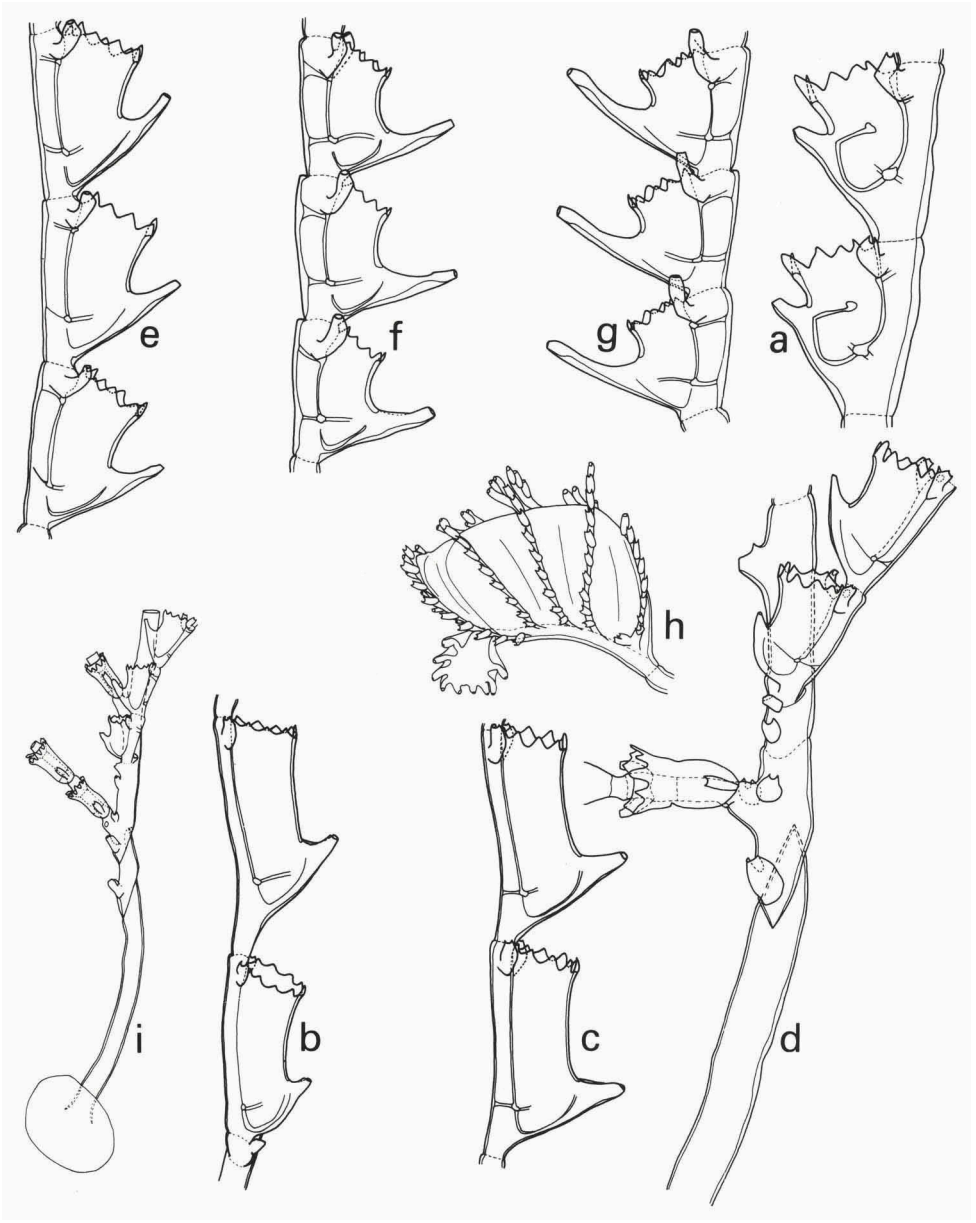


Fig. 23. a, *Aglaophenia kirchenpaueri* (Heller, 1868), from CP 145, two hydrocladial internodes with hydrothecae. b, c, *Aglaophenia* cf. *lophocarpa* Allman, 1877. b, from DR 75, two hydrocladial internodes with hydrothecae; c, from CP 26, two hydrocladial internodes with hydrothecae. d, *Aglaophenia picardi* Svoboda, 1979, from DR 153, basal part of colony, oblique frontal view. e-i, *Aglaophenia tubulifera* (Hincks, 1861). e, from DR 152, three hydrocladial internodes with hydrothecae; f, the same from DW 114; g, the same from DR 115; h, from DR 153, corbula; i, from DW 114, young colony. a-g, × 50; h, i × 20.

Description.— Stolon composed of perisarcal tube giving rise to single erect, monosiphonic, unforked axis; basal part of axis (2.5 mm long) without segmentation. Prosegment absent; first axial segment separated from basal portion by strongly oblique node, bearing one apophysis and three nematothecae: one basal and two axillary (fig. 23d). Same arrangement also observed in rest of axial segments, that are separated by transverse nodes. Hydrocladia inserting on apophyses, alternately directed left and right. Largest hydrocladium composed of three hydrothecate internodes separated by transverse nodes; each internode with single hydrotheca and three nematothecae: one median infracalycine and two laterals at hydrothecal rim. Hydrotheca elongate, almost twice as long as wide, with fine adcauline intrathecal septum; hydrothecal rim with nine distinct marginal cusps with rounded extremities; median abcauline cusp best developed.

Median inferior nematotheca largely adnate to basal half of abcauline hydrothecal border; end of free portion approximately at level of half abcauline wall. Lateral nematothecae slightly surpassing hydrothecal rim. Aperture of median inferior nematotheca apparently gutter-shaped, this however could not unambiguously be observed considering the small number of hydrothecae present. Lateral nematothecae either with gutter-shaped aperture or with two apertures, one terminal, one lateral. The presence of both types of lateral nematothecae, even on the same hydrocladial internode, has occasionally been observed.

Table 30. Measurements of *Aglaophenia picardi* in µm.

| | BALGIM Stn Dr 153 | Mediterranean (holotype; Svoboda, 1979) |
|---|---|---|
| Axial segment, length | 250-370 | |
| diameter at node | 105-115 | |
| Hydrocladial internode, length | 355-365 | 306 |
| diameter at node | 55-60 | |
| Hydrotheca, total depth | 335-345 | 274 |
| diameter at rim | 165-170 | 180 |
| length free part abcauline wall | 180-190 | 137 |

Distribution.— *Aglaophenia picardi* is widely distributed in the Mediterranean: North Adriatic, Sicily, Italian coasts of the Tyrrhenean and Ligurian Seas, off Marseilles and Algerian coasts (Svoboda, 1979). In the Atlantic it has been observed at Bilbao harbour, northern Spain (Isasi & Saiz, 1986) and near the Cape Verdian Islands (Svoboda, 1979). The present material is from a locality in the Strait of Gibraltar (DR 153) and from 580 m depth. This record would considerably extend the bathymetric range of the present species, so far known to extend as deep as 90 m in zones with a strong current, as e.g. Messina Strait (Svoboda, 1979).

Discussion.— In spite of the fact that the BALGIM colony is small and rather mutilated the absence of a prosegment in the axis (fig. 23d) strongly points towards *Aglaophenia picardi*, the only European species of *Aglaophenia* so far known to lack the prosegment. If the measurements of the present material are compared with those of the type of *A. picardi* it is clear that those of the hydrothecate internode, the depth of the hydrotheca and the length of the free portion of the abcauline margin are superi-

or in the BALGIM material, which might be explained from the fact that Svoboda's holotype was collected at 2 m depth and the BALGIM colony originates from c. 580 m depth. In the BALGIM material, however, the depth of the hydrotheca is twice its diameter at the rim, as is also the case in Svoboda's holotype of *A. picardi*. The exact shape of the aperture of the median infracalycine nematotheca could not be distinctly interpreted, but it is probably gutter-shaped as in Svoboda's material. The presence of two types of openings of the lateral nematothecae so far has not been described in this species; the absence of prosegments, however, proves that the material belongs to *Aglaophenia picardi* (Svoboda, personal communication).

### **Aglaophenia tubulifera** (Hincks, 1861)
(fig. 23e-i)

*Plumularia tubulifera* Hincks, 1861: 256, pl. 7 figs. 1-2.
*Aglaophenia tubulifera* - Hincks,1868: 288-289, pl. 63 fig. 2; Billard, 1906d: 231-237, figs. 20-21; Svoboda, 1979: 86-87, figs. 12f, 13f, 15f, 16f, pl. 5 figs. g-i.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: two fragments 17 and 37 mm high; no corbulae. In addition seven fragments 5-15 mm high, one of which with corbula.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: four colonies 4-6 mm high epizootic on *Eudendrium* spec.; no corbulae and one colony 3 mm high on polychaete tube, no corbulae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: single 5 mm high colony without corbulae on polychaete tube.— Stn CP 109, 36°14.5'N-07°56.4'W, 10.vi.1984, 1200 m: single juvenile colony, developed directly from larva, 3 mm high, on *Diphasia pinastrum*. No corbulae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: single colony 6 mm high epizootic on *Sertularella gayi gayi*; no corbulae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: three colonies 20-60 mm high without corbulae. Single colony 5 mm high on *Sertularella gayi gayi*, no corbulae.— Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: single colony 15 mm high without corbulae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: single colony 5 mm high on tube of polychaete and colony 11 mm high epizootic on *Sertularella* spec.; no corbulae. In addition colony developed directly from larva and 5 mm high on *Halecium sibogae marocanum*.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: fragment 28 mm high; no corbulae.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: single fragment 6 mm high without corbulae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: four colonies and 18 fragments 3-15 mm high some with corbulae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: numerous up to 25 mm high colonies, some with corbulae, on coral fragments. Single colony 11 mm high without corbulae epizootic on base of *Polyplumaria flabellata*. Colony composed of three hydrocauli 5-8 mm high, without corbula, epizootic on *Sertularella* spec.

Description.— Axis with one prosegment bearing single frontal nematotheca. Hydrocladia composed of series of internodes each with one hydrotheca and three nematothecae: one median infracalycine and two laterals. Median inferior nematotheca variable in size, but always tubiform, with two apertures, one distal and one proximal, distinguishing the species from others in genus *Aglaophenia* (fig. 23e-g).

Corbula with five pairs of costae; female corbula with one free proximal costa. One of colonies with corbula with free distal costa, as has also been described in *Aglaophenia acacia* Allman, 1883 (cf. Svoboda, 1979) but appears to be undescribed in present species (fig. 23h). Zooxanthellae absent.

Variability.— One of the colonies from DR 153 has a hydrocladium which is transformed into an axis, forming a ramification of the colony. In this instance the hydrocla-

Table 31. Measurements of *Aglaophenia tubulifera* in μm.

| | BALGIM Stn DW 114 |
|---|---|
| Axial segment, length | 320-360 |
| diameter | 160-250 |
| Hydrocladial internodes, length | 355-390 |
| diameter at node | 90-110 |
| Hydrotheca, total depth | 300-325 |
| diameter at rim | 150-170 |
| length free part abcauline wall | 140-160 |

dium above the first hydrotheca is thickened and has three weak annulations, after which it is shaped like an axis bearing various hydrocladia as in a normal colony, though not bearing a basal prosegment. The presence of this extra axis may result from damage to the hydrocladium during development.

Distribution.— *Aglaophenia tubulifera* has a wide distribution in the eastern Atlantic, extending from the Irish Sea in the north (Svoboda, 1979) to the coasts of Guinea Bissau (Gili, Vervoort & Pagés, 1989). Mediterranean records are scarce, being restricted to the island of Alboran (Svoboda, 1979) and its vicinity (Templado et al., 1986). The BALGIM material is from the Atlantic side of the Strait of Gibraltar (DR 42, DW 50, CP 109, DR 115), from the Strait of Gibraltar (DR 151, DR 152, DR 153), and from the Alboran Sea (DR 130, DW 132); depths varying between 115 and 1200 m.

Discussion.— Amongst the material studied there are four colonies (DR 113, DW 114, DR 130, DR 153) representing the primary colony developing from the planula; which has given us the possibility to study the development of the colony. The relevant colonies (fig. 23i) have a small basal attachment disc from which rises an axis (hydrocaulus) of which the basal region is unsegmented, followed by a prosegment with oblique nodes and with a frontal nematotheca, and a regular sequence of axial segments each with one apophysis and three nematothecae. This type of development, without axial hydrothecae in the primary colony appears to be exceptional in the genus *Aglaophenia*. In such species of this genus in which the development of the primary colonies directly from the planula is known, there are always axial hydrothecae on the region of the axis below the first hydrocladium (Svoboda, personal communication).

## **Aglaophenia** spec. A

Material.— BALGIM Stn DW132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: seven mm high fragment without corbulae and much abraded.

Discussion.— The fragment consists of a fragment of axis, without tissue, with three hydrocladia in bad condition bearing only the first hydrotheca. One of hydrocladia with second, much damaged hydrotheca deprived of median nematotheca. Certain identification of the fragment is impossible.

## Genus **Cladocarpus** Allman, 1874

## **Cladocarpus boucheti** spec. nov.
(fig. 24a-f)

Material.— BALGIM Stn DW 16, 36°45.8'N-09°29.4'W, 30.v.1984, 1283 m: single colony 40 mm high

without phylactocarps (paratype).— Stn DW 20, 36°35.9'N-07°34.5'W, 31.v.1984, 452 m (type locality): single 70 mm high colony with basal tuft of fibres and sterile phylactocarp (holotype).— Stn DW 100, 34°28'N-07°42'W, 09.vi.1984, 1691 m: single 60 mm high colony without phylactocarp (paratype).

Description.— Axis polysiphonic, in its basal region not divided into segments, rising from tuft of fine perisarcal fibres. Primary axial tube bearing single longitudinal row of frontal nematothecae and apophyses alternately directed left and right. Normally there are one to three nematothecae between two consecutive apophyses, plus one axillary nematotheca. This, however, appears to represent a variable character as that number in the holotype varies between one and seven and may exceptionally be as much as 12. Axial tube in highest parts divided into segments by indistinct, transverse nodes, each segment with one apophysis and two nematothecae: one inferior, one axillary. In this part of axis there is normally one nematotheca between two consecutive apophyses.

Axial nematothecae tubular, with two apertures: a narrow apical aperture and a circular adcauline aperture near the base (fig. 24e). An incomplete internal septum occurs below basal aperture.

Hydrocladia inserting on apophyses, alternately directed left and right, divided into internodes be means of slightly oblique nodes. Each internode with one hydrotheca and five nematothecae: one median infracalycine, two laterals inserting near hydrothecal border and two supplementary lateral nematothecae, inserting slightly below middle of adcauline hydrothecal wall (fig. 24a).

Hydrothecae large, tubular, nearly whole of adcauline wall adnate, with exception of small distal portion, which at level of insertion of lateral nematothecae curves strongly forward, detaching itself from internode, so that opening of hydrotheca is directed frontally( fig. 24a, c). The abcauline wall is slightly concave in its lower third, to become convex at level of insertion of supplementary nematothecae, curving strongly inwards to form a considerable concavity just below hydrothecal aperture and terminating in that margin. Adcauline hydrothecal wall running practically parallel to abcauline wall: basal part slightly concave, middle region, near insertion of supplementary nematothecae convex and strongly concave distally. Hydrothecal border smooth, without marginal cusps (fig. 24b, d).

Median, infracalycine nematotheca springing from internode under hydrotheca, its terminal aperture at level with hydrothecal base or slightly surpassing, in structure similar to axial nematothecae.

Superior lateral nematothecae large, tubular, with two apertures, one apical with finely serrated border, one circular and basal, directed towards hydrotheca; incomplete internal septum occurs under that basal aperture. Supplementary nematothecae almost as superior ones, slightly longer. Length of lateral nematothecae variable, reaching extreme length in colonies from DW 100 (fig. 24b, c).

Each hydrocladial internode with eight to twelve internal septa: one or two basal septa, six to nine behind hydrotheca and one distal, which may be absent.

Phylactocarps springing from first internode of hydrocladium at base of first hydrotheca, single, composed each of three segments. First segment large, with four pairs of opposite nematothecae; segments two and three short, each with single pair of nematothecae. Nematothecae large and tubular, with finely serrated terminal aperture and with second basal, circular aperture at base of which incomplete inter-

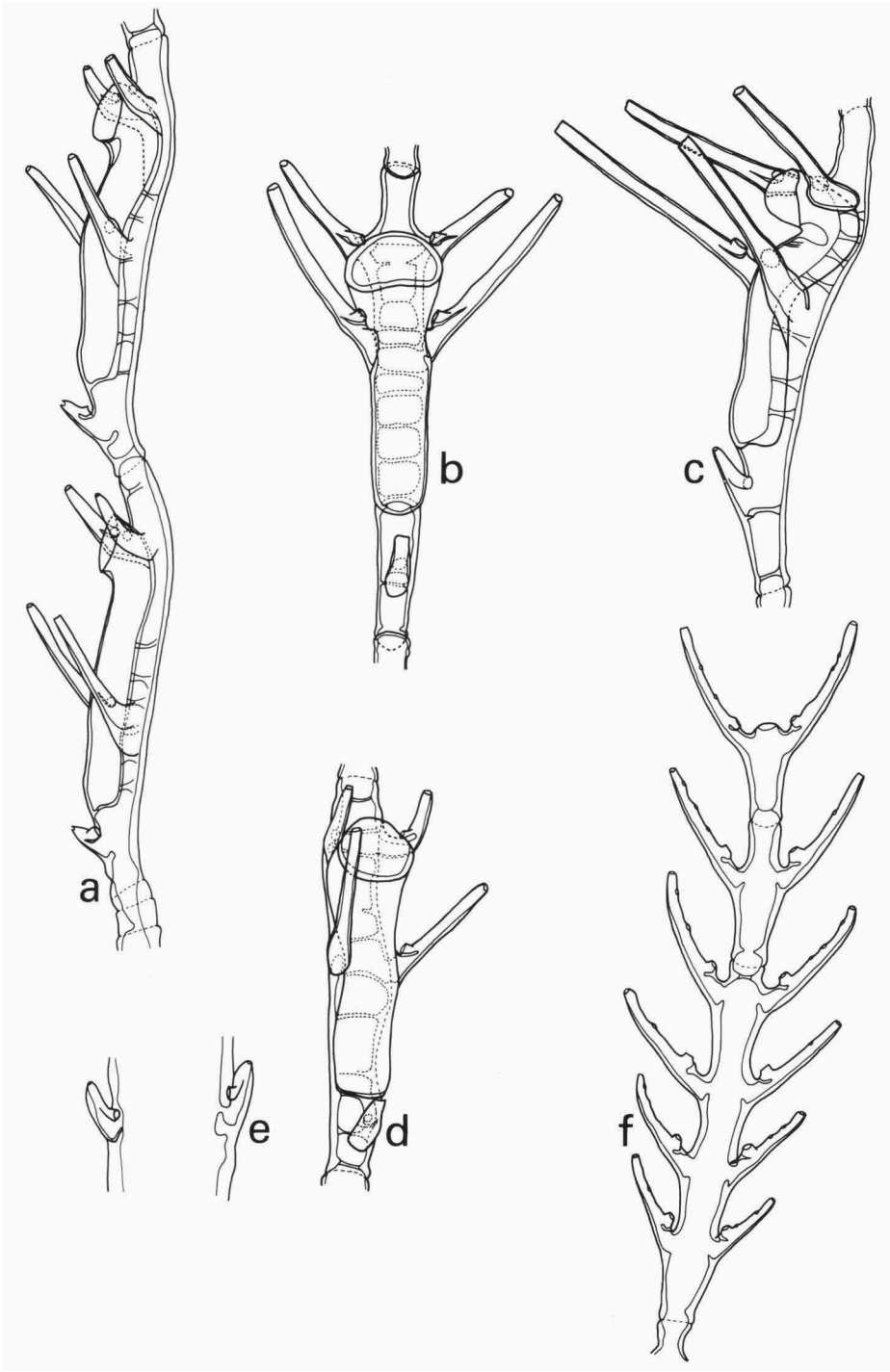


Fig. 24. *Cladocarpus boucheti* spec. nov. a, d, e, f, holotype, from DW 20; b, c, paratype, from DW 100. a, two hydrocladial internodes with hydro- and nematothecae, lateral view; b, hydrocladial internode with hydro- and nematothecae, frontal view; c, idem, oblique lateral view. d, idem, oblique frontal view; e, two axial nematothecae, lateral view; f, sterile phylactocarp, view from above. a-c, f, × 57; d, e, × 60.

nal septum is visible. Between both apertures there are one to three smaller lateral openings (fig. 24f).

Variability.— The colony from DW 100, besides having much longer lateral nematothecae than those from DW 16 and DW 20, also has a much stronger curvature of the distal part of the hydrotheca (fig. 24c), resulting in a great difference between the frontal and lateral diameter, as can also be seen from the measurements presented below.

Table 32. Measurements of *Cladocarpus boucheti* in µm.

| | BALGIM Stn DW 20 | BALGIM Stn DW 100 |
|---|---|---|
| Axial nematotheca, length | 110-130 | 160-180 |
| diameter at rim | 15-20 | 20 |
| Hydrocladial internode, length | 980-1050 | 990-1130 |
| diameter at node | 70-90 | 70-85 |
| Hydrotheca, depth | 560-680 | 535-560 |
| diameter at rim, frontal | 140-200 | 120-140 |
| diameter at rim, lateral | 130-180 | 220-250 |
| Median, infracalycine nematotheca, length | 140-155 | 160-190 |
| diameter at rim | 10-20 | 10-15 |
| Superior lateral nematotheca, length | 200-260 | 450-520 |
| diameter at rim | 15-30 | 25-30 |
| Supplementary lateral nematotheca, length | 220-369 | 550-650 |
| diameter at rim | 20-25 | 30-35 |

Distribution.— This species has been collected at three Atlantic localities, viz. SW of Cape São Vicente (DW 16), S of Faro (DW 20, type locality) and off Rabat at the coast of Morocco. The first two records are between 452 and 1283 m depth, the third from 1691 m depth.

Discussion.— The presence of a phylactocarp in the material from DW 20 makes it possible to include this species in the genus *Cladocarpus* Allman, 1877. In the presence of a pair of supplementary lateral nematothecae and in the structure of the phylactocarp *C. boucheti* approaches *C. corneliusi*, from which species it is directly to separate by the frontal orientation of the hydrothecal aperture, by the length of the lateral nematothecae and by the fact that those lateral nematothecae have but a single circular distal aperture.

Etymology.— It is a pleasure to dedicate this fine species to Dr Philip Bouchet, Laboratoire de Biologie des Invertébrés Marins et Malacologie, Muséum National d'Histoire Naturelle, Paris and 'chef de mission' of the BALGIM (and various other) cruises.

## **Cladocarpus cartieri** Bedot, 1921
(fig. 25a-e)

*Cladocarpus pectiniferus* - Pictet & Bedot, 1900: 49.
*Cladocarpus cartieri* Bedot, 1921a: 326 (nomen nudum); Vervoort, 1966: 149.
*Cladocarpus (?) cartieri* Bedot, 1921c: 56-57, pl. 6 figs. 59-60; Rees & White, 1966: 280.

Material.— **Eastern Atlantic Ocean.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1888: Stn 247, Pico, Azores, 38°24'N-28°01'25'W, 318 m, 30.viii.1888, two carmin stained slides, one of colony 25 mm high, the other of two hydrocladia. One of the slides marked "type". (MOM no. 11 0101).

Description.— Of this species we have been able to inspect the holotype from MOM. The material was originally labelled *"Cladocarpus pectiniferus"* and has been relabelled *"Cladocarpus cartieri"* in Bedot's handwriting. One slide contains the holotype proper, a carmin stained, 25 mm high colony without phylactocarp; the second slide bears two hydrocladia and consequently represents a schizoholotype. The following notes have been taken from of the holotype. Colony composed of 25 mm high axis with alternately arranged hydrocladia, pointing left and right. Axis basally polysiphonic, upper part monosiphonic and there indistinctly divided into segments by weak perisarcal constrictions; division scarcely visible in polysiphonic part. Polysiphony brought about by secondary tubules adnate to the primary axis and on the backside, bearing nematothecae and communicating with the primary axis by means of large, circular holes. Segments of axis each with distal apophysis and three nematothecae, two of which are axillary and placed on both sides of apophysis; the third is on front of basal half of segment (fig. 25a). Apophyses alternately directed left and right and obliquely upwards, supporting 6-8 mm long hydrocladia, composed of long, slender internodes separated by slightly oblique septa; internode slightly S-shaped. Each hydrocladial internode with long, slender hydrotheca and three nematothecae: one median infracalycine and two laterals. Axillar nematothecae (fig. 25d) almost as laterals (fig. 25c); additional nematotheca and those of accessory tubules broader (fig. 25e).

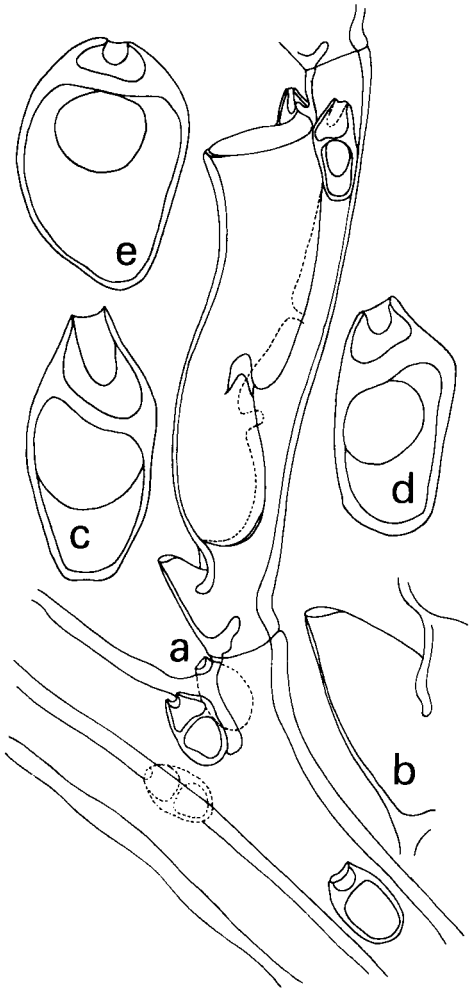


Fig. 25. *Cladocarpus cartieri* Bedot, 1921, from MOM no. 11 0101. a, part of axis with apophysis and first hydrocladial internode with hydro- and nematothecae; b, median inferior nematotheca; c, lateral nematotheca; d, axillary nematotheca; e, axial nematotheca. a, × 88; b-e, × 220.

Hydrothecae with indented, fully adnate adcauline wall and with elongated S-shaped abcauline wall. Indentation of adcauline wall at about one third of its length from the base; at this point interior of hydrotheca with curved, flattened ledge (fig. 25a). Abcauline hydrothecal wall basally rounded, gradually thickening towards rim; hydrothecal cavity

Table 33. Measurements of *Cladocarpus cartieri* in μm.

| | Camp. Océan. Monaco Stn 274, Azores |
|---|---|
| Axial internode, length | 520-630 |
| diameter at node | 125-150 |
| Axillary nematothecae, length | 100-110 |
| maximal diameter | 60-65 |
| diameter at apex | 9-12 |
| Additional nematotheca, length | 110-120 |
| maximal diameter | 85-90 |
| diameter at aperture | 9-12 |
| Hydrocladial internode, length | 645-680 |
| diameter at node | 80-85 |
| Hydrotheca, total depth | 480-495 |
| diameter at rim | 140-145 |
| maximal diameter | 135-140 |
| Median nematotheca, length abcauline wall | 130-140 |
| length adcauline wall | 60-65 |
| diameter | 12-15 |
| Lateral nematotheca, total length | 110-135 |
| maximal diameter | 50-65 |
| diameter at aperture | 29-25 |

basally smoothly rounded. Hydrothecal rim smooth and circular, lightly tilted downwards, slightly curving upwards towards bases of lateral nematotheca and visible between those nematothecae as a teeth-like projection.

Median nematotheca in all internodes inspected separated from basal portion of hydrotheca by a short distance and consequently completely free; abcauline wall straight. Aperture of median nematotheca gutter-shaped, adcauline wall open, widening at apex (fig. 25b). Lateral nematothecae elongated oval, projecting above hydrothecal rim by c. one third, two-chambered and with heavy septum or ridge. Aperture gutter-shaped on adcauline side. Basal chamber with big circular hole for communication with internode (fig. 25c).

Number of internodal septa (ridges) in internode variable, as many as nine have occasionally been counted. There is always a heavy septum at the bottom of the internode, one above and one below the insertion of the intrathecal ledge and two hidden behind the lateral hydrothecae. The number of septa behind the hydrotheca proper may increase to six.

Distribution.— The above mentioned locality near the Azores represents the only known record for this rare species. Since its description by Bedot (1921c) it has apparently never been recorded.

## **Cladocarpus corneliusi** spec. nov.
(fig. 26a-h)

*Cladocarpus tenuis* var. - Vervoort, 1985: 292-294, fig. 3.

Material.— BALGIM Stn CP 09, 36°47.6'N-09°28'W, 29.v.1984, 1163 m (type locality): five fragments between 20 and 30 mm high, some with sterile phylactocarp. In addition two fragments of 25 mm of which one with three pairs of phylactocarps (one fertile with three gonothecae, holotype). All colonies, with exception of holotype, are indicated as paratypes.— Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: single 30 mm high colony; no phylactocarp.— Stn DW 16, 36°45.8'N-09°29.4'W, 30.v.1984, 1283 m: two colonies 20 mm high without phylactocarp.— Stn CP 17, 36°45.3'N-09°30.8'W, 30.v.1984, 1470 m: single fragment 35 mm high without phylactocarp.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: single juvenile colony 30 mm high; no phylactocarp.

Additional material.— **Eastern Atlantic Ocean.** SHACKLETON 3, Stn 152, Ormonde Sea Mount, 36°35.7'-36°37.2'N, 11°04.1'-11°05.3'W, 2292-1691 m, 16.iv.1973: c. 15 colonies 60-80 mm high with phy-

lactocarps and some fragments. BMNH 1980.2.4.1.— Stn 153, Ormonde Sea Mount, 36°39'-36°39.7'N, 11°07.9-11°08.1'W, 871-650 m, 16.iv.1973: eight complete colonies and some fragments. BMNH no. 1980.2.4.3; slides in RMNH under Coel. no. 16.585. All colonies with phylactocarps.— Stn 156, Ormonde Sea Mount, 36°39.2'-36°39.9'N, 11°06.2'-11°05.8'W, 931-826 m, 16.iv.1973: c. 25 colonies with phylactocarps and some fragments. BMNH no. 1980.2.4.2.

Description (of the type material).— Polysiphonic axis rising from hydrorhiza composed of network of perisarcal tubules; short basal portion of axis smooth, remainder of axis with longitudinal row of frontal nematothecae and apophyses, alternately directed left and right, supporting laterally directed hydrocladia. Under first apophysis on axis three to seven nematothecae present in our material; between two consecutive apophyses there are one to four frontal and one axillary hydrotheca.

Primary axis divided into internodes by means of transverse nodes, scarcely visible in some, particularly polysiphonic colonies, whilst in others they are clearly marked. Double nodes occur in some colonies, particularly in apical portions of hydrocauli (fig. 26b). Each internode has one apophysis with its axillary nematotheca in its distal portion and one to four inferior nematothecae.

Axial nematothecae characterized by presence of two apertures, one terminal and one basal, directed towards wall of internode. An incomplete nematothecal septum is visible under the basal aperture (fig. 26c).

Hydrocladia composed of succession of internodes separated by slightly oblique nodes; each internode with one hydrotheca and five nematothecae: one median infracalycine, two laterals at the hydrothecal border and two supplementary laterals slightly below middle of hydrotheca (fig. 26a, f, g).

Hydrotheca large, elongated tubular, with completely adnate adcauline wall. Basal portion of this wall, up to insertion of supplementary nematothecae, almost straight or slightly concave, at insertion adcauline hydrothecal wall distinctly convex to become distinctly concave again in its distal part. Abcauline hydrothecal wall running almost parallel to adcauline wall, being almost straight to slightly concave basally, convex at level of supplementary nematothecae and concave in its distal portion. Hydrothecal border smooth, without median abcauline cusp, running upwards adcaudally towards lateral nematothecae (fig. 26a, g).

Median infracalycine nematotheca placed on internode below hydrothecal base, rim below level of hydrothecal base, as axial nematothecae with one narrow terminal aperture and one basal opening directed towards wall of internode; an incomplete septum is present below that aperture. Lateral nematothecae tubular, surpassing hydrothecal border, with two small terminal apertures and an adcauline circular aperture at level of hydrothecal border, below which there is an incomplete internal septum. Supplementary lateral nematothecae agree in structure with above described lateral nematothecae (fig. 26a, f. g).

Each hydrocladial internode with 13 to 15 well developed internal septa of which two or three are basal, ten or eleven behind the hydrotheca and one or two are apical.

Phylactocarps springing in pairs from base of first hydrotheca of internode, each member of a pair directed away from internode and either composed of one-segmented rachis bearing four pairs of opposite nematothecae or composed of two segments of which first and longest has three or four pairs of nematothecae and second and shortest has a single pair (fig. 26d). Phylactocarpal nematothecae large, with terminal, circular aperture and basal circular aperture, at base of which there is an

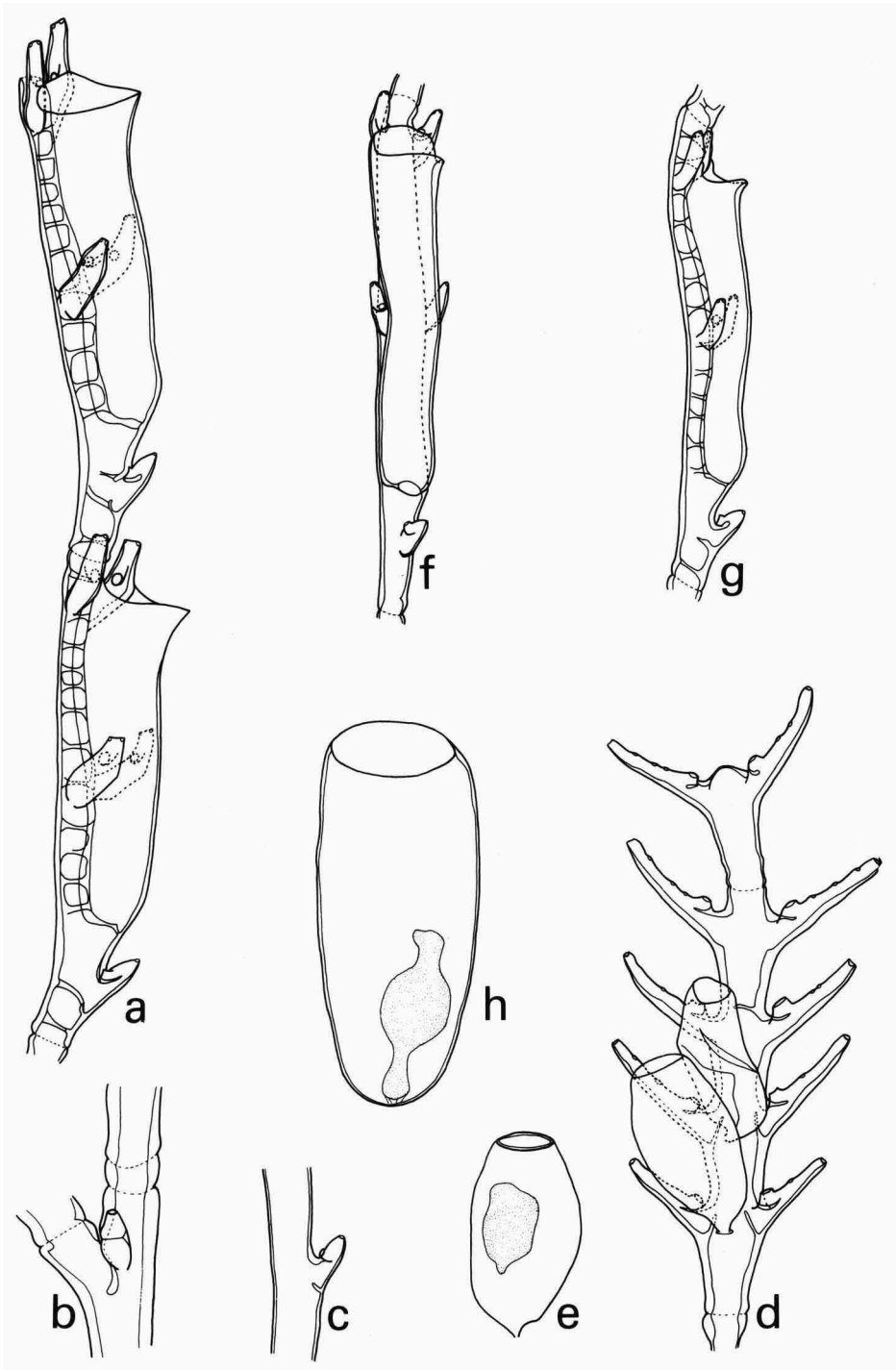


Fig. 26. *Cladocarpus corneliusi* spec. nov. a-e, holotype, from CP 09. a, two hydrocladial internodes with hydro- and gonothecae, lateral view; b, part of axis and apophysis, with 'double' node; c, axial nematotheca; d, fertile phylactocarp, view from above; e, gonotheca. f, g, from CP 14. f, hydrocladial internode with hydro- and nematothecae, oblique frontal view; g, idem, lateral view. h, from Shackleton Exped., Stn 153, RMNH no. 16585, female (?) gonotheca. a-h, × 57.

Table 34A. Measurements of *Cladocarpus corneliusi* in µm.

| | BALGIM Stn CP 09 (holotype) | BALGIM Stn CP 14 | Bay of Biscay (Vervoort, 1985) |
|---|---|---|---|
| Axial nematotheca, length | 130-150 | 110-120 | |
| diameter of terminal aperture | 30-40 | 15-30 | |
| Hydrocladium, length internode | 1090-1280 | 1080-1170 | |
| diameter at node | 80-110 | 70-75 | 90-100 |
| Hydrotheca, depth | 710-770 | 690-780 | 750-850 |
| diameter at rim | 190-210 | 110-140 | 260-300 |
| Median nematotheca, length | 155-170 | 130-140 | 160-165 |
| diameter of terminal aperture | 10-20 | 10-15 | |
| Lateral nematotheca, length | 160-220 | 120-140 | 170-172 |
| diameter at level of terminal aperture | 30-40 | 20-25 | 28-30 |
| Supplementary nematotheca, length | 145-190 | 130-140 | |
| diameter at level of terminal aperture | 30-35 | 20-30 | |
| Male (?) gonotheca, total length | 400-450 | | |
| maximal diameter | 220-250 | | |

Table 34B. Measurements of *Cladocarpus corneliusi* in µm.

| | Ormonde Seamount Shackleton 3, Stn 153 |
|---|---|
| Axial nematotheca, length | 140-160 |
| diameter of terminal aperture | 30-40 |
| Hydrocladium, length internode | 1230-1330 |
| diameter at node | 90-120 |
| Hydrotheca, depth | 730-840 |
| diameter at rim | 200-225 |
| Median nematotheca, length | 170-200 |
| diameter of terminal aperture | 10-15 |
| Lateral nematotheca, length | 170-200 |
| diameter at level of terminal aperture | 30-45 |
| Supplementary nematotheca, length | 160-190 |
| diameter at level of terminal aperture | 30-40 |
| Female (?) gonotheca, total length | 800-900 |
| maximal diameter | 320-460 |

incomplete internal septum. Moreover, one to three smaller accessory apertures may be present. Between each pair of nematothecae rachis may have one or two internal septa. Gonotheca springing singly from rachis between pair of nematothecae, ovoid, flattened at top and there with circular lid (fig. 26d, e).

Additional description.— The material from Ormonde Seamount has numerous fertile phylactocarps, which enables us to complete the description. Phylactocarps farther developed, with nine pairs of opposite nematothecae. Also there appears to be sexual dimorphism in the shape of the gonothecae. Those that we presume to be male are ovoid and small, corresponding to those of the BALGIM material. Those taken to be female are also ovoid but much longer than the presumed males, truncated at the apex and there with a circular aperture closed by a lid (fig. 26h).

Variability.— The colonies from CP 14 and CP 17 differ slightly from the rest of

the material because the hydrothecae are more elongated and both ad- and abcauline borders are slightly curved (fig. 26f, g). The abcauline hydrothecal wall, consequently has a slight concavity in its basal as well as in its distal portion. The remaining characters of these colonies agree with those given above for the type material.

Distribution.— This species has previously only been recorded from the Bay of Biscay, 47°34.3'N-08°33.8'W, depth 2194 m (Vervoort, 1985). The BALGIM material originates from four localities in the Atlantic SW of Cape São Vicente (CP 09, CP 14, DW 16, CP 17) and from one locality off the coast of Rabat, Morocco (CP 90), depths varying between 890 and 1470 m. The rich additional material from the collections of the British Museum (Natural History) comes from the Ormonde Seamount, WSW of Cape São Vicente, depth 650-2292 m.

Discussion.— *Cladocarpus corneliusi* is distinguished from the other species of *Cladocarpus* by the presence of a pair of supplementary lateral nematothecae slightly below the middle of the hydrotheca. This character is only met with in *Cladocarpus boucheti* spec. nov., but between *C. corneliusi* and *C. boucheti* there are so many important differences that the two species can easily be separated. As far as the Bay of Biscay material described by Vervoort (1958) as *Cladocarpus tenuis* var. is concerned, its description concurs with that of *C. corneliusi* presented above and a comparison of the Bay of Biscay and BALGIM material confirms the identity. The only difference we have observed is the presence of a (slight) median tooth-shaped abcauline projection at the hydrothecal rim in the Bay of Biscay material. Bearing in mind that this material has only three hydrothecae, two of which are slightly, the third badly damaged, we hesitate to attach too much importance to this difference.

Etymology.— The specific name has been chosen to honour Dr Paul F.S. Cornelius, Curator of the Cnidaria Section, Department of Zoology, British Museum (Natural History) (The Natural History Museum), London and leading scientist in the field of European Hydroid research.

## Cladocarpus distomus Clarke, 1907

*Cladocarpus distomus* Clarke, 1907: 17-18, pl. 14.

Not *Cladocarpus distomus* - Stechow, 1925b: 506-507, fig. 47; Vervoort, 1966: 150-152, figs. 48-49*; Millard, 1967: 188-191, fig. 6A-B, D-G**; Millard, 1975: 418-421, figs. 130D-F; Vervoort, 1972: 212-214, fig. 73a (all *Cladocarpus stechowi* spec. nov.); Rees & Vervoort, 1987: 142-144, figs. 30b-c (= *Cladocarpus anonymus* spec. nov.).

Discussion.— *Cladocarpus distomus* has originally been described from the eastern tropical Pacific; according to Clarke's description it is characterized by the slight S-shaped curve of the hydrotheca in lateral aspect. There are four nematothecae on each internode: one median infracalycine with a single slit-shaped aperture at its end, two laterals that distinctly surpass the hydrothecal rim and have two apertures, one slit-shaped at the end and one basal that, according to description and figure, consists of a simple circular opening in the internal wall of the nematotheca approximately near the middle of its length, similar to the condition observed in *Cladocarpus pectiniferus*

*See also discussion of *Cladocarpus multiseptatus* (Bale, 1915).

**See discussion of *Cladocarpus distomus*.

Allman, 1883. The fourth nematotheca is a median distal nematotheca of identical morphology as the median infracalycine. The phylactocarps and gonothecae were not described by Clarke and the species probably has not been recorded since its original description.

The material described by Stechow (1925b) as *Cladocarpus distomus* from the Indian Ocean coast of South Africa and later on described after the same material by Millard (1967, 1975) does not show the characteristic S-shape of the hydrothecae; the median infracalycine and distal nematothecae have two apertures (and frequently even 3), while the lateral nematothecae are not tubular and have a lateral expansion of varied width extending along the hydrothecal rim and of highly characteristic shape. In our opinion it is advisable to separate this form on the specific level from the Pacific *Cladocarpus distomus*; we propose to name it *Cladocarpus stechowi* spec. nov. in honour of Dr E. Stechow who first described it.

The material figured by Millard (1967, fig. 6C) and originating from Stn ABD 16B has tubular lateral nematothecae and has no median distal nematotheca; it probably belongs to *Cladocarpus tenuis* Clarke, 1879 (Vervoort, 1972).

Other, differing colonies have been described as *Cladocarpus distomus* by Rees & Vervoort (1987) from the Indian Ocean coast off Kenya. This material has a large number of internal septa in the hydrothecate internodes, duplication of the apertures of all nematothecae, the apertures being placed at the end of two short, tubular distal processes, by the absence of the frontal prolongation of the lateral nematothecae and by the absence of median distal nematothecae on the hydrothecate internodes. We have come to the conclusion that this material must be specifically separated from both *Cladocarpus distomus* and *C. stechowi*; we propose to name it *Cladocarpus anonymus* spec. nov. Of this species the gonosome is unknown.

Also, we now consider *Cladocarpus multiseptatus* (Bale, 1915) to be a species separate from *Cladocarpus distomus* sensu stricto, of which it differs in the shape of the nematothecae that have, throughout the colony, two apertures, one apical and one basal, the latter situated at the end of a short, tubular process, and an incomplete internal septum under the basal aperture. The median distal nematotheca is also absent in this species.

*Cladocarpus sibogae* Billard, 1911, is also different from *Cladocarpus distomus* sensu stricto in the shape of the nematothecae and the absence of a median distal nematotheca; the abcauline wall of the hydrotheca is straight and does not present the S-shaped curve observed in *C. distomus*.

*Cladocarpus alatus* Jarvis, 1922, is near to *C. stechowi* in the shape of the lateral nematothecae, that have a lateral prolongation along the hydrothecal border, and in the shape of the hydrotheca. The differences which separate this species from the others named above have been enumerated by Vervoort (1966) who studied and redescribed part of Jarvis' (type ?) material. *C. alatus* has smaller hydrothecate internodes and smaller hydrothecae than *C. stechowi*, has no median distal nematotheca, while the median infracalycine nematotheca has a gutter-shaped aperture (Rees & Vervoort, 1987). The lateral nematothecae, though with frontal prolongation along the hydrothecal border, have one axial aperture situated at the end of a short tubular process surpassing the hydrothecal rim. The gonosome of *Cladocarpus alatus* is unknown.

*Cladocarpus bathyzonathus* Ritchie, 1911, has also been redescribed by Vervoort,

1966, from type material; the differences from *C. distomus* and the species previously included in the synonymy are the shape of the hydrotheca, of which the abcauline wall is initially distinctly concave with the basal portion strongly convex. There are also differences in the shape of the nematothecae; the median distal nematotheca is absent.

*Cladocarpus multiapertus* Billard, 1911, has large, tubular and nearly cylindrical hydrothecae of which the abcauline wall is practically straight, approaching in this respect *C. alatus, C. stechowi,* and *C. sibogae,* and distinguishing it at the same time from the remaining species discussed above and formerly synonymised with *C. distomus.* In the shape of the lateral nematothecae with three apertures (two apical and one basal) it is quite different from *C. alatus, C. stechowi,* and *C. sibogae.*

*Cladocarpus plumularioides* Jarvis, 1922, described from the Indian Ocean and not recorded since, is the only species which in our opinion comes near *Cladocarpus distomus* sensu stricto. The hydrothecate internodes have a median distal nematotheca and there is no frontal prolongation of the lateral nematothecae. There are, however, pertinent differences as appear from Jarvis' original description and Vervoort's (1966) account of the inspection of the holotype. The nematothecae, particularly the laterals, appear to be different; the latter being small and surpassing the hydrothecal rim, the aperture is gutter-shaped. A further study of (type) material of the species previously synonymised with *C. distomus* and not yet redescribed seems desirable before a final conclusion on *Cladocarpus plumularioides* can be reached.

### **Cladocarpus cf. multiseptatus** (Bale, 1915)
(fig. 27 a)

*Cladocarpella multiseptata* Bale, 1915: 304-306, pl. 47 figs. 1-5; Bale, 1919: 356.

Material.— BALGIM Stn CP 135, 35°26'N-04°14.2'W, 15.vi.1984, 395 m: single 4 mm long fragment of hydrocladium composed of three hydrothecate internodes. No phylactocarp.

Description.— Hydrocladium composed of three internodes separated by oblique nodes and each bearing one hydrotheca and three nematothecae: one median infracalycine and two laterals. Hydrotheca tubular, deep, with fully adnate, straight adcauline wall; there are no internal hydrothecal septa. Abcauline wall also nearly straight; hydrotheca widening slightly just under rim and there abcauline wall slightly curved outwards. Hydrothecal rim with well developed, slightly recurved median cusp, rest of hydrothecal border uneven without showing distinct cusps (fig. 27a).

Median infracalycine nematotheca springing from internode slightly under hydrothecal base; top of nematotheca not reaching that base. Nematotheca small, tubular, with two apertures, one slit-shaped aperture at apex and another circular aperture at end of short tubular process placed at base of nematotheca and directed towards hydrocladial wall. Incomplete internal septum present under basal aperture. Lateral nematothecae also tubular, reaching beyond hydrothecal rim and also with two apertures: one apical aperture with finely serrate rim and one basal aperture on adcauline side, as in median nematotheca placed at end of short tubular process with

Table 35. Measurements of *Cladocarpus multiseptatus* in µm.

| | BALGIM Stn CP 135 | Great Australian Bight (Bale, 1915) |
|---|---|---|
| Hydrocladial internode, length | 940-950 | c. 800 |
| diameter at node | 50-55 | |
| Hydrotheca, depth (without median tooth) | 520-550 | |
| depth including median tooth | 570-600 | c. 600 |
| diameter at rim | 180-200 | |
| Median nematotheca, length | 90-110 | |
| diameter at rim | 10 | |
| Lateral nematotheca, length | 120-150 | |
| diameter at rim | 25-30 | |

incomplete internal septum at its base (fig. 27a).

Each internode with 12-13 well developed internal septa (ridges) of which two are placed under the hydrotheca, nine or ten behind the hydrotheca and one in distal part of internode.

Distribution.— Recorded from one locality off the coast of Queensland, Australia at 74 fms (= 135 m) depth (Bale, 1915, as *Cladocarpella multiseptata*). The BALGIM material originates from the Alboran Sea (CP 135), off the coast of Morocco, depth 395 m.

Discussion.— The scanty material present, composed of a fragment of a hydrocladium with only three hydrothecae, makes it impossible to refer it with certainty to *Cladocarpus multiseptatus* Bale, 1915. However, the shape of the hydrocladia, that of the hydrotheca and the structure of the nematothecae agrees closely with that in *C. multiseptatus*. A comparison of the measurements shows that the length of the hydrothecate internodes and the depth of the hydrotheca are similar. The comparison of our material with the syntype of *Cladocarpus sibogae* Billard, 1913 and the comparison of this type material with Bale's (1915) description has made it possible to establish that the two species are different and can be separated by the following characters:

1. Hydrotheca. Abcauline hydrothecal border in *C. multiseptatus* with slight though distinctly discernible S-shaped curve. Abcauline border in *C. sibogae* straight, though cavity of hydrotheca narrows towards hydrothecal base. Rim of hydrotheca irregularly sinuous in *C. multiseptatus*; in *C. sibogae* there are at least three pairs of low, rounded cusps along that rim.

2. Median, infracalycine nematotheca. Short and tubular in *C. multiseptatus*, with apically a transverse, slit-shaped aperture and basally a circular aperture at the end of a short tube. This nematotheca in *C. sibogae* with characteristic lateral expansions; the semicircular, slit-shaped aperture runs along the length of these lateral expansions and has a very distinctive shape.

Finally it should be pointed out that, although the phylactocarps of both species are similar, the gonothecae of *C. multiseptatus* are still unknown. From *C. stechowi* the present species can be distinguished by the slight S-shape of the abcauline hydrothecal wall, the morphology of the nematothecae, of which the laterals are tubular and have no lateral expansion along the hydrothecal rim, and by the absence of a median

distal nematotheca on the hydrothecate internode.

We also want to mention the re-inspection of a specimen of *Cladocarpus distomus* from Galathea Stn 188, mentioned by Vervoort (1966: 150, 151) and having a great general resemblance with *Cladocarpus multiseptatus*. In this specimen, composed of a fragment of a hydrocladium with only five hydrothecae and made up in a slide, all lateral nematothecae have but a single terminal aperture; it has therefore not been included in the synonymy of *Cladocarpus multiseptatus*.

## **Cladocarpus paraventricosus** spec. nov.
(fig. 27b-d)

Material.— BALGIM Stn CP 09, 36°47.6'N-09°28'W, 29.v.1984, 1163 m (type locality): five colonies 13 - 35 mm high of which three with phylactocarp and gonothecae. A 18 mm high colony bearing a fertile phylactocarp (2 gonothecae) is the holotype (slide).

Description.— Hydrocaulus monosiphonic, basally without segmentation, but there with a number of nematothecae varying between six and eight. Basal portion of axis ending in one or two 'prosegments' separated by oblique nodes, each with a single nematotheca. Remaining part of axis composed of a number of segments separated by oblique nodes. Each segment with one apophysis and two nematothecae in its lower half, one nematotheca being under the apophysis, the other being axillary. Both nematothecae with single, gutter-shaped opening, broad in the axillary nematotheca.

Hydrocladia inserting on apophyses, alternately pointing left or right, divided into (hydrothecate) internodes by means of oblique septa; each internode with one hydrotheca and three nematothecae of which one median infracalycine and two laterals near hydrothecal border. Adcauline wall of hydrotheca completely adnate with internode, with short intrathecal septum at lower third and with concavity above and below that point. Abcauline hydrothecal wall with marked convexity in lower two-thirds, straight and directed obliquely outwards above that point, running into strong median abcauline tooth at hydrothecal rim. Lateral parts of hydrothecal border each with five low, rounded cusps, of which second and third are reduced to mere undulations; fifth, at adcauline border, best developed (fig. 27b, c). Median infracalycine nematotheca placed on internode under hydrotheca, its edge level with hydrothecal base and with single, gutter-shaped opening. Lateral nematothecae small, not surpassing level of 5th (adcauline) cusp at hydrothecal border, also with single gutter-shaped aperture. Both median and lateral nematothecae with finely serrated margin. Internodes slightly curved, generally with 11 well developed internal septa: one below hydrotheca at base of median nematotheca, eight behind hydrotheca and two in part of internode above hydrothecal border (fig. 27b).

Phylactocarp inserting on first hydrocladial internode at level with hydrothecal base, composed of single, dichotomously forked branch, bearing numerous, short nematothecae with gutter-shaped apertures, either placed singly or in opposite or subopposite pairs. Gonothecae borne on branches of phylactocarp just after each ramification. Gonotheca ovoid, slightly swollen, with circular aperture opening laterally in distal portion of gonotheca (fig. 27d).

Variability.— One of the colonies had suffered damaged and was regenerated sev-

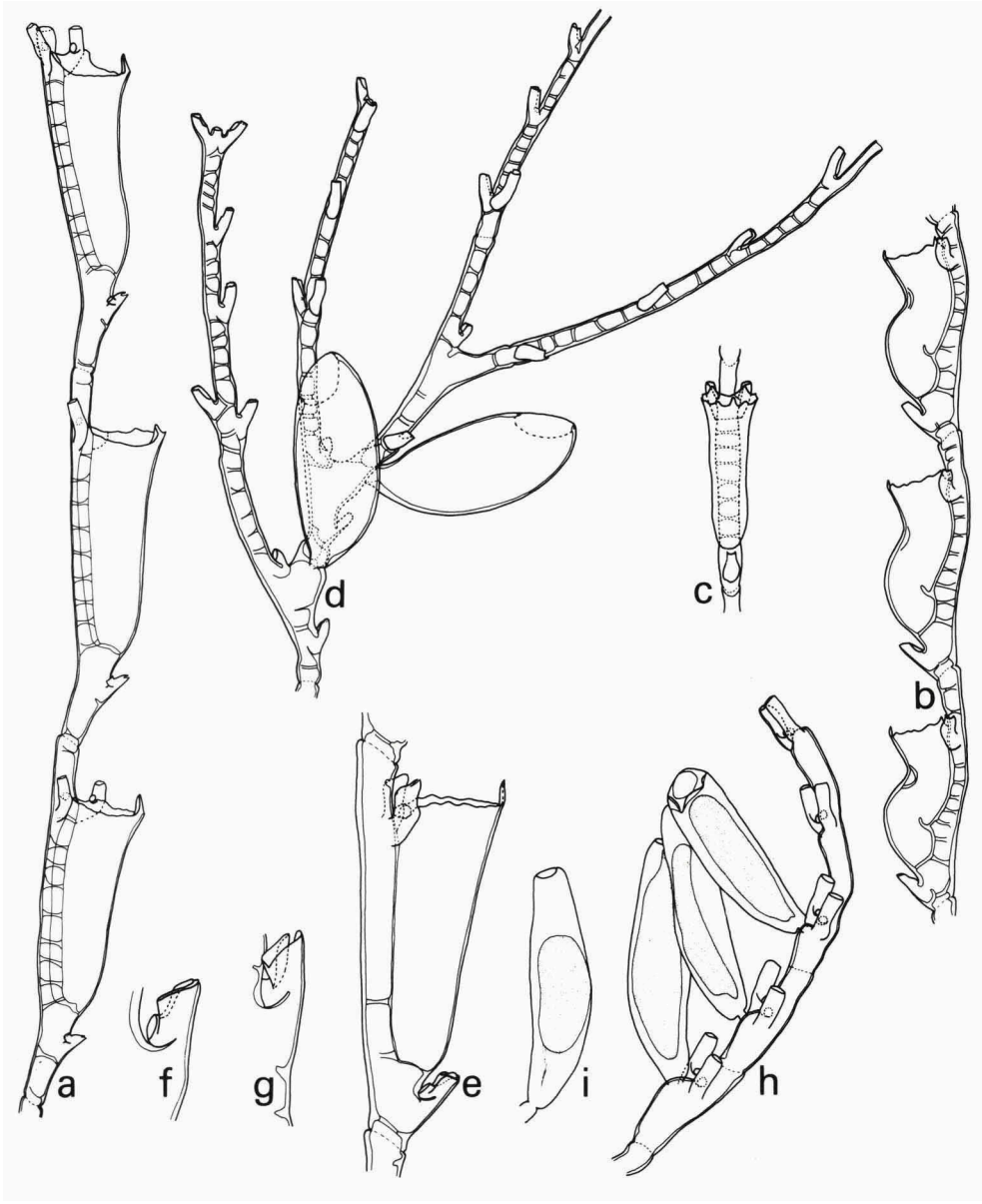


Fig. 27. a, *Cladocarpus* cf. *multiseptatus* (Bale, 1915), from CP 135, three hydrocladial internodes with hydro- and nematothecae, lateral view. b-d, *Cladocarpus paraventricosus* spec. nov., holotype, from CP 09. b, three hydrocladial internodes with hydro- and nematothecae, lateral view; c, single internode with hydro- and nematothecae, frontal view; d, fertile phylactocarp. e-i, *Cladocarpus sibogae* Billard, syntype, from Siboga Exped., Stn 262, ZMA no. 4845. e, hydrocladial internode with hydro- and nematothecae, lateral view; f, median inferior nematotheca, lateral view; g, idem, oblique lateral view; h, fertile phylactocarp, lateral view; i, gonotheca. a-e, h, i, × 50; f, g, × 100.

Table 36. Measurements of *Cladocarpus paraventricosus* in µm.

| | BALGIM Stn CP 09 |
|---|---|
| Axial nematotheca, length | 95-110 |
| diameter at border | 60-90 |
| Hydrocladial internode, length | 575-630 |
| diameter at node | 65-70 |
| Hydrotheca, depth | 350-385 |
| diameter at aperture | 150-160 |
| Median nematotheca, length | 105-120 |
| diameter at rim | 20-30 |
| Lateral nematotheca, length | 85-100 |
| diameter at rim | 20-25 |
| Gonotheca, length | 550-570 |
| maximal diameter | 220-230 |

eral times: after the 'prosegment' the first segment has one hydrotheca and three nematothecae (one median infracalycine and two laterals) which we consider exceptional as it does not concern the first colony developing from the larva (see also discussion of *Cladocarpus sigma* var. *elongata*).

Distribution.— A single record at the Atlantic side of the Strait of Gibraltar (CP 09, SW of Cape São Vicente), 1163 m depth.

Discussion.— *Cladocarpus paraventricosus* is characterized by the ventricose shape of the abcauline hydrothecal wall, the presence of cusps along the hydrothecal rim, an internal, adcauline hydrothecal septum, a single, gutter-shaped aperture of the nematothecae and a dichotomously forked phylactocarp, all characters indicating a species near to *Cladocarpus ventricosus* Allman, 1877. It differs from the latter because the axis basally has but a single row of nematothecae (2 rows of opposite nematothecae basally in *C. ventricosus*), by the presence of a single axillar nematotheca*, and by the curvature of the adcauline hydrothecal wall, the convex part of the adcauline wall becoming concave at about half its length (the inflexion being in the distal part of that wall in *C. ventricosus*). Furthermore, although both species have a dichotomously branched phylactocarp, the ramifications end in points in *C. ventricosus* and the gonothecae, that have distinct apertures, are also found on the apophyses. *C. paraventricosus* has no such points while the gonothecae insert directly on the phylactocarp. The differences relating to the gonothecal aperture and to its insertion should be used with some caution as the shape of the gonothecal aperture may be subjected to sexual dimorphism, as it is in e.g. *C. pectiniferus*, while insertion of the gonothecae on some species (as for instance *C. sigma*) occurs on both hydrocladial apophyses as well as on the phylactocarp.

*Cladocarpus dollfusi* Billard, 1924 and *C. sinuosus* Vervoort, 1966, also have a hydrotheca with ventricose abcauline border and an internal adcauline septum but the hydrothecal rim in these two species is sinuous and not dentate while the nematothecae have two openings. The phylactocarp of these species, moreover, has a median rachis from which rise pairs of opposite nematothecae, short in *C. dollfusi* (cf. Patriti, 1970: 52, fig. 72b) and long and tubular in *C. sinuosus* (cf. Vervoort, 1966: 157, fig. 56a).

Etymology.— The specific name *'paraventricosus'* has been chosen because of the resemblance of the new species with *Cladocarpus ventricosus* Allman, 1877.

*Allman (1877) described the presence of a single axillar nematotheca in *Cladocarpus ventricosus* , but the revision of the holotype of this species has proved the presence of two such axillar nematotheca, which corresponds with Bogle's (1975) observations on the holotype.

## **Cladocarpus pectiniferus** Allman, 1883
(figs. 28a-h, 29a-j, 30a-g)

*Cladocarpus pectiniferus* Allman, 1883: 50-51, pl. 17 figs. 1-5; Billard, 1910: 47; Bedot, 1921a: 325; Bedot, 1921c: 54-56, pl. 6 figs. 54-58; Bedot, 1923: 224, figs. 20-21; Rees & White, 1966: 280; Vervoort, 1966: 149; Van Praët, 1979: 911, fig. 74.

*Aglaophenia (?) pharetra* Broch, 1918: 80-82, figs. 42a-c.

Not *Cladocarpus pectiniferus* - Pictet & Bedot, 1900: 49 (= *Cladocarpus cartieri* Bedot, 1921c).

Material.— BALGIM Stn CP 03, 36°50.4'N-09°14.9'W, 28.v.1984, 681 m: single colony 23 mm high without phylactocarp.— Stn DW 07, 36°46.1'N-09°27'W, 29.v.1984, 1141 m: fragment 20 mm high, no phylactocarp.— Stn DW 11, 36°44.2'N-09°31.4'W, 29.v.1984, 1523 m: fragment 10 mm high, no phylactocarp.— Stn DR 22, 36°35.4'N-07°23.6'W, 31.v.1984, 466 m: single colony 90 mm high with basal tuft of fibres and many phylactocarps.— Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: single colony 65 mm high without phylactocarp.— Stn DR 75, 33°52.7'N-08°15.2'W, 06.vi.1984, 252 m: two fragments 15 and 27 mm high of which one with phylactocarps.— Stn DR 79, 33°49.3'N-08°23.6'W, 06.vi.1984, 260 m: single colony 30 mm high with sterile phylactocarp.— Stn DW 120, 35°51.2'N-05°10.4'W, 13.vi.1984, 425 m: single 35 mm high colony; no phylactocarp.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: single fragment 10 mm high with one hydrocladium, no phylactocarp.— Stn DW 157, 36°21'N-07°55.8'W, 18.vi.1984, 1108 m: single colony 30 mm high, no phylactocarp.

Additional material.— **Eastern Atlantic Ocean.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1904, Stn 1717, Canary Islands, 29°39'45"N-15°42'15"W, 400 m, 02.viii.1904: single colony 80 mm high with sterile phylactocarp. In addition there are three carmin coloured slides: a slide with a 8 mm high top part, a slide with four hydrocladia with phylactocarps and a slide with three hydrocladia (MOM no. 11 0196).— Shackleton 3, Stn 152, Ormonde Sea Mount, 36°35.7'-36°37.2'N, 11°04.1'-11°05.3'W, 2292-1691 m, 16.iv.1973: one colony 90 mm high with numerous fertile phylactocarps; two fragments 20 and 40 mm high. BMNH 1980.2.4.1.— Stn 153, Ormonde Sea Mount, 36°39'-36°39.7'N, 11°07.9-11°08.1'W, 871-650 m, 16.iv.1973: one colony 60 mm high with numerous fertile phylactocarps. BMNH no. 1980.2.4.3.— Stn 156, Ormonde Sea Mount, 36°39.2'-36°39.9'N, 11°06.2'-11°05.8'W, 931-826 m, 16.iv.1973: one colony 100 mm high with numerous fertile phylactocarps. BMNH no. 1980.2.4.2.

Description (based mainly on material from CP 25).— Unforked axis rising from matting of perisarcal tubules, polysiphonic basally, monosiphonic distally, in both parts without division into segments. Axial tube, almost from its base, with a frontal row of nematothecae (fig. 28c) and with apophyses, alternately directed left and right and supporting laterally directed hydrocladia. Normally two to five frontal nematothecae occur between two successive apophyses; each apophysis also has one axillar nematotheca. Number of frontal nematothecae between two successive apophyses greatly varying, in one colony observed to be seven, thirteen, ten, fourty-four, three, two, two..... All axial nematothecae with single, gutter-shaped aperture.

Hydrocladia composed of internodes separated by slightly oblique nodes, each internode with one hydrotheca and three nematothecae: one median infracalycine and two laterals (fig. 28a, b, e).

Hydrothecae elongated tubular, length greatly varying. Adcauline hydrothecal wall completely adnate, straight, without intrathecal septum. Abcauline hydrothecal wall also generally straight, though slightly curved outwards distally to curve slightly inward again at distal extremity. Proximal end of abcauline hydrothecal border smoothly convex. Hydrothecal rim smooth, without median cusp; adcauline parts of rim running upwards towards apex of lateral nematothecae (fig. 28e)

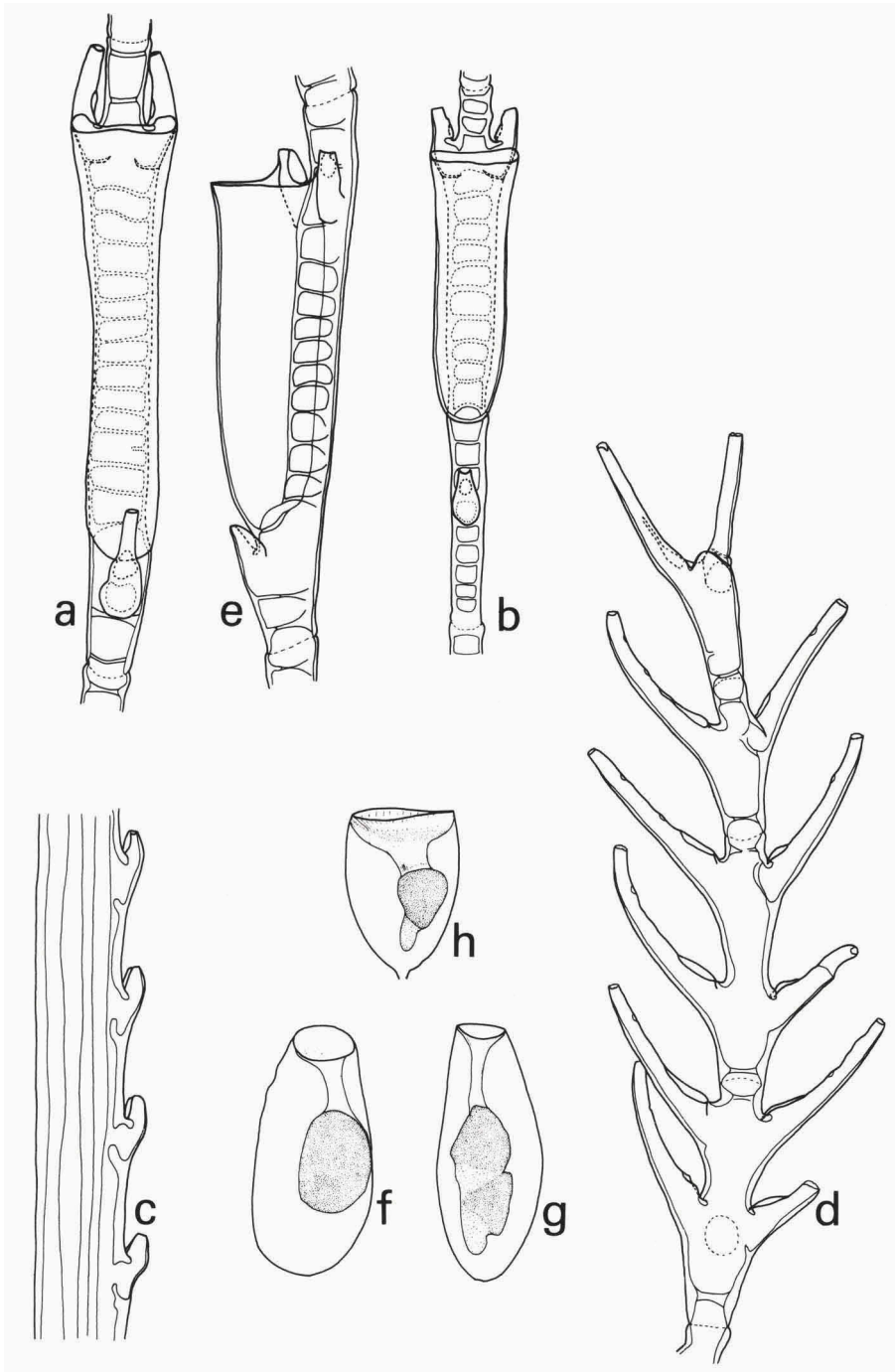


Fig. 28. *Cladocarpus pectiniferus* Allman, 1883. a, c, d, from DR 22. a, hydrocladial internode with hydro- and nematothecae, frontal view; c, part of axis, lateral view; d, sterile phylactocarp, view from above. b, from DW 120, hydrocladial internode with hydro- and nematothecae, frontal view. e-g, from Shackleton 3 Exped., Stn. 156, BMNH no. 1980.2.4.3. e, hydrocladial internode with hydro- and nematothecae, oblique lateral view; f-h, gonothecae. a-h, × 60.

Median, infracalycine nematotheca placed on internode below hydrothecal base; distance from base varied, in some hydrothecae with small distance between apex of nematotheca and hydrothecal base (fig. 28b), in others with apex surpassing that base (fig. 28a, e; see also: Variability). Median nematotheca tubular, of varied length and with two apertures: one terminal with slightly serrated border and one basal directed towards abcauline hydrothecal wall.

Lateral nematothecae also tubular, surpassing distinctly hydrothecal rim and with two apertures: one apical and finely serrated, the other basal and adcauline. As also observed by Bedot (1921c) the same hydrocladium may contain the above described 'typical' lateral nematothecae as well as lateral nematothecae that are not completely closed and have a single more or less gutter-shaped aperture (fig. 28e; cf. Bedot, 1921c: pl. 6 figs. 56-57).

Hydrocladial internode with 17-27 usually well developed septa (see: Variability).

Phylactocarps rising in pairs from first hydrocladial internode at base of hydrotheca and directed one to each side of hydrotheca. Phylactocarp composed of rachis bearing gonothecae and paired nematothecae. There are four internodes per rachis, first two with two pairs of nematothecae each, third and fourth each with one pair. Nematothecae tubular, large, directed obliquely towards apex of rachis, with finely serrated apical aperture and large, oval, basal aperture; one or two additional, smaller apertures may occur between those already mentioned. Each segment of rachis also provided with one basal and one distal septum (fig. 28d).

Additional description.— The material from Ormonde Seamount makes it possible to supplement the description of the phylactocarps of this species. In this material both sterile and fertile phylactocarps occur. In the presence of gonothecae the phylactocarp is much more developed, having up to nine pairs of opposite nematothecae. The gonothecae, probably male, insert on the rachis; each gonotheca being an elongated, ovoid structure with a truncated end and opening by means of a circular lid (fig. 28f-h).

In the material received on loan from the Monaco Museum some of the median, infracalycine nematothecae have a large, gutter-shaped aperture, apparently resulting from unison of the basal, adcauline aperture with that at the apex (fig. 30a, c). In the lateral nematothecae the presence of such gutter-shaped (or deeply scooped apertures) are of more frequent occurrence (fig. 30b).

Variability.— *Cladocarpus pectiniferus* presents a considerable variability in: a, length and depth of the hydrotheca independent of that of the internode, of which the length is more or less uniform;

b, the position of the median, infracalycine nematotheca in relation to that of the hydrothecal base, and

c, the number and arrangement of the internodal septa.

In certain colonies (e.g., DW 120, fig. 29a, f) the hydrothecae are small and placed on the distal half of the internode, leaving free a large portion of the internode beneath the hydrothecal base on which is placed the median nematotheca, separated from that base by a considerable distance. The number of internodal septa varies between 17 and 27 with the following disposition: five to eleven septa below the hydrotheca, ten to thirteen septa behind the hydrotheca and two or three distal septa. In the material from DW 11 (fig. 30b,g) the hydrothecae are short and the internodal septa few and little developed: two occur under the hydrotheca, seven to

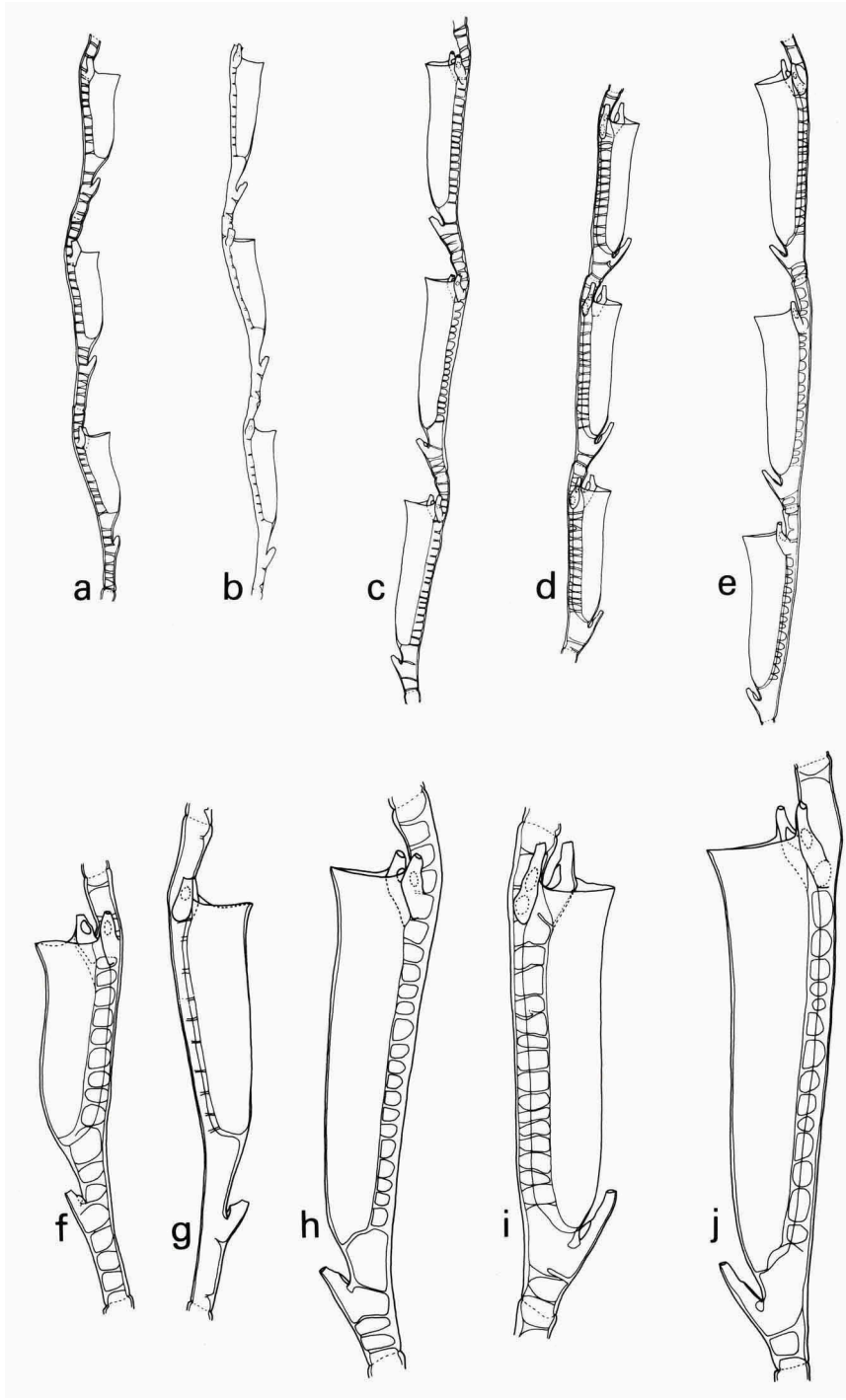


Fig. 29. *Cladocarpus pectiniferus* Allman, 1883; a-e, hydrocladial internodes with hydro- and nematothecae, lateral view; f-j, idem, lateral view. a, f, from DW 120; b, g, from DW 11; c, h, from CP 25; d, i, from DR 22; e, j, from DR 75. a-e, × 19; f-j, × 48.

Table 37A. Measurements of *Cladocarpus pectiniferus* in μm.

In order to give an idea of the variability in size of the present species measurements are given of colonies with small hydrothecae (DW 120), with big hydrothecae (DR 75) and of those with intermediate hydrothecae (CP 25).Measurements are also given of the Ormonde Seamount colonies, of the holotype (taken from a schizoholotype, see below), and from Bedot's (1921c) material from the Musée Océanographie, Monaco (see Discussion).

| | BALGIM Stn DW 120 | BALGIM Stn CP 25 | BALGIM Stn DR 75 | Holotype Billard's slide 947 (own measurements) |
|---|---|---|---|---|
| Axial nematotheca, length | 90-130 | 150-160 | 160-180 | |
| diameter at aperture | 20-25 | 25-30 | 60-70 | |
| Hydrocladial internode, length | 1225-1320 | 1485-1520 | 1460-1620 | 1630-1775 |
| diameter at node | 80-90 | 90-105 | 90-115 | 90-130 |
| Hydrotheca, depth | 580-650 | 970-1030 | 1030-1160 | 1035-1130 |
| diameter at rim | 175-200 | 220-245 | 300-330 | 370-390* |
| Median, infracalycine nematotheca, length | 140-150 | 170-180 | 210-240 | |
| diameter at aperture | 20-30 | 20-25 | 20-30 | 20-30 |
| Lateral nematothecae, length | 130-140 | 190-200 | 235-270 | 120-140 |
| diameter at aperture | 25-30 | 20-30 | 20-30 | 25-30 |

* = probably flattened by cover glass.

Table 37B. Measurements of *Cladocarpus pectiniferus* in μm.

| | MONACO Camp. 1904 Stn 1717 | Ormonde Seamount Shackleton Stn 156 |
|---|---|---|
| Axial nematotheca, length | | 160-170 |
| diameter at aperture | | 40-60 |
| Hydrocladial internode, length | 900-1020 | 1200-1270 |
| diameter at node | 80-105 | 85-110 |
| Hydrotheca, depth | 440-470 | 760-810 |
| diameter at rim | 185-195 | 210-230 |
| Median, infracalycine nematotheca, length | 150-170 | 160-170 |
| diameter at aperture | 20-30 | 20-25 |
| Lateral nematothecae, length | 150-200 | 140-175 |
| diameter at aperture | 30-40 | 25-30 |
| Gonotheca, length | | 500-565 |
| maximal diameter | | 220-330 |

nine behind it and one at the distal end of the internode. Other colonies (DR 75, fig. 30e, f; DR 22, fig. 30d, i) the hydrothecae are large, occupy nearly the whole length of the internode and the median nematotheca inserts directly under the hydrothecal base, far surpassing that base by its apex. In such colonies the number of internodal septa varies between 18 and 22: two at the internodal base, 15-18 behind the hydrotheca and one or two at the distal end of the internode.

Between these extremes there are colonies with intermediate characters, e.g., those from CP 25 (fig. 30c, h).

Distribution.— *Cladocarpus pectiniferus* has so far been recorded from a single locality SW of Iceland at 485 fms (= 887 m) depth (Broch, 1918, as *Aglaophenia (?) pharetra*), from off the Azores, 900 fms (= 1646 m) depth (Allman, 1883, type locality), off Punta Delgada, 50-100 fms (= 92-183 m) (Jäderholm, 1903) and from the Canary Islands region, 400 m depth (Bedot, 1921c). Rees & White (1966) cite the records from the Azores. The present material originates from SW of Cape São Vicente (CP 03, DW 07, DW 11), from off Faro, Portugal (DW 157), from the Gulf of Cádiz (DR 22, CP 25), from two localities near Casa Blanca, Morocco (DR 75, DR 79) in the Atlantic, from one locality in the Strait of Gibraltar (DW 120) and from a locality in the Alboran Sea, near the coast of Morocco (CP 135), constituting the first Mediterranean record for the species. Depths of the BALGIM material vary between 252 and 1523 m; some of the additional material comes from even greater depths (1691-2292 m, Shackleton 3, Stn 152, Ormonde Sea Mount).

Discussion.— *Cladocarpus pectiniferus* presents a considerable range of variation, particularly in the size of the hydrotheca and the location of the median, infracalycine nematotheca. Nevertheless, between the material described by Bedot (1921c, Campagne Monaco 1904, Stn 1717) on one side and the much larger material from DR 75, corresponding in size with Allman's type as given by Billard (1910) on the other side, exists a complete range of intermediate forms, prohibiting the separation of the extreme forms on a specific level. Also we have been able to compare the phylactocarps of the extreme forms (Monaco, Campagne 1904, Stn 1717 and DR 75) and that of an intermediate form (Ormonde Seamount, Shackleton 3 Stn 156), all having an identical structure, which in our opinion confirms that we are dealing with a single species.

At the same time we have been able to notice a considerable variability in the morphology of the nematothecae, that may have two distinct, separate apertures or have a single more or less gutter-shaped aperture that occupies nearly the whole of the abcauline nematothecal wall (cf. Bedot, 1921c, pl. 6 figs. 56-57). In the material studied we have observed that occasionally the major part of the nematothecae, median as well as lateral, has one single 'gutter'-shaped aperture while only the ultimate hydrocladia present nematothecae with two well separated apertures (Ormonde Seamount, Shackleton 3, Stn 156). In other cases (Monaco, Campagne 1904, Stn 1717) the median, infracalycine nematotheca generally has two apertures, while the laterals have only one. Finally in nearly all the BALGIM material examined the morphology of the nematothecae, median and laterals, is uniform; there are two apertures.

As far as the shape of the gonothecae is concerned Allman's figure of the gonotheca (1883, pl. 17 fig. 2) suggests a latero-distal aperture, while this opening is distinctly terminal in the Ormonde Seamount material. In our opinion this is due to sexual dimorphism, the type with the latero-distal opening representing the female gonotheca, that with the terminal aperture the male. Sexual differences of this type have previously been described by Allman (1877) in *Cladocarpus paradiseus* Allman, 1877.

A schizoholotype slide of *Cladocarpus pectiniferus* occurs in Billard's slide collection in MNHN (L 947); the hydrothecae in this slide, though probably slightly compressed, are in good condition and contain remnants of hydranths. Some details of this schizoholotype are given in fig. 30d-g; the measurements are given above. The specimen originates from Challenger Stn 76, East of the Azores, 38°11'N 27°09'W, depth 900 fms (= 1646 m), 03.vii.1873.

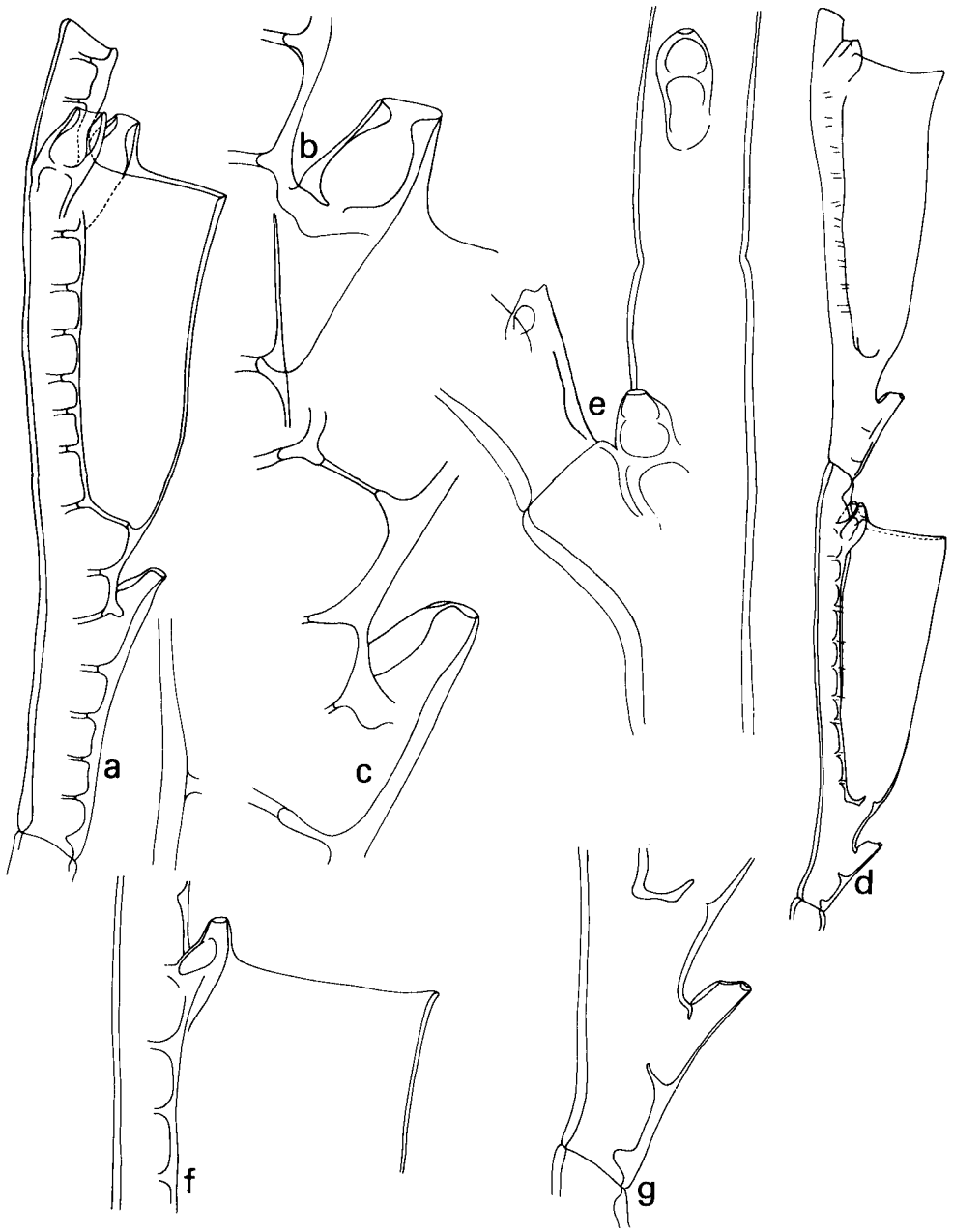


Fig. 30. *Cladocarpus pectiniferus* Allman, 1883. a-c, from MOM no. 11 0196. a, hydrocladial internode with hydro- and nematothecae, lateral view; b, lateral nematotheca, inside view; c, median inferior nematotheca, slightly oblique lateral view. d-g, schizoholotype, Billard's slide no. 947 in MNHN. d, two hydrocladial internodes with hydro- and nematothecae, lateral view; e, part of monosiphonic axis with apophysis and basal part internode; f, lateral nematotheca and hydrothecal rim, lateral view; g, median inferior nematotheca, lateral view. a, e-g, × 100; b, c, × 250, d, × 43.

## **Cladocarpus sibogae** Billard, 1911
(fig. 27e-i)

*Cladocarpus Sibogae* Billard, 1911a: lxx-lxxi, fig. 5; Billard, 1913: 71-73, figs. 57-58, pl. 4 fig. 39; Billard, 1918: 76-77, fig. 5; Bedot, 1921a: 325; Van Soest, 1976: 86.
*Cladocarpella sibogae* - Von Schenck, 1965: 935, 942, fig. 26.

Material.— **Tropical Pacific Ocean.** Siboga Stn 262, 05°33.8'S 132°48.8'E, Arafoera Sea near Kai Islands, 560 m: 50 mm high colony composed of monosiphonic axis with alternately arranged hydrocladia, of which many with phylactocarps (syntype in ITZ, numbered ZMA Coel. no. 4845).

Discussion.— The revision of the syntype of this species has let us to the conclusion that it should be considered a valid species, to be separated from *Cladocarpus distomus* (sensu Stechow, 1925b). Moreover the study of this syntype enables us to add some details to Billard's (1911a, 1913, 1918) previous descriptions.

Thus Billard (1913) described the hydrothecal rim as "plan, souvent on y voit des sinuosités irrégulières qui paraissent plutôt accidentelles que normales". However, the majority of hydrothecae present a hydrothecal rim that has, besides the median abcauline cusp, three pairs of low and rounded lateral cusps, in our opinion representing a characteristic of this species (fig. 27e). As far as the morphology of the nematothecae is concerned we have found considerable differences with Billard's (1918) description. The axial and the median infracalycine nematothecae have a characteristic lateral expansion; the apical aperture of these nematothecae is slit-shaped and extends along the length of the superior part of these expansions. The basal part of these nematothecae presents a second, circular aperture directed towards the wall of the axis or internode and placed at the end of a short tube, below which an incomplete internal septum can be observed (fig. 27f, g). The lateral nematothecae are tubiform in lateral view, surpass the hydrothecal rim and are apically more or less truncate and slightly tilted upwards. There are two apertures in this truncates part: one apically and slit-shaped, directed towards the adcauline side and a second, smaller aperture at the end of the adcauline nematothecal wall. Both apertures may in reality represent a single slit-shaped aperture, covered by a fold of the adcauline wall, forming a kind of operculum (fig. 27e). The adcauline nematothecal wall moreover has a circular aperture situated at the end of a short tube, below which an incomplete internal septum is visible.

The nematothecae of the phylactocarp are tubular, length varying between 120 and 160 µm; they have a single terminal aperture and a second basal aperture situated at the end of a short tube (fig. 27h). The gonothecae are elongated ovoid, slightly curved and have a terminal, circular aperture closed by a lid (fig. 27i).

*Cladocarpus sibogae* differs from *C. stechowi* in the morphology of the nematothecae, the axial and median infracalycine as well as the laterals, the latter having no lateral prolongation along the hydrothecal border. Moreover *C. stechowi* has a median distal nematotheca on the hydrothecate internodes. The structure of the phylactocarp in both species is similar, with several phylactocarps rising from one hydrocladium. The nematothecae of the phylactocarps in *C. stechowi* are shorter, less than 100 µm, and the gonotheca has an elongated oval, laterally displaced aperture (Millard, 1975, fig. 130F). The differences with *Cladocarpus multiseptatus* have already been pointed out.

## **Cladocarpus sigma** (Allman, 1877)
(fig. 31a-c)

*Aglaophenia sigma* Allman, 1877: 45, pl. 26 figs. 9-10.
*Cladocarpus sigma* - Nutting, 1900: 51, 110, 111, pl. 26 figs. 1-2; Pictet & Bedot, 1900: 4, 47, 53, pl. 7 figs. 7-9; Billard, 1905a: 99, figs. 3-4; Billard, 1906d: 233, fig. 18E; Bedot, 1921a: 326; Da Cunha, 1944: 8, 41; Fraser, 1944: 409-410, pl. 90 fig. 398; Da Cunha, 1950: 124; Deevey, 1954: 271; Vervoort, 1966: 149; Vervoort, 1968: 114; 1972: 216, fig. 75.

Material.— **Florida Straits, Western Atlantic Ocean.** U.S. Coast Survey, Gulf Steam Exploration, Stn 189-P, off Aligator Reef, 24°44'45"N-80°31'30"W, 201 m, 08.v.1869: fragments of a large colony [holotype of *Aglaophenia sigma* Allman, 1877 (MCZ)].— **Eastern Atlantic Ocean.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1886, Atlantic Ocean off Galicia, Spain and Bay of Biscay.— Stn 53, 43°44'44"N-08°12'W, 135 m, 02.viii.1886: c. 15 branched and unbranched colonies up to 100 mm high, no phylactocarps (MOM no. 11 0028).— Stn 57, 43°44'30"N-08°32'30"W, 240 m, 05.viii.1886: c. ten branched and unbranched colonies up to 80 mm high, no phylactocarps (MOM no. 11 0037).— Stn 58, 43°40'N-08°55'W, 134 m, 07.viii.1886: c. 15 branched and unbranched colonies up to 120 mm high, many with phylactocarps and gonothecae (MOM no. 11 0046).— Stn 60, 43°57'N-09°27'W, 300 m, 09.viii.1886: fragments of a large branched colony c. 60 mm high, spread 80 mm, no phylactocarps (MOM no. 11 0057).— Stn 61, 43°58'N-10°02'W, 185 m, 10.viii.1886: six branched and unbranched colonies up to 120 mm high, spread 80 mm, no phylactocarps (MOM no. 11 0062).— Stn 63, 44°04'N-11°02'W, 300 m, 19.viii.1886: one or two fragmented colonies up to 60 mm high, no phylactocarps (MOM no. 11 0064). In addition there are three series of longitudinal, horizontal and transverse sections, 23 slides in all (MOM no. 10 0103) and 13 slides of parts of colonies, hydrocladia and phylactocarps (MOM no. 10 0103) of which the locality is not specified. All slides are probably carmin stained and bear a label with M. Bedot's name. All this material was identified by M. Bedot and is mentioned in Pictet & Bedot, 1900.

Notes on the holotype.— The bottle containing the holotype material carries no less than six labels, amongst which is an original label of the U.S. Coast Survey reading: "U.S. Coast Survey, H. Peirce, Supt. Gulf Stream Explor., F. de Poutales, Assist., 1868. May 8, 1869. Section No. (open), Cast No. 7, Depth 110 fms." Other labels mention the presence in the bottle of two species, viz. *Aglaophenia sigma* Allman and *Plumularia megalocephala* Allman. The bottle contains much damaged and broken fragments of *Cladocarpus sigma* (Allman, 1877), *Cladocarpus paradiseus* Allman, 1877, *Lytocarpia bispinosa* (Allman, 1877), and a species of *Nemertesia*, probably *N. antennina* (Linnaeus, 1758); no fragments of *Plumularia megalocephala* Allman, 1877, have been observed. There are many loose hydrocladia and fragments of axis of *C. sigma*. No phylactocarps are present, these also are not mentioned in Allman's description. Two hydrothecate internodes with their hydrothecae and nematothecae have been figured (fig. 31a-c) and measured, the measurements being presented below. The study of Allman's material makes it possible to comment on the description which one of us (Vervoort, 1972: 216-219, fig. 75) published earlier. The number of internal septa (perisarcal rings) in the internode is seven to nine, of which two proximad of the hydrothecal base. The hydrothecal rim has five pairs of cusps and a median abcauline cusp, bringing the total up to 11 (this figure is also stated by Bogle in her 1975 paper; the median cusp is not mentioned in Vervoort's 1972 paper). Of the five pairs of lateral cusps the first, next to the median cusps, and the fifth, behind the lateral nematothecae, are slightly larger than the remaining three pairs; all, with the exception of the fifth, have rounded apices; the cusps of the fifth pair are pointed

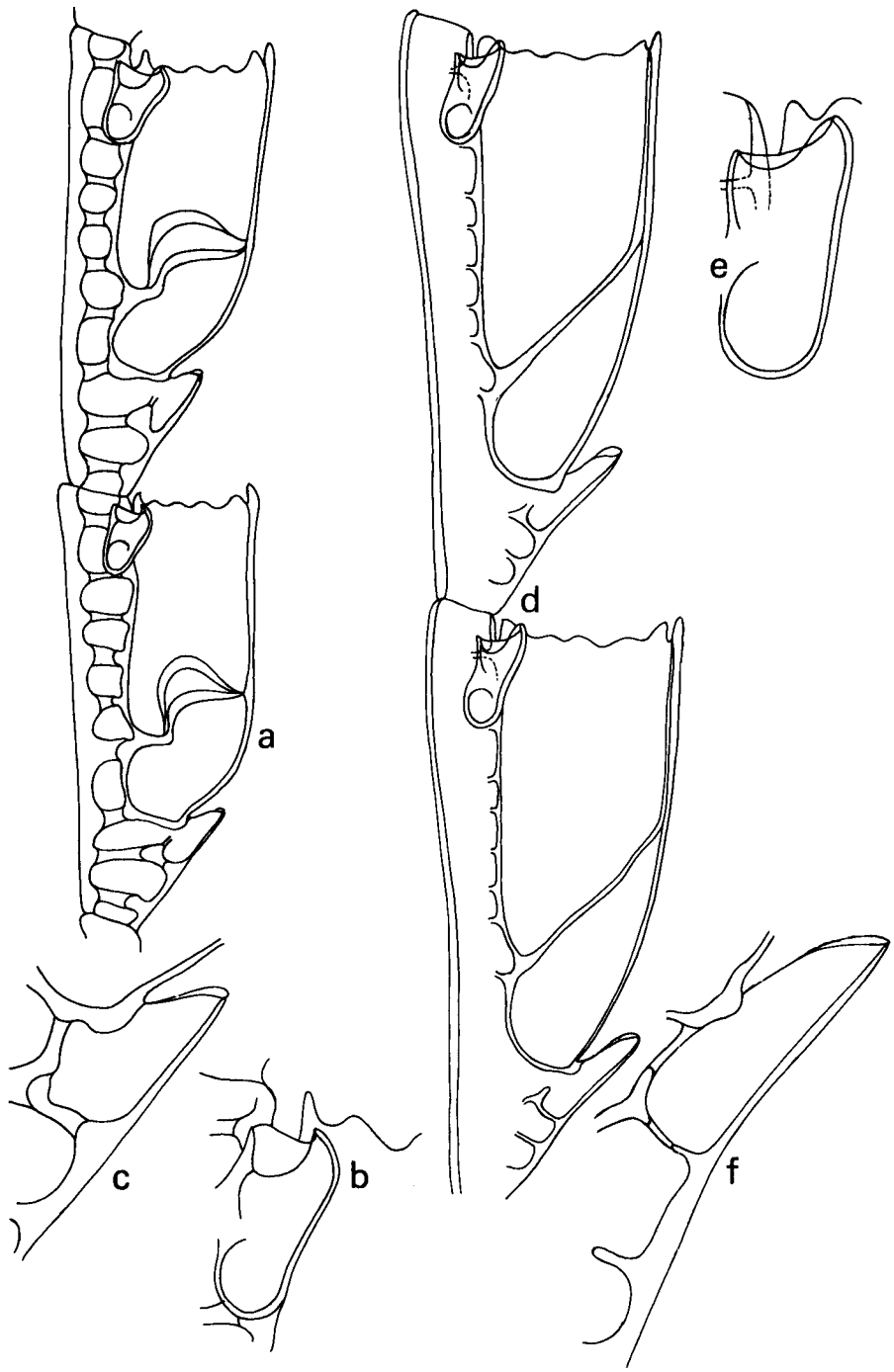


Fig. 31. a-c, *Cladocarpus sigma* (Allman, 1877), schizoholotype, U.S. Gulf Stream Explor., Stn 189-P, MCZ. a, two hydrocladial internodes with hydro- and nematothecae, lateral view; b, lateral nematotheca, outside view; c, median inferior nematotheca, lateral view. d-f, *Cladocarpus sigma* (Allman, 1877) var. *elongata* Bedot, 1921, (schizo)holotype, from MOM no. 11 0181. d, two hydrocladial internodes with hydro- and nematothecae, lateral view; e, lateral nematotheca, outside view; f, median inferior nematotheca, lateral view. a, d, × 80; b, c, e, f, × 190.

(fig. 31a). The median, infracalycine nematotheca covers an extremely short portion of the abcauline hydrothecal wall (fig. 31a, c); the condition in the first hydrocladial internode, where according to Bogle's description abcauline hydrothecal wall and nematotheca are separated, has not been observed, probably because no first internode has been found amongst the debris. The medial nematotheca is one-chambered and the free adcauline wall is fully opened, the aperture being deeply gutter-shaped. The lateral nematothecae are fairly small, one-chambered and just reaching the hydrothecal rim. There is no internal septum; the aperture is deeply scooped-out on the median side. A circular hole in the basal half of the nematotheca serves the communication with the internode (fig. 31b).

The material from the 1886 cruise of Prince Albert I of Monaco has been described and figured by Pictet & Bedot (1900: 47-49, pl. 76 figs. 7-9) and need not be redescribed here.

Table 38. Measurements of *Cladocarpus sigma* in µm.

| | Alligator Reef schizoholotype | Western Atlantic (Vervoort, 1972) |
|---|---|---|
| Hydrocladial internode, length | 90-710 | 600-620 |
| diameter at node | 90-95 | 95-110 |
| Hydrotheca, total depth | 540-560 | 500-540 |
| length free part abcauline wall | 565-570 | 475-500 |
| diameter at rim | 210-220 | 215-245 |
| Median nematotheca, length abcauline wall | 125-135 | 105-120 |
| length free adcauline part | 50-60 | |
| diameter at rim | 30-45 | 47-54 |
| Lateral nematothecae, depth | 120-125 | 130-135 |
| diameter at rim | 45-60 | 34-41 |

Distribution.— The material listed above is all from the temperate northern Atlantic, where the species appears to be widely distributed.

## **Cladocarpus sigma** (Allman, 1877) var. **elongata** Bedot, 1921
(figs. 31d-f, 32a-e)

*Cladocarpus sigma* var. *elongata* Bedot, 1921a: 326 (nomen nudum); Bedot, 1921c: 53, pl. 6 figs. 48-49; Vervoort, 1966: 149: Patriti, 1970: 52, fig. 73; Aguirrezabalaga et al., 1984: 89.

Material.— BALGIM Stn DW 94, 34°24.9'N-07°28.5'W, 08.vi.1984, 1175 m: single fragmentary colony 21 mm high with three hydrocladia and without phylactocarp.
Additional material.— **Eastern Atlantic Ocean.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1901.— Stn 1116, off Mogador, Morocco, 31°43'30"N-10°46'45"W, 2165 m, 11.vii.1901: two carmin stained slides of hydrocladia, (schizo)holotype (MOM no. 11 0181).

Description (of the BALGIM material).— Axis polysiphonic, rising from small matting of perisarcal tubules; secondary axial tubes with longitudinally arranged nematothecae. Primary axial tube without nematothecae basally and there without

division into segments; rest of axis divided into segments be means of slightly oblique nodes that gradually become better visible in distal direction. First segments short, each with single nematotheca ('prosegments') (fig. 32c). Following segments each with hydrotheca and three nematothecae: one median infracalycine and two laterals (fig. 32b). From the sixth segment onwards (prosegments excluded) there is a regular succession of segments each bearing an apophysis (alternately directed left or right) and three nematothecae: one under apophysis and two axillary (fig. 32a).

Hydrocladia composed of internodes separated by oblique nodes, each with one hydrotheca and three nematothecae: one median infracalycine and two laterals. Hydrotheca, both those on axis and hydrocladia, with adnate adcauline wall; from basal third of that wall two septa run upwards towards distal internal abcauline hydrothecal wall. Development of septa symmetrical ( cf. fig. 31b-e), with characteristic curve. Adcauline hydrothecal wall slightly concave below point of insertion of septa, beyond that region practically straight. Abcauline hydrothecal wall slightly convex basally and more or less straight onwards. Hydrothecal rim dentate, with well developed median abcauline cusps and five pairs of cusps along rim, second and third pairs least developed (fig. 32d, e).

Median infracalycine nematotheca springing from internode under hydrotheca. In hydrothecate segments of axis distance between insertion of median nematotheca and base of hydrotheca considerable, rim of nematotheca just reaching base of hydrotheca or some distance below that base. In hydrocladial hydrothecae median nematothecae inserting directly under hydrothecal base, with rim considerably surpassing hydrothecal base. Lateral nematothecae just reaching hydrothecal rim but not surpassing it. All nematothecae with a single, gutter-shaped aperture.

Each hydrocladial internode with seven to nine little developed internal septa: two under hydrotheca, four to six behind hydrotheca and one distal.

Distribution.— *Cladocarpus sigma* var. *elongata* has so far been recorded from a single locality off the Atlantic coast of Morocco close to Essaouira (Mogador) at 2165 m depth (Bedot, 1921). Patriti (1970) refers to the locality given by Bedot. Our material originates from a locality off Rabat, Morocco (DW 94), depth 1175 m.

Discussion.— The presence of two intrathecal septa of characteristic, elongated shape makes it possible to refer this material to Bedot's var. *elongata* of *Cladocarpus sigma* (Allman, 1877). Moreover, we have been able to compare our material with two slides of the holotype of this variety from the collections of MOM (no. 11 0181). These two slides made by Bedot and labelled in Bedot's handwriting comprise one with two and one with a single hydrocladium and have been used for comparison and a more complete series of measurements. The slides have previously been inspected by Dr M. van Praët, who wrote on the slides: "fragment du type, M.v.P.,1985" and "fragment du type que ne comportait qu'1 colonie, Van Praët, 1985". The BALGIM material is in perfect agreement with the (schizo)holotype (fig. 31d-f), the only point of difference being the distance between hydrothecal bottom and median, infracalycine nematotheca: there is no space between the end of the gutter-shaped nematothecal aperture and the base of the abcauline hydrothecal wall (fig. 31d, f). This distance, however, is known to be variable in all species of *Cladocarpus*. There are 11 incomplete internodal septa, three below and eight behind the hydrotheca, the uppermost being almost hidden by the lateral nematothecae (fig. 31d).

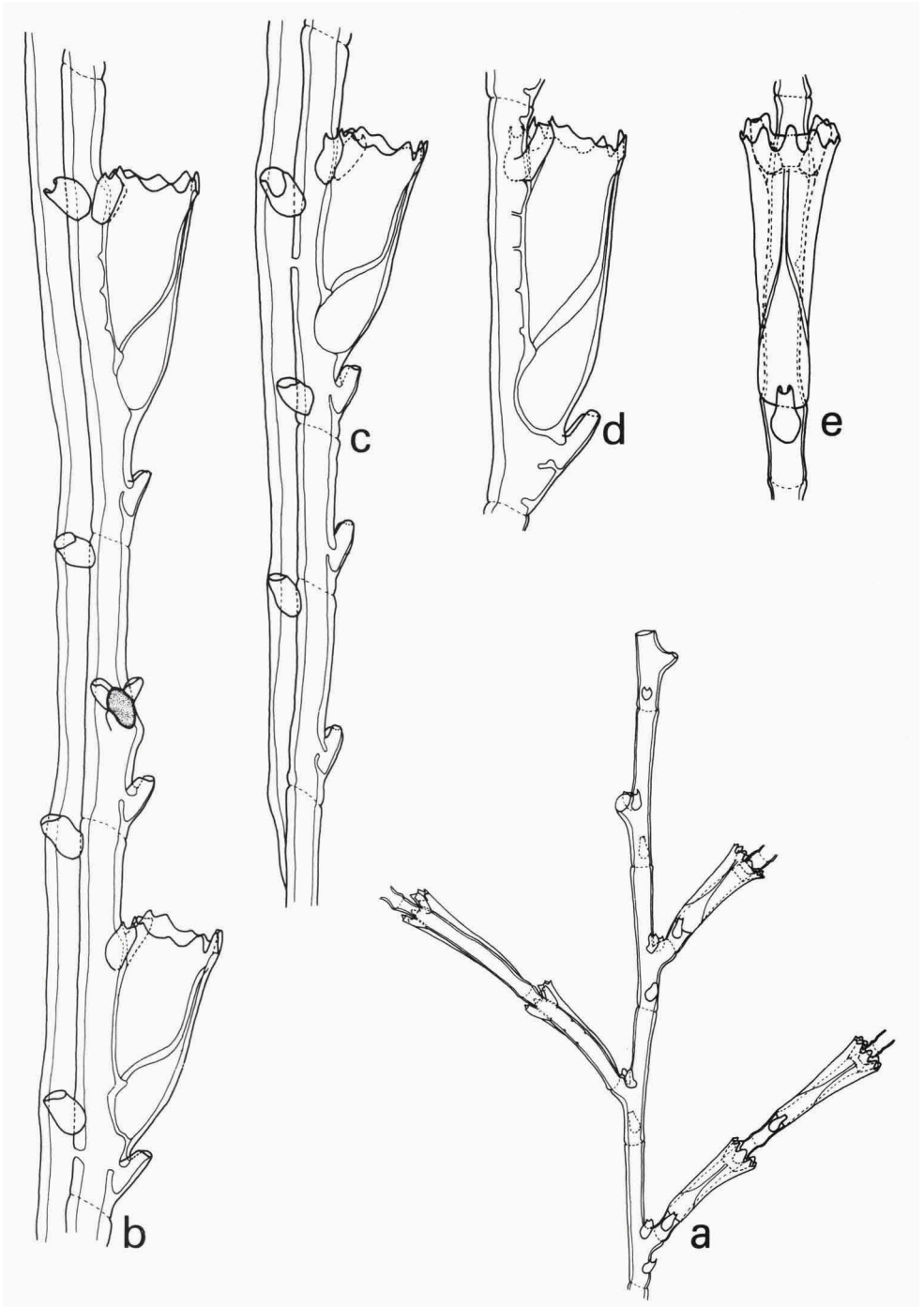


Fig. 32. *Cladocarpus sigma* (Allman, 1877) var. *elongata* Bedot, 1921, from DW 94. a, slightly aberrant top part of colony, frontal view; b, basal part of axis with 2 axial hydrothecae and an apophysis, lateral view; c, extreme base of colony with 'prosegments' and first axial hydrotheca, lateral view; d, hydrocladial internode with hydro- and nematothecae, slightly oblique lateral view; e, idem, frontal view. a, × 24; b-e, × 60.

Table 39. Measurements of *Cladocarpus sigma* var. *elongata* in μm.

| | BALGIM Stn DW 94 | Atlantic (schizoholotype) |
|---|---|---|
| Axial hydrothecate segment, length | 890-1090 | |
| Axial non-hydrothecate segment, length | 600-940 | |
| diameter at node | 95-120 | |
| Axial hydrotheca, depth | 520-580 | |
| diameter at rim | 200-220 | |
| Hydrocladial internode, length | 820-950 | 900-1020 |
| diameter at node | 90-110 | 90-110 |
| Hydrocladial hydrotheca, depth | 660-720 | 690-750 |
| diameter at rim | 220-235 | 270-295 |
| Median axial infracalycine nematotheca, length | 110-130 | |
| diameter at rim | 20-30 | |
| Median hydrocladial nematotheca, length | 150-160 | 150-189 |
| diameter at rim | 35-40 | 30-40 |
| Lateral axial nematotheca, length | 110-120 | |
| diameter at rim | 30-35 | |
| Lateral hydrocladial nematotheca, length | 145-150 | 150-175 |
| diameter at rim | 30-45 | 35-50 |

We have not been able to check Bedot's statement that in var. *elongata*, as in the species, the intrathecal septa are asymmetrical, because none of the hydrotheca in the Monaco slides is in frontal position. In Bedot's figure of a hydrotheca of var. *elongata* in frontal position (Bedot, 1921c, pl. 6 fig. 49) as well as in our material (see fig. 32e) the septa appear to be symmetrical or nearly so. The septa, in lateral and slightly oblique view (fig. 32d) may easily create the impression of being asymmetrical.

Finally we draw attention to the structure of the BALGIM colony. First of all the presence of axial hydrothecae is remarkable, occurring normally only in some species of Aglaopheniidae in the primary colony, originating directly from the planula larva. The present colonies rises from a matting of perisarcal fibres suggesting that we are dealing with an older colony. Moreover, the first two segments of the axis are hydrothecate, then follows a segment with an apophysis from which the hydrocladium has disappeared, after which follow two hydrothecate segments, after which the normal sequence of axial segments (with apophysis and three nematothecae) begins.

Another peculiarity of the present colonies lies in the fact that, after the last hydrothecate axial segment three segments follow which have the nematotheca under the apophysis turned in frontal direction; the hydrocladia have disappeared. From then onwards there are segments of which the nematotheca under the apophysis is alternately turned frontally and backwards. The hydrothecae placed on the hydrocladial internodes supported by those apophyses must also have alternately faced the front and the back of the colony as can be seen from the three hydrocladia present in the colony (and by the direction of the nematothecae on the two remaining segments of the axis, fig. 32a).

Judging from the shape and structure of the hydrothecae there are sufficient differences to separate var. *elongata* from the species at specific level. We have not done so for two reasons. First of all the BALGIM material is small and the colony-structure is slightly aberrant. Secondly, we have been unable to see the phylactocarp of var.

*elongata*. None is present in the BALGIM colony and the material we received from Monaco unfortunately does not comprise the phylactocarp which must have been present originally as Bedot (1921c: 54) remarks that in structure it is not different from that of *Cladocarpus sigma*. The possibility of small structural differences, however, can not be altogether neglected.

### **Cladocarpus sinuosus** Vervoort, 1966
(fig. 34a)

*Cladocarpus sinuosus* Vervoort, 1966: 155-158, figs. 55-57; Millard, 1975: 428-429, fig. 132E-H; Millard, 1977: 107, 129-130, fig. 9A-B; Millard, 1978: 190; Millard, 1980: 133.
*Cladocarpus* cf. *sinuosus* - Gili, Vervoort & Pagès, 1989: 96, fig. 21B.

Material.— BALGIM Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: single fragment composed of 5 mm long hydrocladium with a sterile and much damaged phylactocarp. In addition a 25 mm high fragment with one hydrocladium; no phylactocarp.

Description.— Axis polysiphonic, without apparent division into segments. Basal part of axis without nematothecae followed by nematothecae and apophyses arranged in one row, the apophyses alternately directed left and right. Between two succeeding apophyses there are two nematothecae; in addition there is one axillary nematotheca. Axial nematothecae with two apertures, one terminally, one basally, directed towards axial wall. Hydrocladium composed of hydrothecate internodes separated by oblique septa. Each internode slightly sinuous, more or less following curvature of hydrotheca which it bears in addition to three nematothecae: one median infracalycine and two laterals near hydrothecal margin. Hydrotheca completely adnate on adcauline side, at lower third with intrathecal septum projecting into hydrothecal cavity and recurved characteristically at its tip. Adcauline hydrothecal wall concave above insertion of septum. Abcauline hydrothecal wall strongly convex in proximal half but strongly recurved in distal half and there with considerable concavity. Hydrothecal rim smooth, with single well developed median cusp (fig. 34a).

Median infracalycine nematotheca springing from internode directly under hydrothecal base, its rim almost at level with hydrothecal bottom, bearing two openings: one terminal and one basal directed towards hydrothecal wall. Lateral nematothecae damaged distally, but observed to be tubular, surpassing distinctly hydrothecal rim and with a basal, adcauline opening.

Each internode internally with eight to twelve strong septa of which three are basal, six to eight behind hydrotheca and one apical.

Phylactocarp damaged, inserting laterally at base of first hydrotheca, composed of three-segmented rachis, each segment bearing one pair of opposite nematothecae (fig. 34a). All nematothecae of phylactocarp damaged, but one of nematothecae observed to have a basal aperture. Moreover, segments have five, four and three internal septa, respectively.

Distribution.— This species hitherto has been almost exclusively found in South African waters, which induces Millard (1975, 1978) to consider the species endemic to South Africa. It has been recorded from various localities off the Natal coast between 400 and 680 m depth (Millard, 1977), from off Durban at 495 m depth (type

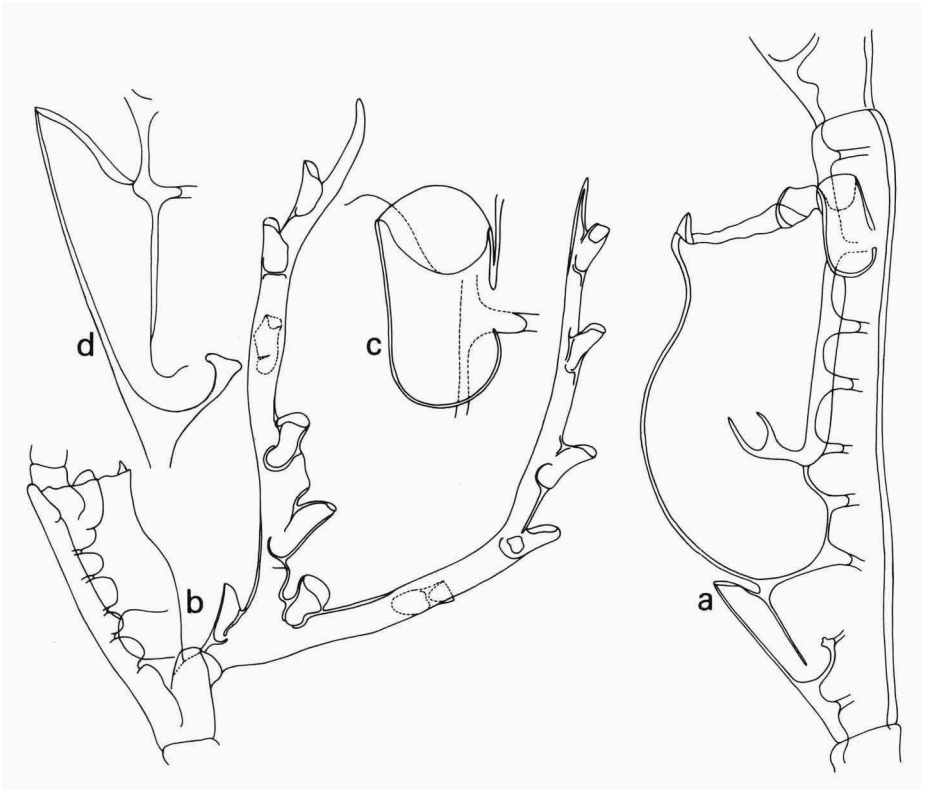


Fig. 33. *Cladocarpus ventricosus* Allman, 1877, schizoholotype, from U.S. Gulf Stream Explor., station unknown (MCZ). a, hydrocladial internode with hydro- and nematothecae, slightly oblique lateral view; b, basal part hydrocladium with sterile phylactocarp; c, lateral nematotheca, inside view; d, median inferior nematotheca, lateral view. a, b, × 85; c, d × 210.

locality, Vervoort, 1966), near East London between 540 and 630 m depth (Millard, 1980), and from various localities on the Agulhas Bank between 183 and 550 m depth (Millard, 1975). Also, this species has doubtfully been recorded from off Guinea Bissau (Gili, Vervoort & Pagès, 1989). The present record is from the Alboran Sea near the coast of Morocco (CP 135), depth 395 m, which considerably extends the geo-

Table 40. Measurements of *Cladocarpus sinuosus* in µm.

| | BALGIM Stn CP 135 | ATLANTIDE off Durban (Vervoort, 1966) | S. Africa (Millard, 1975) |
|---|---|---|---|
| Hydrocladial internode, length | 750-790 | 875-985 | |
| diameter at node | 50-70 | 80-95 | |
| Hydrotheca, depth (excl. cusp) | 380-450 | 445-475 | 300-500 |
| diameter at rim | 180-190 | 230-235 | 130-200 |
| Median nematotheca, length | 115-120 | 90-98 | |
| diameter at aperture | 15-20 | | |

(Lateral nematothecae unfit for measurements).

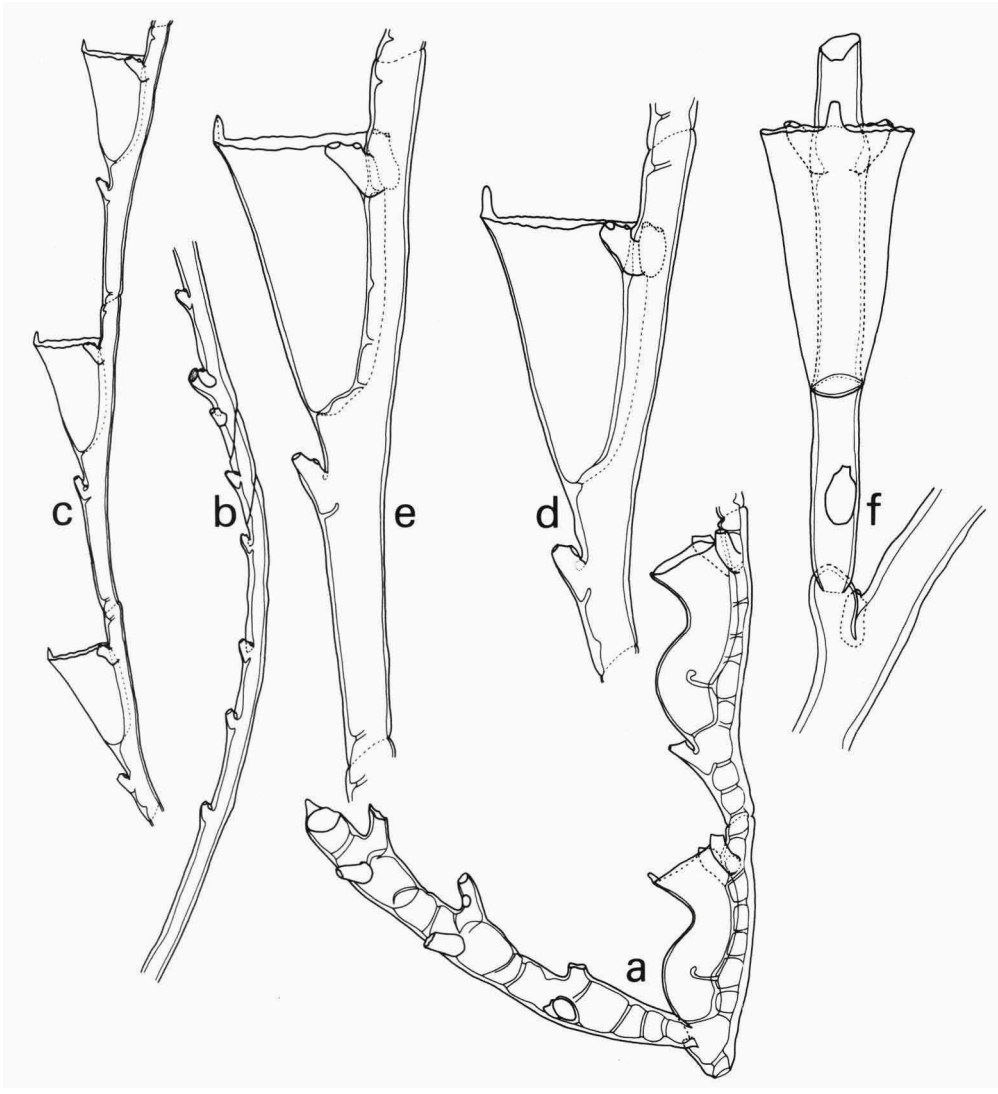


Fig. 34. a, *Cladocarpus sinuosus* Vervoort, 1966, from CP 135, two hydrocladial internodes with hydro- and nematothecae, and sterile phylactocarp, slightly oblique lateral view. b-f, *Cladocarpus* spec. from DW 11. b, basal part axis with 'prosegment'; c, three hydrocladial internodes with hydro- and nematothecae, lateral view; d, e, hydrocladial internodes of different length with hydro- and nematothecae, lateral view; f, insertion of hydrocladium on apophysis, frontal view. a, d-f, × 56; b, c, × 22.

graphical range of the species, constituting at the same time the first Mediterranean record.

Discussion.— In spite of the fact that the present material is small and slightly damaged there can in our opinion be no reasonable doubt that it belongs to *Cladocarpus sinuosus*. On the one hand the presence of a phylactocarp with a central rachis distinguishes the material immediately from *Cladocarpus ventricosus* Allman, 1877, where the phylactocarp is dichotomously forked, on the other hand it is by the shape of its hydrotheca differentiated from *Cladocarpus dollfusi* Billard, 1924, in which

the basal curvature of the abcauline hydrothecal wall is much stronger.

Furthermore, we have compared the BALGIM material with a schizoholotype of *Cladocarpus sinuosus*, affording final proof of a correct identification. Differences do exist in the number of internodal septa and the relative lengths of hydrothecae and internodes. Four weakly developed septa are present in the holotype, while the internodes are slightly longer and the hydrothecae slenderer. The variability in Millard's material, which was mono- as well as polysiphonic and where three to eight septa were present, and her measurements of the South African material are such that the Balgim material is within the known limits of variability of *C. sinuosus*.

### **Cladocarpus ventricosus** Allman, 1877
(fig. 33a-d)

*Cladocarpus ventricosus* Allman, 1877: 52, pl. 31; Nutting, 1900: 112, pl. 26 figs. 6-8; Bedot, 1921a: 326; Fraser, 1944: 412, pl. 91 fig. 401; Fraser, 1946: 93, 410; Deevey, 1954: 271; Vervoort, 1966: 149; Vervoort, 1968: 144; Bogle, 1975: 209-217, fig. 187.

Not *Cladocarpus ventricosus* - Vervoort, 1959: 300, fig. 49 (= *Cladocarpus dollfusi* Billard, 1934).

Material.— **Western Atlantic Ocean.** U.S. Coast Survey, Gulf Steam Exploration, Stn ?, off Sand Key, 180 m, 09.v.1868: c. 25 mm high colony with phylactocarps (holotype, MCZ). Data taken from Bogle, 1975.

Notes on the holotype.— There are no less than eight labels with the tube containing the holotype, two off which are so badly bleached that no data are visible while one refers to the removal of the holotype of *Aglaophenia apocarpa* Allman, 1877. The information on the remaining labels is conflicting in depths records: as a result the exact type locality cannot be given, the reference given above has been taken from Bogle (1975). The type locality is somewhere off Sand Key, Florida, depth 100-120 fms (183-229 m). Because of the scarcity of material the notes presented below are based on the inspection of a few hydrocladia only.

Holotype colony composed of axis with alternately arranged apophyses bearing 10-15 mm long hydrocladia, alternately curving laterally and obliquely upwards. Axis strongly curved in holotype; arrangement of axial nematothecae not studied in detail.

Hydrocladial internodes fairly long, hydrotheca and median nematotheca covering larger part of internode with only fraction of internode distally and proximally free. Hydrotheca of characteristic shape, ventricose; adcauline wall fully adnate with internode, abcauline wall elongated S-shaped, with strong, rounded convexity in lower two-third; distal third smoothly convex, continuing into fairly strong median cusp. Perisarc of abcauline wall not notably strong, of uniform thickness, slightly thicker near median cusp. Hydrothecal rim almost perpendicular to internodal length axis, running upwards towards bases of lateral nematothecae, indistinctly crenulate, on both sides (near median cusp and near lateral nematotheca) with stronger, rounded cusp. Lower third of adcauline wall curved inwards and there producing an intrathecal ridge or ledge, continued on both internal surfaces of hydrothecal wall, distinctly asymmetrical (fig. 33a, b).

Lateral nematothecae elongated, more or less cylindrical, surpassing hydrothecal

Table 41. Measurements of *Cladocarpus ventricosus* in µm.

| | Off Sand Key, Florida |
|---|---|
| Hydrothecate internode, length | 820-850 |
| diameter at node | 65-80 |
| Hydrotheca, length abcauline wall | 520-540 |
| length adcauline wall | 560-590 |
| total depth | 500-510 |
| maximal diameter | 260-275 |
| diameter at rim | 215-230 |
| Lateral nematotheca, total length | 150-170 |
| diameter at rim | 60-90 |
| Median nematotheca, total length | 170-185 |
| length free part adcauline wall | 75-95 |

rim by one third of length, basally rounded; aperture deeply scooped out on adcauline side. Laterals apparently one-chambered: internodal septum behind nematotheca may easily create impression as though laterals are bithalamic ( fig. 33c).

Median nematotheca free from hydrothecal bottom, though closely approximated. Abcauline wall nearly straight; free part adcauline wall fully occupied by gutter-shaped aperture of nematotheca (fig. 33d).

In internodes inspected nine internodal septa or rings are present, six of which are behind hydrotheca. Remaining are found in proximal part of internode (2) and above laterals in distal part of internode (1).

Part of axis occupied by reproductive structures formed by phylactocarps born on first internode of successive hydrocladia and curving towards centre of colony, thus forming an open, protective structure over (female) gonothecae. Each phylactocarp an antler-like structure composed of nematophorus branchlets forming a scorpioid sympodium and springing from a short apophysis lateral to the median nematotheca of first hydrocladial internode, slightly displacing that nematotheca. Hydrotheca in that first internode less bulky but apparently of same size as remaining hydrothecae on hydrocladium. From apophysis springs a curved branch set with nematothecae with gutter-shaped apertures; base of branch with internally directed apophysis flanked by two nematothecae: one axillary, one basal. From this apophysis springs a slightly shorter branchlet of same structure as first with apophysis directed externally (towards primary branchlet); this apophysis usually gives rise to a third branchlet, broken in figured specimen. This third branchlet may or may not have a basal apophysis giving rise to a fourth branchlet. All branchlets end in an obtuse point (fig. 33b). Gonothecae (in holotype) were found to spring in pairs from axial apophyses (not from phylactocarp); they contain a single egg and have a lateral, elongated oval aperture (cf. Allman, 1877, pl. 31 figs. 6-7).

Distribution.— This species in known from a few localities only, viz. from the indistinctly known type locality off Sand Key, Florida (Allman, 1877) and from a second locality given by Bogle (1975): Strait of Florida, 27°45'-27°48'N, 79°18'-79°15'W. The depth records are from 180 and 531 m.

## **Cladocarpus** spec.
(fig. 34b-f)

Material.— BALGIM Stn DW 11, 36°44.2'N-09°31.4'W, 29.v.1984, 1523 m: fragment 26 mm high and much abraded; no phylactocarp.

Description.— Axis rising from small matting of perisarcal fibres, polysiphonic basally, but continuing as monosiphonic, unsegmented axis, bearing four frontal nematothecae. This basal part ending in 'prosegment' set off by oblique nodes and bearing single nematotheca (fig. 34b). Rest of axis formed by series of segments separated by oblique nodes, each with two or three apophyses, alternately pointing left or right, from which rise alternately directed hydrocladia. Each apophysis with single axillary nematotheca (fig. 34f); between two successive apophyses on same segment there is one more nematotheca, while at least two nematothecae occur between two consecutive apophyses from following segments; one above apophysis of proximal segment and another below apophysis of following segment. Axial nematothecae with two apertures: one apical and another basally, directed towards axis.

Hydrocladia composed of succession of internodes separated by oblique nodes; each internode with one hydrotheca and three nematothecae: one median infracalycine and two laterals. Hydrotheca placed in upper half of internode (fig. 34d, e), with fully adnate adcauline wall. Abcauline hydrothecal wall straight, running into strong median cusp at hydrothecal rim. Rest of hydrothecal rim slightly sinuous.

Median infracalycine nematotheca placed on internode some distance below hydrothecal base, its apex below base of hydrotheca, with two apertures: one apical and one basal directed towards internode; both apertures are circular.

Lateral nematothecae short, apex level with hydrothecal rim. There are two apertures: one apical, one basal and directed towards hydrotheca.

Internode with five or six weakly developed septa: one directly following the node, three or four behind the hydrotheca and one distal directly under the node (fig. 34e).

Distribution.— The specimen discussed originates from the eastern Atlantic SW of Cape São Vicente (DW 11), 1523 m depth.

Discussion.— The present material, a fragmentary colony without phylactocarp, has been included in *Cladocarpus* because of the similarity of hydrotheca and nematothecae with those of the other species in this genus. However, it has been impossible to identify this material with any of the species of *Cladocarpus* so far described, so that its inclusion in the genus must still be considered doubtful. The shape of the hydrotheca and the spacing of the hydrothecae along the internodes of a hydrocladium reminds of *Cladocarpus flexuosus* Nutting, 1900, *Cladocarpus distomus* Clarke, 1907 and *Cladocarpus plumularioides* Jarvis, 1922.

The BALGIM colony differs from *Cladocarpus flexuosus* in the place of the hydrotheca on the hydrocladial internode, as it is placed on the basal part of the internode in *C. flexuosus*, leaving the distal part of the internode free. Moreover, there is no reference to the presence of two nematothecal apertures in the description of the latter. From the descriptions of *Cladocarpus distomus* and *C. plumularioides* it is clear that here the hydrotheca is also placed on the basal part of the hydrocladial internode while the distal (free) part of the internode has a supplementary median nematotheca.

Recently Rees & Vervoort (1987: 142-144, fig. 30b-c) have described *Cladocarpus distomus* (= *Cladocarpus anonymus* spec. nov.) from the Indian Ocean; the nematothecae here have two apertures, but both are apical and placed at the end of short funnels.

Furthermore, if we compare the measurements of *Cladocarpus plumularioides*

Table 42A. Measurements of *Cladocarpus spec.* and *C. multiapertus*, in µm.

| | *Cladocarpus* spec. BALGIM Stn DW 11 | *Cladocarpus multiapertus* (cf. Billard, 1911) |
|---|---|---|
| Axial nematotheca, length | 120-150 | |
| diameter at aperture | 20-30 | |
| Hydrocladial internode, length | 1500-1840 | 1050-1085 |
| diameter at node | 110-150 | 70 |
| Hydrotheca, depth (without cusp) | 650-750 | 700-750* |
| diameter at rim | 380-460 | 160-175 |
| Median infracalycine nematotheca, length | 140-170 | |
| diameter at aperture | 25-30 | |
| Lateral nematotheca, length | 160-200 | |
| diameter at aperture | 25-30 | |

* = including cusp.

Table 42B. Measurements of *Cladocarpus plumularioides* and *C. anonymus* in µm.

| | *Cladocarpus plumularioides* (cf. Vervoort, 1966) | *Cladocarpus anonymus* (cf. Rees & Vervoort, 1987) |
|---|---|---|
| Axial nematotheca, length | 120-135 | 140-155 |
| diameter at aperture | 78-85 | 125-130** |
| Hydrocladial internode, length | 978-1105 | 1065-1170 |
| diameter at node | 100-105 | 65-70 |
| Hydrotheca, depth (without cusp) | 650-665 | 700-750 |
| diameter at rim | 230-255 | 295-310 |
| Median infracalycine nematotheca, length | 120-130 | 100-110 |
| diameter at aperture | 28-35 | |
| Lateral nematotheca, length | 127-135 | 120-130 |
| diameter at aperture | 68-76 | 85-95** |

** = maximal diameter.

given by Vervoort (1966, taken from the schizoholotype) and of *Cladocarpus anonymus* given by Rees & Vervoort (1987, taken from Indian Ocean specimens) with those taken from our material, it can be seen that, though the hydrothecal depth is similar in the three cases, there is a considerable discrepancy in the length of the hydrocladial internodes and the diameter of the hydrotheca at the rim, these measurements being much larger in our material. All three differ in the structure of the hydrocladial hydrothecate internode.

Comparing the BALGIM material with descriptions of other species with several nematothecal apertures, only *Cladocarpus multiapertus* Billard, 1911, has a certain resemblance with our material. However *C. multiapertus* differs by the fact that the lateral nematothecae have three apertures, one basal and two apical, while the hydrothecae are longer and slenderer, having a smaller diameter at the rim as also appears from the table of measurements.

## Genus Lytocarpia Kirchenpauer, 1872

### Lytocarpia distans (Allman, 1877)
(fig. 35a)

*Aglaophenia distans* Allman, 1877: 44-45, pl. 26 figs. 1-8.
*Thecocarpus distans* - Vervoort, 1972: 224-227, figs. 73b, 79.
Not *Thecocarpus distans* - Bedot, 1921c: 52-53, pl. 6 figs. 51-52 [= *Lytocarpia myriophyllum* (Linnaeus, 1758)]
*Lytocarpia distans* - Bogle, 1975: 256-266, fig. 22, maps 36-37.

Material.— **Western Atlantic Ocean.** Pourtales Gulf Steam Exploration, off Pacific Reef (25°25'N-79°58'W), 283 fms (= 518 m), cast no. 8, 13.v.1869: fragment of hydrocladium 4 mm long, composed of three hydrothecate internodes. This fragment, which may be part of the holotype, was found in the jar from MCZ containing the 'probable type' of *Cladocarpus dolichotheca* Allman, 1877, described from the same locality.

Description.— Hydrothecate internodes separated by transverse nodes, each with one hydrotheca and three nematothecae: one median infracalycine and two laterals. Hydrothecae elongated, narrowing towards basal portion. Adcauline wall fully adnate, slightly concave and with basal part not projecting towards cavity of hydrotheca (as it does in *Lytocarpia myriophyllum*). Basal third with indication of poorly developed intrathecal septum. Hydrothecal rim dentate, with strong median, abcauline cusp, broad at its base and slightly curved towards interior of hydrotheca. There are five pairs of poorly developed lateral teeth of which fourth and fifth are reduced and represented as mere undulations of hydrothecal rim (fig. 35a).

Median infracalycine nematotheca fully adnate with basal third of abcauline hydrothecal wall, aperture gutter-shaped. Lateral nematothecae small, rim at same level as hydrothecal rim, aperture also gutter-shaped. Hydrothecate internode with two or three poorly developed internal septa (peridermal rings), two under the median, infracalycine nematotheca and one behind the hydrotheca at same level as intrathecal septum.

Discussion.— The small fragment studied makes it possible to establish clearly the differences with *Lytocarpia myriophyllum* as may appear from the following summary:

1. Hydrothecal shape. In *L. distans* the hydrotheca is characteristically narrowed in its basal third; no such narrowing is present in *L. myriophyllum*.

2. Median, infracalycine nematotheca. In *L. distans* this nematotheca is small and occupies the basal third only of the abcauline hydrothecal wall. In *L. myriophyllum* this nematotheca as much larger and occupies c. half the abcauline hydrothecal wall.

3. Adcauline hydrothecal wall basally never projecting into hydrothecal cavity in *L. distans*; it does so in *L. myriophyllum*.

Table 43. Measurements of *Lytocarpia distans* in µm.

| | Off Pacific Reef |
|---|---|
| Hydrothecate internode, length | 1040-1190 |
| diameter at node | 120-140 |
| Hydrotheca, depth (median cusp excluded) | 710-800 |
| depth, including median cusp | 780-835 |
| diameter at rim | 360-380 |
| Median nematotheca, length | 250-275 |

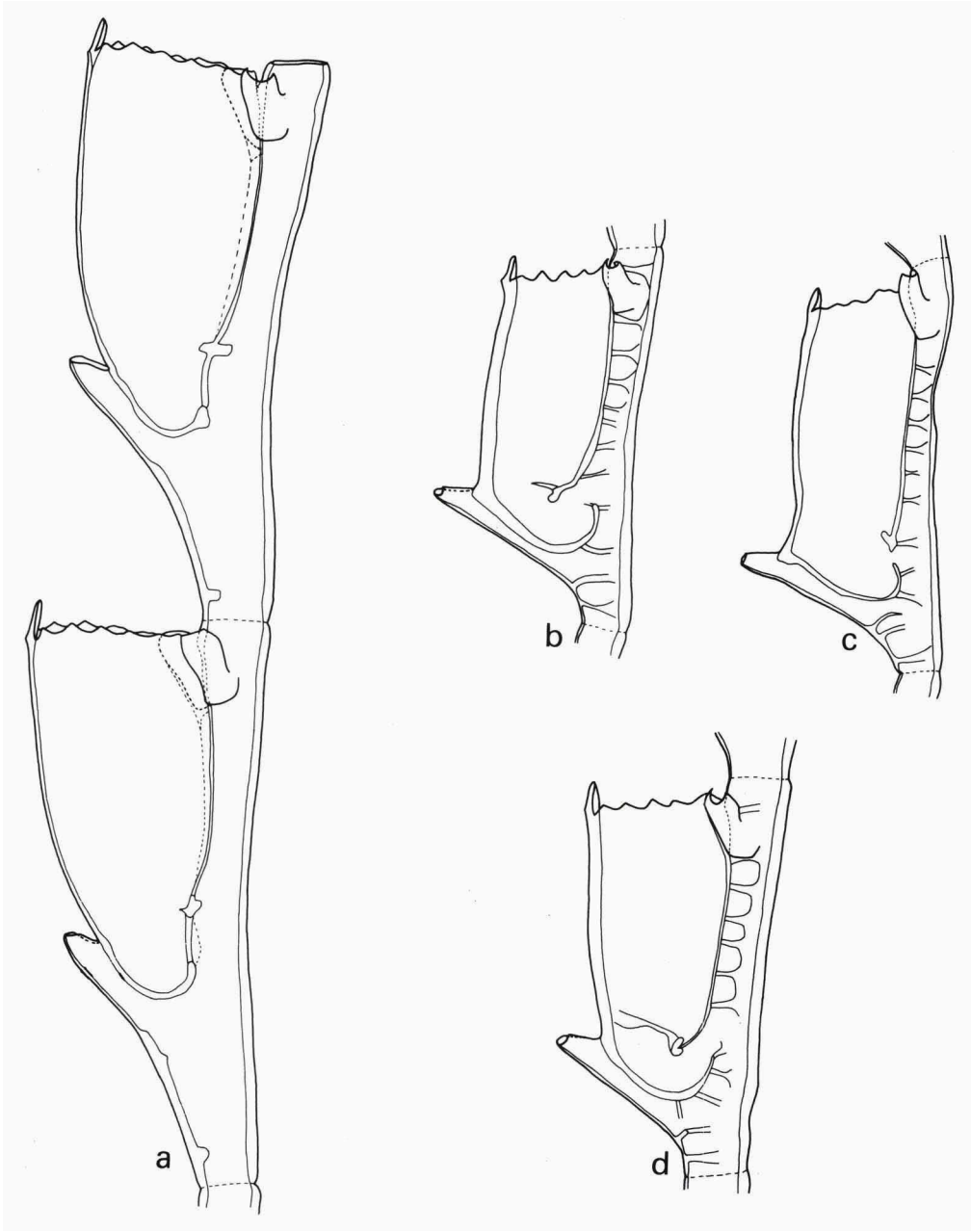


Fig. 35. a, *Lytocarpia distans* (Allman, 1877), from Pourtales Gulf Steam Explor. (MCZ), two hydrocladial internodes with hydro- and nematothecae, lateral view. b-d, *Lytocarpia myriophyllym* (Linnaeus, 1758), from DR 56, hydrocladial internodes from same colony with hydro- and nematothecae, lateral view. a-d, × 65.

4. Internodal septa. In *L. distans* there are maximally two of such septa behind the hydrotheca: one at the level of the intrathecal septum in the basal third of the adcauline hydrothecal wall and one at the base of the median infracalycine nematotheca (Vervoort, 1972; Bogle, 1975).

## **Lytocarpia myriophyllum** (Linnaeus, 1758)
(figs. 35b-d, 36a-j)

*Sertularia myriophyllum* Linnaeus, 1758: 810.
*Aglaophenia myriophyllum* - Hincks, 1868: 290-292, pl. 64 fig. 2; Pictet & Bedot, 1900: 34-41, pl. 8, pl. 9 fig. 1-10.
*Lytocarpus myriophyllum* - Marktanner-Turneretscher, 1890: 277, pl. 7 figs. 10-11.
*Thecocarpus myriophyllum* - Billard, 1906d: 226-227; Vervoort, 1946b: 187-189, fig. 79.
*Lytocarpia myriophyllum* - Stechow, 1923d: 246.
*Thecocarpus myriophyllum* var. *typica* - Billard, 1922: 343-346, fig. 1A.
*Thecocarpus myriophyllum myriophyllum* - Gili, Vervoort & Pagès, 1989: 96-97, fig. 22.
*Aglaophenia radicellata* G.O. Sars, 1874: 9-10, pl. 2 figs. 1-6.
*Thecocarpus myriophyllum* var. *radicellatus* - Billard, 1906d: 227; Billard, 1922: 346, fig. 1B; Vervoort, 1942: 306, fig. 2c.

Material.— BALGIM Stn DW 02, 36°55'N-09°16'W, 28.v.1984, 893 m: two small colonies 15 and 20 mm high; no corbulae.— Stn CP 03, 36°50.4'N-09°14.9'W, 28.v.1984, 681 m: twenty-seven small colonies up to 40 mm high, some with fertile corbulae.— Stn DW 07, 36°46.1'N-09°27'W, 29.v.1984, 1141 m: single small colony 30 mm high; no corbulae.— Stn CP 09, 36°47.6'N-09°28'W, 29.v.1984, 1163 m: nine colonies and three fragments 20-50 mm high; some with corbulae.— Stn CP 10, 36°45.3'N-09°43'W, 29.v.1984, 1592 m: two colonies 20 and 25 mm high, no corbulae.— Stn DW 11,36°44.2' N 09°31.4'W, 29.v.1984, 1523 m: twenty mm high fragment; no corbulae.— Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: twelve colonies 25-75 mm high, some corbulae.— Stn DW 16, 36°45.8'N-09°29.4'W, 30.v.1984, 1283 m: four colonies and one fragment 30-40 mm high; no corbulae.— Stn CP 17, 36°45.3'N-09°30.8'W, 30.v.1984, 1470 m: seven colonies and one fragment 20-60 mm, the majority with corbulae.— Stn CP 21, 36°36.5'N-07°24'W, 31.v.1984, 485 m: two colonies 40 and 50 mm high, no corbulae.— Stn DR 23, 36°38.8'N-07°19.5'W, 31.v.1984, 556 m: five colonies and four fragments 15-30 mm high, some with corbulae; also one detached corbula.— Stn DW 24, 36°41.1'N-07°19'W, 31.v.1984, 545 m: twelve small colonies up to 25 mm high, majority broken. One of colonies with corbula.— Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: eleven fragments 8-30 mm high, two with corbula.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: nineteen colonies and fragments 10-25 mm high; one with corbula.— Stn DW 27, 36°46.3'N-07°07.3'W, 31.v.1984, 370 m: c. 30 small colonies up to 35 mm high, majority broken and in bad condition. No corbulae.— Stn DW 28, 36°45.8'N-07°07.7'W, 31.v.1984, 398 m: thirty-four small colonies up to 40 mm high; no corbulae.— Stn DW 32, 36°47.2'N-07°04.4'W, 01.vi.1984, 250 m: two small colonies 20 and 25 mm high; no corbulae.— Stn CP 33, 36°46.9'N-07°04'W, 01.vi.1984, 256 m: four colonies 20-60 mm high; no corbulae.— Stn CP 34, 36°48.8'N-07°04.9'W, 01.vi.1984, 180 m: two small colonies and one fragment 12-35 mm high; no corbulae.— Stn DW 43, 35°54.1'N-06°14.5'W, 02.vi.1984, 150 m: single colony and one fragment 9 and 20 mm high; no corbulae.— Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: fourty-six colonies and nine fragments 20-50 mm high, some with corbulae.— Stn DW 47, 35°43.5'N-06°18.2'W, 02.vi.1984, 281 m: four colonies 18-35 mm high; no corbulae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: fourty-four colonies 20-100 mm high, with corbulae.— Stn DR 56, 35°41.4'N-06°35.8'W, 03.vi.1984, 481 m: two colonies 30 and 60 mm high; with corbulae.— Stn DW 57, 35°41.7'N-06°35.2'W, 03.vi.1984, 548 m: single colony 25 mm high; no corbulae.— Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: one colony and two fragments 25-75 mm high; no corbulae.— Stn DR 72, 35°52'N-08°11.6'W, 06.vi.1984, 173 m: six colonies 25-45 mm high, two of which have corbulae.— Stn DR 75, 33°52.7'N-08°15.2'W, 06.vi.1984, 252 m: eleven colonies 15-55 mm high; no corbulae.— Stn DR 79, 33°49.3'N-08°23.6'W, 06.vi.1984, 260

m: four colonies and one fragment 20-30 mm high; no corbulae.— Stn DR 81, 33°45.9'N-08°29.9'W, 06.vi.1984, 309 m: one colony and a fragment 30 and 50 mm high; no corbulae.— Stn DR 82, 33°45.5'N-08°32'W, 06.vi.1984, 355 m: thirteen colonies and two fragments 15-65 mm high, one with corbula.— Stn CP 84, 33°45.4'N-08°31.'9W, 06.vi.1984, 345 m: one fragment 20 mm high with sterile corbula.— Stn DR 85, 34°14.1'N-07°23.7'W, 07.vi.1984, 497 m: two colonies and one fragment 25-35 mm high of which one with corbula.— Stn CP 86, 34°15.1'N-07°21'W, 07.vi.1984, 512 m: two colonies and one fragment 35-45 mm high of which one with corbula.— Stn DW 87, 34°15.6'N-07°17.9'W, 07.vi.1984, 500 m: one colony in two parts, 15 and 50 mm; no corbulae.— Stn CP 89, 34°20.3'N-07°18.4'W, 07.vi.1984, 722 m: ten colonies and two fragments 10-80 mm high; with two corbulae in bad condition.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: two colonies 30-50 mm high; no corbulae.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: single colony 40 mm high, no corbulae, and on old stem.— Stn DW 94, 34°24.9'N-07°28.5'W, 08.vi.1984, 1175 m: three colonies 15-30 mm high; no corbulae.— Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: two colonies and a stem fragment 20-25 mm high, one of which with corbula.— Stn DW 96, 34°23.5'N-07°40.3'W, 08.vi.1984, 1255 m: single colony 50 mm high; no corbulae.— Stn DW 100, 34°28'N-07°42'W, 09.vi.1984, 1691 m: one colony in two parts 35 mm high; no corbulae.— Stn DR 101, 34°10.9'N-07°29.8'W, 09.vi.1984, 353 m: eight colonies 20-100 mm high; no corbulae.— Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: fifty-three colonies and some fragments up to 75 mm high, some with corbulae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: nineteen detached hydrocladia.— Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: single colony 25 mm high; no corbulae.— Stn DW 120, 35°51.2'N-05°10.4'W, 13.vi.1984, 425 m: four colonies and one fragment, 25-35 mm; no corbulae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: single fragment 20 mm high; no corbulae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: single colony 55 mm high (in two parts), and one fragment 30 mm high; no corbulae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: three colonies 15-40 mm; no corbulae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: twenty-four colonies and three fragments 15-80 mm high, some with corbulae.— Stn CP 137, 35°33.2'N-04°23'W, 15.vi.1984, 1005 m: four colonies 27-40 mm high; no corbulae.— Stn CP 149, 35°47.5'N-05°11' W, 17.vi.1984, 377 m: nine colonies and one fragment 10-40 mm high, some with corbulae.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: single colony 75 mm high with two corbulae.— Stn CP 155, 36°19.8'N-07°40.6'W, 18.vi.1984, 903 m: single colony 20 mm high; no corbulae.

Description.— Hydrorhiza formed by dense mass of perisarcal fibres from which rises a polysiphonic axis, of which primary tube bears one longitudinal row of frontal nematothecae and a longitudinal series of apophyses, alternately directed left and right and bearing hydrocladia. Primary axial tube divided into large segments by means of strongly oblique, well marked nodes. Each of these segments, especially in younger parts of colonies can be seen to be divided into smaller segments by means of straight nodes, at times hardly visible or indicated only by perisarcal constrictions. Each of these smaller segments bears one basal nematotheca, one apophysis and two axillary nematothecae. In some colonies, or in different parts of one axis, internal septa may be present that in some cases can be well developed and numerous. Between two consecutive apophyses there is 1 frontal nematotheca, but distance between these apophyses variable, at times quite small (200-300 μm), at other times much larger (up to 1 mm).

Hydrocladia formed by regular succession of internodes separated by slightly oblique nodes; each internode bears one hydrotheca and three nematothecae: one frontal infracalycine and two laterals. Hydrothecae cup-shaped, of greatly varying depth; adcauline wall fully adnate, with basal part curved towards interior of hydrotheca and forming the characteristic more or less oblique internal septum, forcing hydranth to take its characteristic position inside hydrotheca. In some hydrothecae, particularly those without rests of hydranths, the internal septum is seen to con-

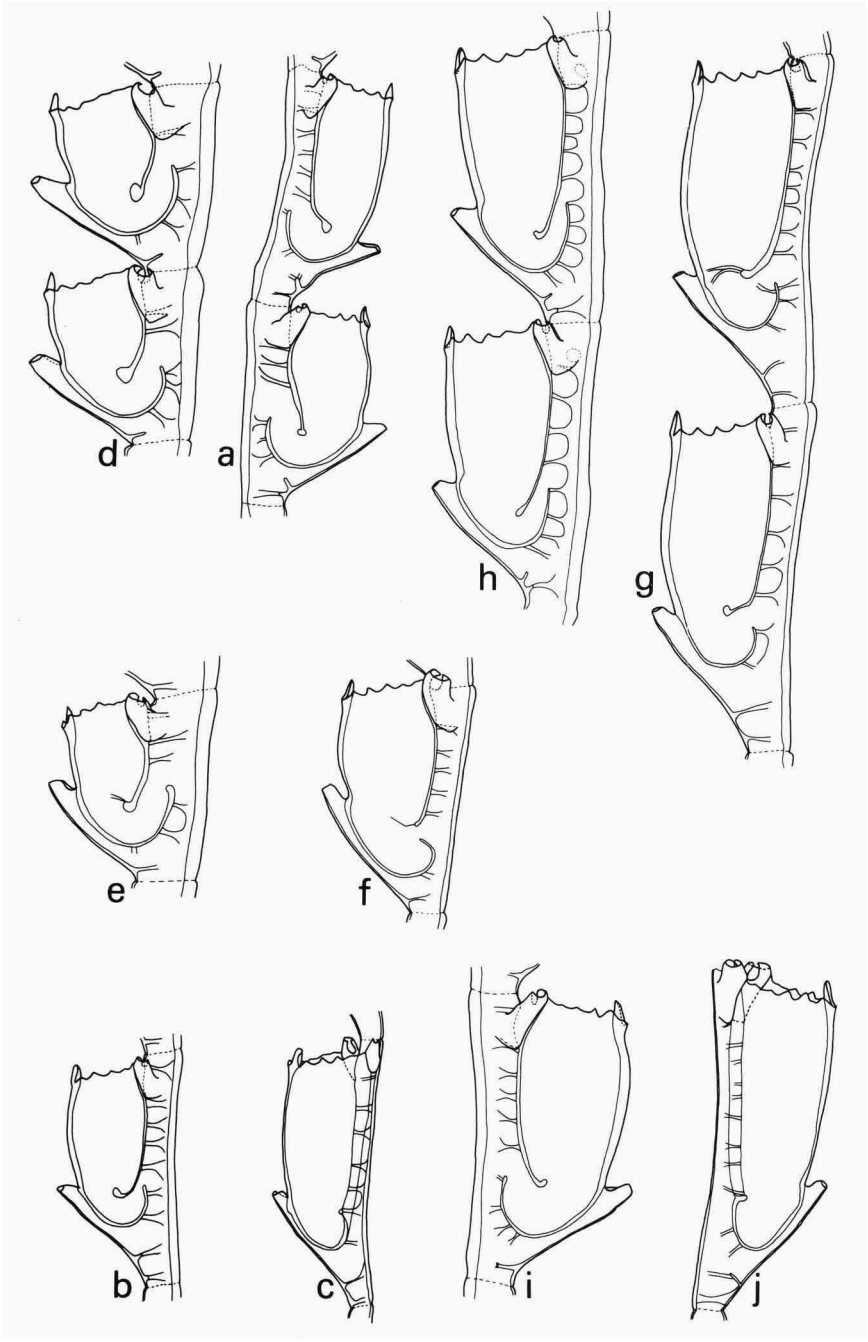


Fig. 36. *Lytocarpia myriophyllum* (Linnaeus, 1758), hydrocladial internodes with hydro- and nematothecae in lateral view. a, b, c, from DR 45, b and c from same colony but from different hydrocladia; d, e, f, from DR 49, e from basal, f from apical part of same hydrocladium; g, from CP 62; h, from CP 89; i, j, from CP 149, same hydrocladium, i hydrotheca from old part of colony, j, regenerated hydrotheca. a-j, × 47.

tinue as two transverse septa or ridges, continuing towards abcauline wall of hydrotheca; development of those ridges varied. Free part abcauline wall (i.e. part not covered by median nematotheca), straight or slightly convex, usually with thickened perisarc. Hydrothecal rim dentate, with one strongly developed, broad, adcauline median cusp, slightly curved interiorly, and five pairs of cusps along lateral parts of rim, usually well developed but varied of size in material studied, diminishing in size in adcauline direction.

Median nematotheca adnate to abcauline hydrothecal wall, in some colonies (DR 49) reaching as far as middle of abcauline wall, but in others as far as the lower third of that border. Lateral nematothecae small, apically reaching as far as hydrothecal rim or slightly surpassing that rim. All nematothecae with gutter-shaped aperture.

Hydrocladial internodes with a number of internal septa or ridges, of which development and number is varied. In development they vary between incomplete septa or complete septa, reaching from external wall of internode until adcauline hydrothecal wall (though there must remain a central opening for passage of coenosarc; complete 'septa' are in reality circular ridges). The number of septa varies between six and thirteen: one or two basal septa and five to eleven behind hydrotheca.

Corbula open; basal part composed of one hydrothecate internode, followed by a rachis bearing a variable number of pairs of lateral costae. Each costa with basal hydrotheca and large branch with longitudinal row of nematothecae. Branch originating from hydrothecal base in region where normally is found the median nematotheca. Between rachis of corbula and base of branch normally two nematothecae are present. Gonothecae springing from rachis in corbula, flattened, oval in outline. In a single corbula there may be a number of large gonothecae as well as a number of considerably smaller gonothecae that have the same outline.

Variability.— *Lytocarpia myriophyllum* is a polymorphic species; the abundance of material from greatly varying depths has permitted us to prove that it is extremely variable in practically all parts of the colony. First of all, as has already been indicated, the distance between consecutive hydrocladia varies between small, resulting in a 'dense' colony, and large, up to c. 1 mm, in which case a gracefully built colony results. However, the greatest variability has been observed in the morphology of the hydrothecae. Thus, as extreme form of this variability, some colonies have closely packed , fairly shallow hydrothecae of which the median nematotheca reaches as far as half the abcauline hydrothecal wall (DR 49, fig. 36d). In other colonies (CP 62, fig. 36g) the hydrothecae are well separated and much deeper, the median hydrotheca occupying the lower third of the abcauline hydrothecal wall or slightly less. In this case variability results primarily from the length of the free part of the abcauline hydrothecal wall which is short in shallow hydrothecae and considerably lengthened in 'deeper' hydrothecae. Colonies with hydrothecae of intermediate morphology occur at other stations (see 'Measurements' and the figures), but intermediate conditions are also met with in the same colony or even in the same hydrocladium, as is shown in the material from DR 49 ( fig. 36e, f), where some hydrocladia have the shallow type of hydrotheca basally and the considerably deeper type distally.

Also a considerable amount of variability is visible in the development of the intrathecal septum. Generally in the older hydrothecae this septum is well developed, but in younger hydrothecae it may be poorly developed or be even completely

absent. Consequently in young colonies still in the process of development, some hydrothecae may have an intrathecal septum while in other hydrothecae it is scarcely visible (DR 45, fig. 36b, c; DR 56, fig. 35b-d). Some colonies have damaged and regenerating hydrocladia (CP 149, fig. 36j); the hydrothecae in the old part have the characteristic intrathecal septum (fig. 36i), while in the hydrothecae of the regenerated part the septum is developing (fig. 36j).

As has also been indicated variability also concerns the development of the cusps of the lateral hydrothecal rim, that may either be well developed or reduced to mere undulations, and the development and number of septa (ridges) in the hydrocladial internode.

As far as the corbula is concerned, the study of the large BALGIM material has shown that it is fairly constant in morphology; in all cases its basal part is formed by a single hydrothecate internode and the rachis. In some cases the costae of a corbula have a second branch, also provided with a longitudinal row of nematothecae and forming a continuation of the hydrothecate internode representing the base of the costa. In the material from DR 49 one of the lateral costae of some corbulae is transformed and gives origin to another corbula. The latter, instead of developing as a modified hydrocladium, develops as a modification of a costa of another corbula.

Distribution.— *Lytocarpia myriophyllum* presents a considerable distribution in Atlantic and Mediterranean, being distributed from the Arctic regions (Broch, 1918) in the north to Guinea Bissau in the south (Gili, Vervoort & Pagès, 1989). The records of *L. myriophyllum* from Indian and Pacific Oceans concern the varieties *orientalis* Billard, 1913, *angulatus* Billard, 1913, and *elongatus* Billard, 1908a, and must be considered with much reserve; in our opinion a thorough revision of these varieties is necessary before they can be included in *Lytocarpia myriophyllum* (see 'Discussion'). The Balgim material originates from 55 localities situated at both sides of the Strait of Gibraltar and originating from depths between 150 and 1592 m.

Discussion.— The great variability met with in this species has induced Billard to describe, in the course of time, a number of varieties: *typica* (*Lytocarpia myriophyllum myriophyllum*), *bedoti* (Billard, 1906d), *radicellatus* (G.O. Sars, 1874) (= *Aglaophenia radicellata* G.O. Sars, 1874), *orientalis* (Billard, 1908a), *perarmatus* (Billard, 1908a), *elongatus* (Billard, 1910), and *angulatus* (Billard, 1913). Later on (Billard, 1913) var. *perarmatus* was raised to specific rank (as *Thecocarpus perarmatus*) and in a subsequent paper (Billard, 1922) the various varieties were redefined.

Amongst these varieties two distinct groups can be observed:

1. var. *typica*, *bedoti*, and *radicellatus* with open corbulae and of mainly Atlantic distribution;

2. var. *orientalis*, *elongatus*, and *angulatus* with closed corbulae and of principally Indo-Pacific distribution.

As already pointed out above we think that the second group, to which in all probability must also be added *Thecocarpus myriophyllum* described by Leloup, 1937b from the China Sea, should be considered to consist of provisional varieties of which the exact status within the species *Lytocarpia myriophyllum* can only be elucidated after a further study of a comprehensive material from Indo-Pacific localities. Moreover, as the main difference between both groups concerns the structure of the corbula, we have to bear in mind that as far as the trophosome is concerned, Billard (1913) noticed in var. *orientalis* the same amount of variability we have now

Table 44A. Measurements of *Lytocarpia myriophyllum* in μm.

Measurements are presented of colonies considered as extremes (DR 49[1], CP 62), of an intermediate form (CP 89), and of colonies with a wide range of variability (DR 49[2], CP 149).

| | BALGIM Stn DR 49[1] | BALGIM Stn CP 89 | BALGIM Stn CP 62 |
|---|---|---|---|
| Hydrocladial internode, length | 420-520 | 720-950 | 940-1010 |
| diameter at node | 150-235 | 110-150 | 95-125 |
| Hydrotheca, total depth (exclusive median cusp) | 380-440 | 580-690 | 650-730 |
| length free portion abcauline wall (including median cusp) | 200-265 | 390-500 | 530-630 |
| diameter at rim | 270-300 | 270-300 | 250-300 |
| Median nematotheca, length | 350-400 | 530-420 | 350-390 |

Table 44B. Measurements of *Lytocarpia myriophyllum* in μm.

| | BALGIM Stn DR 49[2] | BALGIM Stn CP 149 |
|---|---|---|
| Hydrocladial internode, length | 460-660 | 700-1030 |
| diameter at node | 90-180 | 70-145 |
| Hydrotheca, total depth (exclusive median cusp) | 390-560 | 530-770 |
| length free portion abcauline wall (including median cusp) | 230-360 | 430-580 |
| diameter at rim | 240-290 | 280-305 |
| Median nematotheca, length | 315-380 | 320-410 |

described for the BALGIM material with the sole difference that Billard's measurements of var. *orientalis* are smaller that ours for the BALGIM colonies. Finally, to the group with closed corbulae should be added var. *vervoorti* Stepan'yants, 1979, which includes the material described by Vervoort (1972) as *Thecocarpus myriophyllum* var. I and var. II, originating from the Pacific side of the Magelhaen Strait and the South-West Atlantic, which would indicate that this group of forms also occurs in the Atlantic.

As far as the Atlantic varieties of *Lytocarpia myriophyllum* are concerned, the var. *typica* is characterized by its non-ramified colony and by the fact that the internal septa of the internodes, varying in number between five and nine, do not reach the external wall of the internode. The var. *radicellatus* is characterised by unbranched colonies, strongly developed internal septa that reach the external internodal border, well developed cusps along the hydrothecal rim and two internal septa below the hydrotheca. In this variety there are also septa in the segments of the axis. All these characters have also been met with in the BALGIM material. Though it may appear, after the inspection of isolated colonies, that distinct varieties (var. *typica*, var. *radicellatus*) can be distinguished, the inspection of the large material from the BALGIM cruise leads us to the conclusion that the varieties *typica* and *radicellatus* should be sunk into the species *Lytocarpia myriophyllum* and have no real taxonomic value. *Lytocarpia myriophyllum* var. *bedoti* according to Billard (1922) is mainly characterized by the ramified hydrocaulus (axis), the ramifications having no distinct order. There are, nevertheless, additional differences in shape and structure of the internodal

septa as well as in the basal part of the hydrotheca (cf. Pictet & Bedot, 1900); these in our opinion make it necessary to study a more copious material of this variety before reaching a definite conclusion concerning its taxonomic position.

We also want to draw attention to Bedot's (1921c) opinion that *Lytocarpia distans* (Allman, 1877) is no more than a variety of *L. myriophyllum*. This opinion resulted from the fact that Bedot, studying material from the Mediterranean, from the west coast of Morocco and from Madeira, in reality saw material of *L. myriophyllum* corresponding with that of BALGIM CP 62 and CP 149. The study of a fragment of *Lytocarpia distans* has made it possible to establish clearly the differences between both species (see above under *Lytocarpia distans*). The record of *Lytocarpia distans* from the Mediterranean in our opinion also refers to *L. myriophyllum*.

## Family **Halopteridae** Millard, 1962
## Genus **Antennella** Allman, 1877

### **Antennella secundaria** (Gmelin, 1791)
(fig. 37a-d)

*Sertularia secundaria* Gmelin, 1791: 3856.
*Plumularia secundaria* - Pictet & Bedot, 1900: 27-28, pl. 6 fig. 7.
*Antenella secundaria* - Patriti, 1970: 57, fig. 81A-B.
*Antennella secundaria* - Millard, 1975: 332-334, fig. 10F-L; Gravier-Bonnet, 1979: 56-58, fig. 11A-B; Rees & Vervoort, 1987: 113, figs. 23a-b.

Material.— BALGIM Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: single colony 8 mm high without gonothecae.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: several 3-5 mm high stems; no gonothecae. In addition two colonies 5-10 mm high, one with gonotheca, epizootic on *Polyplumaria flabellata*.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: several 3-6 mm high stems; no gonothecae. Small colony 4-8 mm high epizootic on *Acryptolaria conferta minor*; no gonothecae. Single colony 3-7 mm high on polychaete tube; no gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: single colony 2-7 mm high on polychaete tube; with gonothecae. Two colonies composed of stems 3-8 mm high rising from stolonal tube; no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: two colonies 5-10 mm high, without gonothecae, epizootic on *Polyplumaria flabellata* and colony 6 mm high on shell fragment, no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: several colonies 3-8 mm high on old hydroid stem and various stems up to 10 mm high on polychaete tube; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: c. 34 stems 5-25 mm high, with gonothecae.— Stn CP 145, 35°56.6'N-03°07.9'W, 16.vi.1984, 373 m: single 7 mm high stem epizootic on *Sertularella gayi*; no gonothecae. Single 6 mm high stem on polychaete tube; no gonothecae.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: one colony composed of two stems 10 mm high epizootic on *Polyplumaria flabellata*; no gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: small colonies 3-4 mm high on coral fragment; no gonothecae.

Description.— Colony composed of stolonal tube from which rise fairly stiff, upright, unbranched axes, each composed of basal part, divided in variable number of internodes by means of transverse nodes and bearing one to four frontal nematothecae. Rest of axis composed of regular succession of thecate and athecate internodes; thecate internode separated from preceding athecate internode by means of oblique node and from following (athecate) internode by means of transverse node (fig. 37a). Thecate internodes each with hydrotheca and four nematothecae: one median infracalycine, two laterals at end of well developed apophyses besides

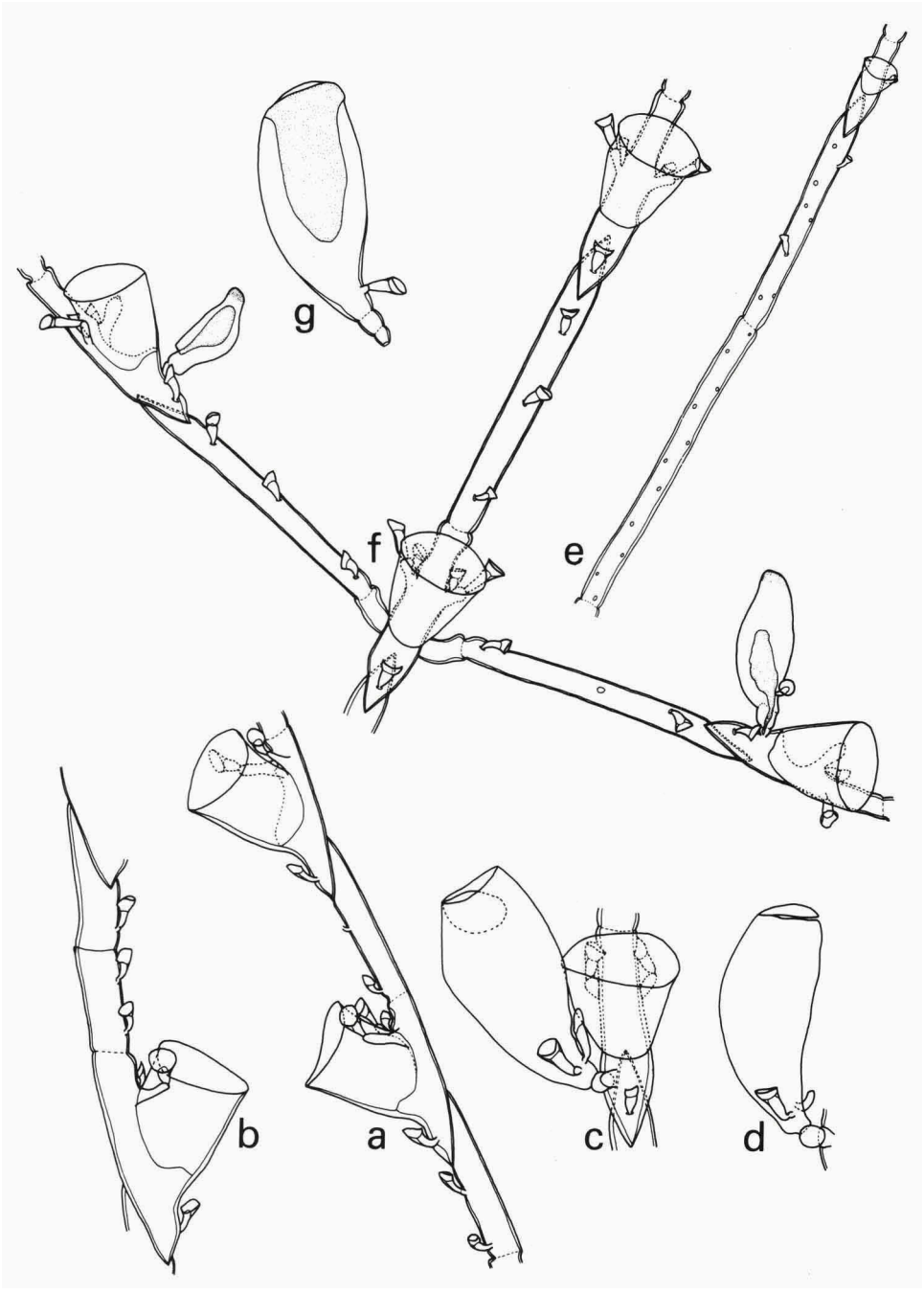


Fig. 37. a-d, *Antennella secundaria* (Gmelin, 1791). a, from DW 114, part of axis, lateral view. b-d, from DW 132. b, part of axis, lateral view; c, d, gonothecae. e-g, *Halopteris catharina* (Johnston, 1833). e, from CP 150, basal part of axis; f, from DR 133, part of axis with two opposite hydrocladia bearing gonothecae, frontal view; g, from DR 42, female gonotheca. a-d, f, g, × 54; e, × 21.

hydrothecal margin and single smaller supracalycine nematotheca behind free part of adcauline hydrothecal wall. Hydrotheca cup-shaped, walls straight, slightly diverging; part of adcauline wall free from internode; rim smooth. Athecate internodes with two frontal nematothecae (fig. 37a).

Gonotheca inserting on internode directly under hydrotheca, pyriform, narrowing basally into short pedicel with two nematothecae. Gonothecal aperture terminal, circular, closed by lid (fig. 37c, d).

Variability.— Some of the colonies examined present a considerable variation in the length of the intermediate (athecate) internodes, that in the basal part of the colony may be long (730 μm) and much shorter in the distal region (540 μm), while in the same colony the length of the thecate internodes remains approximately constant (510-530 μm). Also, we have observed three nematothecae on the athecate internodes in some colonies, though usually after rupture and subsequent regeneration of the internode (fig.37b). However, the number of nematothecae on the athecate internode seems to vary, as has also been remarked by Gravier-Bonnet (1979) who found three nematothecae on athecate internodes in her material of that species from intermediate depths off Madagascar.

Table 45. Measurements of *Antennella secundaria* in μm.

| | BALGIM Stn DW 132 |
|---|---|
| Thecate hydrocladial internode, length | 510-530 |
| Athecate hydrocladial internode, length | 540-730 |
| diameter at node | 100-110 |
| Hydrotheca, length abcauline wall | 300-310 |
| total depth | 260-270 |
| length free part adcauline wall | 150-160 |
| diameter at rim | 265-280 |
| Lateral nematotheca, length | 90-100 |
| diameter at rim | 55-60 |
| Gonothecae, length | 500-600 |
| maximal diameter | 230-290 |

Distribution.— *Antennella secundaria* is a cosmopolitan species with a preference for warmer seas (Gili, Vervoort & Pagès, 1989). From the Gibraltar Strait region it has previously been recorded both from the Mediterranean side (Alboran Sea, Templado et al., 1986) and from the Atlantic side (Bay of Cádiz, Billard, 1906d; numerous localities from the littoral off Morocco, Billard, 1906d; Patriti, 1970). The BALGIM samples originate from the Alboran Sea (DR 132, CP 145), from the Strait of Gibraltar proper (DR 151, DR 152), from various Atlantic localities west of the Strait (DR 40, DR 42, DR 49, DR 50, DR 114) and from the Gulf of Cádiz (CP 26); the depths vary between 135 and 550 m.

Discussion.— The presence of a single supracalycine nematotheca of reduced size in the axil formed by the free part of the adcauline hydrothecal wall and the wall of the internode makes it possible to differentiate this species from the ahydrocladiate form of *Halopteris catharina* (Johnston, 1833) and from *Halopteris diaphana* f. *siliquosa* (Hincks, 1877).

## Genus **Halopteris** Allman, 1877

### **Halopteris catharina** (Johnston, 1833)
(fig. 37e-g)

*Plumularia Catharina* Johnston, 1833: 497, figs. 61, 62; Hincks, 1868: 299-302, fig. 35, pl. 66 fig. 2; Ritchie,

1913: 1-5, figs. 1-3; Bedot, 1914: 94-96, pl. 5 figs. 17-19; Broch, 1918: 56-58, figs. 25-26.
*Antennella catharina* - Vervoort, 1946b: 174-175, figs. 69b, 72.
*Halopteris catharina* - Vervoort, 1972: 236-237.

Material.— BALGIM Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: two colonies 13-15 mm high, no gonothecae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: ten colonies 5-10 mm high, without gonothecae.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: several colonies up to 10 mm high on coral fragment. In addition single colony composed of several stems up to 5 mm high epizootic on *Sertularella gayi gayi*; no gonothecae.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: two fragmentary colonies 9-10 high mm with female gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: six colonies up to 5 mm high of which two with gonothecae. In addition single colony 10 mm high on unidentifiable hydroid, no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: four colonies 5-10 mm high, two with gonothecae, partly on *Polyplumaria flabellata*.— Stn DR 133, 35°25.8'N-04°17.4'W, 15.vi.1984, 195 m: four colonies and three fragments 20-35 mm high with male gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: fragment 15 mm high without gonothecae. One colony composed of three stems 3-8 mm high on axis of *Aglaophenia tubulifera*; no gonothecae. Damaged colony 4-7 mm high on *Nemertesia ramosa*; no gonothecae.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: c. 25 stems 8-25 mm high epizootic on *Schizotricha frutescens*; with female gonothecae.

Description.— Stems erect, monosiphonic, rising from creeping stolon, frequently attached to other hydroids. Basal part of axis divided into segments by means of transverse nodes, each with variable number of frontal nematothecae (up to 11 in BALGIM material), forming two longitudinal rows on basal segments (fig. 37e). Remainder of axis divided in regular succession of thecate and athecate internodes; thecate internodes separated basally from preceding, athecate internode by means of an oblique node and from succeeding athecate internode by a straight node. Thecate internodes each with one hydrotheca and five nematothecae: one median infracalycine and two pairs of laterals; one pair placed at end of well developed apophyses, second pair on base of those apophyses. Hydrotheca cup-shaped with slightly widening, straight walls; free portion of adcauline wall slightly less than half total length of that wall. Hydrothecal rim flat, smooth. Athecate axial segments usually with three frontal nematothecae. Axial hydrothecae basally with pair of apophyses, pointing left and right and each bearing a hydrocladium (fig. 37f). Occasionally this arrangement only present in basal part of colony; higher parts with single apophysis and hydrocladium under each hydrotheca; that part of colony consequently pinnate with alternating hydrocladia. Structure of hydrocladia and arrangement of hydro- and nematothecae almost as in axis; athecate hydrocladial internodes usually with two nematothecae, first (athecate) hydrocladial internode slightly longer than remaining internodes, usually with three nematothecae (fig. 37f).

All nematothecae movable and two-chambered (bithalamic). Pair of lateral nematothecae at base of apophysis at hydrothecal rim smaller than pair placed at end.

Gonothecae springing from thecate internode at base of hydrotheca. Female gonotheca fairly large and ovoid, tapering basally towards short pedicel; two nematothecae occur in basal region; distal end truncate, with circular opening closed by lid (fig. 37g). Male gonothecae smaller and slenderer; greatest diameter in middle; tapering towards both ends (fig. 37f).

Variability.— Part of the material from CP 135, notably that from *Aglaophenia*

*tubulifera* and *Nemertesia ramosa*, is of the *Antennella*-type, being composed of an axis without hydrocladia. The colonies from DR 42, on the other hand, have secondary hydrocladia. In this case a primary hydrocladium has an apophysis supporting a secondary hydrocladium above the first hydrotheca, while other primary hydrocladia have two secondary hydrocladia, one above the first, one above the fourth hydrotheca; all secondary hydrocladia pointing in the same direction (towards the right of the primary hydrocladium). Both the colonies from CP 135 and DR 42 have the arrangement of hydro- and nematothecae as described above.

Table 46. Measurements of *Halopteris catharina* in µm.

The following table gives measurements of the trophosome of colonies from DR 133 and CP 150, there being no distinct difference. The male gonothecae originate from DR 133 and the female from CP 150

| | BALGIM DR 133 & CP 150 |
|---|---|
| Thecate axial segment, length | 520-580 |
| Athecate axial segment, length | 810-900 |
| diameter at node | 80-90 |
| Thecate hydrocladial internode, length | 500-540 |
| Athecate hydrocladial internode, length | 530-660 |
| diameter at node | 60-70 |
| Hydrotheca, total depth | 190-220 |
| length abcauline wall | 270-310 |
| length free part adcauline wall | 120-150 |
| diameter at rim | 220-235 |
| Lateral nematothecae, length | 80-110 |
| diameter at rim | 50-55 |
| Male gonotheca, length | 300-400 |
| maximal diameter | 110-145 |
| Female gonotheca, length | 580-600 |
| maximal diameter | 210-270 |

Distribution.— *Halopteris catharina* is widely distributed in temperate and southern-boreal regions of the Atlantic, both on the eastern and the western side, reaching as far south along the American continent as the Straits of Magellan (Vervoort, 1972). Recently the species has been found along the Atlantic coast of Africa as far south as Lüderitz Bay, Namibia (Gili, Vervoort & Pagès, 1989). In the Mediterranean there are records from off Banyuls-sur-Mer (Redier, 1962, as *Schizotricha catharina*) and from the eastern Mediterranean (Dorian Peninsula, Marinopoulos, 1979, as *Polyplumaria catharina*). The species is also named, without exact locality, in a list of Mediterranean hydroids given by Picard (1958). The records from the Mediterranean coast of Spain (García-Corrales, Aguirre & González, 1878; Gili, 1982, 1984; Gili & Castelló, 1985; Gili & García, 1985) and those from the Canary Islands (Izquierdo, García-Corrales & Bacallado, 1986) in our opinion refer to *Antennella secundaria* (see Discussion). Finally Stechow (1925b) mentions the species from the Red Sea, a record we have been unable to trace.

The present material comes from two localities in the Gulf of Cádiz (CP 25, CP 26), from the Atlantic west of the Strait of Gibraltar (DR 42, DR 49, DW 50), from the Mediterranean side of the Strait (CP 150) and from two localities in the Alboran Sea close to the coast of Morocco (DR 133, CP 135). The depths vary between 135 and 544 m.

Discussion.— As pointed out by Ritchie (1913) after the inspection of type material, the presence of two pairs of lateral nematothecae is the principal character to distinguish *Halopteris catharina* from *Antennella secundaria*, particularly if we bear in mind that young colonies of *H. catharina* usually are of the *Antennella*-type. In

*Antennella secundaria*, moreover, colonies of the *Halopteris*-type, with opposite or pinnately arranged hydrocladia have been described (Vervoort, 1967; Millard, 1975). The descriptions and figures of *Halopteris catharina* given by García-Corrales, Aguirre & González (1978), Gili (1982, 1986), Gili & Castello (1985), Gili & García (1985) and Izquierdo, García-Corrales & Bacallado (1986), all of whom describe or figure the presence of four nematothecae on the thecate internodes: one median infracalycine, two laterals and one behind the hydrotheca, in our opinion all refer to *Antennella secundaria*. Also we consider Patriti's (1970) record of *Halopteris catharina* from the littoral of the Atlantic coast of Morocco as doubtful as here only three nematothecae are mentioned on the thecate internode: one median infracalycine and two laterals.

The presence of secondary hydrocladia in colonies of *Halopteris catharina*, though far from being a regular occurrence in that species, has previously been described by Bedot (1914) from Roscoff material. Our material agrees in the arrangement of the secondary hydrocladia with that described and figured by Bedot (1914, fig. 19).

### **Halopteris diaphana** (Heller, 1868) f. **siliquosa** (Hincks, 1877)
(fig. 38a)

*Plumularia siliquosa* Hincks, 1877: 148, pl. 12 figs. 2-6.
*Antenella simplex* Bedot, 1914: 84-86, pl. 5 figs. 2-5.
*Antenella diaphana* f. *siliquosa* - Broch, 1933: 26-27.
*Antennella diaphana* f. *siliquosa* - Vervoort, 1959: 286-289, fig. 43.
*Halopteris diaphana* f. *siliquosa* - García Corrales, Aguirre & Gonzalez, 1978: 45-46. fig. 19.
*Antenella siliquosa* - Patriti, 1970: 58, fig. 82.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: two colonies 5-8 mm high epizootic on *Sertularella gayi gayi*; no gonothecae. Single 6 mm high stem on *Lafoea dumosa*; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: colony composed of two stems 5 and 6 mm high; no gonothecae. In addition several colonies up to 15 mm high epizootic on *Sertularella gayi gayi* and on polychaete tube; no gonothecae.

Description.— Colony composed of stolonal tube from which rise upright, unbranched stems. Axis composed of basal part formed by one or more segments separated by transverse nodes with one or two frontal nematothecae, followed by a succession of thecate and athecate internodes. Thecate internodes separated from preceding (athecate) internode by means of oblique node and from following (athecate) internode by means of transverse node. This transverse node may be absent in this species but is invariably present in our material. Each thecate internode with one hydrotheca and three nematothecae: one median infracalycine and two laterals. Hydrotheca cup-shaped, walls slightly everted towards hydrothecal rim, with about half of adcauline border free; rim slightly scooped laterally and smooth (fig. 38a). Lateral nematothecae placed on distinct apophyses; rim of lateral nematothecae at or slightly overlapping middle of free part adcauline hydrothecal wall. Moreover each nematotheca with deeply scooped adcauline margin, giving nematotheca very characteristic appearance (fig. 38a). There is no nematotheca in the axil of free part adcauline hydrothecal wall and internode. Intermediate (athecate) internodes with two frontal nematothecae.

Table 47. Measurements of *Halopteris diaphana* f. *siliquosa* in µm.

| | BALGIM Stn DR 113 |
|---|---|
| Hydrothecate internode, length | 300-410 |
| Athecate internode, length | 550-640 |
| diameter at node | 70-80 |
| Hydrotheca, length abcauline wall | 360-420 |
| total depth | 250-350 |
| length free portion adcauline wall | 160-200 |
| diameter at rim | 220-270 |
| Lateral nematotheca, length | 70-80 |
| diameter at rim | 40-50 |

Distribution.— *Halopteris diaphana* is well distributed in the Mediterranean and the subtropical and temperate Atlantic (Vervoort, 1959). From that area f. *siliquosa* has been recorded at the coast of Murcia, Spain, in the Mediterranean (García-Corrales, Aguirre & González, 1978) and between Kénitra and Agadir at the coast of Morocco, while extending its distribution along the Atlantic coasts of Africa as far south as Ivory coast (Vervoort, 1959). The present material is from two localities on the Atlantic coast of Morocco (DR 113, DW 114), off Cape Spartel, depth 144-158 m.

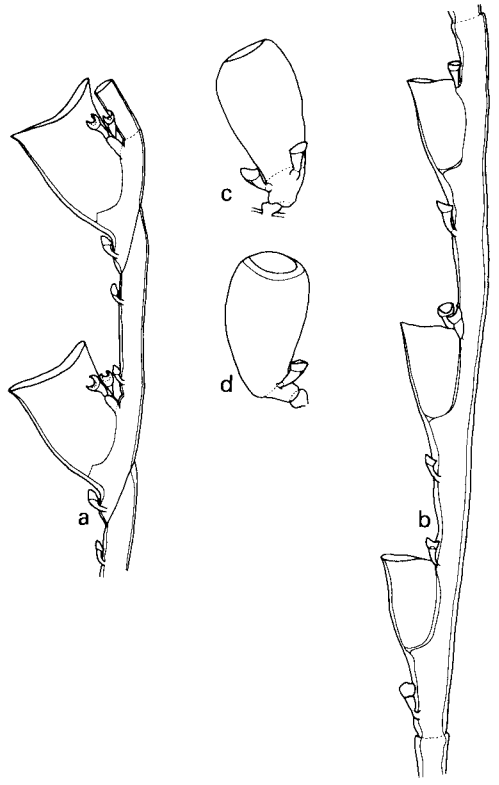


Fig. 38. a, *Halopteris diaphana* (Heller, 1868) f. *siliquosa* (Hincks, 1877), from DW 114, part of axis with hydro- and nematothecae, lateral view. b-d, *Schizotricha frutescens* (Ellis & Solander, 1786). b, from CP 135, part of hydrocladium with hydro- and nematothecae, lateral view; c, d, from CP 150, gonothecae. a-d, × 45.

Discussion.— The principal characters separating this form from *Antennella secundaria* are the shape of the lateral nematothecae, that in *H. diaphana* f. *siliquosa* have a characteristically scooped adcauline wall and the absence of a (reduced) nematotheca behind the free portion of the adcauline hydrothecal wall. Our material is furthermore characterized by the shortness of the lateral nematothecae, that reach approximately the middle of the free adcauline hydrothecal wall and by the fact that the node separating hydrothecate and subsequent athecate internode is just in the axil of the free part of the adcauline hydrothecal wall and the wall of the internode. In *Antennella secundaria* the lateral nematothecae reach the hydrothecal rim and the hydrothecate internode continues some distance beyond the fore mentioned axil.

## Genus **Schizotricha** Allman, 1883

### **Schizotricha frutescens** (Ellis & Solander, 1786)
(fig. 38b-d)

*Sertularia frutescens* Ellis & Solander, 1786: 55 (no. 29), pl. 6 figs. a, A, pl. 9 fig. 1.
*Plumularia frutescens* - Hincks, 1868: 307-308, pl. 67 fig. 3.
*Schizotricha frutescens* - Bedot, 1921c: 11-14, pl. 1 figs. 2, 3, 6; Vervoort, 1946b: 171-173, fig. 71; Patriti, 1970: 59, fig. 84; Millard, 1975: 368.

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: fragment of colony 15 mm high, no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: two detached hydrocladia. In addition single fragment 10 mm high with gonothecae.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: one colony 75 mm high, with gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: single colony 35 mm high, with gonothecae.

Description.— Axis polysiphonic, upright, straight, rising from flattened mass of hydrorhiza fibres; primary tube with longitudinally arranged row of hydrothecae. Hydrocladia pinnately and alternately arranged along axis, inserting under each of axial hydrothecae, directed left and right. Occasionally (DR 153) secondary and tertiary hydrocladia present: secondaries springing from primary hydrocladium at base of first hydrotheca; tertiaries springing from secondary hydrocladium at base of its first hydrotheca. Hydrocladia consists of succession of long internodes separated by transverse septa; internodes with one to five hydrothecae. Hydrothecae deep cup-shaped; adcauline wall completely adnate with wall of internode; rim smooth. Three nematothecae are associated with each hydrotheca: one median infracalycine some distance below hydrothecal base and two laterals at or slightly below hydrothecal rim (fig. 38b).

Gonothecae inserting between hydrothecal base and median nematotheca on both axis and hydrocladia, ovoid, narrowing basally and there with pair of nematothecae. Apex truncate, with circular aperture closed by lid (fig. 38c, d).

Table 48. Measurements of *Schizotricha frutescens* in μm.

| | BALGIM Stn CP 150 |
|---|---|
| Hydrotheca, length abcauline wall | 270-300 |
| depth of hydrotheca | 240-260 |
| diameter at margin | 145-160 |
| Lateral nematotheca, length | 75-90 |
| diameter at rim | 40-55 |
| Gonotheca, length | 430-530 |
| maximal diameter | 230-290 |

Distribution.— *Schizotricha frutescens* has a wide distribution in the subtropical and temperate Atlantic, including the Mediterranean. In the area under study it has previously been recorded from the coast of Murcia, Spanish Mediterranean coast (García-Corrales, Aguirre & González, 1978) and from Agadir on the Atlantic coast of Morocco (Patriti, 1970). The BALGIM material originates from the Alborán Sea (CP 135), from the Mediterranean near the Strait of Gibraltar (CP 150), from the Strait of Gibraltar proper (DR 153) and from the Atlantic off the Strait (DR 40); depths varying between 290 and 580 m.

## Family Kirchenpaueriidae Millard, 1962
## Genus Kirchenpaueria Jickeli, 1883

### Kirchenpaueria bonnevieae (Billard, 1906)
(figs. 39d-g, 40b, e)

*Plumularia rubra* Bonnevie, 1899: 90, 91, 94, pl. 7 fig. 2 [not *Plumularia rubra* Von Lendenfeld, 1884 = *Halopteris campanula* (Busk, 1852)]
*Plumularia elegantula* var. Pictet & Bedot, 1900: 28.
*Plumularia Bonnevieae* Billard, 1906a: 331; Bedot, 1906d: 203-205, fig. 14; Jäderholm, 1909: 29, 107; Van Praët, 1979: 918, fig. 79.
*Kirchenpaueria bonnevieae* - Van Praët, 1979: 918, 935.
*Plumularia triangulata* Totton, 1930: 225-226, fig. 61; Ralph, 1961b: 41-42, fig. 5f-g.
*Kirchenpaueria triangulata* - Vervoort, 1966: 136-138, figs. 38-39; Millard, 1975: 375-376, fig. 119E-H; Rees & Vervoort, 1987: 129-132, fig. 27.

Material.— BALGIM Stn DW 96, 34°23.5'N-07°40.3'W, 08.vi.1984, 1255 m: five colonies 5-18 mm high on old hydroid stem (probably *Lytocarpia myriophyllum*); many empty gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: eight colonies 7-30 mm high epizootic on *Nemertesia* spec.; with gonotheca. In addition a colony consisting of three stems 15-45 mm high and two fragments of which one with two gonothecae. Hydrorhiza composed of perisarcal tubes twisted around an old hydroid stem.
Additional material.— **Bay of Biscay.** Campagne Océanographique Prince Albert I de Monaco, Campagne 1866, Stn 60, 43°57'N-09°27'W, 300 m, 09.viii.1886: c. 17 mm high stem in carmine stained slide of four fragments of *Lictorella halecioides* var. *annellata* (= *Zygophylax biarmata* Billard, 1905) and numbered no. 11 005 (MOM).

Description.— Hydrorhiza attached to other hydroids, tubiform, giving rise to erect, monosiphonic, unbranched axes (hydrocauli) with undivided basal part bearing up to five nematothecae and a distal apophysis above which is a transverse node. Rest of axis composed of regular succession of segments separated by transverse nodes, indistinct at first and gradually becoming more clearly marked. Each of these segments with distal apophysis and one basal nematotheca on opposite side of apophysis on that segment but just above preceding apophysis. Moreover, in upper portion of colony distal half of axial segments with second nematotheca. Apophyses alternately directed left and right, with distinct 'mamelon' on upper surface and one nematotheca above that 'mamelon'.

Hydrocladia borne on apophyses, composed of regular succession of hydrothecate internodes separated by slightly oblique nodes; no basal internode being present. Each internode with one hydrotheca in lower half and two median nematothecae: one under, one above hydrotheca (fig. 39h); infracalycine nematotheca occasionally absent on first hydrocladial internode. Hydrotheca cups-shaped; adcauline wall straight and fully adnate; abcauline wall also straight, slightly longer than adcauline wall so that smooth hydrothecal rim is slightly tilted upwards (fig. 39h). All nematothecae one-chambered (monothalamic) and movable, club-shaped, basally narrowing into a short peduncle; distally nematotheca widened and apically with circular aperture.

Gonothecae inserting on apophysis by means of short pedicel, large, pyriform, triangular in transverse section and distally truncate (fig. 39f, g). Female (?) gonotheca longest, considerably elongated, apically with slit-shaped (?) aperture (fig. 39g).

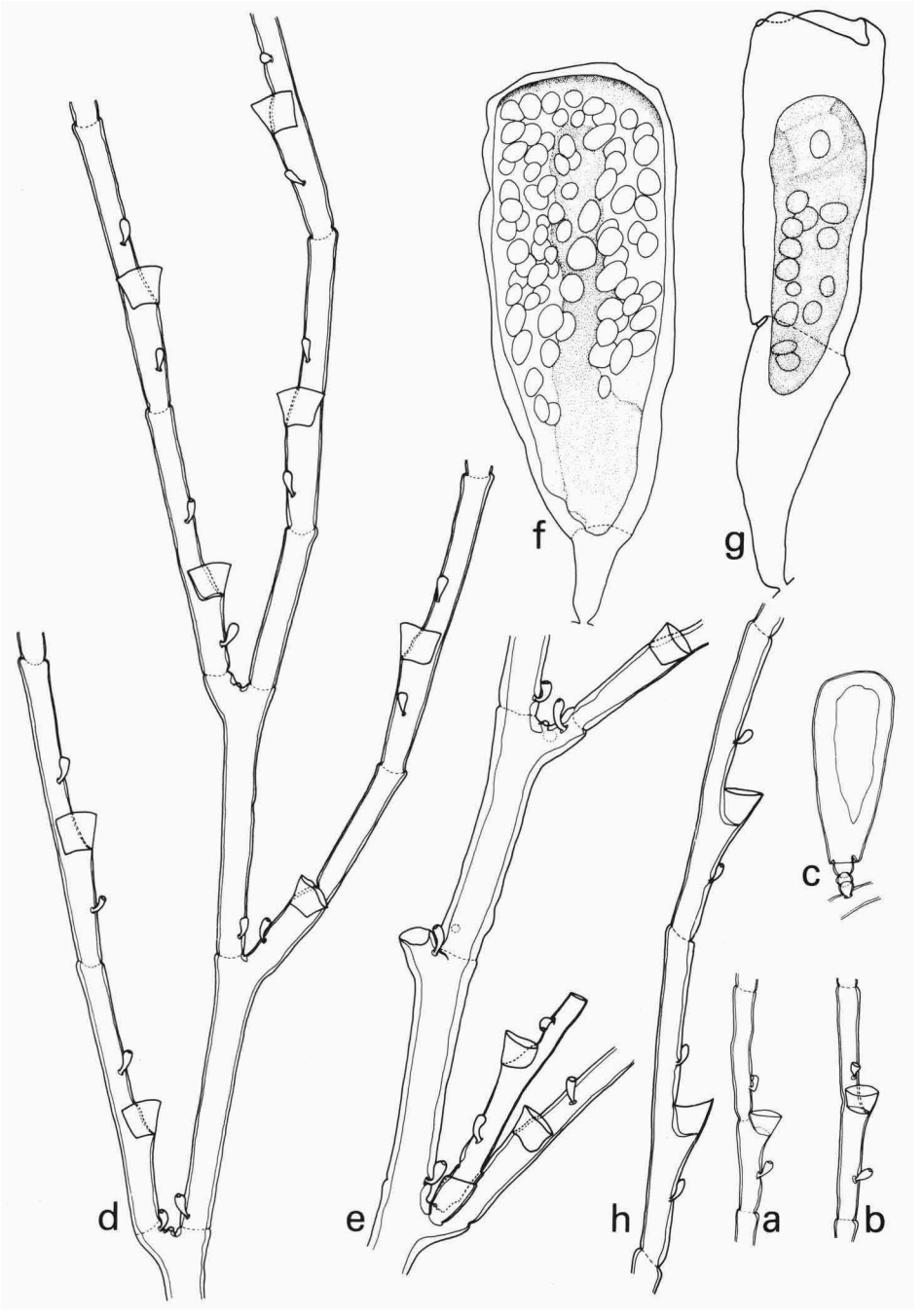


Fig. 39. a-c, *Kirchenpaueria bonnevieae simplex* Billard, 1938, from DR 153. a, b, hydrocladial internodes with hydro- and nematothecae, oblique lateral view; c, gonotheca. d-h, *Kirchenpaueria bonnevieae* (Billard, 1906). d, from CP 113, abnormally developed distal part of axis; e-h, from CP 135; e, supplementary hydrocladium developing from axial apophysis; f, male (?) gonothecae; g, female (?) gonotheca; h, two hydrocladial internodes with hydro- and nematothecae, lateral view. a-h, × 51.

Variability.— As already indicated some of the axial segments may have, besides the constantly present basal nematotheca, a supplementary nematotheca as has also been described by Millard (1975), who describes two to four nematothecae on the axial segments (inclusive the nematotheca on the apophysis). Occasional absence of infracalycine nematotheca on first hydrocladial internode has already been mentioned in description. Also we have observed the presence of a second hydrocladium on two of the axial apophyses, this supplementary hydrocladium inserting on the apophysis under the 'mamelon', at the same place of insertion as the gonothecae (fig. 39e). In both cases the second hydrocladium was broken close to its base and had been regenerated, the regenerated hydrocladium beginning with a short basal internode followed by a single hydrothecate internode.

In another of the colonies studied the distal part of the axis is transformed as no apophysis occurs on one of the segments of the axis, which appears to be bifurcated and gives rise directly to the first hydrothecate internode of the hydrocladium. At the point of bifurcation the axis is continued in a normal segment, complete with its apophysis and hydrocladium, an athecate segment and a succession of hydrothecate internodes as also occur in the hydrocladia (fig. 39d). Exactly the same type of transformation also occurs in *Kirchenpaueria ventruosa* (Billard, 1911).

Finally we have observed, both on axial segments and hydrocladial internodes, signs of possible ramification consisting of perisarcal cups resembling basal parts of internodes, opening into the interior of segment or internode.

Distribution.— *Kirchenpaueria bonnevieae* (Billard, 1906) is known from the North Atlantic as well as from the Indo-Pacific. North Atlantic localities include the Trondhjem Fjord, Norway and two localities between the Faroes and Shetland Islands (Bonnevie, 1899, as *Plumularia rubra*); further records concern two localities NW of Spain * (Pictet & Bedot, 1900, as *Plumularia elegantula* var.; Billard, 1906a, d, as *Plumularia Bonnevieae*). An additional specimen of *K. bonnevieae* occurs in a slide received on loan from the Musée Océanographique, Monaco, containing material from the Bay of Biscay, the locality being that given by Pictet & Bedot, 1900. In the Indopacific it has so far been recorded from Three Kings Island, New Zealand, 300 fms (= 549 m depth) (type locality of *K. triangulata*; Totton, 1930; Ralph, 1961), from Oman and Zanzibar, between 421 and 1046 m depth (Rees & Vervoort, 1987, as *K. triangulata*) and from the Indian Ocean coasts of South Africa from Mozambique to the Cape Peninsula, between 111 and 1207 m depth (Vervoort, 1966; Millard, 1975, both as *K. triangulata*). The BALGIM material originates from the Atlantic N of Rabat, Morocco (DW 96) and from a locality in the Alboran Sea, close to the coast of Morocco (CP 135), considerably extending the area of distribution of this species and recording it for the first time from the Mediterranean.

Discussion.— The BALGIM material is in perfect agreement with the existing descriptions of *Kirchenpaueria bonnevieae* and *K. triangulata*, both as far as the trophosome and the gonothecae are concerned. The characteristic triangular shape of the gonotheca on cross section leaves no doubt about the identity of the specimens. Also the present specimens were found to be epizootic, which appears to be the normal way of growth in this species. The fact that our material originates from the Atlantic

* Billard, 1906d indicates the locality given by Pictet & Bedot (1900) as being near the Azores, while that locality is given by these authors as: Bay of Biscay, 43°57'N 9°27'W, which is NW of Spain.

Table 49A. Measurements of *Kirchenpaueria bonnevieae* in µm.

Besides measurements of the BALGIM material (Stn CP 135) we also include our own measurements of the holotype of *Plumularia bonnevieae* and those of *K. triangulata* as given by Ralph (1961b).

| | *K. bonnevieae* BALGIM Stn CP 135 | *P. bonnevieae* NW of Spain (own measurements) | *K. triangulata* New Zealand (Ralph, 1961b) |
|---|---|---|---|
| Axial segment, length | 620-810 | 725-815 | 800 |
| diameter at node | 70-160 | 110-185 | 250 |
| First hydrocladial internode, length | 650-820 | 925-960 | |
| Following hydrocladial internodes, length | 770-880 | 1035-1075 | |
| Hydrocladial internodes, combined length | | | 800 |
| diameter at node | 80-90 | 75-95 | 90 |
| Hydrotheca, length abcauline wall | 95-110 | 90-95 | 80 |
| length adcauline wall | 80-100 | 85-90 | |
| diameter at rim | 105-115 | 95-110 | 100 |
| Nematotheca, length | 60-70 | 65-70 | 50-62 |
| maximal diameter | 20-30 | 35-45 | |
| Male gonotheca, length | 1470 | 1295-1385 | |
| maximal diameter | 520 | 275-315 | |
| Female gonotheca, length | 1500 | | |
| maximal diameter | 400 | | |
| Gonotheca (sex unspecified), length | | 1500 | 2200 |
| maximal diameter | | 500 | 700 |

Table 49B. Measurements of *Kirchenpaueria bonnevieae* in µm.

| | *K. triangulata* Off Natal (Vervoort, 1966) | *K. triangulata* Zanzibar (Rees & Vervoort, 1987) |
|---|---|---|
| Axial segment, length | 500-635 | 320-540 |
| diameter at node | 162-230 | 100-120 |
| First hydrocladial internode, length | | 540-720 |
| Following hydrocladial internodes, length | | 620-720 |
| Hydrocladial internodes, combined length | 785-835 | |
| diameter at distal end | 80-95 | 70-80 |
| Hydrotheca, length abcauline wall | 68-85 | 70-85 |
| length adcauline wall | 68-73 | 50-65 |
| diameter at rim | 100-110 | 85-100 |
| Nematotheca, length | 68-85 | 55-70 |
| maximal diameter | 30-40 | 28-35 |
| Male gonotheca, length | 850-1755 | 1200-1500 |
| maximal diameter | 575-1015 | 500-600 |
| Female gonotheca, length | 2130 | |
| maximal diameter | 810 | |

and Mediterranean and the conformity to the descriptions of *Plumularia rubra* Bonnevie, 1899 and *Plumularia bonnevieae* Billard, 1906a (a name substituted for the preoccupied trivial name *P. rubra* Bonnevie = *Plumularia elegantula* var. Pictet & Bedot, 1900) seem to confirm the opinion expressed by Billard (1930a) and Rees &

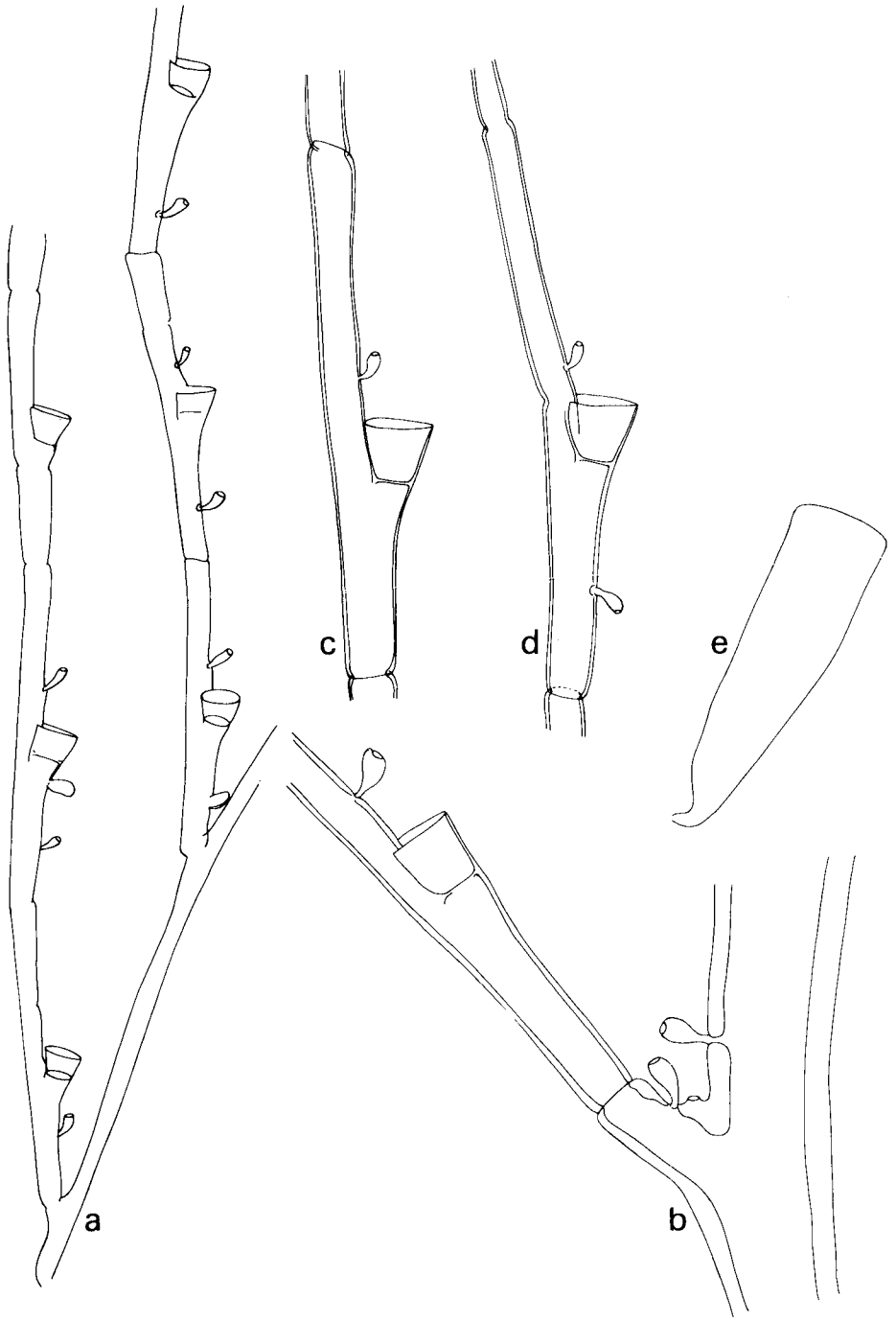


Fig. 40. a, c, d, *Kirchenpaueria bonnevieae simplex* Billard, 1938, from Billard's slide no. 1289 in MNHN, holotype, Vanneau Exped., 32°32'N-09°33'W. a, stolon with 2 axes; c, d, axial internodes with hydro- and nematothecae, lateral view. b, e, *Kirchenpaueria bonnevieae* (Billard, 1906), from Billard's type slide no. 1055 in MNHN, Travailleur Exped., Dr. 8. b, part of axial internode with apophysis supporting hydrocladium; e, young gonotheca. a, × 58; b-d, × 92; e, × 39.

Vervoort (1987) that *K. triangulata* should be referred to *P. bonnevieae*, as does the inspection of Billard's holotype of *K. bonnevieae*. To this we may add that the material studied by Billard (1906d) was found on other hydroids, in this case *Diphasia alata* (Hincks, 1855) [= *Diphasia pinastrum* (Cuvier, 1830)] and *Plumularia marocana* Billard, 1930a. *K. triangulata* was likewise found to be epizootic on other hydroids. Bonnevie (1899) and Pictet & Bedot (1900) give no indication concerning mode of development of their specimens. Furthermore a comparison of the measurements of *P. bonnevieae* with those of *K. triangulata* from a wide range of localities (Mediterranean, BALGIM Stn CP 135; Natal, Vervoort, 1966; Zanzibar, Rees & Vervoort, 1987, and New Zealand, Ralph, 1961) shows only minor differences, which in our opinion strengthens the synonymy.

Billard's type slide (L 1055) in MNHN has previously been inspected by Van Praët (1979); it is labelled: "*Kirchenpaueria bonnevieae* n. nom. = *P. rubra* , Billard févr. 1906, Travailleur, 12/7 1882, Dr. 8, Pr. 400 m". The slide contains several c. 20 mm high stems springing from a stolon on axis of other (unrecognizable) hydroid. Axes monosiphonic and unbranched, in younger (upper) parts divided into segments by perisarcal constrictions, no septa visible; each segment with subterminal apophysis supporting a hydrocladium, alternately directed left and right and obliquely upwards (fig. 40b). In lower parts of axes constrictions indistinct or absent; some of apophyses opposite. In addition to apophysis each segment with two nematothecae: one on basal portion segment directly above perisarcal constriction and on same side as (previous) apophysis, the other on apophysis slightly above almost axillary 'mamelon'. Hydrocladia homomerously segmented; all internodes hydrothecate, separated by slightly oblique to almost transverse constrictions and septa. Internodes elongated, with hydrotheca slightly below middle and with two nematothecae: one on basal portion of internode halfway between thecal bottom and node, the other slightly above hydrotheca. First internode of hydrocladium shorter, occasionally without infracalycine nematotheca. Hydrotheca placed at distinct apophysis; abcauline wall straight, slightly longer than trifle convex adcauline wall, margin as a result slightly tilted upwards. Rim smooth, not everted; hydrotheca slightly widening from base onward. Nematotheca of characteristic club-shaped appearance, monothalamic, movable, with circular opening, easily dislodged. Perisarc firm though hyaline, thick on axis, thinner on internodes; walls of hydrotheca fairly thick; no collapsed hydrothecae observed. One of stems with many developing, apparently male gonothecae of elongated club-shaped appearance (fig. 40e); triangular cross section, mentioned by Billard (1906) could not be observed because of pressure of cover glass. They contain a mass of developing spermatocytes arranged around a densely stained central axis. The measurements of the holotype have been given above.

### **Kirchenpaueria bonnevieae simplex** Billard, 1930
(figs. 39a-c, 40a, c, d)

*Kirchenpaueria bonneviae simplex* Billard, 1930a: 80.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: two colonies composed of various unbranched stems up to 5 mm high, one of which has a gonotheca. Epizootic on *Polyplumaria flabellata*.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: various colonies up to 5 mm high and

with gonothecae, epizootic on *Polyplumaria flabellata*.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: single colony composed of several stems up to 3 mm high, without gonothecae. Epizootic on *Plumularia marocana*.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: several colonies up to 10 mm high, with gonothecae, epizootic on *Polyplumaria flabellata*.

Description.— Colonies rising from stolon attached to axis of various hydroids, with erect, unbranched, slender axis with frequent signs of numerous fractures and subsequent renovation, so that its segmentation is often quite irregular. Undamaged parts of colonies show that normally axis is composed of regular succession of thecate and athecate internodes separated by transverse nodes and of greatly varied length. Hydrothecate internodes with single distal hydrotheca, just below terminal node, and a medio-inferior nematotheca. Athecate internodes at times scarcely separated from thecate internode because of poor development of proximal node, with medio-inferior nematotheca (fig. 39a, b). Hydrotheca small, cup-shaped, with straight, fully adnate adcauline wall. Abcauline hydrothecal wall also straight, widening distally and slightly longer than adcauline wall. Hydrothecal rim circular, smooth (fig. 39a, b).

Nematothecae one-chambered (monothalamic), movable, proximally narrowing into short pedicel, distally club-shaped, with circular, terminal aperture.

Gonotheca borne on frontal aspect of axis, inserting between base of axis and first hydrotheca, elongated pyriform, narrowing basally into peduncle formed of two short articles, distally widening, triangular in cross section, extreme distal part truncate and with terminal aperture (fig. 39c).

Distribution.— *Kirchenpaueria bonnevieae simplex* so far has been recorded only from one locality off the Atlantic coast of Morocco, 32°33'N-09°33'W, at 110 m depth (Billard, 1930a). The BALGIM material originates from one locality off the coast of Casablanca, Morocco (CP 92), from two localities off Cape Spartel (DR 42, DR 49), and from one locality in the Strait of Gibraltar (DR 153). The depths records oscillate between 135 and 1182 m.

Discussion.— This subspecies differs from *Kirchenpaueria bonnevieae* (Billard, 1906) by the morphology of the colony, characterized by the presence of unbranched axes

Table 50. Measurements of *Kirchenpaueria bonnevieae simplex* in µm.

| | BALGIM Stn DR 153 | Atlantic off Morocco Billard's holotype (own measurements) |
|---|---|---|
| Stolon, diameter | | 65 |
| Axis, total length | | 1760-2310 |
| Hydrothecate internode, length | 240-350 | 350-390 |
| Intermediate internode, length | 290-420 | 350-400 |
| diameter at node | 30-55 | 60-65 |
| Hydrotheca, length abcauline wall | 50-70 | 55-65 |
| length adcauline wall | 40-50 | 50-55 |
| diameter at base | | 65-70 |
| diameter at rim | 80-95 | 90-100 |
| Nematotheca, length | 45-60 | 60-65 |
| maximal diameter | 20-25 | 20-30 |
| Gonotheca, maximal length | 600-750 | |
| maximal diameter | 190-290 | |

composed of hydrothecate and ahydrothecate internodes and by the absence of hydrocladia, by the smaller hydrothecae and gonothecae and by the separation of the medio-distal nematotheca on a separate internode. We have already commented on the synonymy of *K. triangulata* and *Kirchenpaueria bonnevieae* (Billard, 1906). Also, Millard (1975) records the presence of unbranched, simple forms in *K. triangulata.* The reasons for including the BALGIM material in the subspecies described by Billard (1930a) as *Kirchenpaueria bonneviae simplex* are twofold. First of all there are small differences with *K. bonnevieae* (mentioned above) and secondly Billard's subspecies originates from the same geographical range and was found epizootic on *Plumularia marocana,* the host of the colonies occurring at CP 92.

Billard's holotype of *K. bonnevieae simplex* could be studied in MNHN; this slide L 1289 is labelled: "*Plumularia marocana* n. spec. Billard fec. 26.ii.27 e(t) *Kirchenp. Bonneviae simplex.* Dollfus leg., "Vanneau", 9°33' W gr 32°32'N, Pr. 100, 8.vii.23". It contains a stem fragment of *Plumularia marocana* bearing a short solon of *K. bonnevieae simplex* with three axes, only two of which are more or less complete. Stolon tubiform, without any sign of subdivision or nematothecae. Axes springing directly from stolon without distinct apophyses. Axis heteromerously segmented into ahydrothecate and hydrothecate internodes, though with many irregularities. There is a number of distinct, slightly oblique septa, separating a hydrothecate and the following ahydrothecate internodes, the division between those two internodes being indicated by a perisarcal constriction directly above the hydrotheca. The hydrothecate internodes carries the almost terminal hydrotheca and an infracalycine nematotheca; the ahydrothecate internode has a single nematotheca on its basal part. Irregularities are frequent and concern the almost complete absence of the supracalycine constriction (resulting in a longer hydrothecate internode bearing one hydrotheca and two nematothecae, observed in both axes), the separation of the basal part of the hydrotheca internode, bearing the infracalycine nematotheca (in the first axis) or the separation of the apical portion of the ahydrothecate internode (in the second axis) by a septum or node, in both cases resulting in an extra, intermediate internode. Hydrotheca cups-shaped, placed at distinct lateral apophysis. Hydrothecal walls slightly widening,a trifle convex; rim smooth, circular, not everted, perpendicular to hydrothecal length axis or slightly tilted downwards. Walls of hydrotheca and notably hydrothecal bottom fairly thick. No distinct gonothecae present, though both axes bear a hyaline, sac-shaped body that may represent the rest of a gonotheca. Measurements of the holotype have been given above.

### **Kirchenpaueria pinnata** (Linnaeus, 1758)
(fig. 41a-c)

*Sertularia pinnata* Linnaeus, 1758: 813.
*Plumularia pinnata* - Hincks, 1868: 295-296, pl. 65 fig. 1.
*Kirchenpaueria pinnata* - Bedot, 1916b: 645; Vervoort, 1946b: 167-171, figs. 69a, 70; Millard, 1975: 372-375, figs. 119A-D; Roca & Moreno, 1987: 46, fig. 1.
*Plumularia echinulata* - Hincks, 1868: 302-303, pl. 65 fig. 2.
*Plumularia similis* - Hincks, 1868: 303-304, pl. 65 fig. 3.
*Kirchenpaueria similis* - Roca & Moreno, 1987: 46-48, fig. 2.
*Plumularia elegantula* G.O. Sars, 1874: 103-104, pl. 3 figs. 9-14.

Material.— BALGIM Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: many colonies up to 40 mm high on a worm-tube; one empty gonotheca present. Several colonies up to 20 mm high epizootic on *Sertularella* spec., no gonothecae. In addition four colonies and a fragment, 10-20 mm high; one gonotheca.

Description.— Stems unbranched, erect and monosiphonic, basally with some hydrorhiza fibres. Axis composed of succession of segments separated by well marked transverse nodes, each segment distally with apophysis on which inserts a hydrocladium. Apophyses, and consequently hydrocladia, alternately directed left and right, each apophysis on upper surface with circular opening ('mamelon') from which emerges naked sarcostyle. Moreover there is a second opening on axial wall just above apophysis from which emerges another naked sarcostyle.

Hydrocladia basally with short internode without hydrotheca or nematotheca, followed by regular succession of hydrothecate and intermediate internodes separated by slightly oblique nodes (fig. 41b). Each hydrothecate internode with one hydrotheca, one reduced, lip-shaped median infracalycine nematotheca and one naked sarcostyle immediately behind free part of adcauline wall of hydrotheca (fig. 41a, b).

Hydrotheca cup-shaped, widening distally; part of adcauline wall free, abcauline wall straight and hydrothecal rim smooth (fig. 41a, b). Intermediate internodes without nematothecae or sarcostyles.

Gonotheca springing from wall of one of axial segments opposite hydrocladial apophysis, empty, cylindrical and elongated, walls slightly undulated, attached by means of short pedicel (fig. 41c).

Some of colonies with distal part of axis as well as some hydrocladia terminating in tendrils for vegetative reproduction.

Variability.— In some of the colonies there is no regular succession of hydrothecate and intermediate internodes in the hydrocladia. There is either no intermediate internode after the first hydrothecate internode or the intermediate internodes begin to appear after the second hydrothecate internode. In some cases it is possible to observe the gradual appearance of the node separating the intermediate internode in the basal parts of the hydrothecate internodes (fig. 41a).

Distribution.— *Kirchenpaueria pinnata* is widely distributed in the Atlantic Ocean, ranging from the North Atlantic (Broch, 1918) as far south as the coasts of South Africa (Millard, 1975). The wide distribution in the Mediterranean has recently been discussed by Roca & Moreno (1989). The BALGIM material originates from the Alboran Sea off the coast of Morocco (DR 130), depth 145 m.

Table 51. Measurements of *Kirchenpaueria pinnata* in µm.

| | BALGIM Stn DR 130 |
|---|---|
| Axial segment, length | 490-580 |
| diameter at node | 150-220 |
| Hydrothecate internode, length | 320-440 |
| Intermediate internode, length | 190-310 |
| diameter at node | 60-80 |
| Hydrotheca, total depth | 80-110 |
| length free part adcauline wall | 40-70 |
| diameter at rim | 170-190 |
| Gonotheca, length | 1300-1500 |
| maximal diameter | 380-500 |

Discussion.— The considerable morphological variability in this species has resulted in the establishment of several species and numerous varieties that have all been unit-

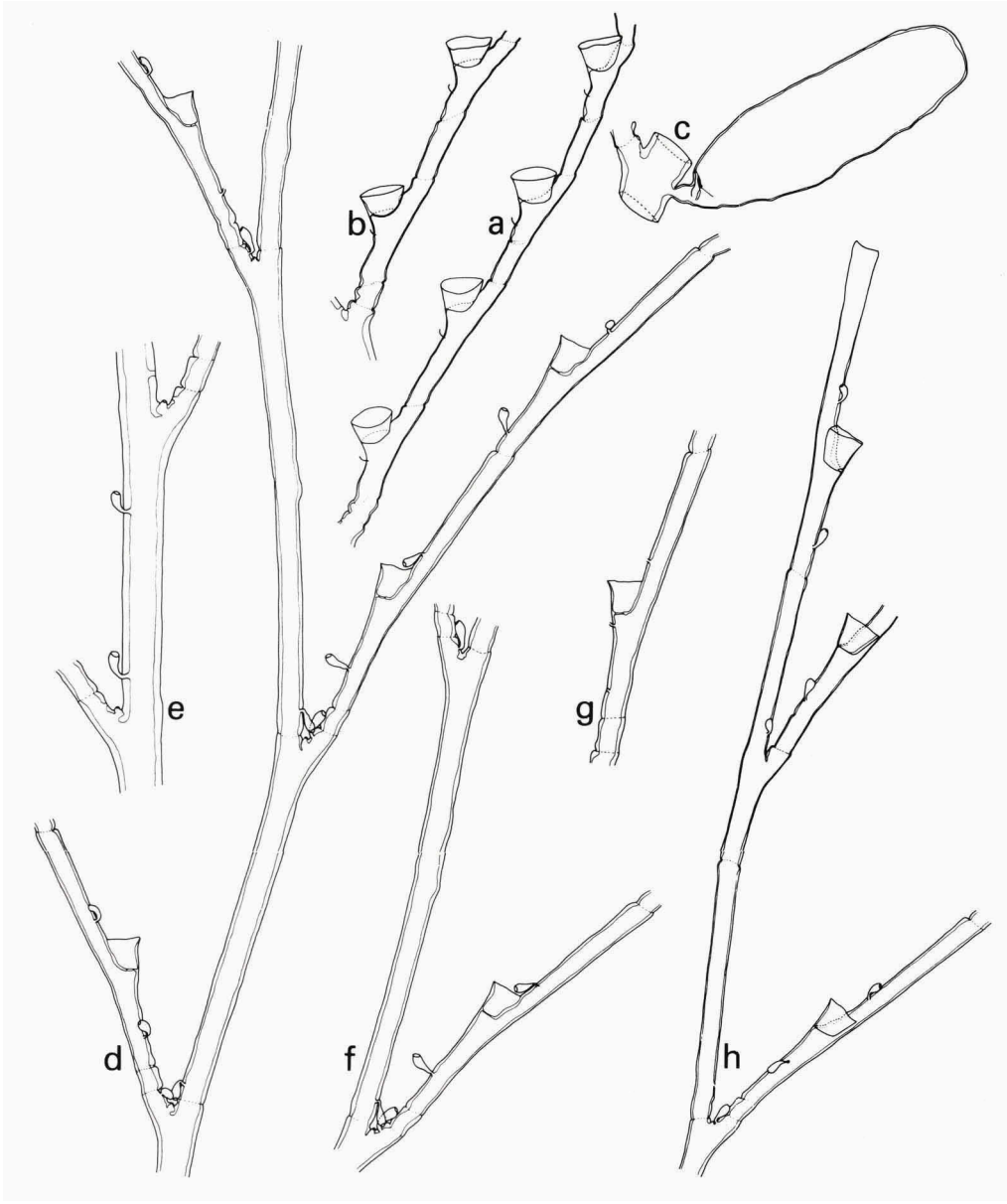


Fig. 41. a-c, *Kirchenpaueria pinnata* (Linnaeus, 1758), from DR 130. a, b, hydrocladial internodes with hydro- and gonothecae, slightly oblique lateral view; c, gonotheca. d-h, *Kirchenpaueria ventruosa* (Billard, 1911), holotype, from Siboga Exped., Stn 175, ZMA no. 4012. d, normally developed part of colony; e, part of axis with additional nematotheca; f, part of axis with two apophyses showing insertion of hydrocladia; g, hydrocladium with 3 (shed) nematothecae and a hydrotheca; h, abnormally developed upper part of colony; all figures lateral view. a-h, × 32.

ed by Bedot(1916b) as a single species: *Kirchenpaueria pinnata* (Linnaeus, 1758), a view which has been adopted here. However, several authors have stressed that at least *K. pinnata* and *Kirchenpaueria similis* (Hincks, 1861) should remain separate, that are

said to differ in the number of hydrocladia for each axial segment, the presence or absence of intermediate internodes in the hydrocladia, the shape of the hydrothecae and the external morphology of the gonotheca, bearing either spinules or being completely smooth (Roca & Moreno, 1987). In our opinion, bearing in mind the numerous studies that have demonstrated the variability of the above listed characters, there are insufficient reasons to keep both 'species' separate and consequently we have listed *K. similis* as a synonym of *K. pinnata.*

### **Kirchenpaueria ventruosa** (Billard, 1911)
(fig. 41d-h)

*Plumularia ventruosa* Billard, 1911a: lxviii-lxix, fig. 11; Billard, 1913: 39, fig. 30, pl. 2 fig. 22.
*Kirchenpaueria ventruosa* - Billard, 1930a: 80.

Material.— **Tropical Pacific Ocean.** Siboga Expedition, Stn 175, Ceram Sea, 02°37.7' S-130°34.4' E, 1914 m, 30.viii.1889: single 40 mm high colony, without gonothecae (holotype, ZMA Coel. no. 4012).

Description (of holotype).— Colony composed of fragment of hydrorhiza from which rises a single monosiphonic, unbranched axis. Basal 5 mm of axis unsegmented and without nematothecae; bearing distally first apophysis of axis above which no distinct node is visible. Rest of axis formed by succession of internodes separated by gradually more distinct, transverse nodes (fig. 41d), first only visible as perisarcal constrictions; internodes each with distal apophysis and basal nematotheca. Axial apophyses alternate; nematotheca just above transverse node on other side of apophysis. In addition one or two extra nematothecae may be present on axial internode on same side as basal nematotheca (fig. 41e). Apophysis on upper surface with well developed 'mamelon'and 1 nematotheca above it (fig. 41f).

Hydrocladia all composed of basal internode and regular succession of hydrothecate internodes, all separated by oblique nodes. Basal internode short, without hydro- or nematothecae; hydrothecate internode fairly long, with one hydrotheca and two nematothecae: one median on basal part internode and one median slightly above hydrotheca. Hydrotheca cup-shaped, with slightly diverging walls, in middle of internode. Adcauline wall of hydrotheca completely adnate, with distinct undulation resulting in slightly concave distal half of that margin. Abcauline border more or less straight, slightly outwardly curved near rim and slightly shorter than adcauline wall, resulting in slightly tilted position of smooth hydrothecal rim (fig. 41d, g, h). All nematothecae of colony uniform, one-chambered (monothalamic), movable, club-shaped, narrowing towards base in a short peduncle. Aperture terminal and circular.

Variability.— The number of nematothecae on the axial segments appears to vary: besides the invariably present basal nematotheca there may be one or two more on the same side of the internode. At the same time the distal part of the axis appears to be modified: an internode without apophysis, nematothecae or hydrotheca is present, followed by an internode with an apophysis at its lower third and one nematotheca slightly above that apophysis. The apophysis bears a normal thecate internode while the axis continues in a single normal hydrothecate internode (fig. 41h).

Table 52. Measurements of *Kirchenpaueria ventruosa* in μm.

| | Siboga Exped. Stn 175 (own measurements) | (Billard, 1913) |
|---|---|---|
| Axial internode, length | 1060-1980 | |
| diameter at node | 100-160 | 80-175 |
| Basal hydrocladial internode, length | 95-150 | 110-135 |
| diameter at node | 80-100 | |
| First hydrothecate hydrocladial internode, length | 1050-1300 | 1160-1400* |
| Following internodes, length | 1110-1390 | |
| diameter at distal end | 80-100 | 80-95 |
| Hydrotheca, length abcauline wall | 130-140 | 135 |
| length adcauline wall | 130-160 | |
| diameter at rim | 120-150 | 120-135 |
| Nematotheca, length | 80-120 | |
| maximal diameter | 30-40 | |

* = general length of hydrothecate internodes.

Finally one of the hydrocladia has its first hydrothecate internode with three nematothecae: two below and one above the hydrotheca; though the nematothecae have become lost the places of insertion are well marked (fig. 41g).

Distribution.— Only known from the type locality in the Ceram Sea, 02°37.7'S-130°34.4'E, depth 1914 m.

Discussion.— The study of the holotype of *Plumularia ventruosa* Billard, 1911a, and of the material of *Kirchenpaueria bonnevieae* (Billard, 1906) in the BALGIM collection has convinced us that the two species, though undoubtedly very similar, are nevertheless distinct and separable by a number of characters. The shape of the colony, the structure of the hydrocladia and the arrangement of hydrotheca and nematothecae on the internodes are very similar in both species, but there are the following differences:

1. The hydrocladia in *K. ventruosa* always begin with a short, athecate internode, absent in *K. bonnevieae.*

2. The hydrotheca, in *K. ventruosa,* has a characteristic undulation of the adcauline wall as a result of which the distal part of that wall is slightly concave, the whole wall is slightly longer than that on the abcauline side, resulting in a slightly tilted position of the hydrothecal rim. In *K. bonnevieae* the adcauline wall is straight and shorter than the abcauline wall, also resulting in a tilted position of the rim, but in opposite direction.

3. The measurements of *K. ventruosa* are superior to those of *K. bonnevieae* in spite of the fact that those in the latter have been taken from specimens from geographically remote localities (see table of measurements of *K. bonnevieae;* distant localities still provide coherent sizes).

4. Billard's (1913) account of *Plumularia ventruosa* provides no indication of the substrate on which it occurred, nor does the inspection of the holotype provide any cue. *K. bonnevieae* so far has exclusively been observed to be epizootic on other hydroids.

## Family Plumulariidae L. Agassiz, 1862
## Genus Nemertesia Lamouroux 1812

### Nemertesia antennina (Linnaeus, 1758)
(figs. 42a-r, 43a-h)

*Sertularia antennina* Linnaeus, 1758: 811.
*Antennularia antennina* - Hincks, 1868: 280-281, pl. 61; Billard, 1904a: 211-216, figs. 80-86.
*Nemertesia antennina* - Bedot, 1917b: 42; Vervoort, 1946b: 179-182, figs. 74a, 75, 76a; Millard, 1975: 381-383, fig. 121D-E.
*Nemertesia (Antennularia) antennina* var. *minor* Kirchenpauer, 1876: 51, pl. 2 fig. 23a.
*Antennularia janini* - Marktanner-Turneretscher, 1890: 259, pl. 6 figs. 9, 9a. (Not *Nemertesia janini* Lamouroux, 1816 = *Nemertesia ramosa* Lamouroux, 1816).
*Antennularia octoseriata* Jäderholm, 1896: 15-16, pl. 2 fig. 6.
*Antennularia Antennina* var. (à longs articles) - Billard, 1901: 71-72.
*Antennularia Antennina* var. (à 2 dactylothèques par article intermédiaire) -Billard, 1901: 72.
*Antennularia antennina* var. *longa* Billard, 1904a: 216-217.
*Antennularia Perrieri* var. *antennoides* Billard, 1904a: 217-219; 1906d: 212-214; Stechow, 1909: 82-83.
*Antennularia antennina* var. *longa* - Billard, 1906d: 210-211, fig. 15B.
*Antennularia antennina* var. *minor* - Stechow, 1909: 82.
*Nemertesia antennina* var. *irregularis* p.p. - Bedot, 1917b: 42-43.
*Nemertesia irregularis* p.p. - Stechow, 1913b: 93-94.
*Nemertesia irregularis* var. *antennoides* - Stechow, 1913b: 94.
*Nemertesia irregularis* var. *longa* - Stechow, 1913b: 94.
*Nemertesia irregularis* - Jäderholm, 1919: 23, pl. 5 fig. 7.
*Nemertesia antennina irregularis* - Vervoort, 1966: 140-142, fig. 42.
*Nemertesia perrieri* - Vervoort, 1966: 138-139, fig. 40.

Material.— BALGIM Stn DW 24, 36°41.1'N-07°19'W, 31.v.1984, 545 m: fifteen colonies 10-55 mm high, majority in bad condition; with gonothecae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: thirty-three colonies up to 50 mm high, in bad shape; with gonothecae.— Stn DW 27, 36°46.3'N-07°07.3'W, 31.v.1984, 370 m: nine colonies 15-50 mm high and fragments; no gonothecae.— Stn DW 28, 36°45.8'N-07°07.7'W, 31.v.1984, 398 m: three colonies and a fragment 12-50 mm high; one of colonies with gonothecae.— Stn CP 33, 36°46.9'N-07°04'W, 01.vi.1984, 256 m: three small colonies 20-40 mm high and a fragment. No gonothecae.— Stn CP 36, 36°16.6'N-07°13.7'W, 01.vi.1984, 990 m: two fragments 30-35 mm high without gonothecae.— Stn DR 40, 35°49.9'N-07°08.6'W, 02.vi.1984, 362 m: one colony 60 mm high; no gonothecae. In addition fragment 10 mm high with gonothecae.— Stn DW 43, 35°54.1'N-06°24.5'W, 02.vi.1984, 150 m: two colonies 30-40 mm high; no gonothecae.— Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: c. 60 small colonies up to 40 mm high, with gonothecae.— Stn DW 47, 35°43.5'N-06°18.2'W, 02.vi.1984, 281 m: four colonies 25-40 mm high; one with gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: fragmentary colony composed of four damaged stems c. 20 mm high rising from communal base; no gonothecae. In addition 20 mm high colony without gonothecae.— Stn DW 53, 35°41'N-06°30.5'W, 03.vi.1984, 364 m: two colonies and a fragment 20-35 mm high: no gonothecae.— Stn DR 56, 35°41.4'N-06°35.8'W, 03.vi.1984, 481 m: single fragment 50 mm high, no gonothecae.— Stn DR 73, 33°52.1'N-08°12.8'W, 06.vi.1984, 181 m: single colony 40 mm high, no gonothecae.— Stn DR 75, 33°52.7'N-08°15.2'W, 06.vi.1984, 252 m: four colonies 10-30 mm high, no gonothecae.— Stn DR 79, 33°49.3'N-08°23.6'W, 06.vi.1984, 260 m: single fragment 12 mm high in bad shape, no gonothecae.— Stn DR 85, 34°14.1'N-07°23.7'W, 07.vi.1984, 497 m: single fragment 15 mm high and in bad shape; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: two colonies 15-40 mm high and a mutilated fragment, no gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: three colonies and a fragment 25-45 mm high; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: c. 25 mutilated colonies up to 125 mm high, with gonothecae.— Stn CP 149, 35°47.5'N-05°11' W, 17.vi.1984, 377 m: fourteen colonies up to 150 mm high, with

gonothecae.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: two fragments 50-55 mm high, with gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: three mutilated fragments 7-12 mm high, no gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: fourteen colonies and various fragments 5-30 mm high, with gonothecae.

Diagnosis.— Axis (hydrocaulus) monosiphonic, unbranched. Hydrocladia heteromerously segmented. Hydrothecate internodes with one hydrotheca and three nematothecae: one median infracalycine, two laterals. Intermediate internodes with one or two nematothecae (never all with two nematothecae). Gonotheca ovoid, with laterally inclined aperture with circular lid.

Description.— Hydrorhiza composed of dense mass of perisarcal fibres that give rise to erect, monosiphonic and generally unbranched stems. Fibres in some colonies with some wineglass-shaped nematothecae, composed of long pedicel and cup-shaped distal portion with circular diaphragm (fig.42p-r). Axis in young colonies broken up into segments separated by transverse nodes; each segment with a varied number of nematothecae along its surface and in its distal region with one (in young colonies of the 'plumularioid' shape) or several apophyses arranged in a verticil. In older colonies with thick perisarc segmentation of axis practically lost and usually only visible as a transverse, less coloured zone in the perisarc just above each verticil. Apophyses of varied length; in large (older) colonies generally short in basal and longer in distal region. Each apophysis invariably with two axillary nematothecae and a 'mamelon' on upper surface. Moreover one or two pairs of nematothecae and a single unpaired nematotheca may frequently be present distally of the 'mamelon' (fig. 42d, e). Number of apophyses per verticil varied between one and eight in the material inspected.

Hydrocladia composed of regular succession of hydrothecate and intermediate (ahydrothecate) internodes, separated by oblique nodes (fig. 42a). Hydrocladia inserting on apophysis by means of single, short basal internode, bearing one nematotheca, or directly by means of first hydrothecate internode. Generally, in basal part of colony where apophyses are short, hydrocladia have one basal internode, while in distal part where apophyses are longer, hydrocladia insert by means of first hydrothecate internode (see fig.42d, e). Hydrothecate internodes with one hydrotheca and three nematothecae: one unpaired infracalycine median and two laterals at hydrothecal border. Hydrotheca small, cup-shaped, with adcauline wall fully adnate; border smooth. Generally adcauline border slightly longer than abcauline border with as result a slightly tilted hydrothecal rim (fig. 42a). Intermediate (ahydrothecate) internodes usually with one nematotheca, but intermediate internodes with two nematothecae also are frequently met with. All nematothecae two-chambered (bithalamic) and movable.

Gonothecae inserting on apophyses, ovoid, more or less elongated, apically narrowed and with laterally inclined opening closed by lid (fig. 42b, c, i-k).

Variability.— Primarily *Nemertesia antennina* (as well as other species of *Nemertesia*) shows many irregularities as a result of damage followed by regeneration (see Billard, 1904a). In such cases the presence of repaired or supplementary internodes gives rise to numerous alteration of the characteristic appearance of the colony, depending also on the place where the damages occurs. Such abnormal internodes may not interfere with the specific characters of the material and should have no bearing upon the identification of the species. However, the abundant BALGIM material shows variability that is not the result of regeneration as the following review indicates.

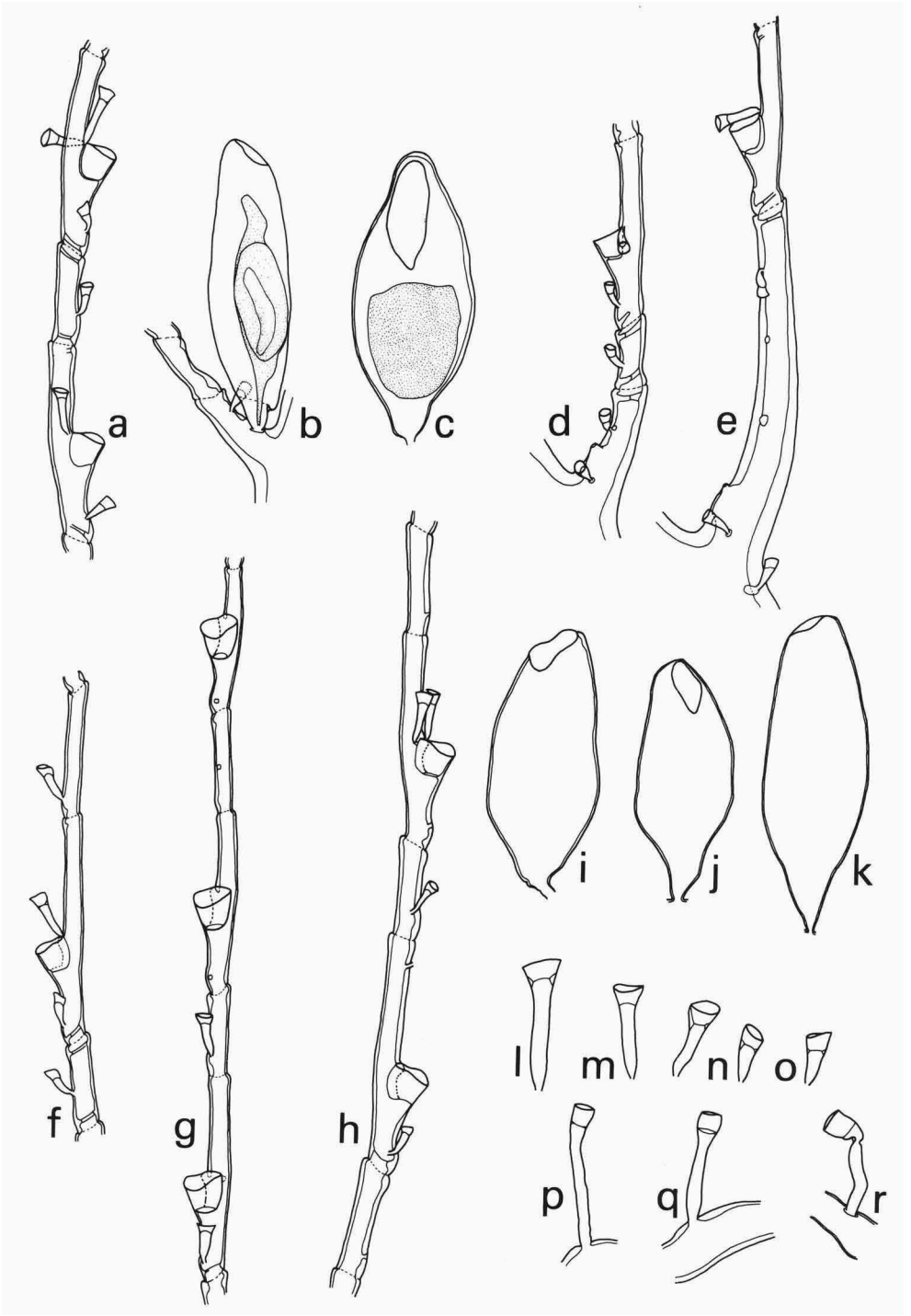


Fig. 42. *Nemertesia antennina* (Linnaeus, 1758), from DR 45, normally developed colony. a, f-h, hydrocladial internodes from same colony in lateral and in slightly oblique lateral view, some hydrothecate internodes with additional distal nematotheca; b,c, i-k, gonothecae from same colony; d, e, apophyses from same colony to show variability in length, d, from basal part with basal internode of hydrocladium, e, from distal part without basal internode of hydrocladium; l-o, lateral nematothecae from same colony to show variability in length; p-r, stolonal nematothecae. a-k, × 58; l-r, × 115.

1. Ramifications or bifurcations of the axis do occur, as is demonstrated by a colony from CP 26. This seems to be exceptional in *N. antennina* but has previously been reported by Hincks (1868) and by Billard (1901).

2. Variability in length of the apophyses has already been indicated in the description (fig. 42d, e). The number of nematothecae per apophysis, even in the same colony, also is highly varied. In the material from DW 24 the presence of a hydrotheca on the distal part of an apophysis has been observed, as has previously been described by Billard (1901, 1904a).

3. The hydrocladia, demonstrating a considerable degree of variability, are always heteromerously segmented, i.e. composed of a regular succession of hydrothecate and ahydrothecate (intermediate) internodes. The lengths of both types of internodes varies considerably, even in the same colony (see tables of measurements and figures). The presence of a supplementary nematotheca on the ahydrothecate internode, raising the number to 2, is of frequent occurrence in young colonies that are either in the plumularioid stage or have the hydrocladia arranged in opposite pairs (fig. 43f). Older, generally adult colonies usually have a single nematotheca per ahydrothecate internode. Two of such nematothecae tend to occur in regenerated hydrocladia, even in such colonies that normally have a single nematotheca per intermediate internode (fig. 43c).

4. A colony from DR 45 shows two separate hydrocauli developing from the same fragment of old axis without hydrocladia. One of the regenerating colonies is plumularioid and has long intermediate internodes, the majority of which has two nematothecae; the other, further developed colony has opposite hydrocladia of which the majority of intermediate internodes bears a single nematotheca.

5. The presence of an additional unpaired median nematotheca on the hydrothecate internode and above the hydrotheca is considered exceptional in this species by Bedot (1916a), but it does occurs sporadically in the material from DW 24, DR 45 and DR 153 ( fig. 43g, h), generally in adult colonies in which the part of the hydrothecate internode above the hydrotheca is lengthened; the lengthening being according to Billard (1904a) related to depth. In only one case (DR 153) we have observed a small fragment (5 mm length) of a young colony with opposite pairs of hydrocladia and an irregular structure as the result of repeated regenerations. Here long intermediate internodes with occasionally two nematothecae are present, while the majority of hydrothecate internodes have a supplementary unpaired distal nematotheca (fig. 43f).

6. There is considerable variability in length of the lateral nematothecae, even in the same colony (fig. 42l-o).

7. Atrophied hydrothecae frequently occur in the distal part of hydrocladia; in such cases the preceding intermediate internode generally has no nematothecae, though a single one may occur (fig. 43d). This has already been mentioned by Billard (1901, 1904a) in his description of *Antennularia Perrieri* var. *antennoides*.

8. The gonotheca, in spite of the considerable variability of the hydrocladia, is always of the shape characteristic for *N. antennina* (fig. 42b, c, i-k).

9. In a colony from DR 153 a new axis develops from the inside of a hydrotheca (fig. 43e).

Distribution.— *Nemertesia antennina* is a cosmopolitan species. The present material originates from both sides of the Strait of Gibraltar; depths varying between 144 and 990 m.

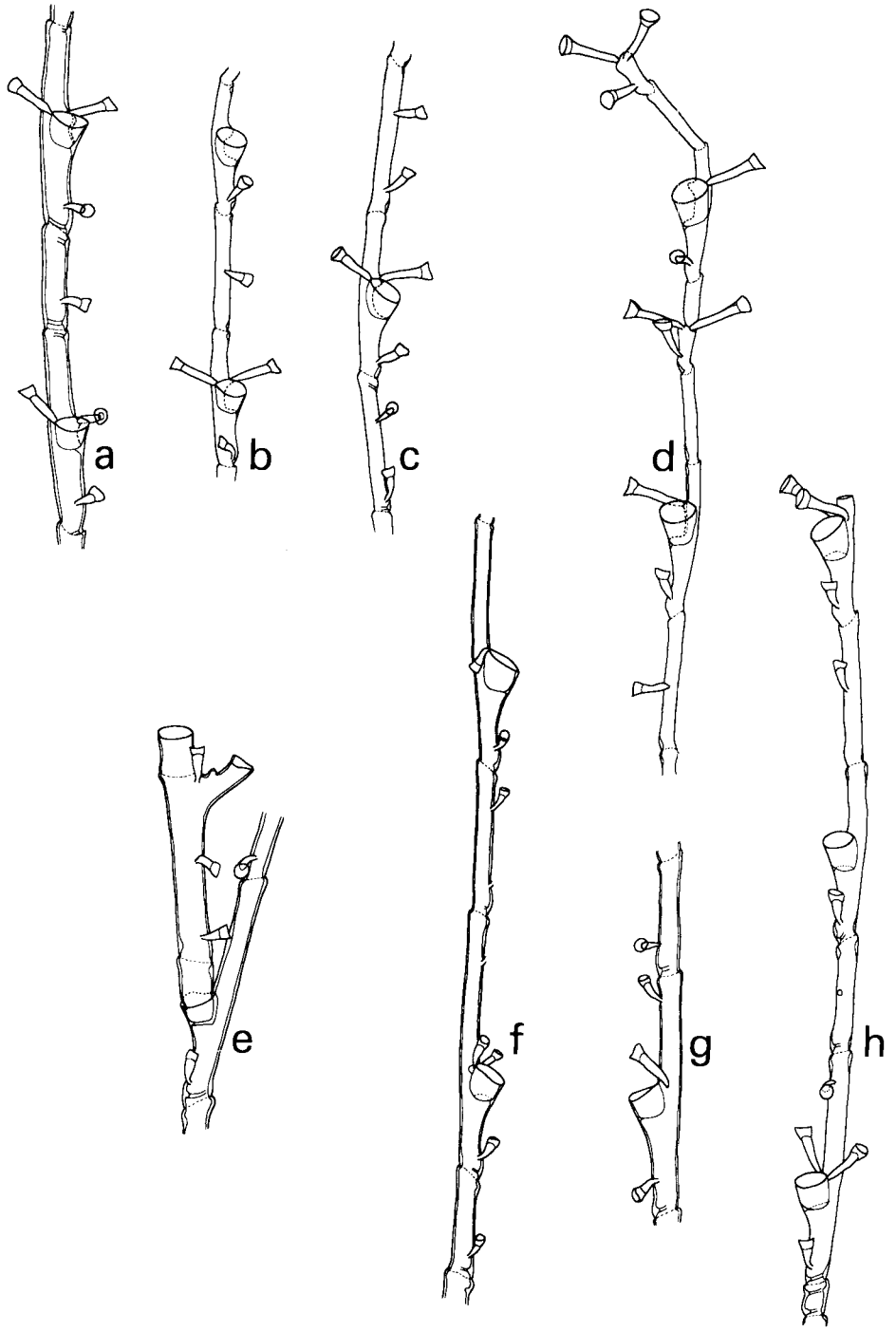


Fig. 43. *Nemertesia antennina* (Linnaeus, 1758). a-c, from DW 28. d, from DR 45. e-h, from DR 153. a-c, three hydrocladia from proximal verticils; a, 'normal' hydrocladium; b, c, regenerated hydrocladia. d, distal part of hydrocladium with atrofied hydrothecae. e, supplementarty hydrocladium originating from a hydrocladial hydrotheca. f, hydrocladium from young, 5 mm high colony with additional nematothecae on hydrothecate and ahydrothecate internodes. g, h, hydrocladia from same colony, showing additional distal nematotheca on hydrothecate internode. All hydrocladia in slightly oblique lateral view. a-h, × 53.

Table 53A. Measurements of *Nemertesia antennina, N. antennina* var. *longa* and *N. perrieri* var. *antennoides* in µm.

In order to appreciate fully the degree of variability in this species the measurements include those of a characteristic specimen (DR $45_1$), of a specimen with long intermediate internodes with two nematothecae (DR $45_2$), of a colony with a supplementary nematotheca on the distal part of the hydrothecate internode (DR $45_3$), and of the fragment from DR 153 with one supplementary nematotheca on the distal part of the hydrothecate internode and two on the intermediate internodes. Also are included measurements of *N. antennina, N. antennina* var. *longa* and *N. perrieri* var. *antennoides* given by Billard (1906d).

| | BALGIM | | | |
|---|---|---|---|---|
| | Stn DR $45_1$ | Stn DR $45_2$ | Stn DR $45_3$ | Stn DR 153 |
| Axis, diameter | 160-240 | 70-110 | 300-360 | 120-150 |
| Basal hydrocladial internode, length | 160-200 | 170-250 | 180-215 | 160-330 |
| diameter at node | 50-80 | 45-50 | 60-65 | 45-50 |
| Hydrothecate internode, length | 340-480 | 360-440 | 420-580 | 370-650 |
| Intermediate internode, length | 205-310 | 360-480 | 210-320 | 350-440 |
| diameter at node | 40-60 | 30-45 | 45-60 | 40-50 |
| Hydrotheca, length abcauline wall | 50-70 | 55-70 | 55-70 | 50-70 |
| length adcauline wall | 60-80 | 70-90 | 75-90 | 70-95 |
| diameter at rim | 65-90 | 80-95 | 75-100 | 60-90 |
| Lateral nematotheca, length | 120-150 | 115-125 | 110-120 | 75-110 |
| diameter at rim | 40-50 | 35-40 | 40-45 | 25-40 |
| Median nematotheca, length | 70-110 | 80-95 | 80-90 | 60-70 |
| diameter at rim | 30-40 | 30-40 | 30-40 | 25-30 |
| Gonotheca, length | 700-750 | | 590-750 | |
| maximal diameter | 200-310 | | 250-380 | |

Table 53B. Measurements of *Nemertesia antennina, N. antennina* var. *longa* and *N. perrieri* var. *antennoides* in µm.

| | *N. antennina* | *N. antennina* var. *longa* | *N. perrieri* var. *antennoides* |
|---|---|---|---|
| Basal hydrocladial internode, length | 210-235 | 160-175 | 175-230 |
| Hydrothecate internode, length | 315-370 | 330-525 | 370-525 |
| Intermediate internode, length | 190-245 | 190-300 | 315-400 |
| diameter at node | 50-70 | 35-50 | 35-50 |
| Hydrotheca, length abcauline wall | 70 | 50 | 50 |
| diameter at rim | 105 | 70 | 70 |
| Lateral nematotheca, length | 80-85 | 120-135 | 120-135 |

Discussion.— Billard (1901, 1904a), after study of a large Atlantic material from the 'Travailleur' and 'Talisman' cruises, described *Antennularia antennina* var. *longa* and *Antennularia Perrieri* var. *antennoides*, which he thought to represent intermediaries between two well established species: *Antennularia* (= *Nemertesia*) *antennina* (Linnaeus, 1758) and *Antennularia* (= *Nemertesia*) *Perrieri* Billard, 1901. The genus *Nemertesia* was later on revised by Bedot (1917b) and because he found it impossible to separate between Billard's intermediate form he proposed to include both forms

in *Nemertesia antennina* var. *irregularis* (Quelch, 1885). The study of the large BALGIM material and comparison with the various forms and varieties described has convinced us of the impossibility to differentiate between *N. antennina* sensu stricto and *N. antennina irregularis* sensu Bedot, 1917b. Both the length of the hydrothecate internodes (leading to the description of *N. antennina* var. *longa*) and the presence of two nematothecae on some of the intermediate internodes (leading to the description of *N. perrieri* var. *antennoides*) are too variable characters to be useful for the definition of species: both are variable within the same colony and are related to the processes of growth and regeneration. We have concluded therefore that *Nemertesia antennina* var. *irregularis* sensu Bedot 1917b should be placed in the synonymy of *Nemertesia antennina* (Linnaeus, 1758). *Nemertesia irregularis* (Quelch, 1885), however, is here considered a valid species differing from *N. antennina*.

As far as the synonymy of *N. antennina* is concerned: those of the typical form (one nematotheca per intermediate internode) have already been listed by Bedot (1917b). Here only those are given that have led to discussion by various authors and some that have been included by Bedot (1917b) in the synonymy of *N. antennina irregularis* and in our opinion belong in *N. antennina*.

Thus *N. antennina* var. *minor* Kirchenpauer, 1876, is considered by Stechow (1913b) a synonym of *N. irregularis*; later on Stechow (1923d) changed the name in *Nemertesia minor* (Kirchenpauer, 1876) (see discussion of *N. irregularis*). According to Kirchenpauer's description this variety differs from *N. antennina* mainly in its smaller size, by the absence of distinct segmentation and by the fact that the verticils are formed by four to six hydrocladia, differences that in our opinion are insufficient to separate the variety which has consequently been included in the synonymy of *N. antennina*, following in this respect Bedot (1917b). Also, we follow Bedot (1917b) in considering *Antennularia octoseriata* Jäderholm, 1896, a synonym of *N. antennina* and not of *N. irregularis*, as has been suggested by Stechow (1913b), the only difference with the former species being the decussate arrangement of the verticils composed of four hydrocladia, resulting in eight longitudinal series of hydrocladia along the stem. We also consider the specimens reported by Jäderholm (1919) from Japan as *N. irregularis* to belong in reality to *N. antennina* as the only difference with *Antennularia octoseriata* listed is the presence of one or two nematothecae on the intermediate internodes in the Japanese specimens.

As far as *Nemertesia irregularis* (Quelch, 1885) is concerned we share Stechow's (1913b) view that this is a valid species, separate from *N. antennina*. As to the synonyms of *N. irregularis* listed by Stechow, only *Antennularia Perrieri* Billard, 1901, *Antennularia dendritica* Stechow, 1907 and *A. Perrieri* var. *irregularis* sensu Stechow, 1909, should be included (see discussion of *N. irregularis*); all other synonyms listed by Stechow relate to varieties of *N. antennina* and should be placed with that species. Also *Antennularia americana* Nutting, 1900, has been excluded from the synonymy of *N. antennina*. In Nutting's species the hydrocladia are characterized by a basal portion formed exclusively of hydrothecate internodes; intermediate internodes with a single nematotheca beginning to appear in the distal part of the hydrocladia. This is characteristic of *N. ramosa* Lamouroux, 1816, and *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890) but certainly not of *N. antennina*.

## Nemertesia irregularis (Quelch, 1885)
(fig. 48a)

*Antennularia irregularis* Quelch, 1885: 8-9, pl. 2 fig. 4. [Not *Antennularia irregularis* Fraser, 1938 = *Nemertesia fraseri* nom. nov.].
*Antennularia Perrieri* Billard, 1901: 73-74; Billard, 1904a: 217; Billard, 1906d: 211-212, fig. 15c; Stechow, 1909: 81-82.
*Nemertesia perrieri* - Bedot, 1917: 45; Vervoort, 1946a: 327; Vervoort, 1959: 292-293, fig. 46a.
*Antennularia Perrieri* var. *irregularis* - Stechow, 1909: 83.
*Antennularia dendritica* Stechow, 1907: 195-196.
*Nemertesia irregularis* p.p. - Stechow, 1913b: 93-94.
*Nemertesia antennina* var. *irregularis* p.p. - Bedot, 1917: 42-43.
*Nemertesia minor* p.p. - Stechow, 1923b: 18; Stechow, 1923d: 229-230.

Material.— BALGIM Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: fragmentary colony composed of two stems rising from communal base, 25 mm high, no gonothecae.

Diagnosis.— Axis (hydrocaulus) monosiphonic, unbranched. Hydrocladia heteromerously segmented. Hydrothecate internodes with one hydrotheca and three nematothecae: one median infracalycine and two laterals. Intermediate internodes invariably with two nematothecae: one on basal third, one on distal third. Occasionally intermediate internode split in two internodes each with one nematotheca. Gonothecae ovoid, distal extremity truncate with slightly oblique lid. (Considered identical with *N. antennina* by Billard, 1901, 1906d).

Description.— Hydrorhiza formed by a dense mass of tangled perisarcal tubules, giving rise to a short (c. 10 mm), polysiphonic basal axis, from which spring two monosiphonic, unbranched axes. One axis basally broken, without hydrocladia; other axis, though also broken, has regenerated another, thinner axis bearing hydrocladia. This axis without nodes or segmentation. Verticils in oldest (broken) part composed of six apophyses; in regenerated part verticils basally with 4, distally with three apophyses. Axis without nematothecae; apophyses with two axillary nematothecae and a 'mamelon' on upper surface. Occasionally one pair of supplementary nematothecae present near 'mamelon' as well as one unpaired, distal nematotheca.

Hydrocladia heteromerously segmented, starting with short basal internode with single nematotheca on basal third. Rest of hydrocladium formed by regular succession of hydrothecate and ahydrothecate internodes separated by oblique nodes. Hydrothecate internodes with one hydrotheca, an unpaired infracalycine nematotheca and two lateral nematothecae. Hydrotheca small, cup- shaped, adcauline wall fully adnate; hydrothecal rim smooth. Ahydrothecate internodes with two nematothecae, one on basal third, one on distal third (fig. 48a). One internode has been observed to bear three nematothecae, but presence of thin septum indicates that internode probably resulted from regeneration (fig. 48a). All nematothecae movable and two-chambered (bithalamic). All internodes with two well developed septa (perisarcal rings), one basal and one distal.

Distribution.— *Nemertesia irregularis* is principally known from the eastern Atlantic: Bay of Biscay south of Belle-Ile (Billard, 1923, 1927), various localities in the Portuguese littoral zone (Da Cunha, 1940, 1944, 1950; Saldanha, 1974), the Gulf of Cádiz (Billard, 1906d), various localities off the Atlantic coast of Morocco (Patriti,

Table 54. Measurements of *Nemertesia irregularis* and *'Antennularia Perrieri'* in µm.

In addition to the BALGIM colony measurements are given of material mentioned by Billard (1906d) and Vervoort (1946a, 1959) as *Nemertesia perrieri*. Some additional measurements have been taken from slides in the RMNH collection.

| | BALGIM Stn DW 114 | *Antennularia Perrieri* (Billard, 1906d) | *Nemertesia perrieri* (Vervoort, 1946a) | *Nemertesia perrieri* (Vervoort, 1959) |
|---|---|---|---|---|
| Axis, diameter | 750-1200 | | 610-630* | 450-540 |
| Basal internode of hydrocladium, length | 150-170 | 210 | 150-180* | 160-170* |
| diameter at node | 70-85 | | 90-100* | 75-85* |
| Hydrothecate internode, length | 300-370 | 315-470 | 255-345 | 450-540 |
| Ahydrothecate internode, length | 250-330 | 315-440 | 240-300 | 250-320 |
| diameter at node | 55-70 | 50-70 | 65-75 | 54-72 |
| Hydrotheca, length abcauline wall | 50-60 | 70-80 | 60-70* | 75-90 |
| length adcauline wall | 55-95 | | 65-90* | 85-95* |
| diameter at rim | 70-90 | 90 | 80-100* | 90-110 |
| Lateral nematotheca, length | 90-100 | 100-110 | 80-90* | 85-90* |
| diameter at rim | 50-60 | | 50-55* | 40-50* |
| Median nematotheca, length | 70-90 | | 70-90* | 70-80* |
| diameter at rim | 40-50 | | 45-55* | 40-45* |

* = additional measurements.

1970), Canary Islands (Billard, 1901, 1904a, 1906d), Cape Blanco, Mauritania (Vervoort, 1946a), Cape Verde Islands (type locality, Quelch, 1885), and one locality near the coast of Senegal (Vervoort, 1959). It has also been found in Japanese waters (Stechow, 1907, 1909, 1913b, 1923b). The record off the coast of Guinea Bissau (Gili, Vervoort & Pagès, 1989, as *N. perrieri*) must be considered doubtful as at least part of that material belongs to *Nemertesia antennina*. The record from off the Congo River (Vervoort, 1966, as *N. perrieri*) must also be referred to *N. antennina*. The BALGIM material comes from the Atlantic outside the Strait of Gibraltar, near Cape Spartel (DW 114), depth 140-158 m.

Discussion.— *Nemertesia irregularis*, in contradistinction to *N. antennina* presents little morphological variation. The following characters emerge after the study of the Balgim material, additional material in the RMNH collection and existing descriptions:

1. Two nematothecae are found per ahydrothecate (intermediate) internode; internode occasionally divided in two smaller internodes each with single hydrotheca.

2. Generally there are no axial nematothecae; though these are mentioned by Quelch (1885).

3. Hydrocladia generally starting with a single basal internode with one nematotheca. Billard (1901), in the description of *N. perrieri* indicates that hydrocladia may start with several basal internodes or directly with a hydrothecate internode. Later (Billard, 1906d) he admits that the presence of several basal internodes is due to damage followed by regeneration. This regeneration may also account for Quelch's record of one or two basal internodes in *N. irregularis*.

Considering the possibility that young or regenerating colonies of *N. irregularis* show the same variability as those described in *N. antennina* it should be pointed out that Quelch (1885) described colonies in which the basal part has alternating hydrocladia (plumularioid form) and the distal part pairs of hydrocladia or verticils of 3. Stechow (1909, as *Antennularia Perrieri*) also describes colonies with pairs of hydrocladia and verticils of 3. Vervoort (1959) describes a young colony with opposite hydrocladia arranged in pairs. All this material shows the morphology characteristic of *N. irregularis* and none of the variability displayed by *N. antennina*, nor is it observed in the (regenerated) axis in the BALGIM material (with the exception of the presence of three nematothecae on an intermediate internode, probably due to rupture and subsequent regeneration). The sole type of variability displayed in this species is that mentioned above under 1: the occasional division of the intermediate internode in two, each bearing one nematotheca. This may well be related to depth as both authors who mention the phenomenon (Quelch, 1885; Stechow, 1909, as *Antennularia Perrieri* var. *irregularis*) studied deep-water material [800 m and less than 600 m ("weniger als 600 m"), respectively]. Material from shallower depths (Vervoort, 1946, 17.5 m, as *Nemertesia perrieri*; Stechow, 1909, 180 m, as *Antennularia perrieri*) has undivided intermediate internodes with two nematothecae. Billard (1906d) described the occurrence of two intermediate internodes as the result of rupture and subsequent regeneration; the line of breakage may be badly visible and create the impression of the presence of two internodes each with one nematotheca. Vervoort (1959) also describes the development of an additional septum between the two nematothecae leading towards the presence of two separate internodes each with a nematotheca. A revision of this material shows the presence of duplication on two occasions, once as the result of breakage, once apparently quite normally.

Billard (1906d), describing *Antennularia Perrieri* from the 'Travailleur' and 'Talisman' collections, indicates that it is close to Quelch's *Antennularia irregularis*, commenting on the fact that Quelch's description leaves open the question whether or not the two intermediate internodes are normal or due to regeneration. Stechow (1913b), after study of colonies with one intermediate internode (Stechow, 1909, as *Antennularia Perrieri*) and those with one or two (Stechow, 1909, as *Antennularia Perrieri* var. *irregularis*) originating from the Japanese coast, reached the conclusion, which we share, that *N. perrieri* (Billard, 1901) is a synonym of *N. irregularis* (Quelch, 1885). As has already been indicated when discussing *N. antennina* it is necessary to revise the list of synonyms given by Stechow (1913b) under *N. irregularis*: only *Antennularia irregularis* Quelch, 1885, *Antennularia Perrieri* Billard, 1901, *Antennularia dendritica* Stechow, 1907, and *Antennularia Perrieri* Billard, 1901 var. *irregularis* Quelch, 1885, should remain. Stechow (1923a, 1923d), after reaching the conclusion that *Nemertesia antennina* var. *minor* Kirchenpauer, 1876 and *N. irregularis* are the same species, substitutes *Nemertesia minor* for *N. irregularis*, the former name having priority. We have, nevertheless, indicated above that Kirchenpauer's species is identical with *N. antennina* and have consequently reinstalled Quelch's *Antennularia irregularis* be it under another generic name.

It is necessary to substitute another name for *Antennularia irregularis* Fraser, 1938, a species different from *N. irregularis* (Quelch, 1885), for which we have chosen the name *Nemertesia fraseri* nom. nov. This species has alternating hydrocladia, at times subopposite and with a tendency to be placed in more than one plane (usually the

beginning of verticil development); the apophyses have a single nematotheca. The hydrocladia begin with either a hydrothecate internode or one to three basal internodes, while one to three intermediate ahydrothecate internodes occur in the hydrocladia, each with one or two nematothecae. These characters set the species apart from *N. irregularis*; the exact systematic position of Fraser's species is still uncertain.

## **Nemertesia ramosa** (Lamarck, 1816)
(fig. 44a-f)

*Antennularia ramosa* Lamarck, 1816: 123; Hincks, 1868, 282-283, pl. 62; Billard, 1904a: 221-227, figs. 86$^{bis}$, 87, 88.

*Nemertesia ramosa* - Bedot, 1917: 46; Broch, 1918: 66-69, figs. 32-33; Vervoort, 1946a: 182-185, figs. 76b, 77.

*Antennularia ramosa* var. *plumularioides* Billard, 1906d: 215-216.

*Nemertesia ramosa* var. *plumularioides* - Bedot, 1917: 46; Vervoort, 1959: 293-297, figs. 46b, 47.

*Antennularia variabilis* Broch, 1903: 10-11, pl. 4 figs. 22-25.

Not *Nemertesia ramosa* - Billard, 1913: 58-60, fig. 49; Leloup, 1937b: 47, fig. 32; Vervoort, 1966: 136-140, fig. 41; Rees & Vervoort, 1987: 133-135, fig. 28a-b.

Not *Nemertesia ramosa* - Vervoort, 1972: 234-236, fig. 82; Blanco, 1976: 57-59, pl. 8 (= *Plumularia insignis* Allman, 1883).

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: one colony 80 mm high in two pieces; no gonothecae.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: six colonies and two fragments 30-90 mm high; no gonothecae.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: single c. 40 mm high fragment in bad shape; no gonothecae.— Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: five fragments 30-60 mm high; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: three detached hydrocladia.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: three fragmentary colonies c. 50 mm high and some pieces; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: c. 30 fragmented colonies up to 140 mm high; no gonothecae.— Stn CP 148, 35°51.8'N-04°59'W, 17.vi.1984, 508 m: three fragmentary colonies 40-90 mm high; no gonothecae.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: single fragment 50 mm high; no gonothecae.

Diagnosis.— Axis (hydrocaulus) polysiphonic, branched. Hydrocladia homomerously segmented; each internode with one hydrotheca and four nematothecae: one median infracalycine, two laterals and one median distal. Hydrothecal rim slightly tilted upwards. Gonotheca ovoid, distally truncate and with more or less oblique lid; gonotheca occasionally slightly curved.

Description.— Axis polysiphonic, generally irregularly branched, rising from dense mass of intertwining hydrorhiza fibres, unsegmented and bearing longitudinal rows of apophyses supporting hydrocladia. Apophyses in BALGIM material alternately arranged on both sides of axis, arranged in pairs or arranged in alternating verticils of three (apophyses in six longitudinal rows). Occasionally members of a verticil not strictly in one plane but slightly dispersed along axis and in various planes. Numerous axial nematothecae present. Apophyses each with distinct 'mamelon' on superior surface and two pairs of nematothecae, one at base of apophysis, one at level of 'mamelon'. Distal part of apophysis sometimes with supplementary nematotheca.

Hydrocladia composed of succession of hydrothecate internodes separated by oblique nodes, inserting on apophysis by means of hydrothecate internode. Each internode with one hydrotheca and four nematothecae, one median infracalycine, two

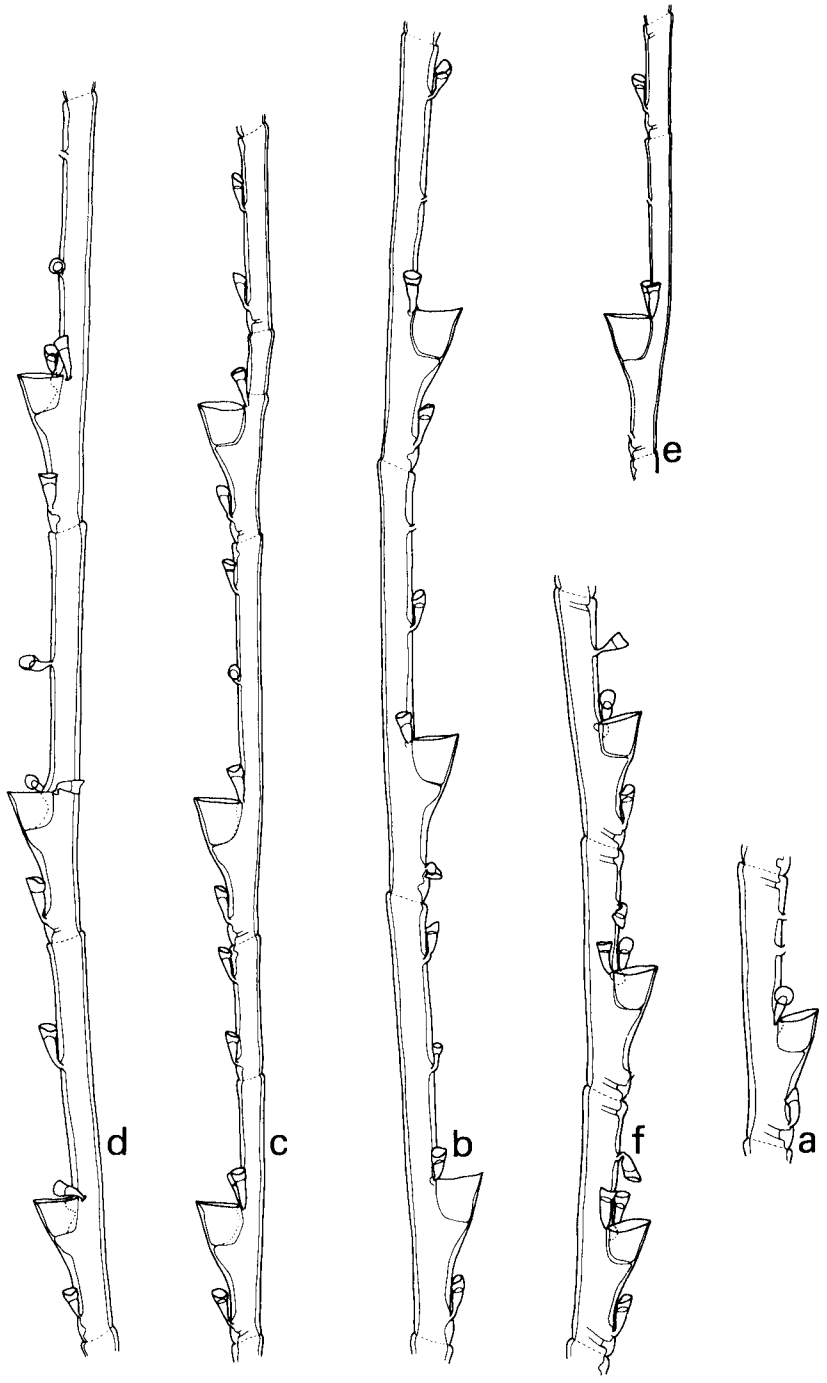


Fig. 44. *Nemertesia ramosa* (Lamarck, 1816). a, f, hydrocladial internodes, lateral view, from DR 42. a, internode of 'normal' length with two (shed) supracalycine nematothecae; f, 'normally' developed internodes. b-e, hydrocladial internodes, lateral view, from CP 90. b, long internodes with two supracalycine nematothecae; c, e, idem, supracalycine nematotheca(e) placed on separate internode; d, long internode with single supracalycine nematotheca. a-f, × 50.

at hydrothecal rim and one median distal. Hydrotheca small, cup-shaped; adcauline wall fully adnate, slightly shorter than abcauline wall with as result hydrothecal rim, which is smooth, slightly tilted upwards. All nematothecae two-chambered (bithalamic); internodes internally with two perisarcal ridges or rings, one basal, one distal (fig. 44f). In distal region of hydrocladia intermediate (ahydrothecate) internodes may appear bearing the median, distal nematotheca.

Variability.— The colonies from CP 90 and CP 92 are remarkable because of the considerable length of the hydrothecate internodes (see measurements), due to lengthening of the distal part (the part above the hydrotheca) of the internode. Moreover, the long internodes usually have two median distal nematothecae, though internodes with a single median distal nematotheca also occur (fig. 44b, d). Here too intermediate (ahydrothecate) internodes may occur bearing the two distal, unpaired nematothecae, along with such internodes with only a single nematotheca (fig. 44c, e).

Distribution.— *Nemertesia ramosa* has a wide distribution in the eastern Atlantic and Mediterranean, occurring from the North Atlantic (Broch, 1918) southwards to the South African coasts (Millard, 1962, 1975). The record of *N. ramosa* from the South-Western Atlantic by Vervoort (1972) has been referred to *Plumularia insignis* Allman, 1883, by Stepan'yants (1979), with which we agree. Here also belongs Blanco's (1976) record of *N. ramosa* from the same area. The BALGIM material comes from various localities, viz. the Atlantic coats of Morocco (CP 90, CP, 92, CP 103), from both the Atlantic (DR 42, DR 113, DW 114) and the Mediterranean (DW 148, CP 150) side of the Strait of Gibraltar and from a locality in the Alboran Sea (CP 135). The depths records are between 135 and 1182 m.

Discussion.— During the study of the BALGIM material of this species we have revised the material described as *N. ramosa* by Vervoort (1966) and Rees & Vervoort (1987) from Indian Ocean localities and reached the conclusion that it is different from the (so far) purely Atlantic *Nemertesia ramosa* Lamouroux, 1816.

This species has besides the fasciculate and ramified axis a slightly tilted position of the hydrothecal aperture because of the greater length of the abcauline hydrothecal wall over the adcauline wall. The Indian Ocean material, which may be composite, has smaller hydrothecae of which the rim is tilted in the opposite direction. We have also excluded Billard's (1913) material from the Malay Archipelago because the description shows important differences; Leloup's (1937b) material from the South China Sea has been excluded because the author considers it identical with Billard's. The material mentioned by Blanco (1976) as *N. ramosa* in reality belongs to *Plumularia insignis* Allman, 1883, because the author considers it identical with material mentioned by Vervoort (1972) from the same area as *N. ramosa* and which was later on transferred to *P. insignis* by Stepan'yants (1979). The gonotheca of *N. ramosa* mentioned by Blanco (1976) and compared by that author with that described by Vervoort (1959) from *Nemertesia ramosa* var. *plumularioides* (Blanco, 1976, pl. 8 figs. 4-5) in reality is identical with that of *Plumularia abietina* Allman, 1883 (= *P. insignis* Allman, 1883).

The synonymy of *N. ramosa* has previously been established by Bedot (1917); from his list of synonyms should be excluded *Cymodocea ramosa* Lamouroux, 1816 [= *Nemertesia antennina* (Linnaeus, 1758), see Billard, 1909] while *Antennularia variabilis* Broch, 1903 should be added (see Broch, 1918). The descriptions of *Antennularia simplex* Allman, 1877, and *Antennularia americana* Nutting, 1900, are too vague and the accompanying drawings too incomplete to decide whether they belong in the syn-

Table 55A. Measurements of *Nemertesia ramosa* and *'Nemertesia ramosa* var. *plumularioides'* in µm.

In addition to measurements of material from DR 42 and CP 90 we also present those of *N. ramosa* given by Billard (1906d) as well as those of *N. ramosa* var. *plumularioides* given by Billard (1906d), Vervoort (1959) and Gili, Vervoort & Pagès (1989).

| | *N. ramosa* BALGIM Stn DR 42 | *N. ramosa* BALGIM Stn CP 90 | *A. ramosa* (Billard, 1906d) |
|---|---|---|---|
| Hydrothecate internode, length | 590-685 | 1,100-1,190 | 525-610 |
| diameter at node | 100-110 | 105-130 | 90 |
| Hydrotheca, length abcauline wall | 120-130 | 110-140 | 105-120 |
| length adcauline wall | 95-105 | 90-110 | |
| diameter at rim | 110-120 | 115-130 | 105-120 |
| Lateral nematotheca, length | 100-110 | 100-110 | |
| diameter at rim | 40-45 | 40-50 | |
| Median nematotheca, length | 100-120 | 100-130 | |
| diameter at rim | 35-45 | 35-45 | |

Table 55B. Measurements of *Nemertesia ramosa* and *'Nemertesia ramosa* var. *plumularioides'* in µm.

| | *A. ramosa* var. *plumularioides* (Billard, 1906d) | *N. ramosa* var. *plumularioides* (Vervoort, 1959) | *N. ramosa* var. *plumularioides* (Gili, Vervoort & Pàges, 1989) |
|---|---|---|---|
| Hydrothecate internode, length | 665-790 | 360-580 | 720-770 |
| diameter at node | 70-90 | 80-100 | 80-95 |
| Hydrotheca, length abcauline wall | 105-120 | 140-150 | 90-100 |
| diameter at rim | 105-120 | 120-140 | 95-110 |
| Lateral nematotheca, length | | | 80-110 |

onymy of *N. ramosa* or represent other species; only the study of the types could solve this problem. We have included *Nemertesia ramosa* var. *plumularioides* in the synonymy of *N. ramosa*, following in this respect Millard (1962), who treats this variety as a growth form of the species characterized by the fact that the hydrocladia are alternately arranged (plumularioid growth stage), are placed opposite or are arranged in verticils of three (see Billard, 1906d; Vervoort, 1959). Castric (1970) has suggested that *N. ramosa* var. *plumularioides* might represent a synonym of *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890). Ramil (1988) reports on the study of Billard's (1906d) material preserved in MNHN: the colonies are polysiphonic and in morphology exactly corresponds with the adult *N. ramosa*.

The material from CP 90 and CP 92 differs by the greater length of the hydrothecate internode, brought about by the elongation of the part distal to the hydrotheca, that may occasionally bear a supplementary (second) supracalycine median nematotheca (fig. 44b, c). As this also happens in other species of the genus (e.g. *N. antennina*); we attach no great taxonomic value to this type of variability. Exceptional occurrence of such a supplementary nematotheca was also noticed by Billard (1904a) and also occurs from time to time in 'typical' colonies of *N. ramosa* (i.e. that have the normal length of the hydrothecate internode) (fig. 44a).

## **Nemertesia ventriculiformis** (Marktanner-Turneretscher, 1890) (fig. 45a-h)

*Plumularia ventriculiformis* Marktanner-Turneretscher, 1890: 256-257, pl. 6 figs. 5, 5a.
*Nemertesia ventriculiformis* - Castric-Fey, 1970: 12-18, figs. 15-22.
*Antennularia norvegica* - Billard, 1906d: 217 [not *Heteropyxis norvegica* G.O. Sars, 1874 = *Nemertesia norvegica* (G.O. Sars, 1874)].
*Nemertesia incerta* Bedot, 1916a: 2-3, fig; Bedot, 1917b: 44; Bedot, 1921c: 20-22, pl. 3 figs. 19-21; Vervoort, 1959: 290-292, figs. 44-45 (not *Nemertesia incerta* - Vervoort, 1972: 229-231, fig. 81 = *Plumularia insignis* Allman, 1883).
*Nemertesia (Antennopsis) disticha* Stechow, 1919: 120-122, fig. U[1] [not *Heteropyxis disticha* Heller, 1868 = *Nemertesia tetrasticha* (Meneghini, 1845)].

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: single colony and a fragment 20-50 mm high, no gonothecae.— Stn CP 54, 35°41.3'N-06°29.7'W, 03.vi.1984, 356 m: single fragment 15 mm high with gonotheca.— Stn DR 85, 34°14.1'N-07°23.7'W, 07.vi.1984, 497 m: six colonies 15-30 mm high of which some broken; no gonothecae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: two colonies 15-30 mm high; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: two colonies and a fragment 15-40 mm high; no gonothecae.— Stn DW 136, 35°26.5'N-04°18.5'W, 15.vi.1984, 298 m: two colonies 30-35 mm high; no gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: nine colonies 5-25 mm high; with gonothecae.

Diagnosis.— Axis (hydrocaulus) monosiphonic, occasionally basally polysiphonic, unbranched. Hydrocladia homomerously segmented; each internode with one hydrotheca and four nematothecae: one median infracalycine, two laterals and one median distal. Hydrothecal rim perpendicular to length axis of internode. Female gonotheca strongly curved, cornucopian, swollen, with single, large egg. Male gonotheca less swollen and less curved, with smaller lid. [Gonotheca described by Marktanner-Turneretscher (1890) as being shaped like a mammalian stomach].

Description.— Axis erect, rising from matting of perisarcal tubes (hydrorhiza), unbranched, basally polysiphonic. Axis in adult colony undivided, in young colony divided by transverse nodes into segments of varied length bearing two or more apophyses. Arrangement of apophyses along axis without characteristic pattern, resulting in numerous ways of arrangement that nevertheless have in common that apophyses are arranged in various vertical planes and have a tendency to be arranged in verticils. Apophyses consequently may occur in alternate arrangement on left and right sides of axis, opposite and decussate, or arranged in decussate verticils of three or four, resulting in six or eight longitudinal rows of apophyses. Apophyses may also occur in sub-opposite arrangement without forming verticils, resulting in irregular distribution of apophyses along axis. Apophysis generally with two axillar nematothecae and two pairs of nematothecae on superior surface; occasionally there is a supplementary unpaired distal nematotheca. Distinct 'mamelon' present between two pairs of nematothecae (fig. 45b).

Hydrocladia inserting either by means of short basal ahydrothecate internode with single nematotheca in young colonies and in basal part of older colonies or directly by means of hydrothecate internode. Rest of hydrocladium made up of hydrothecate internodes separated by oblique nodes; each internode with one hydrotheca in basal third and with four nematothecae: one median infracalycine, two laterals at hydrothecal rim and one median distal. Hydrotheca small, cup-

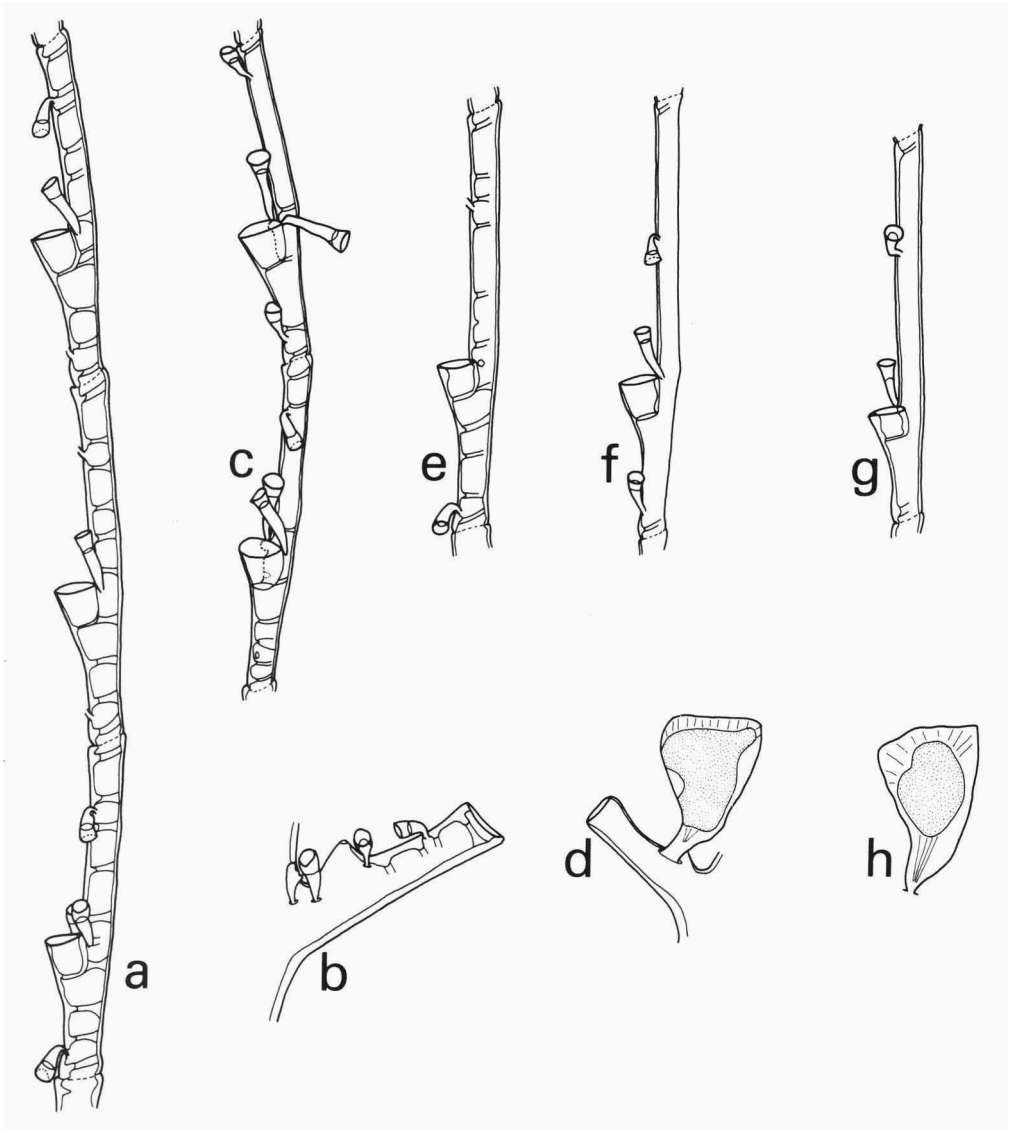


Fig. 45. *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890). a-d, from DR 42. a, c, hydrocladial internodes, lateral view; b, apophysis; d, young gonotheca. e-h, from DR 153. e-g, hydrocladial internodes showing varied degree of perisarcal development, lateral view; h, young gonotheca. a-h, × 68.

shaped, adcauline wall fully adnate and as long as abcauline wall (fig. 45a). Perisarc of abcauline hydrothecal wall occasionally thickened; thickening varied even in same colony (fig. 45e-g). Hydrothecal rim smooth, perpendicular to length axis of hydrocladium. All nematothecae movable and two-chambered (bithalamic). In distal regions of hydrocladium median distal nematotheca may be placed on separate intermediate internode. Hydrocladial internodes may also develop internal septa (perisarcal rings), occasionally well developed and numbering up to 12 per internode. As already observed by Bedot (1916a, 1921c) development of septa, even with-

Table 56. Measurements of *Nemertesia ventriculiformis* and *N. incerta* in µm.

| | BALGIM Stn DR 153 | *Nemertesia incerta* (Vervoort, 1959) | *Nemertesia ventriculiformis* (Castric-Fey, 1970) |
|---|---|---|---|
| Axis, diameter | 210-260 | 270-360 | 230-300 |
| Hydrocladium, length basal internode | 130-160 | | |
| diameter | 60-80 | | |
| Hydrothecate internode, length | 10-850 | 630-720 | 680-960 |
| diameter at node | 50-70 | 55-65 | 60-80 |
| Hydrotheca, length abcauline wall | 55-90 | 72-90 | 70-100 |
| length adcauline wall | 55-90 | | |
| diameter at rim | 70-90 | 90-100 | 90-130 |
| Lateral nematotheca, length | 100-130 | | |
| diameter at rim | 35-40 | | |
| Median nematotheca, length | 70-90 | | |
| diameter at rim | 30-35 | | |
| Gonotheca, length * | 270-320 | | |
| maximal diameter * | 190-240 | | |

* = in process of development, measurements not comparable to those of mature gonotheca given in literature.

in same colony, greatly varied (fig. 45a, c, e-g). Internal septa may also develop in apophyses and number up to four.

Gonothecae inserting on apophysis; in BALGIM material in process of development. Young gonotheca oviform, slightly curved and apically truncate (fig. 45d, h).

Distribution.— The geographical distribution of *N. ventriculiformis* has been reviewed by Castric (1970) and comprises the Mediterranean and the eastern Atlantic from the Glénan Archipelago in the north (Castric, 1970) to the coasts of Senegal (Vervoort, 1959). Vervoort's (1972) record of *N. incerta* (= *N. ventriculiformis*) from the south-western part of the Indian Ocean has been referred to *Plumularia insignis* Allman, 1883, by Stepan'yants (1979).

The BALGIM material comes from one locality off the Atlantic coast of Morocco (DR 85), from the Atlantic side of the Strait of Gibraltar (DW 42), from the Strait of Gibraltar proper (DR 153) and from three localities in the Alboran Sea close to Morocco (DW 128, CP 135, DW 136). The depth records vary between 135 and 580 m.

Discussion.— The BALGIM material generally agrees with the existing descriptions of *N. ventriculiformis* though colonies with a polysiphonic basal portion of the axis and the hydrocladia arranged in verticils, as occur in part of our material, have not yet been described. The latter phenomenon appears to be related to growth as Bedot (1916) described colonies in which the hydrocladia are arranged in one to four longitudinal rows or placed in irregular fashion and Castric (1970) referred to colonies with alternate arrangement of the hydrocladia in the lower two-thirds and an arrangement in opposite and decussate pairs in the distal part of the colonies.

With regards to the synonymy we have followed Castric (1970) in considering *N. incerta* Bedot, 1916, a synonym of *N. ventriculiformis* Marktanner-Turneretscher, 1890, the only real difference being the more strongly curved gonotheca in the material described by Bedot, a differences we estimate insufficient to separate both 'species'. From the list of synonyms suggested by Castric (1970) we have to exclude

*Antennularia ramosa* var. *plumularioides* Billard, 1906 (= *Nemertesia ramosa* Lamarck, 1816). On the other hand we think that *Antennularia norvegica* as cited by Billard (1906d) should be included in *N. ventriculiformis* as Billard indicates the presence of two nematothecae at the hydrothecal rim, which agrees with the latter while *N. norvegica* (G.O. Sars, 1874) has three unpaired nematothecae per hydrothecate internode, which character has later on been confirmed by Bonnevie (1899) after the study of additional Atlantic material of *N. norvegica*. This species has also been recorded from the Bay of Biscay by Browne (1907); this record needs verification by inspection of the original material as Browne, though mentioning three nematothecae per hydrothecate internode, described those nematothecae as being a pair of laterals and one unpaired nematotheca on the distal part of the internode, which does not correspond to the condition found in *N. norvegica* but points in the direction of *N. ventriculiformis*. Differences of this species with *N. ramosa* are the following: axis unbranched and polysiphonic only in the basal region (*N. ramosa*, at least in well developed colonies, with branched and polysiphonic axis), and hydrothecae with ab- and adcauline hydrothecal borders of equal length, rim of hydrotheca consequently perpendicular to hydrocladial length axis (in *N. ramosa* abcauline hydrothecal wall longer than adcauline wall, resulting in a slightly tilted position of the hydrothecal rim).

### **Nemertesia** spec.

Material.— BALGIM Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: three hydrocauli rising from common base and a fragment, 20-50 mm high. No hydrocladia or gonothecae present.

## Genus **Plumularia** Lamarck, 1816

### **Plumularia falcicula** spec. nov.
(fig. 46a-h)

Material.— BALGIM Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: single fragment 16 mm high; no gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: one colony composed of four axes rising from common base and a fragment with gonothecae 10-16 mm high.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m (type locality): eight colonies each composed of several axes and five separate axes 5-25 mm high, with gonothecae. One colony with five hydrocauli (axes) 10-25 mm high and with gonothecae is the holotype (microslide preparation); the remaining colonies from this station are paratypes.

Description.— Colony composed of short, polysiphonic basal portion rising from an intertwining mass of perisarcal fibres (hydrorhiza) and giving rise to several monosiphonic, unbranched hydrocauli. Perisarcal tubes of hydrorhiza as well as secondary tubules covering basal part of axis with numerous wine-glass-shaped nematothecae, composed of fairly long pedicel and cup-shaped distal portion separated from pedicel by thin, circular diaphragm (fig. 46d). Monosiphonic hydrocauli composed of succession of segments separated by transverse nodes, each segment with one or two axial nematothecae and an apophysis at extreme distal part. Apophyses alternately arranged in one plane, pointing left and right, each with two axillary

nematothecae and one 'mamelon' on its superior surface (fig. 46a)

Hydrocladia slender, inserting on apophyses by means of short basal internode with single nematotheca on basal third. Rest of hydrocladium formed by succession of long hydrothecate internodes separated by oblique nodes and each bearing one hydrotheca on its basal third and four nematothecae, one unpaired median infracalycine, a pair of laterals placed on small elevations at the hydrothecal rim and one unpaired median distal nematotheca (fig. 46b). Hydrotheca small, cup-shaped, adcauline wall completely adnate, as long as abcauline wall; this wall, at least in older hydrothecae, with thickened perisarc (fig. 46b, c). Hydrothecal rim smooth, perpendicular to length axis of internode. In distal part of some hydrocladia intermediate internodes may appear, originating from separation of distal part of certain hydrocladia and bearing the unpaired, distal nematotheca. All nematothecae, axial as well as hydrocladial, two-chambered and movable.

Gonothecae inserting on apophyses by means of short pedicel, strongly curved and of characteristic appearance (fig. 46e). Aperture by unequal length of curved gonothecal walls laterally displaced, circular, apparently closed by means of circular lid. Mature female gonothecae with single large egg or developing planula. Developing gonothecae, present in some colonies, less strongly curved, distally truncate and without aperture (fig. 46f, g).

Variability.— In the material studied there are numerous variations as the result of breakage of the slender hydrocladia and subsequent renovation often resulting in the formation of supplementary internodes with or without nematothecae. However, such regenerated internodes do not constitute a proper characteristic of the present species. Normal internodes, not involved in the process of regeneration, may occasionally carry two unpaired, median distal nematothecae, that may also be placed on a separate intermediate internode (fig. 46c). This indicates that though the presence of only one unpaired median distal hydrotheca is considered diagnostic, the presence of two of such nematothecae may occasionally occur.

Some colonies have an aberrant distal portion; the last segment of the axis bearing an apophysis is followed by a (short) internode bearing one nematotheca and a succession of hydrothecate internodes similar to those found in normal hydrocladia, indicating the transformation of the rest of the axis into a hydrocladium (fig. 46a).

Another variation has occurred in a colony where a second hydrocladium has regenerated from the basal part of a broken gonotheca (fig. 46h).

Distribution.— The BALGIM material originates from the Strait of Gibraltar (DR 152, DR 153), 550-580 m depth and from one locality in the Alboran Sea near the coast of Morocco (DW 128), 480 m depth.

Discussion.— *Plumularia falcicula* resembles *Nemertesia ramosa* (Lamarck, 1816) and *N. ventriculiformis* (Marktanner-Turneretscher, 1890) in the segmentation of the hydrocladia and the disposition of nematothecae and hydrotheca on the hydrothecate internodes. It distinguishes itself from both species of *Nemertesia* by the alternate arrangement in one plane of the hydrocladia; in the two species of *Nemertesia* cited the arrangement of the hydrocladia along the axis is in verticils or at least in various longitudinal planes. Within the genus *Plumularia* Lamarck, 1815, there are two species with the same hydrocladial segmentation and the same disposition of hydrotheca and nematothecae, viz. *Plumularia attenuata* Allman, 1877, and *Plumularia mossambicae* Millard, 1975, both with unknown gonosome.

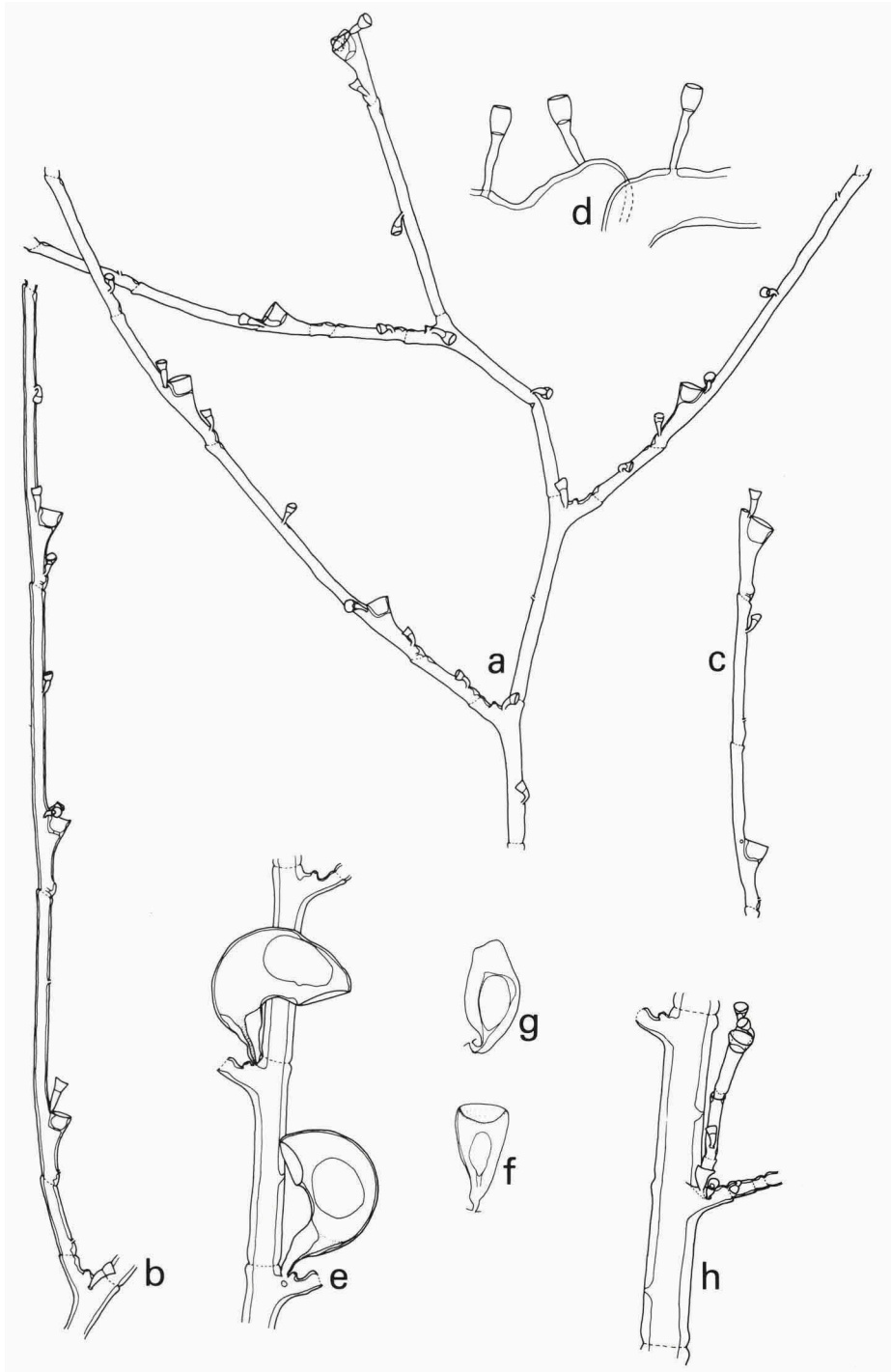


Fig. 46. a-h, *Plumularia falcicula* spec. nov., holotype, from DR 153. a, part of colony with slightly aberrant top part; b, hydrocladium, lateral view; c, hydrothecate internode, distal part, bearing two nematothecae, on separate internode, lateral view; d, stolonal nematothecae; e, mature female gonothecae; f, g, developing gonothecae; h, supplementary hydrocladium regenerating from place of attachment of gonotheca. a-c, e-h, × 50; d, × 100.

Table 57. Measurements of *Plumularia falcicula* in µm.

| | BALGIM Stn DR 153 |
|---|---|
| Axial segment, length | 520-640 |
| diameter at node | 40-190 |
| Basal hydrocladial internode, length | 170-250 |
| diameter | 40-50 |
| Hydrothecate internode, length | 765-910 |
| diameter at node | 40-50 |
| Hydrotheca, length abcauline wall | 40-50 |
| length adcauline wall | 40-50 |
| diameter at rim | 60-70 |
| Lateral nematotheca, length | 70-80 |
| diameter at rim | 30-40 |
| Infracalycine nematotheca, length | 60-65 |
| diameter at rim | 25-30 |
| Gonotheca, length | 760-770 |
| maximal diameter | 380-390 |

*P. attenuata*, from the Atlantic coast of North America (Bocca Grande, Florida) also approaches *Plumularia falcicula* in the structure of the colony: polysiphonic basal portion from which spring various monosiphonic axes. The species has been redescribed by Nutting (1900) and Fraser (1944); all authors indicate that the species is also characterized by the attenuation of the hydrocladial internode (diameter at distal extremity much less than at its base), a characteristic not shared by our material. There is no indication of the presence of nematothecae on hydrorhiza and secondary tubules in the description of Allman, Nutting and Fraser; this character is very prominent in our material.

*Plumularia mossambicae*, described from the coast of Mozambique, has a much different colony structure as the monosiphonic axes rise directly from stolonal tubes. Moreover there are one to five hydrocladia per axial segment and the hydrotheca is larger. Here too no nematothecae are described from the hydrorhiza.

Etymology.— The specific name *falcicula* refers to the falcate condition of the gonothecae.

## **Plumularia filicula** Allman, 1877
(fig. 47a-e)

*Plumularia filicula* Allman, 1877: 29-30, pl. 18 figs. 1-2; Nutting, 1900: 58-59, pl. 2 fig. 2; Fraser, 1944: 344-345, pl. 74 fig. 332.

Material.— BALGIM Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: damaged fragment of juvenile colony 17 mm high, without gonothecae.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: two colonies 15-20 mm high in bad shape; no gonothecae.— Stn CP 91, 34°22.3'N-07°25.1'W, 07.vi.1984, 948 m: single colony composed of six hydrocauli 15-40 mm high on polychaete tube; with gonothecae. Also two colonies 10-15 mm high; no gonothecae.

Description.— Stolon composed of numerous anastomosing perisarcal tubes attached to tube of polychaete. Erect hydrocauli rising in small groups from this stolon, monosiphonic, unbranched, divided into segments by means of transverse nodes, distinctly visible in young colonies and distal parts of adult colonies where the perisarc is thin; in basal parts of adult colonies nodes are practically invisible. Each axial segment with one distal apophysis and usually two nematothecae, one on same side as apophysis, one on opposite side. One of these nematothecae may be absent (fig. 47c).

Apophyses alternately arranged in one plane along axis, pointing left or right

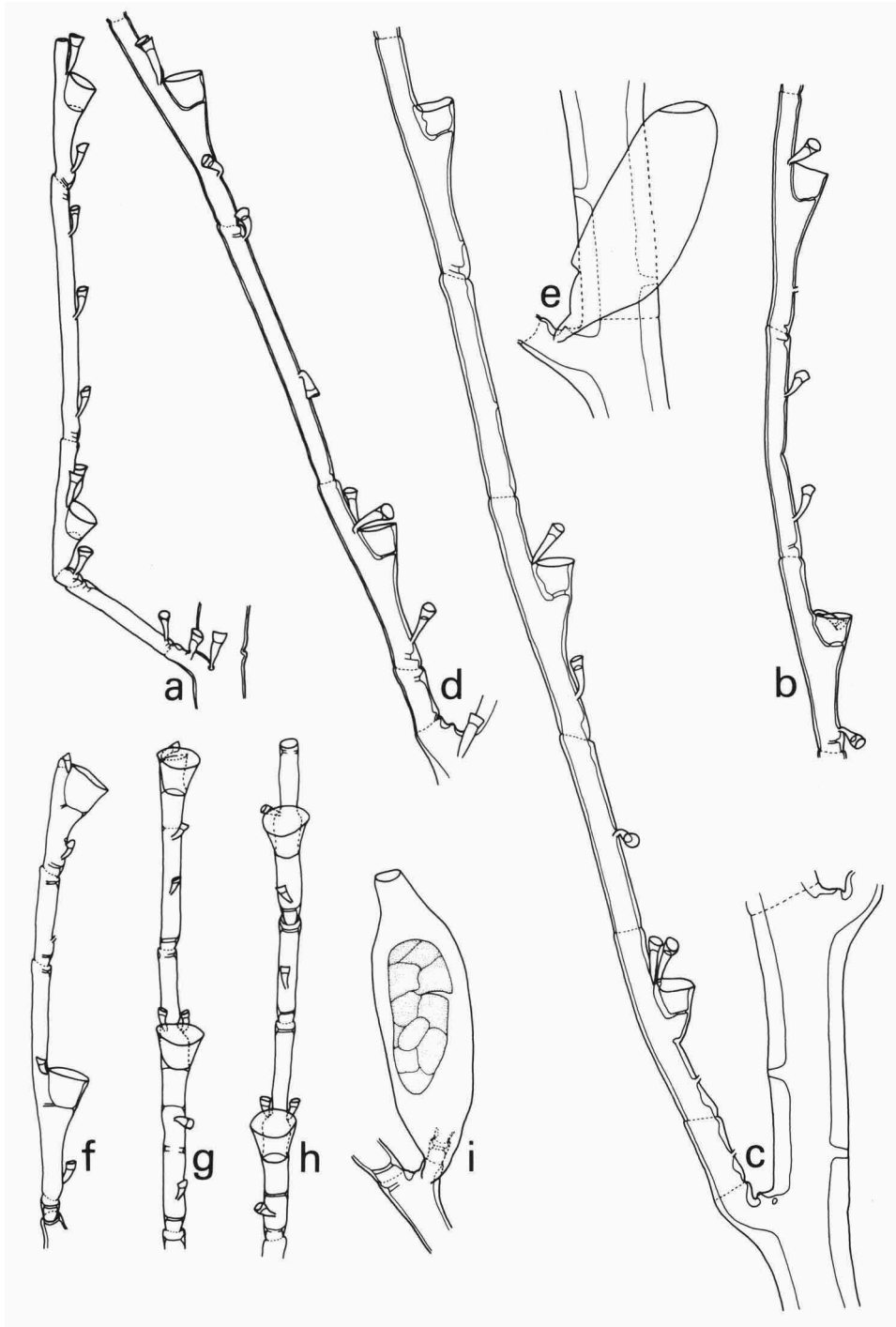


Fig. 47. a-e, *Plumularia filicula* Allman, 1877. a, from CP 14, part of young colony. b, from CP 90, hydrocladial and ahydrothecate internodes with hydro- and nematothecae, lateral view. c-e, from CP 91; c, axial segment with apophysis and hydrocladium, lateral view; d, hydrocladium with two nematothecae on ahydrothecate internode, lateral view; e, gonotheca. f-i, *Plumularia setacea* (Linnaeus, 1758), from CP 149; f-h, hydrocladial internodes showing varied development of internal septa, lateral and frontal views; i, gonotheca. a-i, × 57.

and supporting hydrocladia, each with two axillary nematothecae and one 'mamelon' on its superior surface (fig. 47d). Hydrocladia attached to apophysis by means of short basal internode bearing a single nematotheca which at times may be lacking. Rest of internode composed of regular succession of thecate and athecate internodes; hydrothecate internode separated from preceding intermediate internode by means of oblique septum and from succeeding intermediate internode by means of transverse node. Hydrothecate internode with centrally located hydrotheca and three nematothecae; one median infracalycine and two laterals. Hydrotheca cup-shaped; adcauline wall completely adnate, slightly longer than abcauline wall; hydrothecal rim smooth and slightly tilted downwards. Abcauline wall of hydrotheca with slight perisarcal thickening just under rim (fig. 47c, d).

Intermediate internodes long, with a single centrally placed nematotheca or two nematothecae: one central or on basal third, one on distal third of internode (fig. 47b-d). All nematothecae movable and bithalamic. In basal part of hydrocladia hydrothecate internodes slightly longer than intermediate internodes; reverse condition found in distal part of hydrocladia.

Gonothecae inserting on apophysis, usually in pairs, one on each side of apophysis. Gonotheca large, oviform, inserted by means of short pedicel without nematothecae, apically rounded. Aperture of gonotheca almost terminal but slightly laterally displaced, closed by means of circular lid (fig. 47e).

Variability.— The presence of one or two nematothecae on the axial segments and intermediate internodes has already been mentioned. One of the colonies from CP 90 has a ramification perpendicular to the plane of dispersion of the hydrocladia. This ramification, however, is broken off some distance from its base. As in *Plumularia falcicula* spec. nov. the distal part of the axis in some colonies has hydrothecate internodes as well as supplementary hydrocladia developing on the apophysis from what appears to be the basal part of a gonotheca and probably resulting from the regeneration of a broken gonotheca from its basal part. Variability also occurs as the result of regeneration of broken internodes, resulting in the formation of internodes that differ from the description given above but not influencing the specific characters.

The juvenile colony from CP 14 differs slightly from the rest of the material. The basal internode of the hydrocladia is longer than in the remaining colonies, while the intermediate, athecate internodes are much longer than the thecate internodes. One of these athecate internodes has three nematothecae (fig. 47a). The hydrothecae, though of the same shape, are slightly smaller (see Measurements).

Distribution.— The geographical distribution of *P. filicula* has been summarized by Fraser (1944) and so far included only the Atlantic coasts of the United States, from Florida Keys in the south to 40°05'36"N. The depth distribution ranges between 80 and 440 fms (= 146-805 m) depth. The present material is from Atlantic localities of which one is situated SW of Cape São Vicente (CP 14) and two (CP 90, CP 91) off Rabat, Morocco, depth 890-1318 m.

Discussion.— The BALGIM material agrees well with Allman's description of this species in the general appearance (various axes rising from a common base), in the mode of segmentation of axis and hydrocladia, and in the shape of the gonotheca (large, oviform and with slightly laterally displaced circular aperture). A difference with existing descriptions is observed in the presence of one or two nematothecae on

Table 58. Measurements of *Plumularia filicula* in µm.

| | BALGIM Stn CP 91 | BALGIM Stn CP 14 |
|---|---|---|
| Axial segment, length | 620-860 | 460-780 |
| diameter at node | 60-250 | 120-125 |
| Basal hydrocladial internode, length | 140-250 | 300-310 |
| diameter | 60-90 | 45-50 |
| Hydrothecate internode, length | 540-630 | 440-490 |
| Intermediate internode, length | 510-680 | 630-660 |
| diameter at node | 50-70 | 40-45 |
| Hydrotheca, length abcauline wall | 65-80 | 50-60 |
| length adcauline wall | 70-90 | 75-80 |
| diameter at rim | 90-105 | 70-85 |
| Lateral nematotheca, length | 100-120 | 100-105 |
| diameter at rim | 30-40 | 35-40 |
| Median infracalycine nematotheca, length | 90-105 | 80-85 |
| diameter at rim | 30-40 | 30-35 |
| Gonotheca, length | 640-800 | |
| maximal diameter | 190-280 | |

the intermediate internodes; two being the number given in previous descriptions. We do not consider this difference to be of major importance and certainly insufficient to separate our material from *P. filicula*.

*Plumularia megalocephala* Allman, 1877, comes very close to *P. filicula* and is distinguished primarily by its much larger hydranths. In our material of *P. filicula* the hydranths are not preserved so that we have been unable to evaluate this character. *P. megalocephala* is further distinguished by the branched axis and, according to Allman (1877), the irregular segmentation of the hydrocladia demonstrated by occasional presence or absence of intermediate internodes in the hydrocladia. Fraser (1944) described the gonothecae of *P. megalocephala*. These are usually found in the axil of the apophyses, but occasionally also on the distal part of the apophysis and along the walls of the axial segments. We have never observed these positions in the BALGIM material though gonothecae are plentiful at CP 91. There is also a small difference in the shape of the gonothecae that could also be explained by difference in age or sex. *Plumularia setacea* var. *elongata* Bedot (1921c: 10-11, pl. 1 fig. 1), resembles our material in the segmentation of the hydrocladia and in the presence of one or two nematothecae per intermediate internode. The gonothecae of *P. setacea* var. *elongata* are identical with those of *P. setacea* which suffices to distinguish the BALGIM material.

## **Plumularia marocana** Billard, 1930
(figs. 48b-d, 49a, b)

*Plumularia marocana* Billard, 1930a: 79, fig. 1; Patriti, 1970: 54-55, fig. 76; Van Praët, 1979: 926, fig. 99.
*?Polyplumaria Billardi* var. *deloni* Bedot, 1921c: 17-18, pl. 1 figs. 7, 10-11; Patriti, 1970: 56, fig. 79.
*Polyplumaria flabellata* p.p. - Gili, Vervoort & Pagès, 1989: 91-92, fig. 19.

Material.— BALGIM Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: single colony 80 mm high; no

gonothecae.— Stn CP 54, 35°41.3'N-06°29.7'W, 03.vi.1984, 356 m: single mutilated fragment 20 mm high; no gonothecae.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: two fragments 25 and 50 mm high; no gonothecae.— Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: single mutilated fragment 12 mm high; no gonothecae.

Description.— Polysiphonic and forked axis rising from tuft of hydrorhiza fibres. Side-branches polysiphonic till near end, springing in opposite pairs from secondary tubes and arranged in one plane. Primary tube of main axis and branches, giving rise to the hydrocladia, divided in segments of varied length by transverse septa, each with a number of apophyses varying between one and five in material examined; between two consecutive apophyses there may be a single nematotheca. Apophyses alternately directed left and right, arranged in one plane, each with highly characteristic, much developed 'mamelon' and two axillary nematothecae (fig. 48b). Secondary tubules with numerous nematothecae; all nematothecae, those on secondary tubules as well as axial and axillary nematothecae, indistinctly bithalamic and immovable.

Hydrocladia inserting on apophyses by means of short basal internode with single nematotheca on basal third. Rest of internode formed by regular succession of hydrothecate internodes, separated by oblique nodes, each with one hydrotheca and four nematothecae: one median infracalycine, two laterals and one situated in the axil formed by free adcauline hydrothecal wall and wall of internode. Occasionally there is a supplementary nematotheca on distal part of internode (fig. 48d). Hydrotheca deep cup-shaped, with straight, almost parallel walls. Adcauline wall of hydrotheca free for about half its length; hydrothecal rim circular and smooth (fig. 48b-d).

Median, infracalycine nematotheca (and supplementary nematotheca, if present) indistinctly bithalamic and immovable. Lateral nematothecae placed on small conical apophyses on each side of hydrotheca, elongated conical, bithalamic and movable. Axillary nematotheca small and reduced, squamiform and bithalamic. Reduction in this axillary nematotheca primarily concerns resorption of adcauline nematothecal wall.

Variability.— In the material from CP 14 the occurrence of a supplementary nematotheca on the distal part of hydrothecate internodes is quite accidental; the majority of hydrothecate internodes have no supplementary nematotheca. In the rest of the BALGIM material such supplementary internodes are of more frequent occurrence, though hydrothecate internodes without such supplementary nematothecae are also present.

Distribution.— *Plumularia marocana* has previously been recorded from two localities off the Atlantic coast of Morocco (Billard, 1930a; Patriti, 1970). The geographical distribution of the species extends southwards at least to the coasts of Guinea Bissau as part of the material mentioned by Gili, Vervoort & Pagès (1989) as *Polyplumaria flabellata* belongs to *Plumularia marocana*. Re-inspection of the material of *Polyplumaria flabellata* from Guinea Bissau deposited in RMNH proved that this material belongs to *Plumularia marocana*; the latter being recorded from four stations off Guinea Bissau by Gili, Vervoort & Pagès (1989).

*Polyplumaria Billardi* var. *deloni* has been described by Bedot (1921c) from the Atlantic coast of Morocco; the same locality is cited by Patriti (1970) (see discussion).

The BALGIM colonies originate from 3 localities off the Atlantic coast of Morocco

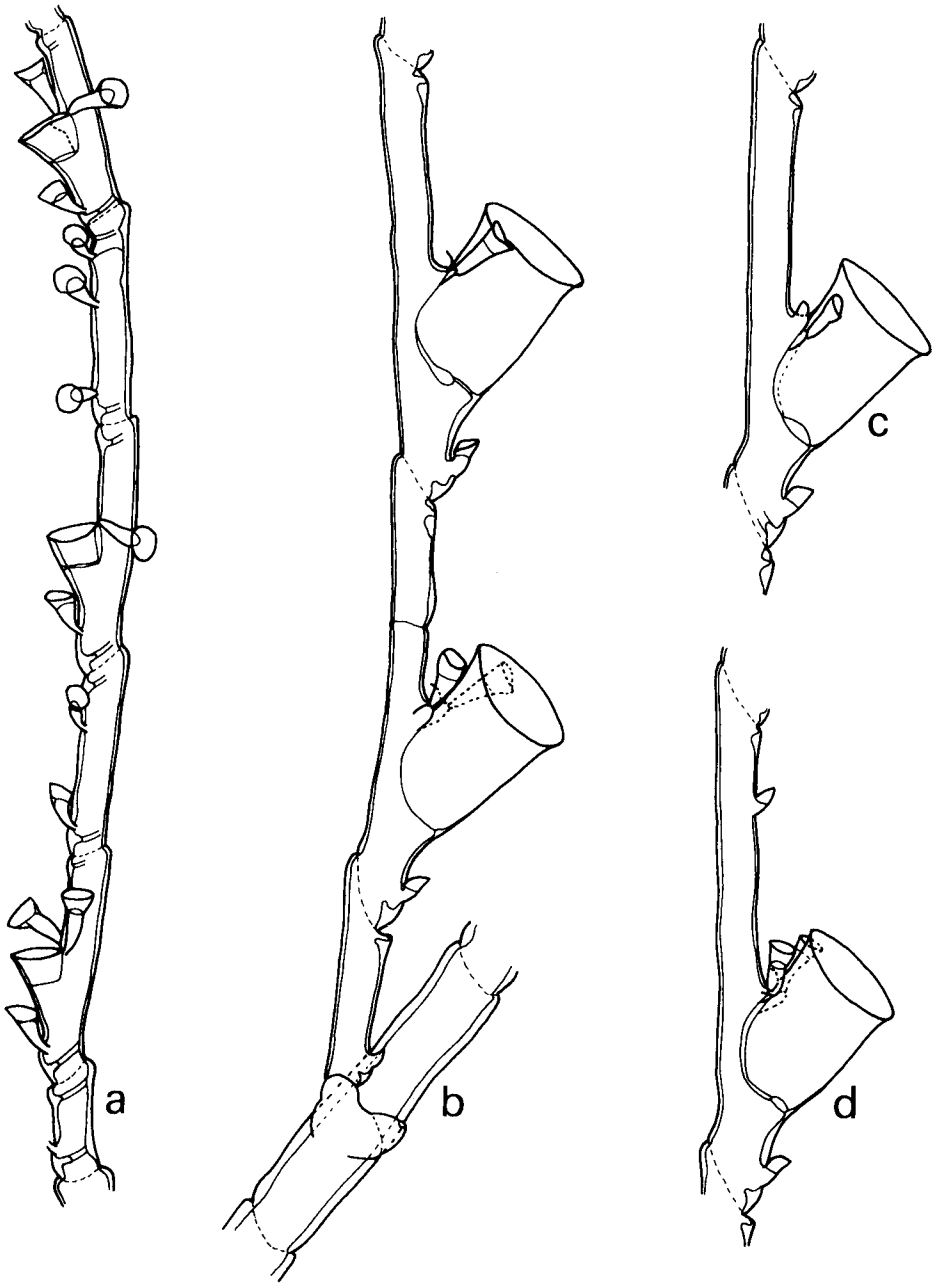


Fig. 48. a, *Nemertesia irregularis* (Quelch, 1885), from DW 144, hydrocladial internodes, lateral view. b-d, *Plumularia marocana* Billard, 1930, from CP 14. b, insertion of hydrocladium on axial apophysis, oblique lateral view; c, d, hydrothecate internodes, lateral view, c, without, d, with reduced, supracalycine nematotheca. a-d, × 85.

Table 59. Measurements of *Plumularia marocana* and *Polyplumaria Billardi* var. *deloni* in µm.

| | BALGIM Stn CP 14 | Billard's schizoholotype (own measurements) | *Polyplumaria Billardi* var. *deloni* (Bedot, 1921c) |
|---|---|---|---|
| Axis, diameter | 115-130 | | |
| Basal internode of hydrocladium, length | 310-355 | | |
| diameter | 70-95 | | |
| Hydrothecate internode, length | 600-760 | 445-750 | 768 |
| diameter at node | 60-80 | 65-90 | 96 |
| Hydrotheca, depth | 220-260 | 190-205 | 275 |
| length free part adcauline wall | 105-135 | 80-95 | |
| diameter at rim | 180-200 | 155-165 | 220 |
| Lateral nematotheca, length | 95-110 | 75-80 | 154 |
| diameter at rim | 40-50 | 50-60 | 71 |
| Median, infracalycine nematotheca, length | 60-70 | 35-45 | 77 |
| diameter at rim | 30-40 | 30-35 | 55 |

(CP 54, CP 92, CP 95) and from one locality SW of Cape São Vicente (CP 14). The depths records vary between 356 and 1378 m.

Discussion.— The existing descriptions of *Plumularia marocana* (Billard, 1930a; Patriti, 1970) are short and give no measurements. Nevertheless the characteristics of the BALGIM material (general shape of the colony, mode of ramification, presence of a large 'mamelon' on the apophysis and presence of a reduced nematotheca behind the hydrotheca) leave no doubt about its identify with Billard's species. The occasional presence of a supplementary nematotheca on the hydrothecate internodes is mentioned by Billard (1930a) and Patriti (1970); similar variability has also been found in other species of *Plumularia*.

Billard's type material of *Plumularia marocana* in MNHN has previously been redescribed and figured by Van Praët (1979:926, fig. 99); the syntype series being composed of a c. 25 cm high alcohol preserved colony and three carmine-stained slides (L 1288-1290), the type locality is 'Vanneau' Stn XI, 32°33'N 09°33'W, depth 110 m, 08.vii.1923. Colony erect, which thick axis and opposite branches all in one plane, both initially strongly polysiphonic. Hydrocladia pinnately arranged along branches, these not re-branching. In monosiphonic parts of colony axis (or branch) divided into segments by means of straight septa, in older parts of colony indicated by perisarcal constrictions and rapidly covered by secondary tubules. Segments with apophyses on frontal aspect and each supporting a hydrocladium, alternately directed obliquely upwards and laterally. Number of apophyses per segment usually 3, though irregularities may occur. Major part of apophysis taken by large swelling supporting a big 'mamelon', flanked on each side by an immobile nematotheca (fig. 49a). Hydrocladium borne on short, cylindrical part of apophysis. Segment in addition with reduced, immobile nematotheca above insertion of apophysis. Hydrocladia homomerously segmented, all internodes, with exception of first, hydrothecate. This first internode of hydrocladium basally with straight, apically with strongly oblique septum and bearing a single reduced, immovable nematotheca; all ensuing hydrothecate internodes separated by strongly oblique septa, though irregularities do occur. Normally developed thecate internodes with reduced, immobile infracalycine nema-

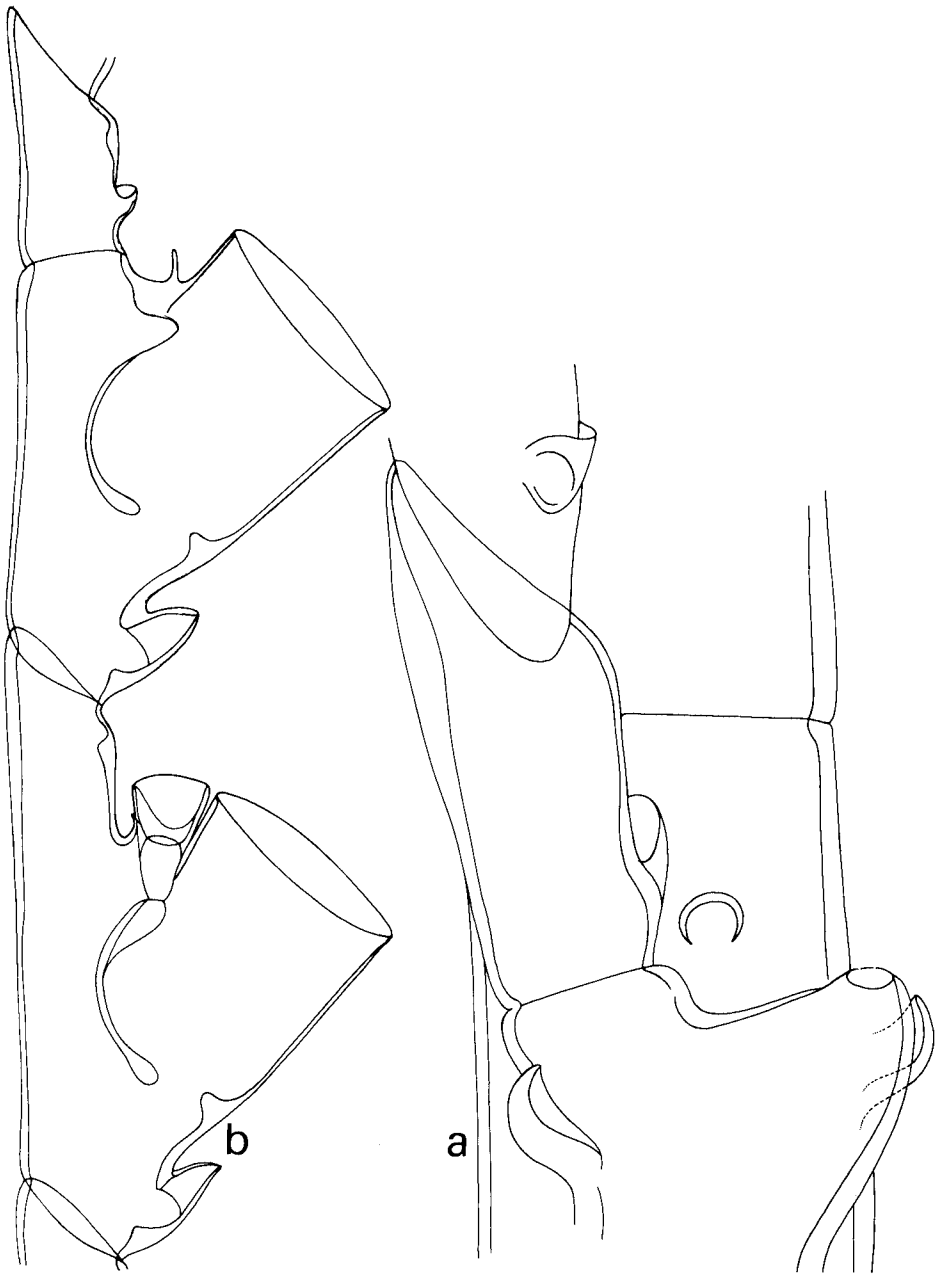


Fig. 49. a, b, *Plumularia marocana* Billard, 1930, syntype, Billard's slide no. 1290, from Vanneau Exped., Stn XI. a, insertion of hydrocladium on axial apophysis, oblique lateral view; b, two hydrocladial internodes with hydro- and nematothecae, lateral view. a, × 295; b, × 180.

totheca, a pair of movable, distinctly bithalamic laterals, and a scale-shaped, strongly reduced nematotheca behind the hydrothecal adcauline wall (fig. 49b). Hydrotheca large, cylindrical, only slightly widening, both ad- and abcauline walls straight,

about half of adcauline wall free. Rim circular, smooth, not everted, perpendicular to hydrothecal length axis. Median inferior nematotheca indistinctly bithalamic, firmly attached, immovable. Laterals conical, bithalamic, movable, adcauline wall strongly scooped, on distinct apophyses at both sides of hydrotheca. slightly surpassing hydrothecal margin. Nematotheca in hydrothecal axil with completely reduced adcauline wall, scale-shaped, immovable. Part of internode above hydrotheca of varied length, occasionally with additional reduced, immovable nematotheca; this part of internode occasionally separated from rest by development of straight septum (fig. 49b). Perisarc strong, particularly along walls of internodes, but also along walls of hydrotheca and particularly at the hydrothecal bottom. The measurements have been given above.

*Polyplumaria Billardi* var. *deloni* Bedot, 1921c, comes very close to *P. marocana*, the principal difference being the apparent absence of a reduced nematotheca behind the adcauline hydrothecal wall. Bedot's description of this variety gives no details of the nematotheca, of which two types, movable and immovable, occur in *P. marocana* and the reduced nematotheca behind the hydrotheca may easily have been overlooked. A re-inspection of Bedot's material of this variety is highly desirable to establish its exact taxonomic position.

### **Plumularia setacea** (Linnaeus, 1758)
(fig. 47f-i)

*Sertularia setacea* Linnaeus, 1758: 813.
*Plumularia setacea* - Hincks, 1868: 296-299, pl. 66 fig. 1; Vervoort, 1946b: 175-178, figs. 24f, 73; Millard, 1968: 278-279, fig. 5F-H; Millard, 1975: 399-401, fig. 124E-K; Vervoort, 1968: 64-66, fig. 29.
*Plumularia setacea* f. *microtheca* Broch, 1918: 56; Broch, 1933: 34, 35.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: single colony 5 mm high epizootic on *Aglaophenia tubulifera*; no gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: several colonies up to 10 mm high epizootic on *Diphasia pinastrum*; with gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: single fragment 4 mm high without gonothecae. In addition colonies with various axes up to 10 mm high and with gonothecae, epizootic on *Diphasia pinastrum* and *Polyplumaria flabellata*.— Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: several colonies up to 5 mm high epizootic on *Aglaophenia tubulifera*; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: single colony 5 mm high epizootic on *Lytocarpia myriophyllum*; no gonothecae.— Stn CP 149, 35°47.5'N-05°11' W, 17.vi.1984, 377 m: several colonies up to 10 mm high epizootic on *Lytocarpia myriophyllum*; with gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: three colonies up to 5 mm high epizootic on *Aglaophenia tubulifera*; with gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: c. 30 colonies up to 10 mm high, epizootic on *Aglaophenia tubulifera*; some with gonothecae.

Description.— Hydrorhiza composed of stolonal tube usually attached to axis or hydrocladia of other hydroids; from it rise monosiphonic, unbranched axes 5-10 mm high. Axis divided into segments separated by transverse nodes; each segment with apophysis at distal extremity and two nematothecae, one at base of apophysis, the other on opposite side of apophysis in basal half of segment. In addition each segment with two internal septa (perisarcal rings), one basal, the other in distal part of internode above apophysis: development of septa varied in colonies inspected.

Apophyses alternately directed left and right and slightly towards front of colony, each with 'mamelon' on superior surface and internal septum near distal end. Hydrocladia inserting on apophysis, because of orientation of apophyses not strictly in one plane but directed towards front of colony; each hydrocladium with short ahydrothecate internode without nematothecae but with distal internal septum. Rest of hydrocladium formed by regular succession of hydrothecate and intermediate internodes; hydrothecate internodes basally with oblique and distally with transverse node. Hydrothecate internodes with one hydrotheca, placed in central part of internode, and three nematothecae, one median infracalycine and two laterals.

Hydrotheca cup-shaped, adcauline wall totally adnate, slightly longer than abcauline hydrothecal wall; rim consequently slightly tilted in abcauline direction, smooth (fig. 47f-h). Intermediate internodes with one nematotheca. Both hydrothecate and intermediate internodes with two internal septa, one basal, one distal; development of septa varied. All nematothecae bithalamic and movable.

Gonothecae inserting on apophysis, single or in pairs (one on each side). Gonotheca large, bottle-shaped, narrowing basally into short pedicel; distally narrowing into short conical process with terminal, circular aperture (fig. 47i).

Variability.— Some colonies of the BALGIM material have hydrocladia without intermediate internodes; basal portion of hydrothecate internodes in such cases much longer, bearing two nematothecae (fig. 47g). The septa in the hydrothecate internodes may increase in number: an additional septum may develop at the hydrothecal base and another between that base and the infracalycine nematotheca. Once a median distal nematotheca was observed on the hydrothecate internode.

Distribution.— *Plumularia setacea* is a cosmopolitan species. The BALGIM material originates from the Strait of Gibraltar (DR 152, DR 153), both the Atlantic (DR 42, DR 49, DR 50, DR 115) and the Mediterranean (CP 149) side, and from the Alboran Sea (CP 135); depths records vary between 133 and 604 m.

Table 59. Measurements of *Plumularia setacea* in µm.

| | BALGIM Stn CP 149 |
|---|---|
| Axial segment, length | 350-460 |
| diameter at node | 55-90 |
| Basal hydrocladial internode, length | 50-70 |
| diameter | 40-50 |
| Hydrothecate internode, length | 410-600 |
| Intermediate internode, length | 210-320 |
| diameter at node | 40-50 |
| Hydrotheca, length abcauline wall | 80-95 |
| length adcauline wall | 90-100 |
| diameter at margin | 100-115 |
| Lateral nematothecae, length | 45-70 |
| diameter at rim | 20-25 |
| Median nematotheca, length | 45-60 |
| diameter at rim | 20-25 |
| Gonotheca, length | 750-890 |
| maximal diameter | 180-240 |

Discussion.— The BALGIM material in its measurements corresponds with *Plumularia setacea* f. *microtheca* Broch, 1918 (cf. Broch, 1933) and, by the small size of the lateral nematothecae, with the epizootic from described by Millard (1968, 1975). The presence of supplementary septa and of an extra median distal nematotheca are considered of little importance by Millard (1975) and we concur.

The disappearance of intermediate hydrocladial internodes has previously been described by Billard (1904a), but in that case the intermediate internode fuses with the preceding hydrothecate internode, resulting in elongation of the distal part of the hydrothecate internode. In our material fusion occurs with the following

hydrothecate internode, resulting in a lengthened proximal portion of the relevant internode bearing two nematothecae, one of which originates from the fused intermediate internode. In this type of variation *Plumularia setacea* approaches *Plumularia antonbruuni* Millard, 1967, from which it is nevertheless differentiated by the presence of a single nematotheca on the apophysis; two axillary nematothecae occurring there in *P. antonbruuni*. The differences between *Plumularia diploptera* Totton, 1930, and *P. setacea* have been pointed out by Ralph (1961b). However, if we bear in mind the variability ascribed to *P. setacea* in the relevant literature and which concerns the orientation of the hydrocladia (in the same plane or directed obliquely towards the front of the colony), the number and the disposition of the internal septa, it may well be that the clearest distinction between the two species lies in the fact that in *P. diploptera* there is a pair of axillar nematothecae on the apophyses.

## Genus **Polyplumaria** G.O. Sars, 1874

### **Polyplumaria flabellata** G.O. Sars, 1874
(fig. 50a-g)

*Polyplumaria flabellata* G.O. Sars, 1874: 101-102, pl. 2 figs. 16-22; Pictet & Bedot, 1900: 28-32, pl. 7 figs. 1-6; Billard, 1906d: 218-222, figs. 16-17; Vervoort, 1966: 134-136, fig. 37.
*Diplopteron insigne* Allman, 1874: 479-480, pl. 68 fig. 2.
*Polyplumaria pumila* Allman, 1883: 31, pl. 4 figs. 7-8.
*Polyplumaria cantabra* Arévalo, 1906: 89-97, pls. 15-18.
*Polyplumaria Billardi* Bedot, 1921c: 14-17, pl. 1 figs. 4, 8-9, pl. 2 figs. 12-16, pl. 3 figs. 17-18.

Material.— BALGIM Stn DR 23, 36°38.8'N-07°19.5'W, 31.v.1984, 556 m: two parts of a large colony 10 and 30 mm high; no gonothecae.— Stn DW 24, 36°41.1'N-07°19'W, 31.v.1984, 545 m: single small, mutilated colony 30 mm high; no gonothecae.— Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: c. 40 colonies and fragments up to 40 mm high; with gonothecae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: large number of colonies up to 40 mm high; no gonothecae.— Stn DW 27, 36°46.3'N-07°07.3'W, 31.v.1984, 370 m: single colony and a fragment 11 and 30 mm high, much damaged; no gonothecae.— Stn CP 33, 36°46.9'N-07°04'W, 01.vi.1984, 256 m: c. 30 colonies and several fragments 15-45 mm high; no gonothecae.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: large number of colonies up to 80 mm high and some fragments; with gonothecae.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: numerous fragments of colonies up to 50 mm high. with gonothecae.— Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: sixteen colonies up to 45 mm high, some with gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: numerous colonies 15-90 mm high, with gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: numerous colonies 20-100 mm high, some with gonothecae, and a few fragments.— Stn DR 51, 35°41.2'N-06°29.5'W, 03.vi.1984, 362 m: single fragment of large colony 25 mm high with single empty gonotheca.— Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: single fragmentary colony 45 mm high; no gonothecae.— Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: single fragment 4 mm high; no gonothecae.— Stn CP 92, 34°24.3'N-07°30.3'W, 08.vi.1984, 1182 m: small fragment 3 mm high; no gonothecae.— Stn CP 95, 34°24'N-07°39.3'W, 08.vi.1984, 1378 m: three small fragments 5 mm high; no gonothecae.— Stn CP 109, 36°14.5'N-07°56.4'W, 10.vi.1984, 1200 m: three fragments 20-50 mm high one with mutilated gonotheca.— Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: two colonies 30 and 40 mm high, with gonothecae.— Stn CP 119, 35°49.7'N-05°13'W, 13.vi.1984, 517 m: single colony in two parts 25 and 35 mm high, with gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: five colonies and various fragments 30-60 mm high; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: four large colonies 60-150 mm high and various fragments; gonothecae present.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: c. 50 colonies and fragments

up to 100 mm high, with gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: numerous small colonies up to 20 mm high, some with gonothecae and a large colony 50 mm high without gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: large number of colonies up to 30 mm high; gonothecae present.— Stn CP 155, 36°19.8'N-07°40.6'W, 18.vi.1984, 903 m: single fragment 20 mm high; no gonothecae.— Stn DW 157, 36°21'N-07°55.8'W, 18.vi.1984, 1108 m: single fragment 10 mm high; no gonothecae.

Description.— Axis (hydrocaulus) rising from mass of perisarcal tubes (hydrorhiza), polysiphonic and erect, with pairs of side-branches all in same plane with axis. Branches originating from secondary tubules, arranged in opposite pairs, polysiphonic, often with tertiary or further branching in same fashion as axis. Original tube of axis and principal tube of branches divided into segments by means of oblique nodes; each segment with numerous nematothecae of varied arrangement and one to five apophyses. Secondary tubules also bearing many nematothecae. Apophyses alternately directed left and right and obliquely forwards, each with two axillary nematothecae and a well developed 'mamelon' on the superior surface. Apophyses either short, in which case first internode of hydrocladium is a short ahydrothecate internode with one median nematotheca, or long as the result of fusion with first ahydrothecate internode of hydrocladium; in this case the apophysis has a median, unpaired nematotheca and the hydrocladium inserts by means of a hydrothecate internode.

Hydrocladia formed by regular succession of hydrothecate internodes separated by oblique nodes; each internode has one hydrotheca and generally five nematothecae: one median infracalycine, two laterals and two median distals (fig. 50c). Hydrotheca large, cylindrical, with straight and firm, nearly parallel walls, pointing away from internode at an angle of c. 60 degrees. About half adcauline wall or slightly more free from internode. Hydrothecal rim circular, smooth, not everted (fig. 50a-d). Lateral nematothecae placed on small apophyses one on each side of hydrothecal base, just reaching hydrothecal rim, conical, bithalamic and movable. Unpaired nematothecae with scooped-out adcauline wall, also bithalamic and movable.

Hydrocladia frequently bearing secondary hydrocladium originating from first hydrothecate internode, springing from base of hydrotheca and curving away from primary hydrocladium. First internode of secondary hydrocladium ahydrothecate, bearing a varied number of nematothecae. Morphology of rest of secondary hydrocladium as in primaries, though internodes may be longer. Tertiary hydrocladia may develop in same fashion on secondary hydrocladia. Secondary and tertiary hydrocladia may be more or less modified, beginning with the disappearance of hydrothecae and leading towards a condition where only perisarcal tubes with numerous nematothecae are present (fig. 50a).

Gonothecae inserting on apophyses of axis (fig. 50g) and ramifications; pyriform, with circular, apical aperture closed by a lid. Plane of aperture slightly tilted downwards. Basal portion of gonotheca with four to six nematothecae; pedicel short, with characteristic transverse constriction (fig. 50f).

Variability.— *Polyplumaria flabellata* shows numerous morphological variations that have already been described in detail by Pictet & Bedot (1900), Billard (1906d) and Bedot (1921c, as *Polyplumaria Billardi*). The BALGIM material afforded ample opportunity to study this variability, which can be summarized as follows:

1. Secondary hydrocladia. Presence of such hydrocladia is one of the principal

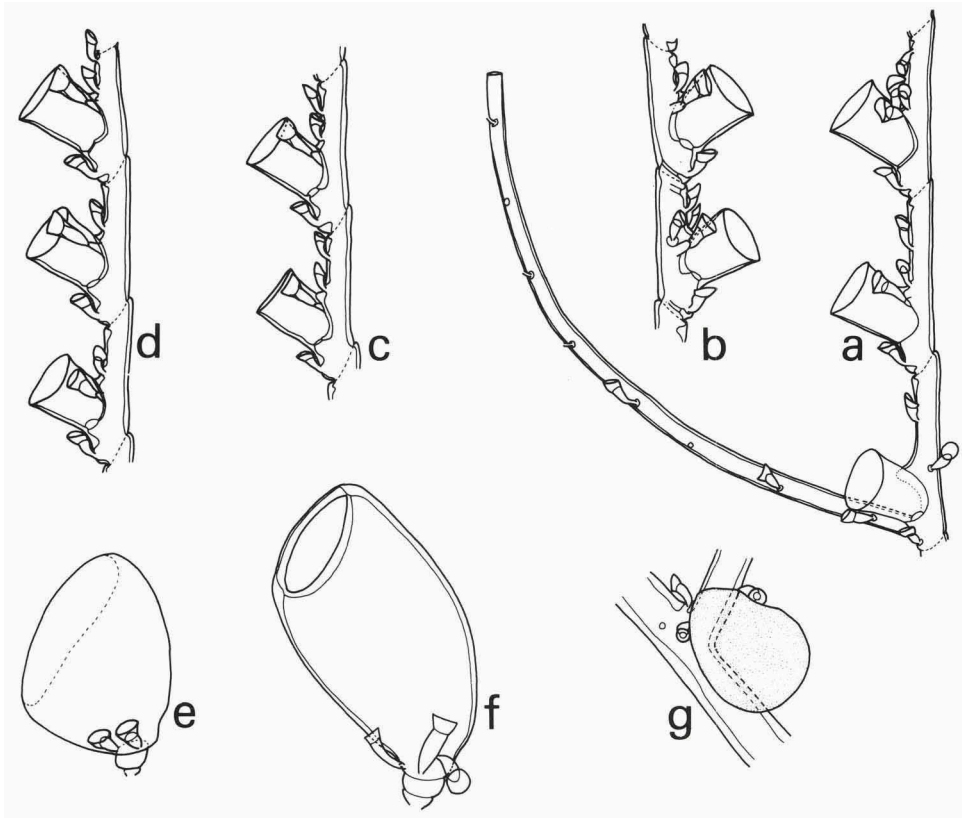


Fig. 50. a-g, *Polyplumaria flabellata* G.O. Sars, 1874. a, from DW 27, development of aberrant secondary hydrocladium, lateral view. b, from DR 49, two hydrocladial internodes one of which has an unpaired and a pair of distal nematothecae. c-f, from DR 151; c, hydrocladial internode with hydro- and nematothecae two of which are on distal part of internode and are unpaired, lateral view; d, 'normal' hydrothecate internodes with hydro- and nematothecae, lateral view; e, young gonotheca; f, mature gonotheca. g, from DR 153, insertion of gonotheca on apophysis. a-g, × 60.

characters of this species. We have met with fertile colonies without secondary hydrocladia, proving that absence of such hydrocladia does not indicate juvenile condition and that their presence is not linked with appearance of gonothecae. Secondary (and tertiary) hydrocladia present every possible intermediate between a full complement of hydrothecae on normally developed internodes and the presence of only a perisarcal tube with numerous nematothecae (fig. 50a). Some colonies have secondary hydrocladia developing from the base of the second hydrotheca of the primary hydrocladium.

2. Number and dispersal of distal nematothecae of hydrothecate internodes. Though two unpaired, median distal nematothecae normally occur on the hydrothecate internode (fig. 50c), displacement of these nematothecae is frequently observed: the unpaired nematothecae are laterally displaced and may insert at the same level, leading towards a condition where a second pair of nematothecae occurs just above the pair of laterals. Occasionally a third, unpaired nematotheca is present under such

conditions on the distal part of the internode (fig. 50b). One of the two unpaired hydrothecae may also be displaced, leaving the other in its proper position. The presence of a single unpaired median nematotheca on the distal part of the internode has also been observed (fig. 50d).

Distribution.— *Polyplumaria flabellata* is widely distributed in the Atlantic, extending from the North Atlantic (Broch, 1918) to the Congo River basin (Vervoort, 1966). The BALGIM material originates from 26 localities on both sides of the Strait of Gibraltar and off the Atlantic coast of Morocco, depths varying between 115 and 1378 m. The records from DW 134 and CP 135, situated in the Alboran Sea, represent the first Mediterranean records of this species.

Discussion.— *Polyplumaria billardi* was described by Bedot (1921c) after material collected off the coast of Portugal; it was not recorded afterwards. According to Bedot's description the principal differences with *P. flabellata* are in the shape of the secondary hydrocladia and the gonothecae. The secondary hydrocladia have various 'transformations' towards phylactogonia while the gonothecae occur in two types, an ovoid gonotheca, rounded or slightly truncate at the apex, and a spherical gonotheca, 220 µm long. Both types have nematothecae. Bedot also described distinct grades of modification of the secondary hydrocladia in the same colony (Bedot, 1921c, pl.2 figs. 12-16, pl. 3 figs. 17-18) and mentions the possibility to find all possible intermediates between a secondary hydrocladium and a real phylactogonium.

In our opinion, as explained above, the presence of secondary hydrocladia is not linked with the presence of gonothecae; the variations described by Bedot in reality representing intermediates between *P. flabellata* and *P. billardi*. As far as the gonothecae are concerned we have been able to study their development from a flattened disk, provided with nematothecae at its base, to a fully grown, pear-shaped gonothe-

Table 60. Measurements of *Polyplumaria flabellata* and *'P. Billardi'* in µm.

Colonies of varied appearance have been measured. Those from DW 27 have strongly modified secondary hydrocladia (similar to *Polyplumaria billardi*). DR 49 represents normal colonies with well developed secondary hydrocladia ('typical' form of *Polyplumaria flabellata*). In DR 151 the colonies have secondary hydrocladia with many modifications. Measurements given by Billard (1906d, as *P. flabellata*) and Bedot (1921c, as *P. Billardi*) are also included.

| | BALGIM Stn DW 27 | BALGIM Stn DR 49 | BALGIM Stn DR 151 | *Polyplumaria flabellata* (Billard, 1906d) | *Polyplumaria Billardi* (Bedot, 1921c) |
|---|---|---|---|---|---|
| Hydrothecate internode, length | 300-380 | 260-335 | 300-340 | 380-400 | 330-468 |
| diameter at node | 50-60 | 55-70 | 55-70 | 70-80 | 50 |
| Hydrotheca, total depth | 140-180 | 140-160 | 140-170 | 160-190 | 176-186 |
| length free part adcauline wall | 85-100 | 85-100 | 85-105 | 95-110 | |
| diameter at rim | 135-150 | 140-145 | 125-150 | 150-160 | 143 |
| Lateral nematotheca, length | 90-100 | 90-100 | 90-110 | | 99 |
| diameter at rim | 40-55 | 50-55 | 45-55 | | 44-50 |
| Median unpaired nematotheca, length | 75-80 | 70-80 | 70-90 | | 71 |
| diameter at rim | 40-45 | 40-45 | 40-45 | | 33 |
| Gonotheca, length | | | 630-710 | 675-750 | 660 |
| maximal diameter | | | 330-360 | 340-400 | |

ca with tilted, flattened top and also with basal nematothecae. The first type represents the gonotheca as described in *P. billardi* (Bedot, 1921c, pl. 1 fig. 9). Also we have met with colonies presenting all forms of secondary hydrocladia as described by Bedot for *P. billardi*, but with the gonotheca characteristic of *P. flabellata* besides others with developing gonothecae as described in *P. billardi*. Moreover there is complete conformity in the measurements of *P. billardi* as given by Bedot (1921c) with those from our colonies of *P. flabellata* and those given in literature. All this has induced us to list *Polyplumaria billardi* amongst the synonyms of *P. flabellata*. In the synonymy of the latter we have completely followed Pictet & Bedot (1900) and Billard (1906d).

## Family **Sertulariidae** Lamouroux, 1812
## Genus **Diphasia** L. Agassiz, 1862

### **Diphasia attenuata** (Hincks, 1866)
(fig. 51c)

*Sertularia attenuata* Hincks, 1866: 298-299.
*Diphasia attenuata* - Hincks, 1868: 247-249, pl. 49 fig. 1; Vervoort, 1946b: 236, fig. 102; Cornelius, 1979: 256-259, fig. 7.

Material.— BALGIM Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: single mutilated fragment 10 mm high, no gonothecae.

Description.— Colony composed of short, monosiphonic axis with pinnately arranged branches (hydrocladia), all in one plane. Hydrothecae, on branches as well as on axis arranged in opposite pairs, though hydrothecae of first pair of branches may be subopposite. Hydrothecae tubular, outwardly curved; adcauline wall adnate to axis or internode of half to one third of its length. Free portion of adcauline wall practically straight; abcauline hydrothecal wall concave with smooth curvature. Hydrothecal rim smooth, scooped out on adcauline side. Hydrothecal operculum composed of a single rounded flap attached to adcauline side of rim. Inside of hydrotheca, at about half the length of free portion, with internal lamina as described by Billard (1924) (fig. 51c). Branches (hydrocladia) originating from axis directly under a hydrotheca, in structure similar to axis.

Distribution.— *Diphasia attenuata* has a wide distribution in the Atlantic, from the Jan Mayen island in the north (Broch, 1918) to the coats of Guinea (Conakry) (Vervoort, 1959). There are also some Pacific records (Redier, 1966). The presence of the species at the Atlantic coast of South Africa (Busk, 1851, as *Diphasia rosacea*) is considered doubtful by Millard (1961, 1975) as no new records are known. The BALGIM material originates from a locality in the Strait of Gibraltar (DR 153), depth 580 m.

Table 61. Measurements of *Diphasia attenuata* in µm.

| | BALGIM Stn DR 153 |
|---|---|
| Hydrotheca, length of adnate part adcauline wall | 350-390 |
| length free part adcauline wall | 200-260 |
| length abcauline wall | 480-530 |
| diameter at rim | 120-140 |

Discussion.— The BALGIM material corresponds well in morphology and size

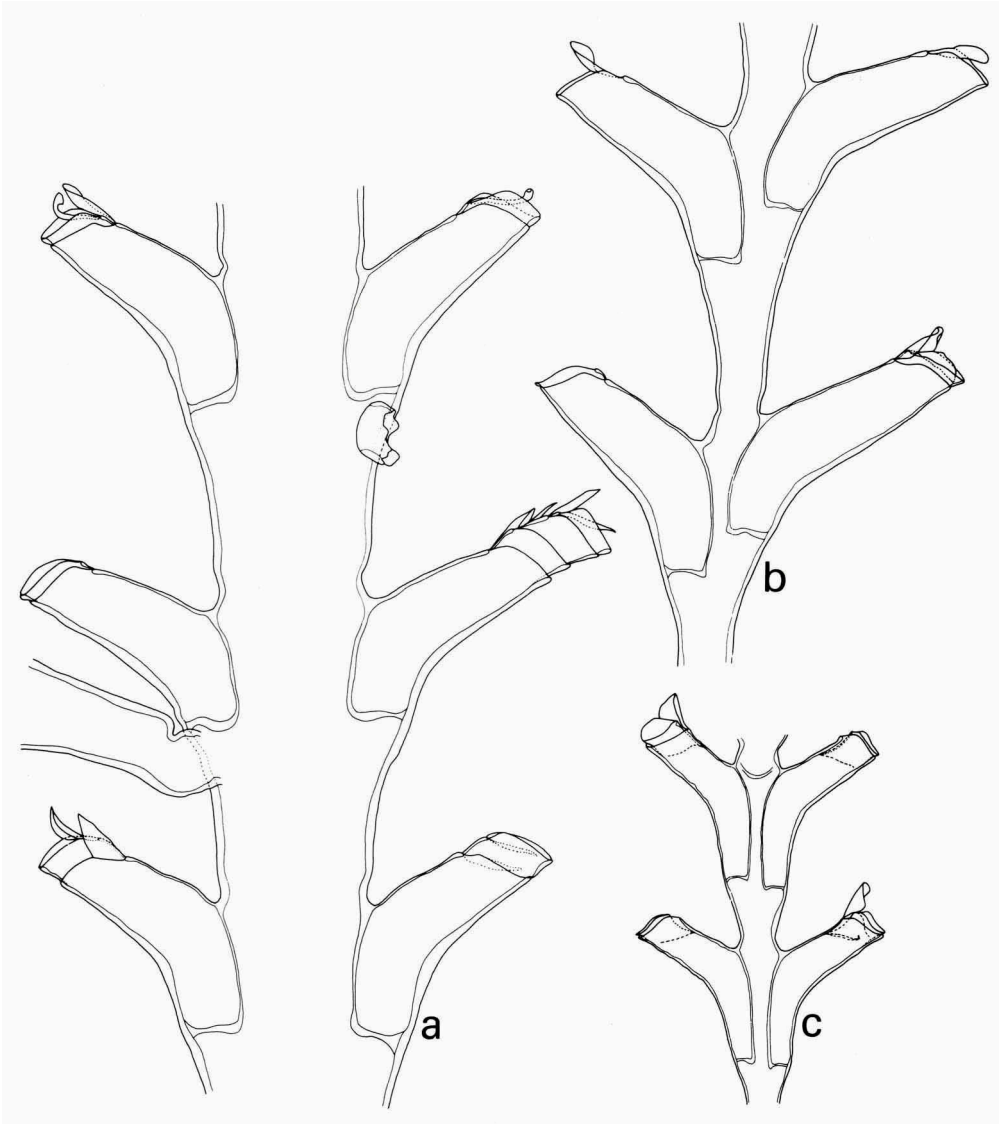


Fig. 51. a, b, *Diphasia attenuata* var. *robusta* Billard, 1924, from DR 113. a, part of axis; b, part of hydrocladium. c, *Diphasia attenuata* (Hincks, 1866), from DR 153, part of hydrocladium. a-c, × 40.

with existing descriptions. It can be differentiated from the closely allied *Diphasia rosacea* (Linnaeus, 1758) by the absence of longitudinal ribs on the exterior of the hydrotheca; the adcauline, internal lamina found in *D. attenuata* has so far not been observed in *D. rosacea*.

### **Diphasia attenuata** (Hincks, 1866) var. **robusta** Billard, 1924
(fig. 51a, b)

*Diphasia attenuata* Billard, 1906d: 195-197, fig. 13.

*Diphasia attenuata* var. *robusta* Billard, 1924: 62-64; Patriti, 1970: 44, fig. 58.

Material.— BALGIM Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: three detached hydrocladia 12-20 mm long, no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: nine fragmented colonies 15-50 mm high with many epizootic hydroids; no gonothecae.— Stn DW 116, 35°48.6'N-06°04.2'W, 11.vi.1984, 340 m: six fragments 5-30 mm high, no gonothecae.

Description.— Colony composed of monosiphonic axis with pinnately arranged branches (hydrocladia), arranged all in one plane. Between two successive branches there are alternately one and two pairs of hydrothecae; between two branches on the same side there are three pairs. Arrangement of hydrothecae along axis biserially and in opposite pairs. Branches inserting just under axial hydrothecae, diameter of hydrocladium much inferior to that of axis (fig. 51a). Structure of branches similar to that of axis, though hydrothecal pairs frequently sub-opposite.

Hydrothecae tubular, curved outwards, adnate part of adcauline wall c. one-third to half of total length, free part of adcauline wall almost straight; abcauline wall concave, with thickened periderm along its whole length. Hydrothecal rim smooth, deeply scooped out on adcauline side. Operculum composed of one valve, attached to scooped portion of hydrothecal rim. Hydrothecae frequently with renovations of hydrothecal border (fig. 51a, b).

Distribution.— *Diphasia attenuata* var. *robusta* is known from various localities off the Atlantic coast of North Africa, between the coast NE of Rabat and Cape Bojador (Billard, 1906d, 1924; Patriti, 1970). The BALGIM material comes from the Atlantic side of the Strait of Gibraltar (DR 42, DR 113, DW 116) at depths varying between 135 and 340 m.

Discussion.— Billard (1924) redescribed specimens previously (Billard, 1906d) named *Diphasia attenuata* as *D. attenuata* var. *robusta* because of considerable differences in size between the European specimens of *D. attenuata* and those found in the subtropical eastern Atlantic by the 'Talisman'. Besides those differences in size the BALGIM material also shows the remaining differences listed by Billard existing between the nominal form and the var. *robusta*, viz.

1, absence of the intrathecal adcauline lamina (usually present in *D. attenuata*);

2, presence of respectively one and two pairs of axial hydrothecae between two successive ramifications (hydrocladia) (normally two in *D. attenuata*).

Table 62. Measurements of *Diphasia attenuata* var. *robusta* in µm.

| | BALGIM Stn DR 113 | Eastern Atlantic (Billard, 1906d, as *Diphasia attenuata*) |
|---|---|---|
| Axis, diameter | 420-550 | 490-665 |
| Hydrocladium, diameter | 150-260 | 175-280 |
| Hydrotheca, length adnate part adcauline wall | 400-470 | 440-525 |
| length free part adcauline wall | 400-750 | 560-700 |
| length abcauline wall | 700-920 | |
| diameter at rim | 190-220 | 240-260* |

* = Diameter of the free part (Billard, 1924: 62, footnote).

Furthermore, the var. *robusta* is characterized by the thickened perisarc of the abcauline hydrothecal wall.

For the time being, and in absence of the gonothecae, we have recorded this form as *Diphasia attenuata* var. *robusta*, though the differences with the nominal form seems considerable and would justify separation on specific level.

## **Diphasia delagei** Billard, 1912
(fig. 56a)

*Diphasia delagei* Billard, 1912: 466-467, figs. 3-4; Billard, 1931a: 246-247; Teissier, 1950: 19; Teissier, 1965: 22; Cornelius, 1979: 259-260, fig. 10.

Material.— BALGIM Stn CP 62, 35°31.3'N-07°26.2'W, 04.vi.1984, 1250 m: two fragments 5 mm high without gonothecae and rather worn.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: two colonies 15 and 25 mm high, without gonothecae, growing on *Diphasia* spec. In addition 18 mm high colony on *Sertularella gayi gayi* and a fragment 7 mm high without gonothecae.

Description.— Hydrocaulus (axis) monosiphonic, erect, with pinnately arranged hydrocladia all in same plane and directed alternately left and right. Axis divided into segments by means of little marked, transverse nodes; each node with variable number of biserially arranged hydrothecae placed in opposite pairs.

Hydrotheca tubular, curved outwards, two-thirds to one half of adcauline border adnate with segment. Free portion of hydrotheca of varied length because of frequent occurrence of renovations of hydrothecal border, that may cause apical portion of hydrotheca to be curved upwards. Abcauline wall of hydrotheca smoothly concave, with slightly thickened perisarc; distal portion of abcauline wall, in strongly renovated hydrothecae, slightly convex. External surface of hydrotheca with fine, highly characteristic striation (fig. 56a). Hydrothecal rim oblique, smooth except for adcauline scooped portion, into which single hydrothecal valve is attached. Some of hydrothecae have an internal, adcauline lamina comparable to the condition observed in *Diphasia attenuata*. Some colonies show formation of a stolon from a hydrocladium.

Distribution.— *Diphasia delagei* so far has only been recorded from the Roscoff area (Billard, 1912; Teissier, 1955, 1965; Cornelius, 1979), from the central (axial ?) region of the English Channel and from the Ouessant area ('fosse de Ouessant', Teissier, 1965). Billard's (1931a) record probably originates from off Camaret (NW

Table 63. Measurements of *Diphasia delagei* in μm.

| | BALGIM CP 62 | Roscoff area (Billard, 1912)* |
|---|---|---|
| Hydrotheca, length adnate part adcauline wall | 320-350 | 270-300 |
| length free part adcauline wall | 190-390 | 160-215 |
| length abcauline wall | 480-640 | |
| diameter at rim | 100-130 | 95-160 |

* = Forms with vertically separated hydrotheca (sensu Cornelius, 1979).

France). The depth records oscillate between 60 and 90 m. The BALGIM specimens come from two Atlantic localities west of Cape Spartel (CP 62, DW 114), the depths varying between 150 and 1250 m.

Discussion.— The material examined corresponds with the form having widely separated hydrothecae (vertically separated hydrothecae, Cornelius, 1979) as described by Billard (1912, fig. 3.). The only difference observed is in the length of the free part of the hydrotheca, up to 390 μm in our specimens while Billard gives as maximal length 215 μm. This is due to the presence of many renovations of the hydrothecal aperture in our specimens, considerably lengthening the primary hydrotheca.

*Diphasia tropica* Nutting, 1904, has the fine external striation of the hydrotheca in common with *D. delagei*, but in Nutting's species the hydrotheca is pentagonal in cross section, clearly distinguishing it from *D. delagei*. Cornelius (1979) first described the gonothecae of *D. delagei*, that are quite different from those observed in *D. tropica* and that have been described by Vannucci-Mendes (1949, as *Diphasiella ornata* = *Diphasia tropica*, see Van Gemerden Hoogeveen, 1965). Striation of the hydrotheca is also found in *Sertularia hupferi* Broch, 1914, in *Sertularia subtilis* Fraser, 1937 and in *Geminella subtilis* Vannucci-Mendes, 1946, considered by Cornelius to be closely allied to *D. tropica*. In our opinion those three species should be excluded from the genus *Diphasia* as in the first two the operculum is said to be composed of two valves and in the third even of three valves. In *Diphasia* there is invariably a single valve attached in the adcauline sinus of the hydrothecal rim.

### **Diphasia margareta** (Hassall, 1841)
(figs. 52a-c, 53a-g, 54a-e, 55a-c, 56c-e, 57a, 58a-d)

*Sertularia Margareta* Hassall, 1841b: 284, pl. 6 fig. 34.
*Diphasia margareta* - Cornelius, 1979: 263-265, fig. 11.
*Diphasia pinaster* - Hincks, 1868: 252-253, pl. 50 fig. 1; Philbert, 1934: 1-6, pl. 1.
*Diphasia elegans* - G.O. Sars, 1874: 107-108, pl. 3 figs. 23-26.
*Diphasia pectinata* - Vervoort, 1959: 255-256, figs. 23-24.

Material.— BALGIM Stn CP 09, 36°47.6'N-09°28'W, 29.v.1984, 1163 m: two colonies 30 and 35 mm high without gonothecae.— Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: seven colonies 15-40 mm high; no gonothecae.— Stn KR 15, 36°46.4'N-09°30.1'W, 30.v.1984, 1305 m: single colony 10 mm high with seven pairs of hydrothecae; no gonothecae.— Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: two fragments 15 and 25 mm high without gonothecae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: seventeen colonies 20-45 mm high one of which has a deteriorated gonotheca.— Stn CP 33, 36°46.9'N-07°04'W, 01.vi.1984, 256 m: single colony 35 mm high, no gonothecae.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: two fragments 30 and 40 mm high, without gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: three colonies 8-20 mm high, without gonothecae, epizootic on *Polyplumaria flabellata*.— Stn DW 74, 33°52.1'N-08°12.8'W, 06.vi.1984, 181 m: two colonies 17 and 40 mm high without gonothecae. In addition detached hydrocladium with single empty male gonotheca.— Stn DW 94, 34°24.9'N-07°28.5'W, 08.vi.1984, 1175 m: single colony 30 mm high; no gonothecae.— Stn DW 96, 34°23.5'N-07°40.3'W, 08.vi.1984, 1255 m: single colony 25 mm high; no gonothecae.— Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: single colony 40 mm high; no gonothecae.— Stn CP 109, 36°14.5'N-07°56.4'W, 10.vi.1984, 1200 m: fragment of a larger colony 20 mm high; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: two stem fragments 35 mm high with *Lafoea dumosa*, *Campanularia hincksii* and *Obelia* spec.; no gonothecae.— Stn DR 152,

35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: three colonies and seven fragments 5-20 mm high one of which has single male gonotheca.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: 14 fragments 7-25 mm high, one with single female and one with single male gonotheca. In addition three colonies between 3 and 10 mm high without gonothecae epizootic on *Polyplumaria flabellata*.
Additional material.— Trondheimsfjord, Norway, 03.viii.1961 (RMNH Coel. no. 2535): three colonies 65-90 mm high, with female gonothecae.— Trondheims Leden, Norway, 22.viii.1963 (RMNH Coel. no. 1978): single colony 65 mm high, without gonothecae.— Lorn-Meer, Scotland, 1928 (RMNH Coel. no. 202): eight colonies and two fragments 40-65 mm high with male and female gonothecae.— Irish Sea, 55°19'N-05°25'W, 08.1932 (RMNH Coel. no. 539): several colonies up to 100 mm high with male and female gonothecae.— Clyde, U.K., 55°15'N-05°15'W, no date (RMNH Coel. no. 540): three colonies and four fragments 30-80 mm high, with male gonothecae.— Ile de Batz, Bretagne, France, 18.ix.1958 (RMNH Coel. no. 1427): six colonies between 25 and 50 mm, without gonothecae.— Surroundings of Roscoff, Bretagne, France, no date (RMNH Coel. no. 1338): five colonies between 15 and 50 mm, with male gonothecae.— Roscoff, Bretagne, France, 09.1990 (RMNH Coel. no. 25627): single colony 50 mm high with single female gonotheca. Taken from lobster pots in harbour.

Description.— Hydrorhiza composed of perisarcal tubes that attach colony to fixed substratum or form a basal tuft to anchor colony in movable sandy substrate. Hydrorhiza giving rise to erect, straight, monosiphonic axis bearing pairs of opposite hydrothecae; axis may be divided into segments by more or less distinct transverse nodes; length of segments and number of hydrothecae per segment much varied in various colonies. Axis supporting pinnately arranged lateral ramifications (hydrocladia), all in same plane as axis. Normally one and two pairs of axial hydrothecae occur alternately between two successive ramifications; between two successive ramifications on same side there are three pairs of hydrothecae.

Axial hydrothecae biseriate and strictly in pairs of opposite hydrothecae, tubular, curving outwards under greatly varying angle; adnate part of adcauline wall one-half to three-fourths of total length. Free portion of adcauline wall straight or slightly concave; concavity increased by renovations of hydrothecal border. Abcauline hydrothecal wall with distinct flexure; perisarc of uniform thickness or with internal perisarcal thickening or even perisarcal ridge of greatly varying development at place of flexure. Usually abcauline wall below flexure more or less concave and above flexure slightly convex; exact shape of abcauline hydrothecal wall much dependent upon development of perisarcal thickening. Hydrothecal rim smooth, with adcauline sinus; hydrothecal aperture closed by means of single flap attached to adcauline sinus (fig. 55a-c). One or more renovations of hydrothecal aperture frequently present.

Lateral ramifications (hydrocladia) inserting directly under axial hydrothecae (fig. 55c), generally of same structure as axis. First hydrotheca may occasionally be unpaired or first pair of hydrothecae of hydrocladium alternate or subopposite, to become strictly opposite towards distal portion of hydrocladium and thus resembling condition also observed on axis.

Female and male gonothecae occur on separate colonies, springing from axis or hydrocladium directly under hydrotheca. Female gonotheca much larger than male, quadrangular in cross section and with distal portion apically rounded and dome-shaped. Distal half of interior of female gonotheca forms a marsupium, communicating with the interior of the gonotheca proper by means of a short, tubular process with circular aperture. On both sides of this aperture runs a tubular prolongation of the marsupium directed towards the proximal portion of the gonotheca and opening

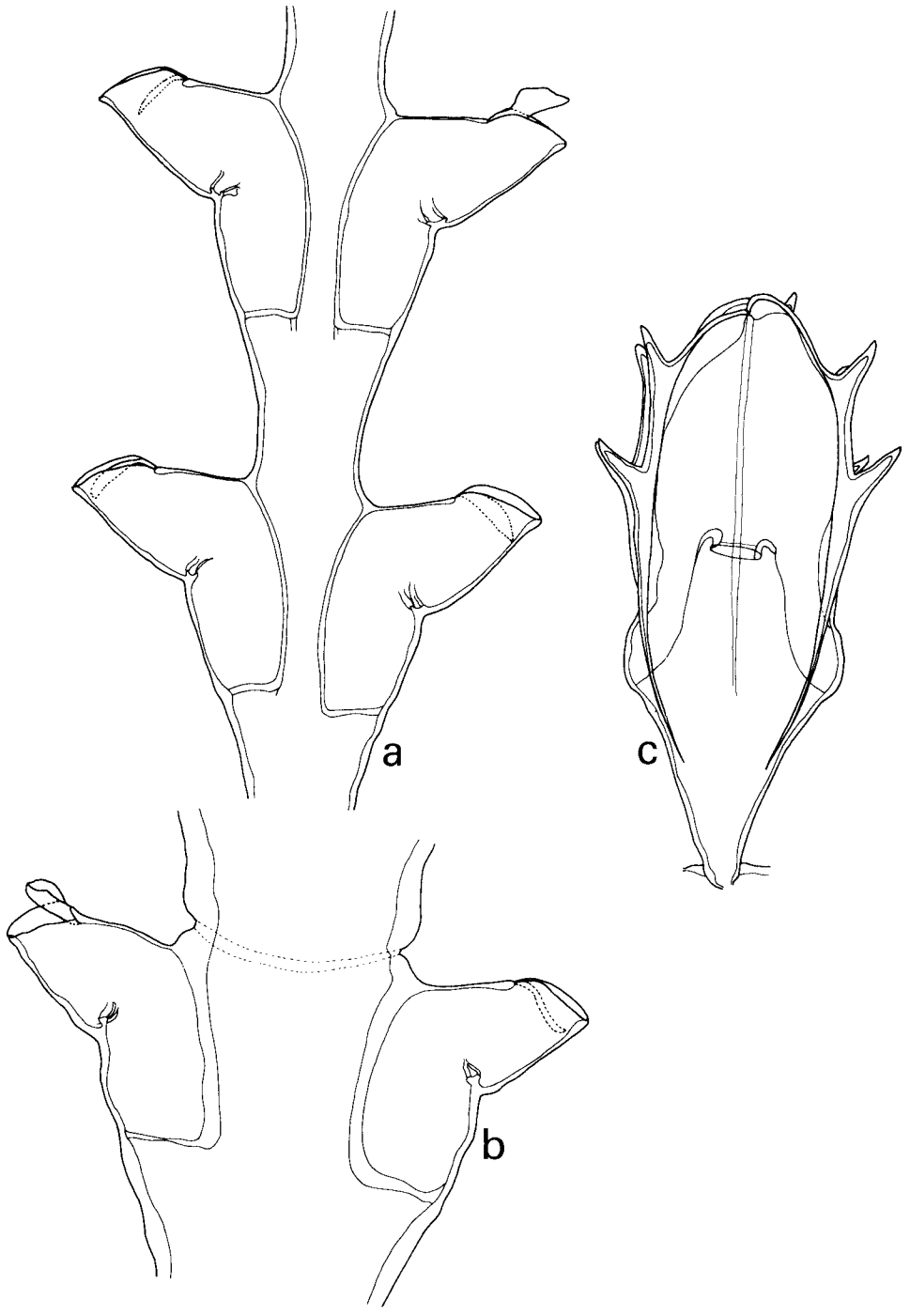


Fig. 52. a-c, *Diphasia margareta* (Hassall, 1841), female colony from Irish Sea, RMNH no. 539. a, two pairs of hydrothecae from hydrocladium; b, pair of hydrothecae from axis; c, female gonotheca. a, b, × 53; c, × 23.

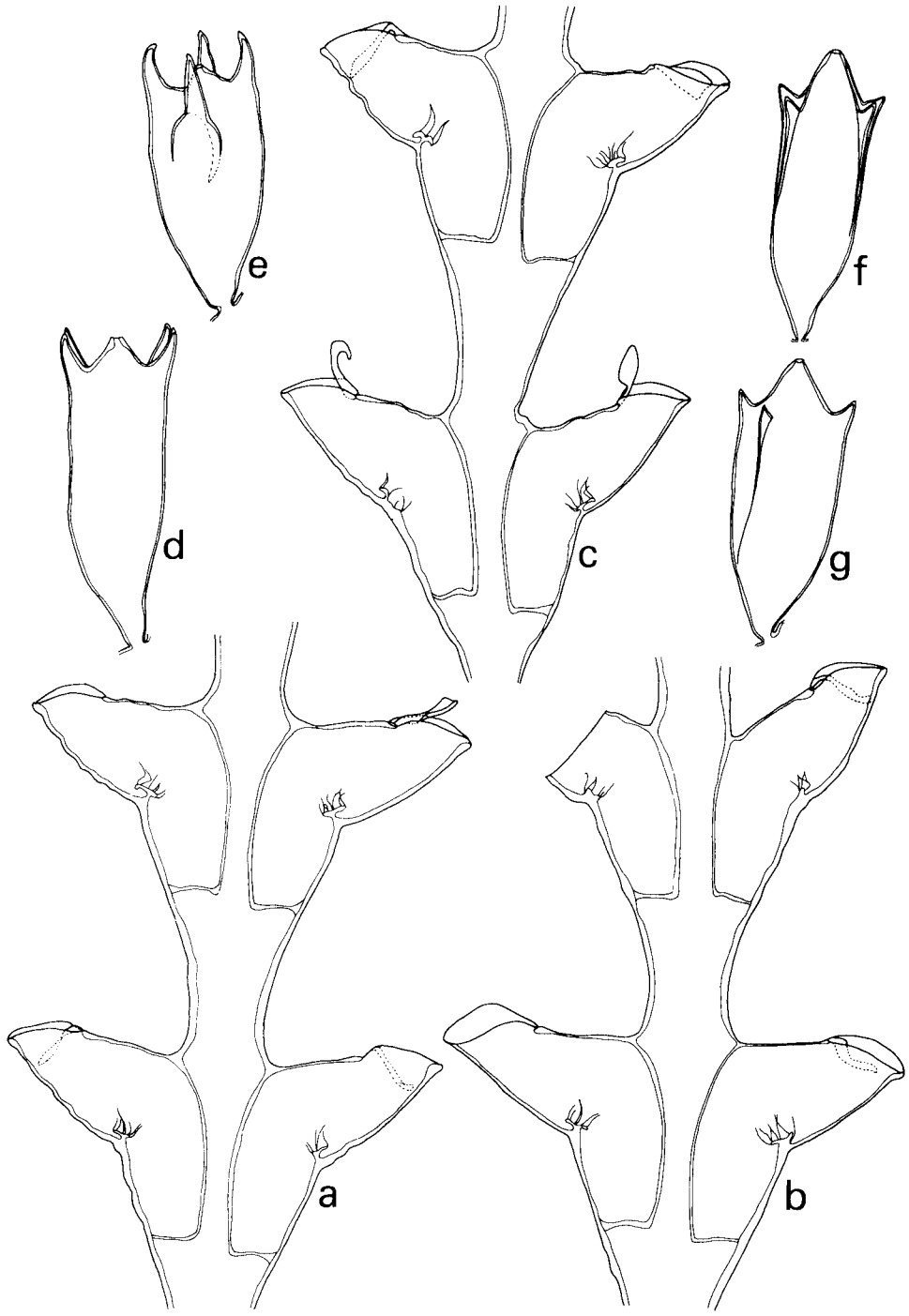


Fig. 53. a-g, *Diphasia margareta* (Hassall, 1841). a-e, male colony from Irish Sea, RMNH no. 539. a-c, two pairs of hydrothecae from various hydrocladia; d, e, male gonothecae. f, g, from RMNH no. 25511, Guinea Bissau, Stn P-102, 11°53'N-17°20'W, male gonothecae. a-c, × 56; d-g, × 22.

exteriorly, forming a pair of lateral and opposite, circular openings in the basal part of the gonotheca. Larvae developed in the marsupium can leave the gonothecae through these holes. Superior portion of female gonotheca exteriorly with one to four broad spines along each of its four ribs; development of these spines subjected to considerable variation.

Male gonotheca gradually widening from narrow base onwards, distinctly quadrangular at cross section some distance under apex, each of four angles lengthened into spiniform process of varied development. Gonothecal aperture terminal, circular, at the end of a conical process of varied length.

Variability.— The material studies shows a great variability, both in shape of trophosome and gonosome; we have arranged that variability in four major groups.

1. This type of variability is found in the specimens from Lorn-Meer (part), Clyde, Irish Sea and Roscoff and is characterized by the presence of an internal perisarcal ledge of the abcauline hydrothecal wall of varied development (fig. 52a, b, 53a-c). Abcauline wall at the level of this ledge distinctly concave, curving upwards fairly suddenly and with distal portion of abcauline wall distinctly convex and with occasional undulations of periderm. Free part of adcauline wall generally straight. Female gonothecae greatly varying in size, being 3390 μm in the Lorn-Meer specimens (fig. 52c) and 4030 μm in those from Roscoff. In the female gonotheca the number and development of the spines is also varied, being one or two, two, and two or three at each rib. Male gonotheca fairly constant in shape, with the four spines well developed, slightly curved and surpassing slightly the gonothecal aperture (fig. 53d, e).

The specimens described by Vervoort (1959) from the coast of Senegal and those described by Gili, Vervoort & Pagès (1989) from Guinea Bissau approach this form. In the Senegal specimens the female gonotheca has but a single little developed spine at each rib; those from Guinea Bissau have male gonothecae with moderately developed spines not reaching the level of the gonothecal aperture, situated at the end of a conical elevation (fig. 53f, g).

2. Type of variation found in majority of BALGIM material and that from Trondheimsfjord, Trondheims Leden, Lorn-Meer (part) and Ile de Batz. Here the axis and hydrocladia, in cross section under the hydrothecae, are polygonal because of the presence of characteristic, longitudinal striae or ribs, continued on the abcauline portion of the hydrotheca (fig. 54a, b, 55a-c). A second pair of longitudinal striae, one on each side, may occur on the adcauline (free) portion of the hydrotheca (fig. 54d, 55a-c). Striation of axes and hydrocladia greatly varied, occasionally only visible on basal part of hydrothecae. In the Ile de Batz specimens, however, the striation or presence of ribs is clearly marked. Form of hydrothecae dependent upon the development of the colony, those of young colonies considerably larger than those of older colonies, while the longitudinal striae may be quite distinct. In young colonies or in the younger parts of colonies the abcauline hydrothecal wall may be of uniform thickness (fig. 55c), though in older colonies or in older parts of colonies a perisarcal thickening may develop that may at times reach dimensions described above under (1) and take the form of a perisarcal ledge at the inside of the abcauline hydrothecal wall.

The female gonotheca, present in the material from Trondheimsfjord, is large, measuring 4400 μm. The spines, three or four of which are present along each rib, are

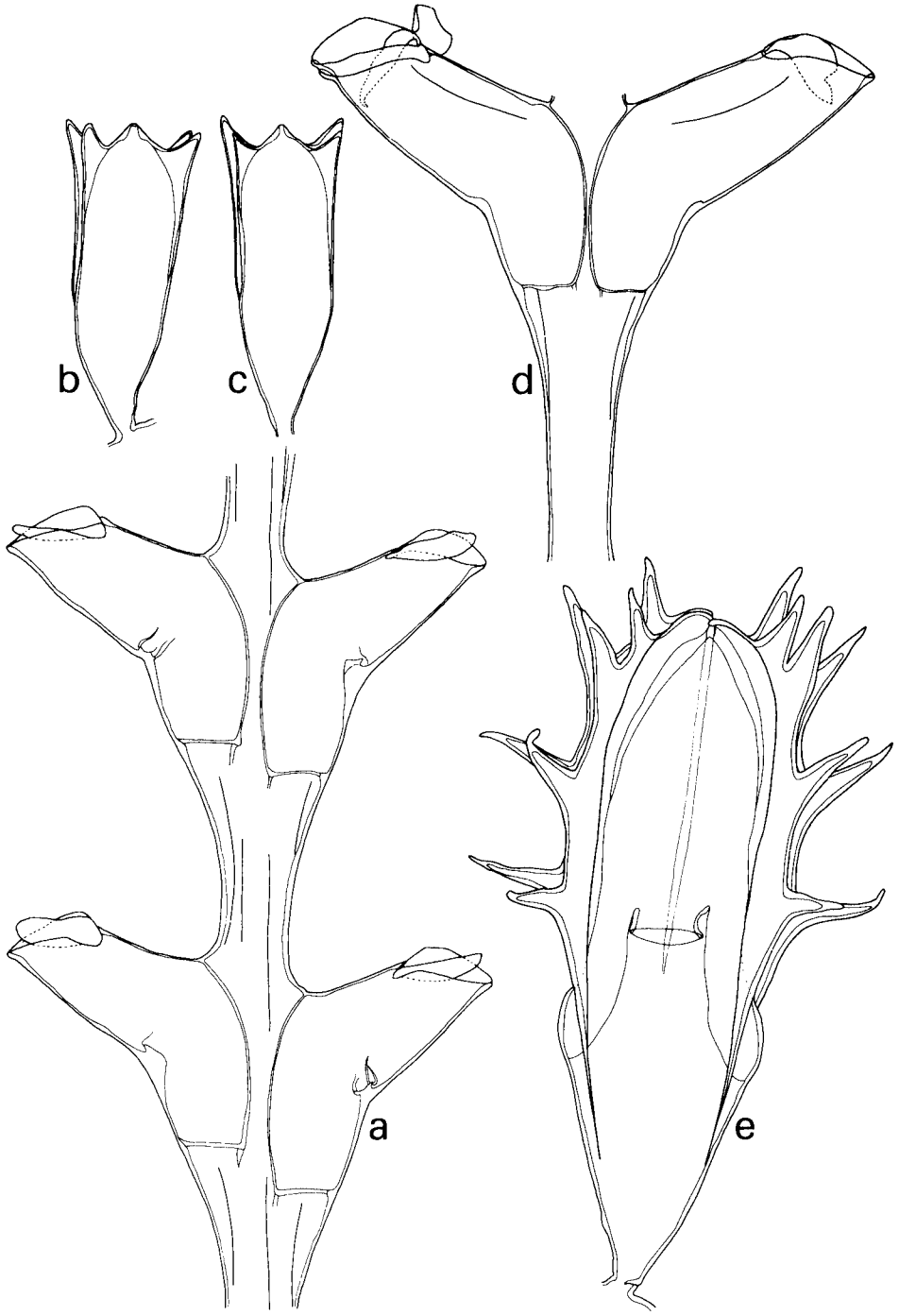


Fig. 54. a-e, *Diphasia margareta* (Hassall, 1841). a-c, from Lorn-Meer, RMNH no. 202. a, two pairs of hydrothecae from hydrocladium; b, c, male gonothecae. d, e, from Trondheimsfjord, RMNH no. 2535. d, pair of hydrothecae from hydrocladium; e, female gonotheca. a, d, × 56; b, c, e, × 22.

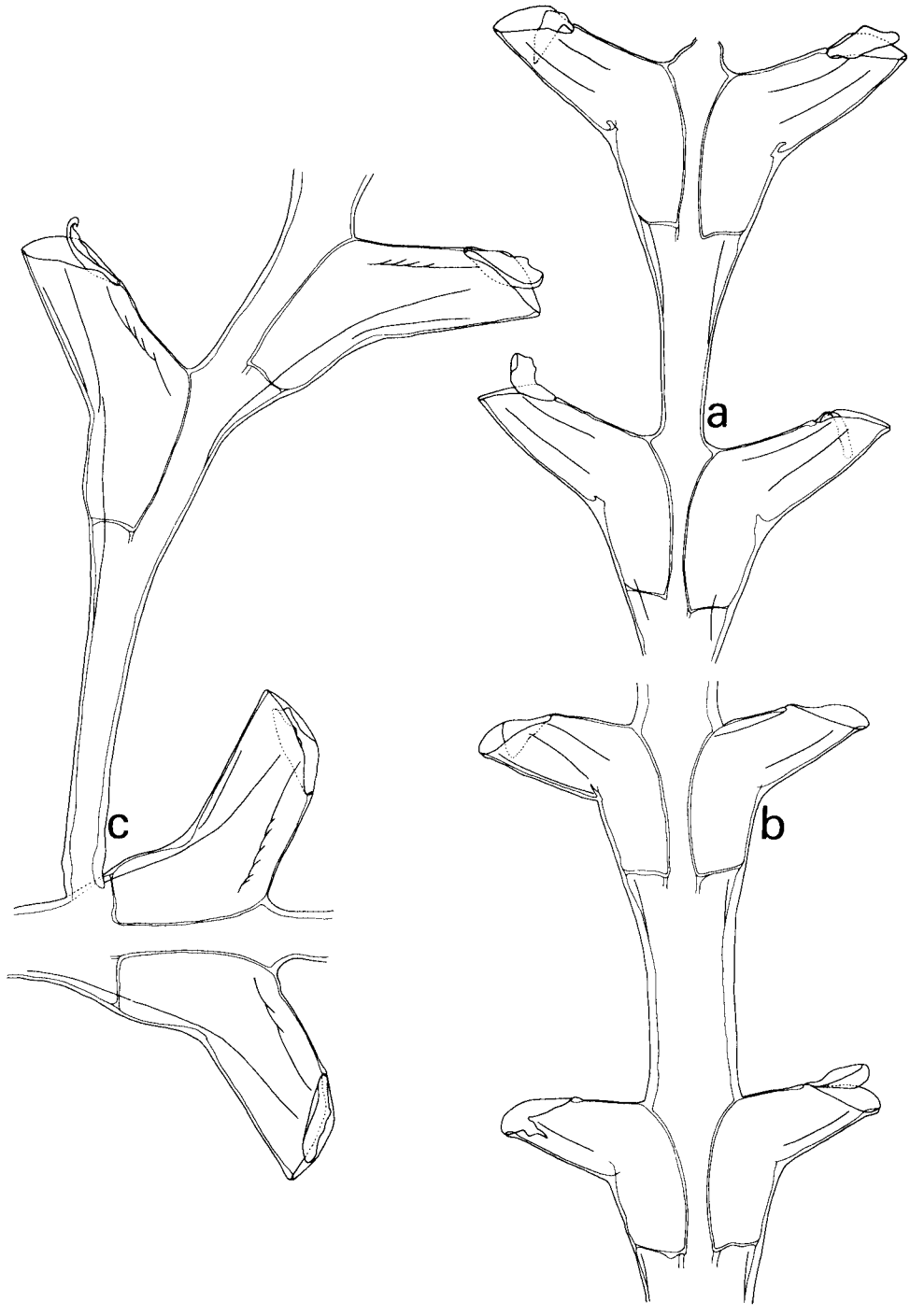


Fig. 55. a-c, *Diphasia margareta* (Hassall, 1841), from CP 26. a, two pairs of hydrothecae from hydrocladium; b, idem, from axis; c, part of axis with insertion of hydrocladium. a-c, × 46.

large (fig. 54e). The male gonotheca, present in the Lorn-Meer material, is similar to that of the previous form but the spines are less developed (fig. 54b, c).

In the material from Guinea Bissau, described by Gili, Vervoort & Pagès (1987) and which has been re-inspected, there are two juvenile colonies, c. 15 mm high, that show the characters of the form just described under 2.

3. The material from CP 109 and from the vicinity of Roscoff is characterized by the presence of a strongly developed, upward curved perisarcal ledge or tooth at the interior surface of the abcauline hydrothecal wall without demonstrating the perisarcal folds that characterize the first form (figs. 56c, 57a). In the present form the concave basal portion of the abcauline hydrothecal wall continues smoothly into the convex distal part; in the form described first the transit is abrupt. The free part of the adcauline hydrothecal wall is concave; the concavity is strengthened by the frequently present renovations of the hydrothecal border. The male gonotheca - the only sex known in this form - is present in the material from the surroundings of Roscoff; is larger than that of forms one, two and four, with considerably developed, slightly inward-curved spines (fig. 56d, e).

4. In this form, present at BALGIM Stns DR 42, DR 49, DR 152 and DR 153, the abcauline hydrothecal border has no ledge, tooth or folds; in older hydrothecae with thick perisarc there may be a slight swelling at the place of flexure of the abcauline wall (fig. 58a, b). The only female gonotheca observed has three well developed spines along each rib (fig. 58c); the spines on the male gonotheca are poorly developed and do not surpass the hydrothecal aperture (fig. 58d).

Distribution.— *Diphasia margareta* is widely distributed in the North-eastern Atlantic, extending from the Norwegian coast to the coats of Guinea Bissau (G.O. Sars, 1874, as *Diphasia elegans*; Gili, Vervoort & Pagès, 1989). In the Mediterranean it has been recorded from the Alboran Sea (Templado et al., 1986), from the Spanish

Table 64. Measurements of *Diphasia margareta* in μm.

Of the four forms measurements are presented below as well as the maximal variability encountered in all the material examined. The measurements of the gonothecae do not include the spines.

| | no. 1 Irish Sea | no. 2 BALGIM Stn CP 26 | no. 3 BALGIM Stn CP 109 | no. 4 BALGIM Stn DR 153 | maximal variability |
|---|---|---|---|---|---|
| Hydrotheca, length adnate part adcauline wall | 460-550 | 420-570 | 440-530 | 470-550 | 400-620 |
| length free part adcauline wall | 200-260 | 240-440 | 170-310 | 240-470 | 170-460 |
| length abcauline wall | 530-660 | 590-910 | 585-700 | 670-870 | 530-1020 |
| diameter at rim | 140-190 | 60-270 | 140-190 | 200-270 | 140-290 |
| Female gonotheca, maximal length | 3550-3730 | 4280-4400* | | 3300 | 3300-4400 |
| maximal diameter | 1250-1400 | 1400-1420* | | 1200 | 1050-1420 |
| Male gonotheca, maximal length | 1550-2070 | 1770-2110* | 2100-2110** | 1800 | 1550-2150 |
| maximal diameter | 620-730 | 620-700* | 870-960** | 690 | 660-960 |

* = measurements of female gonotheca taken from Trondheimsfjord, that of male gonotheca from Lorn-Meer material.

** = measurements of male gonotheca taken from material from surrounding of Roscoff.

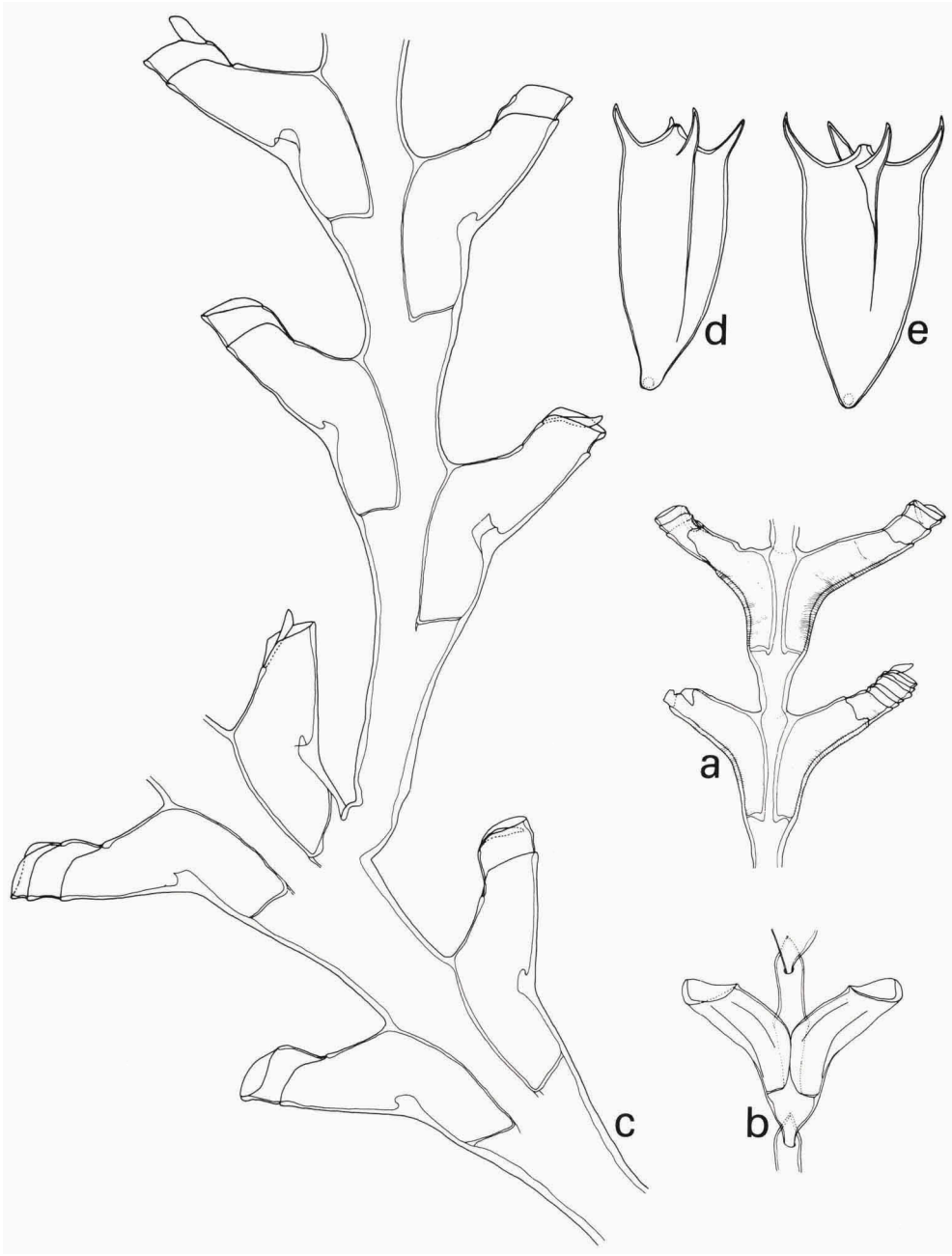


Fig. 56. a, *Diphasia delagei* Billard, 1912, from CP 62, two pairs of hydrothecae from hydrocladium. b, *Diphasia rosacea* (Linnaeus, 1758), from DR 49, two pairs of hydrothecae from hydrocladium. c-e, *Diphasia margareta* (Hassall, 1841), male colony from surrounding of Roscoff, RMNH no. 1338. c, part of axis with insertion of hydrocladium; d, e, male gonothecae. a-c, × 42; d, e, × 17.

coast near Murcia (García-Corrales, Aguirre & González, 1980) and from the Adriatic (Carus, 1884, as *Diphasia pinaster*).

The BALGIM material originates all from the Ibero-Moroccan Bay with the exception of two localities from the Strait of Gibraltar (DR 152, DR 153). The depth records oscillate between 135 and 1318 m.

Discussion.— *Diphasia margareta* demonstrates an extremely large spectrum of variability. Though we have outlined four principal groups in this large variability we have been utterly unable to draw distinct lines to separate four subspecies or species and have refrained from doing so because all have the same type of male gonotheca and with the exception of group no. 3, of which we have not been able to inspect the female type, also the same type of female gonotheca with a highly characteristic internal structure, constant in the free forms. We have therefore concluded that the variability described above occurs within one species: *Diphasia margareta* (Hassall, 1841).

## Diphasia pinastrum (Cuvier, 1830)
(fig. 57b-e)

*Sertularia pinastrum* Cuvier, 1830: 301.
*Diphasia pinastrum* - Cornelius, 1979: 267-269, fig. 13.
*Sertularia Pinaster* Ellis & Solander, 1786: 55-56, pl. 6 fig. b. (Not *Sertularia pinaster* Lepechin, 1783).
Not *Diphasia pinaster* - Hincks, 1868: 252-253, pl. 50 fig. 1 [= *Diphasia margareta* (Hassall, 1841)].
*Sertularia alata* Hincks, 1855: 127-128, pl. 12
*Diphasia alata* Hincks, 1868: 258, pl. 48 fig. 2.

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: numerous colonies 5-20 mm high, some with gonothecae, epizootic on *Polyplumaria flabellata*. Single fragment 10 mm high without gonothecae.— Stn DR 42, 35°54.5'N-06°13.3'W, 02.vi.1984, 135 m: four colonies 5-25 mm high, without gonothecae, epizootic on *Polyplumaria flabellata*.— Stn DR 45, 35°44.1'N-06°17.4'W, 02.vi.1984, 293 m: single colony 10 mm high, without gonothecae, epizootic on *Polyplumaria flabellata*.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: numerous, partly damaged colonies 5-100 mm high, the majority epizootic on *Polyplumaria flabellata*; gonothecae present.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: ten colonies and five fragment 5-35 mm high epizootic on *Polyplumaria flabellata*, with gonothecae.— Stn DR 51, 35°41.2'N-06°29.5'W, 03.vi.1984, 362 m: single fragment 17 mm high; no gonothecae.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: five large and numerous young colonies 10-150 mm high epizootic on *Polyplumaria flabellata*, also many fragments; gonothecae present.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: young colony composed of several shoots 5 mm high epizootic on *Polyplumaria flabellata*; no gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: colony composed of several shoots up to 10 mm high epizootic on *Polyplumaria flabellata*; no gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: ten colonies 5-25 mm high epizootic on *Polyplumaria flabellata*; no gonothecae.

Description.— Colony composed of erect monosiphonic axis with many pinnately arranged branches (hydrocladia), all in same plane as axis. Hydrothecae biseriate and placed in opposite pairs, tubular, suddenly curved outwards to form an angle of c. 90 degrees with axis or hydrocladium, with adcauline wall adnate for c. two-thirds of its length and with free part slightly concave. Abcauline wall of hydrotheca at place of flexure at about half its length and there with strong perisarcal peg or ledge visible in lateral aspect as strong tooth; abcauline portion below internal thickening

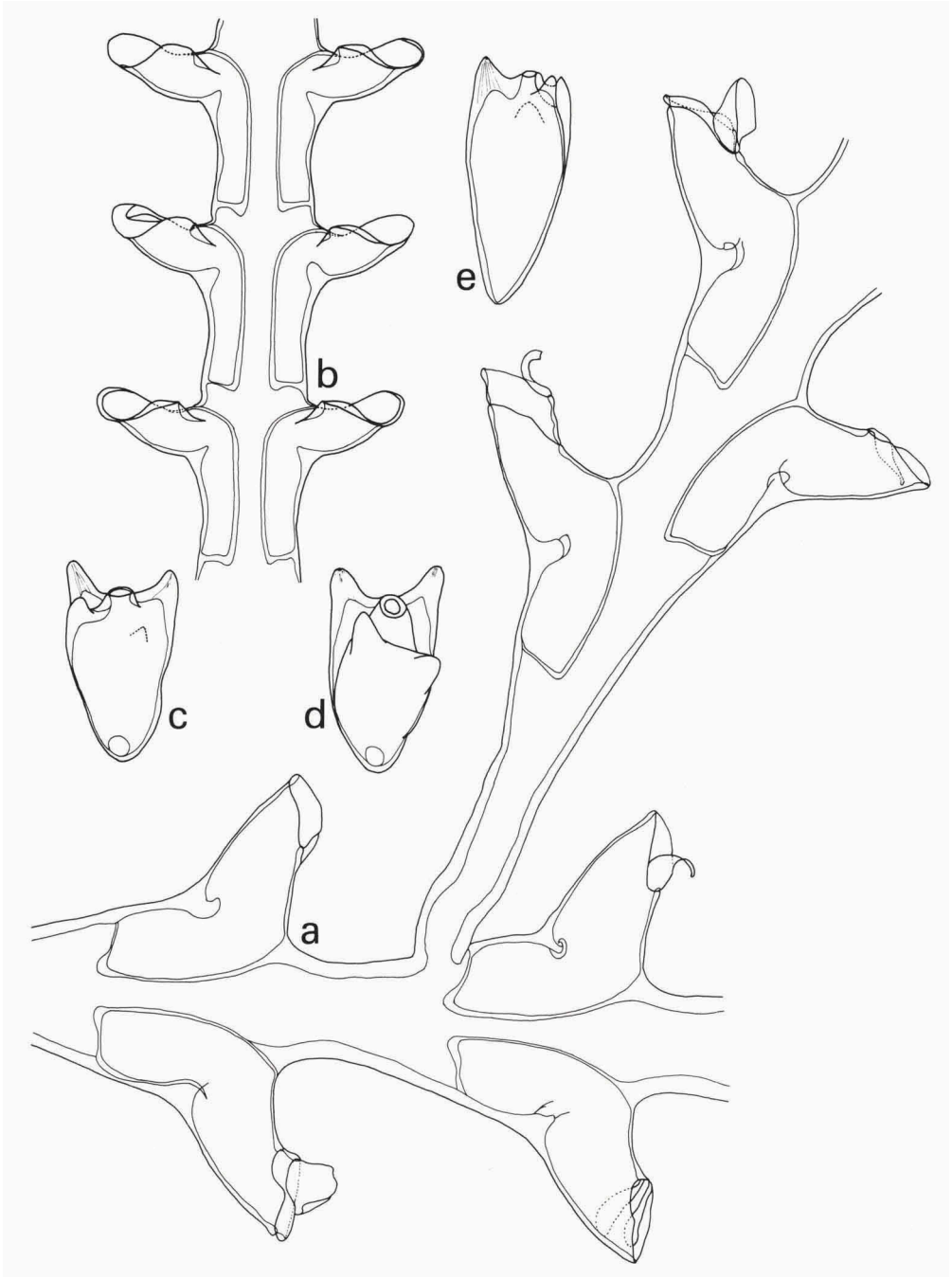


Fig. 57. a, *Diphasia margareta* (Hassall, 1841), from CP 109, part of axis with insertion of hydrocladium. b-e, *Diphasia pinastrum* (Cuvier, 1830), from DR 49. b, part of hydrocladium; c, d, female gonothecae; e, male gonotheca. a-e, × 54.

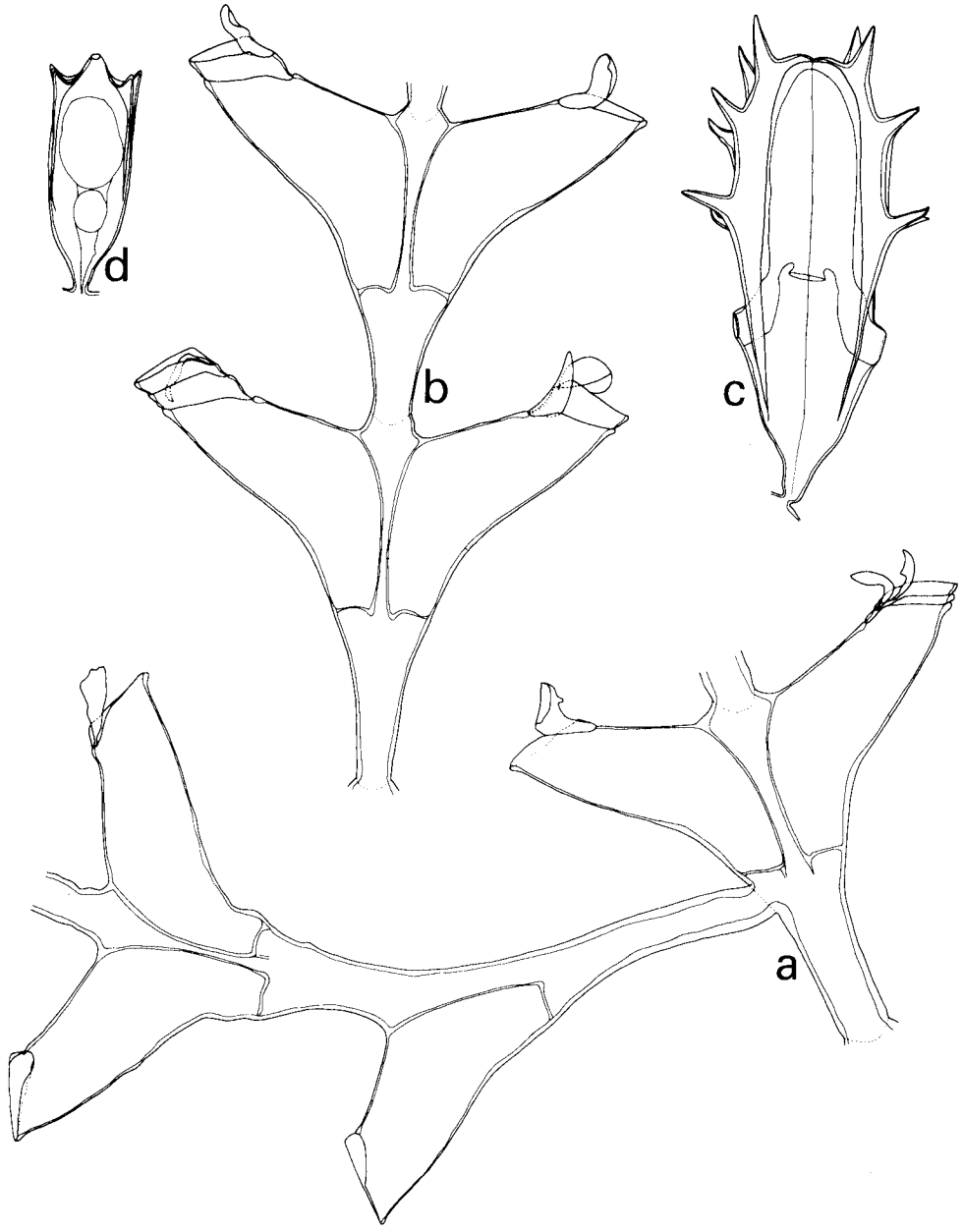


Fig. 58. *a-d, Diphasia margareta* (Hassall, 1841), from DR 153. a, part of axis with (base of) hydrocladium from female colony; b, two pairs of hydrothecae from hydrocladium of male colony; c, female gonotheca; d, male gonotheca. a, b, × 45; c, d, × 18.

straight or slightly concave; outward-curved distal portion distinctly convex (fig. 57b). Hydrothecal rim smooth, with large adcauline sinus; aperture wide, closed by means of single flap attached in adcauline sinus.

Hydrocladia inserting on axis directly under a hydrotheca, with same structure as axis, though the first pair of hydrothecae on a hydrocladium may be subopposite. In some cases secondary ramifications have been observed, originating in same fashion as the primaries and with same structure.

Gonothecae inserting on basis of hydrothecae of (primary) hydrocladia, quadrangular in cross section and shaped as an inverted pyramid, narrowing towards the base. Apical portion of gonotheca with four blunt cusps, one on each angle of pyramid, surrounding the slightly elevated, circular aperture (fig. 57c-e). Interior of each cusp with fine canal communicating with small opening at top of cusp. Male and female gonothecae identical exteriorly, but male gonothecae filled with single mass of developing spermatocytes and female gonothecae with several developing eggs or planulae.

Table 65. Measurements of *Diphasia pinastrum* in µm.

| | BALGIM Stn DR 49 |
|---|---|
| Hydrotheca, length adnate part adcauline wall | 270-360 |
| length free part adcauline wall | 70-100 |
| diameter at rim | 150-210 |
| Female gonotheca, total length | 450-600 |
| maximal diameter | 270-300 |
| Male gonotheca, total length | 520-600 |
| maximal diameter | 220-300 |

Distribution.— *Diphasia pinastrum* has a wide distribution in the northern and temperate eastern Atlantic, extending from just north of Bergen, Norway (Broch, 1918) to the Atlantic coast of Morocco (Patriti, 1970). The BALGIM material originates from six localities situated between the Gulf of Cádiz and the vicinity of Cape Spartel (DR 40, DR 42, DR 45, DR 49, DW 50, DR 51), from the Strait of Gibraltar proper (DR 151, DR 152, DR 153) and from one locality in the Alboran Sea, close to the coast of Morocco (CP 135). This last record is the first from the Mediterranean. The depth records oscillate between 115 and 580 m.

Discussion.— This is a well known species which does not need a lengthy discussion. We want to draw attention to *Thuiaria thermacopola* Allman, 1888, included by Rees & White (1966) in the synonymy of *Diphasia alata* Hincks, 1855 (= *D. pinastrum*); this record evidently refers to *Thuiaria pharmacopola* Allman, 1888, placed in the synonymy of *Diphasia alata* by Billard (1910) after revision of the type.

## **Diphasia rosacea** (Linnaeus, 1758)
(fig. 56b)

*Sertularia rosacea* Linnaeus, 1758: 807.

*Diphasia rosacea* - Hincks, 1868: 245-247, pl. 48 fig. 1; Vervoort, 1946b: 230-232, figs. 98-99; Cornelius, 1979: 269-270, fig. 8.

Not *Diphasia rosacea* - Vervoort, 1959: 257-258, fig. 25.

Material.— BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: two juvenile colonies 2-3 mm high epizootic on *Diphasia pinastrum*; no gonothecae.

Description.— Colonies composed of erect, monosiphonic, unbranched stems, divided into internodes by (strongly oblique) septa; each internode with one pair of hydrothecae. One of colonies has opposite pairs of hydrothecae, in the other these are subopposite or even alternate.

Hydrothecae tubular, smoothly curved outwards, about half the length of adcauline wall adnate. Free portion of hydrotheca almost straight; abcauline wall concave. Exterior of hydrotheca with longitudinal carinae: two laterals (on each side) and one abcauline. One of lateral carinae at same level as beginning of scooped portion of hydrothecal rim, the remaining between that and the abcauline carina. Hydrothecal rim smooth, scooped out at adcauline side; hydrotheca closed by single valve attached to scooped portion of hydrothecal rim (fig. 56b).

Table 66. Measurements of *Diphasia rosacea* in µm.

| | BALGIM Stn DR 49 |
|---|---|
| Hydrotheca, length adnate part adcauline wall | 200-240 |
| length free part adcauline wall | 190-230 |
| length abcauline wall | 350-400 |
| diameter at rim | 150-160 |

Distribution.— *Diphasia rosacea* is well distributed along both sides of the North Atlantic. In the eastern Atlantic its distribution ranges from the Kara and Barents Seas (Naumov, 1960) to the Portuguese coasts (Da Cunha, 1944, 1950). Naumov (1960) also includes records from the coasts of South Africa and from Tristan da Cunha in the southern Atlantic.

The material from Guinea (Conakry) described by Vervoort (1959) must probably be excluded from the synonymy of this species: the material, on further examination, proved to be fairly heavily carinated and may well represent another species of *Diphasia*. The colonies recorded by Busk (1851) from South Africa as *Diphasia rosacea* were referred by Millard (1961) to *Diphasia attenuata* and considered doubtful (see above).

The Balgim material comes from a locality on the Atlantic side of the Strait of Gibraltar, depth 521 m.

Discussion.— The (sterile) BALGIM material has been compared with colonies from the North Sea (Deep Water Channel, 'Wodan', Wr. 86, 45 m depth, 19.vii.1907; RMNH Coel. no. 9707) bearing abundant gonothecae. Characters to distinguishing this species from *Diphasia attenuata* are the presence of longitudinal carinae on the exterior of the hydrothecae, the division of the axis and branches into internodes by means of strongly oblique nodes with each of the internodes bearing a single pair of hydrothecae.

## Diphasia spec.
(fig. 59)

Material.— BALGIM Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: single colony 35 mm high; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: single hydrocladium 15 mm long; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: two fragments 25 and 35 mm high and some detached hydrocladia; no gonothecae.— Stn DR 115, 35°47.5'N-06°04.2'W, 11.vi.1984, 332 m: three fragments 10-30 mm high; no gonothecae.

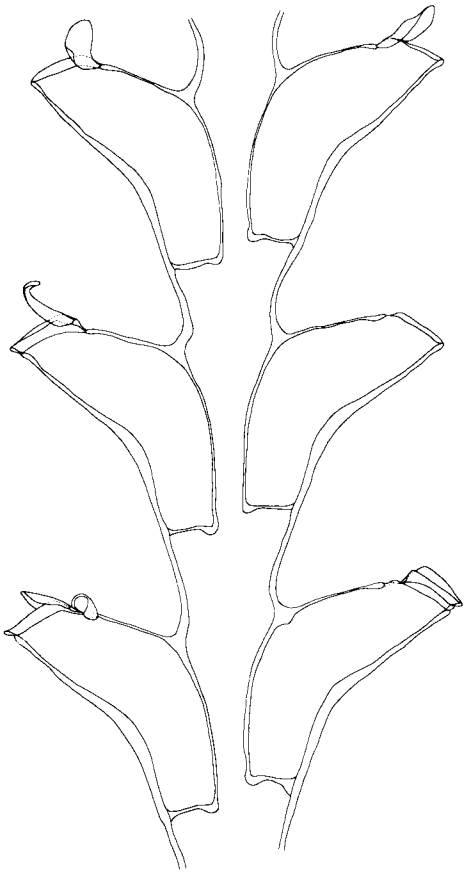

Fig. 59. *Diphasia* spec., from DW 114, part of hydrocladium. × 35.

Description.— Colonies composed of erect, monosiphonic axis with laterally arranged, pinnate branches (hydrocladia), all in same plane. Normally there are alternately one or two pairs of hydrothecae between two consecutive ramifications; between two branches (hydrocladia) on the same side there are normally three pairs. Irregularities occur frequently.

Hydrothecae of axis biserially arranged in one plane, forming opposite or sub-opposite pairs, tubiform, curving outwards from about middle of height. Adcauline hydrothecal wall adnate for c. two-thirds of hydrothecal depth; free portion almost straight. Abcauline wall of hydrotheca concave, in some hydrothecae distal portion of abcauline wall curved upwards and slightly convex. Whole of abcauline wall with thickened perisarc, reaching greatest thickness at about middle of abcauline wall, without forming internal cusp or fold as happens in many colonies of *Diphasia margareta*. Hydrothecal rim smooth, with adcauline sinus, into which the single flap of the operculum is attached. Hydrothecal border usually with many renovations, at times considerably lengthening the free portion of the hydrotheca (fig. 59).

Branches (hydrocladia) inserting just under axial hydrothecae; diameter of hydrocladium much inferior to that of axis. Structure of hydrocladia and arrangement of hydrothecae as in axis; occasionally secondary hydrocladia have been observed.

Distribution.— The BALGIM colonies originate from four localities west of Cape Spartel (DW 50, DR 113, DR 114, DR 115) at depths varying between 144 and 523 m.

Table 67. Measurements of *Diphasia* spec. in µm.

| | BALGIM Stn DW 114 |
|---|---|
| Hydrotheca, length adnate part adcauline wall | 640-780 |
| length free part adcauline wall | 250-450 |
| length abcauline wall | 810-930 |
| diameter at rim | 210-270 |

Discussion.— The BALGIM material described above comes close to *Diphasia margareta* (Hassall, 1841), particularly the material from BALGIM Stns DR 42, DR 49, DR

152 and DR 153, which we have here assigned to group 4. However, the measurements of the hydrothecae in the present material are much superior to those of 'group 4' of *D. margareta* and no intermediate forms have been encountered. As we also failed to find gonothecae we thought it advisable to refer this larger material to *Diphasia* spec. without it this moment establishing its exact systematic position.

## Genus **Hydrallmania** Hincks, 1868

### **Hydrallmania falcata** (Linnaeus, 1758)
(fig. 60c, d)

*Sertularia falcata* Linnaeus, 1758: 810.
*Hydrallmania falcata* - Hincks, 1868: 273-275, pl. 58; Broch, 1918: 135-138, figs. 73-74; Stechow, 1925b: 488-489, fig. 40; Vervoort, 1946b: 255-258, figs. 111-113; Cornelius, 1979: 273-276, figs. 15-16.

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: single colony and two fragments 10-50 mm high, no gonothecae observed.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: fourteen juvenile colonies 8-20 mm high, no gonothecae.— Stn DW 116, 35°48.6'N-06°04.2'W, 11.vi.1984, 340 m: single fragment 5 mm high without gonothecae.

Description (of the DR 40 material).— Axis monosiphonic, divided into segments of varied length by means of oblique nodes. Each segment basally with apophysis supporting a hydrocladium and with axillary hydrotheca. In basal portion of colony hydrocladia pinnately arranged, pointing alternately left and right (fig. 60c), but in distal part the arrangement becomes gradually helicoidal, as is characteristic for the species. Each hydrocladium attached to apophysis be means of short intermediate, athecate internode, divided into internodes by means of oblique septa; each internode with basal apophysis supporting a secondary hydrocladium and with three hydrothecae, one of which is axillary. Apophyses, and consequently the secondary hydrocladia they support, alternately directed left and right; secondary hydrocladia thus becoming pinnately and alternately arranged along both sides of the primary hydrocladium. Hydrothecae on primary and secondary hydrocladia arranged in a single row, but alternately curved towards left and right sides of hydrocladium. Hydrotheca more or less tubular, swollen basally, adcauline wall convex, abcauline wall concave. Hydrothecal rim with two blunt lateral cusps bordering a large adcauline and a smaller abcauline sinus. Hydrothecal opercular apparatus composed of large adcauline flap, attached in adcauline sinus, and smaller abcauline flap attached in abcauline sinus. Number of hydrothecae on internodes of secondary hydrocladium varied; tertiary hydrocladia absent in BALGIM specimens.

Variability.— The material from DR 49 is juvenile and shows the following differences with that described above:

1. Axis divided into segments by means of oblique nodes as also happens in the internodes of adult colonies. Each of the segments has a basal apophysis and a varied number of hydrothecae (1-4), one of which is axillary.

2. Hydrocladia alternately and pinnately arranged, pointing left and right; there are no secondary hydrocladia.

3. Hydrothecae biseriate, though in some of the colonies there is a tendency

Table 68. Measurements of *Hydrallmania falcata* in µm.

| | BALGIM Stn DR 40 | BALGIM Stn DR 49 |
|---|---|---|
| Hydrotheca, maximal length | 330-400 | 300-370 |
| maximal diameter | 150-190 | 130-170 |
| diameter at rim | 100-140 | 80-95 |

towards arrangement in a single row. Moreover, the hydrothecae are more strongly narrowed apically and the ad- and abcauline walls are less curved (fig. 60d).

Distribution.— *Hydrallmania falcata* is mainly a North Atlantic species occurring along both the American and European Atlantic coasts. In the eastern part of the North Atlantic its distribution extends from the Kara Sea (Naumov, 1960) to the Bay of Biscay (Vervoort, 1985). Busk (1851, as *Plumularia falcata*) records the species from Algoa Bay, South Africa. Busk's material was revised by Millard (1961) and really belongs to *Hydrallmania falcata*; however, the actual occurrence of this species in South African waters must be strongly doubted as its occurrence there has never been reconfirmed since Busk's record (Millard, 1961, 1975).

The BALGIM specimens originate from three localities west of the Strait of Gibraltar (DR 40, DR 49, DW 116) and were collected at depths between 340 and 521 m.

Discussion.— Several authors (Stechow, 1925b; Naumov, 1960; Cornelius, 1979) describe the hydrotheca as being 'even-rimmed' (Cornelius, 1979: 274) and the operculum to be composed of a single flap. However, in the BALGIM material the hydrothecal border is as described above, with two lateral cusps separated by ab- and adcauline sinuses, and an operculum composed of two flaps: a large adcauline and a smaller abcauline flap. This agrees with descriptions published by Vervoort (1946b) and Leloup (1952) and also with characters included in the diagnosis of the genus *Hydrallmania* by Millard (1975) and Bouillon (1985).

Juvenile material, as occurs at DR 49, has previously been described by Broch (1918) and by Stechow (1925b); the BALGIM material agrees with these descriptions.

## Genus **Sertularella** Gray, 1848

### **Sertularella cylindritheca** (Allman, 1888)
(fig. 60a)

*Sertularia cylindritheca* Allman, 1888: 59-60, pl. 29 figs. 1, 1a.
*Sertularella cylindritheca* - Nutting, 1904: 87, pl. 19 fig. 4; Vervoort, 1959: 266-269, figs. 30-31; Vervoort, 1972: 126, fig. 39a.
*Sertularelloides mercatoris* Leloup, 1937a: 101-103, fig. 6.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: nine fragments 10-40 mm high, much damaged and without gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: two fragmentary colonies 10 mm high on worm-tube with other hydroids; no gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: small fragment 10 mm high; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: two fragments 17 and 65 mm high, much damaged and without gonothecae.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: two damaged fragments 20 and 85 mm high; no gonothecae.

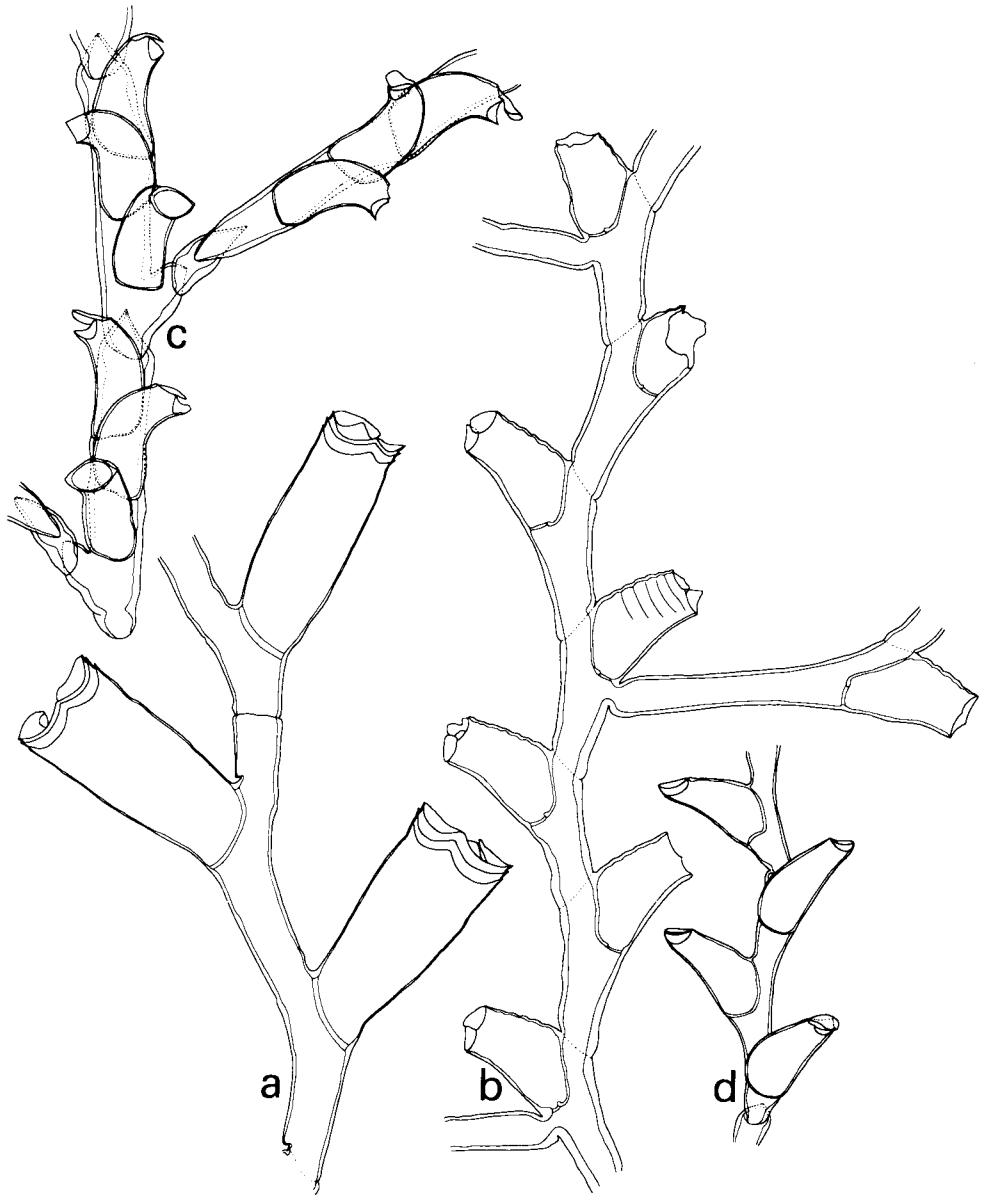


Fig. 60. a, *Sertularella cylindritheca* (Allman, 1888), from DR 113, fragment of axis. b, *Sertularella gayi robusta* Allman, 1873, from CP 90, monosiphonic part of colony showing insertion of three hydrocladia. c, d, *Hydrallmania falcata* (Linnaeus, 1758). c, from DR 40, part of axis of older colony with insertion of two hydrocladia; d, from DR 49, part of hydrocladium of young colony. a, b, × 16; c, d, × 42.

Description.— Axis erect, monosiphonic, with laterally disposed hydrocladia, alternately directed left and right and in same plane as axis; three hydrothecate segments between two successive hydrocladia. Axis divided into segments by means of indistinct, oblique nodes, occasionally only indicated by slight perisarcal constrictions. Each segment with hydrotheca inserting on distal portion of segment and

alternately directed left or right in same plane as axis.

Hydrothecae of characteristic shape, more or less cylindrical, with basal portion circular on cross section, but with apical portion quadrangular on cross section; adnate portion of adcauline wall much reduced. Hydrothecal rim with four low cusps separated by shallow, rounded embayments; hydrothecal operculum composed of four triangular flaps. Renovations of hydrothecal margin frequent (fig. 60a).

Hydrocladia always inserting directly under axial hydrothecae; structure identical with that of axis. Secondary hydrocladia have not been observed.

Table 69. Measurements of *Sertularella cylindritheca* in µm.

| | BALGIM Stn DR 113 |
|---|---|
| Stem segments, length | 1750-1850 |
| diameter at node | 350-470 |
| Hydrotheca, length adcauline wall | 1590-1790 |
| length abcauline wall | 1670-2000 |
| diameter at base | 510-650 |
| diameter at rim | 680-1150 |

Distribution.— *Sertularella cylindritheca* has a wide distribution in the tropical Atlantic, the western as well as the eastern side. From the African Atlantic coast the species is known from the Moroccan littoral zone (Patriti, 1970) to the estuary of the Niger (Vervoort, 1959). It has also been recorded from the Alboran Sea, Mediterranean (Templado et al., 1986), from the Bay of Biscay, off the coast of Bermeo, Vizcaya, Spain (Aguirrezabalaga et al., 1986) and from off the Norfolk (U.K.) coast (Cornelius, 1979). This North Sea record is considered doubtful by Cornelius (1979) though the material undoubtedly belongs to the species. The later record from the Bay of Biscay seems to confirm the presence of this species farther to the north. Finally Vervoort (1972) records the species from the Falkland Islands and the Tierra del Fuego region; the presence of the species in colder waters is here explained by the probable transportation of the specimens over a greater distance.

The BALGIM material comes from two localities on the Atlantic side of the Strait of Gibraltar, west of Cape Spartel (DR 113, DW 114), and from three localities in the Alboran Sea, off the coast of Morocco (DR 130, DW 132, CP 150). The depth records vary between 144 and 290 m.

Discussion.— The BALGIM specimens are in complete agreement with existing descriptions and need no further comment. In one case we observed the development of the terminal part of the axis into a stolon.

### **Sertularella gayi gayi** (Lamouroux, 1821)
(fig. 61a-e)

*Sertularia Gayi* Lamouroux, 1821: 12, pl. 66 figs. 8, 9.
*Sertularella Gayi* - Hincks, 1868: 237-239, fig. 29, pl. 46 fig. 2.
*Sertularella gayi* - Vervoort, 1959: 273-275, figs. 33b, c, 34b; Vervoort, 1966: 127-128, fig. 30; Cornelius, 1979: 284-287, fig. 21.

Material.— BALGIM Stn CP 36, 36°16.6'N-07°13.7'W, 01.vi.1984, 990 m: four colonies 10-30 mm high, without gonothecae, on tube of polychaete. In addition colony 40 mm high, without gonothecae.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: c. 20 colonies and many fragments 10-35 mm high, with gonothecae. Some colonies attached to coral fragments.— Stn DR 49, 35°53'N-06°32.8'W,

03.vi.1984, 521 m: c. 80 colonies and fragments, 5-70 mm high, with gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: five colonies and nine fragments 12-50 mm high, with gonothecae.— Stn DR 72, 35°52'N-08°11.6'W, 06.vi.1984, 173 m: single colony and a fragment 15-20 mm high, without gonothecae.— Stn DW 74, 33°52.1'N-08°12.8'W, 06.vi.1984, 181 m: ten small colonies and four fragments up to 30 mm high, without gonothecae.— Stn CP 84, 33°45.4'N-08°31.9'W, 06.vi.1984, 345 m: single colony 40 mm high without gonothecae.— Stn CP 103, 34°10.7'N-07°29.8'W, 09.vi.1984, 347 m: seven colonies and four fragments 10-35 mm high without gonothecae.— Stn CP 109, 36°14.5'N-07°56.4'W, 10.vi.1984, 1200 m: small colony 12 mm high; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: c. 40 fragments of larger colonies 7-60 mm high, without gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: seventeen colonies and several fragments 5-65 mm high, without gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: four fragments 10-25 mm high, no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: two colonies and five fragments 8-35 mm high, without gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: ten colonies and a fragment 15-55 mm high without gonothecae.— CP 145, 35°56.6'N-03°07.9'W, 16.vi.1984, 373 m: two colonies 60 and 70 mm high without gonothecae, growing on tube of polychaete. In addition single colony 45 mm high without gonothecae. Some colonies basally with *Opercularella panicula*.

Description.— Colony erect, with usually fairly thick, polysiphonic axis, branched in regular, pinnate fashion. In less strongly polysiphonic parts of axis secondary tubules are seen to originate, as do also the hydrocladia, from the base of hydrothecae, they are directed towards the base of the colony, adhering to the main axis. Occasionally a secondary tubule and a ramification (hydrocladium) leave the main axis at the same point, the secondary tubule communicating with both main axis and ramification ( fig. 61d).

Main axis with more or less thickened perisarc (fig. 61e), this depending upon age of colony, indistinctly divided into segments by means of little marked, oblique internodes that may only be indicated by slight perisarcal constrictions. Each segment distally with a hydrotheca, alternately directed left and right and placed in same plane. Adcauline wall of hydrotheca adnate for about half its length; free portion generally straight, though to a variable degree undulated, the undulations continuing on lateral surfaces of hydrotheca for some distance and occasionally reaching the abcauline hydrothecal wall; this wall straight in basal half and slightly concave in distal portion, usually best marked directly under hydrothecal rim. Hydrothecal aperture perpendicular to hydrothecal length axis, rim with four well marked cusps, one adcauline, one abcauline and two laterals, separated by rounded embayments. Hydrothecal operculum composed of four triangular flaps attached in embayments of rim and when closed forming a low roof. No intrathecal cusps present, though abcauline hydrothecal wall may be thickened directly under hydrothecal rim without however forming an internal cusp. Renovations of hydrothecal rim are frequent.

Branches of axis (hydrocladia) alternately directed left and right and in same plane, arranged in pairs; between two members of a pair, one left, one right, there is only a single hydrotheca; between two consecutive branches of different pairs there are three or more hydrothecae (fig. 61d). Structure of branches (hydrocladia) identical with that of axis. Hydrocladia of second order may occasionally be present, though sporadic in the material examined, in shape agreeing with primary hydrocladia and axis. Both axis and hydrocladia fairly frequently develop into stolonal tubes and thus serve vegetative reproduction of the colony; sporadically those stolonal tubes were seen to originate from inside a hydrothecae.

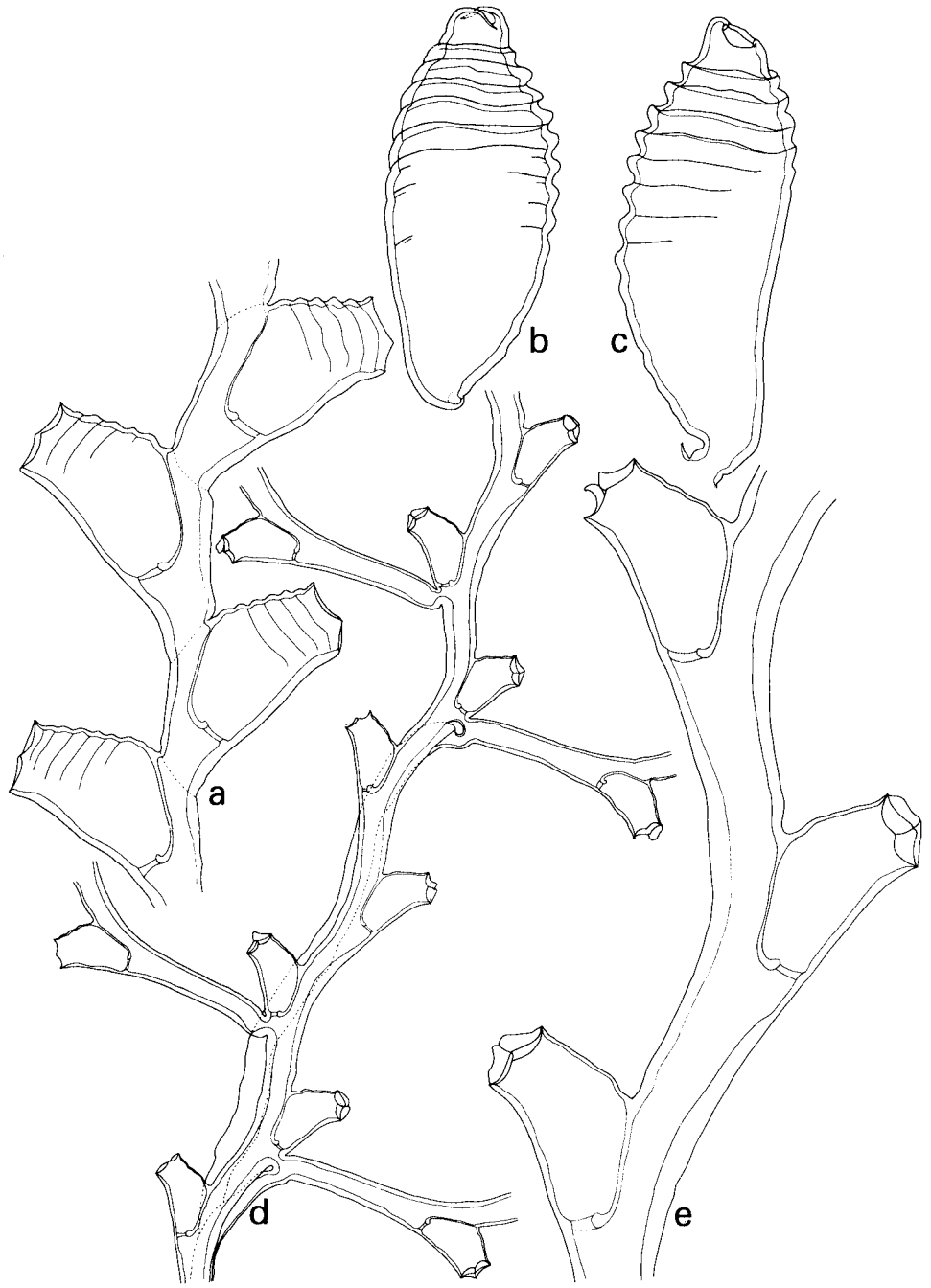


Fig. 61. a-e, *Sertularella gayi gayi* (Lamouroux, 1821). a-c, from DR 40. a, part of hydrocladium; b, c, gonothecae. d, e, from DW 134. d, part of colony with beginning polysiphony; e, part of monosiphonic axis. a-c, e, × 35; d, × 14.

Table 70. Measurements of *Sertularella gayi gayi* in μm.

The measurements include those from a colony with short segments and almost fully annulated hydrothecae (DR 40) and from material with long segments and scarcely undulated adcauline hydrothecal wall (DW 134).

| | BALGIM Stn DR 40 | BALGIM Stn DW 134 |
|---|---|---|
| Axial and hydrocladial segment, length | 765-1060 | 1120-1540 |
| diameter at node | 210-400 | 220-320 |
| Hydrotheca, length adnate part adcauline wall | 420-480 | 475-540 |
| length free part adcauline wall | 415-490 | 420-480 |
| length abcauline wall | 570-650 | 600-650 |
| diameter at rim | 270-310 | 290-320 |
| Gonotheca, maximal length | 1320-1830 | |
| maximal diameter | 610-670 | |

Gonothecae occur both on stem and branches, inserting directly under hydrothecae, in shape elongated ovoid; distal half annulated, rings gradually petering out on basal half. Hydrothecal aperture apical, circular, flanked by two 'lips' of characteristic shape, one of which is slightly enlarged (fig. 61b, c).

Variability.— The regular, ramified, pinnate structure of the colony may at times become irregular by the development of polysiphonic branches formed by the secondary tubules or by formation of hydrocladia from the interior of a hydrotheca, occurring together with completely normal branches (hydrocladia). Also we have observed a considerable variability in the length of the axial (and hydrocladial) segments. The degree of annulation of the (free) adcauline hydrothecal border is quite variable, being scarcely noticeable in some hydrothecae, while others (at the same colony) may be almost fully annulated (cf. DR 40, fig. 61a).

Distribution.— *Sertularella gayi gayi* has a wide distribution in the Atlantic ocean, being recorded as far north as Spitzbergen (Leloup, 1940b) and as far south as Gough Island in the southern Atlantic (Ritchie, 1907, 1909: Rees & Thursfield, 1965). The BALGIM material originates from 11 localities on the Atlantic side of the Strait of Gibraltar (CP 36, DW 40, DW 49, DW 50, CP 109, DR 113, DW 114) and from near the coast of Morocco off Rabat and Casablanca (DR 72, DW 74, CP 84, CP 103); furthermore four records originate from the Alboran Sea, Mediterranean (DR 130, DW 132, DW 134, CP 145). The depths records vary between 144 and 1200 m.

Discussion.— *Sertularella gayi gayi* is characterized by the strongly polysiphonic axis, present even in comparatively young colonies, by the regular, pinnate ramification in one plane, by undulations of the adcauline hydrothecal wall (to a variable extent, occasionally resulting in almost complete annulation of the hydrothecal surface), and by the characteristic bilobate gonothecal aperture. These characters distinguish the species from *Sertularella polyzonias* (Linnaeus, 1758), where a distinct axis is never present. Moreover *S. polyzonias* is monosiphonic, irregularly branched, with almost smooth hydrothecal surface, and with four more or less developed cusps surrounding the gonothecal aperture (see also description of *S. polyzonias*). The way of branching, the size of the hydrothecae and the gonothecal aperture distinguish *S. gayi gayi* from *Sertularella gayi robusta* Allman, 1873 (vide infra).

## Sertularella gayi robusta Allman, 1873
(figs. 60b, 62a-c)

*Sertularella Gayi* var. *robusta* Allman, 1873: 186; Allman, 1874: 474, pl. 66 figs. 3, 3a; Allman, 1877: 22-23, pl. 15 figs. 3-5; Billard, 1906d: 185, fig. 9B.
*Sertularella Gayi* var. *elongata* Billard, 1906d: 185-186, fig. 9c.
*Sertularella gayi robusta* - Vervoort, 1972: 118-120, figs. 36c, d.

Material.— BALGIM Stn CP 90, 34°21.4'N-07°23.6'W, 07.vi.1984, 890 m: single colony and a fragment, 80 and 10 mm high, without gonothecae.— Stn DR 152, 35°56.7'N-05°34.7'W, 17.vi.1984, 550 m: three fragments 10-15 mm high, one of which with gonotheca.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: eighteen colonies, mostly fragmented, between 5 and 25 mm high, some with gonothecae.

Description.— Colony with erect, thick, polysiphonic, branched axis. Polysiphony of axis and development of secondary tubules as in *S. gayi gayi* (fig. 6a), but branching in adult or older parts of colony irregular and in all directions; in young colonies or younger parts of older colonies branching pinnate and in same plane, branches (hydrocladia) alternately directed left and right, with generally three hydrothecae

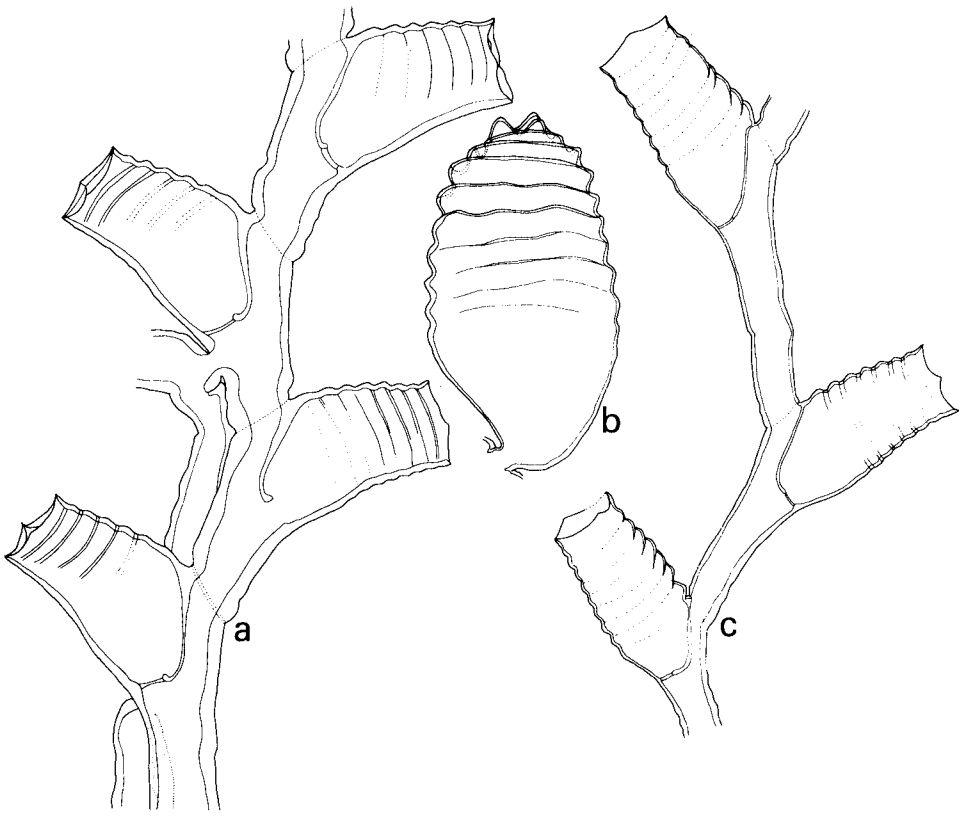


Fig. 62. a-c, *Sertularella gayi robusta* Allman, 1873. a, b, from DR 152. a, part of axis showing beginning polysiphony. b, gonotheca. c, from DR 153, part of axis of young colony. a-c, × 34.

between two consecutive branches (hydrocladia) (cf. fig. 60b).

Axis divided into segments by usually well marked, oblique nodes; each segment distally with a hydrotheca.

Hydrothecae alternately arranged along stem and hydrocladia, pointing left and right and in same plane. Adnate part of adcauline wall generally shorter than in *S. gayi gayi*, occupying two-fifths of adcauline length; free portion generally straight, with undulated, thick perisarc (fig. 62a, c); undulations extending downwards, occasionally reaching abcauline border; this border with even thicker perisarc, straight in basal part and slightly concave distally just under hydrothecal rim. Hydrothecal rim with four low cusps (one ab-, one adcauline and two laterals), separated by shallow embayments. Hydrothecal closing apparatus composed of four triangular flaps, when closed forming scarcely elevated roof. There are no intrathecal cusps. Some hydrothecae show renovations of hydrothecal rim. Structure of branches (hydrocladia) as main axis. Formation of stolons from otherwise normal hydrocladia has occasionally been observed.

Gonothecae found on axis or hydrocladia, inserting directly under hydrotheca, ovoid, distal two-thirds of surface annulated; proximal part smooth, narrowing into short, obliquely placed pedicel. Gonothecal aperture surrounded by three low cusps (fig. 62b).

Variability.— In parts of the colonies with regularly pinnate arrangement of the branches and with three hydrothecae between two consecutive branches (hydrocladia) supplementary branches may occur, forming 'pairs' of branches as in *S. gayi gayi*. However, this occurrence is exceptional and probably results from the irregular mode of branching in this subspecies: the supplementary branching taking place in all directions as do also the other branches (hydrocladia). The length of the hydrothecate segments and internodes is also varied, as is the size of the hydrotheca and its degree of annulation. In young colonies the hydrothecae tend to be smaller and more strongly annulated, the annulations reaching the abcauline border (as in the material from DR 153, fig. 62c). Adult colonies have larger hydrothecae with a varied degree

Table 71. Measurements of *Sertularella gayi robusta* in µm.

For the purpose of comparison measurements of material described by Billard (1906d) and Vervoort (1972) are also given.

| | BALGIM Stn CP 90 | BALGIM Stn DR 152 | *S. gayi robusta* (Billard, 1906d) | *S. gayi elongata* (Billard, 1906d) | *S. gayi robusta* (Vervoort, 1972) |
|---|---|---|---|---|---|
| Hydrothecate internode, length | 1420-1580 | 870-970 | | | 945-1015 |
| diameter at node | 270-380 | 220-310 | 200-325 | 195-260 | 335-380 |
| Hydrotheca, length adnate part adcauline wall | 500-590 | 420-490 | 580-700 | 325-390 | 565-635 |
| length free part adcauline wall | 620-760 | 550-615 | 650-875 | 550-810 | 675-730 |
| length abcauline wall | 780-890 | 700-795 | 810-970 | 710-840 | 840-880 |
| diameter at rim | 390-430 | 330-365 | 420-450 | 290 | 390-430 |
| Gonotheca, maximal length | | 1400-1495 | | | |
| maximal diameter | | 710-770 | | | |

of annulation in the same colony, where the hydrothecae from the basal and polysiphonic part are usually more distinctly annulated than in the higher parts.

Distribution.— *Sertularella gayi robusta* has previously been recorded from various localities off the Atlantic coasts of the United States (Allman, 1877; Nutting, 1904; Vervoort, 1972), from one locality west of the Shetland Islands (Stechow, 1925b), from various localities north of Scotland (Allman, 1874), off the Atlantic coast of Morocco (Billard, 1906d), and from one locality south of Madeira (Billard, 1906d, as *Sertularella gayi* var. *elongata*). The BALGIM material is from two localities in the Strait of Gibraltar (DR 152, DR 153) and from one locality off Rabat, Morocco (CP 90). The depth records oscillate between 550 and 890 m.

Discussion.— The BALGIM material is in agreement with existing descriptions of *S. gayi robusta;* the measurements agree with those given by Billard (1906d) and Vervoort (1972). This subspecies and the nominate subspecies agree in general appearance and variability of lengths of internodes and degree of annulation of the hydrothecae. However, closer inspection of the colonies shows a fairly regular pinnate ramification in *S. gayi gayi,* the branches (hydrocladia) being disposed in the same plane, while in *S. gayi robusta* that ramification is much more irregular, the branches (hydrocladia) being disposed on all sides of the axis. In the younger parts of the colonies of both subspecies such branches (hydrocladia) are pinnately arranged and generally in the same plane, but in *S. gayi robusta* there are three hydrothecae between two consecutive branches (hydrocladia) while in *S. gayi gayi* such branches (hydrocladia) occur in pairs (see description). There are also differences in the size of the hydrothecae (larger in *S. gayi robusta*) and in the gonothecal aperture (3 low cusps in *S. gayi robusta* and bilabiate in *S. gayi gayi*).

*Sertularella gayi* var. *elongata* was differentiated from *S. gayi* var. *robusta* by Billard (1906d) on account of smaller and slenderer hydrothecae, longer hydrothecate internodes and well developed annulation on the adcauline hydrothecal wall. We consider this a young specimen of *S. gayi robusta* (already indicated by Billard, 1906d), as has also been met with at DR 153 (fig. 62c); it has consequently been included in the synonymy of that subspecies.

## **Sertularella polyzonias** (Linnaeus, 1758)
(fig. 63a, b)

*Sertularia polyzonias* Linnaeus, 1758: 814.
*Sertularella polyzonias* - Hincks, 1868: 235-237, pl. 46 fig. 1; Stechow, 1923d: 194, fig. $D^1c$; Vervoort, 1946b: 224-226, fig. 96; Cornelius, 1979: 287-290, fig. 22.

Material.— BALGIM Stn CP 84, 33°45.4'N-08°31.9'W, 06.vi.1984, 345 m: single fragment 25 mm high with two gonothecae, one of which damaged.

Description.— Fragment examined composed of monosiphonic axis with two laterally disposed branches (hydrocladia), both on same side and separated by four hydrothecae. Axis divided into segments by means of poorly visible nodes, each distally with one hydrotheca. Hydrothecae alternately directed left and right and all in same plane; adnate part of adcauline wall slightly exceeding half hydrothecal depth, free portion slightly convex. Abcauline wall straight in basal part and distinctly con-

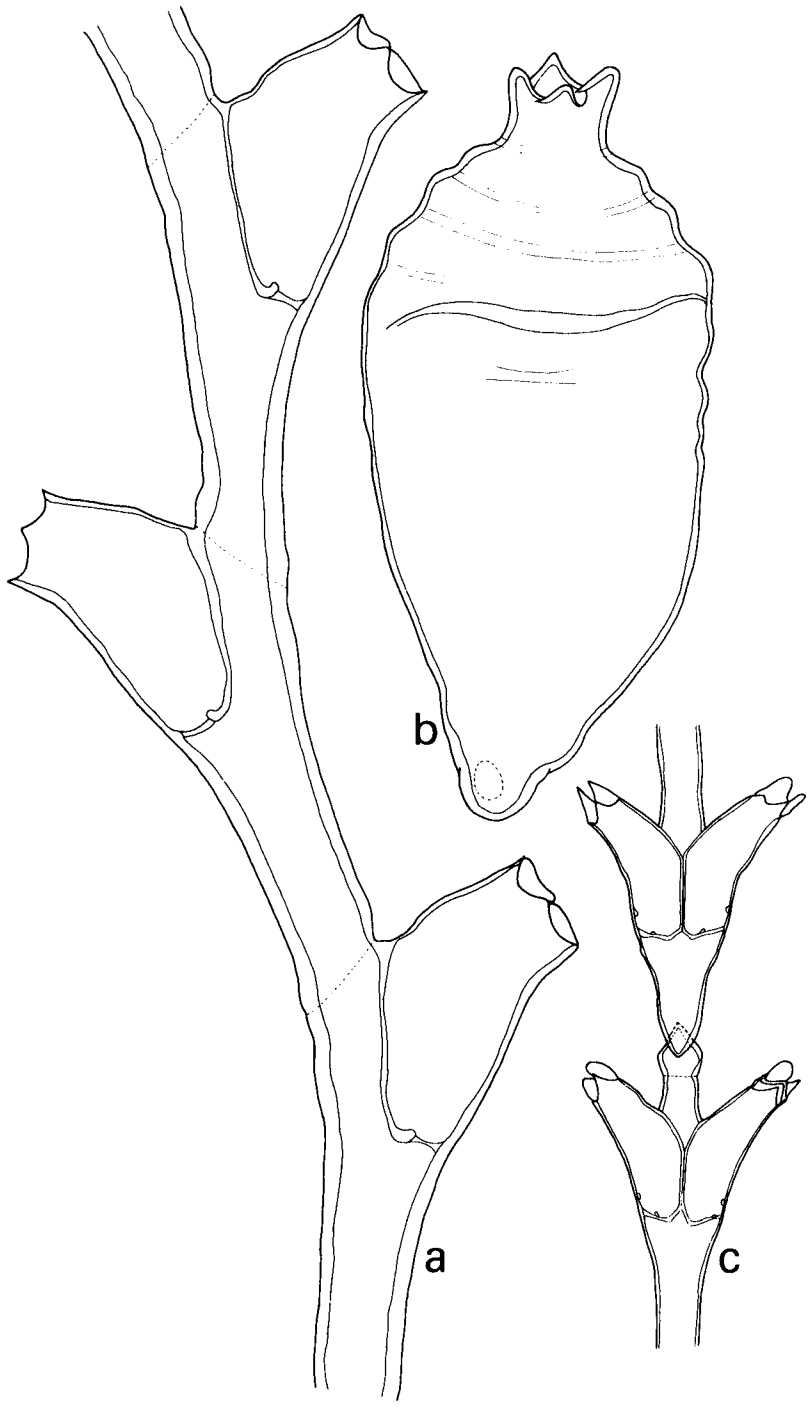


Fig. 63. a, b, *Sertularella polyzonias* (Linnaeus, 1758), from CP 84. a, part of axis; b, gonothecae. c, *Sertularia distans* Lamouroux, 1816, from DW 58, part of axis with two pairs of hydrothecae. a-c, × 58.

cave in distal half. Hydrothecal rim perpendicular to hydrothecal length axis, rim with four well developed, acute cusps (one ad-, one adcauline and two laterals), separated by fairly deep, rounded embayments. Hydrothecal operculum composed of four triangular flaps attached in embayments and forming low roof when closed. There are no intrathecal cusps (fig. 63a). Renovations of hydrothecal border frequent.

Gonothecae inserting directly under hydrocladial hydrothecae, ovoid, with irregularly annulated distal portion. Gonothecal aperture terminal, at the end of a short neck, surrounded by four well developed, obtuse cusps (fig. 63b).

The branches (hydrocladia) have the same structure as the axis.

Table 72. Measurements of *Sertularella polyzonias* in µm.

| | BALGIM Stn CP 84 |
|---|---|
| Hydrothecate internode, length | 1080-1310 |
| diameter at node | 190-280 |
| Hydrotheca, length adnate part adcauline wall | 420-520 |
| length free part adcauline wall | 320-410 |
| length abcauline wall | 510-570 |
| diameter at rim | 220-240 |
| Gonotheca, maximal length | 1740 |
| maximal diameter | 810 |

Distribution.— *Sertularella polyzonias* is a cosmopolitan species. The BALGIM material comes from a single Atlantic locality (CP 84) off the coast of Casablanca (Morocco), depth 345 m.

Discussion.— Though the material of this species in the BALGIM collection is limited, the presence of gonothecae, along with the characters presented by colony structure and hydrothecae, make it possible to distinguish the material distinctly from *Sertularella gayi gayi*. Under the latter the differences between *S. polyzonias* and *S. gayi gayi* have been discussed.

## Genus **Sertularia** Linnaeus, 1758

### **Sertularia distans** Lamouroux, 1816
(fig. 63c)

*Sertularia distans* Lamouroux, 1816: 191; Allman, 1877: 25, pl. 16 figs. 9, 10; Millard, 1975: 306-307, figs. 99E-H; Cornelius, 1979: 296-299, fig. 26; García Corrales, Aguirre & González, 1980: 49-52, fig. 17.
*Sertularia gracilis* - Hincks, 1868: 262-263, pl. 53 fig. 2.
*Tridentata distans* - Calder, 1991: 105-107, fig. 55.

Material.— BALGIM Stn DW 58, 35°39.4'N-06°45.6'W, 03.vi.1984, 826 m: fragment 10 mm long; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: single juvenile colony 6 mm high, no gonothecae.

Description.— Fragment from BALGIM DW 58 composed of monosiphonic axis bearing two frontal ramifications, one of which is broken at the base. Axis composed of succession of thecate and athecate internodes; thecate segments basally with oblique 'hidge' joint (fig. 63c) and distally with transverse node, each with one or two pairs of hydrothecae; athecate internodes small and easily overlooked.

Hydrothecae biseriate and in opposite pairs; on frontal aspect of colony touching and adnate for part of adcauline length, on backside of colony hydrothecae of a pair

completely separate. Hydrothecae tubular, curving laterally; adnate part of adcauline wall c. two-thirds of hydrothecal depth; free part of adcauline wall almost straight. Abcauline hydrothecal wall concave; hydrothecal rim with two well developed lateral cusps and a much smaller adcauline cusp. Closing apparatus of hydrotheca composed of two flaps; adcauline flap folded. Inside of abcauline hydrothecal wall basally with some characteristic perisarcal pegs probably serving the attachment of the hydranth (fig. 63c).

Ramifications originating from frontal part of axis and inserting on apophysis placed on internode at point of divergence of adcauline walls of pair of hydrothecae. First internode of branch short and athecate, as athecate internodes of axis; structure of remainder of branch as in axis with exception of the hydrothecae of the first pair that do not touch along adcauline border but are completely free from each other.

Colony from DW 144 juvenile, differing from above described specimen by the absence of ramifications and athecate, intermediary internodes. Hydrothecae of slightly inferior dimensions.

Table 73. Measurements of *Sertularia distans* in µm.

| | BALGIM Stn DW 58 |
|---|---|
| Hydrotheca, length adnate part adcauline wall | 235-270 |
| length free part adcauline wall | 120-180 |
| length abcauline wall | 270-310 |
| diameter at rim | 80-100 |

Distribution.— *Sertularia distans* is widely distributed in the temperate and tropical parts of the oceans (Calder, 1983). In the eastern Atlantic the distribution extends from the Shetland Islands in the north (Hincks, 1868) to the coasts of southern Africa (Millard, 1975). It also occurs abundantly in the western Mediterranean. The BALGIM material originates from two localities west of Cape Spartel (DW 58, DW 114) at depths varying between 150 and 826 m.

Discussion.— This well known species needs no further comment. The type of frontal ramification observed in our material has previously been described by García-Corrales, Aguirre & González (1980). The presence of the hinge-type of node, found between the distal part of the athecate internode and the proximal part of the thecate internode, is quite variable in *Sertularia distans* (see Millard, 1975; Cornelius, 1979; García-Corrales, Aguirre & González, 1980). The species has recently been removed to the genus *Tridentata* Stechow, 1920, a genus that was not recognized by Vervoort & Vasseur, 1977.

## Genus **Thuiaria** Fleming, 1828

### **Thuiaria** spec.
(fig. 64a, b)

*Thuiaria* spec. aff. *distans* - Broch, 1918: 148-149, fig. 79.

Material.— BALGIM Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: single colony 45 mm high and two unbranched fragments, 9 and 20 mm long, no gonothecae.

Description.— Axis erect, monosiphonic, with pinnately arranged lateral branches alternately directed left and right in the same plane (fig. 64a). Axis slightly geniculate, divided into segments of greatly varying length by transverse internodes, best indicated and occurring in greater number in basal part of axis.

Hydrothecae biseriate, alternately pointing left and right and in same plane, tubular, curved outwards, with two-thirds of adcauline wall adnate. Free part of adcauline wall almost straight; abcauline wall slightly concave, with perisarcal thickening just under hydrothecal rim. Rim of hydrotheca smooth, with characteristic sinus at abcauline side; in this sinus the sole circular plate of the hydrothecal opercu-

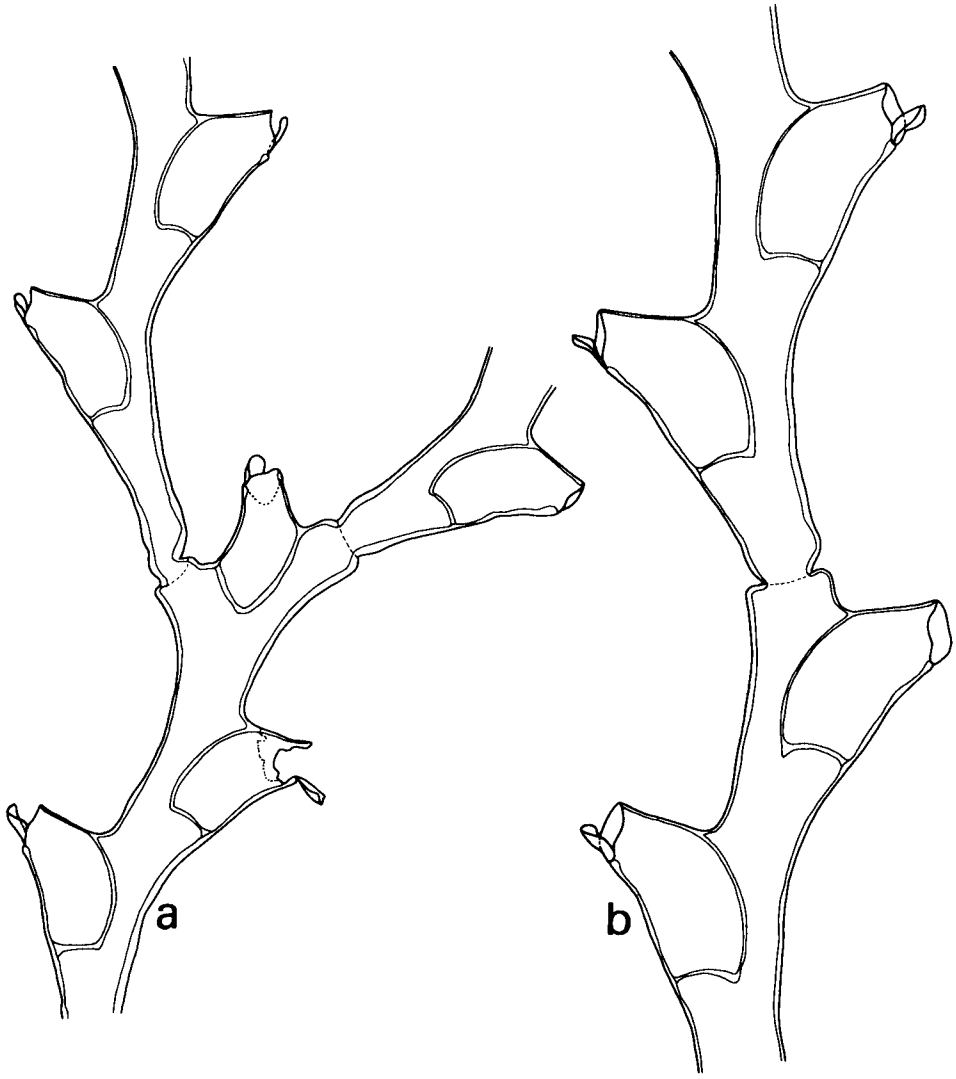


Fig. 64. a, b, *Thuiaria* spec., from DW 132. a, part of colony; b, part of hydrocladium (ramification). a, × 47; b, × 60.

Table 74. Measurements of *Thuiaria* spec. in µm.

| BALGIM Stn DW 132 | |
|---|---|
| Hydrotheca, length adnate part adcauline wall | 300-350 |
| length free part adcauline wall | 130-220 |
| length abcauline hydrothecal wall | 280-320 |
| diameter at rim | 110-140 |

lum is attached (fig. 64a, b).

Ramifications (hydrocladia) originating directly under an axial hydrotheca and inserting on distinctly marked apophysis; between two consecutive ramifications there are usually three hydrothecae, though irregularities (five hydrothecae between two ramifications) do occur. Ramifications have the same structure as axis, though transverse nodes have not been observed, secondary ramifications too are absent.

Distribution.— Broch's record of *Thuiaria* cf. *distans* is from near Iceland, 63°21'N-25°21'W, depth 170 fms (= 311 m). The BALGIM material is from the Alboran Sea, Mediterranean, off the coast of Morocco, depth 170 m.

Discussion.— The BALGIM material agrees perfectly with Broch's (1918) description and figure of *Thuiaria* spec. aff. *distans*, but in our opinion it is quite different from *Thuiaria geniculata* Fraser, 1918 (= *T. distans* Fraser, 1914, preoccupied by *Thuiaria distans* Allman, 1877, see Fraser, 1918), in which species the hydrothecae are more widely separated, the adnate part of the adcauline hydrothecal wall occupies about half the length of that wall, and the hydrothecal rim has no abcauline sinus. Furthermore and as already pointed out by Broch (1918) *Thuiaria* spec. is near to *Thuiaria carica* Levinsen, 1893, from which it is nevertheless different because in the latter the hydrothecae are subalternately arranged (Calder, 1970) and have a smooth hydrothecal rim that is parallel (or nearly so) to the length axis of stem or branch (Naumov, 1960; Calder, 1970). Though in the BALGIM specimens the hydrothecal rim is parallel to that length axis the rim has a very characteristic abcauline sinus. Scarcity of material and the absence of gonothecae makes it impossible to reach a definitely conclusion. We have therefore refrained from a definite identification of the BALGIM material.

## Family **Syntheciidae** Marktanner-Turneretscher, 1890
## Genus **Synthecium** Allman, 1872

### **Synthecium evansii** (Ellis & Solander, 1786)
(fig. 65)

*Sertularia evansii* Ellis & Solander, 1786: 58 (no. 35).

*Synthecium evansii* - Stechow, 1919: 82; Stechow, 1923d: 150; Leloup, 1934: 11; Picard, 1951b: 261; García-Corrales, Arcas & De Diego, 1979: 33, fig. 18; Cornelius, 1979: 307; Cornelius, 1980: 7-8; Gili i Sardá, 1982: 69, fig. 31; Izquierdo, García-Corrales & Bacallado, 1986a: 93, fig. 9.

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: two stems 5 mm high on *Sertularella gayi gayi*, with *Lafoea dumosa*; no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: 5 mm high stem with four pairs of hydrothecae; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: single fragmentary colony, c. 10 mm high, with *Egmundella amirantensis*.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: small colonies, a few mm high, with on stem *Halecium* spec. and *Campanularia hincksii*; no gonothecae observed.

Description (of the material from DR 113).— Stem (in present specimen) monosi-

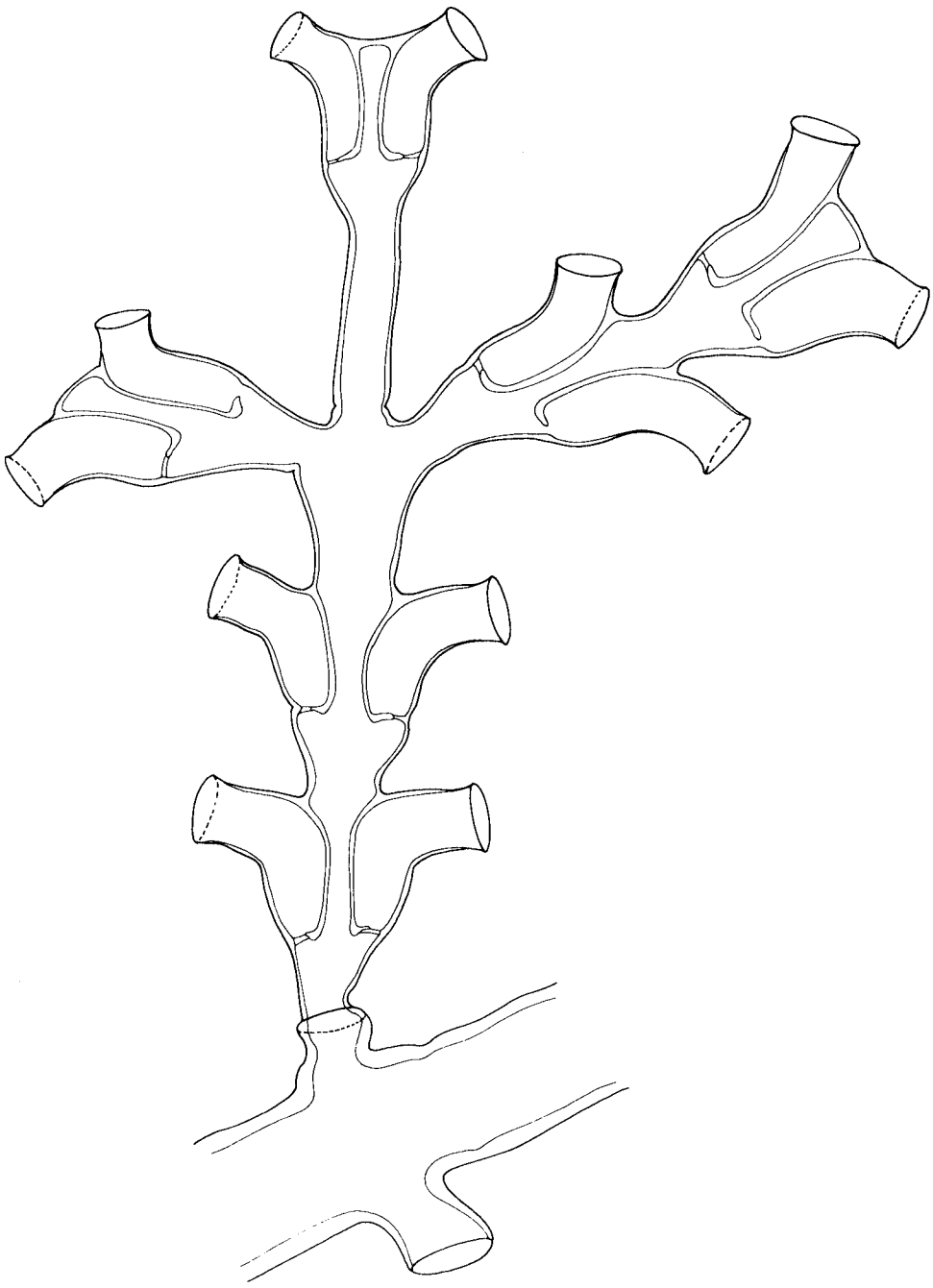

Fig. 65. *Synthecium evansi* (Ellis & Solander, 1786), from DR 113, part of colony showing side-branch (hydrocladium) with secondary ramification. × 30.

phonic, composed of two segments; basal segment inserting directly on small piece of stolon and bearing a pair of opposite apophyses, the remaining segment has a pair of opposite hydrothecae and a pair of opposite apophyses; all hydrothecae and apophyses in one plane. Segments separated by indistinct constrictions of perisarc. Primary hydrocladia (side-branches) springing from apophyses, only one complete primary hydrocladium present, composed of two internodes separated by circular peridermal constriction. There are two pairs of opposite hydrothecae and one pair of opposite apophyses on this first segment; the apophyses bear short secondary hydrocladia, one with a single pair of hydrothecae, the other with two pairs (fig. 65). Second hydrocladial internode with single pair of hydrothecae. All hydrothecae and apophyses in same plane as those of stem.

Hydrothecae tubular, apical third curving outwards, angle of curvature between 90 and 60 degrees. Adcauline wall adnate to internode for about two-thirds of its length, basally with slightly thickened 'heel', thecal bottom with large hole to permit passage of perisarc, occasionally slightly oblique. Free part of adcauline wall straight. Abcauline wall of hydrotheca with gracefully curved concavity grading towards a more abrupt curvature. Hydrothecal rim slightly though distinctly everted, circular, slightly tilted upwards. Hydrothecae of first pair on secondary hydrocladia not exactly opposite (fig. 65).

Perisarc fairly strong, particularly on axis, thinner along walls of hydrocladia and thinning out along walls of hydrothecae. Hydrothecae firm; no collapsed hydrothecae observed, only one single renovation of hydrothecal rim observed.

Variability.— Even in the scarce BALGIM material of this species there is a considerable variability in the shape of the hydrothecae brought about by the varied length of the free portion of the hydrotheca, the degree of curvature, shape of the abcauline hydrothecal wall and total depth of the hydrotheca.

Table 75. Measurements of *Synthecium evansii* in µm.

| | BALGIM Stn DR 113 | Canary Isl., (Izquierdo et al., 1987) |
|---|---|---|
| Axis, diameter at base | 590 | |
| Hydrocladium, length internode | 2560 | |
| diameter | 335 | |
| Hydrotheca, total depth | 680-740 | |
| length free part adcauline wall1 | 85-335 | 256-400 |
| length adnate part adcauline wall | 500-615 | 544-640 |
| length abcauline wall | 480-575 | |
| diameter at rim | 215-250 | 192-288 |

Distribution.— *Synthecium evansii* is generally considered to be a strictly Mediterranean species (Cornelius, 1980), there is scarcely any reliable Atlantic record: Izquierdo, García-Corrales & Bacallado (1986a) record indubitable material from the Canary Islands region. There is no Mediterranean material in the present collection; all BALGIM records are from the Atlantic directly west of the Strait of Gibraltar (DR 40, DW 50, DR 113, DW 114); the depths vary between 144 and 523 m.

Discussion.— All material in the BALGIM collection is young and epizootic; no independently growing colonies have been observed.

## Family **Campanulariidae** Johnston, 1836
## Genus **Campanularia** Lamarck, 1816

### **Campanularia hincksii** Alder, 1856
(fig. 66)

*Campanularia hincksii* Alder, 1856: 360, pl. 13 fig. 9; Hincks, 1868: 162-163, fig. 18, pl. 24 fig. 3; Vervoort, 1946b: 276-277, figs. 122, 124a; Millard, 1975: 208, fig. 67B-E; Cornelius, 1982: 53-55, fig. 3; Calder, 1991: 49-50, fig. 29.

Material.— BALGIM Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: two colonies composed of several hydrothecae on *Sertularella gayi gayi*; no gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: single colony with four hydrothecae on *Polyplumaria flabellata*; several colonies on *Sertularella gayi gayi* and worm-tubes; all colonies without gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: damaged colony without gonothecae on worm-tube and separate hydrothecae without gonothecae on *Polyplumaria flabellata*.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: isolated hydrothecae on axis of *Diphasia margareta*, with *Lafoea dumosa*; no gonothecae. In addition isolated hydrothecae on various hydroids, i.a. *Bimeria vestita, Diphasia attenuata robusta, Sertularella cylindritheca, Sertularella gayi gayi* and *Synthecium evansi*. All colonies without gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: some hydrothecae on unidentifiable athecate hydroid on worm-tube, together with *Bimeria vestita, Eudendrium capillare, Filellum* cf. *serratum, Halecium tenellum* and *Clytia linearis*; no gonothecae. Also specimens on *Sertularella gayi gayi* and worm-tube with many other epizootic hydroids; no gonothecae.— Stn DW 128, 35°35.3'N-03°45.1'W, 14.vi.1984, 480 m: isolated hydrothecae from stolon on *Acryptolaria conferta minor*; no gonothecae.— Stn DR 130, 35°25.3'N-04°19.3'W, 15.vi.1984, 145 m: some isolated hydrothecae on old hydroid stem with *Filellum* cf. *serratum*; no gonothecae. Also single hydrotheca on *Lytocarpia myriophyllum*.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: a few hydrothecae on *Zygophylax biarmata, Eudendrium* spec., and *Nemertesia* spec.; no gonothecae. Also isolated hydrothecae on old hydroids stem, with *Filellum* cf. *serpens*, without gonothecae and a fragment of hydrorhiza bearing one hydrotheca.— Stn CP 135, 35°26.5'N-04°14.2'W, 15.vi.1984, 395 m: hydrothecae and empty gonothecae on *Acryptolaria conferta minor*.— Stn CP 150, 35°47.2'N-05°17'W, 17.vi.1984, 290 m: single colony composed of various hydrothecae from stolon on *Sertularella cylindritheca*; no gonothecae.— Stn DR 153, 35°55.8'N-05°35.3'W, 17.vi.1984, 580 m: two isolated hydrotheca on algae and one hydrotheca on *Polyplumaria flabellata*.

Description.— Colonies composed of a stolon attached to substrate (other hydroids, various solid substrates), at irregular intervals bearing erect pedicels supporting a single hydrotheca. Pedicel never branched, basally with wrinkled or smooth perisarc, occasionally, depending upon regeneration after breakage, indistinctly or irregularly ringed. Apically, just under hydrotheca, pedicel with characteristic spherule. Pedicel may show distinct traces of breakage and subsequent regeneration by presence of transverse perisarcal constrictions.

Hydrotheca deep cylindrical, major part of lateral hydrothecal walls parallel, basally rounded and narrowing towards spherule; extreme basal part with diaphragm formed by ring-shaped perisarcal ridge, delimiting a small basal chamber. Hydrothecal rim circular, thin, with eight to twelve marginal cusps separated by fairly deep, U-shaped incisions. Cusps either truncate (DW 132, fig. 66d) or distinctly bicuspidate, the smaller cusps separated by rounded incisions (DR 113, fig. 66a). Intermediates between the two extremes do occur (DW 114, fig. 66b, c). Margin of hydrotheca corresponding with marginal cusps curved inwards, distal part of hydrotheca undulated or slightly polygonal on cross section and exterior surface of

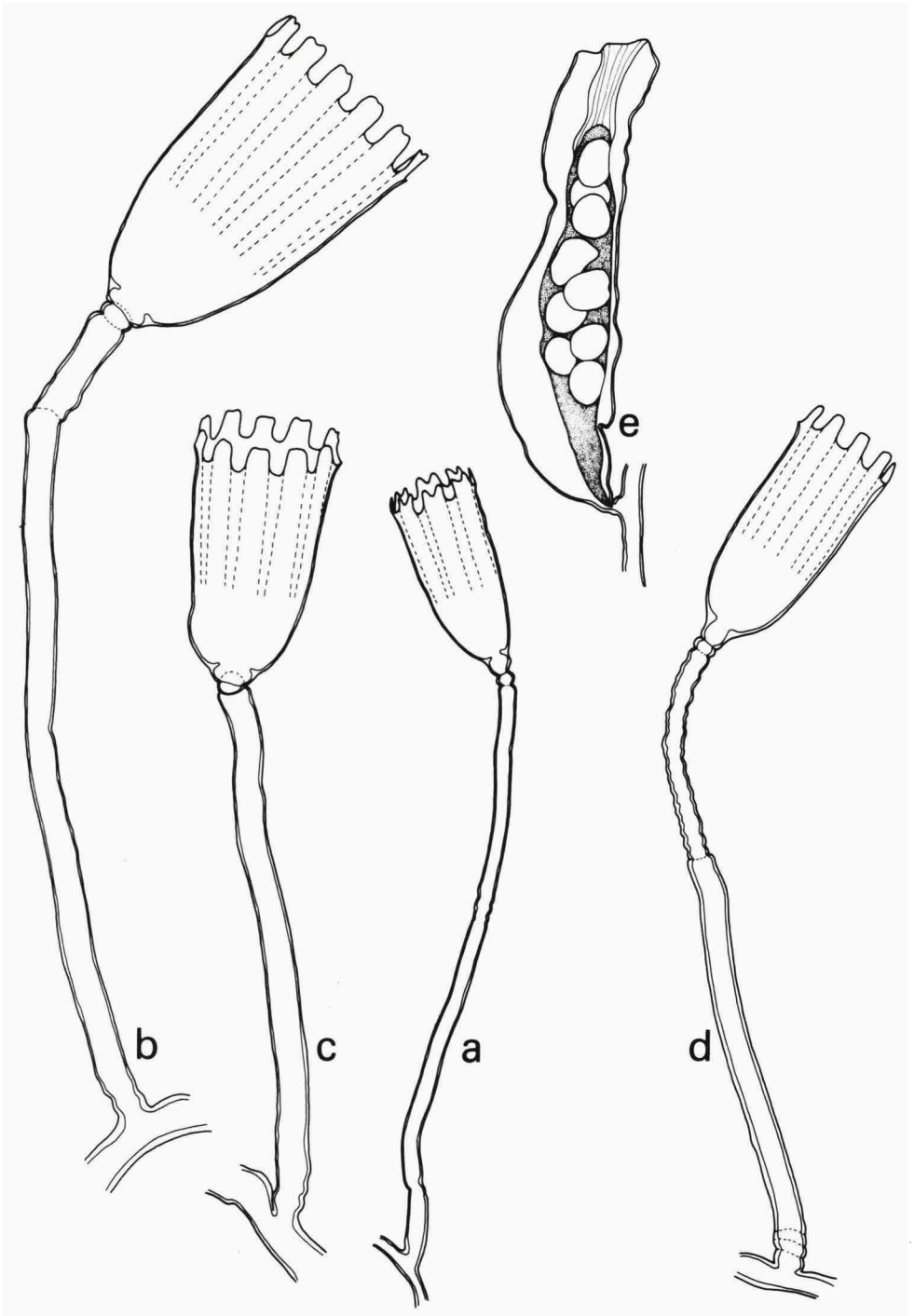


Fig. 66. *Campanularia hincksii* Alder, 1856. a, DR 113, hydrotheca; b, c, DW 114, hydrothecae; d, DW 132, hydrotheca; e, CP 135, gonotheca. a-e, × 58.

Table 76. Measurements of *Campanularia hincksii* in µm.

| | BALGIM Stn DW 114 | BALGIM Stn CP 135 |
|---|---|---|
| Hydrothecal pedicel, length | 2010-4510 | |
| diameter | 90-140 | |
| Hydrotheca, total depth | 830-1120 | |
| diameter at rim | 440-580 | |
| Gonotheca, maximal length | | 1540 |
| maximal diameter | | 380 |

hydrotheca with longitudinal striae that may give it a characteristic appearance.

Gonothecae large, more or less cylindrical, directly attached to hydrorhiza. with smooth or irregularly undulated perisarc, truncated apically. Gonothecae observed filled with a number (c. 9) of eggs or developing planulae (fig. 66e).

Variability.— Besides variability in shape of the marginal teeth we have also observed a considerable variability in length of the hydrothecal pedicel and size of the hydrotheca.

Distribution.— *Campanularia hincksii* is a cosmopolitan species. The BALGIM material originates from five localities west of the Strait of Gibraltar (DR 40, DR 49, DW 50, DR 113, DW 114), from one locality in the Strait proper (DR 153) and from four localities in the Alboran Sea off the coast of Morocco (DR 130, DW 132, CP 135, CP 150). The depth records are from between 144 and 580 m.

Discussion.— This is a well known species; the variability described above coincides with the general concept of variability met with in this species (cf. Cornelius, 1988).

## Genus **Clytia** Lamouroux, 1812

### **Clytia gracilis** (M. Sars, 1850)
(fig. 67a)

*Laomedea gracilis* p.p. M. Sars, 1850: 138.
*Laomedea (Campanularia) gracilis* - M. Sars, 1857: 161, pl. 1 figs. 1-3, 5.
*Gonothyraea gracilis* - Hincks, 1868: 183-184, pl. 36 fig. 1.
*Clytia gracilis* - Cornelius & Östman, 1986: 165-166; Calder, 1991: 54-57, fig. 31.
*Laomedea pelagica* - Vervoort, 1946b: 285-288, fig. 126.
*Laomedea (Phialidium) pelagica* - Vervoort, 1959: 313-315, fig. 55b-c; Vervoort, 1968: 15-17, fig. 5.
*Laomedea (Clytia) pelagica* - Vervoort, 1972: 91-92, fig. 26c.
*Clytia sarsi* Cornelius, 1982: 78.

Material.— BALGIM Stn CP 25, 36°41.5'N-07°19.4'W, 31.v.1984, 544 m: colony of five hydrothecae on *Polyplumaria flabellata* and colony of various hydrothecae on *Diphasia margareta*; no gonothecae.— Stn CP 26, 36°45.5'N-07°08.4'W, 31.v.1984, 392 m: colony of various isolated hydrothecae on hydrorhiza of *Diphasia margareta*; no gonothecae.— Stn DW 28, 36°45.8'N-07°07.7'W, 31.v.1984, 398 m: two colonies, with one and six hydrothecae respectively, on *Lytocarpia myriophyllum*; no gonothecae.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: isolated hydrothecae on *Polyplumaria flabellata*; no gonothecae.— Stn CP 54, 35°41.3'N-06°29.7'W, 03.vi.1984, 356 m: single hydrotheca on unidentified hydroid fragment; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: various hydrothecae

from stolon on *Sertularella cylindritheca*; no gonothecae. Also five hydrothecae on fragment of unidentifiable hydroid; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: numerous hydrothecae on *Diphasia* spec. and *Sertularella gayi gayi*; no gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: isolated, damaged hydrothecae on *Halecium sibogae marocanum* and on calcareous worm-tube; no gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: single colony composed of number of pedicels from stolon creeping on *Sertularella gayi gayi*; four complete hydrothecae, no gonothecae.

Description.— Stolon attached to substrate, either other hydroids or fixed substrate, giving rise to erect pedicels of which some have a lateral ramification; pedicels and ramifications terminating in a hydrotheca. Pedicel and ramifications basally with a number of rings (10-20 in BALGIM material), remainder of pedicel smooth with exception of portion just basal to hydrotheca, which has four to six rings. Hydrotheca elongate, slightly campanulate, basal part rather narrowed than rounded, lateral walls slightly widening towards hydrothecal rim. Rim with eight acute cusps separated by deep, rounded embayments; cusps slightly but distinctly inclined inwards. Also in major part of hydrothecae portion of rim bearing marginal cusp curved inwards so that cross section of hydrotheca just under rim is undulated. These hydrothecal curvatures may at times give the impression of longitudinal striae running downwards from the base of the marginal embayment, occasionally until halfway hydrothecal depth; this, however, is an optical effect not supported by actual present of structural striae. Basal part of hydrotheca with fine, laminar diaphragm separating off small basal chamber.

Variability.— Some of the pedicels show signs of regeneration after breakage: regeneration starts at the broken end of the pedicel with a number of rings similar to those found under the hydrotheca (fig. 67a). Actual length of pedicel as well as depth of hydrotheca greatly varied amongst the various colonies.

Table 77. Measurements of *Clytia gracilis* in µm.

| | BALGIM Stn DW 134 |
|---|---|
| Hydrothecal pedicel, length | 1220-2750 |
| diameter | 70-90 |
| Hydrotheca, total depth | 560-670 |
| diameter just below rim | 220-275 |

Distribution.— *Clytia gracilis* has a wide geographical distribution and is considered by some authors (Rossi, 1961; Patriti, 1970) to be a cosmopolitan species. The present material originates from three localities west of Cádiz (CP 25, CP 26, DW 28), from four localities west of Cape Spartel, Morocco (DW 50, CP 54, DR 113, DW 114) and from two in the Alboran Sea off the coast of Morocco (DW 132, DW 134), depth records between 144 and 544 m. The species has previously been recorded from the Mediterranean by Picard (1958).

Discussion.— The validity of the binomen *Clytia gracilis* (M. Sars, 1850) and its possible synonymy with *Clytia hemisphaerica* (Linnaeus, 1767) has given rise to lengthy discussion in the literature (cf. Vervoort, 1959, 1968; Millard, 1975; Cornelius, 1982). Östman's studies (1979a, b, 1982) of the species of Campanulariidae from Scandinavian waters as well as the study of living specimens from both Scandinavian and British waters (Cornelius & Östman, 1986) have now unambiguously demonstrated the validity of both species; Cornelius & Östman (1986) furthermore have proposed to validate the binomen *Clytia gracilis* (M. Sars, 1850) by a decision of the International Commission on Zoological Nomenclature.

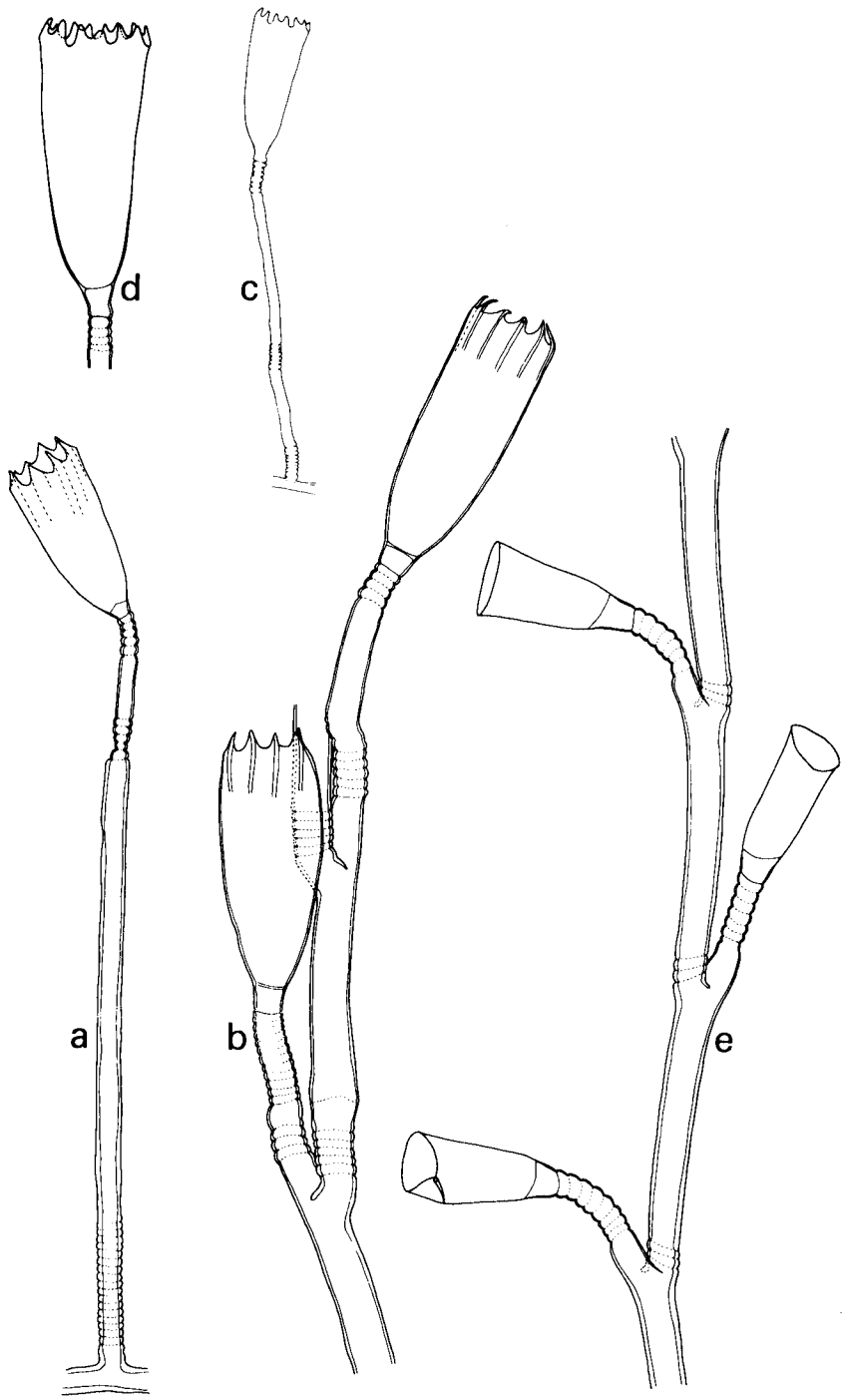


Fig. 67. a, *Clytia gracilis* (M. Sars, 1850), from DW 134, regenerated hydrotheca. b, *Clytia linearis* (Thornely, 1899), from DW 114, part of colony. c, d, *Clytia paulensis* (Vanhöffen, 1910), from DW 114. c, hydrotheca with its pedicel; d, hydrotheca. e, *Laomedea pseudodichotoma* Vervoort, 1959, from CP 34, monosiphonic part of axis. a-c, e, × 37; d, × 72.

The material recorded here, though without gonothecae, agrees with previous descriptions of the species by Vervoort (1946b, 1959, 1968, 1972) and distinguishes itself from *Clytia hemisphaerica* by the generally larger, slenderer hydrothecae, and the acute, slightly internally inclined marginal cusps. The inward curvature of the marginal cusps, resulting in an undulated cross section just under the hydrothecal rim has previously been described by Vervoort (1959, as *Laomedea (Phialidium) pelagica*) and by Mammen (1965).

## Clytia linearis (Thornely, 1899)
(fig. 67b)

*Obelia linearis* Thornely, 1899: 453, pl. 44 fig. 6.
*Clytia linearis* - Cornelius, 1982: 84-86, fig. 12; Rees & Vervoort, 1987: 94-95; Calder, 1991: 62-64, fig. 34.
*Campanularia Gravieri* Billard, 1904b: 482, fig. 1.
*Clytia gravieri* - Millard & Bouillon, 1973: 51-54, fig. 7E-G; Millard, 1975: 215-217, figs. 71F-H.

Material.— BALGIM Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: single colony 12 mm high, without gonothecae, on *Sertularella gayi gayi*. In addition a few hydrothecae, some with branched pedicels, on worm-tube and a fragmentary colony 10 mm high, all without gonothecae. With *Bimeria vestita, Eudendrium capillare, Halecium tenellum* and *Campanularia hincksii*.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: isolated hydrothecae from stolon on *Bimeria vestita*; no gonothecae.

Description.— Colonies composed of stolon creeping on substrate (other hydroids, fixed substrate, etc.) bearing either erect, unbranched pedicels or erect axes resulting from repeated sympodial branching of such pedicels; pedicels or branches terminating in a hydrotheca. Pedicels basally and distally ringed, both portions separated by smooth interval of varied length. In case of sympodially branched colonies the branch always originates from the preceding pedicel directly under distal annulation and also has a basal and terminal ringed portion.

Hydrotheca slender, slightly campanulate with almost parallel walls, narrowing basally. Hydrothecal rims with 10-12 acute, slightly inwardly curved cusps. Moreover each cusp with characteristic longitudinal perisarcal band or ridge, running downwards for one-fourth to one-third of hydrothecal depth. Diaphragm distinct, straight or slightly oblique, delimiting a spacious basal chamber (fig. 67b).

Table 78. Measurements of *Clytia linearis* in µm.

| | BALGIM Stn DW 114 |
|---|---|
| Hydrotheca, total depth | 980-1250 |
| diameter | 330-440 |

Distribution.— The geographical distribution of *Clytia linearis* has recently been discussed by Rees & Vervoort (1987); it comprises the tropical and subtropical zones of Atlantic, Indian and Pacific Oceans, including also the Mediterranean. The present records are from the Atlantic west of the Strait of Gibraltar, off Cape Spartel (DW 114) and from the Alboran Sea off the coast of Morocco (DW 132). The depth records are from between 150 and 170 m.

Discussion.— Though the BALGIM material is scarce and has no gonothecae it can, by the structure of its hydrotheca, unambiguously be referred to the present species.

## Clytia paulensis (Vanhöffen, 1910)
(fig. 67c, d)

*Campanularia paulensis* Vanhöffen, 1910: 272, 298, fig. 19a, b.
*Clytia paulensis* - Stechow, 1923d: 110, fig. N; Millard, 1966: 481-483, fig. 15; Millard, 1975: 221, fig. 73A-D; Cornelius, 1982: 88-91, fig. 14.

Material.— BALGIM Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: colony composed of 17 hydrothecae on *Sertularella gayi gayi*; also two hydrothecae on unidentifiable hydroid; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: c. 20 hydrothecae on fragment of *Sertularella gayi gayi*; three damaged gonothecae.— Stn DW 132, 35°25.7'N-04°18.8'W, 15.vi.1984, 170 m: isolated hydrothecae on shell fragment and old hydroid stem, on the latter with *Eudendrium capillare*.— Stn DR 151, 35°55.2'N-05°25.4'W, 17.vi.1984, 115 m: isolated hydrothecae springing from stolon creeping on Bryozoa. No gonothecae.

Description.— Colony formed by creeping, thin hydrorhiza (stolon) attached to substrate (usually other hydroids) and from which arise, at irregular intervals, erect, unbranched pedicels each with one terminal hydrotheca. Pedicels basally and apically ringed (fig. 67c); regenerated pedicels have the previous rupture marked by an additional series of rings at base of regenerating pedicel.

Hydrotheca slender, deep-campanulate and small, basally gradually rounded and apically widening almost imperceptibly. Hydrothecal rim with six to eight composite cusps, each cusp being bidentate, the 'teeth' rounded and separated by rounded embayment, not unlike to condition observed in *Obelia bidentata* but without internal thickening of the 'teeth' (fig. 67d). Diaphragm at hydrothecal base fine, straight to slightly oblique; basal chamber fairly spacious.

Gonothecae much damaged, with short pedicel composed of two or three rings, apparently elongated ovoid with smooth walls and terminal aperture.

Table 79. Measurements of *Clytia paulensis* in µm.

| | BALGIM Stn DW 114 |
|---|---|
| Hydrothecal pedicel, length | 1180-1840 |
| diameter | 25-50 |
| Hydrotheca, total depth | 420-530 |
| diameter at rim | 140-200 |

Distribution.— The geographical distribution of *Clytia paulensis* is wide and rather dispersed, comprising the east and west sides of the Atlantic Ocean, the Mediterranean, and the Indian and Pacific Oceans; there are also many Antarctic records (Millard, 1975). On the eastern side of the Atlantic the species has been recorded from south of Great Britain (Cornelius, 1982) southwards until Francis Bay, South Africa (Stechow, 1925b). The BALGIM material originates from the Atlantic off Cape Spartel, Morocco (DR 113, DW 114), from the Strait proper (DR 151) and from the Alboran Sea off Morocco (DW 132). the depth records are from between 115 and 170 m.

Discussion.— The BALGIM material is in conformity with the general concept of this species; it needs no further comment.

## Clytia spec.

Material.— BALGIM Stn CP 14, 36°44.1'N-09°27.6'W, 30.v.1984, 1318 m: two damaged hydrothecae on

*Lytocarpia myriophyllum*.— Stn DR 40, 35°49.9'N-06°08.6'W, 02.vi.1984, 362 m: two hydrothecae on *Sertularella gayi gayi*, hydrothecal border damaged; no gonothecae.— Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: damaged colony without gonothecae, partly on *Sertularella gayi gayi*.— Stn DW 50, 35°52.7'N-06°31.9'W, 03.vi.1984, 523 m: various hydrothecae with damaged rim on *Sertularella gayi gayi*; no gonothecae. Also two damaged hydrothecae on unidentifiable hydroid; no gonothecae.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: colony with damaged hydrotheca on *Sertularella gayi gayi*; no gonothecae.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: damaged hydrothecae on *Sertularella gayi gayi* and other hydroids; no gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: three hydrothecae on *Sertularella gayi gayi*; no gonothecae.

Discussion.— All *Clytia* material with damaged hydrothecal rim which in our opinion could not be satisfactorily be identified, has been listed as *Clytia* spec.

## Genus **Laomedea** Lamouroux, 1812

### **Laomedea pseudodichotoma** Vervoort, 1959
(fig. 67e)

*Laomedea (Eulaomedea) pseudodichotoma* Vervoort, 1959: 316-318, figs. 56-57; Vervoort, 1966: 104; Redier, 1971a: 505; Cornelius, 1982: 111-112, fig. 21.

Material.— BALGIM Stn CP 34, 36°48.8'N-07°04.9'W, 01.vi.1984, 180 m: single slightly polysiphonic, 25 mm high colony; no gonothecae.

Description.— Hydrorhiza formed by a tangled mass of perisarcal tubules, that give impression of having anchored colony in mud and giving rise to erect, polysiphonic, branched axis, some of the branches giving rise to secondary ramifications. Axis in monosiphonic part slightly geniculate, divided into segments separated by two or three perisarcal rings, each segment giving rise to one hydrotheca at its extreme distal part. Hydrothecal pedicel composed of four to eight annulations inserting on distinct apophysis. Hydrotheca elongated conical, with smooth lateral walls and smooth, circular hydrothecal rim. Basal part of hydrotheca with oblique hydrothecal diaphragm separating a spacious basal chamber from the rest of the hydrotheca (fig. 67e).

In BALGIM specimen lateral branches always originate from the primary tube just under hydrothecal apophysis, the hydrotheca becoming axillary. Though many ramifications are damaged they demonstrate a tendency towards alternate arrangement on both sides of the axis and to be arranged in one plane, as do also the secondary ramifications. Structure of primary and secondary ramifications as in main axis.

Table 80. Measurements of *Laomedea pseudodichotoma* in µm.

| | BALGIM Stn CP 34 | Gulf of Guinea (Vervoort, 1959) |
|---|---|---|
| Axial segments, length | 800-1080 | 750-900 |
| diameter | 110-130 | 110-150 |
| Total depth of hydrotheca | 540-640 | 540-630 |
| diameter at rim | 250-300 | 270-340 |

In the axil of some hydrothecae there are occasionally short, ringed pedicels of a diameter inferior to that of the hydrothecal pedicel, probably representing pedicels of gonothecae that have disappeared.

Distribution.— So far only known from coastal waters off Ghana, Côte d'Ivoire and Senegal, depth distribution 35-89 m (Vervoort, 1959; Redier, 1971a; Cornelius, 1982). The present record (CP 34) is from the Gulf of Cádiz at a depth of 180 m and considerably extends the distribution of this species to the north. It is, moreover, the first record from European waters.

Discussion.— The description of the BALGIM material perfectly fits that of the original Atlantide material, as do also the measurements.

## Genus **Obelia** Péron & Lesueur, 1810

### **Obelia bidentata** Clarke, 1875
(fig. 68a, b)

*Obelia bidentata* Clarke, 1875: 58, pl. 9 fig. 2.
*Obelia bidentata* - Cornelius, 1975: 260-265, fig. 2; Cornelius, 1982: 113-117; Cornelius, 1990: 547-550, fig. 1; Calder, 1991: 70-72, fig. 37.
*Obelia bicuspidata* Clarke, 1875: 58, pl. 9 fig. 1.
*Laomedea bicuspidata* - Vervoort, 1946b: 298-300, fig. 132.
*Laomedea (Obelia) bicuspidata* - Vervoort, 1968: 19-21, fig. 7.
*Obelia bicuspidata* - Millard, 1975: 226-227, fig. 75C-D.

Material.— BALGIM Stn CP 03, 36°50.4'N-09°14.9'W, 28.v.1984, 681 m: colony 25 mm high, basally polysiphonic, bearing five hydrothecae; no gonothecae.

Description.— Hydrorhiza composed of a tangled mass of perisarcal tubules from which rises an erect, basally slightly polysiphonic axis with three lateral branches arranged alternately in the same plane.

Axis, in monosiphonic part slightly geniculate, divided into segments with two or three basal rings and distally supporting the hydrothecal pedicel; next internode springing from apophysis at base of hydrothecal pedicel (fig. 68a). Side-branch springing from segment just under hydrothecal pedicel; hydrothecae alternately directed left and right. Hydrothecal pedicel with three to six rings; hydrothecae deeply campanulate, slender, with smooth walls narrowing basally and gradually widening distally. Hydrothecal rim with c. ten castellated cusps separated by fairly deep, rounded embayments. Each cusp bicuspidate by presence of less deep, rounded incision, the two resulting teeth each with short, internal carina running downward the depth of the castellated cusp and usually visible externally. Basally hydrotheca with thin laminar diaphragm separating a spacious basal chamber (fig. 68a, b).

Table 81. Measurements of *Obelia bidentata* in µm.

| | BALGIM Stn CP 03 |
|---|---|
| Segments of axis, length | 950-1200 |
| diameter | 120-160 |
| Hydrotheca, total depth | 900-970 |
| diameter at rim | 290-345 |

Structure of branches identical with that of axis, the hydrotheca from whose

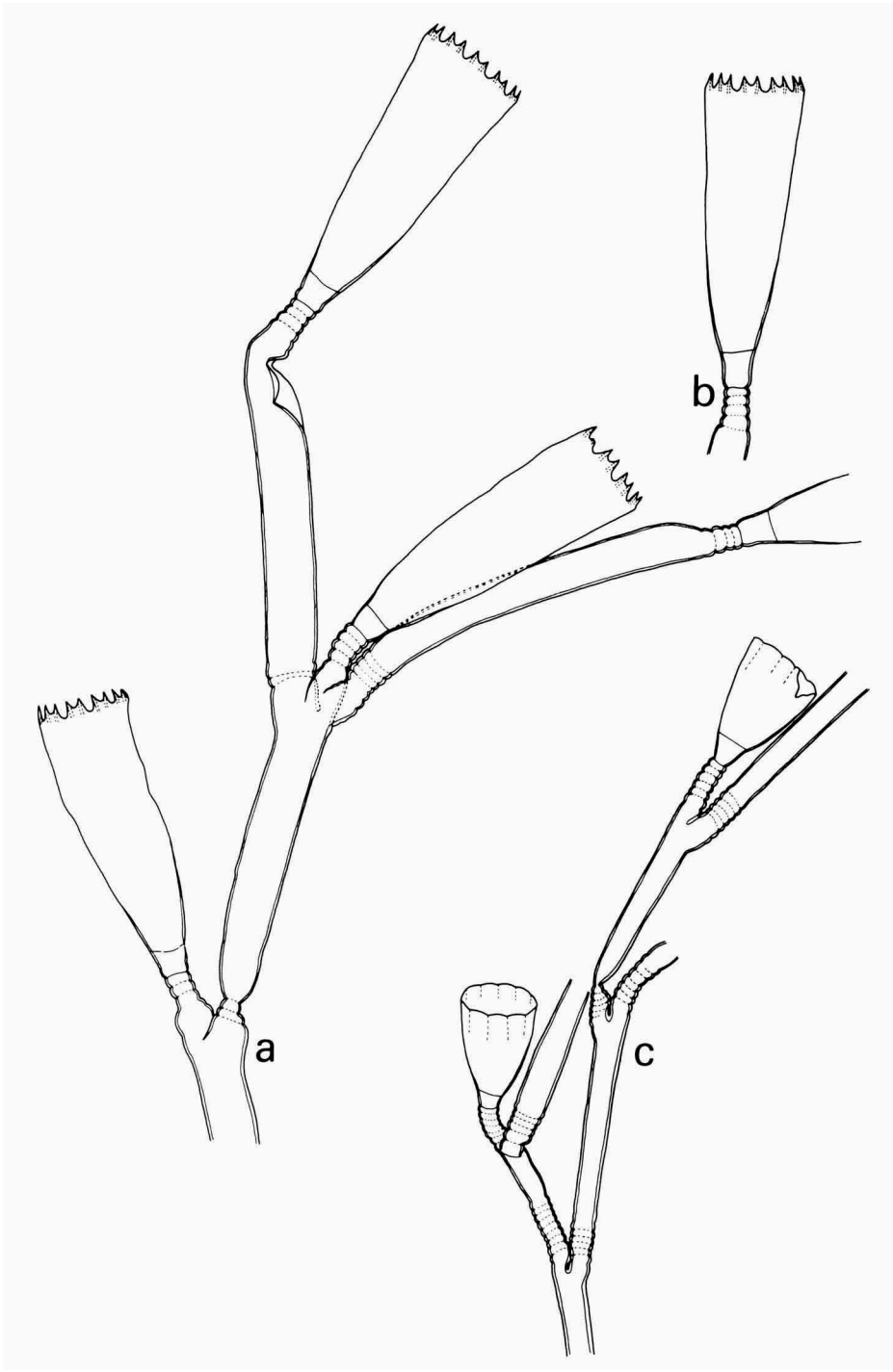


Fig. 68. a, *b*, *Obelia bidentata* Clarke, 1875, from CP 03. a, top part of colony; b, hydrotheca. c, *Obelia dichotoma* (Linnaeus, 1758), from DW 134, part of small colony. a-c, × 68.

base they spring becoming axillary. No secondary ramifications have been observed.

Distribution.— *Obelia bidentata* is well distributed in the tropical and subtropical zones of the great oceans, penetrating deeply in temperate and boreal waters of the northern and southern hemispheres (Cornelius, 1975). In the eastern Atlantic is has been observed from the North Sea (Leloup, 1960) as far south as the Atlantic coasts of South Africa (Millard, 1975). The BALGIM material comes from the Atlantic south of Cape São Vicente (CP 03) at 681 m depth.

Discussion.— The BALGIM material agrees with the general concept of this variable species.

## **Obelia dichotoma** (Linnaeus, 1758)
(fig. 68c)

*Sertularia dichotoma* Linnaeus, 1758: 812.
*Obelia dichotoma* - Hincks, 1868: 156-157, pl. 28 fig. 1; Cornelius, 1990: 550-555, figs. 2-3; Calder, 1991: 72-76, fig. 38.
*Obelia dichotoma* p.p. Cornelius, 1975: 265-272, figs. 3-4; Cornelius, 1982: 117-119.
*Laomedea dichotoma* - Vervoort, 1946b: 292-294, fig. 128.

Material.— BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: two colonies c. 10 mm high on *Sertularella gayi gayi* without gonothcae and in bad shape.— Stn DW 114, 35°45.5'N-06°04.2'W, 11.vi.1984, 150 m: single fragment 7 mm high; no gonothecae.— Stn DW 134, 35°25.8'N-04°17'W, 15.vi.1984, 205 m: fragmentary colonies 5-10 mm high on *Sertularella gayi gayi*. One colony 10 mm high on worm-tube. Also colony 15 mm high composed of several stems. All material without gonothecae.

Description.— Stolon creeping over substrate (other hydroids, fixed substrate), giving rise to erect, monosiphonic, slightly geniculate, occasionally branched axes. Axis divided into segments with a number of annulation basally and bearing a terminal hydrotheca placed on short, ringed pedicel at the base of which there is an apophysis supporting the next segment (fig. 68c); hydrothecae alternately pointing left and right and arranged in same plane. Length of hydrothecal pedicels varied, sometimes short and completely ringed, occasionally longer and with smooth central portion.

Hydrotheca campanulate, walls smoothly curving into basal portion, rim circular and with 10-12 rounded, low cusps, at times difficult to observe; transversal section of hydrotheca just under rim polygonal; angles of polygon marked by indistinct longitudinal plicae on external surface of hydrotheca (fig. 68c). Basal part of hydrotheca with distinct, straight or slightly oblique diaphragm separating off spacious basal chamber.

Table 82. Measurements of *Obelia dichotoma* in µm.

| | BALGIM Stn DW 134 |
|---|---|
| Segment of axis, length | 720-980 |
| diameter | 75-85 |
| Hydrotheca, total depth | 350-420 |
| diameter at rim | 230-285 |

Ramification brought about by development of a branch from longer hydrothecal pedicels just below distal, ringed portion; the structure is as that of the axis.

Distribution.— *Obelia dichotoma* is usually considered to be a cosmopolitan species (Rossi, 1961; Patriti, 1970;

Millard, 1975; Gili, Vervoort & Pagès, 1987). The BALGIM material comes from the Atlantic west of the Strait of Gibraltar (DR 49, DW 114) and from a locality in the Alboran Sea off the coast of Morocco (DW 134), depths between 150 and 521 m.

Discussion.— We have followed Cornelius's most recent (1990) concept of this species. The hydrothecae of the BALGIM material have the characteristic low, rounded cusps at the hydrothecal rim and are polygonal in cross section some distance below that rim; they agree with fig. 3b in Cornelius's 1990 paper, though the diaphragm is quite straight (this character may be considerably influenced by the angle of vision). The BALGIM material is too young to demonstrate the colonial structure attributed by Cornelius to this species though its structure is in no way contradictory to Cornelius's remarks and drawings. In our opinion, therefore, the BALGIM colonies should be attributed to *O. dichotoma* rather than to *Obelia longissima* (Pallas, 1766).

### Obelia spec.

Material.— BALGIM Stn DR 49, 35°53'N-06°32.8'W, 03.vi.1984, 521 m: several damaged colonies 5 mm high and without gonothecae on *Eudendrium* spec.— Stn DR 113, 35°45.4'N-06°04.8'W, 11.vi.1984, 144 m: damaged colony 10 mm high on *Sertularella cylindritheca*.

Discussion.— This material, besides being much damaged, has fully collapsed hydrothecae that inhibit proper identification.

### Unidentifiable hydroid

Material.— BALGIM Stn DR 01, 36°52.9'N-09°15.7' W, 28.v.1984, 720 m: Fragment of stem, probably *Obelia* spec.

## Biogeographical considerations

Hydrographic conditions in the Alboran Sea, Strait of Gibraltar and Ibero-Moroccan Bay may be summarized as follows. Water masses in the Mediterranean (of which the Alboran Sea forms the westward extension) and the Atlantic, or more directly the Ibero-Moroccan Bay, communicate through the fairly narrow Strait of Gibraltar. Communication is influenced by the presence of a sill transversely across the Strait and rising to a depth of c. 280 m below the water surface. In the Straits two superimposed water layers move in opposite directions: the upper 200 m being composed of Atlantic water flowing eastward into the Mediterranean, the deeper layer - 200 m to the depth of the sill - being composed of Mediterranean water flowing westward. Under the influence of Coriolis forces the westward flow gradually curves north-westerly, flowing into the northern part of the Ibero-Moroccan Bay, roughly parallel to the South Spanish Atlantic coast, sinking deeper (until its equilibrium level is reached) as it moves north-westerly and all the time being sandwiched between Atlantic surface and bottom waters. The outflowing Mediterranean water has a considerable effect on sedimentological processes, the bottom in the area of

influence being characterized by coarse detritus. Certain animals groups, as for instance the deep echinoderm fauna and large hexactinellid sponges are known to be considerable influenced by sedimentological conditions in the area influenced by Mediterranean water and appear to avoid that area. For further oceanographic and hydrographic details we refer to Ambar, Howe & Abdullah (1976), Minas, Coste & Minas (1984), and Gascar & Richez (1985).

A total number of 89 (sub)species discussed in the present report has been listed in table I and their main geographical and vertical distributions indicated. The sill in the Straits has been taken as geographical border between Atlantic and Mediterranean: the species occurring at BALGIM stations DR 152 and DR 153 being recorded as occurring in the Mediterranean. Fifteen species have not been recorded in table 1 because of occurrence outside Atlantic and Mediterranean or because of questionable identification. Nine species (*Garveia arborea, Cryptolaria abyssicola, Zygophylax bathyphila, Z. brownei, Z. elongata, Cladocarpus cartieri, C. sigma, C. ventricosus* and *Lytocarpia distans* have not been used for calculations as they do not occur in the area under consideration. This leaves us with 80 species occurring in the Ibero-Moroccan Bay, the Straits of Gibraltar and the Alboran Sea. Thirty species are only recorded from stations in the Ibero-Moroccan Bay, but five of these (*Corydendrium parasiticum, Aglaophenia lophocarpa, Halopteris diaphana* f. *siliquosa, Sertularia distans* and *Synthecium evansii*) are also known to occur in the Mediterranean and should be added to the list of Atlantic-Mediterranean species. Of these five *Synthecium evansii* has generally been considered to be a Mediterranean species, but has, in addition to the Canary Islands record, also been observed in the Ibero-Moroccan Bay. Thus 25 species are exclusively recorded from the Ibero-Moroccan Bay, of which 15 outside and ten inside the zone of influence of Mediterranean water (table 83). *Laomedea pseudodichotoma* has been considered to occur outside that zone, but the locality at which is was recorded (BALGIM Stn CP 34)is at the edge of that zone. Eleven species have only been recorded from Mediterranean stations, but eight of these also occur in the Atlantic and should thus be added to list of Atlantic-Mediterranean species. This leaves us with only three 'Mediterranean' species: *Cladocarpus multiseptatus, C. sinuosus* and *Plumularia falcicula*; the first two have also been recorded from the Indo-Pacific, *P. falcicula* is 'purely' Mediterranean but by its occurrence at BALGIM Stns DR 152 and DR 153 it is close to the Atlantic. Moreover it is a bathyal species occurring at c. 500 m depth and may be expected to have reached Atlantic waters by means of the outflowing Mediterranean water.

The list of species now known from both Atlantic and Mediterranean numbers 52 out of a total of 80 species considered (65%).Twenty-five species (c. 31%) have not been recorded from the Mediterranean and have been found at localities in the Ibero-Moroccan Bay of which 15 (c. 19% of the total of 80 species considered or 60% of the 25 Atlantic species considered) outside the zone of influence of Mediterranean water. The list of fifteen Atlantic species mentioned above includes a large number (10) of bathyal-abyssal species (*Stegolaria geniculata, Stegopoma bathyale, S. giganteum, Zygophylax leloupi, Z. levinseni, Cladocarpus boucheti, C. corneliusi, C. paraventricosus, C. sigma* var. *elongata* and *Cladocarpus* spec.) that are probably unable to cross the sill in the Strait of Gibraltar, their occurrence outside the zone of influence being rather due to preference for great depth than prevailing oceanographic or bottom conditions. Of the five remaining species *L. pseudodichotoma* has been found at a single sta-

tion close to the zone of influence; the remaining four (*H. sessile, P. filicula, Sertularella polyzonias* and *Obelia bidentata,* are definitely out of that zone but represent single deep water records of species that have a much wider distribution and we hesitate to base conclusions of those four. Consequently the evidence of an adverse effect of outflowing Mediterranean water on benthic hydroid distribution in the zone of influence of Mediterranean water is thin, being restricted to c. 15 species, ten of which are bathyal-abyssal species that prefer greater depths than normally found in that zone, one is at the edge of that zone and the four remaining have been recorded from a single locality. These results are not in direct conflict with those obtained by Grasshoff (1989) for the benthic fauna of Gorgonaria, Pennatularia and Antipatharia: "None of the typical bathyal species of the Atlantic enters the Mediterranean sea. In the Ibero-Moroccan Bay they do not settle in the region influenced by the Mediterranean water masses, which hence can be called a faunal barrier" (from Grasshoff's Abstract on p. 201). Though some 'typical bathyal species', as for instance *Zygophylax brownei* appear to have reached the Mediterranean, a fair number stays outside (e.g. all those excluded from our calculations). However, the number of less 'typical' abyssal species (i.e., those with a considerable vertical range) occurring in both Atlantic and Mediterranean is impressive, as a scrutiny of table I shows and many of those are found both inside and outside the zone of influence. It is our impression that preference for greater depth in certain hydroids is more decisive than aversion of the bottom sediment or hydrographical conditions in the zone of influence. For definite conclusions we feel we would need a larger material as species records from a single station give little conviction to conclusions relative to a large area.

Table 83. The geographical and depths distribution of species discussed in present report.

[At = Atlantic; I = Ibero-Moroccan Bay; Io = Ibero-Moroccan Bay outside influence of Mediterranean outflow; S = Strait of Gibraltar; Al = Alboran Sea; M = Mediterranean Sea; L = littoral zone; B = bathyal zone; Ab = abyssal depth; BB = Bay of Biscay]

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Bimeria vestita Wright*, 1859 | At | I | | Al | | L-B | |
| *Garveia arborea* (Browne, 1907) | | | | | | Ab | BB |
| *Garveia nutans* Wright, 1859 | At | | S | | | L-B | |
| *Corydendrium parasiticum* (Linnaeus, 1767) | At | | | | M | L | |
| *Turritopsis nutricula* McCrady, 1859 | At | I | S | Al | M | L | |
| *Eudendrium capillare* Alder, 1856 | At | I | S | Al | M | L-B | |
| *Eudendrium ramosum* (Linnaeus, 1758) | At | I | S | Al | M | L-B | |
| *Leuckartiara octona* (Fleming, 1823) | At | | | Al | M | L-B | |
| *Egmundella amirantensis* Millard & Bouillon, 1973 | | I | | | M | L-B | |
| *Operculariella panicula* (G.O. Sars, 1874) | At | Io | | Al | | L-B | BB |
| *Laodicea undulata* (Forbes & Goodsir, 1853) | At | I | | Al | M | L | |
| *Modeeria rotunda* (Quoy & Gaimard, 1827) | At | I | S | Al | M | L-B | BB |
| *Stegolaria geniculata* (Allman, 1888) | At | Io | | | | B-Ab | BB |
| *Stegopoma bathyale* Vervoort, 1966 | At | Io | | | | B-Ab | |
| *Stegopoma giganteum* spec. nov. | | Io | | | | B-Ab | |
| *Mitrocomella polydiademata* (Romanes, 1876) | At | I | | | | L | |
| *Acryptolaria conferta conferta* (Allman, 1877) | At | I | S | Al | M | B-Ab | BB |
| *Acryptolaria conferta minor* subspec. nov. | At | I | S | Al | | B-Ab | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Acryptolaria crassicaulis* (Allman, 1888) | At | I | | | | B-Ab | BB |
| *Bedotella armata* (Pictet & Bedot, 1900) | | I | S | Al | M | B-Ab | BB |
| *Cryptolarella abyssicola* (Allman, 1888) | | | | | | Ab | BB |
| *Cryptolaria pectinata* (Allman, 1888) | At | | S | | | B-Ab | BB |
| *Filellum* cf. *serratum* (Clarke, 1879) | At | I | S | Al | | B-Ab | |
| *Lafoea dumosa* (Fleming, 1820) | At | I | S | Al | M | L-B-Ab | BB |
| **Zygophylax bathyphila* Leloup, 1940 | | | | | | B-Ab | BB |
| *Zygophylax biarmata* Billard, 1905 | At | I | S | Al | | L-B | BB |
| **Zygophylax brownei* Billard, 1924 | | | | | M | L-B | BB |
| **Zygophylax elongata* spec. nov. | At | | | | | B-Ab | |
| *Zygophylax leloupi* spec. nov. | At | Io | | | | B-Ab | |
| *Zygophylax levinseni* (Saemundsson, 1911) | At | Io | | | | B-Ab | BB |
| *Halecium delicatulum* Coughtrey, 1876 | At | I | | Al | M | L-B | |
| *Halecium sessile* Norman, 1867 | At | Io | | | | L-B | |
| *Halecium sibogae marocanum* Billard, 1934 | | I | S | Al | | L-B | |
| *Halecium tenellum* Hincks, 1861 | At | I | | Al | | L-B | |
| *Aglaophenia kirchenpaueri* (Heller, 1868) | At | | | Al | M | L-B | |
| *Aglaophenia* cf. *lophocarpa* Allman, 1877 | At | I | | | M | L-B | |
| *Aglaophenia picardi* Svoboda, 1979 | At | | S | | M | L-B | |
| *Aglaophenia tubulifera* (Hincks, 1861) | At | I | S | Al | M | L-B | |
| *Cladocarpus boucheti* spec. nov. | At | Io | | | | L-B | |
| **Cladocarpus cartieri* Bedot, 1921 | At | | | | | L-B | |
| *Cladocarpus corneliusi* spec. nov. | At | Io | | | | L-B | BB |
| *Cladocarpus* cf. *multiseptatus* (Bale, 1915) | | | | Al | | L-B | |
| *Cladocarpus paraventricosus* spec. nov. | | Io | | | | B-Ab | |
| *Cladocarpus pectiniferus* Allman, 1883 | At | I | | Al | | B-Ab | |
| **Cladocarpus sigma* (Allman, 1877) | At | | | | | L-B | |
| *Cladocarpus sigma* var. *elongata* Bedot, 1921 | At | Io | | | | B-Ab | |
| *Cladocarpus sinuosos* Vervoort, 1966 | | | | Al | | B | |
| **Cladocarpus ventricosus* Allman, 1877 | At | | | | | L-B | |
| *Cladocarpus* spec. | | Io | | | | B-Ab | |
| **Lytocarpia distans* (Allman, 1877) | At | | | | | B-Ab | |
| *Lytocarpia myriophyllum* (Linnaeus, 1758) | At | I | | Al | M | L-B-Ab | BB |
| *Antennella secundaria* (Gmelin, 1791) | At | I | S | Al | M | L-B | |
| *Halopteris catharina* (Johnston, 1833) | At | I | | Al | M | L-B | |
| *Halopteris diaphana* f. *siliquosa* Hincks, 1877 | At | I | | | M | L-B | |
| *Schizotricha frutescens* (Ellis & Solander, 1786) | At | I | S | Al | M | L-B | |
| *Kirchenpaueria bonnevieae* (Billard, 1906) | At | I | | Al | | L-B | BB |
| *Kirchenpaueria bonnevieae simplex* Billard, 1930 | | I | S | | | L-B | |
| *Kirchenpaueria pinnata* (Linnaeus, 1758) | At | | | Al | M | L | |
| *Nemertesia antennina* (Linnaeus, 1758) | At | I | S | Al | M | L-B | BB |
| *Nemertesia irregularis* (Quelch, 1885) | At | I | | | | L | BB |
| *Nemertesia ramosa* Lamarck, 1816 | At | I | | Al | M | L-B | BB |
| *Nemertesia ventriculiformis* (M.-T., 1890) | At | I | S | Al | M | L-B | |
| *Plumularia falcicula* spec. nov. | | | S | Al | | B | |
| *Plumularia filicula* Allman, 1877 | At | Io | | | | B | |
| *Plumularia marocana* Billard, 1930 | At | I | | | | B | |
| *Plumularia setacea* (Linnaeus, 1758) | At | I | S | Al | M | L-B | BB |
| *Polyplumaria flabellata* G.O. Sars, 1874 | At | I | S | Al | M | L-B | |
| *Diphasia attenuata* (Hincks, 1866) | At | | S | | | L-B | |
| *Diphasia attenuata* var. *robusta* Billard, 1924 | | I | | | | L-B | |
| *Diphasia delagei* Billard, 1912 | At | I | | | | L-B | |
| *Diphasia margareta* (Hassall, 1841) | At | I | S | Al | M | L-B | |
| *Diphasia pinastrum* (Cuvier, 1830) | At | I | S | Al | | L-B | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Diphasia rosacea* (Linnaeus, 1758) | At | I | | | | L-B | |
| *Diphasia* spec. | | I | | | | L-B | |
| *Hydrallmania falcata.* | At | I | | | | L-B | BB |
| *Sertularella cylindritheca* (Allman, 1888) | At | I | | Al | | L-B | BB |
| *Sertularella gayi gayi* (Lamouroux, 1821) | At | I | | Al | | L-B | BB |
| *Sertularella gayi robusta* Allman, 1873 | At | I | S | | | L-B | |
| *Sertularella polyzonias* (Linnaeus, 1758) | At | Io | | | | L-B | BB |
| *Sertularia distans* Lamouroux, 1816 | At | I | | | M | L-B | |
| *Thuiaria* spec. | At | | | Al | | L-B | |
| *Synthecium evansi* (Ellis & Solander, 1786) | At | I | | | M | L-B | |
| *Campanularia hincksii* Alder, 1856 | At | I | S | Al | M | L-B | BB |
| *Clytia gracilis* (M. Sars, 1850) | At | I | | Al | M | L-B | |
| *Clytia linearis* (Thornely, 1899) | At | I | | Al | | L | |
| *Clytia paulensis* (Vanhöffen, 1910) | | I | | Al | M | L | |
| *Laomedea pseudodichotoma* Vervoort, 1959 | At | Io | | | | L-B | |
| *Obelia bidentata* Clarke, 1875 | | Io | | | | L | |
| *Obelia dichotoma* (Linnaeus, 1758) | At | I | Al | | | L | BB |

Species not recorded in list:
Unidentifiable athecate hydroid
Corymorphid or tubularioid hydroid
*Eudendrium* spec.
**Zygophylax flexilis* (Pictet & Bedot, 1900)
*Halecium* spec. 1
*Halecium* spec. 2
*Aglaophenia* spec.
**Cladocarpus distomus* Clarke, 1907
**Cladocarpus stechowi* spec. nov.
**Cladocarpus anonymus* spec. nov.
**Cladocarpus sibogae* Billard, 1911
**Kirchenpaueria ventruosa* (Billard, 1911)
*Nemertesia* spec.
*Clytia* spec.
*Obelia* spec.

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