Atlantic Leptolida (Hydrozoa, Cnidaria) of the families Aglaopheniidae, Halopteridídae, Kirchenpaueriidae and Plumulariidae collected during the CANCAP and Mauritania-II expeditions of the National Museum of Natural History, Leiden, the Netherlands

CANCAP-project. Contributions, no. 125

J. Ansín Agís, F. Ramil & W. Vervoort

Ansín Agís, J., F. Ramil & W. Vervoort. Atlantic Leptolida (Hydrozoa, Cnidaria) of the families Aglaopheniidae, Halopteridídae, Kirchenpaueriidae and Plumulariidae collected during the CANCAP and Mauritania-II expeditions of the National Museum of Natural History, Leiden, the Netherlands.
Zool. Verh. Leiden 333, 29.vi.2001: 1-268, figs 1-97.— ISSN 0024-1652/ISBN 90-73239-79-6.
J. Ansín Agís & F. Ramil, Depto de Ecoloxía e Bioloxía Animal, Universidade de Vigo, Spain; e-mail addresses: agis@uvigo.es & framil@uvigo.es.
W. Vervoort, National Museum of Natural History, Leiden, The Netherlands; e-mail: vervoort@naturalis.nnm.nl.

Key words: Cnidaria; Hydrozoa; Leptolida; Aglaopheniidae; Halopteridídae; Kirchenpaueriidae; Plumulariidae; north-eastern Atlantic; geographical distribution.
Forty-six species of the superfamily Plumularioidea (Hydrozoa, Cnidaria) and some material identified to the generic level, collected by the CANCAP and Mauritania-II expeditions of the Rijkmuseum van Natuurlijke Historie (now Nationaal Natuurhistorisch Museum) in the period 1976-1988, are described, as well as two other species that were used in the present study. In addition to the descriptions, synonymy, variability and geographical distribution are discussed; autoecological data and measurements are also presented. The new species described here are: *Aglaophenia svobodai* spec. nov., *Streptocaulus caboverdensis* spec. nov., *S. chonae* spec. nov., *Antennella confusa* spec. nov. and *Nemertesia anonyma* spec. nov. All species are figured. The general classification used follows Bouillon (1985, 1995); nomenclature on the species level is as used by Svoboda & Cornelius (1991), Ramil & Vervoort (1992a, 1992b), Calder (1997) and Schuchert (1997). The material originates from the seas and coasts around the Azores, Madeira, Selvagens, Canary Islands and Cape Verde Islands, as well as the Atlantic off Morocco and Mauritania, at depths varying between 0 and 4000 m. All species discussed have a wider, usually Atlantic distribution, with the exception of *Streptocaulus pulcherrimus* Allman, 1883, endemic in the Cape Verde area and *Nemertesia belini* Bedot, 1916, known only from the Azores and Cape Verde Islands.

Contents

Introduction

The leptolid material forming the basis of this study was collected in the years 1976-1986 during the CANCAP expeditions of the Rijksmuseum van Natuurlijke Historie, now Nationaal Natuurhistorisch Museum (National Museum of Natural History), Leiden, The Netherlands, to the Canarian-Cape Verde region of the eastern Atlantic and during a subsequent cruise off Mauritania (Mauritania-II expedition, 1988). After preliminary sorting and study in Leiden part of it was transferred to the 'Departamento de Ecoloxía e Bioloxía Animal' of the University of Vigo, Spain, where it was studied in detail by the first author. The results of this study were laid down in the memoir on which he obtained his Doctor's degree at Vigo University in July 1998. As this memoir had a very restricted circulation and can not be considered a publication in the sense of the 'Code for Zoological Nomenclature' it was decided that a proper publication should be prepared that would also give the new species sound scientific standing. A re-description of several type specimens of *Nemertesia* species, used in the identification of CANCAP *Nemertesia*'s, will be given elsewhere (Ansín Agís, in prep.).

In the course of the expeditions leptolid material, taken on board with a variety of

collecting gear, was roughly sorted and preserved in ethanol 80% or formalin 6% in sea water; it was then processed in the laboratory, involving final sorting, storage in ethanol 80% and preparation of slides. The standard procedure used to obtain slides for microscopic observation involved staining in diluted haemalum Mayer (Merck) for c. 5 minutes, dehydration in a series of ethanol-water mixtures of increasing ethanol concentration, ending in 96% ethanol, removal of the remaining water in a saturated solution of phenol in xylene, a short rinse in pure xylene and embedding in Malinol (Chroma, Köngen, Germany). The material is now partly stored in the collections the National Museum of Natural History, Leiden, The Netherlands (indicated by RMNH-Coel. and a slide number[1]), partly in the Departamento de Ecoloxía e Bioloxía Animal, Universidade de Vigo, Spain (indicated by DEBA-UV and a number). Only those references not listed in Vervoort, 1995, are fully cited in the list of references at the end of this paper.

List of the stations
(figs 1-17)

CANCAP Stations:

Stn 1.K16, SE coast of Madeira, Ponta de São Lourenço, W of Prainha, 32°44'N 16°44'W, rocky shore with tide pools, shore collecting, 0-1 m, 29.ii, 01.iii & 03.iii.1976: *Aglaophenia picardi* Svoboda, 1979.

Stn 1.029, SE of Madeira; 32°41'N 16°46'W, 340 m, Van Veen grab, 09.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.072, E of Madeira, 32°41'N 16°35'W, 80 m, Van Veen grab, 14.iii.1976: *Aglaophenia tubulifera* (Hincks, 1861).

Stn 1.D80, S coast of Madeira, near Ponta da Atalaia; 32°39'N 16°49'W, 0-22 m, Scuba diving, 15.iii.1976: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 1.D82, S coast of Madeira, near Ponta da Oliveira; 32°39'N 16°49'W, 0-20 m, Scuba diving, 15.iii.1976: *Aglaophenia lophocarpa* Allman, 1877; *Aglaophenia octodonta* (Heller, 1868); *Halopteris alternata* (Nutting, 1900); *Plumularia setacea* (Linnaeus, 1758).

Stn 1.093, S of Madeira, 32°38'N 16°50'W, 98-105 m, triangular dredge, 16.iii.1976: *Aglaophenia tubulifera* (Hincks, 1861); *Nemertesia ramosa* (Lamarck, 1816).

Stn 1.094, S of Madeira, 32°39'N 16°49'W, 125-150 m, triangular dredge, 16.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.097, S of Madeira, 32°38'N 16°49'W, 193-196 m, rectangular dredge, 16.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.098, S of Madeira, 32°38'N 16°49'W, 220-226 m, rectangular dredge, 16.iii.1976: *Lytocarpia distans* (Allman, 1877); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791).

Stn 1.099, S of Madeira, 32°38'N 16°49'W, 280-300 m, rectangular dredge, 16.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.102, S of Madeira, 32°38'N 16°49'W, 300 m, triangular and rectangular dredge, 16.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus pectiniferus* (Allman, 1883); *Streptocaulus sinuosus* (Vervoort, 1966); *Antennella secundaria* (Gmelin, 1791); *Kirchenpaueria pinnata* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

Stn 1.108, S of Madeira, 32°42'N 16°44'W, 180-210 m, triangular dredge, 17.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.112, S of Madeira, 32°37'N 16°49'W, 180-210 m, triangular dredge, 17.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

[1]RMNH-Coel. ####, slide(s) #### indicates presence of both a sample and slide(s); RMNH-Coel. #### = slides(s) #### indicates exclusive presence of slides.

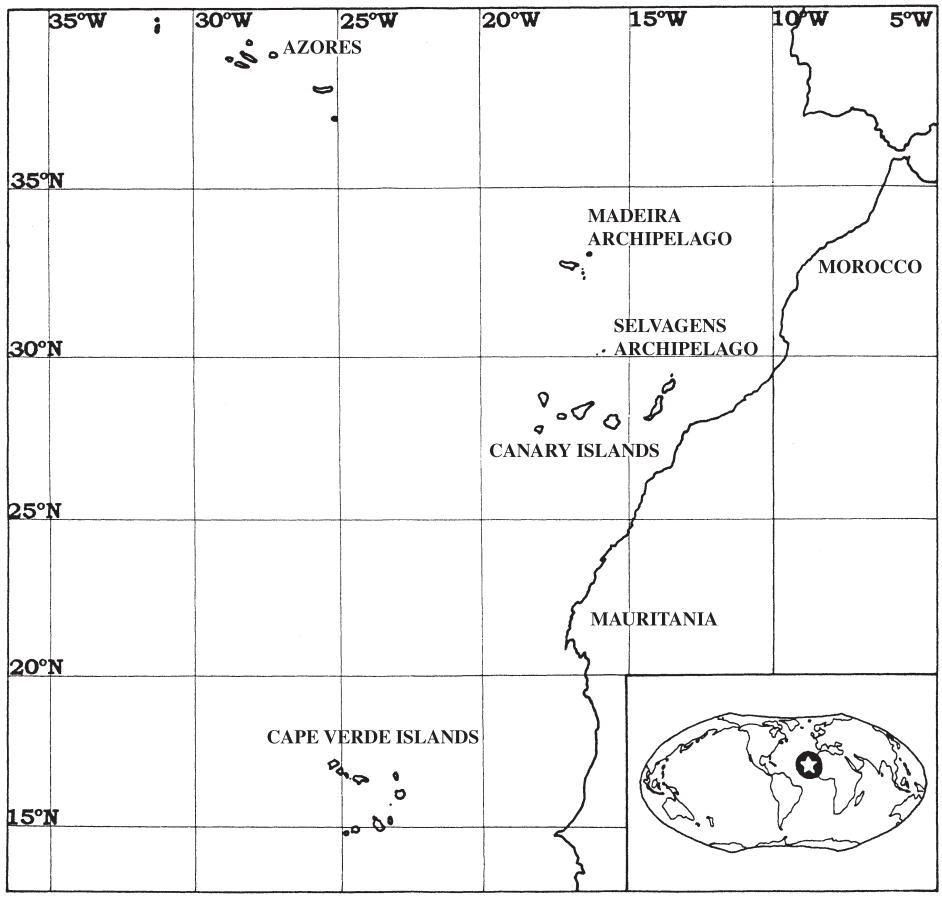


Fig. 1. Area studied during the CANCAP and Mauritania-II Expeditions of the Rijksmuseum van Natuurlijke Historie (now National Museum of Natural History), Leiden, the Netherlands.

Stn 1.114, S of Madeira, 32°38'N 16°48'W, 280-320 m, rectangular dredge, 17.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791); *Plumularia setacea* (Linnaeus, 1758).

Stn 1.118, Morocco, off Cape Dra, 28°22'N 11°47'W, 48 m, 5 m beam trawl, 23.iii.1976: *Aglaophenia acacia* Allman, 1883; *Aglaophenia parvula* Bale, 1882; *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758).

Stn 1.121, Morocco, off Cape Hadid, 32°01'N 09°57'W, 125 m, Van Veen grab 3 x, 23.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.130, Morocco, off Cap Blanc du Nord, 33°17'N 09°10'W, 273 m, triangular dredge, 26.iii.1976: *Nemertesia perrieri* (Billard, 1901).

Stn 1.138, Morocco, off Cap Blanc du Nord, 33°16'N 09°13'W, 410 m, triangular dredge, 27.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 1.145, Morocco, off Cap Blanc du Nord, 33°14'N 08°49'W, 100 m, triangular dredge, 28.iii.1976: *Antennella siliquosa* (Hincks, 1877); *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 1.154, Morocco, off Cap de Mazagan, 33°40'N 08°45'W, 570 m, Agassiz trawl, 28.iii.1976: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 2.039, Morocco, W of Cape Yubi, 28°02'N 13°26'W, 1010 m, 2.4 m Agassiz trawl, 26.viii.1977: *Lyto-*

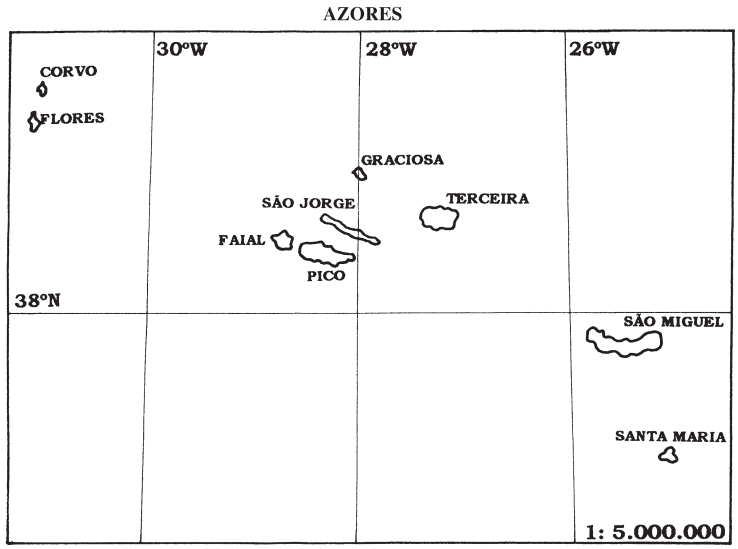


Fig. 2. Azores Archipelago; position of the various islands.

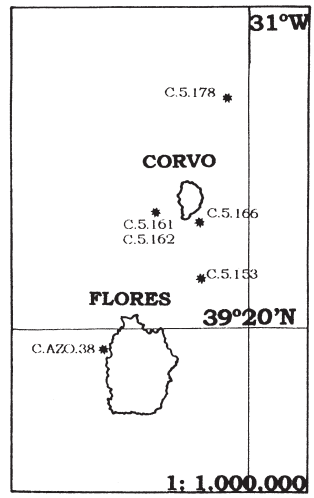


Fig. 3. Azores Archipelago; location of CANCAP stations at islands Corvo and Flores.

carpia myriophyllum (Linnaeus, 1758); *Streptocaulus corneliusi* (Ramil & Vervoort, 1992).

Stn 2.047, Canary Islands, SE of Fuerteventura, Punta de Gran Tarajal, 28°11'N 14°02'W, 100-125 m, 1.2 m Agassiz trawl, 27.viii.1977: *Nemertesia ramosa* (Lamarck, 1816).

Stn 2.048, Canary Islands, SE of Fuerteventura, Punta de Gran Tarajal, 28°14'N 13°51'W, 100 m, Van Veen grab, 27.viii.1977: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890).

Stn 2.058, Morocco, W of Cape Yubi, 27°58'N 13°24'W, 500 m, 5 m beam trawl, 28.viii.1977: *Lytocarpia myriophyllum* (Linnaeus, 1758).

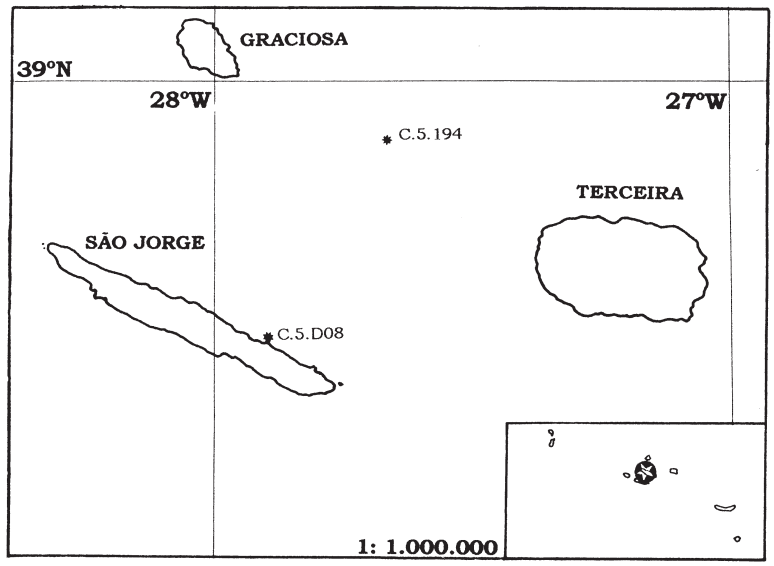


Fig. 4. Azores Archipelago; location of CANCAP stations at islands São Jorge, Terceira and Graciosa.

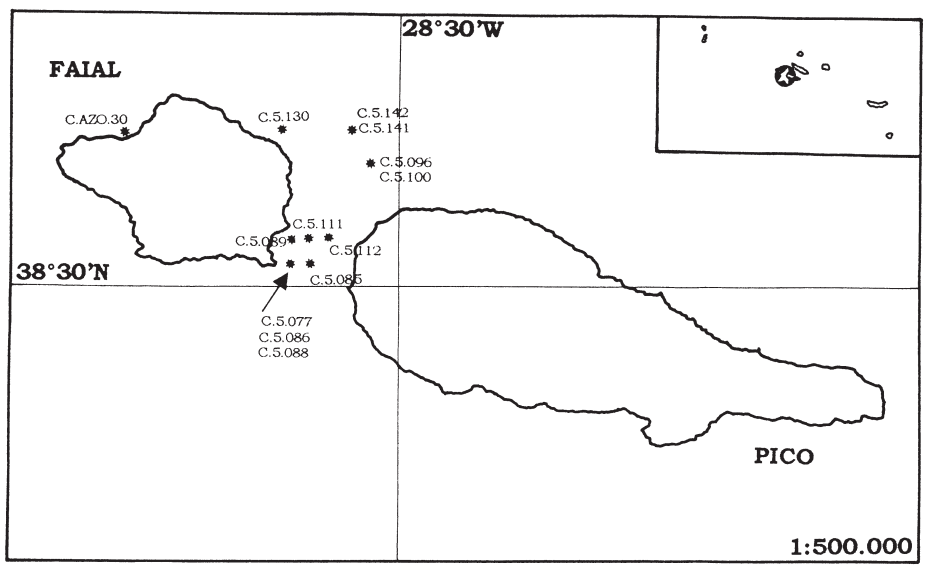


Fig. 5. Azores Archipelago; location of CANCAP stations at islands Faial and Pico.

Stn 2.072, Canary Islands, S of Fuerteventura, Punta del Morro Jable, 28°02'N 14°20'W, 92-114 m, triangular dredge, 30.viii.1977: *Nemertesia antennina* (Linnaeus, 1758).

Stn 2.119, Canary Islands, SW of Hierro, off Punta de Orchilla, 27°42'N 18°09'W, 335 m, rectangular dredge, 30.viii.1977: *Aglaophenia* spec.; *Gymnangium sinuosum* (Fraser, 1925); *Nemertesia falcicula* (Ramil & Vervoort, 1992); *Plumularia setacea* (Linnaeus, 1758).

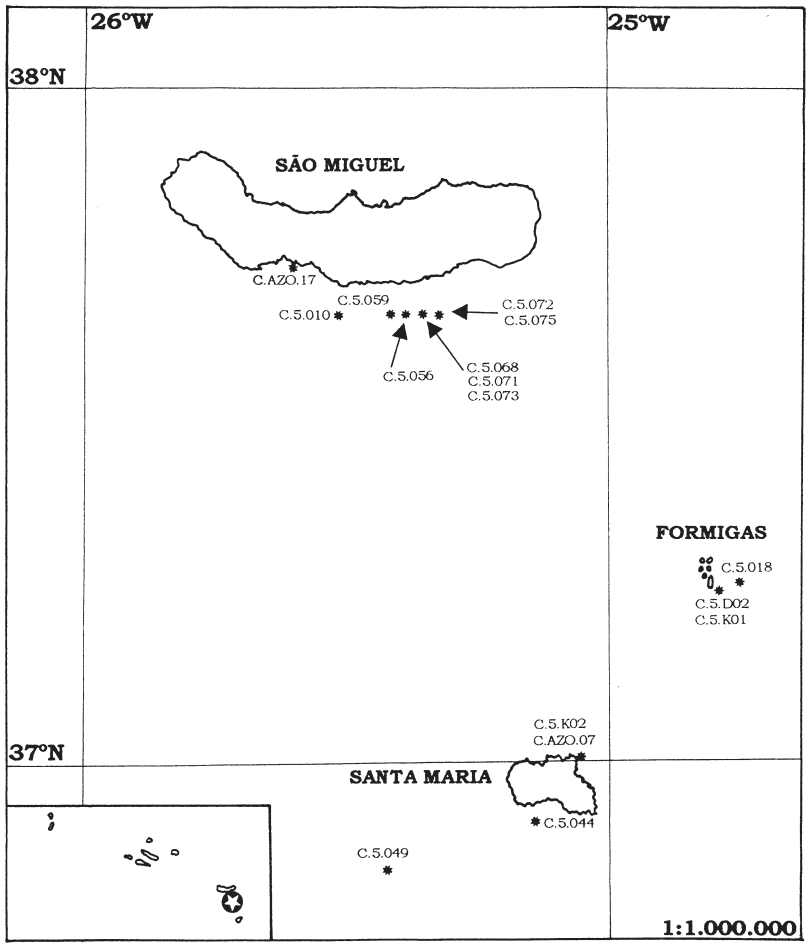


Fig. 6. Azores Archipelago; location of CANCAP stations at islands São Miguel, Formigas and Santa Maria.

Stn 2.130, Canary Islands, SW of Hierro, off Punta de Orchilla, 27°40'N 18°10'W, 1500-1800 m, 1.2 m Agassiz trawl, 08.ix.1977: *Aglaophenia lophocarpa* Allman, 1877; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus corneliusi* (Ramil & Vervoort, 1992); *Streptocaulus chonae* spec. nov.; *Nemertesia falcicula* (Ramil & Vervoort, 1992); *Pseudoplumaria* spec.

Stn 2.162, Canary Islands, S of Hierro, off Punta de la Restinga, 27°35'N 17°59'W, 550-800 m, rectangular dredge, 10.ix.1977: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 2.D01, Canary Islands, SW coast of Fuerteventura, Punta de Jandia, 28°04'N 14°30'W, 10-15 m, Scuba diving, 24 & 31.viii.1977: *Aglaophenia pluma* (Linnaeus, 1758); *Monotheca margaretta* Nutting, 1900.

Stn 2.D04, Canary Islands, S coast of Fuerteventura, near Punta del Morro Jable, 28°04'N 14°20'W, 10-15 m, Scuba diving, 30.viii.1977: *Aglaophenia pluma* (Linnaeus, 1758); *Monotheca margaretta* Nutting, 1900.

Stn 2.D07, Canary Islands, S coast of Hierro, W of Punta de los Saltos, Puerto de Naos, 27°39'N 18°00'W, 10-15 m, Scuba diving, 03 & 10.ix.1977: *Aglaophenia pluma* (Linnaeus, 1758).

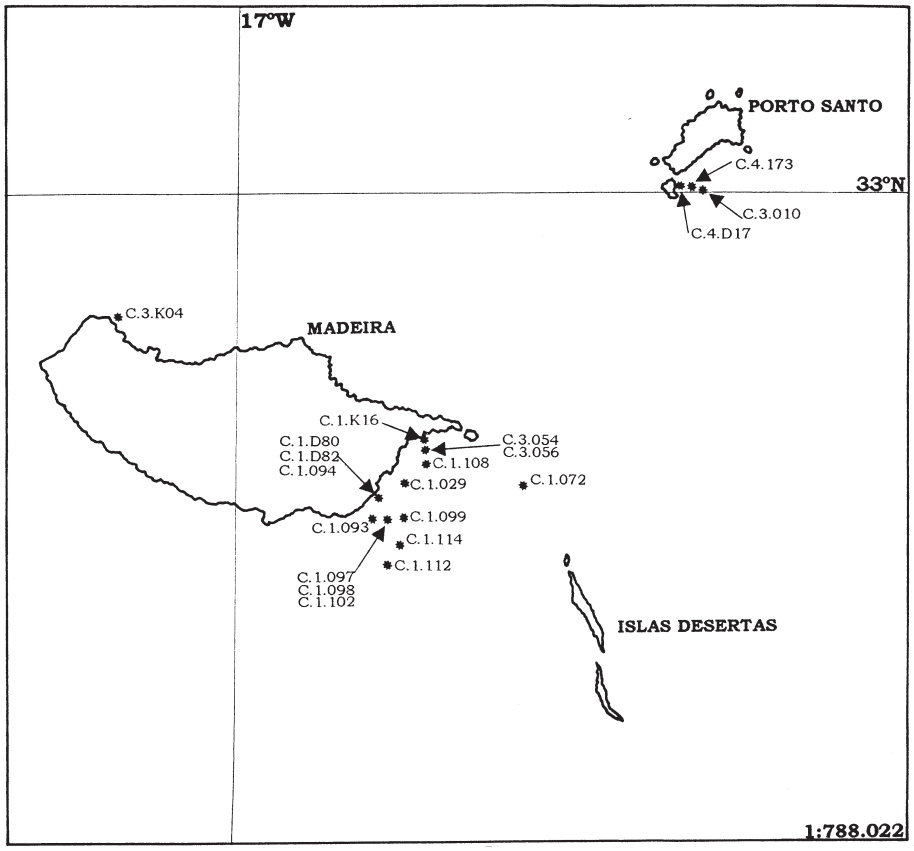


Fig. 7. Madeira area; location of CANCAP stations at islands Madeira and Porto Santo.

Stn 2.D08, Canary Islands, SW coast of Hierro, off Faro de Orchilla, 27°42'N 18°08'W, 5-25 m, Scuba diving, 05/09.ix.1977: *Aglaophenia kirchenpaueri* (Heller, 1868); *Aglaophenia pluma* (Linnaeus, 1758); *Antennella campanulaformis* (Mulder & Trebilcock, 1909); *Halopteris diaphana* (Heller, 1868); *Monotheca margaretta* Nutting, 1900; *Plumularia floridana* Nutting, 1900.

Stn 2.D09, Canary Islands, S coast of Hierro, Tecerone, 27°41'N 18°02'W, 10-15 m, Scuba diving, 09 & 10.ix.1977: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 3.010, Madeira Archipelago, S of Porto Santo, 33°00'N 16°21'W, 410-630 m, triangular dredge, 14.x.1978: *Antennella secundaria* (Gmelin, 1791).

Stn 3.054, SE of Madeira, 32°43'N 16°44'W, 300-320 m, rectangular dredge, 20.x.1978: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 3.056, SE of Madeira, 32°43'N 16°44'W, 280-480 m, rectangular dredge, 20.x.1978: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791).

Stn 3.083, Selvagens Archipelago, S of Selvagem Pequena, 30°01'N 16°01'W, 192 m, Van Veen grab, 22.x.1978: *Aglaophenia lophocarpa* Allman, 1877; *Antennella secundaria* (Gmelin, 1791); *Plumularia setacea* (Linnaeus, 1758).

Stn 3.085, Selvagens Archipelago, S of Selvagem Pequena, 30°01'N 16°01'W, 140-160 m, rectangular dredge, 22.x.1978: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 3.086, Selvagens Archipelago, S of Selvagem Pequena, 30°01'N 16°00'W, 140-170 m, rectangular dredge, 22.x.1978: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791).

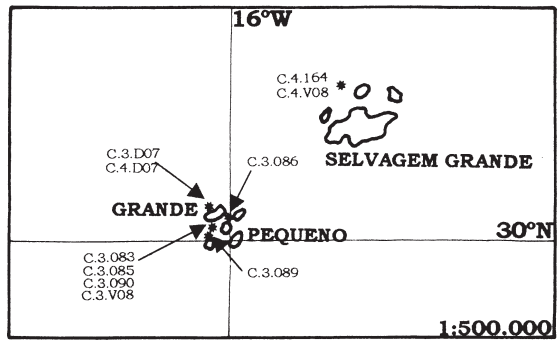


Fig. 8. Selvagens Archipelago; location of CANCAP stations.

Stn 3.089, Selvagens Archipelago, S of Selvagem Pequena, 30°00'N 16°01'W, 200-260 m, rectangular dredge, 22.x.1978: *Aglaophenia lophocarpa* Allman, 1877; *Streptocaulus pectiniferus* (Allman, 1883); *Nemertesia ramosa* (Lamarck, 1816).

Stn 3.090, Selvagens Archipelago, S of Selvagem Pequena, 30°01'N 16°01'W, 250-300 m, rectangular dredge, 22.x.1978: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

Stn 3.182, off Mauritania, 20°21'N 17°02'W, 12 m, 1.2 m Agassiz trawl, 01.xi.1978: *Aglaophenia octodonta* (Heller, 1868); *Nemertesia antennina* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

Stn 3.D07, Selvagens Archipelago, E coast of Selvagem Pequena, 30°02'N 16°01'W, up to 20 m, Scuba diving, 22.x.1978: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 3.V08, Selvagens Archipelago, Selvagem Grande, 30°01'N 16°01'W, 102 m, baited winged fish-trap, 22/23.x.1978: *Aglaophenia kirchenpaueri* (Heller, 1868).

Stn 3.K04, NE coast of Madeira, Porto de Moniz, 32°52'N 17°10'W, coastal swimming pool, 11 & 12.x.1978: *Macrorhynchia philippina* (Kirchenpauer, 1872).

Stn AZO.07, Azores, Santa Maria, E coast, Baía de São Lourenço, 37°00'N 25°03'W, 0-1 m, shore collecting, 16.ix.1979: *Aglaophenia octodonta* (Heller, 1868).

Stn AZO.17, Azores, São Miguel, S coast, E of Praia do Pópulo, in front of church, 37°45'N 25°36'W, 0-1 m, shore collecting and snorkling, 23.ix.1979: *Aglaophenia octodonta* (Heller, 1868).

Stn AZO.30, Azores, Faial, Fajã, Praia do Norte, 38°37'N 28°45'W, 0-1 m, shore collecting, 07, 09 & 18.x.1979: *Aglaophenia pluma* (Linnaeus, 1758).

Stn AZO.38, Azores, Flores, W coast, Porto do Fajã Grande, 39°28'N 31°15'W, 0-1 m, shore collecting, 21 & 22.x.1979: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 4.003, Canary Islands, S of Lanzarote, 28°50'N 13°48'W, 21-24 m, triangular dredge, 14.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Aglaophenia pluma* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

Stn 4.004, Canary Islands, S of Lanzarote, 28°50'N 13°48'W, 26-37 m, triangular dredge, 14.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Aglaophenia pluma* (Linnaeus, 1758).

Stn 4.012, Canary Islands, S of Lanzarote, 28°51'N 13°51'W, 34-46 m, triangular dredge, 14.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868).

Stn 4.015, Canary Islands, S of Lanzarote, 28°51'N 13°52'W, 35-70 m, triangular dredge, 14.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Aglaophenia pluma* (Linnaeus, 1758); *Nemertesia perrieri* (Billard, 1901).

Stn 4.017, Canary Islands, S of Lanzarote, 28°49'N 13°49'W, 36 m, triangular dredge, 15.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Plumularia setacea* (Linnaeus, 1758).

Stn 4.019, Canary Islands, S of Lanzarote, 28°48'N 13°50'W, 37-40 m, triangular dredge 2 x, 15.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Plumularia setacea* (Linnaeus, 1758).

Stn 4.021, Canary Islands, S of Lanzarote, 28°50'N 13°48'W, 24-34 m, Van Veen grab, 15.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868).

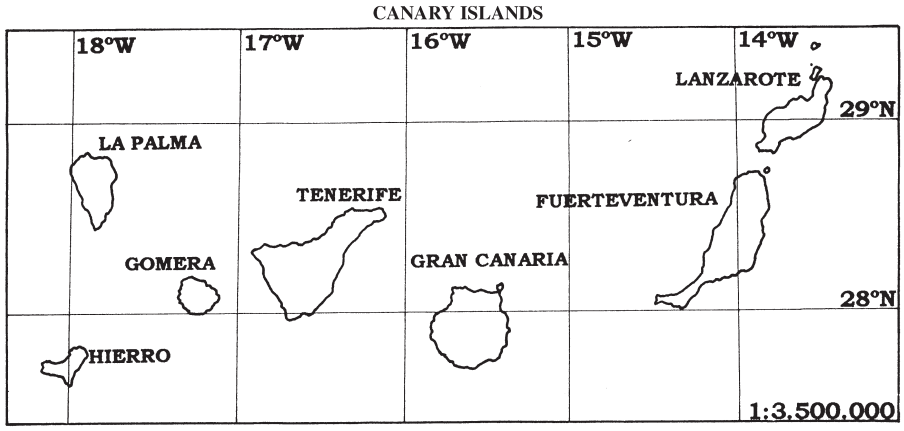


Fig. 9. Canary Islands; position of the various islands.

Stn 4.023, Canary Islands, S of Lanzarote, 28°49'N 13°49'W, 38-40 m, triangular dredge, 15.v.1980: *Nemertesia perrieri* (Billard, 1901).

Stn 4.026, Canary Islands, S of Lanzarote, 28°48'N 13°49'W, 37-38 m, triangular dredge, 15.v.1980: *Nemertesia perrieri* (Billard, 1901).

Stn 4.030, Canary Islands, S of Lanzarote, 28°49'N 13°48'W, 26-31 m, triangular dredge, 15.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Nemertesia perrieri* (Billard, 1901).

Stn 4.039, Canary Islands, S of Lanzarote, 28°48'N 13°47'W, 70-50 m, rectangular dredge, 16.v.1980: *Monostaechas quadridens* (McCrady, 1859).

Stn 4.040, Canary Islands, S of Lanzarote, 28°48'N 13°46'W, 45-70 m, rectangular dredge, 16.v.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.070, Canary Islands, SE of Lanzarote, 28°56'N 13°33'W, 41-50 m, triangular dredge, 20.v.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.084, Canary Islands, SE of Lanzarote, 28°54'N 13°33'W, c. 500 m, rectangular dredge, 21.v.1980: *Nemertesia* spec.1.

Stn 4.089, Canary Islands, E of Lanzarote, 29°08'N 13°26'W, 45 m, rectangular dredge, 21.v.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.090, Canary Islands, E of Lanzarote, 29°08'N 13°25'W, 65 m, Hamon grab, 21.v.1980: *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia* spec.

Stn 4.091, Canary Islands, E of Lanzarote, 29°08'N 13°25'W, 55-82 m, triangular dredge, 21.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

Stn 4.092, Canary Islands, E of Lanzarote, 29°08'N 13°25'W, 92 m, Van Veen grab, 22.v.1980: *Nemertesia antennina* (Linnaeus, 1758).

Stn 4.097, Canary Islands, E of Lanzarote, 29°08'N 13°26'W, 50-60 m, 1.2 m Agassiz trawl, 22.v.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.098, Canary Islands, E of Lanzarote, 29°08'N 13°26'W, 50-70 m, 1.2 m Agassiz trawl, 22.v.1980: *Aglaophenia kirchenpaueri* (Heller, 1868); *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.138, Canary Islands, SW of Palma, 28°39'N 17°58'W, 75 m, Van Veen grab, 02.vi.1980: *Antennella secundaria* (Gmelin, 1791); *Nemertesia ramosa* (Lamarck, 1816).

Stn 4.141, Canary Islands, SW of Palma, 28°39'N 17°58'W, 75 m, Hamon grab, 02.vi.1980: *Nemertesia ramosa* (Lamarck, 1816).

Stn 4.143, Canary Islands, SW of Palma, 28°38'N 17°58'W, 110-86 m, rectangular dredge, 02.vi.1980: *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Nemertesia antennina* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

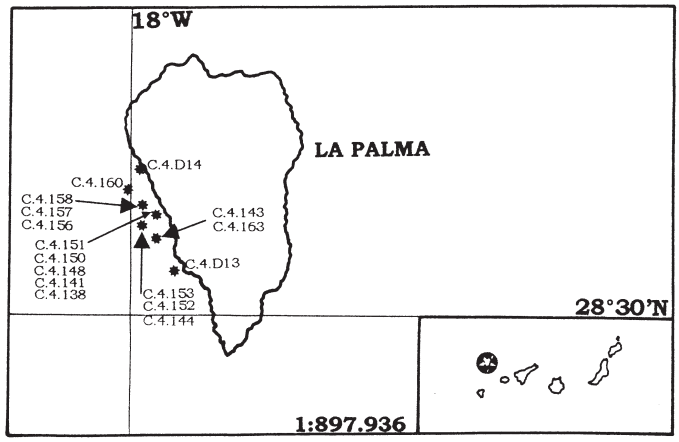


Fig. 10. Canary Islands; location of CANCAP stations at La Palma.

Stn 4.144, Canary Islands, SW of Palma, 28°38'N 17°59'W, 200-140 m, rectangular dredge, 02.vi.1980: *Aglaophenia lophocarpa* Allman, 1877; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791).

Stn 4.148, Canary Islands, SW of Palma, 28°39'N 17°58'W, 60-80 m, rectangular dredge, 03.vi.1980: *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Nemertesia ramosa* (Lamarck, 1816).

Stn 4.150, Canary Islands, SW of Palma, 28°39'N 17°58'W, 90-50 m, 1.2 m Agassiz trawl, 03.vi.1980: *Aglaophenia tubulifera* (Hincks, 1861).

Stn 4.151, Canary Islands, SW of Palma, 28°39'N 17°58'W, 150-50 m, 1.2 m Agassiz trawl, 03.vi.1980: *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Antennella siliquosa* (Hincks, 1877).

Stn 4.152, Canary Islands, SW of Palma, 28°39'N 17°59'W, 180-120 m, 1.2 m Agassiz trawl, 03.vi.1980: *Aglaophenia tubulifera* (Hincks, 1861); *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791); *Nemertesia ramosa* (Lamarck, 1816).

Stn 4.153, Canary Islands, SW of Palma, 28°38'N 17°59'W, 200 m, 1.2 m Agassiz trawl, 03.vi.1980: *Aglaophenia lophocarpa* Allman, 1877; *Aglaophenia tubulifera* (Hincks, 1861); *Aglaophenia* spec.; *Antennella secundaria* (Gmelin, 1791).

Stn 4.156, Canary Islands, SW of Palma, 28°39'N 17°59'W, 310 m, Van Veen grab 2x, 04.vi.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.157, Canary Islands, SW of Palma, 28°39'N 17°59'W, 250-200 m, rectangular dredge, 04.vi.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.158, Canary Islands, SW of Palma, 28°39'N 17°59'W, 350-250 m, rectangular dredge, 04.vi.1980: *Aglaophenia lophocarpa* Allman, 1877; *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.160, Canary Islands, SW of Palma, 28°40'N 18°00'W, 500 m, Van Veen grab, 04.vi.1980: *Streptocaulus corneliusi* (Ramil & Vervoort, 1992).

Stn 4.163, Canary Islands, SW of Palma, 28°38'N 17°58'W, 450-375 m, rectangular dredge, 05.vi.1980: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn 4.164, Selvagens Archipelago, 30°07'N 15°53'W, 500-400 m, rectangular dredge, 06.vi.1980: *Streptocaulus pectiniferus* (Allman, 1883).

Stn 4.173, Madeira Archipelago, Porto Santo, 33°01'N 16°22'W, 25-40 m, triangular dredge, 09.vi.1980: *Kirchenpaueria halecioides* (Alder, 1859).

Stn 4.D01, Canary Islands, S coast of Lanzarote, W of Punta Papagayo, 28°50'N 13°47'W, 0-15 m, shore collecting and Scuba diving, 14/19.v.1980: *Aglaophenia pluma* (Linnaeus, 1758).

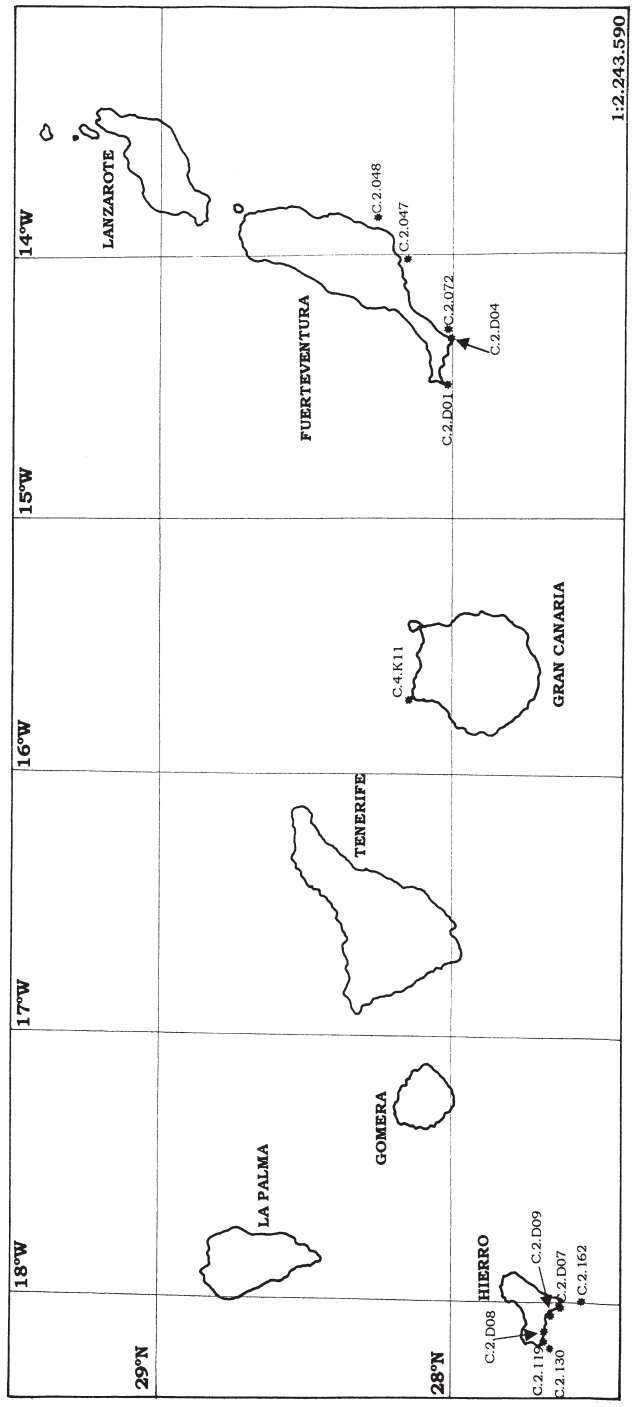


Fig. 11. Canary Islands; location of CANCAP stations at islands Hierro, Gran Canaria and Fuerteventura.

Stn 4.D02, Canary Islands, S coast of Lanzarote, E of Punta Papagayo, 28°51'N 13°47'W, 0-15 m, Scuba diving, 19.v.1980: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 4.D07, Selvagens Archipelago, S coast of Selvagem Pequena, 30°02'N 16°01'W, 10-20 m, Scuba diving, 06.vi.1980: *Aglaophenia pluma* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758).

Stn 4.D13, Canary Islands, W coast of La Palma, N of Puerto de Naos, 28°36'N 17°55'W, 0-15 m, Scuba diving, 03.vi.1980: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 4.D14, Canary Islands, W coast of La Palma, Tijarafe, 28°42'N 17°58'W, 0-20 m, Scuba diving, 04 & 05.vi.1980: *Aglaophenia picardi* Svoboda, 1979; *Aglaophenia pluma* (Linnaeus, 1758).

Stn 4.D17, Madeira Archipelago, Porto Santo, SE coast of Baixo 33°00'N 16°23'W, 5-20 m, Scuba diving, 09 & 10.vi.1980: *Aglaophenia pluma* (Linnaeus, 1758).

Stn 4.V08, Selvagens Archipelago, S of Selvagem Grande, 30°07'N 15°53'W, 260 m, fish-, shrimp- and snail-traps, 26/27.v.1980: *Aglaophenia lophocarpa* Allman, 1877; *Antennella secundaria* (Gmelin, 1791).

Stn 4.K11, Canary Islands, NW coast of Gran Canaria, Puerto de las Nieves, 28°06'N 15°42'W, submerged rock barrier, 0-8 m, 04 & 05.vi.1980: *Aglaophenia octodonta* (Heller, 1868).

Stn 4.K12, Canary Islands, SE coast of Lanzarote, Arrecife, 28°57'N 13°33'W, rocky shore, tide pools, shallow sandy bay, 0-2 m, 21.v.1980: *Aglaophenia picardi* Svoboda, 1979; *Aglaophenia pluma* (Linnaeus, 1758); *Halopteris alternata* (Nutting, 1900); *Kirchenpaueria pinnata* (Linnaeus, 1758).

Stn 5.010, Azores, S of São Miguel, 37°41'N 25°31'W, 150 m, Van Veen grab, 26.v.1981: *Nemertesia belini* Bedot, 1916; *Nemertesia norvegica* (G.O. Sars, 1874); *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.018, Azores, E of Formigas, 37°16'N 24°45'W, 43-45 m, Van Veen grab, 27.v.1981: *Aglaophenia octodonta* (Heller, 1868).

Stn 5.044, Azores, S of Santa Marta, 36°55'N 25°08'W, 60-150 m, rectangular dredge, 29.v.1981: *Aglaophenia acacia* Allman, 1883; *Aglaophenia tubulifera* (Hincks, 1861); *Halopteris catharina* (Johnston, 1833); *Nemertesia antennina* (Linnaeus, 1758); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.049, Azores, SW of Santa Marta, 36°49'N 25°25'W, 2200-2450 m, 2.4 m Agassiz trawl, 30.v.1981: *Nemertesia antennina* (Linnaeus, 1758).

Stn 5.056, Azores, S of São Miguel, 37°41'N 25°26'W, 180 m, Van Veen grab, 31.v.1981: *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.059, Azores, S of São Miguel, 37°41'N 25°27'W, 146 m, Van Veen grab, 31.v.1981: *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.068, Azores, S of São Miguel, 37°41'N 25°25'W, 210 m, Van Veen grab, 31.v.1981: *Streptocaulus pectiniferus* (Allman, 1883).

Stn 5.071, Azores, S of São Miguel, 37°49'N 25°25'W, 220 m, Van Veen grab, 31.v.1981: *Aglaophenia lophocarpa* Allman, 1877.

Stn 5.072, Azores, S of São Miguel, 37°41'N 25°24'W, 315 m, Van Veen grab, 31.v.1981: *Halopteris catharina* (Johnston, 1833); *Plumularia* spec.

Stn 5.073, Azores, S of São Miguel, 37°41'N 25°25'W, 245 m, Van Veen grab, 31.v.1981: *Streptocaulus pectiniferus* (Allman, 1883).

Stn 5.075, Azores, S of São Miguel, 37°41'N 25°25'W, 196 m, Van Veen grab, 31.v.1981: *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.077, Azores, E of Faial, 37°31'N 28°36'W, 56-64 m, Van Veen grab, 01.vi.1981: *Nemertesia antennina* (Linnaeus, 1758).

Stn 5.085, Azores, E of Faial, 38°31'N 28°35'W, 150-170 m, 1.2 m Agassiz trawl, 01.vi.1981: *Aglaophenia tubulifera* (Hincks, 1861); *Halopteris catharina* (Johnston, 1833); *Plumularia* spec.; *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.086, Azores, E of Faial, 38°31'N 28°36'W, 95-120 m, 1.2 m Agassiz trawl, 01.vi.1981: *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.088, Azores, E of Faial, 38°31'N 28°36'W, 50-60 m, rectangular dredge, 01.vi.1981: *Aglaophenia acacia* Allman, 1883; *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758).

Stn 5.089, Azores, E of Faial, 38°32'N 28°36'W, 50-70 m, rectangular dredge, 01.vi.1981: *Nemertesia ramosa* (Lamarck, 1816).

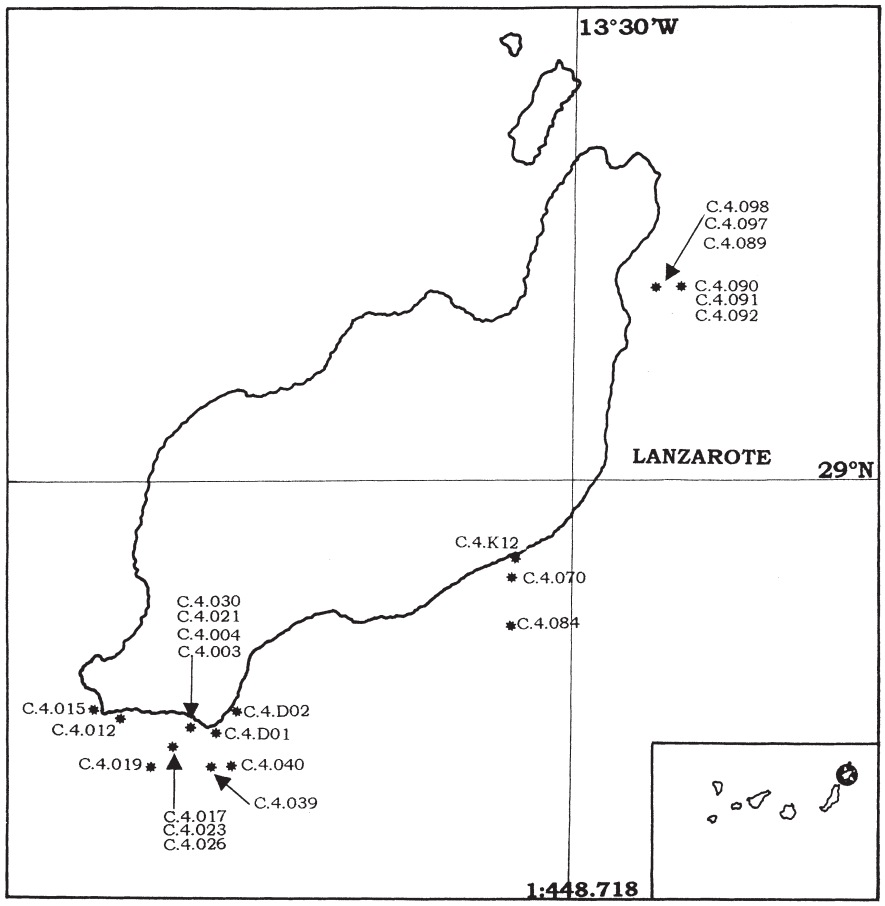


Fig. 12. Canary Islands; location of CANCAP stations at island Lanzarote.

Stn 5.096, Azores, W of Pico, 38°34'N 28°32'W, 52 m, Van Veen grab, 02.vi.1981: *Aglaophenia acacia* Allman, 1883; *Aglaophenia tubulifera* (Hincks, 1861); *Antennella secundaria* (Gmelin, 1791); *Halopteris catharina* (Johnston, 1833); *Nemertesia ramosa* (Lamarck, 1816).

Stn 5.100, Azores, W of Pico, 38°34'N 28°32'W, 55 m, triangular dredge, 02.vi.1981: *Aglaophenia acacia* Allman, 1883.

Stn 5.111, Azores, E of Faial, 38°32'N 28°35'W, 140 m, Van Veen grab, 03.vi.1981: *Nemertesia ramosa* (Lamarck, 1816).

Stn 5.112, Azores, W of Pico, 38°32'N 28°34'W, 85 m, Van Veen grab, 03.vi.1981: *Halopteris catharina* (Johnston, 1833); *Nemertesia antennina* (Linnaeus, 1758).

Stn 5.130, Azores, E of Faial, 38°35'N 28°38'W, 80-90 m, Van Veen grab, 06.vi.1981: *Aglaophenia acacia* Allman, 1883; *Aglaophenia tubulifera* (Hincks, 1861); *Plumularia setacea* (Linnaeus, 1758).

Stn 5.141, Azores, W of Pico, 38°35'N 28°33'W, 82-87 m, 1.2 m Agassiz trawl, 07.vi.1981: *Aglaophenia acacia* Allman, 1883; *Nemertesia ramosa* (Lamarck, 1816).

Stn 5.142, Azores, W of Pico, 38°35'N 28°33'W, 108-118 m, rectangular dredge, 07.vi.1981: *Aglaophenia acacia* Allman, 1883; *Antennella secundaria* (Gmelin, 1791); *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758); *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.153, Azores, E of Flores, 39°26'N 31°06'W, 150-168 m, rectangular dredge, 09.vi.1981: *Polyplumaria flabellata* G.O. Sars, 1874; *Antennella/Halopteris* spec.

Stn 5.161, Azores, N of Flores, 39°31'N 31°10'W, 45 m, triangular dredge, 10.vi.1981: *Aglaophenia tubulifera* (Hincks, 1861).

Stn 5.162, Azores, N of Flores, 39°31'N 31°10'W, 75 m, Van Veen grab, 10.vi.1981: *Aglaophenia tubulifera* (Hincks, 1861).

Stn 5.166, Azores, NE of Flores, 39°30'N 31°06'W, 150 m, rectangular dredge, 10.vi.1981: *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.178, Azores, SE of Corvo, 39°41'N 31°03'W, c. 650 m, rectangular dredge, 11.vi.1981: *Aglaophenia tubulifera* (Hincks, 1861).

Stn 5.194, Azores, W of Terceira, 38°54'N 27°40'W, 2419-2476 m, 3.5 m Agassiz trawl, 13.vi.1981: *Aglaophenia octodonta* (Heller, 1868); *Polyplumaria flabellata* G.O. Sars, 1874.

Stn 5.D02, Azores, Formigas, 37°16'N 24°47'W, 0-15 m, Scuba diving, 27.v.1981: *Aglaophenia pluma* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791).

Stn 5.D08, Azores, N coast of São Jorge, E of Ponta da Caldeira, 38°37'N 28°54'W, up to 15 m, Scuba diving, 04.vi.1981: *Aglaophenia octodonta* (Heller, 1868).

Stn 5.K01, Azores, Formigas, 37°16'N 24°47'W, tide pools and fissures with strong currents, 27.v.1981: *Aglaophenia octodonta* (Heller, 1868).

Stn 5.K02, Azores, E coast of Santa Maria, Baía de São Lourenço, 37°00'N 25°03'W, rock flat with holes and tide pools, many algae, 28.v.1981: *Aglaophenia octodonta* (Heller, 1868).

Stn 6.004, Cape Verde Islands, S of São Tiago, 14°54'N 23°30'W, 63-58 m, Van Veen grab 3 x, 05.vi.1982: *Monostaechas quadridens* (McCrady, 1859).

Stn 6.020, Cape Verde Islands, W of São Tiago, 15°01'N 23°44'W, 470 m, Van Veen grab 3 x, 06.vi.1982: *Streptocaulus caboverdensis* spec. nov.

Stn 6.033, Cape Verde Islands, SW of Brava, 14°49'N 24°45'W, 540 m, rectangular dredge, 08.vi.1982: *Antennella confusa* spec. nov.

Stn 6.038, Cape Verde Islands, W of Fogo, 14°55'N 24°31'W, 29 m, rectangular dredge, 09.vi.1982: *Aglaophenia lophocarpa* Allman, 1877.

Stn 6.048, Cape Verde Islands, SW of Fogo, 14°52'N 24°32'W, 800-1000 m, rectangular dredge, 10.vi.1982: *Antennella secundaria* (Gmelin, 1791); *Plumularia* spec.

Stn 6.049, Cape Verde Islands, SW of Fogo, 14°52'N 24°32'W, 1100-1300 m, 1.2 m Agassiz trawl, 10.vi.1982: *Aglaophenia lophocarpa* Allman, 1877.

Stn 6.050, Cape Verde Islands, SW of Fogo, 14°53'N 24°32'W, 1100-1200 m, 1.2 m Agassiz trawl, 10.vi.1982: *Aglaophenia lophocarpa* Allman, 1877; *Plumularia* spec.

Stn 6.058, Cape Verde Islands, SE of Boa Vista, 15°58'N 22°46'W, 34 m, 1.2 m Agassiz trawl, 12.vi.1982: *Aglaophenia lophocarpa* Allman, 1877.

Stn 6.060, Cape Verde Islands, SE of Boa Vista, 15°57'N 22°45'W, 50-55 m, 1.2 m Agassiz trawl, 12.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883.

Stn 6.062, Cape Verde Islands, SE of Boa Vista, 15°55'N 22°46'W, 82-98 m, 1.2 m Agassiz trawl, 12.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883; *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia* spec.

Stn 6.065, Cape Verde Islands, E of Boa Vista, 15°58'N 22°33'W, 950-1040 m, 2.4 m Agassiz trawl, 12/13.vi.1982: *Streptocaulus caboverdensis* spec. nov.

Stn 6.067, Cape Verde Islands, SW of Boa Vista, 15°55'N 23°00'W, 58-62 m, 1.2 m Agassiz trawl, 13.vi.1982: *Aglaophenia svobodai* spec. nov.; *Streptocaulus pulcherrimus* Allman, 1883; *Antennella siliquosa* (Hincks, 1877); *Monostaechas quadridens* (McCrady, 1859).

Stn 6.069, Cape Verde Islands, SW of Boa Vista, 15°53'N 23°00'W, 76-90 m, 1.2 m Agassiz trawl, 13.vi.1982: *Aglaophenia svobodai* spec. nov.; *Streptocaulus pulcherrimus* Allman, 1883; *Nemertesia ramosa* (Lamarck, 1816); *Nemertesia anonyma* spec. nov.; *Plumularia* spec.

Stn 6.070, Cape Verde Islands, SW of Boa Vista, 15°56'N 23°05'W, 107 m, Van Veen grab 3 x, 13.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883.

Stn 6.071, Cape Verde Islands, SW of Boa Vista, 15°55'N 23°06'W, 110 m, rectangular dredge, 13.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus pulcherrimus* Allman, 1883.

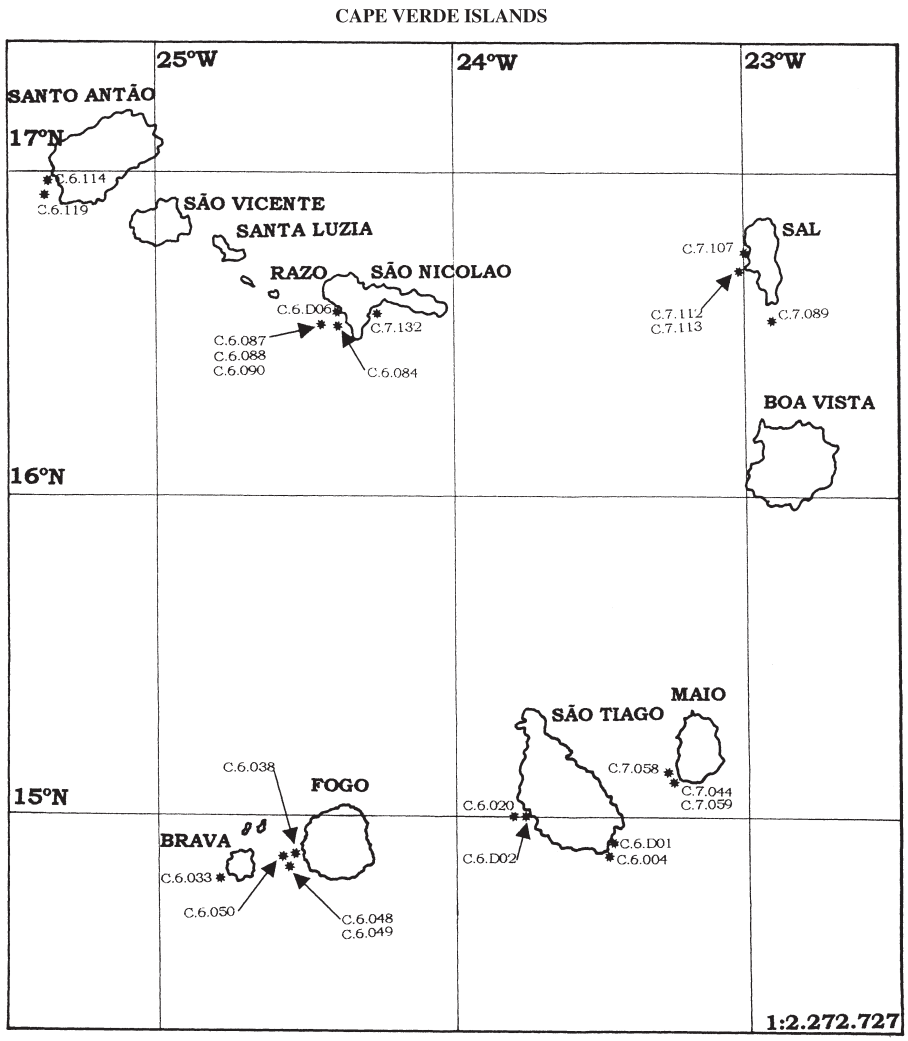


Fig. 13. Cape Verde Archipelago; location of CANCAP stations.

Stn 6.072, Cape Verde Islands, SW of Boa Vista, 15°54'N 23°06'W, 110 m, rectangular dredge, 13.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus pulcherrimus* Allman, 1883; *Nemertesia belini* Bedot, 1916.

Stn 6.074, Cape Verde Islands, SW of Boa Vista, 15°55'N 23°04'W, 91 m, rectangular dredge, 13.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883; *Monostaechas quadridens* (McCrady, 1859); *Nemertesia belini* Bedot, 1916; *Plumularia* spec.

Stn 6.075, Cape Verde Islands, SW of Boa Vista, 15°55'N 23°04'W, 90 m, rectangular dredge, 13.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.076, Cape Verde Islands, SW of Boa Vista, 15°55'N 23°05'W, 92 m, 1.2 m Agassiz trawl, 13.vi.1982: *Aglaophenia svobodai* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Monostaechas quadridens* (McCrady, 1859); *Nemertesia belini* Bedot, 1916; *Plumularia setacea* (Linnaeus, 1758); *Plumularia* spec.

Stn 6.078, Cape Verde Islands, SW of Boa Vista, 15°55'N 23°06'W, 185-190 m, 1.2 m Agassiz trawl, 13.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791); *Nemertesia belini* Bedot, 1916; *Plumularia* spec.

Stn 6.080, Cape Verde Islands, SW of Boa Vista, 15°56'N 23°08'W, 220-250 m, 1.2 m Agassiz trawl, 13.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus pulcherrimus* Allman, 1883; *Streptocaulus caboverdensis* spec. nov.; *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.084, Cape Verde Islands, S of São Nicolau, 16°34'N 24°22'W, 72 m, Van Veen grab, 14.vi.1982: *Plumularia setacea* (Linnaeus, 1758).

Stn 6.087, Cape Verde Islands, S of São Nicolau, 16°34'N 24°23'W, 300-445 m, rectangular dredge, 14.vi.1982: *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890).

Stn 6.088, Cape Verde Islands, S of São Nicolau, 16°34'N 24°23'W, 460-540 m, rectangular dredge, 14.vi.1982: *Antennella confusa* spec. nov.

Stn 6.090, Cape Verde Islands, S of São Nicolau, 16°34'N 24°23'W, 260-300 m, rectangular dredge, 14.vi.1982: *Streptocaulus caboverdensis* spec. nov.

Stn 6.102, Cape Verde Islands, SW of Santa Luzia, 16°44'N 24°46'W, 25-33 m, rectangular dredge, 16.vi.1982: *Aglaophenia latecarinata* Allman, 1877.

Stn 6.104, Cape Verde Islands, SSW of Santa Luzia, 16°43'N 24°46'W, 110-150 m, rectangular dredge, 16.vi.1982: *Nemertesia ramosa* (Lamarck, 1816).

Stn 6.106, Cape Verde Islands, SSW of Santa Luzia, 16°43'N 24°47'W, 150-300 m, rectangular dredge, 16.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus pulcherrimus* Allman, 1883; *Monostaechas quadridens* (McCrady, 1859).

Stn 6.108, Cape Verde Islands, SW of Santa Luzia, 16°44'N 24°46'W, 55-65 m, rectangular dredge, 16.vi.1982: *Nemertesia ramosa* (Lamarck, 1816).

Stn 6.109, Cape Verde Islands, SW of Santa Luzia, 16°44'N 24°46'W, 55-80 m, 1.2 m Agassiz trawl, 16.vi.1982: *Nemertesia ramosa* (Lamarck, 1816).

Stn 6.110, Cape Verde Islands, SW of Santa Luzia, 16°44'N 24°46'W, 60-80 m, 1.2 m Agassiz trawl, 16.vi.1982: *Nemertesia ramosa* (Lamarck, 1816).

Stn 6.114, Cape Verde Islands, SW of Santo Antão, 16°58'N 25°20'W, 200 m, Van Veen grab, 17.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883.

Stn 6.119, Cape Verde Islands, SW of Santo Antão, 16°57'N 25°20'W, 591-396 m, rectangular dredge, 17.vi.1982: *Antennella confusa* spec. nov.; *Nemertesia* spec. 2.

Stn 6.131, Cape Verde Islands, S of São Vicente, 16°47'N 25°02'W, 30-43 m, 1.2 m Agassiz trawl, 19.vi.1982: *Aglaophenia svobodai* spec. nov.; *Plumularia setacea* (Linnaeus, 1758).

Stn 6.137, Cape Verde Islands, S of São Vicente, 16°46'N 25°03'W, 75-90 m, 1.2 m Agassiz trawl, 19.vi.1982: *Aglaophenia svobodai* spec. nov.; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nematophorus clarkei* (Nutting, 1900); *Streptocaulus pulcherrimus* Allman, 1883; *Antennella siliquosa* (Hincks, 1877); *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.139, Cape Verde Islands, S of São Vicente, 16°45'N 25°04'W, 400-500 m, rectangular dredge, 19.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883; *Antennella secundaria* (Gmelin, 1791); *Antennella confusa* spec. nov.; *Nemertesia* spec. 2.

Stn 6.144, Cape Verde Islands, SW of São Vicente, 16°49'N 25°06'W, 51 m, 1.2 m Agassiz trawl, 20.vi.1982: *Halopteris alternata* (Nutting, 1900); *Halopteris polymorpha* (Billard, 1913); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.146, Cape Verde Islands, SW of São Vicente, 16°48'N 25°06'W, 75 m, 1.2 m Agassiz trawl, 20.vi.1982: *Nematophorus clarkei* (Nutting, 1900).

Stn 6.148, Cape Verde Islands, SW of São Vicente, 16°47'N 25°06'W, 100-200 m, 1.2 m Agassiz trawl, 20.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Streptocaulus pulcherrimus* Allman, 1883; *Antennella siliquosa* (Hincks, 1877); *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758); *Plumularia* spec.

Stn 6.151, Cape Verde Islands, SW of São Vicente, 16°47'N 25°05'W, 300-500 m, rectangular dredge, 20.vi.1982: *Streptocaulus pulcherrimus* Allman, 1883.

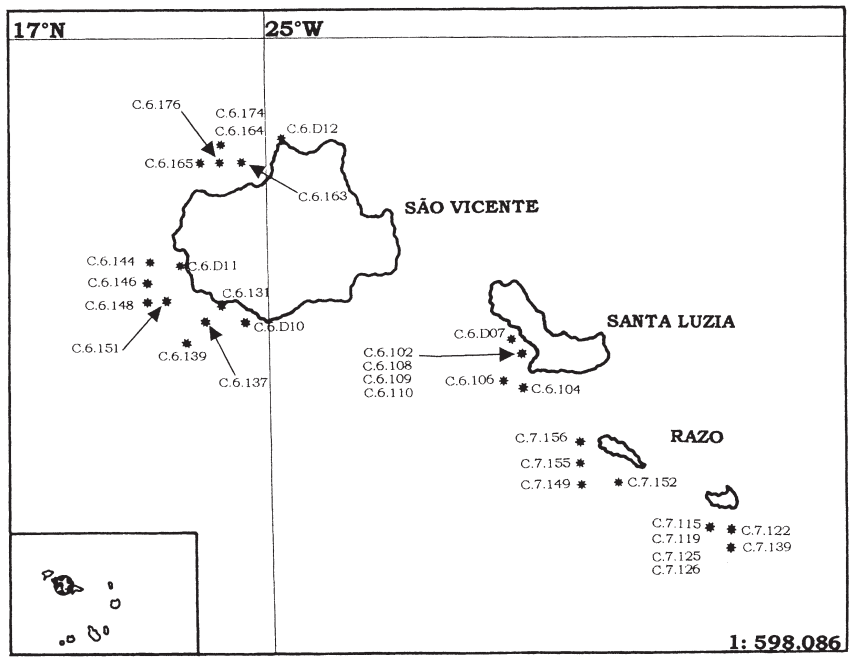


Fig. 14. Cape Verde Archipelago; location of CANCAP stations at islands São Vicente, Santa Luzia and Razo.

Stn 6.163, Cape Verde Islands, NW of São Vicente, 16°54'N 25°01'W, 45-50 m, 1.2 m Agassiz trawl, 21.vi.1982: *Monostaechas quadridens* (McCrady, 1859).

Stn 6.164, Cape Verde Islands, NW of São Vicente, 16°55'N 25°02'W, 67 m, Van Veen grab 2 x, 21.vi.1982: *Antennella siliquosa* (Hincks, 1877); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.165, Cape Verde Islands, NW of São Vicente, 16°54'N 25°03'W, 74-78 m, triangular dredge, 21.vi.1982: *Antennella siliquosa* (Hincks, 1877); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.174, Cape Verde Islands, NW of São Vicente, 16°55'N 25°02'W, 75 m, 1.2 m Agassiz trawl, 22.vi.1982: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia ramosa* (Lamarck, 1816).

Stn 6.176, Cape Verde Islands, NW of São Vicente, 16°54'N 25°02'W, 54-62 m, 1.2 m Agassiz trawl, 22.vi.1982: *Nematophorus clarkei* (Nutting, 1900); *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.D01, Cape Verde Islands, S coast of São Tiago, SE of Porto Praia, 14°55'N 23°30'W, 0-15 m, Scuba diving, 04 & 05.vi.1982: *Nematophorus clarkei* (Nutting, 1900); *Halopteris alternata* (Nutting, 1900); *Halopteris carinata* Allman, 1877; *Halopteris polymorpha* (Billard, 1913); *Plumularia setacea* (Linnaeus, 1758).

Stn 6.D02, Cape Verde Islands, W coast of São Tiago, Baía de Santa Clara, 15°01'N 23°44'W, 0-20 m, Scuba diving, 06 & 07.vi.1982: *Aglaophenia svobodai* spec. nov.; *Nematophorus clarkei* (Nutting, 1900); *Halopteris carinata* Allman, 1877; *Plumularia setacea* (Linnaeus, 1758).

Stn 6.D06, Cape Verde Islands, SW coast of São Nicolau, Baía do Tarrafal, 16°35'N 24°22'W, 0-15 m, Scuba diving, 10.vi.1982: *Aglaophenia lophocarpa* Allman, 1877.

Stn 6.D07. Cape Verde Islands, SW coast of Santa Luzia, 16°45'N 24°46'W, 0-10 m, Scuba diving, 16.vi.1982: *Macrorhynchia philippina* (Kirchenpauer, 1872).

Stn 6.D10, Cape Verde Islands, S coast of São Vicente, 16°48'N 25°01'W, 0-15 m, Scuba diving, 19.vi.1982: *Nematophorus clarkei* (Nutting, 1900).

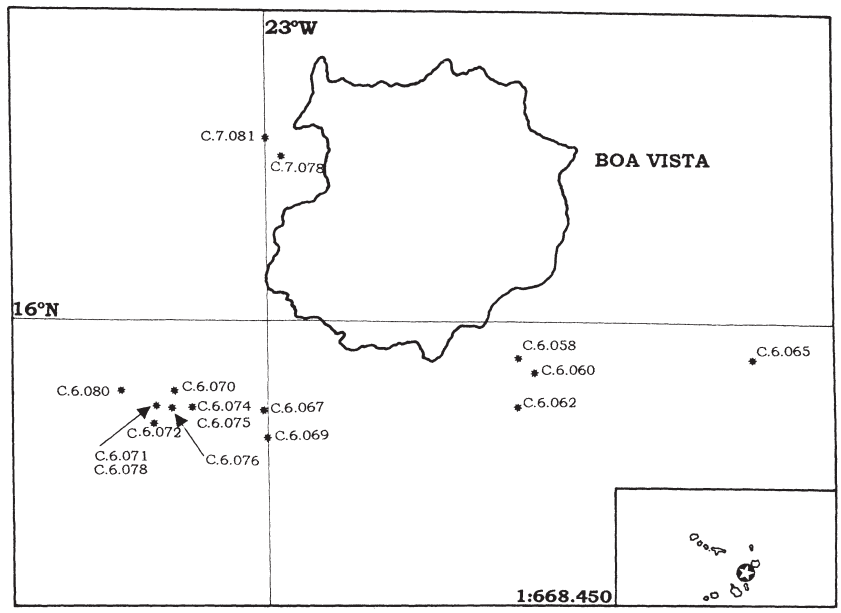


Fig. 15. Cape Verde Archipelago; location of CANCAP stations at island Boa Vista.

Stn 6.D11, Cape Verde Islands, SW coast of São Vicente, Baía de São Pedro, 16°50'N 25°04'W, 0-15 m, Scuba diving, 20.vi.1982: *Nematophorus clarkei* (Nutting, 1900).

Stn 6.D12, Cape Verde Islands, N coast of São Vicente, bay W of Mindelo, 16°55'N 24°59'W, 0-15 m, Scuba diving, 21 & 22.vi.1982: *Macrorhynchia philippina* (Kirchenpauer, 1872); *Nematophorus clarkei* (Nutting, 1900).

Stn 7.044, Cape Verde Islands, SW of Maio, Ponta Inglez/Ponta Preta, 15°07'N 23°14'W, 45 m, rectangular dredge, 25.viii.1986: *Aglaophenia svobodai* spec. nov.; *Monostaechas quadridens* (McCrady, 1859).

Stn 7.058, Cape Verde Islands, SW of Maio, Ponta Inglez/Ponta Preta, 15°07'N 23°14'W, 69 m, rectangular dredge, 26.viii.1986: *Streptocaulus pulcherrimus* Allman, 1883; *Antennella siliquosa* (Hincks, 1877); *Plumularia* spec.

Stn 7.059, Cape Verde Islands, SW of Maio, Ponta Inglez/Ponta Preta, 15°07'N 23°14'W, 61 m, rectangular dredge, 26.viii.1986: *Aglaophenia svobodai* spec. nov.; *Streptocaulus pulcherrimus* Allman, 1883; *Antennella siliquosa* (Hincks, 1877); *Plumularia setacea* (Linnaeus, 1758).

Stn 7.078, Cape Verde Islands, W of Boa Vista, W of Ilhéu de Sal Rei, 16°10'N 22°59'W, 45 m, 1.2 m Agassiz trawl, 28.viii.1986: *Nematophorus clarkei* (Nutting, 1900); *Antennella siliquosa* (Hincks, 1877); *Plumularia setacea* (Linnaeus, 1758).

Stn 7.081, Cape Verde Islands, W of Boa Vista, W of Ilhéu de Sal Rei, 16°11'N 23°00'W, 70 m, 1.2 m Agassiz trawl, 28.viii.1986: *Aglaophenia svobodai* spec. nov.; *Streptocaulus pulcherrimus* Allman, 1883; *Antennella secundaria* (Gmelin, 1791).

Stn 7.089, Cape Verde Islands, S of Sal, SW of Ponta do Leme Velho, 16°34'N 22°54'W, 75-90 m, Van Veen grab, 29.viii.1986: *Streptocaulus pulcherrimus* Allman, 1883; *Antennella siliquosa* (Hincks, 1877).

Stn 7.107, Cape Verde Islands, W of Sal, off Palmeira, 16°45'N 23°00'W, 70 m, 1.2 m Agassiz trawl, 30.viii.1986: *Monostaechas quadridens* (McCrady, 1859); *Nemertesia ramosa* (Lamarck, 1816).

Stn 7.112, Cape Verde Islands, W of Sal, off Palmeira, 16°42'N 23°02'W, 125-164 m, 1.2 m Agassiz trawl, 31.viii.1986: *Monostaechas quadridens* (McCrady, 1859).

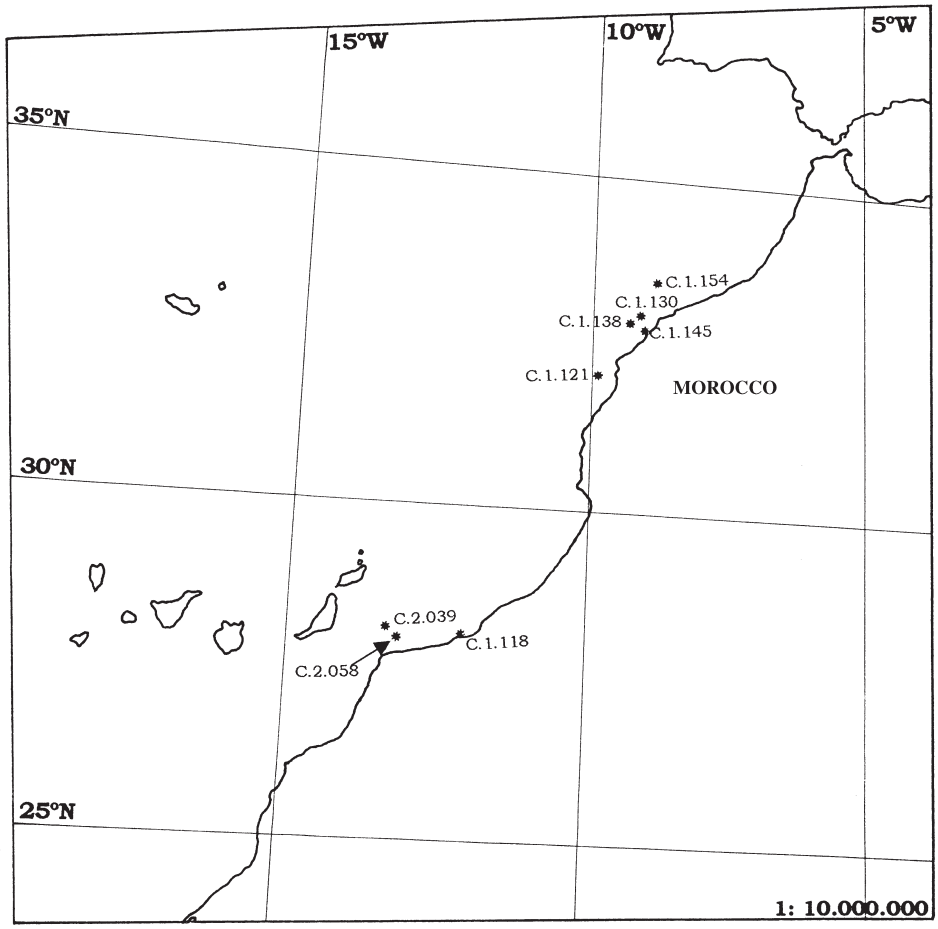


Fig. 16. Location of CANCAP stations at coast of Morocco.

Stn 7.113, Cape Verde Islands, W of Sal, off Palmeira, 16°42'N 23°01'W, 224-248 m, 1.2 m Agassiz trawl, 31.viii.1986: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nematophorus clarkei* (Nutting, 1900).

Stn 7.115, Cape Verde Islands, S of Razo, 16°36'N 24°36'W, 60 m, Van Veen grab, 01.ix.1986: *Nemertesia ramosa* (Lamarck, 1816).

Stn 7.119, Cape Verde Islands, S of Razo, 16°36'N 24°36'W, 140-160 m, Van Veen grab, 01.ix.1986: *Streptocaulus pulcherrimus* Allman, 1883; *Nemertesia ramosa* (Lamarck, 1816).

Stn 7.122, Cape Verde Islands, S of Razo, 16°36'N 24°35'W, 100 m, rectangular dredge, 01.ix.1986: *Streptocaulus pulcherrimus* Allman, 1883; *Nemertesia ramosa* (Lamarck, 1816).

Stn 7.125, Cape Verde Islands, S of Razo, 16°36'N 24°36'W, 85-130 m, rectangular dredge, 01.ix.1986: *Aglaophenia svobodai* spec. nov.; *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890).

Stn 7.126, Cape Verde Islands, S of Razo, 16°36'N 24°36'W, 208-930 m, rectangular dredge, 01.ix.1986: *Streptocaulus pulcherrimus* Allman, 1883; *Kirchenpaueria bonnevieae* (Billard, 1906).

Stn 7.132, Cape Verde Islands, SE of São Nicolau, 16°33'N 24°17'W, 395 m, 1.2 m Agassiz trawl, 02.ix.1986: *Aglaophenia lophocarpa* Allman, 1877; *Halopteris catharina* (Johnston, 1833); *Plumularia setacea* (Linnaeus, 1758).

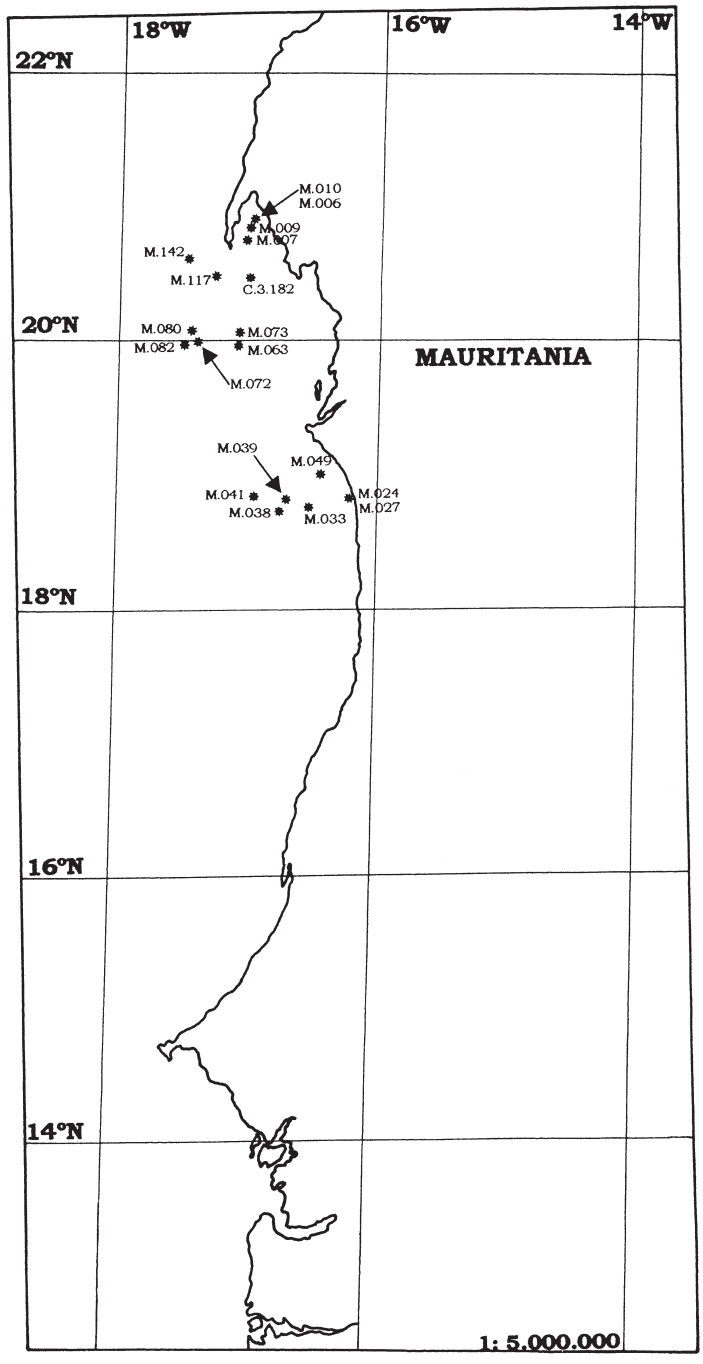


Fig. 17. Location of CANCAP and Mauritania-II stations at coast of Mauritania.

Stn 7.139, Cape Verde Islands, S of Branco and Razo, 16°35'N 24°35'W, 612-647 m, rectangular dredge, 04.ix.1986: *Streptocaulus caboverdensis* spec. nov.

Stn 7.149, Cape Verde Islands, S of Branco, 16°38'N 24°43'W, 100 m, rectangular dredge, 05.ix.1986: *Aglaophenia svobodai* spec. nov.; *Nemertesia ramosa* (Lamarck, 1816).

Stn 7.152, Cape Verde Islands, S of Branco, 16°38'N 24°41'W, 159 m, 1.2 m Agassiz trawl, 05.ix.1986: *Streptocaulus pulcherrimus* Allman, 1883; *Monostaechas quadridens* (McCrady, 1859).

Stn 7.155, Cape Verde Islands, SW of Branco, 16°39'N 24°43'W, 75 m, rectangular dredge, 05.ix.1986: *Nematophorus clarkei* (Nutting, 1900); *Plumularia setacea* (Linnaeus, 1758).

Stn 7.156, Cape Verde Islands, SW of Branco, 16°40'N 24°43'W, 90-110 m, rectangular dredge, 05.ix.1986: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia ramosa* (Lamarck, 1816).

MAURITANIA-II Expedition:

Stn MAU. 006, Mauritania, Passe du Lévrier, E of Cap Blanc, 20°49'N 17°01'W, 15 m, 1.2 m Agassiz trawl, 07.vi.1988: *Aglaophenia parvula* Bale, 1882.

Stn MAU. 007, Mauritania, E coast of Cap Blanc, 20°47'N 17°03'W, 0-1 m, handcollecting and snorkling, 07.vi.1988: *Aglaophenia parvula* Bale, 1882.

Stn MAU. 009, Mauritania, Passe du Lévrier, E of Cap Blanc, 20°48'N 17°02'W, 17 m, 1.2 m Agassiz trawl, 07.vi.1988: *Aglaophenia parvula* Bale, 1882.

Stn MAU. 010, Mauritania, Passe du Lévrier, E of Cap Blanc, 20°49'N 17°01'W, 17 m, 1.2 m Agassiz trawl, 07.vi.1988: *Aglaophenia parvula* Bale, 1882.

Stn MAU. 024, off Mauritania, 18°50'N 16°18'W, 14 m, 3 baited shrimp-traps, 08/09.vi.1988: *Aglaophenia parvula* Bale, 1882.

Stn MAU. 027, off Mauritania, 18°50'N 16°18'W, 16 m, 1.2 m Agassiz trawl, 09.vi.1988: *Aglaophenia parvula* Bale, 1882.

Stn MAU. 033, off Mauritania, 18°47'N 16°34'W, 114 m, Van Veen grab, 09.vi.1988: *Streptocaulus dollfusi* (Billard, 1924).

Stn MAU. 038, off Mauritania, 18°46'N 16°45'W, 260 m, 2.4 m Agassiz trawl, 10.vi.1988: *Lytocarpia myriophyllum* (Linnaeus, 1758); *Antennella secundaria* (Gmelin, 1791).

Stn MAU. 039, off Mauritania, 18°48'N 16°43'W, 260-280 m, 3.5 m Agassiz trawl, 10.vi.1988: *Aglaophenia lophocarpa* Allman, 1877; *Lytocarpia myriophyllum* (Linnaeus, 1758); *Nemertesia antennina* (Linnaeus, 1758).

Stn MAU. 041, off Mauritania, 18°51'N 16°56'W, 800-840 m, 3.5 m Agassiz trawl, 10.vi.1988: *Lytocarpia myriophyllum* (Linnaeus, 1758).

Stn MAU. 049, off Mauritania, 19°05'N 16°25'W, 12-18 m, rectangular dredge, 11.vi.1988: *Nemertesia antennina* (Linnaeus, 1758).

Stn MAU. 063, Mauritania, off Banc d'Arguin, 20°00'N 17°09'W, 20 m, Van Veen grab, 13.vi.1988: *Aglaophenia octodonta* (Heller, 1868); *Plumularia setacea* (Linnaeus, 1758).

Stn MAU. 072, Mauritania, off Banc d'Arguin, 20°00'N 17°24'W, 48-52 m, 3.5 m Agassiz trawl, 13.vi.1988: *Antennella secundaria* (Gmelin, 1791); *Antennella siliquosa* (Hincks, 1877); *Nemertesia antennina* (Linnaeus, 1758); *Nemertesia perrieri* (Billard, 1901); *Nemertesia ramosa* (Lamarck, 1816); *Plumularia setacea* (Linnaeus, 1758); *Pseudoplumaria marocana* (Billard, 1930).

Stn MAU. 073, Mauritania, off Banc d'Arguin, 20°03'N 17°09'W, 19 m, 1.2 m Agassiz trawl, 13.vi.1988: *Nemertesia antennina* (Linnaeus, 1758).

Stn MAU. 080, Mauritania, off Banc d'Arguin, 20°02'N 17°26'W, 60-70 m, 3.5 m Agassiz trawl, 14.vi.1988: *Nemertesia perrieri* (Billard, 1901).

Stn MAU. 082, Mauritania, off Banc d'Arguin, 19°59'N 17°30'W, 100 m, 2.4 m Agassiz trawl, 14.vi.1988: *Nemertesia perrieri* (Billard, 1901).

Stn MAU. 117, Mauritania, off Banc d'Arguin, 20°24'N 17°19'W, 35-40 m, 3.5 m Agassiz trawl, 18.vi.1988: *Aglaophenia parvula* Bale, 1882; *Plumularia setacea* (Linnaeus, 1758).

Stn MAU. 142, Mauritania, off Cap Blanc, 20°39'N 17°36'W, 75-100 m, 3.5 m Agassiz trawl, 21.vi.1988: *Streptocaulus dollfusi* (Billard, 1924); *Nemertesia perrieri* (Billard, 1901); *Nemertesia ramosa* (Lamarck, 1816).

Taxonomic review

Family Aglaopheniidae Marktanner-Turneretscher, 1890
Genus *Aglaophenia* Lamouroux, 1812
Aglaophenia acacia Allman, 1883
(figs 18-19)

Aglaophenia acacia Allman, 1883: 38, pl. 12 figs 1-4; Quelch, 1885: 10; Marktanner-Turneretscher, 1890: 270, pl. 7 fig. 7; Pictet & Bedot, 1900: 44, pl. 10 figs 4-7; Billard, 1906b: 228; Fraser, 1912c: 377, fig. 42A-D; Bedot, 1919a: 50; 1919b: 277; Jäderholm, 1920: 9; Bedot, 1921a: 338; 1921c: 45; 1922: 158; Fraser, 1944a: 364, pl. 79 fig. 352a-e; 1945a: 21; Von Schenck, 1965: 928; Rees & White, 1966a: 278; Blanco, 1967a: 288, pl. 6 figs 4-8; Vervoort, 1972a: 201; Svoboda, 1979: 79, figs 12d, 13d, 14d, 15d, 16d; Gili, 1986: 144, fig. 4.35A-C; Roca, 1986: 407, fig. 69; Gili, Ros & Pagès, 1987: 92; Gili, Murillo & Ros, 1989: 23; Cornelius & Ryland, 1990: 156, fig. 4.24; Cairns et al., 1991: 28; Castric, Girard & Michel, 1991: 104; El Beshbeeshy, 1991: 277, fig. 70a-b; Svoboda & Cornelius, 1991: 14, figs 1, 17a-b, 20a-b, 21a-b; Cornelius, 1992b: 83; Genzano & Zamponi, 1992: 53, fig. 22; Boero & Bouillon, 1993a: 263; Vervoort, 1993b: 546; Cornelius, 1995: 182, fig. 42A-D; Medel & Vervoort, 1995: 7, fig. 1a-d; Peña Cantero, 1995: 249, pl. 27 figs c-d.

Aglaophenia elongata; Van Gemerden-Hoogeveen, 1965: 79, fig. 44; García Carrascosa, 1981: 302, pl. 29 fig. g, pl. 44 figs d-e, pl. 45 fig. e (not *Aglaophenia elongata* Meneghini, 1845).

Aglaophenia acacia elegans Milstein, 1976: 80, figs 13-16.

Material.— **Azores area**: Stn 5.044: One colony without corbulae (RMNH-Coel. 28579, 28659, 28688, slide 4462).— Stn 5.088: Several colonies with corbulae (RMNH-Coel. 28580, 28690, four slides 4463).— Stn 5.096: Two strongly ramified colonies with corbulae (RMNH-Coel. 28578, two slides 4464).— Stn 5.100: One colony with three cormoids without corbulae (RMNH-Coel. 28581; DEVA-UV, two slides R. 291).— Stn 5.130: One colony without corbulae (RMNH-Coel. 29056 = two slides 4465).— Stn 5.141: One fragment without corbulae (RMNH-Coel. 29057 = slide 4466).— Stn 5.142: One colony with seven cormoids, two with corbulae (RMNH-Coel. 28654, slide 4467).— **Atlantic coast of Morocco and Mauritania**: Stn 1.118: Three fragments without corbulae (RMNH-Coel. 28582).

Description (of material from Stn 5.044).— Hydrorhiza tubular, supporting a thick, monosiphonic hydrocaulus ramified in threefold fashion. Hydrocaulus with short, unsegmented basal portion, followed by prosegment separated by oblique nodes and provided with frontal nematotheca. Remainder of hydrocaulus composed of succession of internodes separated by oblique nodes, each with one apophysis provided with a mamelon on its distal half, and three nematothecae: two in the axil and one inferior. Threefold ramification originating from two consecutive internodes of hydrocaulus; from each springs a lateral branch composed of an apophysis with two axillary nematothecae and five to nine hydrothecate internodes separated by oblique nodes, each with one hydrotheca, two lateral nematothecae and one median inferior nematotheca under hydrotheca. Remainder of branch of same structure as main stem. The two branches diverging and with continuation of stem forming a trifold ramification. Occasionally one of the branches is replaced by a corbula.

Hydrocladia pinnately arranged, alternately pointing left and right, composed of hydrothecate internodes separated by oblique nodes. Each internode with one hydrotheca and three nematothecae: one mesial inferior adnate to abcauline hydrothecal wall and two lateral. Hydrotheca narrow and deep, with short adcauline intrathecal septum; hydrothecal rim with four pairs of lateral cusps and one median abcauline

Fig. 18. *Aglaophenia acacia* Allman, 1883. a, Stn 5.142, colony; b, Stn 5.088, detail of a branch, lateral view; c, Stn 5.044, aberrant branch giving rise to hydrocladium, frontal view. Scales: a, 1 cm; b, 0.5 mm; c, 0.2 mm.

cusp. Lateral cusps decreasing in size in adcauline direction. Lateral nematothecae slightly surpassing hydrothecal rim; median nematotheca reaching halfway hydrothecal abcauline wall. All nematothecae with gutter-shaped aperture.

Colonies dioecious and with sexual dimorphism. Female corbula with completely fused costae, more globular than male one. Male corbula with several openings in basal and distal parts of costae. Number of costae five to nine; all corbulae with a pedicel composed of one thecate internode.

Variability.— Some colonies basally with internodes separated by straight nodes; such internodes are devoid of nematothecae. A colony from Stn 1.118 with a prosegment in basal part of a branch. A colony from Stn 5.044 has a branch of normal development basally that degenerates and develops into a normal hydrocladium distally.

Table I. Measurements of *Aglaophenia acacia* in µm:

	Stn 5.088
Height of colony (in mm)	31-252
Internode of hydrocaulus, length	500-870
Diameter at node	260-360
Hydrocladial internode, length	310-510
Diameter at node	75-150
Hydrotheca, depth	310-400
Length of free part abcauline wall	120-150
Diameter at rim	190-215

Table II. Measurements of corbulae of *Aglaophenia acacia* in µm:

	Stn 5.088	Stn 1.188	Stn 5.142
Female corbula, length		3200–5050	3250–3740
Maximum diameter		1250–1300	1310–1510
Male corbula, length	2560–3840		
Maximum diameter	1150–1300		

Discussion.— Bedot (1921a, 1921c), Blanco (1967a) and Vervoort (1972a) include, with a question mark, the followings species in the synonymy: *Aglaophenia patagonica* (d'Orbigny, 1846), *Aglaophenia cristata* McCrady, 1859, and *Aglaophenia trifida* L. Agassiz, 1862. The description and figures of *A. patagonica* by d'Orbigny (1846, as *Plumularia patagonica*), do not permit certain identification, as has already been remarked by Bedot (1921c) and it is therefore here excluded from the synonymy of *A. acacia*. *Aglaophenia cristata* and *A. trifida* represent a single species that is here considered different from *A. acacia*. *Aglaophenia rigida* Allman, 1877, considered a possible synonym by Bedot (1921c) and Blanco (1967a), is a different species according to Vervoort (1972a). The colonies mentioned by Van Gemerden-Hoogeveen (1965) and García Carrascosa (1981) as *Aglaophenia elongata* were included in *A. acacia* by Svoboda &

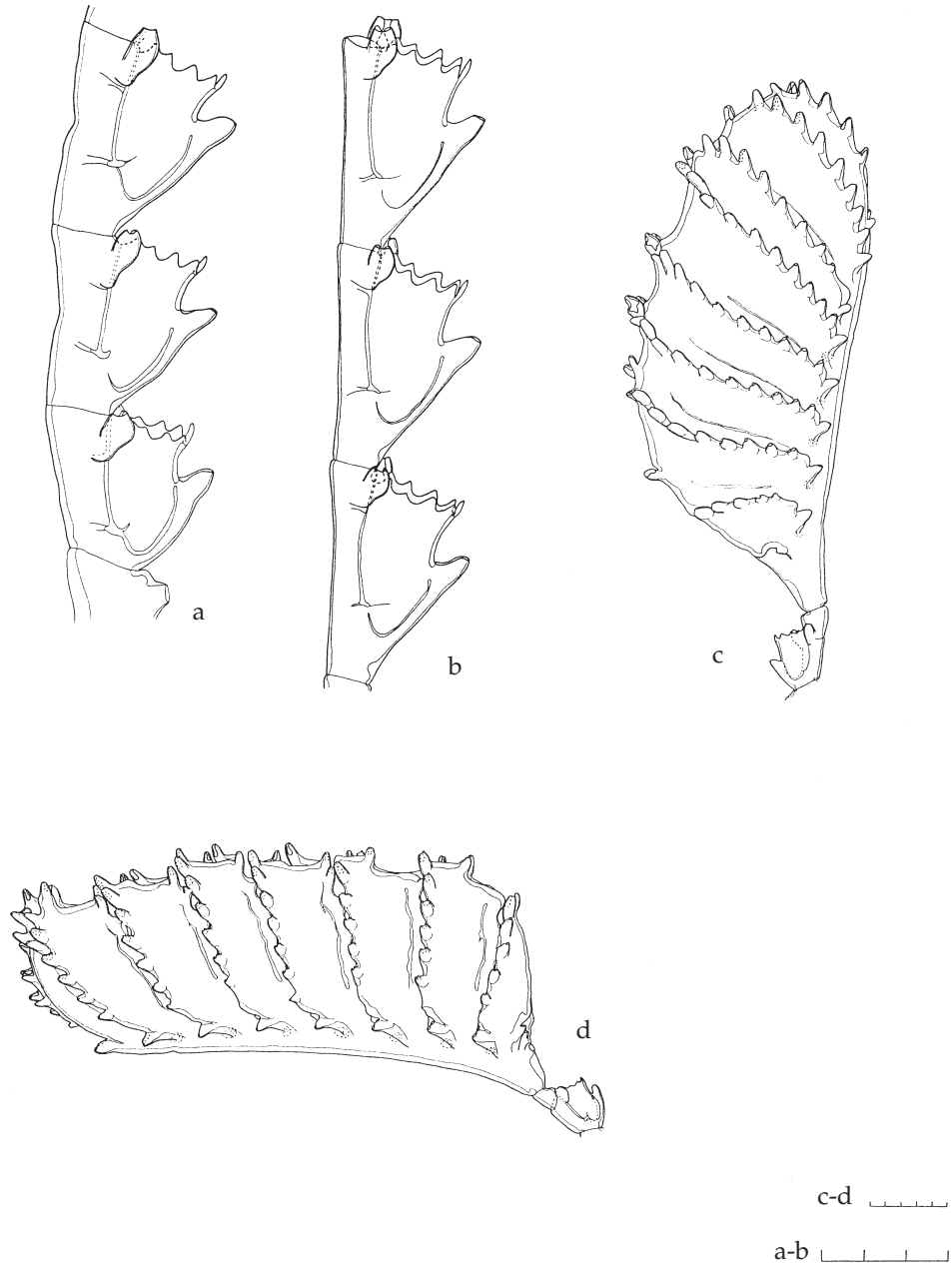


Fig. 19. *Aglaophenia acacia* Allman, 1883. a, Stn 5.088, three internodes from basal part of hydrocladium; b, Stn 5.096, three internodes from distal part of hydrocladium; c, Stn 5.142, female corbula; d, Stn 5.088, male corbula; all lateral view. Scales: a-b, 0.3 mm; c-d, 0.5 mm.

Cornelius (1991) and Peña Cantero (1995) respectively, after revision of the material.

Reproduction.— Corbulae are mentioned by Allman (1883), Pictet & Bedot (1900), Billard (1906b), Vervoort (1972a), Milstein (1976), Svoboda (1979), Gili (1986), Roca (1986), Svoboda & Cornelius (1991), Medel & Vervoort (1995) and Peña Cantero (1995); they have been observed all the year round, with the exception of February and September-November. In the CANCAP material they occur in the months of March, May and June.

Distribution.— *Aglaophenia acacia* is widely distributed in tropical, subtropical and temperate waters of Atlantic Ocean and Mediterranean. In the western Atlantic it has been recorded from North Carolina (Fraser, 1912c, 1944a), from the Caribbean: Jamaica (Fraser, 1945a), Tortuga Island (Van Gemerden Hoogeveen, 1965, as *A. elongata*; Svoboda & Cornelius, 1991); from the coast of Uruguay (Milstein, 1976, as *A. acacia elegans*) and from various localities along the Argentine coast (Blanco, 1967a; Vervoort, 1972a; El Beshbeeshy, 1991; Genzano & Zamponi, 1992). In the eastern Atlantic it is known from the coasts of Ireland and Great Britain (Cornelius & Ryland, 1990; Svoboda & Cornelius, 1991; Cornelius, 1995), from the French Channel coast (Castric, Girard & Michel, 1991; Svoboda & Cornelius, 1991), from NW Spain (Svoboda, 1979), from the Azores (Allman, 1883; Pictet & Bedot, 1900; Bedot, 1921c; Rees & White, 1966a; Cornelius, 1992b), from NW of Cape Garnet (Billard, 1906b) and from the Cape Verde Islands (Quelch, 1885).

In the Mediterranean it has been mentioned from the Spanish coasts (García Carrascosa, 1981, as *A. elongata*; Gili, 1986; Svoboda & Cornelius, 1991; Medel & Vervoort, 1995), the Balearic Islands (Roca, 1986), the Chafarinas Islands (Peña Cantero, 1995), Cape Bon (Tunisia) (Marktanner-Turneretscher, 1890; Svoboda & Cornelius, 1991), the Italian coasts (Svoboda, 1979; Svoboda & Cornelius, 1991), and the coast of Israel (Svoboda & Cornelius, 1991; Vervoort, 1993b).

The bathymetrical range is from 5 (Medel & Vervoort, 1995) to 823 m (Allman, 1883).

CANCAP material originates from eight stations, of which seven near the Azores and one off Cape Dra, Morocco, collected between 48 and 150 m.

Epibionts.— Stn 1.118: *Plumularia setacea* (L., 1758), *Obelia dichotoma* (L., 1758).— Stn 5.044: *Filellum serratum* (Clarke, 1879), *Aglaophenia tubulifera* (Hincks, 1861), *Plumularia setacea* (L., 1758), *Campanularia hincksii* Alder, 1856.— Stn 5.088: *Plumularia setacea* (L., 1758), *Sertularella* spec., *Sertularia distans* (Lamouroux, 1816), *Campanularia hincksii* Alder, 1856, *Clytia gracilis* (M. Sars, 1850), *Obelia/Laomedea* spec.— Stn 5.096: Bryozoa.— Stn 5.130: *Plumularia setacea* (L., 758), *Campanularia hincksii* Alder, 1856.— Stn 5.141: Foraminifera.— Stn 5.142: *Antennella secundaria* (Gmelin, 1791), *Campanularia hincksii* Alder, 1856.

Aglaophenia kirchenpaueri (Heller, 1868)
(fig. 20)

Sertularia pluma Linnaeus, 1758: 811 p.p.

Plumularia kirchenpaueri Heller, 1868: 40, 82, pl. 2 fig. 4.

Aglaophenia kirchenpaueri; Carus, 1884: 16; Marktanner-Turneretscher, 1890: 263, pl. 7 figs 9, 22; Bedot, 1919a: 51, fig. 1; 1921a: 339; Billard, 1923: 17, figs 1B-C, 2; Hadzi, 1925: 239; Billard, 1927c: 344; Da Cunha, 1950: 131, fig. 3; Picard, 1955b: 189; 1958b: 192; Rossi, 1961: 78; Patriti, 1970: 49, fig. 68A-C;

Rossi, 1971: 29, fig. 11F; Saldanha, 1974: 325; Gili, 1979: 133; Svoboda, 1979: 87, figs 12g, 13g, 14c, 15g, 16g, pl. 5 figs d-f; Boero, 1980a: 133; 1981a: 182; García Carrascosa, 1981: 309, pl. 28 figs d-e, pl. 44 figs a-c, pl. 45 fig. d; Gili, 1981: 111; Gili i Sardà, 1982: 94, fig. 50A-B; Gili, García & Colomer, 1984: 420; Boero, 1985a: 136; Gili & Castelló, 1985: 21, fig. 7D; Gili & García Rubies, 1985: 48, fig. 5C; Isasi, 1985: 90, fig. 28A-C; Aguirrezabalaga et al., 1986: 139; Boero & Fresi, 1986: 145; Gili, 1986: 143, figs 4.33A-B, 4.54C; Isasi & Saiz, 1986: 70; Izquierdo et al., 1986: 62, fig. 11A-C; Roca, 1986: 415, fig. 71; Templado et al., 1986: 99; García Carrascosa et al., 1987: 373; Aguirrezabalaga et al., 1988: 232; Gili, Murillo & Ros, 1989: 23; Altuna & García Carrascosa, 1990: 86, fig. 89; Cornelius & Ryland, 1990: 156, fig. 4.24; Castric, Girard & Michel, 1991: 104; Svoboda & Cornelius, 1991: 20, figs 4a-f, 17c-d, 20d, 21c-d; Cornelius, 1992a: 255; Ramil & Vervoort, 1992a: 93, fig. 23a; Boero & Bouillon, 1993a: 263; Altuna Prados, 1994a: 210; 1995a: 54; Álvarez Claudio, 1995: 12; Cornelius, 1995: 186, fig. 43A-D; Medel & Vervoort, 1995: 9, fig. 2; Peña Cantero, 1995: 257, pl. 28 figs a-c.

Aglaophenia septifera Broch, 1912a: 61; 1913: 6, fig. 8a-b; Stechow, 1919c: 148; 1923d: 254; Hadzi, 1925: 239, fig. 1; Leloup, 1934c: 16; 1939b: 11; Picard, 1951f: 261; 1952a: 342; Riedl, 1959: 665; Fey, 1969: 406; Riedl, 1970: 152, pl. 42; Castric-Fey, 1973: 214; Castric-Fey & Chassé, 1991: 523.

?*Halicornaria Richardi* Bedot, 1921c: 36, pl. 5 figs 31, 35-36.

?*Halicornaria Richardi* var. Bedot, 1921c: 37, pl. 5 figs 33-34.

Thecocarpus phyteuma; García Corrales et al., 1978: 66, fig. 32 [not *Lytocarpia phyteuma* (Kirchenpauer, 1876)].

Aglaophenia septiphera; Gili & Romero, 1983: 36 (incorrect subsequent spelling).

Material.— **Canary Islands and Selvagens Archipelago**: Stn 2.D08: 36 detached colonies of which 25 with male corbulae (RMNH-Coel. 28594).— Stn 3.V08: One colony with six female corbulae (RMNH-Coel. 28599, two slides 4468).— Stn 4.003: One colony without corbulae (RMNH-Coel. 28597; DEBA-UV, slide R. 292).— Stn 4.004: One colony with ten cormoids, two with male corbulae (RMNH-Coel. 28600).— Stn 4.012: One colony with two cormoids, one with 14 female corbulae (RMNH-Coel. 28598, two slides 4469).— Stn 4.015: One colony with 21 cormoids, without corbulae (RMNH-Coel. 28593).— Stn 4.017: A fragment with three male corbulae (RMNH-Coel. 28974, two slides 4470).— Stn 4.019: Three colonies, of which one big, with male corbulae (RMNH-Coel. 28592).— Stn 4.021: One colony with 50 cormoids and male corbulae (RMNH-Coel. 28591).— Stn 4.030: One colony with 21 cormoids, with corbulae (RMNH-Coel. 28596).— Stn 4.091: Three fragments without corbulae (RMNH-Coel. 28967, slide 4471).— Stn 4.098: One fragment with four male corbulae (RMNH-Coel. 28595, three slides 4472).

Description (of material from Stn 4.004).— Hydrorhiza tubular, adhering to substrate, from which arise monosiphonic, unbranched hydrocauli.

Hydrocaulus with short, unsegmented basal part, followed by one or two prosegments separated by oblique nodes, each with frontal nematotheca. Remainder of hydrocaulus uniformely segmented; internodes separated by oblique nodes; each internode with one apophysis with mamelon and three nematothecae: two in the axil and one under apophysis.

Hydrocladia inserting on apophyses, alternately pointing left and right, composed of a succession of thecate internodes separated by slightly oblique nodes. Each internode with one hydrotheca and three nematothecae: one mesial inferior, adnate with abcauline hydrothecal wall, and two lateral. Hydrotheca basally rounded, characterized by strong, abcauline internal septum; hydrothecal rim with 4 pairs of lateral cusps and short median abcauline cusp, smaller in size than first pair of lateral cusps. Lateral nematothecae slightly surpassing hydrothecal rim. Median nematotheca reaching beyond middle of abcauline wall of hydrotheca, occasionally reaching hydrothecal rim. Aperture of nematothecae gutter-shaped.

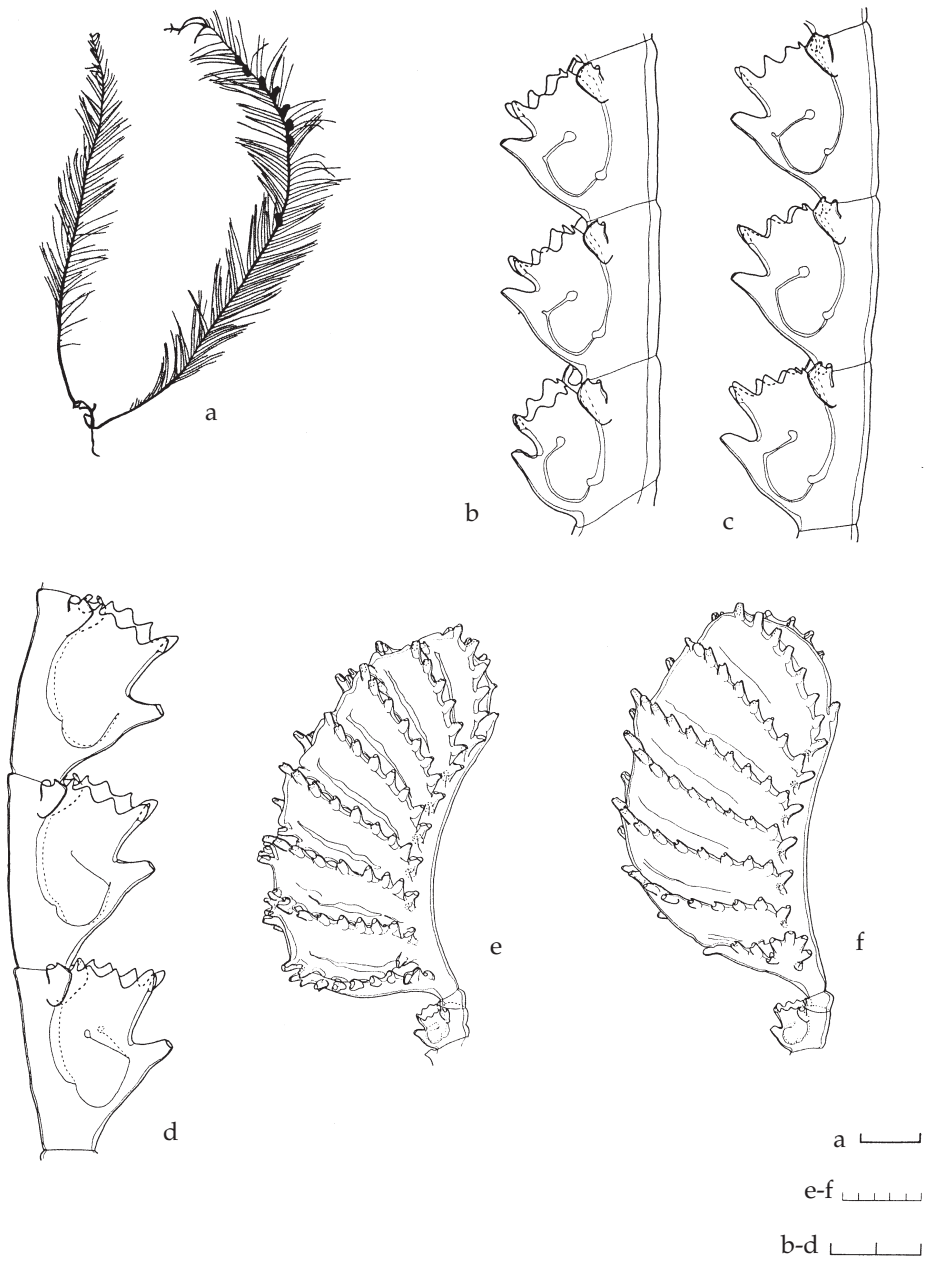


Fig. 20. *Aglaophenia kirchenpaueri* (Heller, 1868). a, Stn 4.019, colony; b, Stn 4.003, three internodes from basal part of hydrocladium; c, Stn 4.012, three internodes from median part of hydrocladium; d, Stn 3.V08, three internodes from distal part of hydrocladium; e, Stn 4.098, male corbula; f. Stn 3.V08, female corbula; hydrocladia and corbulae in lateral view. Scales: a, 1 cm; b-d, 0.2 mm, e-f, 0.5 mm.

Colonies dioecious; sexual dimorphism apparent. Female corbulae with six to nine pairs of completely fused costae; male corbulae with five to eight pairs of partly fused costae; several openings occur in basal part and in fusion zone between costae, development varied in various corbulae. All corbulae with basal thecate internode. Number of corbulae per cormoid high, in one case 18 (Stn 4.021).

Variability.— Many colonies examined have vegetative stolons apically, in some cases (Stn 4.004) attached to substrate and giving rise to new hydrocauli. In a colony from Stn 4.003 the stolon originates from a hydrocladial apophysis in basal part of stem.

Colonies from Stns 2.D08, 4.003 and 4.012 have lateral branches developing from point of insertion of a hydrocladium. In two cases this happens after damage of hydrocladium followed by regeneration, but in remaining cases no signs of damage can be observed. Some of these branches have one or two prosegments basally. In a specimen from Stn 4.030 a normal colony develops from the apex of a hydrocladium.

In various colonies the intrathecal septum of the ultimate hydrotheca of a hydrocladium is not fully developed.

Table III. Measurements of *Aglaophenia kirchenpaueri* in µm:

	Stn 4.004
Height of colony (in mm)	8-198
Internode of hydrocaulus, length	320-480
Diameter at node	180-220
Hydrocladial internode, length	250-350
Diameter at node	100-160
Hydrotheca, depth	220-280
Length of free part abcauline wall	100-125
Diameter at rim	170-190

Table IV. Measurements of corbulae of *Aglaophenia kirchenpaueri* in µm:

	CANCAP 3.V08	CANCAP 4.012	CANCAP 4.019	CANCAP 4.021
Female corbula, length	2400-2500	2450-2900		
Maximum diameter	1120-1200	1200-1300		
Male corbula, length			1820-2570	1900-2700
Maximum diameter			1020-1150	1000-1140

Discussion.— *Halicornaria richardi* Bedot, 1921c, according to its author is a species near to *A. kirchenpaueri,* differing in the gonosome (which was detached from the colony when making a slide). The variety *Halicornaria Richardi* var. Bedot, 1921c, described by the same author, is characterized by ramified colonies, in which the branches have a basal zone composed of hydrothecate internodes, identical with those of a hydrocladium. Leloup (1939), after inspection of the type, indicates that the only known gonangium is not attached to the colony and in his opinion it does not

belong there. Because of this and the characters of the trophosome, he does not hesitate to synonymize *H. richardi* Bedot 1921 with *A. septifera* [= *A. kirchenpaueri* (Heller, 1868)]. If we follow Leloup (1939) both species are conspecific; if the gonosome described by Bedot (1921c) really belongs to the type colony, two separate species are present. As far as the variety described by Bedot is concerned, several colonies in our material have branches matching Bedot's description.

García Corrales et al. (1978) described *Thecocarpus phyteuma* (Kirchenpauer, 1876) from the Mediterranean coast near San Pedro del Pinatar (Murcia). Following García Carrascosa (1981), Isasi (1985), Aguirrezabalaga et al., (1986), Izquierdo et al. (1986) and García Carrascosa et al. (1987) we relegate this record to *A. kirchenpaueri*; although the description is short, the figures clearly show an intrathecal septum characteristic of that species; in *A. phyteuma* the intrathecal septum is developed on the adcauline wall.

Reproduction.— Occurrence of corbulae is recorded by Stechow (1923d), Da Cunha (1950), Picard (1952a, 1958a), Rossi (1961), Fey (1969), Svoboda (1979), Gili (1982, 1986), Isasi (1985), Aguirrezabalaga et al. (1986), Boero & Fresi (1986), Izquierdo et al. (1986), Roca (1986), Svoboda & Cornelius (1991), Cornelius (1995), Medel & Vervoort (1995) and Peña Cantero (1995); they have been found in all the months of the year with the exception of January and December; in the CANCAP colonies they occur in material collected in May, September and October.

Distribution.— *Aglaophenia kirchenpaueri* has an Atlantic-Mediterranean distribution (Boero & Bouillon, 1993a). From the Atlantic it has been recorded off Ireland and Great Britain (Svoboda & Cornelius, 1991; Cornelius, 1995), from the coasts of France (Billard, 1923; Fey, 1969, as *Aglaophenia septifera*; Castric-Fey, 1973, as *A. septifera*; Castric-Fey & Chassé, 1991, as *A. septifera*; Castric, Girard & Michel, 1991; Svoboda & Cornelius, 1991), from the Basque coast (Isasi, 1985; Aguirrezabalaga et al., 1986; Isasi & Saiz, 1986; Aguirrezabalaga et al., 1988; Altuna & García Carrascosa, 1990; Svoboda & Cornelius, 1991; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995), from the Portuguese coast (Da Cunha, 1950; Svoboda & Cornelius, 1991), from Morocco (Broch, 1913, as *A. septifera*; Patriti, 1970; Cornelius & Ryland, 1990), from the Canary Islands (Izquierdo et al., 1986) and from the Cape Verde Archipelago (Svoboda, 1979; Cornelius & Ryland, 1990; Cornelius, 1995).

In the Mediterranean it is cited from the Strait of Gibraltar (Medel & Vervoort, 1995), the Alborán Sea (Templado et al., 1986; Ramil & Vervoort, 1992a), numerous localities along the coast of Spain (García Corrales et al., 1978, as *Thecocarpus phyteuma*; Gili, 1979; Svoboda, 1979; García Carrascosa, 1981; Gili, 1981, 1982; Gili, García & Colomer, 1984; Gili & Castelló, 1985; Gili, 1986; García Carrascosa et al., 1987; Svoboda & Cornelius, 1991), the Chafarinas Islands (Peña Cantero, 1995), the Balearic Islands (Gili & García Rubies, 1985; Roca, 1986), the south coast of France (Stechow, 1919c; Picard, 1952a, both as *A. septifera*), various localities in the Italian littoral zone (Stechow, 1923d; Picard, 1952a, both as *A. septifera*; Rossi, 1961; Svoboda, 1979; Boero, 1980a, 1985; Boero & Fresi, 1986; Svoboda & Cornelius, 1991), both sides of the Adriatic (Heller, 1868, as *Plumularia kirchenpaueri*; Riedl, 1970, as *A. septifera*), and Cape Bon, Tunisia (Marktanner-Turneretscher, 1890).

The bathymetrical distribution varies between 0.5 (Isasi, 1985) and 400 m (Cornelius, 1995).

The present material originates from 12 stations, of which 11 from the Canary Islands and one from the Selvagens Archipelago, in depth varying from 5 to 102 m.

Epibionts.— Stn 2.D08: Algae, *Antennella campanulaformis* (Mulder & Trebilcock, 1909), Bryozoa.— Stn 3.V08: Bryozoa.— Stn 4.003: *Plumularia setacea* (L., 1758).— Stn 4.015: Campanulariidae indet.— Stn 4.017: *Plumularia setacea* (L., 1758).— Stn 4.019: Algae, *Plumularia setacea* (L., 1758), *Campanularia hincksii* Alder, 1856.— Stn 4.021: Algae, *Halecium* cf. *nanum* Alder, 1859, *Sertularia distans* (Lamouroux, 1816), Bryozoa.— Stn 4.030: *Aglaophenia kirchenpaueri* (Heller, 1868), *Clytia hemisphaerica* (L., 1767).

Aglaophenia latecarinata Allman, 1877
(fig. 21)

Aglaophenia latecarinata Allman, 1877: 56; 1885: 151, pl. 23 figs 5-6; Stechow, 1912a: 370; Bedot, 1921a: 339; 1921c: 40, pl. 5 figs 41-44; Hentschel, 1922: 4, 8; Bedot, 1923: 224, fig. 19; Leloup, 1932c: 160, 164; 1935c: 57; 1935e: 4; 1937a: 113, 117; 1940b: 22; Fraser, 1944a: 378, pl. 82 fig. 368a-e; Vannucci-Mendes, 1946: 586, pl. 7 figs 60-64, 68, 69; Vervoort, 1946a: 338; Leloup, 1947: 34; Buchanan, 1957: 368; Vervoort, 1959: 309, fig. 54; Leloup, 1960: 230; Millard, 1962: 303; Rees & Thursfield, 1965: 191; Van Gemerden-Hoogeveen, 1965: 76; Von Schenck, 1965: 940, 952, figs 33, 34c; Vervoort, 1968: 72, 112, fig. 33; Mayal, 1973: 50, fig. 35; Morris & Mogelberg, 1973: 17, fig. 21a-d; Bogle, 1975: 34, fig. 1A-D; Millard, 1975: 409, fig. 128D-F; Wedler, 1975: 333; Mergner & Wedler, 1977: 24, pl. 6 fig. 41, pl. 11 figs 74, 75; Millard, 1978: 188; Hirohito, 1983: 72, fig. 37a-d; Calder, 1986b: 139, pl. 39; Bandel & Wedler, 1987: 38; Calder, 1991b: 223; 1991c: 2068; Cairns et al., 1991: 28; De Oliveira Pires et al., 1992: 5; Boero & Bouillon, 1993a: 263; Calder, 1993b: 68; Bouillon, Massin & Kresevic, 1995: 33; Calder, 1995: 543; Hirohito, 1995: 283, fig. 98a-d; Migotto, 1996: 38, fig. 8a-d; Calder, 1997: 55, fig. 17a-f.

?Aglaophenia pelagica Lamouroux, 1816: 170.

Aglaophenia perpusilla Allman, 1877: 48, pl. 29 figs 5-7; Nutting, 1900: 98, pl. 21 figs 4-5; Bedot, 1921a: 342; Fraser, 1944a: 385, pl. 83 fig. 374a-c; Deevey, 1954: 271; Vervoort, 1968: 113; Morris & Mogelberg, 1973: 17, fig. 22a-b.

Aglaophenia minuta Fewkes, 1881: 132, pl. 3 fig. 7; Nutting, 1900: 96, pl. 21 figs 1-3; Jäderholm, 1903: 294; Congdon, 1907: 483, fig. 37; Hargitt, 1908: 109; Fraser, 1912: 378, fig. 43; Bennitt, 1922: 252; Jarvis, 1922: 350.

Aglaophenia perforata Allman, 1885: 150, pl. 21 figs 5-8.

Aglaophenia mammillata Nutting, 1900: 98, pl. 21 figs 6-10.

Aglaophenia minima Nutting, 1900: 98, pl. 21 figs 11-13.

Aglaophenia latecarinata var. *madagascariensis* Billard, 1907: 387, pl. 26 figs 18-19; Bedot, 1921a: 340.

Aglaophenia late-carinata; Broch, 1913: 7, fig. 7; 1914a: 29; Fraser, 1945a: 22; Vannucci-Mendes, 1949: 255; Vannucci, 1951b: 108, 110, 111, 112, 114, 117; Deevey, 1954: 271; Millard, 1958: 213, fig. 14; Mayal, 1981d: 231; 1983: 8, fig. 13.

Macrorhynchia bermudensis Stechow, 1920a: 44.

Aglaophenoides mammillata; Fraser, 1943b: 83, pl. 19 fig. 14a-b; Morris & Mogelberg, 1973: 19, fig. 24a-b.

Aglaophenia cf. *perpusilla*; Vervoort, 1972a: 202, fig. 69a-b.

Not *Aglaophenia latecarinata*; García Corrales et al., 1978: 65, fig. 31; Izquierdo et al., 1986: 62, fig. 10.

Material.— **Cape Verde Islands:** Stn 6.102: Single colony without corbulae (RMNH-Coel. 29058 = four slides 4473).

Description.— Hydrorhiza tubular, adhering to substrate, perisarc on attached side thickened, giving rise to monosiphonic, unbranched hydrocaulus. Basal part of

stem short, first internode separated by straight nodes and without nematothecae, followed by six to eight internodes separated by slightly oblique, obscure, scarcely visible nodes, each with frontal nematotheca. This part followed by typical prosegment, separated by distinct, oblique nodes and with frontal nematotheca. Remainder of hydrocaulus formed by succession of internodes separated by oblique nodes, each with one apophysis with mamelon in median part, two axillary nematothecae and one inferior nematotheca. First two apophyses after prosegment closely approximated.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of hydrothecate internodes, each with one hydrotheca and three nematothecae: one mesial inferior adnate with hydrothecal abcauline wall, and two lateral. Hydrothecal rim with four pairs of lateral cusps and a median, abcauline cusp, furthermore with median, abcauline carina extending from mesial nematotheca until base of abcauline marginal cusp, where it ends in a point. Interior of hydrotheca with slightly oblique septum running from adcauline wall to abcauline wall at a point slightly below middle of hydrotheca. Lateral nematothecae short, not reaching beyond hydrothecal rim, aperture gutter-shaped. Mesial inferior nematotheca with gutter-shaped aperture, covering basal third of abcauline wall, with two thickenings of perisarc on abcauline wall, one basal and one distal, latter missing in first hydrocladial internode. Hydrocladial internodes with two internal perisarc rings, one at level of intrathecal septum and one at level of lateral nematothecae. Occasionally third perisarc ring present at level of basal thickening in mesial nematotheca. No fertile colonies were observed; vegetative stolons occasionally present.

Variability.— Damage to the hydrocaulus followed by regeneration may result in the development of two inferior nematothecae under the apophysis. Variability exists in development of the perisarc thickening of the mesial inferior nematothecae and development of the carina, even on the same hydrocladium.

Table V. Measurements of *Aglaophenia latecarinata* in µm:

	Stn 6.102
Height of colony (in mm)	5-28
Internode of hydrocaulus, length	330-470
Diameter at node	90-150
Hydrocladial internode, length	310-440
Diameter at node	50-70
Hydrotheca, depth	280-360
Diameter at rim (without carina)	160-195
Diameter at rim (with carina)	170-210
Length of free part abcauline wall	185-242

Discussion.— *Aglaophenia latecarinata* was shortly described by Allman (1877) and later on more fully described and figured (Allman, 1885). It is characterised by the small size of the colonies, presence of a well developed intrathecal septum and of a carina on the free part of the abcauline hydrothecal wall, thickened perisarc of the

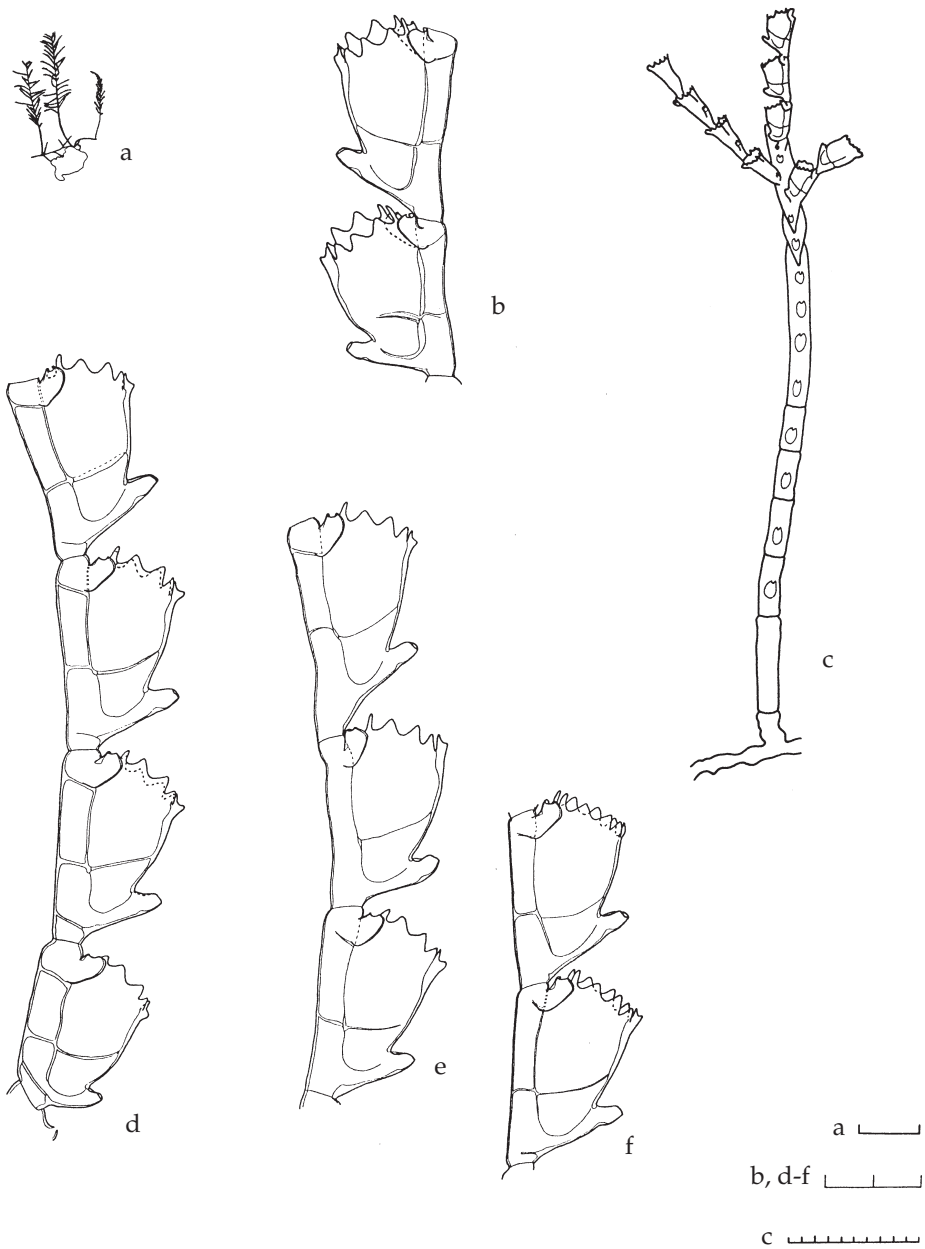


Fig. 21. *Aglaophenia latecarinata* Allman, 1877, Stn 6.102. a, colony; b, two internodes from median part of hydrocladium, lateral view; c, basal part of cormoid, frontal view; d, four internodes from basal part of hydrocladium, lateral view; e, three internodes from median part of hydrocladium, lateral view; f, two internodes from distal part of internode, lateral view. Scales: a, 1 cm; c, 1 mm; b, d-f, 0.2 mm.

abcauline wall of the mesial nematotheca and internal 'septa' (rings) in the internode behind the hydrotheca. However, most of these characters are quite variable (Bedot, 1921c; Leloup, 1932, 1937a; Millard, 1958, 1975; Vervoort, 1959, 1968; Van Gemerden-Hoogeveen, 1965; Bogle, 1975), resulting in the description of various species that must be considered conspecific or related species under discussion.

Aglaophenia minuta Fewkes, 1881, the first to be included in *A. latecarinata*, was initially maintained and *A. latecarinata* was sunk into its synonymy because the original publication (Allman, 1877) was overlooked. This was corrected by Billard (1907: 387, footnote).

A. latecarinata was thought by Allman (1877, 1885) to be close to *Aglaophenia perpusilla* Allman, 1877, from which it was considered to differ by greater width of the carina, greater depth of the hydrotheca and more pronounced intrathecal septum. Bedot (1921c) commented on their great similarity, suggesting they were possibly conspecific and Bogle (1975) included *A. perpusilla* in the synonymy of *A. latecarinata*, a move we endorse because of variability of the characters on which the differences are based, as was demonstrated by Leloup (1937a), Van Gemerden-Hoogeveen (1965), Vervoort (1968) and Bogle (1975).

Billard (1907) described *Aglaophenia latecarinata var. madagascariensis*, differing from the typical form by the bifid cusps at the hydrothecal border. This variety was relegated to the typical form and sunk into its synonymy by Millard (1958, 1975) because of the presence of both types of dentition in the same colony and we concur.

Billard (1914a), after the study of specimens identified as *Plumularia cristata* Lamarck, 1816 [= *Aglaophenia pluma* (Linnaeus, 1758)] in the collection Westendorp, reached the conclusion that material belonged to *A. latecarinata* as a carina and other details could be observed in spite of the bad state of preservation. Leloup (1947) reached a similar conclusion.

Bogle (1975) included *Aglaophenia minima* Nutting, 1900, in the synonymy of *Aglaophenia perforata* Allman, 1885, as species near *A. latecarinata*, differing only in the absence of a carina. Vervoort (1968) described specimens of *A. latecarinata* in which the carina is scarcely visible and suggested that the two might be conspecific. Bogle (1975) described the presence of a perisarc thickening in the abcauline wall in some hydrothecae of *A. perforata*, suggesting the beginning of a carina. Variability in development of the carina in *A. latecarinata* has previously been recorded by Vannucci-Mendes (1946); Van Gemerden-Hoogeveen (1965); Vervoort (1968), and Bogle (1975); in our material, moreover, development of the carina varies between scarcely visible to well developed. Calder (1997), after studying the type series of *A. perforata*, confirms the presence of a distinct carina in that material (cf. Calder, 1997, fig. 17f) and he therefore included *A. perforata* in the synonymy of *A. latecarinata*. We have followed Calder in this respect.

Nutting (1900) suggested that *Aglaophenia pelagica* (Lamouroux, 1816) collected on *Sargassum bacciferum* (Turner) C. Agardh, might be conspecific with *A. latecarinata*. No carina is mentioned in Nutting' s description, and we therefore, along with Bogle (1975) and Calder (1997), consider that they are doubtfully conspecific.

Bedot (1921c) indicated that *Plumularia simplex* d' Orbigny, 1846, might be a synonym of *A. latecarinata*, but because of incomplete description and dubious figures he preferred to call it unidentifiable; after consultation of d' Orbigny' s paper we concur.

Nutting (1900) described *Aglaophenia mammillata*, separating it from the *Aglaophenia minuta* (=*Aglaophenia latecarinata*) group by size, larger carina, absence of annulations in the hydrorhiza and a much smaller 'basal process' (apophysis?) of the hydrocladia. Leloup (1932a) after careful examination of many colonies of *Dynamena quadridentata*, *Monotheca obliqua* and *Aglaophenia latecarinata* observed that in all those species the hydrorhiza may develop trabeculae that give it an annulated aspect. He pointed out that trabeculae develop to achieve better attachment of colonies developing on smooth, moving substrates, like algae. Millard (1958) and Bogle (1975) described colonies of *A. latecarinata* without annulations of the hydrorhiza when developing on non-algal substrate, which seems to corroborate Leloup's suggestions. As indicated above development of the carina is highly varied, moreover Leloup (1937a) and Bogle (1975) relate colony-size to external conditions. It seems justified, therefore to include *Aglaophenia mammillata* in the synonymy of *A. latecarinata* as suggested by Bedot (1921c) and accepted by Vannucci-Mendes (1946) and Calder (1997). Bogle (1975) remarked that although all this suggests they are conspecific, it does not invalidates Fraser's (1943b) action to indicate *A. mammillata* as type, by monotypy, of *Aglaophenoides* Fraser, 1943, though she doubted the validity of that genus. According to Fraser (1943) *Aglaophenoides* differs from *Aglaophenia* by its gonothecae, that are not protected by corbulae. This coincides with observations by Morris & Mogelberg (1973), describing material of *Aglaophenoides mammillata* developing on *Sargassum* spec. with gonothecae growing direct from the hydrocaulus, without being protected by corbulae. Bouillon (1985a) included *Aglaophenoides* in the synonymy of *Gymnangium* Hincks, 1874, but recently Calder (1997), after revision of Fraser's (1943b) material, indicated that the unusual gonophores of *A. mammillata* observed by Fraser are aberrant; he included *Aglaophenoides* in the synonymy of *Aglaophenia*.

The records of *A. latecarinata* by García Corrales et al. (1978) from the Mediterranean and by Izquierdo et al. (1986) from the Canary Islands must be excluded as descriptions and figures do not correspond with that species.

Congdon (1907) recorded *A. minuta* (=*Aglaophenia latecarinata*) and *Lytocarpus philippinus* from the Bermudas; both species have a reference to fig. 37. We believe this figure to represent *A. latecarinata* and not *L. philippinus*. Stechow (1920a) considered that figure to refer to *L. philippinus* and as it does not correspond with the characters of that species he described it as a new species: *Macrorhynchia bermudensis*. This species was included by Calder (1997) in the synonymy of *Macrorhynchia allmani* (Nutting, 1900). We do not support that conclusion and refer *Macrorhynchia bermudensis* Stechow, 1920 to the synonymy of *A. latecarinata*.

Reproduction.— Our material, collected in June, is sterile. Fertile material has been found in February (Millard, 1958), March and April (Vannucci-Mendes, 1946), May (Leloup, 1935c), June (Leloup, 1935c; Vannucci-Mendes, 1946), July (Leloup, 1935c) and December (Mergner & Wedler, 1977).

Distribution.— Boero & Bouillon (1993) consider *Aglaophenia latecarinata* a species with Atlantic-Mediterranean distribution, but the only record from the Mediterranean (García Corrales et al., 1978) does not belong here. *A. latecarinata* is widely distributed in the tropical, subtropical and temperate Atlantic, with some dispersed records from the Indian and Pacific Oceans.

In the western Atlantic it is recorded from Block Island, Martha's Vineyard and

Woods Hole on Rhode Islands (Hargitt, 1908, as *Aglaophenia minuta*; Fraser, 1944a), from the Bermudas (Congdon, 1907, as *A. minuta*; Stechow, 1920a, as *Macrorhynchia bermudensis*; Bennitt, 1922, as *A. minuta*; Leloup, 1935c; Vervoort, 1972, as *A.* cf. *perpusilla*; Morris & Mogelberg, 1973; Calder, 1993b), from the Sargasso Sea (Stechow, 1912a; Broch, 1913; Hentschel, 1922; Leloup, 1935e, 1937a; Vervoort, 1946a), from North Carolina (Fraser, 1912, as *A. minuta*), from a locality near the coast of South Carolina (Fewkes, 1881, as *A. minuta*), from Little Bahama Bank (Bogle, 1975), from Florida (Leloup, 1935a; Fraser, 1944a; Deevey, 1954), from Florida Strait (Bogle, 1975), from the Cay Sal Bank (Leloup, 1937a), from the coast of Texas (Fraser, 1944a), from the Gulf of Mexico (Allman, 1877, 1885; Stechow, 1912a; Deevey, 1954), from Cuba (Stechow, 1912a), from the coast of Belice (Calder, 1991b, 1991c), from Colombia (Wedler, 1975; Bandel & Wedler, 1987), from Aruba, Curaçao and Bonaire (Leloup, 1935a; Van Gemerden-Hoogeveen, 1965), from the littoral zone of Venezuela (Van Gemerden-Hoogeveen, 1965), from various localities in the Lesser Antilles (Fraser, 1945a; Van Gemerden-Hoogeveen, 1965; Vervoort, 1968), from French Guyana (Leloup, 1960) and from various localities in the Brazilian littoral between Pernambuco and São Sebastião (Vannucci-Mendes, 1946, 1949, Vannucci, 1951b; Mayal, 1973, 1981d, 1983; De Oliveira Pires et al., 1992; Migotto, 1996). Also collected at various Atlantic localities west of the Azores (Nutting, 1900; Jäderholm, 1903, both as *A. minuta*; Stechow, 1912a; Bedot, 1921c; Leloup, 1935c, 1940b) and on the eastern side has been found at the Belgian coast (Leloup, 1947)[2], at Sierra Leone (Vervoort, 1959), at Ghana (Buchanan, 1957) and at Angola (Broch, 1914a).

Indian Ocean records are from the coast of South Africa (Millard, 1958, 1962, 1975, 1978), from Mozambique (Millard, 1975) and from Madagascar (Billard, 1907, as *Aglaophenia latecarinata* var. *madagascariensis*). Mergner & Wedler (1977) mentioned its presence in the Red Sea and Hirohito (1983) records it from the coasts of Japan.

Bathymetrical distribution between 0 (Leloup, 1937a) and 516 m (Bogle, 1975). Fraser (1944a) recorded the species from *Sargassum* spec. as deep as 2810 m but thought that this material evidently originated from more shallow waters. Our material comes from a single station in the Cape Verde Archipelago at 25-32 m depth.

Epibionts.— CANCAP 6.102: Algae, Foraminifera, tubes of Amphipoda, Bryozoa.

Aglaophenia lophocarpa Allman, 1877
(figs 22-25)

Aglaophenia apocarpa Allman, 1877: 41, pl. 24 figs 5-9; Clarke, 1879: 247; Fewkes, 1881: 127; Nutting, 1900: 93, pl. 18 figs 9-11; Bedot, 1921a: 338; 1921c: 43, pl. 6 figs 45-47; Fraser, 1944a: 367, pl. 79 fig. 355a-c; Rees & White, 1966: 278; Bogle, 1975: 73, figs 4-5, maps 7-8; Cairns et al., 1991: 28.

Aglaophenia lophocarpa Allman, 1877: 41, pl. 24 figs 1-4; Nutting, 1900: 92, pl. 18 figs 6-8; Bennitt, 1922: 252; Stechow, 1922a: 151; 1923d: 250; Fraser, 1937b: 177, pl. 40 fig. 215a-d; 1938c: 111; 1939c: 160; 1944a: 381, pl. 82 fig. 369a-d; Deevey, 1954: 271; Svoboda, 1979: 82, figs 12b-e, 13e, 15e, 16e (1-3); Gili, Murillo & Ros, 1989: 23; Gili, Vervoort & Pagès, 1989: 92, fig. 20A; Altuna & García Carrascosa, 1990: 55; Castric, Girard & Michel, 1991: 104, fig.; Svoboda & Cornelius, 1991: 22, fig. 5; Svoboda, 1992: 177, figs 3, 7c; Álvarez Claudio, 1993: 204, pl. 17 fig. 35A-D; Boero & Bouillon, 1993a: 263; Álvarez Claudio, 1995: 12; Álvarez Claudio & Anadón, 1995: 239; Peña Cantero, 1995: 264, pl.

[2]Leloup (1947) considered his record of *Aglaophenia latecarinata* from the Belgian coast as accidental, remarking that the species should not be considered to belong to the Belgian fauna.

29 figs a-e; Ramil, Vervoort & Ansín, 1998: 9.
Aglaophenia aperta Nutting, 1900: 95, pl. 20 figs 1-2; Bedot, 1921a: 338; Fraser, 1944a: 366, pl. 79 fig. 354; Deevey, 1954: 271; Vervoort, 1968: 111.
Aglaophenia cristifrons Nutting, 1900: 95, pl. 20 figs 3-4; Bedot, 1921a: 339; Fraser, 1944a: 369, pl. 80 fig. 358; Deevey, 1954: 271; Vervoort, 1968: 111.
Aglaophenia elegans Nutting, 1900: 94, pl. 19 figs 3-4.
Aglaophenia elongata p.p. Picard, 1955b: 190; Gili, 1986: 146, fig. 4.34e-g.
Not *Aglaophenia lophocarpa*; Vervoort, 1968: 70, fig. 32a-c.
Aglaophenia sp. cf. *lophocarpa*; Isasi, 1985: 99, fig. 32F-H; Isasi & Saiz, 1986: 70.
Aglaophenia cf. *lophocarpa*; Ramil & Vervoort, 1992a: 93, fig. 23b-c.

Material.— **Azores area**: Stn 5.071: One colony with badly preserved corbula and a fragment (RMNH-Coel. 29121 = slide 4480).— **Atlantic coast of Morocco and Mauritania**: Stn MAU 039: one colony with two corbulae (RMNH-Coel. 29061 = three slides 4487).— **Madeira area**: Stn 1.D82: Nine detached colonies, some with female corbulae [RMNH-Coel. 28568, three slides 4474 and slide 4488, with *Aglaophenia octodonta* (Heller, 1868)].— **Canary Islands and Selvagens Archipelago**: Stn 2.130: One colony with 37 cormoids, of which 22 with corbulae (RMNH-Coel. 28569, three slides 4475).— Stn 3.083: One colony with 15 cormoids of which four with corbulae (RMNH-Coel. 28700, four slides 4476).— Stn 3.089: One colony with corbulae (RMNH-Coel. 28571; DEBA-UV, two slides R. 293).— Stn 4.144: One colony with 36 cormoids, of which six with corbulae (RMNH-Coel. 28570; DEBA-UV, slide R. 294).— Stn 4.153: One colony with several cormoids, corbulae present (RMNH-Coel. 28916, two slides 4477 and two slides 4478).— Stn 4.158: One colony on *Sertularella* spec., with immature corbula (RMNH-Coel. 28970, two slides 4479).— Stn 4.V08: One colony with nine cormoids, one with an immature corbula (RMNH-Coel. 28797).— **Cape Verde Islands**: Stn 6.038: Nine detached cormoids of which seven with male and female corbulae (RMNH-Coel. 28687, two slides 4481, four slides 4482 and four slides 4483).— Stn 6.049: One colony with corbulae (RMNH-Coel. 29059 = slide 4484).— Stn 6.050: One colony with three female corbulae (DEBA-UV, three slides R. 295).— Stn 6.058: A fragment without corbulae (RMNH-Coel. 29060 = two slides 4485).— Stn 6.D06: 13 detached cormoids without corbulae (RMNH-Coel. 28947, two slides 4486).— Stn 7.132: One colony with three cormoids without corbulae, with *Halopteris catharina* (Johnston, 1833) (RMNH-Coel. 28931; DEBA-UV, slide R. 296).

Description (of material from Stn 3.083).— Hydrorhiza tubular, adhering to substrate, giving rise to monosiphonic, unbranched hydrocauli.

Hydrocaulus with short, undivided basal zone, followed by two or three prosegments separated by little marked, oblique nodes, each with one frontal nematotheca. Remainder of hydrocaulus made up of internodes separated by oblique nodes, only visible in juvenile parts of colony. Each internode with one median apophysis, provided with one mamelon and three nematothecae: two in the axil and one inferior.

Hydrocladia formed by succession of hydrothecate internodes separated by slightly oblique nodes, provided each with one hydrotheca and three nematothecae: one mesial inferior attached to abcauline wall of hydrotheca for nearly its total length, and two lateral. Hydrothecal margin with four pairs of lateral cusps and one mesial abcauline cusp. Lateral nematothecae generally slightly surpass hydrothecal rim; mesial inferior nematotheca covering basal third of hydrothecal abcauline wall. All nematothecae with gutter-shaped opening. Foramen opening from mesial nematotheca into hydrothecal cavity occasionally closed.

Colonies dioecious and with sexual dimorphism. Female corbula with six to eight pairs of completely fused costae projecting slightly beyond breadth of corbula. Male corbula with same number of costae, partly or completely separated. Both male and female corbulae with pedicel composed of one hydrothecate internode.

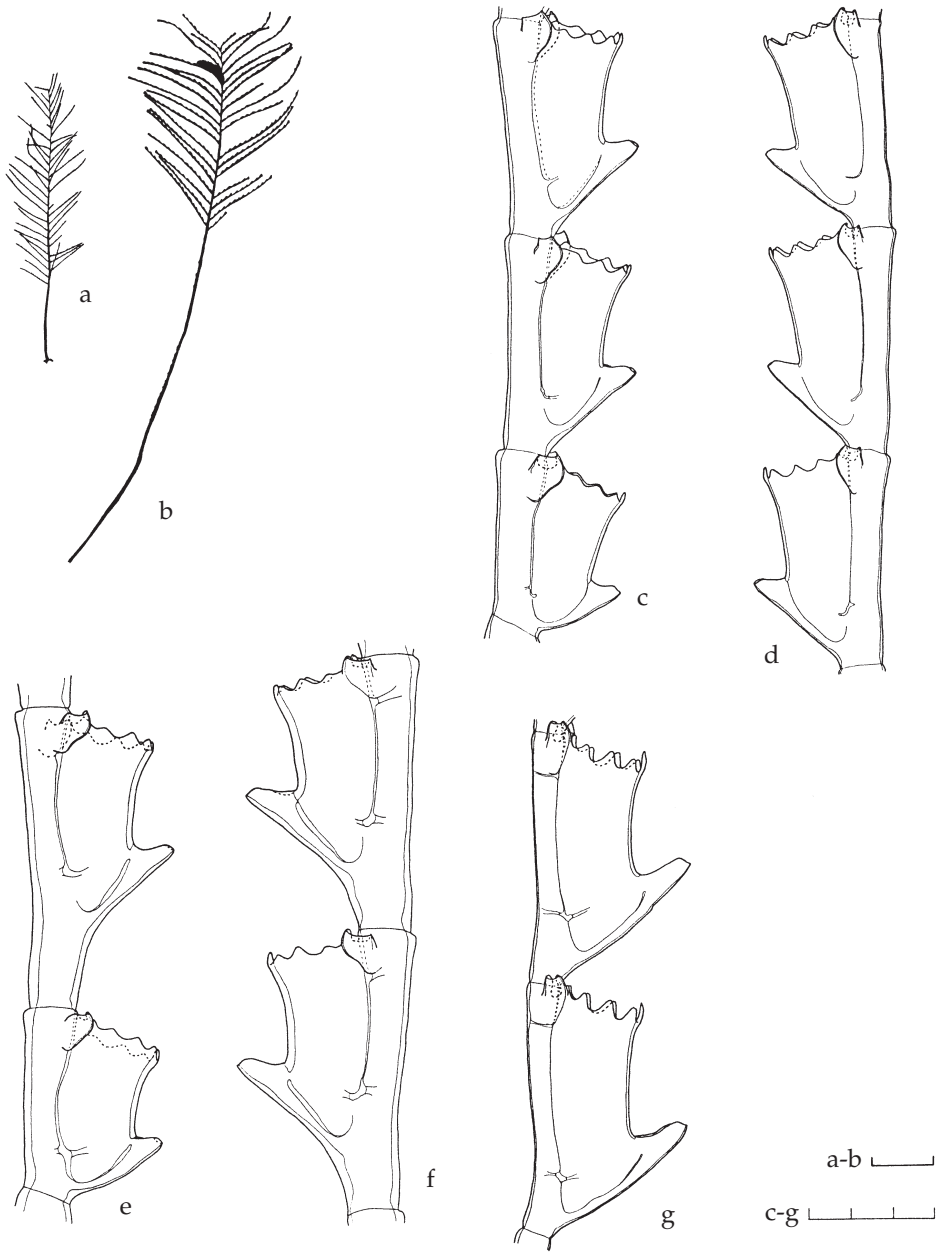


Fig. 22. *Aglaophenia lophocarpa* Allman, 1877. a, Stn 3.083, colony; b, Stn 6.038, colony; c-d, Stn 3.083, c, three internodes from basal part of hydrocladium; d, three internodes from distal part of hydrocladium; e-f, Stn 2.130, e, two internodes from basal part of hydrocladium; f, two internodes from distal part of hydrocladium; g, Stn MAU 039, two internodes from distal part of hydrocladium; all hydrocladia in lateral view. Scales: a-b, 1 cm; c-g, 0.3 mm.

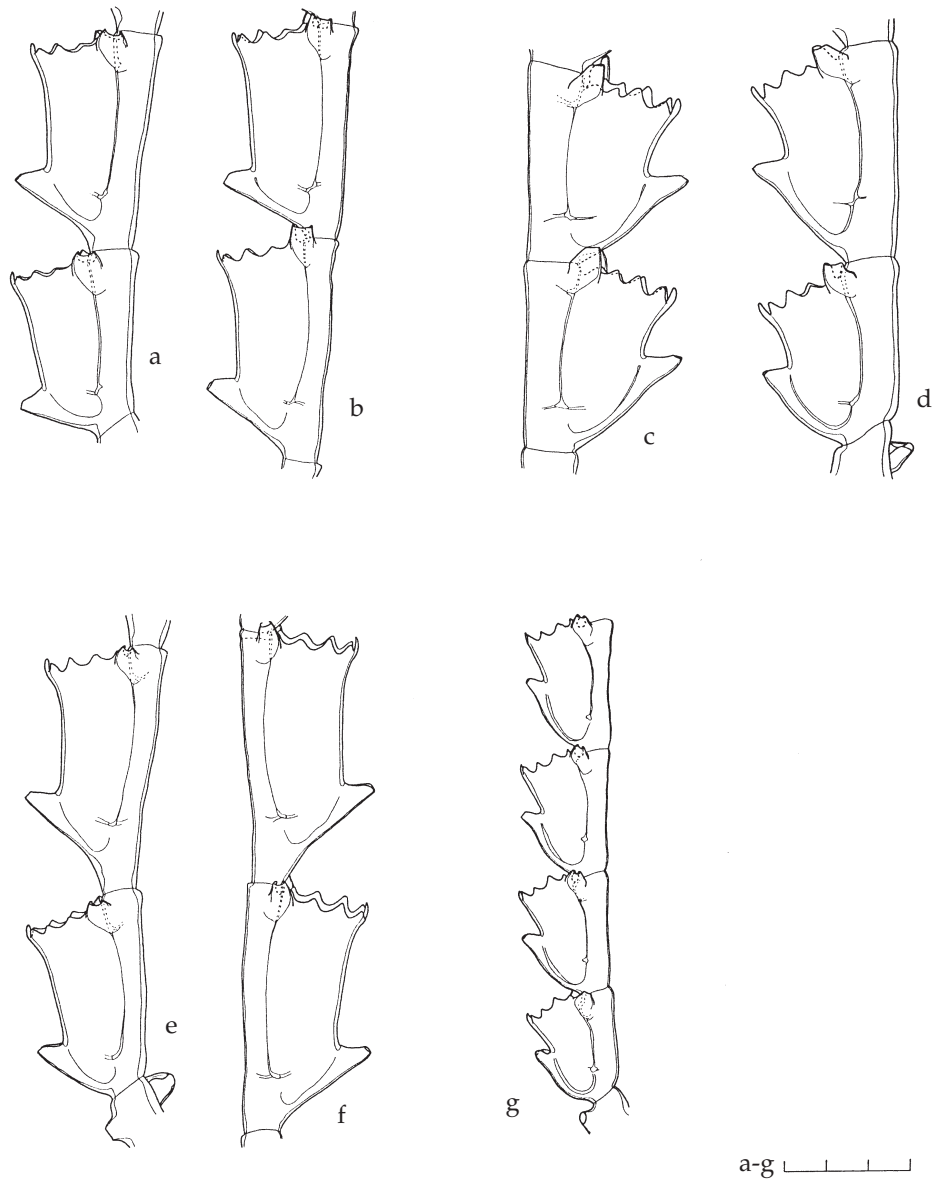


Fig. 23. *Aglaophenia lophocarpa* Allman, 1877. a-b, Stn 4.144, a, two internodes from basal part of hydrocladium; b, two internodes from distal part of hydrocladium; c-d, Stn 4.153, c, two internodes from basal part of hydrocladium; d, two internodes from distal part of hydrocladium; e-f, Stn 4.158, e, two internodes from basal part of hydrocladium; f, two internodes from distal part of hydrocladium; g, Stn 6.D06, four internodes from basal part of hydrocladium; all hydroladia in lateral view. Scales a-g, 0.3 mm.

Variability.— The material inspected varies considerably in size. The colonies from Stns 1.D82, 6.038 (partly) and 6.D06 are small whereas those from Stns 6.038 (partly), 6049, 6.050 and 6.058 are considerably larger (cf. table of measurements); this material has a single prosegment, has well marked oblique nodes, has the communication between mesial nematotheca and hydrotheca typically closed and has big corbulae with a high number of costae: ten to 14 in male and 11 or 12 in female corbulae. Number of nematothecae on the costae is low (cf. fig. 25e-f).

The material from Stn 2.130 has thick perisarc and large hydrocladial internodes with hydrothecae placed at distal end. The hydrothecae in the material from Stn 4.158 are quite deep, the ratio between depth and marginal diameter being 2.3, probably because the colonies are juvenile. A cormoid from Stn 5.071, regenerating after suffering damage, has a prosegment with much marked oblique nodes and a thick hydrocaulus.

On three occasions (Stns 3.089, 4.153 and 4.V08) vegetative shoots occur, once formed by distal part of hydrocladium, twice by apical zone of hydrocaulus. Colonies from Stn 1.D82 were treated with JKJ but no zooxanthellae were observed.

Table VI. Measurements of *Aglaophenia lophocarpa* in µm:

	Stn 3.083	Stn 2.130	Stn 4.158	Stn 5.071	Stn 7.132	Stn 6.038	Stn 6.D06
Height of colony (in mm)	14-52	14-45	9-25	82	21-29	51-93	11-50
Internode of hydrocaulus, length	440-720	550-900	500-650	650-740	480-610	720-1200	340-380
Diameter at node	130-250	150-230	110-140	240-310	160-220	190-430	100-190
Hydrocladial internode, length	380-540	410-720	420-630	430-670	420-620	720-1080	220-290
Diameter at node	90-110	90-130	60-90	90-100	80-110	90-160	50-65
Hydrotheca, depth (1)	340-450	420-450	450-500	410-440	390-420	620-780	250-270
Diameter at rim (2)	190-210	200-220	190-210	190-210	180-200	290-330	110-120
Length free part abcauline wall	220-290	240-260	300-340	250-270	230-240	430-530	100-130
Female corbula, length	2320-2600					5930**	1800-2300++
Maximum diameter	1030-1220					1450**	1000-1250++
Male corbula, length		2200-2850				5610-7780*	1750-2280+
Maximum diameter		1000-1150				1500-1650*	850-990+
Ratio (1)/(2)	1.7-2.1	2.04-2.1	2.36-2.38	2.09-2.15	2.1-2.16		

* = two measurements; ** = one measurement; + = four measurements; ++ = six measurements

Discussion.— Allman (1877) described *Aglaophenia lophocarpa* and *Aglaophenia apocarpa*, differentiating basically on the morphology of the corbulae: closed in *A. lophocarpa* and open in *A. apocarpa*. Bedot (1921c), on account of Torrey & Martin's (1906) work on sexual dimorphism in *Aglaophenia*, synonymized both species as *A. apocarpa*, indicating that the colonies described as *A. lophocarpa* represent female colonies and those as *A. apocarpa* male. Stechow (1923d) indicated that the valid name of the species is *A. lophocarpa* because of page precedence. Bogle (1975) considered the synonymy doubtful; on inspection of the type series of *A. lophocarpa* she observed the presence of a constriction ("pinched zone") at the base of the hydrocaulus, a constant character in certain species of *Aglaophenia* (*A. rhynchocarpa*, *A. perforata* and *A. latecarinata*). This in her opinion might distinguish both species but for a definite judgement

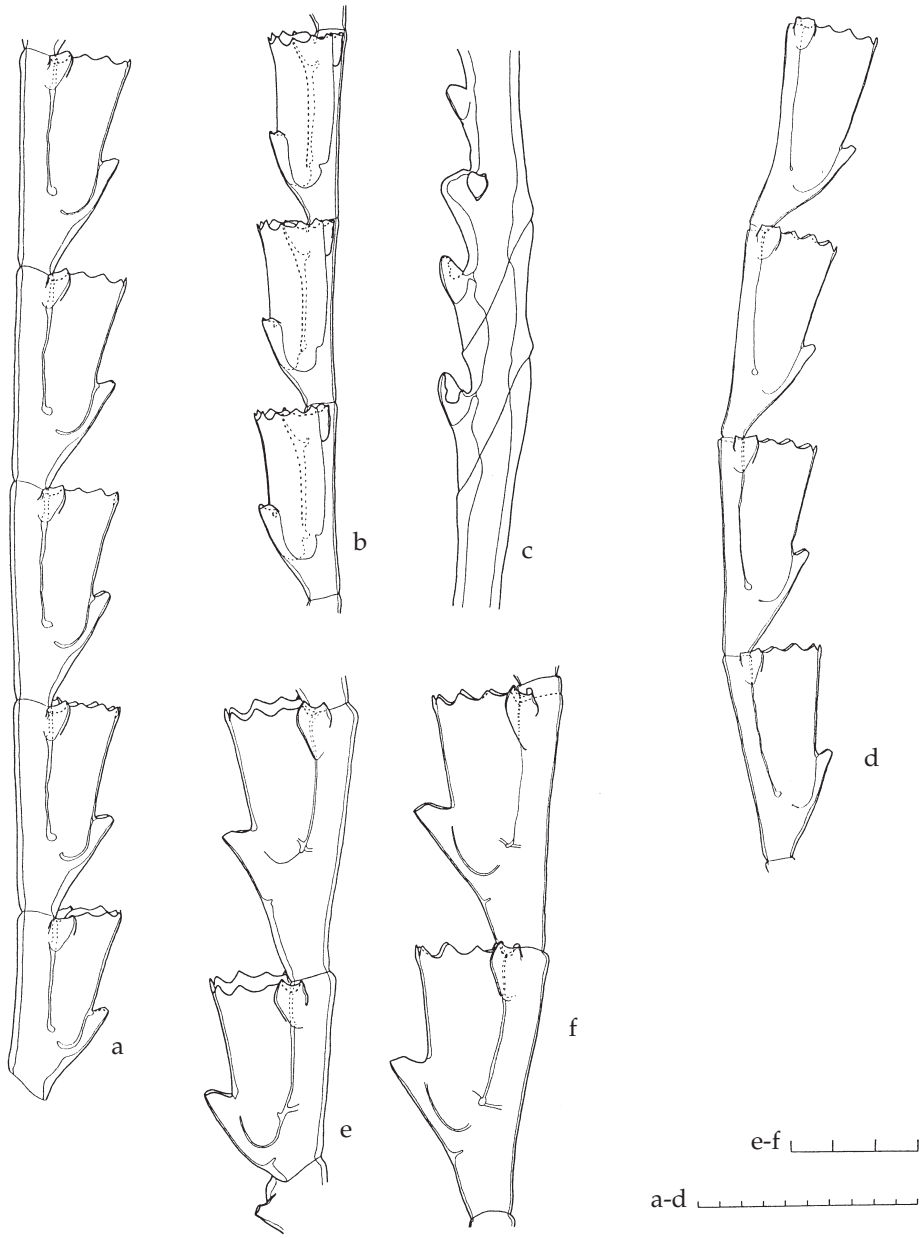


Fig. 24. *Aglaophenia lophocarpa* Allman, 1877. a-d, Stn 6.038, five internodes from basal part of hydrocladium, lateral view; b, three hydrothecae in latero-frontal view, showing hydrothecal foramen; c, detail of prosegment, lateral view; d, four internodes from distal zone of hydrocladium, lateral view; e-f, Stn 5.071, e, two internodes from basal part of hydrocladium, lateral view; f, two internodes from distal part of hydrocladium, lateral view. Scales: a-d, 1 mm; e-f, 0.3 mm.

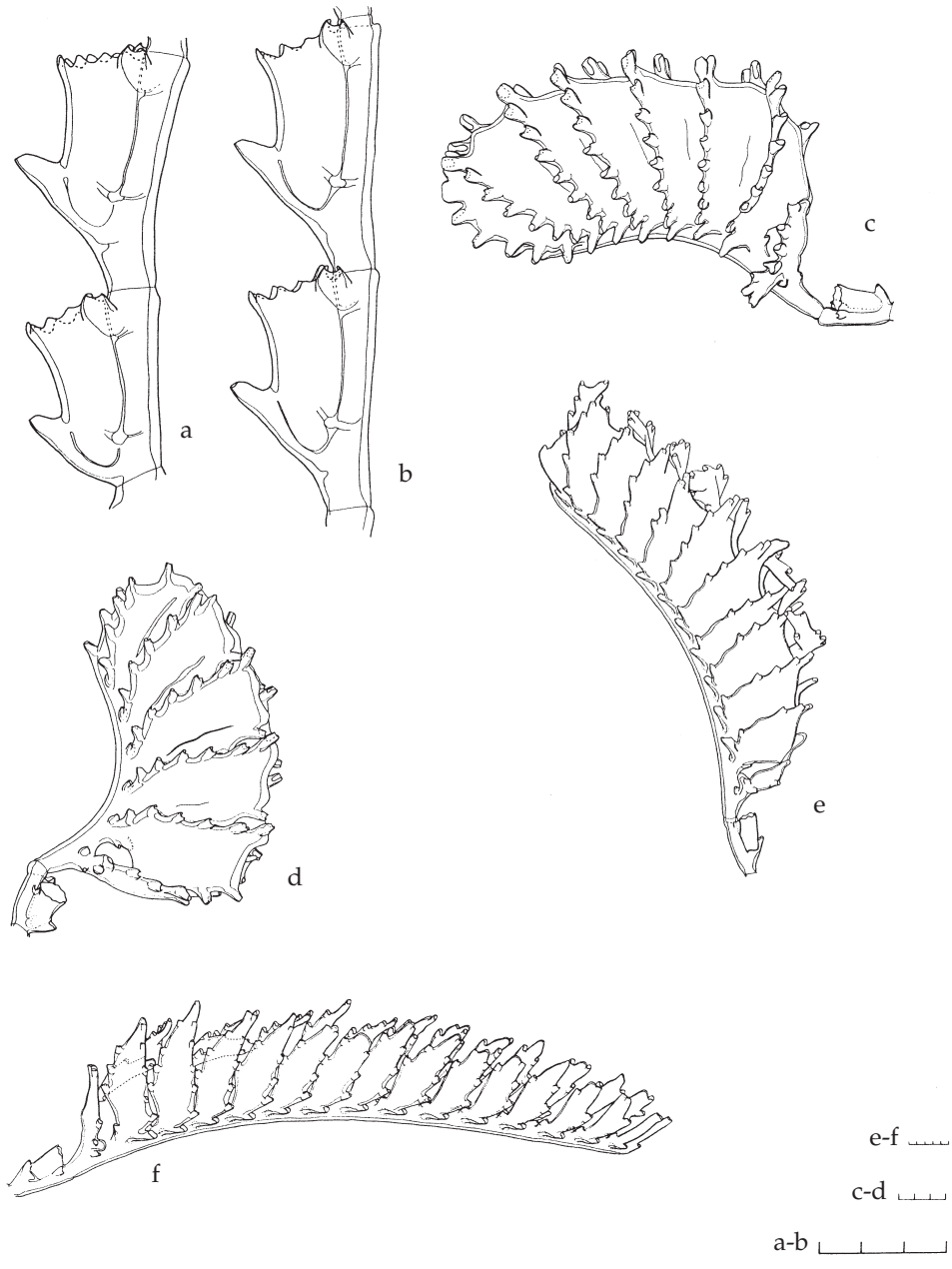


Fig. 25. *Aglaophenia lophocarpa* Allman, 1877. a-b, Stn 7.132, a, two internodes from basal part of hydrocladium; b, two internodes from distal part of hydrocladium; c, Stn 3.083, female corbula; d, Stn 2.130, male corbula; e-f, Stn 6.038, e, female corbula; f, male corbula; hydrocladia and corbulae in lateral view. Scales, a-b, 0.3 mm; c-d, 0.3 mm; e-f, 0.5 mm.

she preferred an inspection of the type series of *A. apocarpa.* Both types were re-inspected by Svoboda & Cornelius (1991); they appeared to be identical in all details, with the exception of some trivial deformations and following their suggestion they are now synonymized as *Aglaophenia lophocarpa*.

Bedot (1921c) also synonymized *Aglaophenia elegans* Nutting, 1900, with *A. apocarpa* (= *A. lophocarpa*), later confirmed by Bogle (1975) after revision of the type of *A. elegans*.

Aglaophenia aperta and *Aglaophenia cristifrons*, described by Nutting (1900) and considered possible varieties of *A. apocarpa* (= *A. lophocarpa*) by Bedot (1921c), differ from each other by the morphology of the corbulae, open in the first and closed in the second; moreover in *A. cristifrons* the hydrocladia stand off perpendicularly from the hydrocaulus. Nutting (1900) also indicates that *A. aperta* differs from *A. apocarpa* by a larger mesial nematotheca. Bogle (1975) mentioned colonies with characters of both *A. aperta* and *A. cristifrons* but that have, in the same colony, open, partly open and closed corbulae, which in her opinion are stages in corbula development. She therefore considered *A. cristifrons* and *A. aperta* conspecific. Moreover, she found colonies intermediate between *A. apocarpa* and *A. aperta* in material from the GERDA Expedition and after study of the types of both species she believed *A. aperta* and *A. apocarpa* (= *A. lophocarpa*) to be conspecific.

The material identified as *A. apocarpa* by Vervoort (1968) does not belong here as it had large median nematothecae, seven inwardly curved marginal cusps and double lateral nematothecae of the basal hydrotheca. We agree with Bogle (1975) that this material should be placed in *Macrorhynchia* and probably represents *Macrorhynchia furcata* (Nutting, 1900) (= *Nematophorus furcatus* Nutting, 1900).

The variability in size met with in our material could, at least in certain cases, be the result of external conditions, because the small-sized material generally originates from shallow localities (Stns 1.D82, 6.038 and 6.D06) where it is exposed to the action of waves, absent at the other localities (Stns 6.049 and 6.050). This material has also been inspected by Dr A. Svoboda, Bochum, who corroborated our identification and reported that the larger colonies greatly resemble the type series of *A. lophocarpa* that he recently revised (Svoboda, pers. comm.).

Reproduction.— The presence of corbulae was mentioned by Bogle (1975), Svoboda (1979), Gili, Vervoort & Pagès (1989), Svoboda & Cornelius (1991), Svoboda (1992a) and Álvarez Claudio (1993); they have been found in every month of the year with the exception of November. The CANCAP material had corbulae in March, May, June, September and October.

Distribution.— *Aglaophenia lophocarpa* is mainly a tropical-Atlantic species (Boero & Bouillon, 1993), though it has also been found in the Pacific. In the Atlantic it is known from the Bermudas (Bennitt, 1922), from various localities in the Gulf of Mexico (Nutting, 1900; Deevey, 1954), from Florida (Allman, 1877; Fewkes, 1881 and Nutting, 1900, both as *A. apocarpa*; Deevey, 1954; Bogle, 1975, as *A. apocarpa*), from Cuba (Clarke, 1879, as *A. apocarpa*; Nutting, 1900; Deevey, 1954), from north of Puerto Rico (Fraser, 1944a), from the Azores (Bedot, 1921c, as *A. apocarpa*), from the French Channel coast (Castric, Girard & Michel, 1991), from the north coast of Spain (Isasi, 1985, as *Aglaophenia* sp. cf. *lophocarpa*; Isasi & Saiz, 1986, as *A.* sp. cf. *lophocarpa*; Altuna & García Carrascosa, 1990; Álvarez Claudio, 1993, 1995; Álvarez Claudio & Anadón, 1995), from the Gulf of Cádiz and the coast of Morocco (Ramil & Vervoort, 1992a, as

Aglaophenia cf. *lophocarpa*), from Josephine Bank (Ramil, Vervoort & Ansín, 1998) and from the coast of Guinea Bissau (Gili, Vervoort & Pagès, 1989).

In the Mediterranean it is known from the Chafarinas Islands (Peña Cantero, 1995), various places at the Spanish coasts (Gili, 1986, as *Aglaophenia elongata*; Svoboda & Cornelius, 1991), from Algeria (Picard, 1955b, as *A. elongata*), from the south coast of France (Svoboda & Cornelius, 1991) and from various localities in the Italian littoral (Svoboda, 1979; Svoboda & Cornelius, 1991).

In the Pacific found at Pacific Grove (Stechow, 1923d; Fraser, 1937b) and north of Isla de San Pedro Nolasco in the Gulf of California (Fraser, 1938c).

The bathymetrical range is between 5 (Svoboda & Cornelius, 1991) and 2160 m (Nutting, 1900).

The CANCAP material originates from 16 stations of which six in the Cape Verde Archipelago, four at the Canary Islands, three near the Selvagens and one near the Azores, Madeira and Mauritania, respectively. The depth records are between 0 and 1800 m.

Epibionts.— Stn 1.D82: *Plumularia setacea* (L., 1758).— Stn 3.083: *Plumularia setacea*; (L., 1758).— Stn 3.089: *Filellum* spec.— Stn 4.153: *Filellum* spec., *Antennella secundaria*, (Gmelin, 1791), Sertulariidae indet., Bryozoa.— Stn 4.158: *Modeeria rotunda* (Quoy & Gaimard, 1827).— Stn 5.071: Foraminifera, polychaete tubes.— Stn 6.038: *Campanularia*/*Clytia* spec.— Stn 6.050: Foraminifera, *Plumularia* spec.— Stn 6.D06: Algae, *Filellum serratum* (Clarke, 1879), Bryozoa.— Stn 7.132: Foraminifera, *Filellum serratum* (Clarke, 1879), *Zygophylax* spec., *Halopteris catharina* (Johnston, 1833).

Aglaophenia octodonta (Heller, 1868)
(figs 26-27)

Plumularia octodonta Heller, 1868: 40, 82, pl. 2 fig. 3.

Aglaophenia helleri Marktanner-Turneretscher, 1890: 271, pl. 7 figs 3, 14-15; Stechow, 1919a: 144; Bedot, 1921a: 340; Prenant & Teissier, 1924: 26; Teissier, 1930: 184; Gur'yanova, 1972: 71.

Aglaophenia helleri var. Marktanner-Turneretscher, 1890: 271, pl. 7 figs 13, 16.

Not *Aglaophenia Helleri*; Marine Biological Association, 1904: 197; 1957: 51 [=*Aglaophenia pluma* (Linnaeus, 1758)].

Aglaophenia filicula Kühn, 1909: 452, fig. Ua, pl. 21 figs 64-69, pl. 22 figs 70-74.

Aglaophenia adriatica Babic, 1911a: 542, figs 1-2; Bedot, 1921a: 340.

Aglaophenia pluma var. *helleri*; Bedot, 1919b: 265; 1921a: 340; Philbert, 1935c: 18; 1935d: 34.

Aglaophenia octodonta; Stechow, 1922a: 151; 1923d: 247; Picard, 1952d: 344; 1955b: 191; 1958b: 192; 1958c: 2; Bellan-Santini, 1961: 25, 27; Rossi, 1961: 78; Bellan-Santini, 1962: 187, 192; 1970: 338; Rossi, 1971: 29, fig. 11A, E; Chas Brínquez & Rodríguez Babío, 1977: 31, fig. 21A-C; Gili, 1979: 128; Marinopoulos, 1979b: 120; Svoboda, 1979: 65, figs 12a, 13a, 15a, 16a, pl. 15C; Boero, 1980a: 133; 1981b: 113; 1981d: 5; García Carrascosa, 1981: 296, pl. 29 figs d-f, pl. 43 figs e-f, pl. 45 fig. f; Boero, 1983b: 543; Gili & Romero, 1983: 36; Marinopoulos, 1983: 295; Altuna et al., 1984: 136; Boero, 1984: 101, fig. 6; 1985a: 136; Gili & Castelló, 1985: 20, fig. 7A; Gili & García Rubies, 1985: 50, fig. 5K; Gili & Ros, 1985: 329; Boero & Fresi, 1986: 145; Gili, 1986: 148, figs 4.33C-E, 4.55b; Roca, 1986: 419; Aguirrezabalaga et al., 1987: 116; García Carrascosa et al., 1987: 373; Gili, Ros & Pagès, 1987: 92; Gili, Murillo & Ros, 1989: 23; Altuna & García Carrascosa, 1990: 54, fig. 90; Castric, Girard & Michel, 1991: 89, fig.; Gili & Ballesteros, 1991: 247; Svoboda & Cornelius, 1991: 23, fig. 6; Ansín Agís, 1992: 126, pl. 28; Boero & Bouillon, 1993a: 263; García Álvarez et al., 1993: 271; Altuna Prados, 1994a: 211; 1995a: 54; Álvarez Claudio, 1995: 12; Medel & Vervoort, 1995: 11, fig. 3; Peña Cantero, 1995: 269, pl. 30 figs a-e.

Aglaophenia pluma var. *octodonta*; Stechow, 1923d: 248.
Aglaophenia pluma f. *helleri*; Broch, 1933b: 50; Da Cunha, 1944: 37, fig. 16b; Vervoort, 1949: 147, fig. 4a; Rossi, 1950: 25; Teissier, 1950b: 24; García Corrales et al., 1978: 63, fig. 29A-B; Gili, 1981: 108; Gili i Sardà, 1982: 93; Gili, García & Colomer, 1984: 414; Izquierdo et al., 1986: 61, fig. 9.
Aglaophenia pluma f. *octodonta*; Picard, 1951a: 113; Riedl, 1959: 662.
Aglaophenia octodonta var. *adriatica*; Picard, 1958b: 192.
Not *Aglaophenia pluma* f. *helleri*; Fey, 1969: 405 [= *Aglaophenia pluma* (Linnaeus, 1758)].
Aglaophenia tubulifera; García Carrascosa, 1981: 305, pl. 28 figs a-c, pl. 43 figs a-b [not *Aglaophenia tubulifera* (Hincks, 1861)].
Aglaophenia octodonta p.p. Ramil, 1988: 443.

Material.— **Azores area**: Stn AZO 07: One colony with various cormoids, no corbulae (RMNH-Coel. 28965, two slides 4489).— Stn AZO 17: Two colonies, first with many cormoids and corbulae, second on sponge without corbulae (RMNH-Coel. 28587, three slides 4490).— Stn 5.018: One colony with many cormoids on alga, with corbulae (RMNH-Coel. 28583, five slides 4491, two slides 4492).— Stn 5.194: One colony with various cormoids, with corbulae (RMNH-Coel. 29062 = three slides 4493).— Stn 5.D08: Seven cormoids of which four with corbulae (RMNH-Coel. 28669, two slides 4494).— Stn 5.K01: One colony without corbulae (RMNH-Coel. 29063 = slide 4495).— Stn 5.K02: One colony on rock fragment with 43 cormoids of which two with corbulae (RMNH-Coel. 28779, slide 4496).— **Atlantic coast of Morocco and Mauritania**: Stn 3.182: One colony with few cormoids and three detached colonies with corbulae (RMNH-Coel. 28584; DEBA-UV, three slides R. 297).— Stn MAU 063: One colony on sponge, with corbulae (RMNH-Coel. 28665, four slides 4497, two slides 4498).— **Madeira area**: Stn. 1.D82: Two colonies with numerous cormoids, with corbulae (RMNH-Coel. 28585, slide 4488, with *Aglaophenia lophocarpa* Allman, 1877).— **Canary Islands and Selvagens Archipelago**: Stn 4.K11: One colony with a few cormoids, with corbulae (DEBA-UV, three slides R. 298).

Description (of material from Stn 5.018).— Hydrorhiza tubular, adhering to substrate, giving rise to a number of monosiphonic, unbranched hydrocauli, these with short basal zone of two or three short internodes separated by transverse nodes followed by a prosegment with frontal nematotheca separated by well marked, oblique nodes, superior more oblique than inferior. Remainder of hydrocaulus composed of succession of internodes separated by oblique nodes, each with one apophysis with one well developed mamelon and three nematothecae: two in the axil and one inferior.

Hydrocladia inserted on apophysis, alternately directed left and right, composed of internodes separated by slightly oblique nodes and each with one hydrotheca and three nematothecae: one mesial inferior adnate to hydrothecal abcauline wall and two lateral. Hydrotheca triangular, plane of aperture tilted in abcauline direction and provided with four pairs of lateral cusps and one median abcauline cusp. Abcauline pair of marginal cusps biggest, cusps decreasing in size adcaudally; median abcauline cusp curved inward. Adcauline intrathecal septum present at one-third height of hydrotheca; development varying from scarcely visible to almost reaching abcauline hydrothecal wall. Lateral nematothecae not surpassing hydrothecal rim. Mesial nematotheca adnate to abcauline wall of hydrotheca for c. two-thirds of its length, free part reaching hydrothecal rim or occasionally slightly longer in some colonies. Aperture of all nematothecae gutter-shaped.

Colonies dioecious with sexual dimorphism of corbulae. Female corbula with completely fused costae, those of male corbula not completely fused as appears clearly in distal part of costae. Number of costae in both sexes three to five pairs. Some-

Fig. 26. *Aglaophenia octodonta* (Heller, 1868). a, Stn 5.018, colony; b-d, Stn MAU 063, b, colony; c, four internodes from basal part of hydrocladium; d, three internodes from distal part of hydrocladium; e-f, Stn 5.018, e, three internodes from basal part of hydrocladium; f, three internodes from distal part of hydrocladium; g-h, Stn 5.K01, g, three internodes from basal part of hydrocladium; h, three internodes from distal part of hydrocladium; all hydrocladia in lateral view. Scales: a-b, 1 cm; c-h, 0.3 mm.

times, most frequently with female corbulae, first costa appears to be free. All corbulae with pedicel composed of one hydrothecate internode.

Variability.— Material from Stn AZO 17 has one to four prosegments and big corbulae with eight to ten costae. Several colonies from Stn 5.018 develop new hydrocauli from openings left by shed hydrocladia. In material from Stns 3.182 and Mau 063 lateral and mesial nematothecae are tubular and the costae of corbulae are slightly obliquely arranged. This material stained in Lugol solution, though no zooxanthellae could be observed in the tissue, as happens in *Aglaophenia tubiformis* Marktanner-Turneretscher, 1890. Dr Svoboda (in lit.) confirmed our identification as *Aglaophenia octodonta*.

Table VII. Measurements of *Aglaophenia octodonta* in µm:

	Stn 5.018	Stn MAU 063
Height of colony (in mm)	6-47	4-82
Internode of hydrocaulus, length	340-490	
Diameter at node	90-320	
Hydrocladial internode, length	280-360	190-300
Diameter at node	60-120	95-185
Hydrotheca, depth	250-310	230-310
Diameter at rim	180-240	160-195
Length of free part abcauline wall	90-110	80-90
Female corbula, length	1650-2210	
Maximum diameter	910-1310	
Male corbula, length	1270-2230	
Maximum diameter	890-1220	

Discussion.— This species greatly resembles *Aglaophenia pluma* (Linnaeus, 1758); many authors have considered it a variety. Stechow (1923d) indicates that both species can easily be separated by size and morphology of the colonies, that in *Aglaophenia octodonta* are more dense with closely approximated hydrocladia. Svoboda & Cornelius (1991) pointed out that in the eastern Mediterranean both species can so be distinguished, but problems arise when both species grow together and *A. pluma* is unbranched. In such cases Svoboda & Cornelius (1991) propose to use biometrical analysis and other data like reproductive period, colour of the living colonies and substrate.

Reproduction.— Presence of corbulae was mentioned by Stechow (1919), Teissier (1950), Chas Brínquez & Rodríguez Babío (1977), Ansín Agís (1992), Altuna et al. (1983), Gili & Castelló (1985), Gili & García Rubies (1985), Boero & Fresi (1986), Gili (1986), Roca (1986), Medel & Vervoort (1995) and Peña Cantero (1995); they have been found in all months of the year, with the exception of January and December. Svoboda (1979) and Svoboda & Cornelius (1991) indicated that the reproductive period of this species in the Adriatic is the whole year round, but in the remainder of the Mediterranean fertile colonies are only met with in winter. CANCAP colonies collected in March, May, June, September and November bear corbulae.

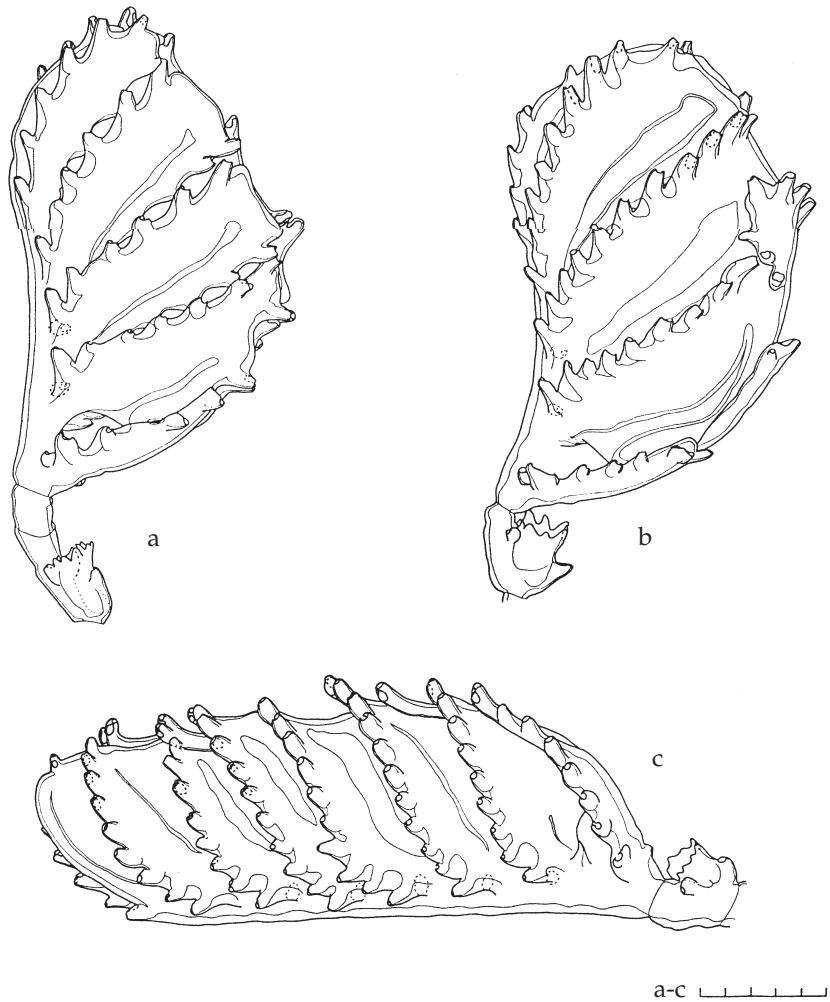


Fig. 27. *Aglaophenia octodonta* (Heller, 1868). a-b, Stn 5.018, a, male corbula; b, female corbula; c, Stn MAU 063, female corbula?; all in lateral view Scales: a-c, 0.5 mm.

Distribution.— Boero & Bouillon (1993a) attributed an Atlantic-Mediterranean distribution to this species. In the Atlantic it has been recorded from the Channel Islands (Philbert, 1935c, as *Aglaophenia pluma* var. *helleri*), from the coast of Brittany (Prenant & Teissier, 1924; Teissier, 1930a, both as *A. helleri*; 1950b, as *A. pluma* f. *helleri*; Castric, Girard & Michel, 1991), from the Basque coast (Altuna et al., 1983; Aguirreza-balaga et al., 1987; Altuna & García Carrascosa, 1990; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995), from Ribadesella (García Corrales et al., 1978, as *A. pluma* f. *helleri*), from Galicia (Chas Brínquez & Rodríguez Babío, 1977; Ramil, 1988; Ansín Agís, 1992), from the Portuguese coast (Da Cunha, 1944, as *A. pluma* f. *helleri*; Svoboda & Cornelius, 1991), from the Strait of Gibraltar (Medel & Vervoort, 1995), from the

coast of Morocco (Svoboda & Cornelius, 1991), from the Canary Islands (Izquierdo et al., 1986, as *A. pluma* f. *helleri*) and from the coast of Senegal (Picard, 1951a, as *A. pluma* f. *octodonta*).

In the Mediterranean it has been found along the Spanish coasts (García Corrales et al., 1978, as *A. pluma* f. *helleri*; Gili, 1979; García Carrascosa, 1981; Gili i Sardà, 1982; Gili, García & Colomer, 1984, both as *A. pluma* f. *helleri*; Gili & Castelló, 1985; Gili, 1986; Gili, Ros & Pagès, 1987; Svoboda & Cornelius, 1991), at the Chafarinas Islands (Peña Cantero, 1995), at the Balearic Islands (Gili & García Rubies, 1985; Roca, 1986), along the Algerian coast (Picard, 1955b), along the coast of southern France (Stechow, 1919a, as *A. helleri*; Picard, 1952d; Bellan-Santini, 1961, 1962, 1970; Svoboda & Cornelius, 1991), at Corsica (Stechow, 1919a, as *A. helleri*), at numerous localities of the Italian littoral (Marktanner-Turneretscher, 1890; Stechow, 1919a, both as *A. helleri*; Riedl, 1959, as *A. pluma* f. *octodonta*; Rossi, 1961, 1971; Boero, 1980a, 1981b, 1985a; Boero & Fresi, 1986; Svoboda & Cornelius, 1991), in the Adriatic (Heller, 1868, as *Plumularia octodonta*; Marktanner-Turneretscher, 1890, as *A. helleri*; Broch, 1933b, as *A. pluma* f. *helleri*; Svoboda, 1979; Svoboda & Cornelius, 1991), at Malta (Svoboda & Cornelius, 1991), along the Turkish coasts (Svoboda & Cornelius, 1991), and along the coast of Israel (Picard, 1958c).

The bathymetrical distribution is between 0 and 46 m (Peña Cantero, 1995).

The CANCAP material comes from 11 stations, of which seven from the Azores, one from Madeira, one from the Canary Islands and two from the coasts of Mauritania. At these stations the depth varies between 0 and 45 m, with the exception of Stn 5.194, where material was obtained between 2419 and 2476 m, but as this is without coenosarc is was probably carried to deeper water by currents.

Epibionts.— Stn 1.D82: Algae, unidentifiable athecate leptolid, *Plumularia setacea* (L., 1758).— Stn 3.182: Algae, *Aglaophenia octodonta* (Heller, 1868), *Plumularia setacea* (L., 1758).— Stn AZO 07: *Scandia mutabilis* (Ritchie, 1907).— Stn 4.K11: Algae.— Stn 5.018: Bryozoa.— Stn 5.K02: Algae.— Stn MAU 063: *Plumularia setacea* (L., 1758); *Campanularia hincksii* Alder, 1856, gastropod eggs, tubes of Amphipoda, Bryozoa.

Aglaophenia parvula Bale, 1882
(fig. 28)

Aglaophenia parvula Bale, 1882: 35, pl. 14 fig. 3; 1884: 165, pl. 14 fig. 3, pl. 17 fig. 10; 1887: 97; 1888: 790; Marktanner-Turneretscher, 1890: 269; Vanhöffen, 1910: 335, fig. 47; Briggs, 1918: 45; Bedot, 1921a: 340; Stechow, 1923c: 118; 1925b: 516; Leloup, 1937a: 115, fig. 16A-B; Vervoort, 1946a: 339, fig. 9b; Hodgson, 1950: 57, fig. 88; Patriti, 1970: 49, fig. 67A-B; Ramil, 1988: 448, pl. 22 figs A-C; Gili, Vervoort & Pagès, 1989: 94, fig. 21A; Altuna & García Carrascosa, 1990: 55; Castric-Fey & Chassé, 1991: 523; Castric, Girard & Michel, 1991: 104; Svoboda & Cornelius, 1991: 25, figs 7-9, 10a-e, 13h, 18, 22-23; Ansín Agís, 1992: 131, pl. 29; Cornelius, 1992a: 255; Thorpe et al., 1992: 891, fig. 1E-H; Altuna Prados, 1994a: 213, pl. 38; 1995a: 47; Cornelius, 1995: 189, fig. 44; Medel & Vervoort, 1995: 13, fig. 4a-c.

Aglaophenia heterodonta Jäderholm, 1903: 296, pl. 13 fig. 10, pl. 14 fig. 1; Ritchie, 1909: 96; Bedot, 1921a: 340.

Aglaophenia dichotoma p.p. Broch, 1913: 5, fig. 6a-b.

Aglaophenia dichotoma f. *heterodonta*; Billard, 1931d: 677; 1934: 230; Patriti, 1970: 48, fig. 66A-B.

Aglaophenia pluma var. *parvula*; Day & Morgans, 1956: 301; Millard, 1957: 239, fig. 15D-F; 1958: 215; 1962: 304; ?Redier, 1965: 380; Millard, 1968: 254, 280; Day, Field & Penrith, 1970: 13; Leloup, 1971:

4, fig. 2; Millard, 1975: 413, fig. 129 B, F; 1978: 188.
Not *Aglaophenia pluma* var. *parvula*; Vervoort, 1959: 307, figs 52a, 53b.
Aglaophenia pluma pluma p.p. Millard, 1975: 412, fig. 129D.
Aglaophenia pluma dichotoma p.p. Millard, 1975: 413, fig. 129A, C, E.
Aglaophenia sp. cf. *parvula*; Isasi, 1985: 99, fig. 32A-E; Isasi & Saiz, 1986: 70.

Material.— **Atlantic coast of Morocco and Mauritania**: Stn 1.118: One colony with 12 cormoids, on hydrorhiza of *Nemertesia antennina* (Linnaeus, 1758); no corbulae (RMNH-Coel. 28572).— Stn MAU 006: Several fragments without corbulae (RMNH-Coel. 28683, slide 4499).— Stn MAU 007: Several colonies without corbulae (RMNH-Coel. 28962, slide 4500).— Stn MAU 009: Numerous colonies without corbulae (RMNH-Coel. 28643, slide 4501).— Stn MAU 010: Numerous dichotomously branched colonies without corbulae (RMNH-Coel. 28959, two slides 4502).— Stn MAU 024: Numerous dichotomously branched colonies without corbulae (RMNH-Coel. 28943, two slides 4503).— Stn MAU 027: Numerous dichotomously branched colonies without corbulae (RMNH-Coel. 16592, slide 4504).— Stn MAU 117: One colony without corbulae (RMNH-Coel. 28662; DEBA-UV, slide R. 292).

Description (of material from Stn MAU 007).— Colonies with hydrorhiza attached to substrate, giving rise to unbranched or dichotomously branched hydrocauli. Hydrocaulus inserted on small apophysis of hydrorhiza, with basal part of varied length composed of varied number of internodes separated by straight, obscure nodes, followed by one prosegment separated by distinct, oblique nodes and with one frontal nematotheca. Rest of hydrocaulus formed by succession of internodes separated by slightly oblique nodes, each with one apophysis with one mamelon and three nematothecae: two in the axil and one inferior.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of a series of hydrothecate internodes separated by straight nodes, each with one hydrotheca and three nematothecae: one mesial inferior adnate to hydrothecal abcauline wall and two lateral. Hydrotheca triangular, rim with four pairs of lateral cusps and one abcauline cusp. Lateral cusps varied in development; second from abcauline side doubled. Basal part of hydrothecal cavity with well developed adcauline septum, typically reaching opposite (abcauline) side. Lateral nematothecae small, not reaching hydrothecal rim. Mesial nematotheca adnate for c. two-thirds of its length, typically reaching base of lateral cusps. Each hydrocladial internode with two perisarc rings, one at level of intrathecal septum, one at level of base of lateral nematothecae.

Gonosome absent.

Variability.— In some colonies from Stn MAU 007 the hydrocaulus has regenerated after previous damage, forming a prosegment identical with that of basal zone or an internode with slightly oblique basal and very oblique distal node, both quite well marked. Some colonies from Stn MAU 009 have the second and third pairs of lateral cusps doubled (fig. 28f). The material from Stn MAU 010 shows great variability in the shape of second pair of lateral cusps, varying between the characteristic double cusp to a simple cusp without any sign of bifurcation.

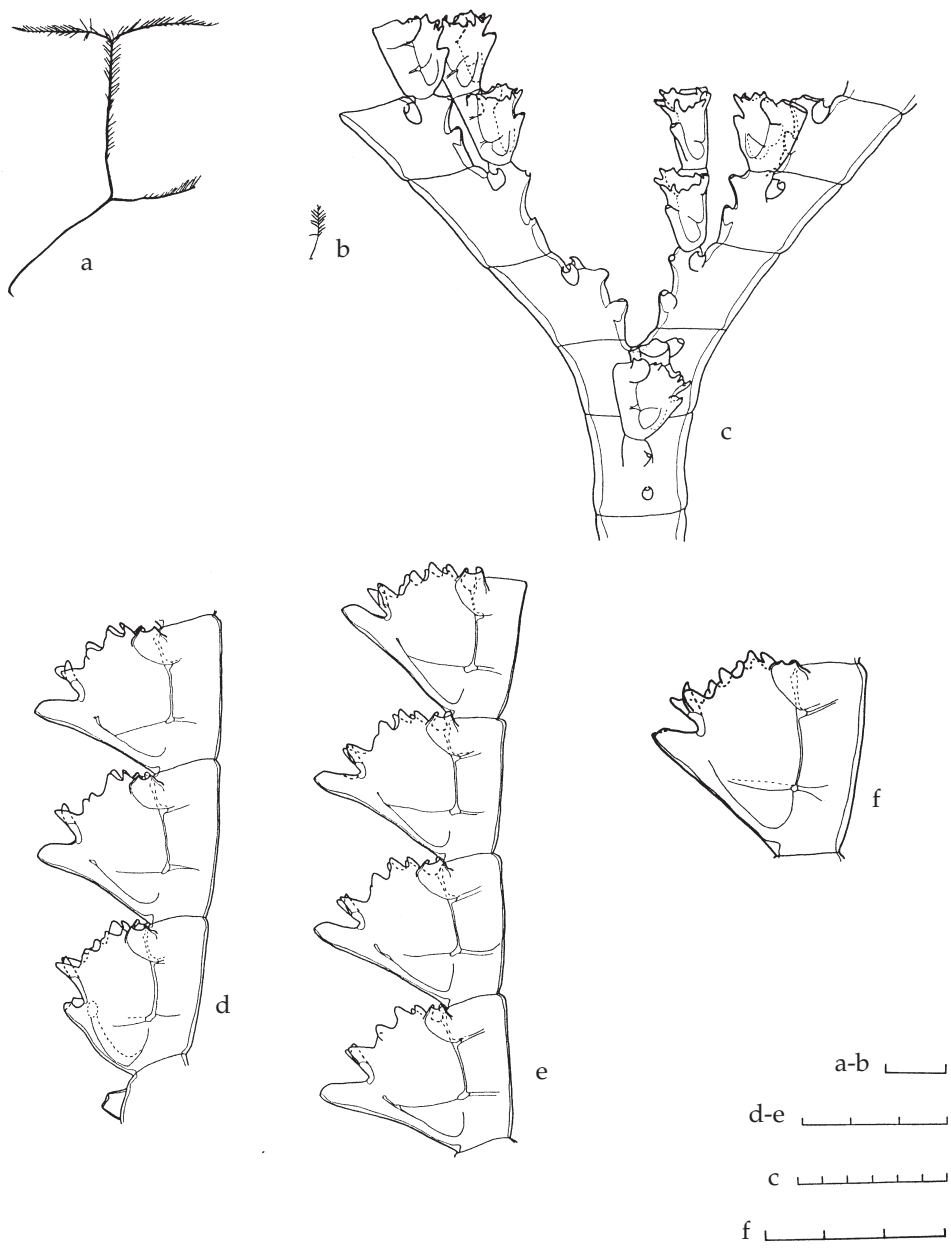


Fig. 28. *Aglaophenia parvula* Bale, 1882. a, Stn MAU 027, branched colony; b, Stn MAU 007, unbranched colony; c, Stn MAU 117, detail of ramification, frontal view; d-e, Stn MAU 024, three internodes from basal part of hydrocladium, lateral view; e, four internodes from distal part of hydrocladium, lateral view; f, Stn MAU 009, hydrotheca with doubled 2nd and 3rd pairs of lateral cusps, lateral view. Scales: a-b, 1 cm; c, 0.6 mm; d-e, 0.3 mm; f, 0.3 mm.

Table VIII. Measurements of *Aglaophenia parvula* in µm:

	Stn MAU 010
Height of the colony (in mm)	5-188
Internode of hydrocaulus, length	310-450
Diameter at node	200-350
Hydrocladial internode, length	280-320
Diameter at node	70-110
Hydrotheca, depth	260-300
Diameter at rim	160-200
Length free part abcauline wall	50-90

Discussion.— *Aglaophenia parvula* greatly resembles *Aglaophenia pluma* (Linnaeus, 1758), with which she has repeatedly been confused (Svoboda & Cornelius, 1991). Both species can be separated, however, by the shape of the second pair of lateral hydrothecal cusps, that have doubled. Thorpe et al. (1992) compared material of *A. parvula* and *A. pluma* from various English localities, studying 14 enzyme loci of 11 different enzymes with electrophoretic technology and concluded that two different species indeed are present.

In the synonymy of this species we follow Svoboda & Cornelius (1991). We have referred a record of *Aglaophenia dichotoma* by Broch (1913), from a locality near Cape Bojador, to *A. parvula* because the author indicates a tendency to divide in some of the marginal cusps. His fig. 6a, with two hydrothecae, shows the second pair of cusps in one of the hydrothecae to have doubled and in the second hydrotheca even the second and third pairs. The record of *Aglaophenia pluma* var. *parvula* of Redier (1965) from the Gulf of Guinea is here considered doubtful because the author referred to the great resemblance of his material with that recorded by Vervoort (1959), excluded from the synonymy of *A. parvula* by Svoboda & Cornelius (1991). Re-inspection of Redier's material seems imperative.

Reproduction.— All material examined was collected in March and June and is sterile, though fertile material from those months is described in literature. Millard (1957) collected specimens with corbulae in February and between April and September; Svoboda & Cornelius (1991) indicate that in the North Atlantic the reproductive period extends from May to September, whereas Ramil (1988) and Ansín Agís (1992) found fertile colonies in Galicia during February, March, April, October and November.

Distribution.— Svoboda & Cornelius (1991) ascribe the species a considerable distribution in warm and temperate waters, though frequently confused with *Aglaophenia pluma*. Atlantic localities are: coasts of Ireland (Svoboda & Cornelius, 1991), Irish Sea near Wales (Svoboda & Cornelius, 1991; Thorpe et al., 1992), North Sea coasts of England (Svoboda & Cornelius, 1991; Cornelius, 1995), coast of Brittany (Castric-Fey & Chassé, 1991; Castric, Girard & Michel, 1991; Svoboda & Cornelius, 1991), Basque coasts (Isasi, 1985, as *Aglaophenia* sp. cf. *parvula*; Isasi & Saiz, 1986, as *A.* sp. cf. *parvula*; Svoboda & Cornelius, 1991; Altuna Prados, 1994a, 1995a), coasts of Galicia (Ramil, 1988; Ansín Agís, 1992), Strait of Gibraltar (Medel & Vervoort, 1995), coast of Moroc-

co (Leloup, 1937a; Patriti, 1970; Svoboda & Cornelius, 1991), western Sahara (Leloup, 1937a), Mauritania (Stechow, 1925b; Billard, 1931d, as *A. dichotoma* f. *heterodonta*; Leloup, 1937a, 1971, as *A. pluma* var. *parvula*; Svoboda & Cornelius, 1991), Gulf of Guinea (?Redier, 1965, as *A. pluma* var. *parvula*), Namibia (Millard, 1962, as *A. pluma* var. *parvula*; Gili, Vervoort & Pagès, 1989; Svoboda & Cornelius, 1991) and South African west coast (Day & Morgans, 1956; Millard, 1957, 1962, 1968; Day, Field & Penrith, 1970; Millard, 1975, all as *A. pluma* var. *parvula*; Svoboda & Cornelius, 1991). In the Indian Ocean it has been found along the South African east coast (Millard, 1958, 1962, 1975, all as *A. pluma* var. *parvula*; Svoboda & Cornelius, 1991) and at Saint Paul Island (Vanhöffen, 1910). In the Pacific it has been recorded at the south-eastern coasts of Australia (Bale, 1882, 1884, 1888; Svoboda & Cornelius, 1991), from several localities at Tasmania (Hodgson, 1950) and from Lord Howe Island (Briggs, 1918).

Bathymetrical distribution extending from the meso-littoral zone (Ansín Agís, 1992; Medel & Vervoort, 1995) to 429 m depth (Gili, Vervoort & Pagès, 1989).

CANCAP material originates from 8 stations, of which one situated at Morocco and 7 along the Mauritanian coast, collected between 0 and 40 m.

Epibionts.— Stn 1.118: *Campanularia hincksii* Alder, 1856, *Obelia/Laomedea* spec., Bryozoa.— Stn MAU 006: *Campanularia hincksii* Alder, 1856, *Obelia dichotoma* (L., 1758), gastropod eggs.— Stn MAU 007: *Clytia hemisphaerica* (L., 1767), *A. parvula* Bale, 1882, gastropod eggs, Polychaeta, Bryozoa.— Stn MAU 009: *Clytia gracilis* (M. Sars, 1850), *Obelia dichotoma* (L., 1758), gastropod eggs.— Stn MAU 010: Bryozoa.— Stn MAU 024: eggs of *Sepia* cf. *officinalis* L., 1758, Bryozoa.— Stn MAU 027: Gastropod eggs; eggs of *Sepia* cf. *officinalis* L., 1758, Bryozoa.

Aglaophenia picardi Svoboda, 1979
(fig. 29)

Aglaophenia spec. Picard, 1955b: 190.
Aglaophenia pluma f. *typica*; Riedl, 1959: 660.
Aglaophenia pluma var. *teissieri* Svoboda, 1970: 676 (nomen nudum).
Aglaophenia picardi Svoboda, 1976: 41 (nomen nudum).
Aglaophenia picardi Svoboda, 1979: 70, figs 12b, 13b, 15b, 16b, pl. 1b; Boero, 1981a: 182; Isasi, 1985: 95, fig. 30; Boero & Fresi, 1986: 145; Isasi & Saiz, 1986: 70; Altuna & García Carrascosa, 1990: 55; Piraino & Morri, 1990: 55; Svoboda & Cornelius, 1991: 29, fig. 11; Cornelius, 1992b: 83; Ramil & Vervoort, 1992a: 94, fig. 23d; Boero & Bouillon, 1993a: 263; Vervoort, 1993b: 548; Altuna Prados, 1994a: 215, pl. 39 figs A-E; 1995a: 54; Medel & Vervoort, 1995: 15, fig. 5a-d; Peña Cantero, 1995: 274, pl. 28 figs d-e.

Material.— **Madeira area:** Stn 1.K16: One colony with six cormoids; no corbulae (RMNH-Coel. 29064 = two slides 4505).— **Canary Islands and Selvagens Archipelago:** Stn 4.D14: One colony with 12 cormoids without corbulae (RMNH-Coel. 28567).— Stn 4.K12: one colony without corbulae (RMNH-Coel. 29065 = slide 4506).

Description (of colony from Stn 4.K12).— Colonies with tubular hydrorhiza from which arise monosiphonic, unbranched hydrocauli. Hydrocaulus with basal part of varied length, divided into internodes by straight nodes, followed by a succession of internodes separated by oblique nodes, each with one apophysis with one small mamelon and three nematothecae: two in the axil and one inferior.

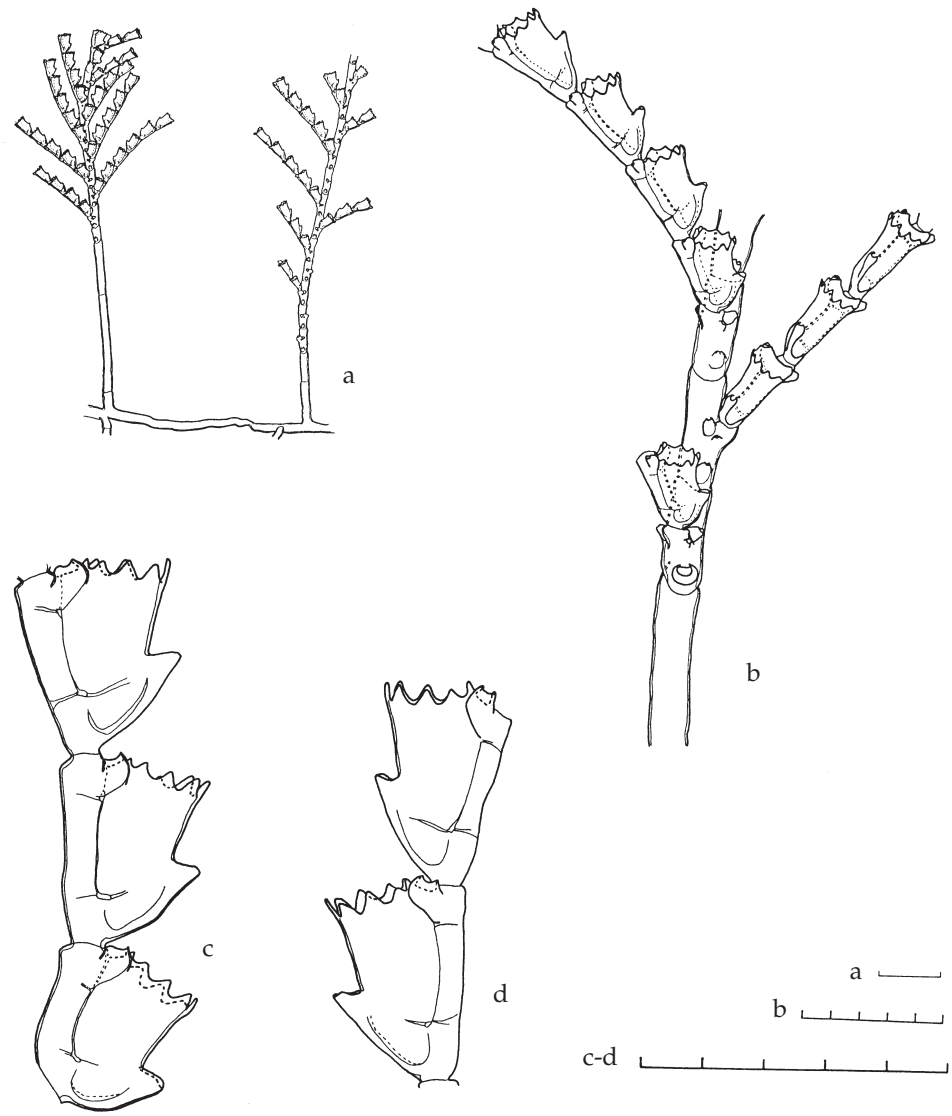


Fig. 29. *Aglaophenia picardi* Svoboda, 1979. a, Stn 1.K16, two cormoids from a colony; b, Stn 4.K12, basal part of cormoid, frontal view; c-d, Stn 1.K16, c, three internodes from basal part of hydrocladium, lateral view; d, two internodes from basal part of hydrocladium, lateral view. Scales: a, 1 mm; b, 0.5 mm; c-d, 0.5 mm.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of thecate internodes separated by slightly oblique nodes, provided with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrothecal aperture slightly tilted abcaudally, rim with four pairs of lateral cusps and one abcauline cusp; size of lateral cusps decreasing gradually in adcauline direc-

tion. Basal third of hydrothecal cavity with adcauline septum, not reaching abcauline wall. Lateral nematothecae slightly surpassing hydrothecal rim. Mesial nematotheca almost reaching middle of abcauline hydrothecal wall and largely adnate; aperture of all nematothecae gutter-shaped. Each internode with two internal perisarc rings, one in basal third at level of intrathecal septum, one at base of lateral nematothecae. Development of septa varied, even in same hydrocladium.

Gonosome absent.

Variability.— The material from Stn 1.K16 is characterised by the presence of prosegments in three of the seven cormoids that make up the colony (fig. 29a).

Table IX. Measurements of *Aglaophenia picardi* in µm:

	Stn 4.K12
Height of colony (in mm)	5-15
Internode of hydrocaulus, length	340-450
Diameter at node	90-130
Hydrocladial internode, length	270-340
Diameter at node	50-60
Hydrotheca, depth	280-300
Diameter at rim	140-170
Length free part abcauline wall	115-175

Discussion.— Svoboda (1979) and Svoboda & Cornelius (1991) indicate that *Aglaophenia picardi* is the only species of the genus without prosegments. In our material we have found typical cormoids of *A. picardi* without prosegments, springing from the same hydrorhiza as other cormoids with a typical prosegment provided with a frontal nematotheca. This phenomenon has so far remained undescribed. The presence of prosegments in certain cormoids might cast doubts on identification but as prosegments are absent from other cormoids and as such cormoids are morphologically similar they have been included in *A. picardi*; Svoboda (in lit.) supports this conclusion.

Reproduction.— The CANCAP material, all sterile, was collected in February, March, May and June. Reproductive period in the Mediterranean is from April to November (Svoboda, 1979).

Distribution.— Considered endemic for the Mediterranean by Boero & Bouillon (1993a), some north-eastern Atlantic localities, however, are known: Basque coast (Isasi, 1985; Isasi & Saiz, 1986; Altuna & García Carrascosa, 1990; Svoboda & Cornelius, 1991; Altuna Prados, 1994a, 1995a), Azores (Cornelius, 1992b), Canary Islands (Svoboda & Cornelius, 1991) and Cape Verde Islands (Svoboda, 1979).

In the Mediterranean it is known from the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), the Chafarinas Islands (Peña Cantero, 1995), Algeria (Picard, 1955b, as *Aglaophenia* spec.), Malta (Svoboda & Cornelius, 1991), numerous localities in the Italian littoral (Svoboda, 1979; Boero & Fresi, 1986; Piraino & Morri, 1990; Svoboda & Cornelius, 1991), the Adriatic (Svoboda, 1976, 1979) and the coast of Israel (Svoboda & Cornelius, 1991; Vervoort, 1993b). Svoboda & Cornelius (1991) also records its presence in the Black Sea.

The bathymetrical distribution varies between 0 (Boero & Fresi, 1986) and 580 m (Ramil & Vervoort, 1992a).

The CANCAP specimens originate from three localities, one at Madeira and two from the Canary Islands, collected between 0 and 20 m depth.

Aglaophenia pluma (Linnaeus, 1758)
(fig. 30)

Sertularia pluma Linnaeus, 1758: 811.
Plumularia cristata Lamarck, 1816: 125.
Plumularia pluma var. *dichotoma* M. Sars, 1857: 164.
Aglaophenia pluma p.p. Hincks, 1868: 286, fig. 37, pl. 63, fig. 1; Vervoort, 1946b: 190, figs 80-81.
Aglaophenia dichotoma p.p. Kirchenpauer, 1872: 13, 25, 30, pls 1-3 fig. 7.
Aglaophenia pluma; Torrey, 1902: 73; 1904: 34; Rioja y Martín, 1906: 277; Bedot, 1911: 226; Fraser, 1911: 80; Ritchie, 1911: 225; Billard, 1912a: 461; Linko, 1912: 25, figs 2-4; Stechow, 1912a: 370; Müller-Calé & Krüger, 1913: 42, figs 5-7; Broch, 1914a: 28; Rodríguez Rosillo, 1914: 40; Bedot, 1919a: 53, figs 2, 4; 1921a: 340; 1921c: 42; Neppi, 1922: 85; Van Benthem Jutting, 1922: LXXXVI; Prenant & Teissier, 1924: 26; Beutler, 1926: 740; Billard, 1927c: 343; Broch, 1928a: 63, fig. 52A; Teissier, 1930a: 184; Marine Biological Association, 1931: 78; Nobre, 1931: 21; Payne, 1931: 743; Leloup, 1933a: 1, figs 1-21; 1933b: 1, figs 1-7; 1933c: 10, 28; Borcea, 1934: 401; Leloup, 1935c: 54; Philbert, 1935a: 86; Billard, 1936: 10; Fraser, 1937b: 179, pl. 41 fig. 217a-c; Nobre, 1937: 23; Leloup, 1939b: 11, fig. 7; Da Cunha, 1940: 114; 1944: 7, 36, fig. 17; Leloup, 1947: 34; Fraser, 1948: 260; Da Cunha, 1950: 130; Picard, 1951f: 261; Leloup, 1952a: 129, fig. 65; Picard, 1952a: 349; 1952d: 220; Lewis, 1953: 534; Williams, 1954: 50; Marine Biological Association, 1957: 51; Picard, 1958b: 192; 1958c: 2; Faure, 1960: 185, figs 1-13; Kerneïs, 1960: 163; Naumov, 1960: 488, figs 23, 379A-C; Manea, 1961: 220; Millard, 1961: 207; Rossi, 1961: 78; Swennen, 1961: 209; Redier, 1962a: 23; 1962b: 34; Fredj, 1964: 49; Redier, 1964b: 145; De Haro, 1965: 109, 115; Rees & Thursfield, 1965: 190; Yamada, 1965: 362; Redier, 1966b: 96, pl. 3 fig. 2; Rees & White, 1966: 279; Vervoort, 1966: 147; Redier, 1967a: 400; Vervoort, 1968: 113; Vidal, 1968: 189; Naumov, 1969: 527, figs 23, 379A-C; Robins, 1969: 334; Patriti, 1970: 48, fig. 65A-E; Riedl, 1970: 152, pl. 42; Bouillon & Levi, 1971: 221; Guille, 1971: 265; Manea, 1971: 29, fig. 4; Redier, 1971a: 513; Rossi, 1971: 29, fig. 11B, D; Von Salvini-Plawen, 1972: 394; Houvenaghel-Crèvecoeur, 1973: 2815; Desbruyères et al., 1974: 356; Saldanha, 1974: 325; Cooke, 1975: 105, pl. 6 fig. 4; Fry, 1975: 528; Chimez-Guzzo & Rivosecchi Taramelli, 1976: 116; Ros, 1978: 153; Estrada, 1979: 69; Gili, 1979: 128; Polo et al., 1979: 346; Svoboda, 1979: 98, figs 15j(1-4); Ljubenkov, 1980: 50; García Carrascosa, 1981: 287, pl. 29 figs a-c, pl. 43 figs c-d, pl. 45 fig. b; Morri, 1981a: 194; Morri & Martini, 1981: 308; Wolff & Dankert, 1981: 26; Gili & Romero, 1983: 36; Urgorri & Besteiro, 1983: 17; Gili & Castelló, 1985: 21, fig. 7H; Gili & García-Rubies, 1985: 50, fig. 6G; Gili & Ros, 1985: 329; Isasi, 1985: 97, fig. 31A-F; Gili, 1986: 147, figs 4.35D-F, 4.57e; Isasi & Saiz, 1986: 70; Morri & Boero, 1986: 65, fig. 43a-c; Oosterbaan, 1986: 36, figs 1-2; Roca, 1986: 425, fig. 73; García Carrascosa et al., 1987: 373; Llobet i Nadal, 1987: 201, fig. 62A-C; Llobet, Gili & Barangé, 1988: 40, fig. 4G; Ramil, 1988: 455; Gili, Murillo & Ros, 1989: 23; Gili, Ros & Romero, 1989: 282; Altuna & García Carrascosa, 1990: 86, fig. 92; Cornelius & Ryland, 1990: 156, figs 4.24, 4.25; Cairns et al., 1991: 29; Castric, Girard & Michel, 1991: 44, fig. 104, fig.; Gili & Ballesteros, 1991: 247; Llobet, Gili & Hughes, 1991: 153; Svoboda & Cornelius, 1991: 30, figs 10f, 12, 13a-g, 19a-b, 24a-b; Cornelius, 1992a: 255, 257; 1992b: 79; Thorpe et al., 1992: 887, fig. 1A-D; Álvarez Claudio, 1993: 209, fig. 36A-B, pl. 18 figs A-B; Boero & Bouillon, 1993a: 263; Altuna Prados, 1994a: 218; 1995a: 54; Álvarez Claudio, 1995: 13; Álvarez Claudio & Anadón, 1995: 239; Medel & Vervoort, 1995: 17, fig. 6a-c.
Not *Aglaophenia pluma*; Marktanner-Turneretscher, 1890: 269, pl. 7 figs 1-2, 18; Broch, 1912a: 32, figs 9, 34, fig. 10 (only the dichotomously branched specimens = *Aglaophenia tubiformis* Marktanner-Turneretscher, 1890).
Aglaophenia dichotoma; Broch, 1912a: 6, fig. 6; Stechow, 1919c: 144.

Aglaophenia pluma f. *typica* Bedot, 1919b: 276; Da Cunha, 1944: 37, fig. 16a; Teissier, 1950b: 24; Millard, 1957: 238, fig. 15A; 1958: 215; Teissier, 1965: 29; Fey, 1969: 405; Chas Brínquez & Rodríguez Babío, 1977: 33, fig. 20A-B; García Corrales et al., 1978: 61, fig. 27; Gili, 1981: 108; Izquierdo et al., 1986: 59, fig. 8.

Not *Aglaophenia pluma*; Stechow, 1919c: 147; 1923d: 248.

Not *Aglaophenia pluma* and var. *dichotoma*; Neppi, 1921: 10, pl. 1 figs 7-9 (= *Aglaophenia tubiformis* Marktanner-Turneretscher, 1890).

Not *Aglaophenia pluma* f. *typica*; Broch, 1933b: 44, fig. 18a.

Aglaophenia pluma var. *typica*; Rossi, 1950: 25, fig. 11A-B; Vervoort, 1959: 307, fig. 53a.

Not *Aglaophenia pluma*; Picard, 1955b: 191 (= *Aglaophenia harpago* Von Schenck, 1965).

Aglaophenia helleri; Marine Biological Association, 1957: 51.

Not *Aglaophenia pluma*; Riedl, 1959: 660 (= *Aglaophenia picardi* Svoboda, 1979).

Aglaophenia pluma pluma; Van Gemerden-Hoogeveen, 1965: 80, fig. 45; Millard, 1968: 254, 279; Berrisford, 1969: 394; Day, Field & Penrith, 1970: 13; Millard, 1978: 188.

Aglaophenia pluma f. *helleri*; Fey, 1969: 405.

Aglaophenia pluma pluma p.p. Millard, 1975: 412, fig. 129D.

Aglaophenia pluma typica; Gili i Sardà, 1982: 91, fig. 48; Gili, García & Colomer, 1984: 414.

Material.— **Azores area**: Stn AZO 30: One colony with two cormoids in bad state, with corbulae (RMNH-Coel. 28975, three slides 4513).— Stn AZO 38: One colony with few cormoids, some with corbulae (RMNH-Coel. 28969; DEBA-UV, three slides R. 300).—Stn 5.D02: 137 cormoids, of which 75 with corbulae (RMNH-Coel. 28642).— **Madeira area**: Stn 1.D80: One colony with four cormoids and a detached fragment, without corbulae (RMNH-Coel. 29066 = slide 4507).— Stn 4.D17: One colony developing on balanids, with one corbula (RMNH-Coel. 28678; DEBA-UV, three slides R. 301).— **Canary Islands and Selvagens Archipelago**: Stn 2.D01: One colony with numerous cormoids on *Zostera* spec., with corbulae (RMNH-Coel. 28566, two slides 4508).— Stn 2.D04: One colony with numerous cormoids on *Zostera* spec., with corbulae (RMNH-Coel. 28562, two slides 4509).— Stn 2.D07: One colony with various cormoids, with corbulae (RMNH-Coel. 28560, five slides 4510).— Stn 2.D08: Six colonies on algae, three with female, one with male corbulae (RMNH-Coel. 28563, two slides 4511).— Stn 2.D09: One colony with 33 cormoids, eight with corbulae (RMNH-Coel. 28564).— Stn 3.D07: Two colonies, one with corbulae (RMNH-Coel. 28565, three slides 4512).— Stn 4.003: One colony and an epibiontic colony, without corbulae (RMNH-Coel. 28561, two slides 4514).— Stn 4.004: One colony with 23 cormoids on *Zostera* spec., 15 with corbulae (RMNH-Coel. 28559, three slides 4515).— Stn 4.015: One colony with nine cormoids, seven with corbulae (RMNH-Coel. 28558, 28593).— Stn 4.D01: Two colonies, one on rock fragment, one on alga, without corbulae (RMNH-Coel. 28679, five slides 4516).— Stn 4.D02: One colony on *Zostera* spec., with corbulae (RMNH-Coel. 28972, three slides 4517).— Stn 4.D07: One colony without corbulae (RMNH-Coel. 28674, 28956).— Stn 4.D13: One colony with nine cormoids on rock with calcareous algae, without corbulae (RMNH Coel. 29067 = two slides 4518).— Stn 4.D14: One colony with 12 cormoids, without corbulae (RMNH-Coel. 29068 = slide 4519).— Stn 4.D17: One colony with c. 20 cormoids, no corbulae (RMNH-Coel. 28678; DEBA-UV, three slides R. 301). — Stn 4.K12: Two colonies with corbulae (RMNH-Coel. 28794, five slides 4520).

Additional material: **Azores**.— Fayal, Monte de Guio, 20 m, vii.1992: One colony (RMNH-Coel. 26972).

Description (of material from Stn 2.D07).— Hydrorhiza tubular, adhering to substrate, irregularly branched, giving rise to unbranched, monosiphonic hydrocauli. Basal part of hydrocaulus typically with one or two straight nodes close to hydrorhiza, followed by one to three prosegments separated by oblique, occasionally obscure nodes and with one frontal nematotheca. Remainder of hydrocaulus with oblique nodes separating internodes each with one apophysis in upper half, carrying

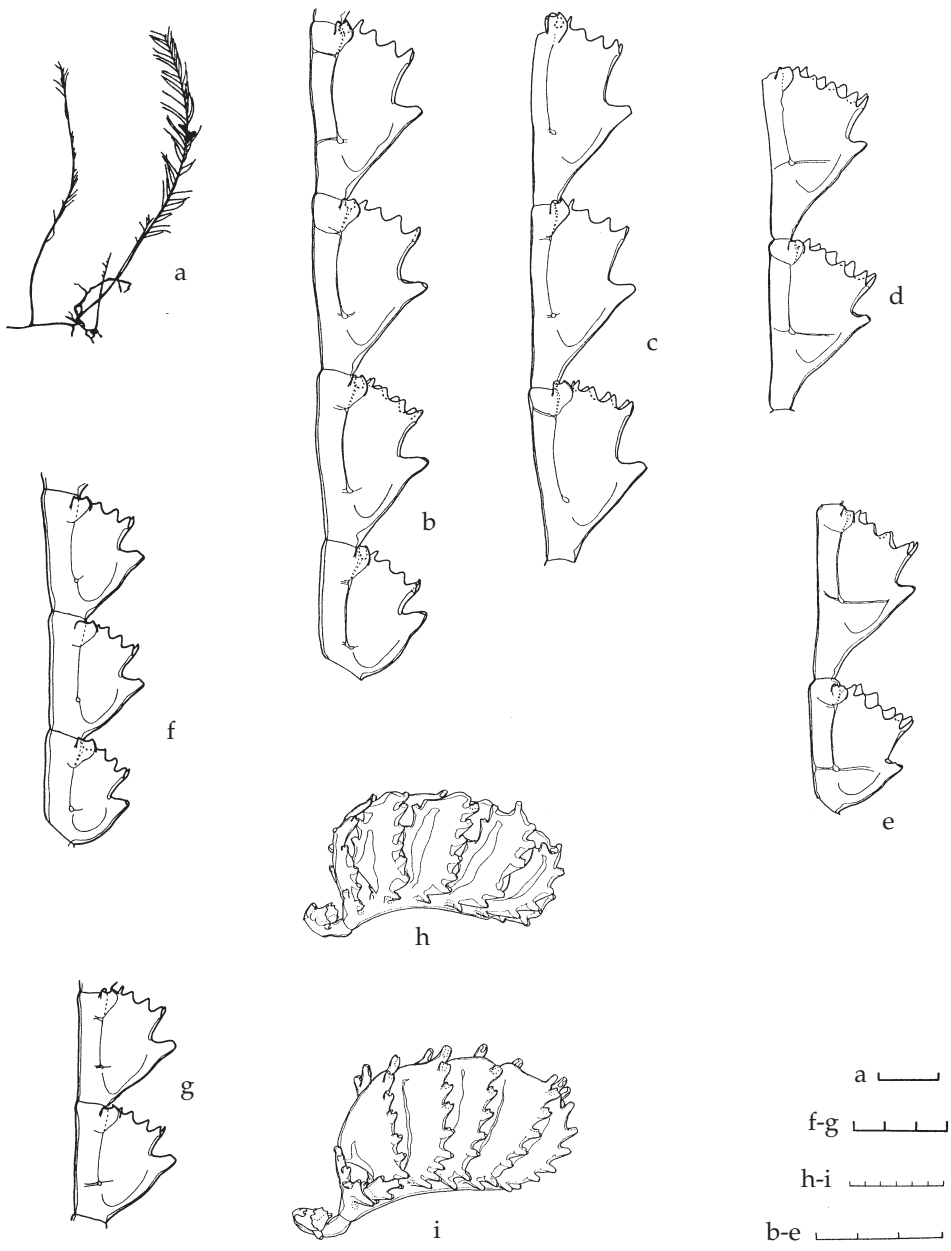


Fig. 30. *Aglaophenia pluma* (Linnaeus, 1758). a, Stn 2.D07, colony; b-c, Stn 2.D01, b, four internodes from basal part of hydrocladium; c, three internodes from distal part of hydrocladium; d-e, Stn 4.004, d, two internodes from distal part of hydrocladium; e, two internodes from basal part of hydrocladium; f-g, Stn 2.D07, f, three internodes from basal part of hydrocladium; g, two internodes from distal part of hydrocladium; h, Stn 4.004, male corbula; i, Stn 2.D04, female corbula; hydrocladia and corbulae in lateral view. Scales: a, 1 cm; b-e, 0.3 mm; f-g, 0.3 mm; h-i; 0.6 mm.

one mamelon and three nematothecae: two in the axil and one inferior situated on basal half of internode.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of internodes separated by oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior, adnate with hydrothecal abcauline wall, and two lateral. Hydrothecal rim with four pairs of lateral cusps and one abcauline cusp. Lateral cusps equal in size or slightly decreasing in size adcaudally. Abcauline cusp typically straight, occasionally slightly curved inward. Hydrotheca sometimes with short adcauline intrathecal septum in lower third of cavity. Lateral nematothecae slightly surpassing hydrothecal rim; mesial nematotheca covering c. half of hydrothecal abcauline wall and adnate for c. two-thirds of its length; apertures of nematothecae gutter-shaped. Internode occasionally with two perisarc rings, one in basal third at level of intrathecal septum, if present; the second in upper third at base of lateral nematothecae.

Colonies dioecious, with sexual dimorphism of corbulae. Female corbulae with four to six pairs of completely fused costae and one free, unpaired costa near pedicel. Male corbulae with five or six partly free costae. Pedicel composed of one hydrothecate internode.

Variability.— In material from Stns 2.D07, 3.D07 and 4.D07 cormoids have regenerated from places where hydrocladia had been shed. In a colony from Stn AZO 38 a cormoid with corbulae has regenerated from the apical part of a hydrocladium. Colonies from Stns 2.D01, 2.D04, 4.004 and 4.D02 are characterised by the presence, in the hydrorhiza, of a varied number of perisarc thickenings, as were previously described in *A. latecarinata* developing on algae. Leloup (1932c) indicated that such trabeculae might assist in attaching the colony to smooth and movable objects like algae. In the same material we observed that the distance between inferior node and bottom of mesial nematotheca is variable in the same colony; it is biggest in young and greatly reduced in adult internodes (fig. 30e-d). Material from Stn 1.D80 was treated with Lugol solution but no zooxanthellae were observed. A cormoid from Stn 4.D17 has six prosegments. Colonies from Stn 4.004 have hydrothecae with well developed intrathecal septae, occasionally reaching the abcauline wall (fig. 30d-e).

Table X. Measurements of *Aglaophenia pluma* in µm:

	Stn 2.D07	Stn 2.D01
Height of colony (in mm)	6-50	4-54
Internode of hydrocaulus, length	420-570	390-620
Diameter at node	120-200	70-220
Hydrocladial internode, length	280-390	260-430
Diameter at node	70-110	50-80
Hydrotheca, depth	250-310	250-330
Diameter at rim	150-180	150-180
Length of free part abcauline wall	100-115	90-150
Female corbula, length	1975-2420	1470-2000*
Maximum diameter	950-1150	830-1020*
Male corbula, length	2150-2400	1310-1870
Maximum diameter	970	800-900

* Measurements from Stn 2.D04

Discussion.— Though considered cosmopolitan by several authors (Picard, 1958b; Rossi, 1961; Redier, 1966b, 1967a; Patriti, 1970; Rossi, 1971; Cooke, 1975; Boero & Bouillon, 1993a) it is extremely difficult to establish exactly its distribution because of continuous confusion with other species of the genus, like *Aglaophenia octodonta*, *A. parvula* and *A. tubiformis*. The first author giving a complete list of synonyms of *A. pluma* was Bedot (1919b); later on Svoboda (1979) and Svoboda & Cornelius (1991) studied the Atlantic representatives of *Aglaophenia*, particularly from the Mediterranean, giving a key for identification and characters to separate the various species. To present a complete list of synonyms is difficult because in many cases the species is cited without description or figures and inspection of the material is imperative.

Reproduction.— Occurrence of corbulae is given by Billard (1936), Rossi (1961); Teissier (1965), Redier (1966), Millard (1968), Svoboda & Cornelius (1991) and Medel & Vervoort (1995); they have been observed in all months of the year. CANCAP colonies with corbulae were found in May, June, August, September and October.

Distribution.— Svoboda & Cornelius (1991) stated that the well characterized species of *Aglaophenia* have a much more restricted distribution then formerly envisaged. This particularly applies to *A. pluma* as many records may relate to other species.

Aglaophenia pluma is known from the North Sea (Broch, 1928a; Naumov, 1960), the coasts of Ireland (Hincks, 1868; Williams, 1954; Svoboda, 1979), many places of the English littoral zone (Hincks, 1868; Ritchie, 1911; Marine Biological Association, 1931; Lewis, 1953; Marine Biological Association, 1957, as *Aglaophenia helleri*; Rees & Thursfield, 1965; Robins, 1969; Fry, 1975; Svoboda, 1979; Cornelius & Ryland, 1990; Svoboda & Cornelius, 1991; Thorpe et al., 1992), the coast of Holland (Van Benthem Jutting, 1922; Leloup, 1933c; Vervoort, 1946b; Swennen, 1961; Wolff & Dankert, 1981; Oosterbaan, 1986, all referring to dead material!), Belgium (Leloup, 1947, 1952), the Channel Islands (Hincks, 1868; Philbert, 1935a), the Channel and Atlantic coasts of France (Bedot, 1911; Billard, 1912a; Prenant & Teissier, 1924; Billard, 1927a; Teissier, 1930a; Leloup, 1933a; Teissier, 1965, as *A. pluma* f. *typica*; Redier, 1967a; Vidal, 1968; Fey, 1969, as *A. pluma* f. *helleri*; Houvenaghel-Crèvecoeur, 1973; Castric, Girard & Michel, 1991; Svoboda & Cornelius, 1991), north and north-west coasts of Spain (Rioja y Martín, 1906; Rodríguez Rosillo, 1914; Chas Brínquez & Rodríguez Babío, 1977, as *A. pluma* f. *typica*; García Corrales et al., 1978, as *A. pluma* f. *typica*; Estrada, 1979; Polo et al., 1979; Urgorri & Besteiro, 1983; Isasi, 1985; Isasi & Saiz, 1986; Ramil, 1988; Altuna & García Carrascosa, 1990; Svoboda & Cornelius, 1991; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez Claudio & Anadón, 1995), the coast of Portugal (Nobre, 1931, 1937; Da Cunha, 1940, 1944, 1950; Saldanha, 1974; Svoboda & Cornelius, 1991), the Azores (Rees & White, 1966a; Cornelius, 1992b), the Strait of Gibraltar (Medel & Vervoort, 1995), various localities along the coast of Morocco (Patriti, 1970; Svoboda & Cornelius, 1991), the Canary Islands (Izquierdo et al., 1986, as *A. pluma* f. *typica*), the Cape Verde Archipelago (Bedot, 1921c), Ivory Coast (Redier, 1971a), French Guinea (Vervoort, 1959, as *A. pluma* var. *typica*), Congo and Namibia (Broch, 1914a) and the coast of South Africa (Broch, 1914a; Millard, 1957, as *A. pluma* f. *typica*; 1968, as *A. pluma pluma*; Berrisford, 1969, as *A. pluma pluma*; Day, Field & Penrith, 1970, as *A. pluma pluma*; Millard, 1975, 1978, as *A. pluma pluma*).

On the western Atlantic side it has been recorded from the Caribbean (Van Gemerden-Hoogeveen, 1965, as *A. pluma pluma*; Vervoort, 1968) and from Patagonia (Stechow, 1912).

In the Mediterranean it is cited from the Strait of Gibraltar (Medel & Vervoort, 1995), numerous localities along the Iberian coasts (Rioja y Martín, 1906; Rodríguez Rosillo, 1914; De Haro, 1965; García Corrales et al., 1978, as *A. pluma* f. *typica*; Gili, 1979; Svoboda, 1979; García Carrascosa, 1981; Gili, 1981, 1982, as *A. pluma typica*; Gili & Romero, 1983; Gili, García & Colomer, 1984, as *A. pluma typica*; Gili & Castelló, 1985; Gili, 1986; García Carrascosa et al., 1987; Llobet i Nadal, 1987; Llobet, Gili & Barangé, 1988; Gili, Murillo & Ros, 1989; Gili & Ballesteros, 1991; Llobet, Gili & Hughes, 1991; Svoboda & Cornelius, 1991), Mallorca (Gili & García Rubies, 1985; Roca, 1986), the French Mediterranean coast (Stechow, 1919a, as *A. dichotoma*; Picard, 1951f, 1952a, 1952d; Kerneïs, 1960; Redier, 1962a, 1962b; Guille, 1971; Desbruyères, Guille & Ramos, 1974; Svoboda & Cornelius, 1991), numerous sites in the Italian littoral (Müller-Calé & Krüger, 1913; Stechow, 1923d; Rossi, 1950, as *A. pluma* var. *typica*; Rossi, 1961, 1971; Chimez-Guzzo & Rivosecchi Taramelli, 1976; Morri, 1981a; Morri & Martini, 1981), Adriatic (Broch, 1912a as *A. dichotoma*; Riedl, 1970), Greece (Yamada, 1965), Egypt (Billard, 1936), and Israel (Picard, 1958c). Also recorded from the Black Sea (Borcea, 1934; Manea, 1961; Naumov, 1969; Manea, 1971).

In the Indian Ocean it has been recorded from South Africa (Millard, 1958, as *A. pluma* f. *typica*, 1961; Rees & Thursfield, 1965; Millard, 1975, 1978, as *A. pluma pluma*).

In the Pacific it has been cited from Japan (Rees & Thursfield, 1965), Marshall Islands (Cooke, 1975), Tonga (Leloup, 1939b), and the coast of California (Torrey, 1904; Fraser, 1911, 1937b, 1948; Ljubenkov, 1980).

The bathymetrical distribution extends from 0 to 200 m (Ritchie, 1911).

The CANCAP material comes from 20 stations of which three from the Azores, two from Madeira, two from the Selvagens and 13 from the Canary Islands. The depth at these stations varied between 0 and 24 m, with the exception of Stns 4.004 and 4.015, being between 26-37 and 35-70 m, respectively.

Epibionts.— Stn 1.D80: Algae.— 2.D01: Algae.— Stn 2.D04: Algae.— Stn 2.D08: *Plumularia floridana* Nutting, 1900.— Stn 2.D09: Algae.— Stn 3.D07: *Hebella* spec., *Aglaophenia pluma* (L., 1758).— Stn AZO 30: Algae.— Stn AZO 38: Algae, Bryozoa.— Stn 4.003: *Aglaophenia pluma* (L., 1758).— Stn 4.D01: *Hebella* spec., *Clytia gracilis* (M. Sars, 1850), Bryozoa.— Stn 4.D07: *Plumularia setacea* (L., 1758).— Stn 4.D14: Algae.— Stn 4.D17: Algae, *Hebella* spec.— Stn 4.K12: *Clytia hemisphaerica* (L., 1767), *Sertularia distans* (Lamouroux, 1816).— Stn 5.D02: Sertulariidae indet., *Campanularia hincksii* Alder, 1856, Bryozoa.

Aglaophenia trifida L. Agassiz, 1862
(fig. 31)

Aglaophenia cristata; McCrady, 1859: 202 [not *Plumularia cristata* Lamarck, 1816 = *Aglaophenia pluma* (Linnaeus, 1758)]

Aglaophenia trifida L. Agassiz, 1862: 358; A. Agassiz, 1865: 140; Kirchenpauer, 1872: 26; Nutting, 1900: 105; Fraser, 1944a: 392; Calder, 1976: 169; Calder & Hester, 1978: 91; Calder, 1983: 21, fig. 12; Cairns et al., 1991: 29.

Aglaophenia rigida Allman, 1877: 43, pl. 25 figs 5-9; Clarke, 1879: 248; Jäderholm, 1896: 17; Nutting, 1900: 91, pl. 18 figs 3-4; Fraser, 1912: 378, fig. 44A-D.

Material.— *Aglaophenia rigida*. De Pourtalès Gulf Stream Exploration, Atlantic Ocean, U.S.A.: North Carolina, Cape Fear Point, 16 m, 1868: several branched fragments, only one with hydrocladia and without corbulae. (MCS = Museum of Comparative Zoology, Cambridge, Massachusetts, U.S.A., syntype).
Aglaophenia rigida. De Pourtalès Gulf Stream Exploration, Atlantic Ocean, U.S.A.: North Carolina, off Cape Fear, 16 m, 1868: One colony with 11 unbranched stems and several fragments of which some branched, without corbulae. (MCZ, syntype).
Aglaophenia trifida. South Carolina, near mouth of river North Santee, dredge, 17.xii.1974: Three branched colonies without corbulae. (ROM = Royal Ontario Museum, Toronto, Canada, B2170).

Description (of the syntypes of *Aglaophenia rigida*).— Hydrorhiza tubular, tortuous, bearing monosiphonic hydrocauli branching dichotomously. Stem with short, undivided basal zone, followed by two to six prosegments separated by oblique nodes; on each prosegment one frontal nematotheca. Remainder of stem formed by internodes separated by oblique nodes, each with one apophysis with a mamelon on distal extremity and three nematothecae: two in the axil and one inferior on basal half. Apophyses alternately directed left and right. Branches springing from frontal part of internodes, without prosegments, divided into internodes separated by oblique nodes over their whole length, in structure similar to those of the stem.

Hydrocladia inserting on apophyses, composed of thecate internodes separated by oblique nodes; each with one hydrotheca and three nematothecae: one mesial inferior, adnate to abcauline wall of hydrotheca, and two lateral. Hydrothecal rim provided with four pairs of cusps of which one pair hidden by lateral nematothecae, and an unpaired abcauline cusp, curved towards interior of hydrotheca. Free part of abcauline wall slightly concave; interior of hydrotheca with incomplete adcauline septum at lower third. Lateral nematothecae reaching the hydrothecal rim or slightly surpassing; mesial nematotheca covering half abcauline hydrothecal wall, being adnate over practically its whole length; apertures of all nematothecae gutter-shaped. Communication between mesial nematotheca and interior of hydrotheca apparently permanent. Hydrocladial internodes with two incomplete septa or perisarc rings: one in lower third behind intrathecal septum, second at base of lateral nematothecae.

No corbulae have been observed.

Table XI. Measurements of *Aglaophenia trifida* in µm:

	Syntype of *A. rigida*
Height of colony (in mm)	14-62
Internodes of hydrocaulus, length	360-700
Diameter at node	240-510
Hydrocladial internodes, length	230-330
Diameter at node	70-170
Hydrotheca, depth	260-315
Diameter at rim	110-135
Length free part abcauline wall	170-220

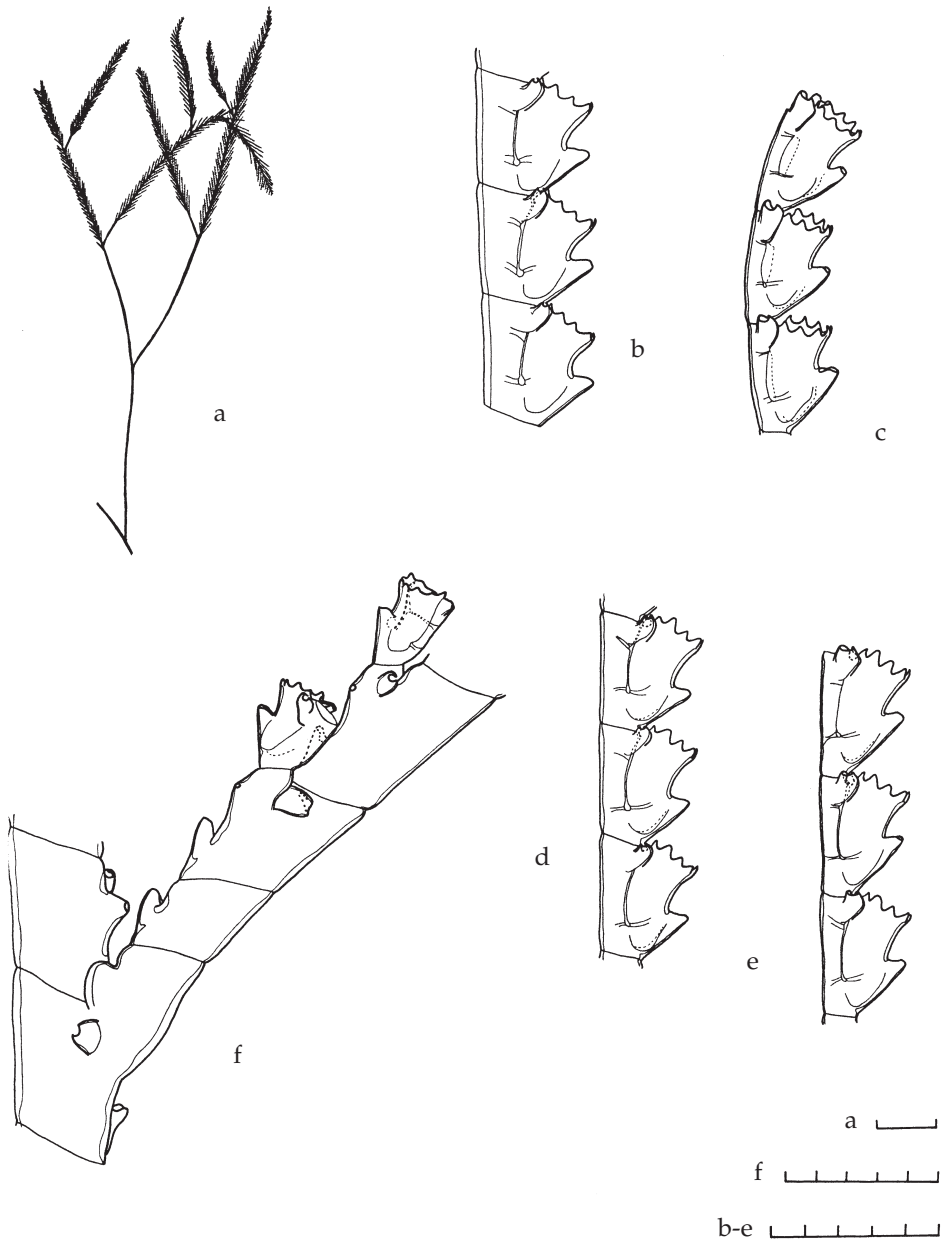


Fig. 31. *Aglaophenia trifida* L. Agassiz, 1862. a, ROM B2170, fragment of a colony; b-c, MCZ, Syntype of *Aglaophenia rigida* Allman, 1877; b, three internodes from basal part of hydrocladium, lateral view; c, three internodes from distal part of hydrocladium, lateral view; d-f, *Aglaophenia trifida* L. Agassiz, 1862; ROM B2170, d, three internodes from basal part of hydrocladium, lateral view; e, three internodes from distal part of hydrocladium, lateral view; f, detail of branch, oblique view. Scales, a, 1 cm; b-e, 0.5 mm; f, 0.5 mm.

Discussion.— McCrady (1859) identified as *Aglaophenia cristata* material from South Carolina (Sullivans Island and Charleston), though suspecting that this material was probably different from the European species described by Lamarck (1816) as *Plumularia cristata* (=*Aglaophenia pluma* Linnaeus, 1758), but Johnston's publications, which McCrady used, had no illustrations of that species and McCrady could not study European material. Later on L. Agassiz (1862) proposed the name *Aglaophenia trifida* for McCrady's material without figuring or describing it. Nutting (1900) compared specimens of *A. pluma* from Plymouth, U.K., with *A. trifida* and concluded that two different species were involved, differing in the shape of the abcauline hydrothecal wall and the corbulae. Fraser (1944a) gives Nutting as the author of the species as L. Agassiz only proposed a new name and did not figure or describe the species. Calder (1983), basing himself on artícle 16 of the 'Code for Zoological Nomenclature', maintained L. Agassiz as the author.

Nutting (1900) and Fraser (1944a) indicate that *A. trifida* differs from *Aglaophenia rigida* Allman, 1877 in the number of marginal cusps, nine in *A. trifida* and eight in *A. rigida*. Calder (1983), when revising the holotype of *A. rigida*, found nine marginal cusps on the hydrotheca and observed no characters that justified differentiation between *A. rigida* and *A. trifida*. As a result both species were considered conspecific and we concur. In *A. trifida* Calder (1997) included the records of *Aglaophenia dichotoma* by Leloup (1937a) and Fraser (1944a), and of *Aglaophenia pluma pluma* by Van Gemerden-Hoogeveen (1965). In our opinion it seems problematic to include those records without revision of their material. Leloup's material comes close to *A. trifida* as the corbulae are big and have 11 pairs of costae. Fraser (1944a) indicated that his specimens were branched, but his figures are those of Bedot (1921c) and Kirchenpauer (1872). Van Gemerden-Hoogenveen (1965) finally presented a figure (fig. 45) that in our opinion does not represent *A. trifida* and the description too does not fit that species.

Allman (1877) remarked that *Aglaophenia gracilis* Allman, 1877, resembles *A. rigida*. Though we received the holotype of *A. rigida* from the Museum of Comparative Zoology, the type material of *A. gracilis* could not be located.

Distribution.— *A. trifida* has been found in the western Atlantic between North Carolina and the Caribbean Sea (Calder, 1983). It is cited from North Carolina (Allman, 1877, as *A. rigida*; Nutting, 1900; Fraser, 1912, as *A. rigida*), from various localities in South Carolina (McCrady, 1859, as *A. cristata*; Fraser, 1944a; Calder, 1976; Calder & Hester, 1978; Calder, 1983), from Georgia (Jäderholm, 1896, as *A. rigida*), from Florida (Nutting, 1900, as *A. rigida*) and from the island Zoblos (Clarke, 1879).

The bathymetrical distribution of *A. trifida* is between 0 (Calder, 1983) and 617 m (Clarke, 1879).

Aglaophenia tubulifera (Hincks, 1861)
(fig. 32)

Plumularia tubulifera Hincks, 1861: 256, pl. 7 figs 1-2.

Aglaophenia tubulifera; Hincks, 1868: 288, pl. 63 fig. 2, pl. 64 fig. 3; Marine Biological Association, 1904: 198; Billard, 1906b: 231, figs 20A-F, 21A-B; Rioja y Martín, 1906: 278; Bedot, 1911: 226; Ritchie, 1911: 225; Billard, 1912a: 461; Crawshay, 1912: 330; Broch, 1913: 7, fig. 9a-e; 1918a: 93; Bedot, 1921a: 341; 1921c: 46; Billard, 1923: 17; Prenant & Teissier, 1924: 25; Hadzi, 1925: 246; Billard,

1927c: 344; 1931b: 247; Marine Biological Association, 1931: 78; Nobre, 1931: 21; Payne, 1931: 743; Cart & Crichton, 1936: 264; Da Cunha, 1940: 108; Leloup, 1940b: 22; Da Cunha, 1944: 39; Kramp, 1947b: 15; Da Cunha, 1950: 130, fig. 2; Teissier, 1950b: 24; Picard, 1951f: 261; Marine Biological Association, 1957: 51; Picard, 1958b: 192; Cabioch, 1961: 19, 26; Millard, 1961: 206; Cabioch, 1965: 56; Rees & Thursfield, 1965: 192; Teissier, 1965: 30; Rees & White, 1966: 279; Cabioch, 1968: 561, 589, 655, 686; Fey, 1969: 406; Robins, 1969: 335; Patriti, 1970: 50, fig. 69A-C; Guille, 1971: 265; Castric-Fey, 1973: 214; Edwards, 1973: 586; Saldanha, 1974: 325; Millard, 1975: 416; Svoboda, 1979: 86, figs 12f, 13f, 15f, 16f; Cornelius & Garfath, 1980: 287; Isasi, 1985: 95, figs 28D-F, 29; Aguirrezabalaga et al., 1986: 139; Isasi & Saiz, 1986: 70; Templado et al., 1986: 98; Aguirrezabalaga et al., 1988: 234, fig. 17; Ramil, 1988: 467; Gili, Vervoort & Pagès, 1989: 95, fig. 20B; Altuna & García Carrascosa, 1990: 86, fig. 91; Cornelius & Ryland, 1990: 156, fig. 4.24; Castric-Fey & Chassé, 1991: 523; Castric, Girard & Michel, 1991: 104; Svoboda & Cornelius, 1991: 36, figs 15-16, 19c-d, 24c-d; Cornelius, 1992b: 83; Ramil & Vervoort, 1992a: 97, fig. 23e-i; Svoboda, 1992: 177, figs 1a-c, 2a-d, 4a-b, 5a-b, 6a-b, 7a-b; Álvarez Claudio, 1993: 215, fig. 37A-F, pl. 19 figs A-G; Boero & Bouillon, 1993a: 263; Altuna Prados, 1994a: 223, pl. 40 figs A-D; 1995a: 54; Álvarez Claudio, 1995: 13; Álvarez Claudio & Anadón, 1995: 239; Cornelius, 1995: 197, fig. 46A-D; Medel & Vervoort, 1995: 22, fig. 8a-d; Ramil, Vervoort & Ansín, 1998: 10, figs 2-4.

Aglaophenia filicula Allman, 1883: 36, pl. 11 figs 1-6; Pictet & Bedot, 1900: 41, pl. 9 figs 11-14, pl. 10 figs 1-3.

Not *Aglaophenia tubulifera*; Stechow, 1923d: 249; Riedl, 1959: 666, pl. 10 fig. 3 (= *Aglaophenia tubiformis* Marktanner-Turneretscher, 1890).

Not *Aglaophenia tubulifera*; García Carrascosa, 1981: 305, pl. 28 figs a-c, pl. 43 figs a-b, pl. 45 fig. a [= *Aglaophenia octodonta* (Heller, 1868)].

Material.— **Azores area**: Stn 5.044: Three colonies with numerous cormoids, with corbulae (RMNH-Coel. 26883, slide 1983; 28589, 28688, slide 4527).— Stn 5.085: Several colonies with numerous cormoids, with corbulae (RMNH-Coel. 28653, 28663).— Stn 5.096: Single colony with some cormoids, one with male corbulae (RMNH-Coel. 29069 = slide 4528).— Stn 5.130: One colony on rock fragment with four cormoids, three with female corbulae (RMNH-Coel. 28575, four slides 4529).— Stn 5.161: One colony without corbulae (RMNH-Coel. 29070 = slide 4530).— Stn 5.162: Three developing colonies, without corbulae (unregistered sample).— Stn 5.178: A fragment without corbulae (DEBA-UV, slide R. 303).— **Madeira area**: Stn 1.072: Young colony developing on *Eudendrium* spec., without corbulae (unregistered sample).— Stn 1.093: 12 detached cormoids of which six with corbulae (RMNH-Coel. 28590, two slides 4521).— **Canary Islands and Selvagens Archipelago**: Stn 4.143: Several colonies with numerous cormoids, with corbulae (RMNH-Coel. 28576; DEBA-UV, slide R. 302).— Stn 4.144: One colony with corbulae and an epibiontic colony (RMNH-Coel. 28588, three slides 4522).— Stn 4.148: 19 cormoids, of which three with corbulae, four fragments (RMNH-Coel. 28666, slide 4523).— Stn 4.150: Two fragments with corbulae (RMNH-Coel. 28973, two slides 4524).— Stn 4.151: Seven cormoids, two with corbulae (RMNH-Coel. 28789).— Stn 4.152: One colony with 24 cormoids, with corbulae (RMNH-Coel. 28577, 28657, two slides 4525).— Stn 4.153: Several colonies with numerous cormoids, with corbulae (RMNH-Coel. 28574, 28684, four slides 4526).

Description (of material from Stn 4.153).— Hydrorhiza tubular, tortuous, attached to substratum, giving rise to monosiphonic, unbranched hydrocauli with a short basal zone followed by a prosegment with oblique nodes and one frontal nematotheca. Rest of hydrocaulus formed by internodes separated by oblique nodes, difficult to observe in older parts of colony. Each internode with one apophysis with one mamelon in median zone and three nematothecae: two in the axil and one inferior.

Hydrocladia inserted on apophyses, alternately directed left and right, formed by succession of hydrothecate internodes separated by oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior, adnate with abcauline

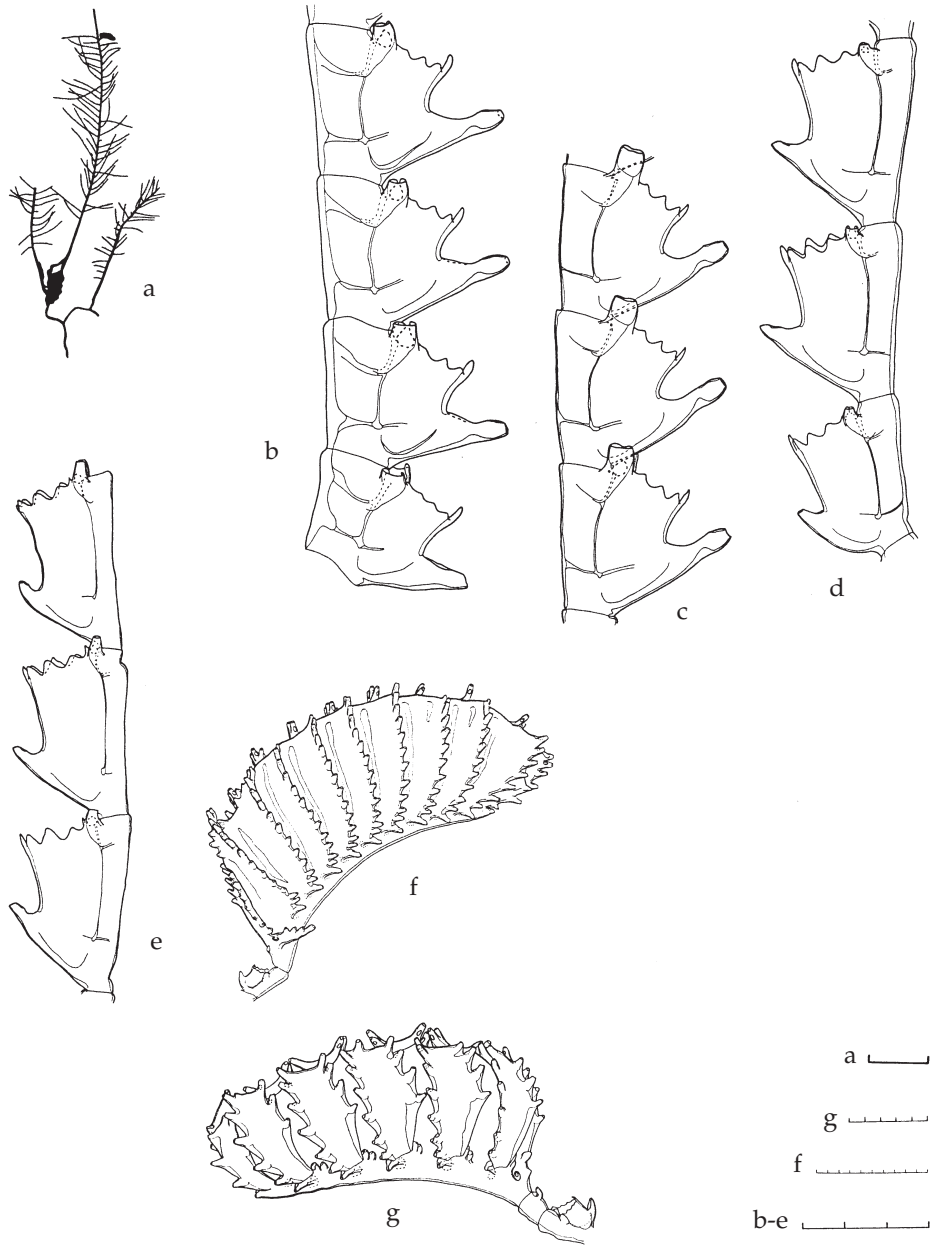


Fig. 32. *Aglaophenia tubulifera* (Hincks, 1861). a, Stn 5.085, colony; b-c, Stn 4.153, b, four internodes from basal part of hydrocladium; c, three internodes from distal part of hydrocladium; d-e, Stn 5.044, d, three internodes from basal part of hydrocladium; e, three internodes from distal part of hydrocladium; f, Stn 4.153, female corbula; g, Stn 4.144, male corbula; hydrocladia and corbulae in lateral view. Scales: a, 1 cm; b-e, 0.3 mm; f, 1 mm; g, 0.5 mm.

hydrothecal wall, and two lateral. Plane of hydrothecal aperture tilted downwards, with four pairs of lateral cusps and one abcauline cusp. Free part abcauline wall slightly concave; intrahydrothecal septum on adcauline side present but varied in development, even in same hydrocladium. Lateral nematothecae tubular, distinctly surpassing hydrothecal rim; mesial nematotheca adnate for c. half its length with abcauline hydrothecal wall, with perisarc thickening of distal part of its abcauline wall, tubular and with two apertures: one near abcauline wall of hydrotheca, one terminal. Mesial nematotheca of first internode of each hydrocladium open, aperture gutter-shaped, perisarc thickening poorly developed. Internodes furthermore with two perisarc rings, one at level of intrathecal septum, one at base of lateral nematothecae.

Colonies dioecious, corbulae with sexual dimorphism. Female corbulae with fused, occasionally much developed costae, with distal part free. Male corbulae with completely free costae. Number of costae in male corbulae six to nine and in female corbulae six to ten. Pedicel of corbula composed of one or two internodes of which first hydrothecate and with open mesial nematothecae, the second with single frontal nematotheca.

Variability.— Variability of intrathecal septum and perisarc thickening of mesial nematotheca has already been pointed out. In a colony from Stn 4.148 a normally developed branch originates from posterior part of hydrocaulus. In colonies from Stn 4.151 costae of the female corbulae are strongly developed and project above corbula. In material from Stns 5.044 and 5.085 marginal cusps of hydrothecae are large; free part of abcauline hydrothecal wall almost straight and mesial nematotheca short and narrow (fig. 32d-e). The fragment from Stn 5.178 has short mesial nematothecae, but tubular as is typical for the species.

Table XII. Measurements of *Aglaophenia tubulifera* in µm:

	Stn 4.153
Height of colony (in mm)	4-145
Internodes of hydrocaulus, length	240-610
Diameter at node	190-400
Hydrocladial internode, length	260-390
Diameter at node	80-150
Hydrotheca, depth	220-300
Diameter at rim	170-190
Length free part abcauline wall	130-150
Female corbula, length	3080-3450
Maximum diameter	1330-1400
Male corbula, length	2580-3600
Maximum diameter	1150-1250

Discussion.— *Aglaophenia tubulifera* can be separated from other eastern Atlantic species of this genus by the mesial nematotheca (except that of first internode) being long and tubular and usually surpassing the hydrothecal rim. Certain colonies of *Aglaophenia octodonta* (Heller, 1868) may have a long mesial nematotheca surpassing

the hydrothecal rim and being occasionally tubular (cf. variability of *A. octodonta* on p. 51). Some colonies of *A. tubulifera* have short mesial nematothecae (cf. fig. 32d-e), sometimes as short as in remaining species of *Aglaophenia*. Ramil, Vervoort & Ansín (1998: 11, figs 3-4) described and figured colonies of *A. tubulifera* that have short, tubular mesial nematothecae, while in the same hydrocladium several hydrothecae have an open, gutter-shaped mesial nematotheca.

Variability of the kind described here has caused a number of mistakes, particularly with Mediterranean material. Thus, *A. tubulifera* of Stechow (1923d) and Riedl (1959) has been synonymized by Svoboda (1979) with *Aglaophenia tubiformis* Marktanner-Turneretscher, 1890, and García Carrascosa's (1981) record, excluded by Ramil (1988) from the synonymy of *A. tubulifera*, was put in *A. octodonta* by Peña Cantero (1995).

The material figured by Cornelius & Ryland (1990, fig. 4.25) as *A. tubulifera*, does not represent this species (nematotheca not tubular, inwardly curved adcauline marginal cusp, strongly developed intrathecal septum) but probably *A. octodonta*. The occurrence of *A. tubulifera* in South Africa, though present in Busk's collection of South African hydroids, was rejected by Millard (1975). The presence of this species off Guinea-Bissau (Gili, Vervoort & Pagès, 1989) makes its presence in South African waters much more likely, a conclusion also supported by Svoboda & Cornelius (1991). Busk's locality reference may after all have been correct.

Reproduction.— Details on the occurrence of corbulae were published by Billard (1923, 1931a), Da Cunha (1950), Teissier (1965), Fey (1969), Isasi (1985), Gili, Vervoort & Pagès (1989), Svoboda & Cornelius (1991), Ramil & Vervoort (1992a). Álvarez Claudio (1993) and Medel & Vervoort (1995); they were found in all month with the exception of October, November and December. In CANCAP material they occur in March, May and June.

Distribution.— Considered an Atlantic-Mediterranean species by Boero & Bouillon (1993a) whereas Ramil & Vervoort (1992a) and Svoboda & Cornelius (1991) indicate that this is principally an Atlantic species penetrating the Mediterranean as far as the Alborán Sea. It has been recorded from the Hebrides (Hincks, 1868; Cart & Crichton, 1936), Ireland (Cornelius & Garfath, 1980; Svoboda & Cornelius, 1991), numerous localities along the English coasts (Hincks, 1861, as *Plumularia tubulifera,* 1868; Ritchie, 1911; Crawshay, 1912; Marine Biological Association, 1904, 1931, 1957; Rees & Thursfield, 1965; Robins, 1969; Edwards, 1973; Cornelius & Garfath, 1980; Cornelius & Ryland, 1990; Svoboda & Cornelius, 1991; Cornelius, 1995), the French littoral (Bedot, 1911; Billard, 1912a, 1923; Prenant & Teissier, 1924; Billard, 1927c, 1931b; Teissier, 1950b; Cabioch, 1961, 1965; Teissier, 1965; Fey, 1969; Castric-Fey & Chassé, 1991; Castric, Girard & Michel, 1991; Svoboda & Cornelius, 1991), the Bay of Biscay (Pictet & Bedot, 1900, as *Aglaophenia filicula*), the coasts of north and north-western Spain (Rioja y Martín, 1906; Rodríguez Rosillo, 1914; Isasi, 1985; Isasi & Saiz, 1986; Aguirrezabalaga et al., 1986, 1988; Ramil, 1988; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez Claudio & Anadón, 1995), the Portuguese littoral (Nobre, 1931; Da Cunha, 1940, 1944, 1950; Saldanha, 1974; Svoboda & Cornelius, 1991), the Azores (Pictet & Bedot, 1900, as *A. filicula*; Billard, 1906b; Bedot, 1921c; Leloup, 1940b; Rees & White, 1966), the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), Josephine Bank (Kramp, 1947b; Ramil, Vervoort & Ansín, 1998), Gorringe and Ampère Banks (Ramil, Vervoort & Ansín, 1998), the coast of

Morocco (Billard, 1906b; Broch, 1918a; Patriti, 1970; Svoboda & Cornelius, 1991), a locality between Madeira and the Canary Islands (Bedot, 1921c), West Sahara (Billard, 1906b; Broch, 1913), the Cape Verde Islands (Svoboda, 1979), Guinea Bissau (Gili, Vervoort & Pagès, 1989; Svoboda & Cornelius, 1991) and Algoa Bay, South Africa (Svoboda & Cornelius, 1991).

In the Mediterranean found in the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), at Ceuta (Svoboda & Cornelius, 1991), and in the Alborán Sea (Templado et al., 1986; Svoboda, 1979; Svoboda & Cornelius, 1991; Ramil & Vervoort, 1992a). Additional records are from the Gulf of Valencia (Rioja y Martín, 1906; Rodríguez Rosillo, 1914) and the French Mediterranean coast (Picard, 1951f; Guille, 1971); these are the only records from outside the Alborán Sea so they need confirmation.

The bathymetrical distribution varies between 8 (Rees & Withe, 1966a) and 1440 m (Bedot, 1921c).

The CANCAP material comes from 16 stations, of which seven in the Canary Islands, seven from the Azores and two from off Madeira; the depths at those localities vary between 45 and 650 m.

Epibionts.— Stn 1.093: Campanulinidae indet., Bryozoa.— Stn 4.143: *Filellum serratum* (Clarke, 1879), *Antennella secundaria* (Gmelin, 1791), *Plumularia setacea* (L., 1758), Bryozoa.— Stn 4.144: *Aglaophenia tubulifera* (Hincks, 1861).— Stn 4.148: *Filellum* spec., Campanulariidae.— Stn 4.151: *Antennella secundaria* (Gmelin, 1791).— Stn 4.152: *Antennella secundaria* (Gmelin, 1791), *Campanularia hincksii* Alder, 1856.— Stn 4.153: ?*Eudendrium* spec., *Filellum serratum* (Clarke, 1879), *Antennella secundaria* (Gmelin, 1791), *Clytia gracilis* (M. Sars, 1850), Sertulariidae indet., Bryozoa.— Stn 5.044: *Filellum serratum* (Clarke, 1879), *Campanularia hincksii* Alder, 1856, *Laomedea calceolifera* (Hincks, 1871), *Obelia bidentata* Clarke, 1875.— Stn 5.085: *Halopteris* spec., *Obelia dichotoma* (L., 1758), Bryozoa.— Stn 5.096: Bryozoa.

Aglaophenia svobodai spec. nov.
(figs 33-35)

Material.— **Cape Verde Islands**: Stn 6.067: Four colonies with 42, 25, 18 and three cormoids, of which two biggest with corbulae (RMNH-Coel. 28605, 28680, five slides 4531).— Stn 6.069: One colony without corbulae (RMNH-Coel. 28606, slide 4532).— Stn 6.076: One colony with five male corbulae (RMNH-Coel. 29071 = two slides 4533).— Stn 6.131: One colony without corbulae (RMNH-Coel. 28673, slide 4534).— Stn 6.137 (type locality): One colony with 31 cormoids, of which two branched, without corbulae (holotype, RMNH-Coel. 28651, three slides 4535 are part of the type series; also RMNH-Coel. 28656).— Stn 6.D02: One colony attached to rock fragment with calcareous algae and 15 detached cormoids with female corbulae (RMNH-Coel. 28661, four slides 4536)).— Stn 7.044: One colony on balanids with 18 cormoids, of which three with corbulae (RMNH-Coel. 28686).— Stn 7.059: Two colonies without corbulae (RMNH-Coel. 28671).— Stn 7.081: One colony on *Streptocaulus pulcherrimus* and Bryozoa, without corbulae (RMNH-Coel. 28664, two slides 4537).— Stn 7.125: One colony without corbulae (RMNH-Coel. 28681; DEBA-UV, three slides R. 304).— Stn 7.149: Two branched colonies without corbulae (RMNH-Coel. 28689, three slides 4538). All these colonies, with the exception of RMNH-Coel. 28651 (holotype) are paratypes.

Description (of holotype).— Hydrorhiza tubular, tortuous, adhering to substrate; hydrocauli rising from hydrorhiza monosiphonic, unbranched or irregularly branched,

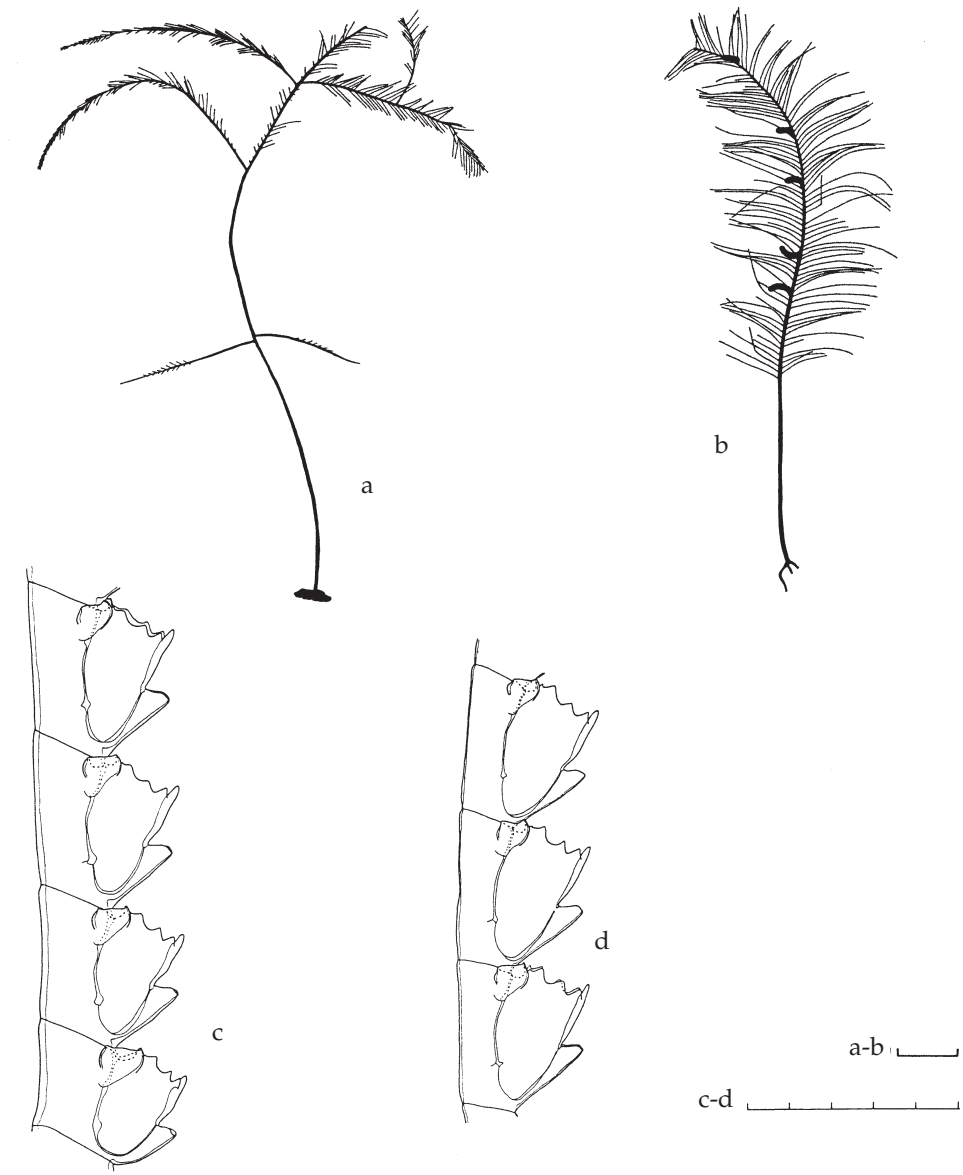


Fig. 33. *Aglaophenia svobodai* spec. nov. a, Stn 7.149, branched colony; b-d, Stn 6.067, b, unbranched colony; c, four internodes from basal part of hydrocladium, lateral view; d, three internodes from distal part of hydrocladium, lateral view. Scales: a-b, 1 cm; c-d, 0.5 mm.

occasionally with threefold ramification. Hydrocaulus with short, undivided basal part, followed by five or six prosegments separated by oblique nodes and with a frontal nematotheca. Nodes only visible in young colonies. Remainder of hydrocaulus consisting of succession of internodes separated by oblique nodes, visible only

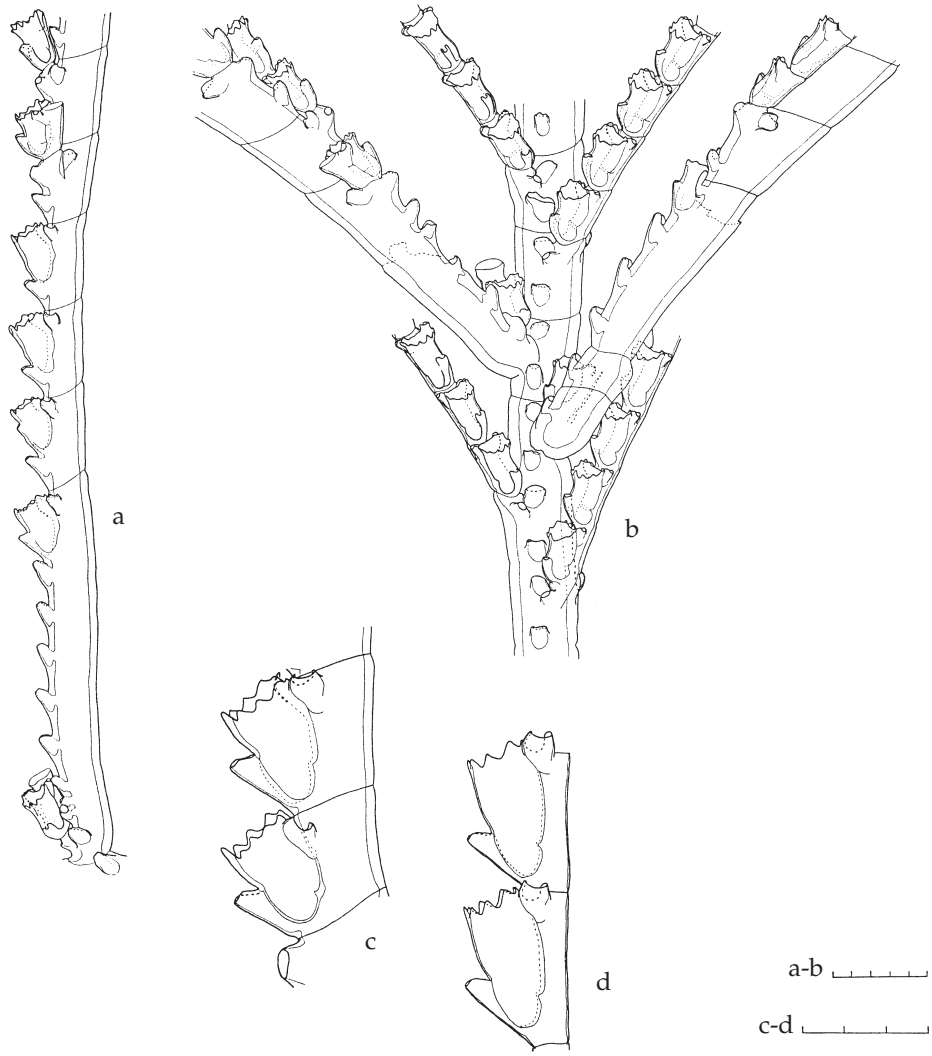


Fig. 34. *Aglaophenia svobodai* spec. nov. a-b, Stn 7.149, a, basal part of branch, lateral view; b, detail of a ramification, frontal view; c-d, Stn 6.067, c, two internodes from basal part of hydrocladium, lateral view; d, two internodes from distal part of hydrocladium, lateral view. Scales: a-b, 0.5 mm; c-d, 0.3 mm.

in younger parts of colonies. Each internode with one apophysis and one mamelon placed on superior half and three nematothecae: two in the axil and one inferior close to basal node of internode. Branches of hydrocaulus originating from stem internodes, inserting between apophysis and inferior nematotheca, with basally one to six prosegments separated by oblique nodes; rest of branch identical with main stem. Occasionally prosegments of branch followed by internodes with cauline hydrothe-

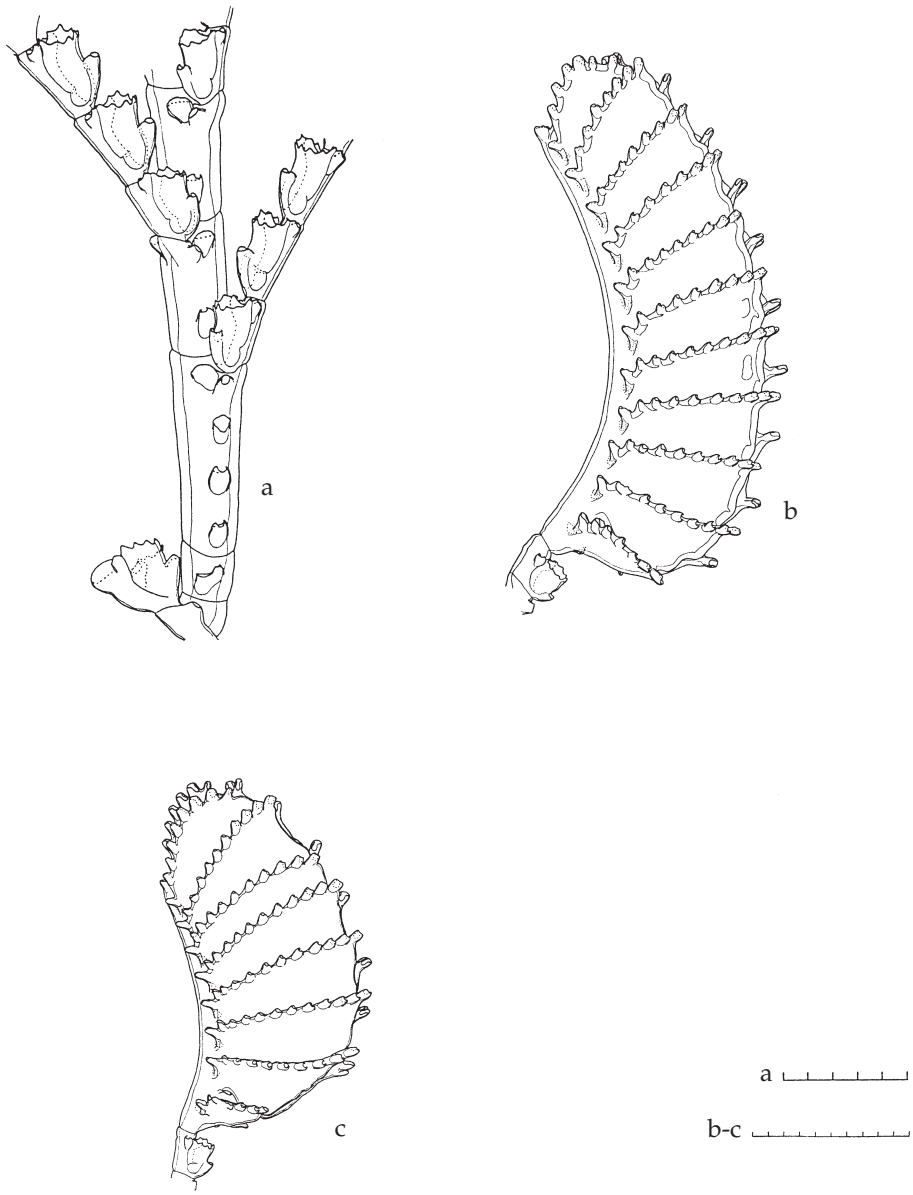


Fig. 35. *Aglaophenia svobodai* spec. nov. a, Stn 7.125, detail of branch, frontal view; b, Stn 6.067, male corbula, lateral view; c, Stn 6.D02, female corbula, lateral view. Scales: a, 0.5 mm; b-c, 1 mm.

cae, followed by typical cauline internodes with apophyses supporting hydrocladia. A short hydrocladium inserts on apophysis of caudal segment bearing the ramification; this hydrocladium always composed of a single internode with a hydrotheca and three nematothecae in morphology and arrangement identical with those of normal hydrocladia described below.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of internodes separated by oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior, adnate with hydrothecal abcauline wall, and two lateral. Plane of hydrothecal aperture slightly tilted downwards, with four pairs of lateral cusps and one abcauline cusp. Lateral cusps of uniform size with exception of most adcauline pair being much smaller; abcauline cusp with carina, continuing downward along free part abcauline wall. Development of carina varied, but never completely absent even in distal part of hydrocladia. Basal third of intrahydrothecal cavity with poorly developed septum. Lateral nematothecae short, generally reaching hydrothecal rim. Mesial inferior nematotheca nearly completely adnate, covering basal half of hydrothecal abcauline wall; aperture of all nematothecae gutter-shaped. Aperture between mesial nematotheca and hydrothecal cavity occasionally closed. Internode with two poorly developed perisarc rings, one in basal third at level of intrathecal septum and one at base of lateral nematothecae.

Colonies dioecious and with sexual dimorphism of corbulae. Female corbula (Stn 6.D02) with seven or eight pairs of costae, of which first free; remainder completely fused but occasionally slightly projecting above breadth of corbula. Male corbula (Stn 6.067) with eight to eleven pairs of costae, not completely fused basally and distally as apertures are present. Occasionally male corbulae also with median apertures between costae. All corbulae with pedicel composed of one hydrothecate internode.

Variability.— Though in majority of material the number of prosegments is five or six, this number actually varies between two (Stn 6.069) and ten (Stn 6.067). In some colonies from Stns 6.067 and 7.059 the hydrocladia of the distal part point in opposite direction compared with those of basal part, achieving a torsion of 180° in orientation of colony.

Table XIII. Measurements of *Aglaophenia svobodai* in µm:

	Stn 6.067	Stn 6.D02
Height of colony (in mm)	7-132	9-63
Internode of hydrocaulus, length	400-700	430-490
Diameter at node	150-500	160-180
Hydrocladial internode, length	250-370	210-340
Diameter at node	85-190	90-155
Hydrotheca, depth	270-320	240-330
Diameter at rim	155-190	155-170
Length free part abcauline wall	140-180	120-155
Female corbula, length		1970-2600
Maximum diameter		900-1140
Male corbula, length	2600-3400	
Maximum diameter	900-1000	

Discussion.— This species is characterised by its ramification, resembling that of *Aglaophenia elongata* Meneghini, 1845, and a median hydrothecal carina as occurs in *Aglaophenia latecarinata* Allman, 1877. From *A. elongata* it differs by the presence of that carina, moreover in *A. elongata* the hydrocladium inserting on the apophysis sup-

porting a branch is a normal hydrocladium, composed of a varied number of hydrothecate internodes. Here that hydrocladium has one single hydrothecate internode. From *A. latecarinata* it differs by its branched colonies, moreover the hydrotheca of *A. latecarinata* has a well developed intrathecal septum and a perisarc thickening of the abcauline wall of the mesial nematotheca, characters absent in *Aglaophenia svobadai* spec. nov.

Reproduction.— Gonothecae of the CANCAP colonies were found in June and August.

Distribution.— All material comes from the Cape Verde Archipelago and was collected between 20 and 130 m depth.

Epibionts.— Stn 6.067: Foraminifera, *Sertularella* spec., *Sertularia distans* (Lamouroux, 1816).— Stn 6.076: *Filellum serratum* (Clarke, 1879), *Plumularia setacea* (L., 1758).— Stn 6.131: *Plumularia setacea* (L., 1758).— Stn 6.137: *Clytia paulensis* (Vanhöffen, 1910), *Obelia bidentata* Clarke, 1875.— Stn 6.D02: Algae.— Stn 7.044: Algae, *Eudendrium* spec., *Sertularella* spec., Bryozoa.— Stn 7.059: *Sertularia distans* (Lamouroux, 1816).— Stn 7.081: *Campanularia hincksii* Alder, 1856, Bryozoa.— Stn 7.125: *Clytia gracilis* (M. Sars, 1850), Bryozoa.

Etymology.— The specific name *svobodai* has been chosen to honour Dr Armin Svoboda, Bochum, a great specialist of Atlantic Aglaopheniids.

Aglaophenia spec.
(fig. 36)

Material.— **Canary Islands and Selvagens Archipelago:** Stn 2.119: One colony with several cormoids, seven with corbulae (RMNH-Coel. 28607, five slides 4539).— Stn 4.153: Two colonies with various cormoids, with corbulae (RMNH-Coel. 28608, three slides 4540; DEBA-UV, two slides R. 305).

Description (of material from Stn 4.153).— Colonies with irregularly branched hydrorhiza; hydrocauli arising from it monosiphonic and unbranched. Hydrocaulus with short, undivided basal zone, followed by one to three prosegments separated by scarcely visible, oblique nodes, each with one frontal nematotheca. Remainder of hydrocaulus formed by succession of internodes separated by slightly oblique nodes, best visible in younger parts of colony. Each internode with one apophysis with one mamelon, placed in median part, and three nematothecae: two in the axil and one inferior, close to inferior node.

Hydrocladia composed of succession of internodes with transverse nodes, each with one hydrotheca and three nematothecae: one mesial inferior, adnate to abcauline wall of hydrotheca, and two lateral hydrothecae deep, rim provided with four pairs of lateral cusps and one abcauline cusp, all of same size. Some hydrothecae with indication of intrathecal septum in lower third. Lateral nematothecae projecting slightly above hydrothecal rim; mesial nematotheca almost fully adnate, covering basal third of abcauline hydrothecal wall. All nematothecae with gutter-shaped aperture.

Colonies dioecious, with sexual dimorphism of corbulae. Female corbula with eight or nine pairs of costae of which first free; remaining costae completely fused. Male corbulae with seven to nine costae that are not completely fused and occasionally free in superior part of corbula. Rachis of both types curved, strongest in male cor-

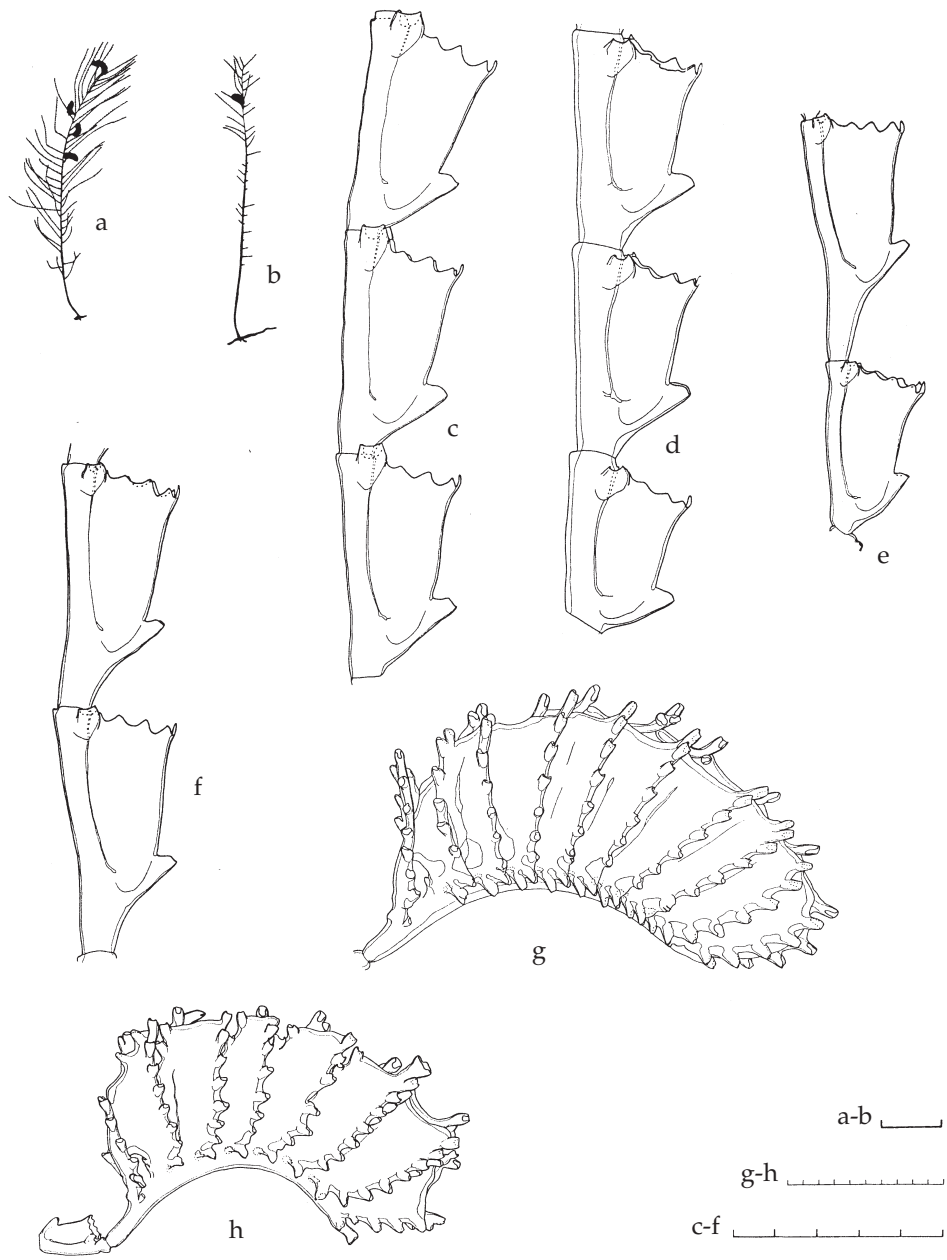


Fig. 36. *Aglaophenia* spec. a, Stn 4.153, colony; b, Stn 2.119, colony; c-f, Stn 4.153, c, three internodes from distal part of hydrocladium; d, three internodes from basal part of hydrocladium; e, two internodes from basal part of hydrocladium of young colony; f, two internodes from distal part of hydrocladium of young colony; g, Stn 2.119, female corbula; h, Stn 4.153, male corbula; hydrocladia and corbulae in lateral view. Scales: a-b, 1 cm; c-f, 0.5 mm; g-h, 1 mm.

bula. All corbulae with pedicel composed of one thecate internode.

Variability.— In the colony from Stn 2.119 we noticed development of a new cormoid from place of insertion of a shed hydrocladium. Stem of this new cormoid basally with two prosegments. Occasionally stolons develop from distal part of cormoid. In colonies from Stns 2.119 and 4.153 regeneration of hydrocladia has occurred after breakage; in such cases regenerating part has two basal prosegments. Material from Stn 4.153 contains juvenile and adult specimens differing considerably in measurements.

Table XIV. Measurements of *Aglaophenia* spec. in µm:

	Stn 4.153	Stn 2.119
Height of colony (in mm)	4-59	11-78
Internode of hydrocaulus, length	420-780	600-750
Diameter at node	70-230	100-130
Hydrocladial internode, length	380-600	480-600
Diameter at node	40-120	70-90
Hydrotheca, depth	320-410	380-435
Diameter at rim	160-200	200-220
Length of free part abcauline wall	220-320	290-360
Female corbula, length		2550-3020
Maximum diameter		1090-1200
Male corbula, length	2000-2810	
Maximum diameter	940-1040	

Discussion.— This material resembles *Aglaophenia dubia* Nutting, 1900, but in that species colonies are branched, there is a short and strong intrathecal septum and the abcauline wall of the hydrotheca is concave. In our material the colonies are unbranched, there is hardly an intrahydrothecal septum and the abcauline hydrothecal wall is almost straight. These characters might be variable. For proper judgment revision of the type of *A. dubia* seems imperative.

Reproduction.— CANCAP colonies had corbulae in June and September.

Distribution.— Collected at two stations in the Canary Islands region between 200 and 350 m depth.

Epibionts.— Stn 2.119: *Gymnangium sinuosum* (Fraser, 1925), *Plumularia setacea* (L., 1758), *Scalpellum* spec.— Stn 4.153: *Filellum serratum* (Clarke, 1879).

Genus *Cladocarpus* Allman, 1874
Cladocarpus alatus Jarvis, 1922
(fig. 37)

Cladocarpus alatus Jarvis, 1922: 351, fig. 2, pl. 26 fig. 25; Vervoort, 1966a: 149, 152, fig. 52a-b; Rees & Vervoort, 1987: 139-142, fig. 30a; Bouillon, Massin & Kresevic, 1995: 35.

Material.— Cargados, Carajos, Indian Ocean, 45 fms (= 82 m), J.S. Gardiner Colln, presented by Dr H.W. Tims. Part of type series (BMNH nº 23.2.15.169).

Description.— Material consists of a stained microslide containing distal part of colony. Hydrocaulus polysiphonic basally, divided into internodes by straight nodes, visible as minor constrictions of perisarc. Each internode with three to five nematothecae arranged in a frontal row and one apophysis near distal extremity with one axillar nematotheca.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of hydrothecate internodes separated by quite oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca deep and tubular, bottom straight. Walls of hydrotheca straight and almost parallel; rim almost hidden by lateral nematothecae, with well developed abcauline cusp. Intrahydrothecal cavity with small adcauline septum halfway its length. Mesial nematotheca placed on basal part of internode under hydrotheca, reaching or slightly surpassing the hydrothecal base, tubular, with two apertures, one apical and one facing hydrothecal base. Lateral nematothecae much developed, extending along hydrothecal rim, with three to five apertures of which more adcauline is at end of a short funnel; remaining apertures at level of hydrothecal rim. Rim of all nematothecal apertures finely dentate. Hydrocladial internodes with varied number of internal perisarc rings; one in basal third at level of mesial nematothecae, one at level of lateral nematothecae, four to six in between and one distal.

Gonosome absent.

Variability.— Typically the lateral nematothecae almost completely occupy the hydrothecal rim, but in three hydrothecae they reach the middle of that rim (fig. 37d). Lateral nematothecae may be developed differently in a single hydrotheca. Rings in the internode may be much differing in development and are almost absent in internodes of distal hydrocladia.

Table XV. Measurements of *Cladocarpus alatus* in µm:

	Part of type series BMNH nº 23.2.15.169
Cauline nematotheca, length	70-95*
Diameter at rim	20-40*
Hydrocladial internode, length	530-630
Diameter at node	80-120
Hydrotheca, depth (without cusp)	370-430
Depth (with cusp)	400-460
Diameter at rim	170-190
Mesial nematotheca, length	120-140**
Diameter at rim	10-18**

* Frontal view
**Lateral view

Discussion.— The gonosome of this species is unknown and therefore its inclusion in *Cladocarpus* is provisional.

Distribution.— Described by Jarvis (1922) from Cargados in the Indian Ocean and later on recorded from the Gulf of Aden (Rees & Vervoort, 1987). There is also a

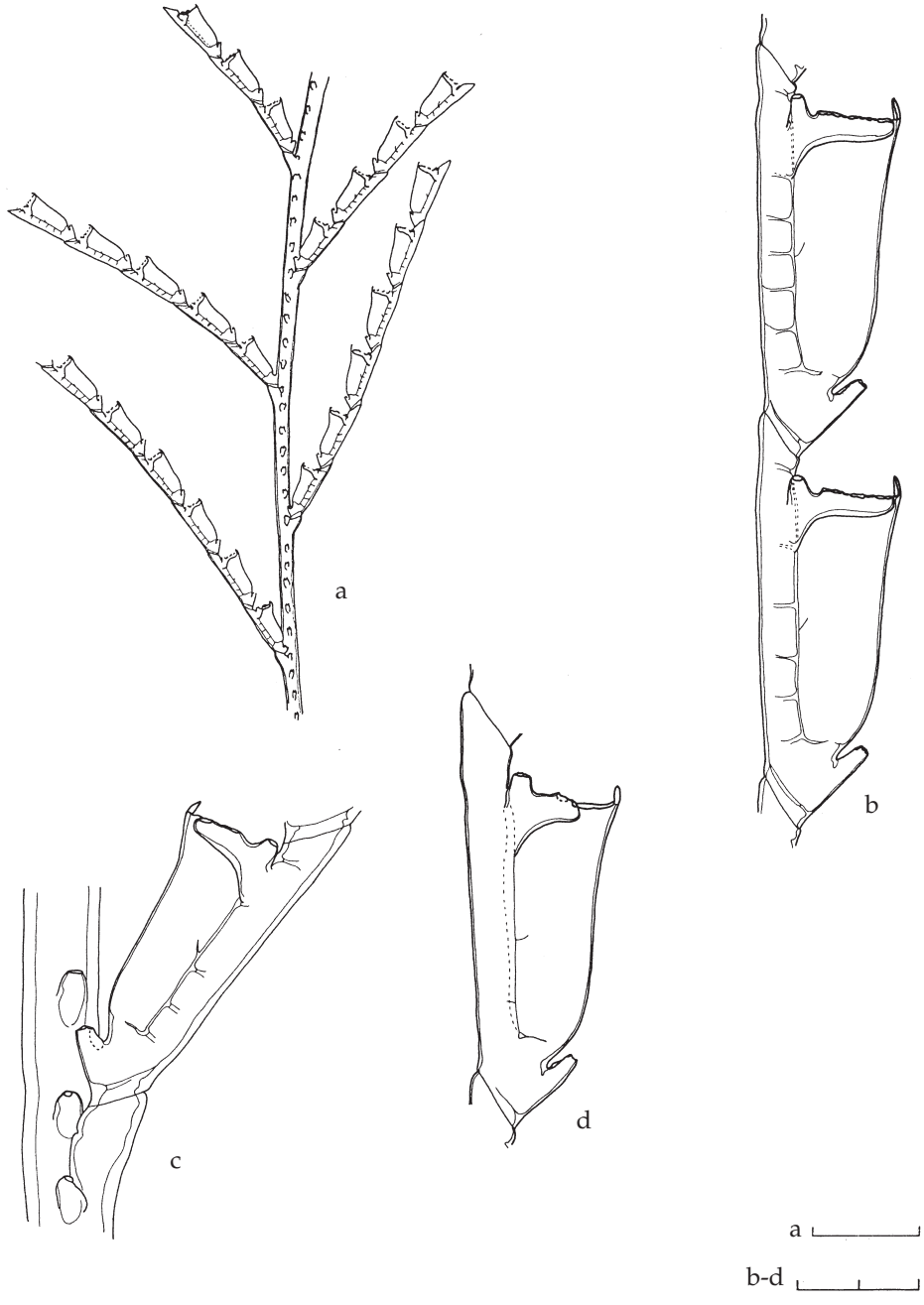


Fig. 37. *Cladocarpus alatus* Jarvis, 1922, holotype (BMNH no. 23.2.15.169). a, colony fragment, frontal view; b, two normally developed hydrocladial internodes, lateral view; c, apophysis and first hydrocladial internode, lateral view; d, internode with short lateral nematothecae, lateral view. Scales: a, 1 mm; b-d, 0.2 mm.

record from "Mission Iris" in the Antarctic (Bouillon, Masin & Kresevic, 1995) but this material urgently needs revision.

The bathymetrical distribution is between 73 and 200 m (Rees & Vervoort, 1987).

Genus *Gymnangium* Hincks, 1874
Gymnangium sinuosum (Fraser, 1925)
(fig. 38)

Halicornaria sinuosa Fraser, 1925: 171, fig. 7a-c; 1944a: 414, fig. 403; Deevey, 1954: 271.
Halicornaria speciosa p.p. Nutting, 1900: 127 [not *Gymnangium speciosum* (Allman, 1877)].
Aglaophenia (?) allmani p.p. Leloup, 1935c: 57 (not *Aglaophenia allmani* Nutting, 1900).
Not *Halicornaria sinuosa*; Leloup, 1937a: 110, fig. 13 [= *Gymnangium speciosum* (Allman, 1877)].
Halicornaria hians var. *balei*; Van Gemerden-Hoogeveen, 1965: 70, figs 39-41 [not *Gymnangium hians balei* (Marktanner-Turneretscher, 1890)].
Gymnangium hians var. *balei*; Vervoort, 1968: 114 [not *Gymnangium hians balei* (Marktanner-Turneretscher, 1890)].
Gymnangium sinuosum; Vervoort, 1968: 114; Bogle, 1975: 271, fig. 23A-B, charts 38-39; Calder, 1997: 43, fig. 10a-b.
Not *Gymnangium sinuosum*; Bouillon, Massin & Kresevic, 1995: 36. [= *Gymnangium speciosum* (Allman, 1877)].

Material.— **Canary Islands and Selvagens Archipelago**: Stn 2.119: Single colony epibiontic on *Aglaophenia* spec., no gonothecae (RMNH-Coel. 29072 = two slides 4541).

Description.— Hydrorhiza tubular, developing along stem of *Aglaophenia* spec., monosiphonic and unbranched hydrocaulus rising from stolon on which nematothecae may be present. Internodes of hydrocaulus separated by oblique nodes with varied inclination even in same cormoid. First internode without apophysis, with one or two frontal nematothecae; remaining internodes with one or two apophyses, though in our material usually one, placed on distal half of internode. In case two apophyses are present one is in basal third and second on distal part of internode. Each apophysis associated with three nematothecae: two in the axil and one inferior close to base of internode.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of internodes separated by oblique nodes, each internode with one hydrotheca and three nematothecae: one mesial inferior adnate to hydrothecal abcauline wall and two lateral. Plane of hydrothecal aperture strongly tilted downwards to a varied degree, varying between being almost parallel to internode and forming an angle of c. 30°, angle smallest in distal part of hydrocladium. Distal third of adcauline wall of hydrotheca free. Rim of hydrotheca with well developed pair of lateral cusps. Second, weakly developed adcauline pair occasionally present. Hydrothecal cavity with well developed septum springing from abcauline wall, curving upwards at distal margin. Observed from above septum shows dentate central zone (fig. 38d). Lateral nematothecae short, not reaching hydrothecal rim. Mesial nematotheca attached to major part of hydrothecal abcauline wall leaving small fraction free. Free part of mesial nematotheca tubular, of varied length and with adcauline wall cleft over whole length. Length of free part varying between quite short, scarcely surpassing hydrothecal rim and about as long as fused part.

Gonosome absent.

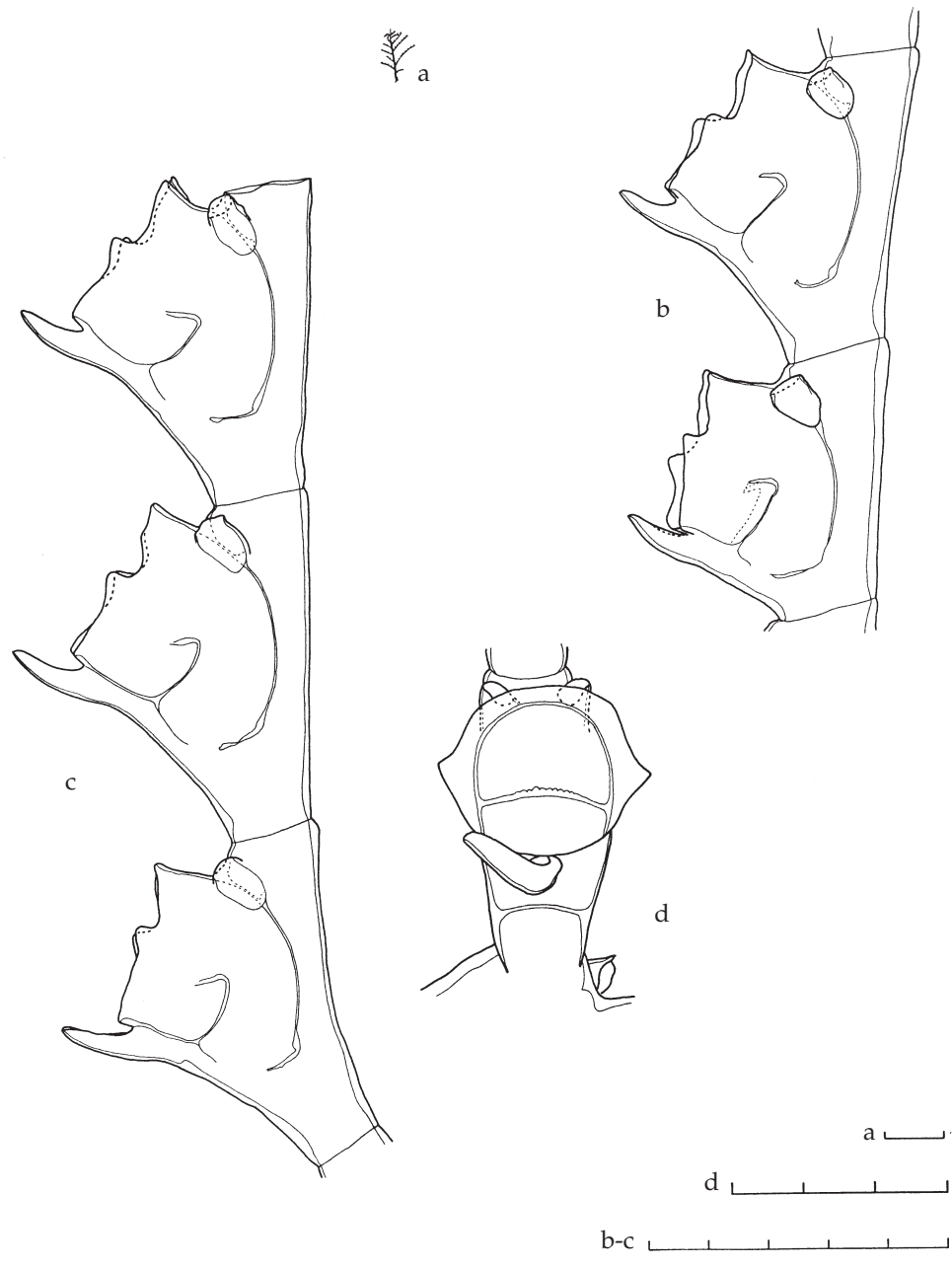


Fig. 38. *Gymnangium sinuosum* (Fraser, 1925), Stn 2.119. a, colony; b, two internodes from basal part hydrocladium, lateral view; c, three internodes from distal part hydrocladium, lateral view; d, internode, frontal view. Scales: a, 1 cm; b-c, 0.5 mm; d, 0.3 mm.

Table XVI. Measurements of *Gymnangium sinuosum* in µm:

	Stn 2.119
Height of colony (in mm)	8-19
Internodes of hydrocaulus, length	460-780
Diameter at node	200-260
Hydrocladial internode, length	400-610
Diameter at node	80-160
Hydrotheca, depth	300-360
Diameter at margin	220-280
Length free part abcauline wall	20-30
Length free part adcauline wall	75-110

Discussion.— Three species of *Gymnangium*, *G. hians* (Busk, 1852), *G. speciosum* (Allman, 1877) and *G. sinuosum* (Fraser, 1925) are very similar and distinguished mainly by number of cusps of hydrothecal rim. *G. hians* has three pairs of lateral cusps, *G. speciosum* has two and *G. sinuosum* only one. *G. hians*, moreover, seems to be an Indo-Pacific species, whereas the remaining two are only known from the western Atlantic. Several authors (Billard, 1913; Vervoort, 1941; Pennycuik, 1959; Millard, 1975 and Vervoort & Vasseur, 1977) described a wide range of variation of marginal cusps, but Bogle (1975), after revision of the types of *G. speciosum* and *G. sinuosum*, recognized both species. *G. speciosum* is differentiated by great variability in length of mesial nematothecae in one colony and presence of two pairs of lateral cusps. According to Calder (1997) validity of the species recognized by Bogle (1975) is questionable bearing in mind the variability described in *G. hians* but he advised to keep the three species separate pending careful inspection of type material of all three species.

Van Gemerden-Hoogeveen (1965) included part of the material identified by Leloup (1935c) as *Aglaophenia (?) allmani* Nutting, 1900, in *Gymnangium hians* var. *balei* and later Bogle (1975) placed those references in *G. sinuosum*, together with part of the material identified by Nutting (1900) as *Halicornaria speciosa* (Allman, 1877). Bogle (1975) also excluded from *G. sinuosum* Leloup's (1937a) record because of the presence of two cusps at the hydrothecal rim. We have here followed Bogle (1975) and Calder (1997) in referring the CANCAP material to *G. sinuosum*.

Reproduction.— The CANCAP material, collected in August, has no gonothecae.

Distribution.— *Gymnangium sinuosum* so far has only been found in the western Atlantic. It was recorded from Bermuda (Calder, 1997), from various localities near the Strait of Florida (Nutting, 1900, as *Halicornaria speciosa*; Fraser, 1925, as *H. sinuosa*; Bogle, 1975), and from Tortugas (Leloup, 1935c, as *Aglaophenia (?) allmani*; Van Gemerden-Hoogeveen, 1965, as *H. hians* var. *balei*).

The bathymetric range varies between 64 and 174 m (Bogle, 1975).

CANCAP material comes from the Canarian Islands region at 350 m depth, being the first eastern Atlantic record and an example of amphi-Atlantic distribution. The bathymetrical range is also considerably extended (350 m).

Genus *Lytocarpia* Kirchenpauer, 1872
Lytocarpia distans (Allman, 1877)
(fig. 39)

Aglaophenia distans Allman, 1877: 44, pl. 26 figs 1-8; Clarke, 1879: 247; Pictet & Bedot, 1900: 39.
Thecocarpus distans; Nutting, 1900: 108, pl. 24 figs 14-16; Bedot, 1921a: 333; Fraser, 1944a: 424, pl. 94 fig. 415a-b; 1944b: 47; Deevey, 1954: 271; Vervoort, 1968: 115; 1972: 224, figs 73b, 79a-d; ?Gili, Ros & Pagès, 1987: 92; Boero & Bouillon, 1993a: 263.
Lytocarpia distans; Stechow, 1923d: 245; ?Picard, 1958b: 192; Bogle, 1975: 256, fig. 22A-B, charts 36-37; Cairns et al., 1991: 29; El Beshbeeshy, 1991: 287, fig. 73; Ramil & Vervoort, 1992a: 135, fig. 35a.
Not *Thecocarpus distans*; Bedot, 1921c: 52, pl. 6 figs 51, 52; Patriti, 1970: 51, fig. 71; Gili, 1986: 151, fig. 4.26C [= *Lytocarpia myriophyllum* (Linnaeus, 1758)].

Material.— **Madeira area**: Stn 1.098: Single colony without corbulae (RMNH-Coel. 28718, two slides 4542).

Description.— Hydrorhiza tubular, adhering to substrate; hydrocaulus monosiphonic. Basal part of hydrocaulus smooth, not divided into internodes, with five nematothecae, followed by prosegment with oblique nodes and single frontal nematotheca. Rest of hydrocaulus with indistinct, straight nodes visible as perisarc constrictions, separating internodes with one apophysis in distal part and three nematothecae: two in the axil and one inferior under apophysis.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of series of internodes with oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrothecae deep, rim provided with distinct abcauline cusp and pairs of rounded lateral cusps decreasing in size in adcauline direction and occasionally almost absent, giving rim smooth appearance; median cusp always present. Hydrotheca placed on upper two-thirds of internode; basal third free. Abcauline wall of hydrotheca convex; bottom rounded. Intrathecal septum completely absent. Lateral nematothecae small, reaching hydrothecal rim but not surpassing. Mesial nematotheca also small, fully adnate to abcauline wall of hydrotheca of which it only occupies lower third.

Gonosome absent.

Table XVII. Measurements of *Lytocarpia distans* in μm:

	Stn 1.098
Height of colony (in mm)	10
Hydrocladial internode, length	650-860
Diameter at node	70-80
Hydrotheca, depth (without median cusp)	465-580
Diameter at rim	210-250
Length abcauline wall hydrotheca (median cusp included)	385-520

Discussion.— The material studied consists of one small, 10 mm high colony without corbula. The trophosome (fig. 39a-b) has all characters of this species and dif-

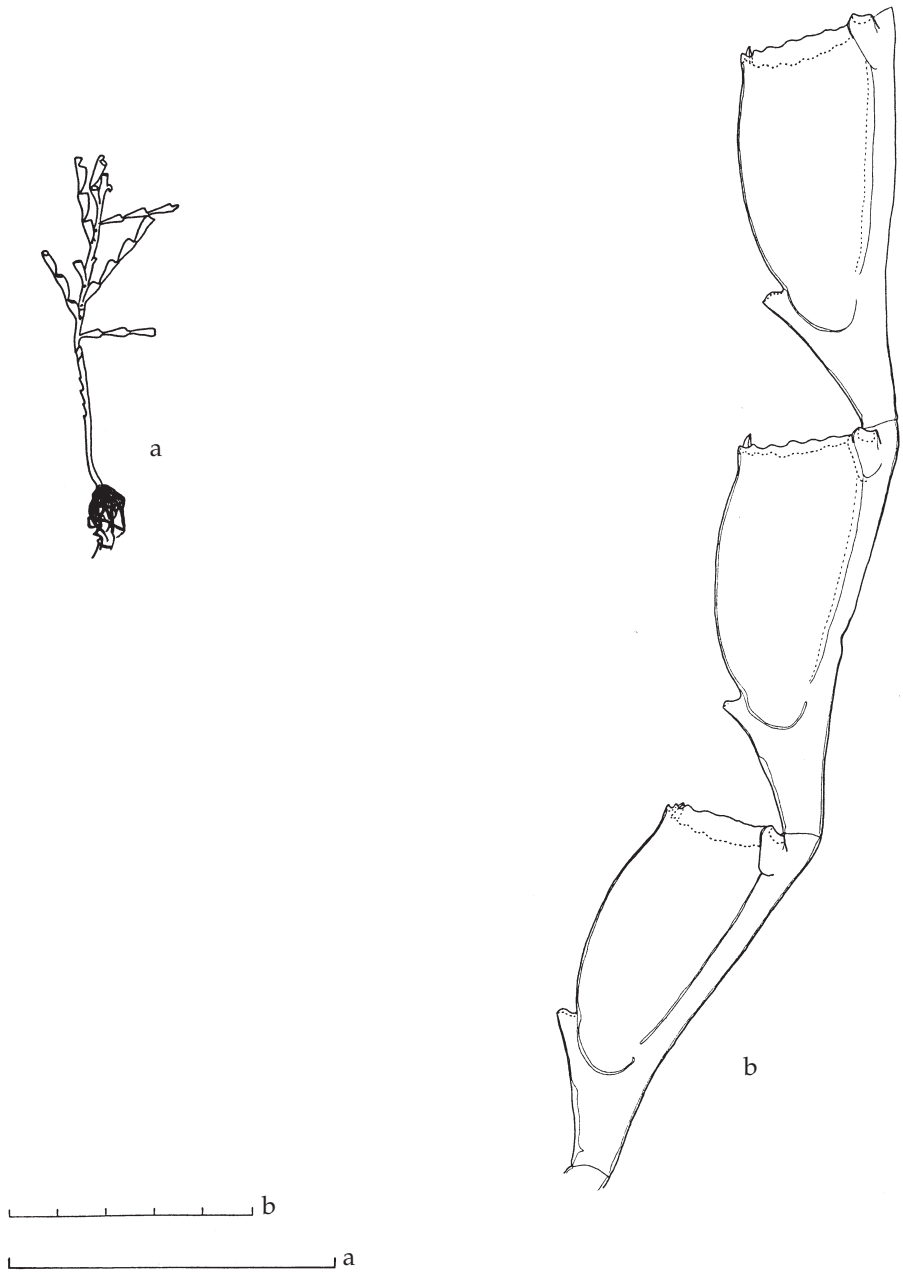


Fig. 39. *Lytocarpia distans* Allman, 1877, Stn 1.098. a, colony; b, three hydrocladial internodes, lateral view. Scales: a, 1 cm; b, 0.5 mm.

fers from *Lytocarpia myriophyllum* in shape of hydrothecae, length of mesial nematotheca, free part of internode and absence of internodal septa (cf. Ramil & Vervoort, 1992a).

Picard (1958c) and Boero & Bouillon (1993a) have included *L. distans* in a species list for the Mediterranean and Gili, Ros & Pagès (1987) cite the species from the coast of Catalonia. Occurrence of this species in the Mediterranean is highly doubtful and should be substantiated by inspection of new material. Records so far probably all relate to aberrant specimens of *L. myriophyllum*. The material described and figured by Gili (1986) as *Lytocarpia distans*, from the Catalan coast, clearly belongs to *L. myriophyllum* of which it has all characters.

Reproduction.— The CANCAP material was collected in March and has no corbulae.

Distribution.— Boero & Bouillon (1993a) considered *L. distans* a boreal species. It is chiefly known from the western Atlantic and has been recorded from Georgia (Vervoort, 1972a, as *Thecocarpus distans*), from Florida Keys (Bogle, 1975), from Pacific Reef (Allman, 1877, as *Aglaophenia distans*; Ramil & Vervoort, 1992a), from north-west of Tortugas (Clarke, 1879, as *Aglaophenia distans*) and from the Argentine coastal shelf (El Beshbeeshy, 1991). Mediterranean records by Picard (1958b), Gili, Ros & Pagès (1987) and Boero & Bouillon (1993a), have not been included.

The bathymetrical distribution is between 90 (El Beshbeeshy, 1991) and 986 m (Clarke, 1879).

The CANCAP colony was collected south of Madeira between 220 and 226 m depth.

Lytocarpia myriophyllum (Linnaeus, 1758)
(figs 40-45)

Sertularia myriophyllum Linnaeus, 1758: 810; A. Agassiz, 1865: 145.

Aglaophenia myriophyllum; Hincks, 1868: 290, pl. 64 figs 2, 2a; Carus, 1884: 16; Thornely, 1894: 8; Pictet & Bedot, 1900: 34, pl. 8 figs 1-5, pl. 9 figs 1-10; Marine Biological Association, 1904: 198; Rioja y Martín, 1906: 278; Browne, 1907: 34; Crawshay, 1912: 330; Massy, 1912: 216; Rodríguez Rosillo, 1914: 40; Nobre, 1931: 21; Bacci, 1947: 173; Redier, 1965: 380; 1967: 401.

Aglaophenia radicellata G.O. Sars, 1874: 9, pl. 2 figs 1-6; Rioja y Martín, 1906: 278.

Lytocarpia myriophyllum; Verrill, 1879: 17; Stechow, 1922a: 151; 1923b: 20; 1923d: 246; Picard, 1951f: 261; Pérès & Picard, 1958: 73, 89, 109; Picard, 1958b: 192; 1958c: 2; Rossi, 1958: 4; Tortonese, 1958: 194; Riedl, 1959: 659; Costa, 1960: 47; Fredj, 1964: 49; Pérès & Picard, 1964: 78, 95, 104, 116; De Haro, 1965: 116, photo 3; Gamulin-Brida, 1967: 536; Pérès, 1967: 509; Riedl, 1970: 152, pl. 42; Guille, 1971: 274; Rossi, 1971: 4, fig. 11G-H; Von Salvini-Plawen, 1972: 391; Marinopoulos, 1981: 176; Gili i Sardà, 1982: 152; Gili, Murillo & Ros, 1989: 23; Cornelius & Ryland, 1990: 158, fig. 4.25; Cairns et al., 1991: 29; Marano et al., 1991: 8; Ramil & Vervoort, 1992a: 137, figs 35b-d, 36a-j; Altuna Prados, 1994a: 234; 1995a: 54; Álvarez Claudio, 1995: 15; Álvarez Claudio & Anadón, 1995: 239; Cornelius, 1995: 216, fig. 51A-G; Medel & Vervoort, 1995: 30, fig. 12A-E; Ramil, Vervoort & Ansín, 1998: 19, figs 9-12.

Lytocarpus myriophyllum; Marktanner-Turnertscher, 1890: 277, pl. 7 figs 10-11.

Thecocarpus myriophyllum; Nutting, 1900: 107, pl. 24 figs 12-13; Billard, 1906b: 226; Ritchie, 1911: 225; Broch, 1912a: 37, fig. 11a-c; 1913: 27; 1914a: 8; 1918a: 92; Fraser, 1918b: 362; Stechow, 1919a: 143; Bedot, 1921a: 333; 1921c: 51; Fraser, 1921: 46, fig. 109; Bedot, 1922: 157; Billard, 1922b: 343, fig. 1A; Bedot, 1923: 233; Billard, 1927c: 343; Broch, 1928a: 63, fig. 52B; Billard, 1931b: 247; Leloup, 1933c: 28; 1934: 16; Nobre, 1937: 23; Da Cunha, 1940: 108; Leloup, 1940b: 22; Kramp, 1943b: 44; Da

Cunha, 1944: 41, fig. 19; Fraser, 1944a: 425, pl. 94, fig. 416a-b; Vervoort, 1946b: 187, fig. 79a-b; Kramp, 1947b: 15; Leloup, 1947: 35; Da Cunha, 1950: 124; Rossi, 1950: 215; Buchanan, 1957: 368; Marine Biological Association, 1957: 51; Redier, 1964b: 151; Cabioch, 1965: 55; Rees & Thursfield, 1965: 185; Teissier, 1965: 29; Rees & White, 1966: 281; Cabioch, 1968: 548, 577, 695; Vidal, 1968: 189; Fey, 1969: 405; Robins, 1969: 334; Patriti, 1970: 50, fig. 70A-C; Jägerskiöld, 1971: 64; Christiansen, 1972: 305; Svoboda, 1979: 62, pl. 4 fig. a; Estrada, 1980: 11, fig. 3; García Carrascosa, 1981: 284, pl. 29 figs h-i, pl. 41 figs a-e; Aguirrezabalaga et al., 1986: 139; Boero & Fresi, 1986: 147; Gili, 1986: 151, fig. 4.26A, D; Roca, 1986: 434, fig. 74; García Carrascosa et al., 1987: 373; Gili, Ros & Pagès, 1987: 92; Ramil, 1988: 474; Altuna & García Carrascosa, 1990: 87, fig. 94; Cornelius, 1992b: 84; Álvarez Claudio, 1993: 231, fig. 40A-F, pl. 22, photographs A-K; Boero & Bouillon, 1993: 263.

Thecocarpus myriophyllum var. *bedoti* Billard, 1906b: 227; 1922: 346; Vervoort, 1959: 306, fig. 51b.

Thecocarpus (*Aglaophenia*) *myriophyllum*; Billard, 1906c: 333; Marine Biological Association, 1931: 78; Williams, 1954: 50.

Thecocarpus myriophyllum var. *radicellatus*; Billard, 1906b: 227; 1922b: 346, fig. 1B; Vervoort, 1942: 306, fig. 2c.

Thecocarpus distans; Bedot, 1921c: 52, pl. 6 figs 51-52; Patriti, 1970: 51, fig. 71; Gili, 1986: 151, fig. 4.26C [not *Lytocarpia distans* (Allman, 1877)].

Thecocarpus myriophyllum var. *typica*; Billard, 1922b: 343, fig. 1A; Vervoort, 1959: 305, fig. 51a.

Thecocarpus myriophyllum f. *typica*; Broch, 1933b: 42, fig. 16.

Thecocarpus myriophyllum; ?Leloup, 1937b: 52, fig. 37.

Thecocarpus myriophyllum myriophyllum; Gili, Vervoort & Pagès, 1989: 96, fig. 22A-B.

Material.— **Atlantic coast of Morocco and Mauritania**: Stn 1.121: Unbranched colony without corbulae (RMNH-Coel. 29073 = slide 4550).— Stn 1.138: Unbranched colony without corbulae (RMNH-Coel. 29074 = slide 4551).— Stn 1.154: Unbranched colony without corbulae (RMNH-Coel. 29075 = slide 4552.— Stn 2.039: Unbranched colony with one corbula (RMNH-Coel. 29076 = slide 4553).— Stn 2.058: Three unbranched colonies with corbulae (RMNH-Coel. 28637; DEBA-UV, four slides R. 310).— Stn MAU 038: Four unbranched colonies without corbulae (RMNH-Coel. 28960, three slides 4570).— Stn MAU 039: 13 colonies, of which some branched and a fragment, without corbulae (RMNH-Coel. 28934, five slides 4571).— Stn MAU 041: Five colonies without corbulae (RMNH-Coel. 28782; DEBA-UV, two slides R. 312).— **Madeira area**: Stn 1.029: Unbranched colony without corbulae (RMNH-Coel. 28616, three slides 4543).— Stn 1.094: Nine colonies of which some branched, three with corbulae (RMNH-Coel. 28622, four slides 4544, three slides 4545).— Stn 1.097: Ten unbranched colonies, nine with corbulae (RMNH-Coel. 28620, four slides 4546).— Stn 1.098: 31 colonies, 16 with corbulae (RMNH-Coel. 28615, 28629, four slides 4547).— Stn 1.099: Four colonies, two with corbulae (RMNH-Coel. 28638, three slides 4548).— Stn 1.102: 25 colonies, nine with corbulae (RMNH-Coel. 28621, 28624).— Stn 1.108: Three unbranched colonies, two with corbulae (RMNH-Coel. 28636; DEBA-UV, four slides R. 309).— Stn 1.112: Unbranched colony without corbulae (RMNH-Coel. 28633, two slides 4549).— Stn 1.114: 40 colonies, 19 with corbulae (RMNH-Coel. 28614).— Stn 3.054: Unbranched colony with three corbulae (RMNH-Coel. 28635, two slides 4556).— Stn 3.056: Unbranched colony with two corbulae (RMNH-Coel. 28631, slide 4557).**— Canary Islands and Selvagens Archipelago**: Stn 2.048: 12 unbranched colonies without corbulae (RMNH-Coel. 28610).— Stn 2.130: Unbranched colony with a corbula (RMNH-Coel. 28632, slide 4554).— Stn 2.162: Unbranched colony and a fragment, without corbulae (RMNH-Coel. 29122 = two slides 4555).— Stn 3.085: Branched colony with corbulae (RMNH-Coel. 28619, three slides 4558).— Stn 3.086: Three branched colonies of which two with corbulae (RMNH-Coel. 28613, slide 4559).— Stn 3.090: Branched colony with corbulae (RMNH-Coel. 28618).— Stn 4.040: Two branched colonies and two fragments, with corbulae (RMNH-Coel. 28627, slide 4560).— Stn 4.070: Three branched fragments with corbulae (RMNH-Coel. 28625).— Stn 4.089: Five branched colonies and two fragments of which two with corbulae (RMNH-Coel. 28609).— Stn 4.091: 14 colonies, some branched, of which one with corbulae and six fragments (RMNH-Coel. 28963, two slides 4561).— Stn 4.097: 17 colonies, some branched and nine fragments, of which 11 colonies and six fragments with corbulae (RMNH-Coel. 28611).— Stn 4.098: Two branched colonies

without corbulae (RMNH-Coel. 28626, two slides 4562).— Stn 4.152: Three branched colonies and a branched fragment, one colony and fragment with corbulae (RMNH-Coel. 28628, 28733).— Stn 4.156: Unbranched colony with two corbulae (RMNH-Coel. 28623).— Stn 4.157: Three colonies of which two branched and with corbulae (RMNH-Coel. 28612, four slides 4563, five slides 4564).— Stn 4.158: Unbranched colony without corbulae (RMNH-Coel. 28910).— Stn 4.163: Unbranched colony without corbulae (RMNH-Coel. 28658, two slides 4565).— **Cape Verde Islands**: Stn 6.071: Four branched colonies and two branched fragments, three colonies and a fragment with corbulae (RMNH-Coel. 28617).— Stn 6.072: Four colonies, three with corbulae (RMNH-Coel. 28929).— Stn 6.075: Branched colony without corbulae (RMNH-Coel. 28641, DEBA-UV, two slides R. 311).— Stn 6.076: Five branched colonies and a branched fragment, with corbulae (RMNH-Coel. 28964).— Stn 6.078: Branched colony with corbulae and a colony with two small cormoids without corbulae (RMNH-Coel. 28650).— Stn 6.080: 43 colonies and two fragments, some branched, 14 with corbulae (RMNH-Coel. 28928, five slides 4566, six slides 4567).— Stn 6.106: Nine colonies, some branched, without corbulae (RMNH-Coel. 28941).— Stn 6.137: Fragment in bad condition, without corbulae (RMNH-Coel. 28682, slide 4568).— Stn 6.148: Four colonies of which three branched and a fragment, without corbulae (RMNH-Coel. 28648).— Stn 6.174: Eight branched colonies and four fragments of which five colonies and a fragment with corbulae (RMNH-Coel. 28940).— Stn 7.113: Branched colony without corbulae (RMNH-Coel. 28672, slide 4569).— Stn 7.156: Two branched colonies with corbulae (RMNH-Coel. 28935).

Description (of material from Stn 4.091).— Hydrorhiza composed of bundle of interwoven hydrorhizal tubules adhering to sandy sediment and anchoring one or more polysiphonic, unbranched or irregularly branched hydrocauli. Hydrocaulus divided into several big internodes, separated by strongly oblique nodes, composed of a primary tube with apophyses and a number of secondary tubules bearing cup-shaped nematothecae. Main tube with undivided basal part with row of frontal nematothecae, followed by one to three prosegments, each with one frontal nematotheca. Undivided part and prosegments only visible in young colonies, covered by secondary tubules in older specimens. Remainder of primary axis composed of internodes separated by oblique nodes, each with one apophysis at distal extremity and three or four nematothecae: two in the axil and one or two under apophysis.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of internodes with slightly oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca more or less cup-shaped, quite varied in depth, with adcauline wall fully adnate and abcauline wall straight or slightly convex. Hydrothecal rim dentate, with well developed abcauline cusp and five pairs of lateral cusps, decreasing in size in adcauline direction. Hydrothecal cavity with septum in basal third of adcauline wall; development of septum much varied. Lateral nematothecae slightly surpassing hydrothecal rim; mesial nematotheca covers c. one-third of hydrothecal abcauline wall; apex of nematotheca free. Aperture of all nematothecae gutter-shaped. Internode with four to ten perisarc rings of much varied development.

Corbulae of both sexes fully open, pedicel composed of one to six hydrothecate internodes; rachis of corbula supporting a varied number of costae. Rachis articulated, nodes oblique, each internode with small apophysis and three nematothecae: one in the axil, one on apophysis and one on internode. Costae inserted on apophyses, each composed of one hydrothecate internode and a curved, flattened spur with a series of nematothecae along its superior edge, springing from internode between

Fig. 40. *Lytocarpia myriophyllum* (Linnaeus, 1758). a-b, Stn 4.091, a, branched colony; b, unbranched colony; c-d, Stn 6.080, young colonies. Scales: a-d, 1 cm.

hydrothecal base and inferior nematotheca. Gonothecae ovoid, flattened, springing from base of apophyses.

Variability.— *Lytocarpia myriophyllum* presents great morphological variability as shown by figures and tables of measurements. In our material variability occurs in separation between hydrocladia, size of hydrothecae and development of intrathecal septum, coinciding with variability described previously by Ramil & Vervoort (1992a). In addition, we observed variability in shape of hydrothecal abcauline wall, that may be distinctly convex (Stns 6.071, 6.072, 6.075, 6.076, 6.080 and 7.113; figs 43c-d, 44d-e), in development of lateral cusps that may be much developed (Stns 2.039 and 2.058; fig. 41a-d) or merely indicated (Stn 7.113; fig. 43c-d) and in development of the mesial nematotheca, of which the free part may be almost tubular (Stns 2.039, 2.058, MAU 038; figs 41a-d, 45a-b). Corbulae are occasionally branched (Stns 3.090, 4.157, 6.072), may have costae in which the spur springs from behind hydrotheca or from its interior (Stns 1.094 and 1.114), or a hydrotheca may be found on distal part of

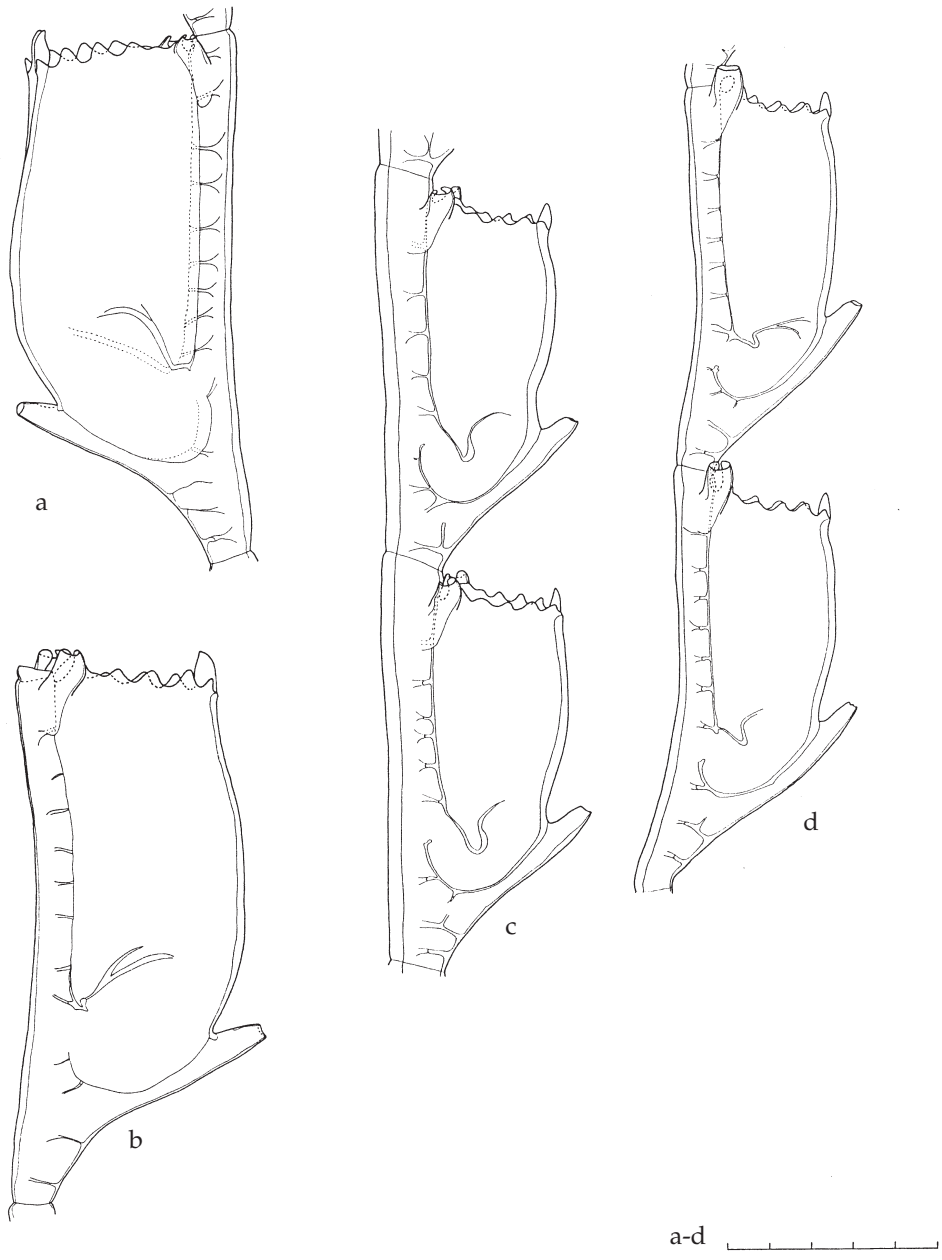


Fig. 41. *Lytocarpia myriophyllum* (Linnaeus, 1758). a-b, Stn 2.039, a, internode from median part of hydrocladium; hydrotheca with well developed intrathecal septum; b, internode from distal part of hydrocladium; hydrotheca with well developed intrathecal septum; c-d, Stn 2.058, c, two internodes from basal part of hydrocladium; d, two internodes from distal part of hydrocladium; all lateral view Scales: a-d, 0.5 mm.

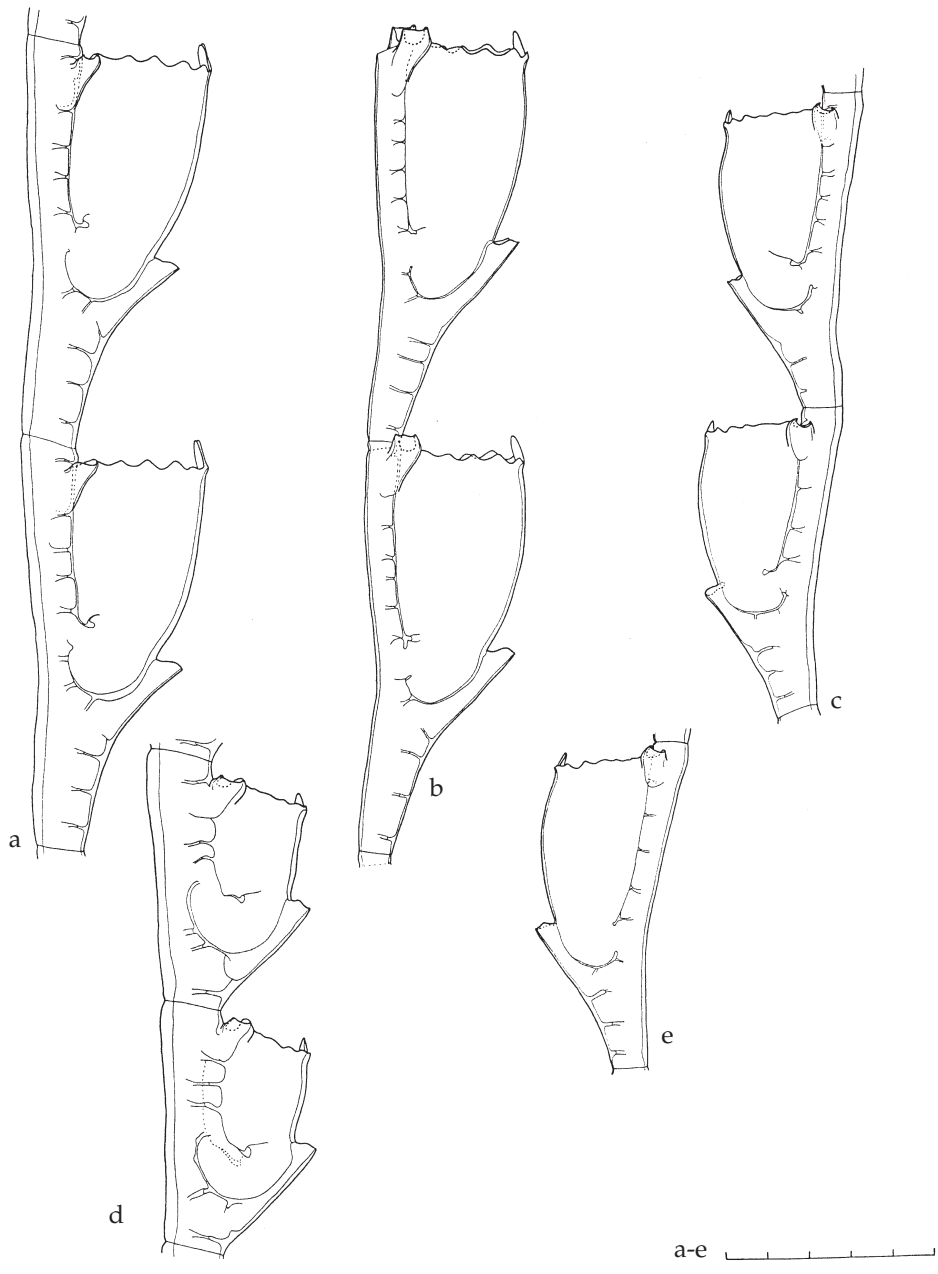


Fig. 42. *Lytocarpia myriophyllum* (Linnaeus, 1758). a-b, Stn 2.162, a, two internodes from basal part of hydrocladium; b, two internodes from distal part of hydrocladium; c-e, Stn 4.091, c, two hydrocladial internodes; d, two internodes; hydrothecae with well developed intrathecal septum; e, hydrocladial internode; all lateral view. Scales: a-e, 0.5 mm.

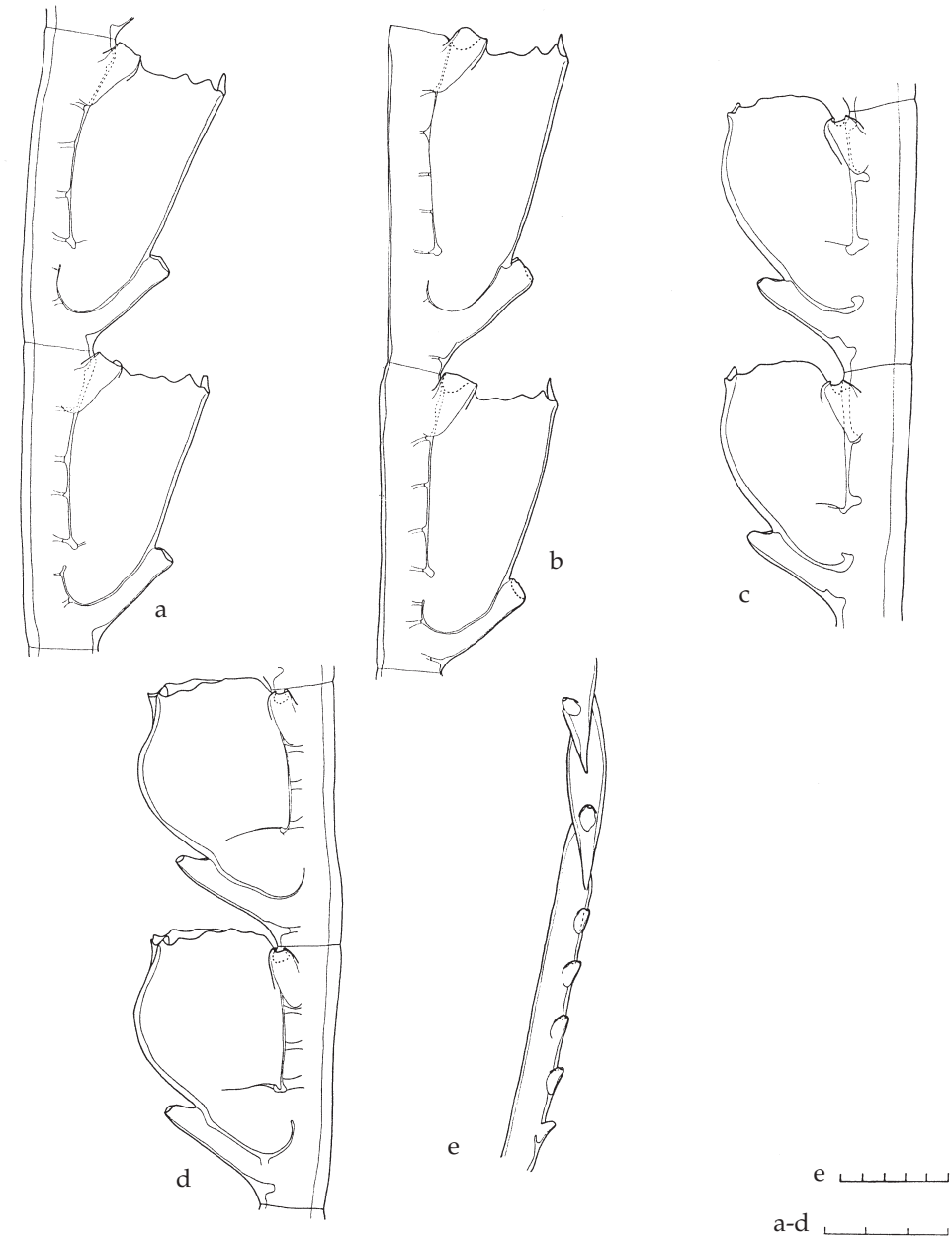


Fig. 43. *Lytocarpia myriophyllum* (Linnaeus, 1758). a-b, Stn 4.157, a, two internodes from basal part hydrocladium; b, two internodes from distal part of hydrocladium; c-d, Stn 7.113, c, two internodes from basal part of hydrocladium; d, two internodes from distal part of hydrocladium; e, Stn MAU 038, prosegment with frontal nematotheca, oblique view; all hydrocladia in lateral view. Scales: a-d, 0.3 mm; e, 0.5 mm.

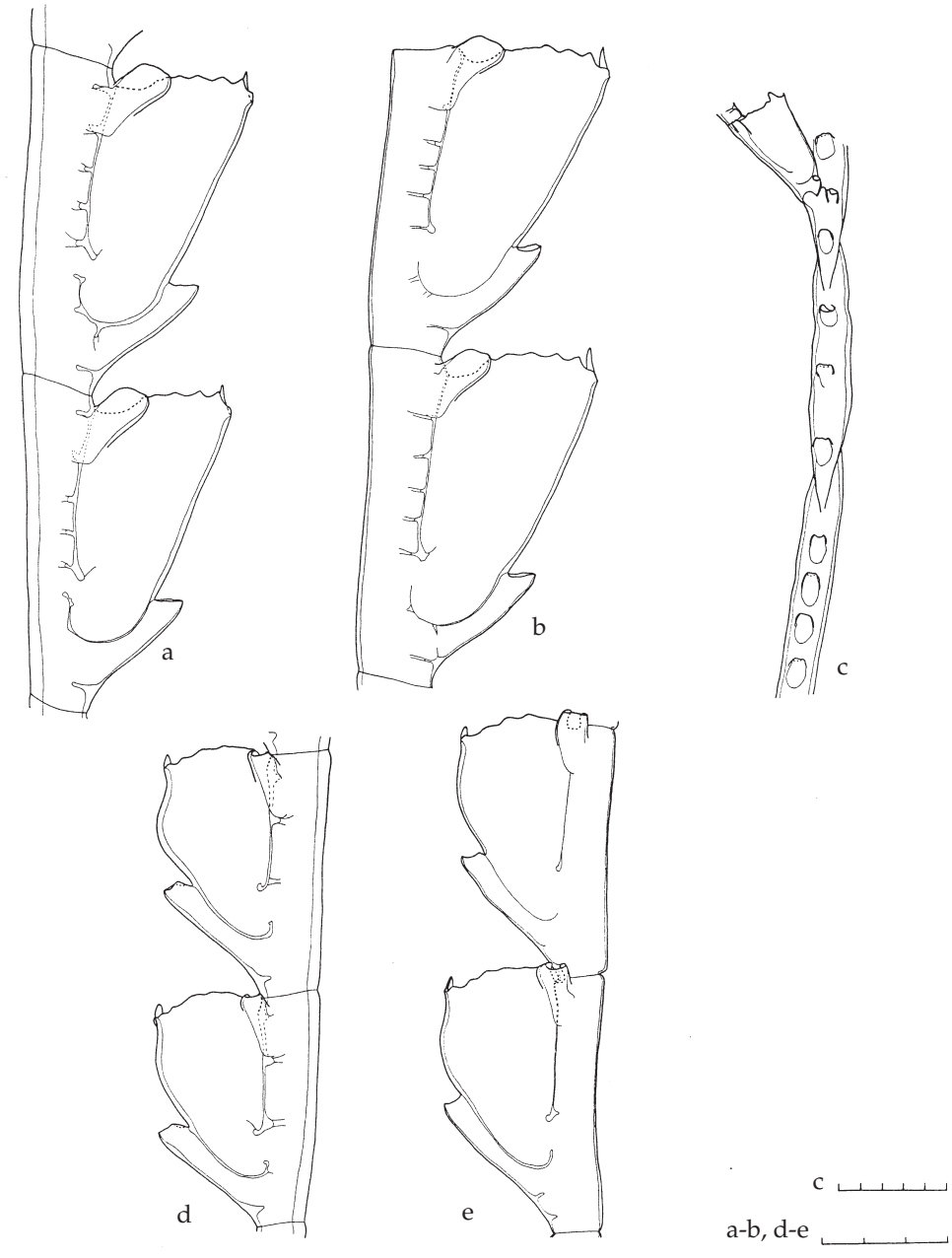


Fig. 44. *Lytocarpia myriophyllum* (Linnaeus, 1758). a-b, Stn 4.163, a, two internodes from basal part of hydrocladium; b, two internodes from distal part of hydrocladium; c-e, Stn 6.080, c, prosegment with three frontal nematothecae, frontal view; d, two internodes from basal part of hydrocladium; e, two internodes from distal part of hydrocladium; all hydrocladia in lateral view. Scales: a-b, d-e, 0.3 mm; c, 0.5 mm.

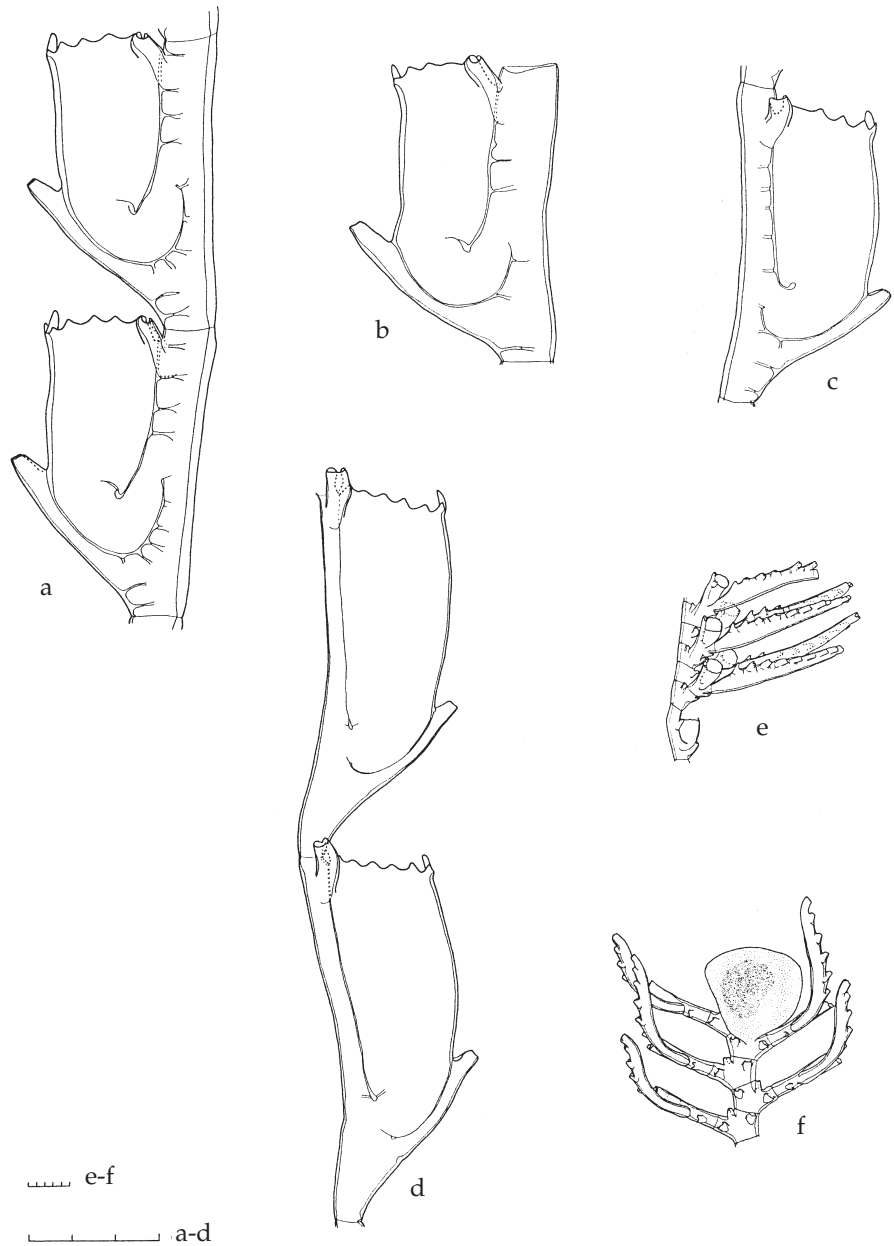


Fig. 45. *Lytocarpia myriophyllum* (Linnaeus, 1758). a-b, Stn MAU 038, a, two internodes from basal part of hydrocladium; b, internode from distal part of hydrocladium; c-d, Stn MAU 041, c, internode from basal part of hydrocladium; d, two internodes from distal part of internode; e, Stn 6.080, fragment of corbula, lateral view; f, Stn 1.108, fragment of corbula, frontal view; all hydrocladia in lateral view. Scales: a-d, 0.3 mm; e-f, 0.5 mm.

some costae (Stns 1.098 and 4.040). Moreover, at Stns 3.090 and 4.070 colonies were observed in which a branch bears gonothecae on its axis, though in these cases some hydrocladia are modified, having a costa springing from the first hydrothecate internode.

Table XVIIIA. Measurements of *Lytocarpia myriophyllum* in µm:

	Stn 4.091	Stn 2.039	Stn 2.058	Stn 2.162	Stn 4.157
Height of colony (in mm)	12-289	46	24-41	41-51	195-432
Hydrocladial internode:					
Length	530-635	900-1270	690-950	710-1020	720-790
Diameter at node	130-160	90-140	85-140	90-155	100-240
Hydrotheca:					
Depth (without abcauline cusp)	350-445	810-1020	625-730	510-630	590-680
Depth (with abcauline cusp)	375-475	850-1050	670-760	535-670	660-720
Length free part abcauline wall*	230-290	750-915	490-560	450-580	470-590
Diameter at rim	210-240	330-380	270-290	250-300	290-320
Mesial nematotheca:					
Length	160-270	360-480	410-460	200-280	190-220
Diameter at rim	25-30	20-30	20-30	55-65	60-70
Lateral nematotheca:					
Length	90-110	160-190	150-180	120-140	150-200
Diameter at rim	45-50	25-45	40-60	35-50	70-90

* Measured with abcauline cusp.

Table XVIIIB. Measurements of *Lytocarpia myriophyllum* in µm:

	Stn 4.163	Stn 6.080	Stn 7.113	Stn MAU 038	Stn MAU 041
Height of colony (in mm)	71	11-575	119	18-80	20-50
Hydrocladial internode:					
Length	610-850	450-610	490-640	640-720	640-735
Diameter at node	80-190	115-150	140-160	105-120	100-110
Hydrotheca:					
Depth (without abcauline cusp)	550-700	430-500	510-560	540-560	455-580
Depth (with abcauline cusp)	590-730	450-490	530-570	545-570	485-590
Length free part abcauline wall*	450-580	290-330	390-440	320-400	320-380
Diameter at rim	240-260	240-260	270-290	240-260	240-250
Mesial nematotheca:					
Length	240-300	250-310	220-270	340-440	280-350
Diameter at rim	50-60	30-35	20-25	25-30	20-25
Lateral nematotheca:					
Length	170-200	140-160	140-150	140-150	120-150
Diameter at rim	50-70	35-45	25-30	25-30	20-40

* Measured with abcauline cusp.

Discussion.— The considerable variability of *Lytocarpia myriophyllum* induced Billard to consider the existence of several varieties or subspecies, formalised in a later

paper (Billard, 1922b). Ramil & Vervoort (1992a) distinguished two groups of varieties (subspecies): *typica*, *radicellatus* and *bedoti*, with open corbulae and mainly Atlantic distribution, and *orientalis*, *elongatus* and *angulatus*, with closed corbulae and mainly Indo-Pacific distribution. In that group should also be included subspecies *vervoorti* Stepan'yants, 1979, (= *Thecocarpus myriophyllum* var. *I* and var. *II*, described by Vervoort, 1972a) and probably also *Thecocarpus myriophyllum* described by Leloup (1937b) from the China Sea. Ramil & Vervoort (1992a) also expressed doubts whether or not this second group belongs in *L. myriophyllum* but they refrained from a definite answer without proper study of the material. Varieties *typica* and *radicellatus* were abolished while var. *bedoti*, characterized by branched colonies, was provisionally maintained.

We studied both branched and unbranched colonies that are identical with the description of var. *bedoti*, but, with exception of the ramification there are no other characters differentiating this variety so we have included it in the synonymy of *Lytocarpus myriophyllum*.

Reproduction.— The presence of corbulae was mentioned by Stechow (1923d), Broch (1933), Vervoort (1942), Redier (1965), Teissier (1965), Robins (1969), Gili, Vervoort & Pagès (1989), Ramil & Vervoort (1992a) and Ramil, Vervooort & Ansín (1998); they occurred in all months except January, February, April and December. The CANCAP material was fertile in March, May, June and August-October.

Distribution.— Picard (1958b), Rees & Thursfield (1965) and Boero & Bouillon (1993a) consider *Lytocarpia myriophyllum* a cosmopolitan species. However, the records from Indian and Pacific Oceans referring to var. *orientalis*, *angulatus*, *elongatus* and the subspecies *vervoorti* are considered doubtful by Ramil & Vervoort (1992a) and have not been considered here.

In the Atlantic it has been found in the Arctic (Broch, 1918a, as *Thecocarpus myriophyllum*), Oslo Fjord, Norway (Christiansen, 1972, as *T. myriophyllum*), west coast of Sweden (Jägerskiöld, 1971, as *T. myriophyllum*), Shetland Islands (Hincks, 1868, as *Aglaophenia myriophyllum*), North Sea (Bedot, 1921c; Broch, 1928a; Leloup, 1933c; Vervoort, 1946b, Rees & Thursfield, 1965, all as *T. myriophyllum*; Vervoort, 1942, as *T. myriophyllum* var. *radicellatus*), coasts of Ireland [Hincks, 1868; Massy, 1912, both as *A. myriophyllum*; Williams, 1954, as *T. (Aglaophenia) myriophyllum*], various localities along the British coasts [Hincks, 1868; Thornely, 1894; Marine Biological Association, 1904, all as *A. myriophyllum*; Ritchie, 1911, as *T. myriophyllum*; Crawshay, 1912, as *A. myriophyllum*; Marine Biological Association, 1931, as *T. (Aglaophenia) myriophyllum*; Marine Biological Association, 1957; Robins, 1969, both as *T. myriophyllum*; Cornelius & Ryland, 1990; Cornelius, 1995], English Channel (Billard, 1931b; Cabioch, 1965, 1968, all as *T. myriophyllum*), Channel Islands (Hincks, 1868, as *A. myriophyllum*), numerous localities along the French Channel coast between Roscoff and Belle-Île (Bedot, 1921c; Billard, 1927c; Leloup, 1940b; Teissier, 1965; Vidal, 1968; Fey, 1969, all as *T. myriophyllum*), Bay of Biscay (Browne, 1907; Pictet & Bedot, 1900, both as *A. myriophyllum*), Basque coast (Bedot, 1921c; Aguirrezabalaga et al., 1986; Altuna & García Carrascosa, 1990, all as *T. myriophyllum*; Altuna Prados, 1994a, 1995a), Cantabrian coast (Rioja y Martín, 1906; Rodríguez Rosillo, 1914, both as *A. myriophyllum*), Asturian coast (Álvarez Claudio, 1993, 1995; Álvarez Claudio & Anadón, 1995, as *T. myriophyllum*), coast of Galicia (Billard, 1906; Bedot, 1921c; Estrada, 1980; Ramil, 1988, all as

T. myriophyllum), Portuguese coast (Bedot, 1921c, as *T. myriophyllum*; Nobre, 1931, as *A. myriophyllum*; 1937; Da Cunha, 1940, 1944, as *T. myriophyllum*), Strait of Gibraltar (Broch, 1933b, as *T. myriophyllum* f. *typica*; Ramil & Vervoort 1992a; Medel & Vervoort, 1995), Gorringe and Ampère Banks (Ramil, Vervoort & Ansín, 1998), Azores (Pictet & Bedot, 1900, as *A. myriophyllum*; Billard, 1906b; Bedot, 1921c; Rees & White, 1966; Cornelius, 1992b, all as *T. myriophyllum*), Atlantic coast of Morocco (Billard, 1906b; Broch, 1913, both as *T. myriophyllum*; Bedot, 1921c, as *T. distans*; Kramp, 1947b; Patriti, 1970, both as *T. myriophyllum*), Madeira (Billard, 1906b, as *T. myriophyllum*; Bedot, 1921c, as *T. distans*), Canary Islands (Bedot, 1921c, as *T. myriophyllum*), Cape Verde Islands (Billard, 1906b, as *T. myriophyllum*), coasts of Senegal (Vervoort, 1959, as *T. myriophyllum*), Guinea Bissau (Gili, Vervoort & Pagès, 1989, as *T. myriophyllum myriophyllum*), Sierra Leone (Vervoort, 1959, as *T. myriophyllum* var. *typica*), Liberia (Broch, 1914a, as *T. myriophyllum*), Ghana (Buchanan, 1957, as *T. myriophyllum*) and the Gulf of Guinea (Redier, 1965, as *A. myriophyllum*). Also recorded from the Atlantic coast of Canada (Fraser, 1918b, 1921, as *T. myriophyllum*) and the U.S.A. (A. Agassiz, 1865, as *Sertularia myriophyllum*).

In the Mediterranean cited from the Levantine coast (Rioja y Martín, 1906; Rodríguez Rosillo, 1914, both as *A. myriophyllum*; García Carrascosa, 1981, as *T. myriophyllum*), Columbretes Islands (García Carrascosa et al., 1987, as *T. myriophyllum*), Catalonia (De Haro, 1965; Gili, 1986; Gili, Ros & Pagès, 1987, all as *T. myriophyllum*), Balearic Islands (Roca, 1986, as *T. myriophyllum*), French Mediterranean coast (Stechow, 1919a; Leloup, 1934c; Picard, 1951f; Costa, 1960; Guille, 1971, all as *T. myriophyllum*), numerous localities along the Italian coasts (Carus, 1884, as *A. myriophyllum*; Stechow, 1919a; 1923d; Rossi, 1950; 1958; Tortonese, 1958; Riedl, 1959; Rees & Thursfield, 1965; Rossi, 1971; Boero & Fresi, 1986, all as *T. myriophyllum*), Adriatic (Carus, 1884, as *A. myriophyllum*; Marktanner-Turneretscher, 1890, as *Lytocarpus myriophyllum*; Broch, 1912a, as *T. myriophyllum*; 1933, as *T. myriophyllum* f. *typica*; Rossi, 1950; Gamulin-Brida, 1967; Riedl, 1970; Marano et al., 1991, all as *T. myriophyllum*) and Israeli coast (Picard, 1958c).

Depths range between 8 (Marine Biological Association, 1931) and 1592 m (Ramil & Vervoort, 1992a).

The CANCAP material originates from 48 localities, of which five from the coast of Morocco, three from the coast of Mauritania, 11 from Madeira, three from the Selvagens, 14 from the Canary Islands and 12 from the Cape Verde Archipelago, taken between 5 and 1800 m.

Epibionts.— Stn 1.098: unidentifiable athecate leptolid, *Zygophylax* cf. *biarmata* Billard, 1906, *Antennella secundaria* (Gmelin, 1791).— Stn 1.102: *Hebella* spec., *Antennella secundaria* (Gmelin, 1791), *Plumularia setacea*. (L., 1758).— Stn 2.048: bivalve mollusc.— Stn 2.162: Bryozoa.— Stn 3.056: *Antennella secundaria* (Gmelin, 1791).— Stn 3.086: *Antennella secundaria* (Gmelin, 1791).— Stn 3.090: *Plumularia setacea* (L., 1758).— Stn 4.091: gastropod eggs.— Stn 6.075: *Plumularia setacea* (L., 1758).— Stn 6.076: *Plumularia setacea* (L., 1758), *Campanularia* spec., *Obelia* spec.— Stn 6.078: Foraminifera, *Scalpellum scalpellum* (L., 1761), *Obelia/Laomedea* spec.— Stn 6.080: *Filellum serratum* (Clarke, 1879), *Plumularia setacea* (L., 1758), *Scalpellum scalpellum* (L., 1767), Bryozoa.— Stn 6.148: *Obelia bidentata* (Clarke, 1875).— Stn 6.174: *Clytia gracilis* (M. Sars, 1850).— Stn 7.113: *Filellum serratum* (Clarke, 1879).— Stn MAU 039: Amphipoda (Caprellidae).

Genus *Macrorhynchia* Kirchenpauer, 1872
Macrorhynchia philippina (Kirchenpauer, 1872)
(fig. 46)

Aglaophenia (*Macrorhynchia*) *Philippina* Kirchenpauer, 1872: 45, pls 1, 2, 7 fig. 26.
Aglaophenia (*Macrorhynchia*) *urens* Kirchenpauer, 1872: 46, pls 1, 2, 7 fig. 27.
Aglaophenia urens; Bale, 1884: 155, pl. 14 fig. 6, pl. 17 fig. 9.
Lytocarpus philippinus; Bale, 1888: 786, pl. 21 figs 5-7; Kirkpatrick, 1890: 604; Marktanner-Turneretscher, 1890: 274, pl. 6 figs 15-16; Pictet, 1893: 60, pl. 3 fig. 53; Nutting, 1900: 122, pl. 31 figs 4-7; Jäderholm, 1903: 298; Billard, 1907: 377, fig. 18; Congdon, 1907: 484; Ritchie, 1910a: 20; Fraser, 1912: 379, fig. 45A-D; Billard, 1913: 78, fig. 63; Jäderholm, 1916b: 7; Bale, 1919: 351; Jäderholm, 1920: 9; Bedot, 1921a: 320; 1922: 150; Bennitt, 1922: 254; Jarvis, 1922: 354; Jäderholm, 1923: 5; Hargitt, 1924: 503; Billlard, 1926: 99; Gravely, 1927: 18, pl. 3 fig. 18; Nutting, 1927: 235; Billard, 1931c: 249; Briggs & Gardner, 1931: 193, fig. 4; Billard, 1933: 25; Leloup, 1937b: 5, 48; Fraser, 1938b: 10, 61; 1938d: 135; 1939c: 161; Leloup, 1939b: 13, fig. 9; Vervoort, 1941: 225; Fraser, 1944a: 419, pl. 93 fig. 410a-e; 1944b: 46; De Oreo, 1946: 646; Vervoort, 1946a: 329; Fraser, 1948: 273; Deevey, 1954: 271; Millard, 1958: 220; Pennycuik, 1959: 186; Rees & Thursfield, 1965: 176; Van Gemerden-Hoogeveen, 1965: 74, fig. 42; Von Schenk, 1965: 942, 952, fig. 34a; Redier, 1966b: 93; 1967a: 405; Millard, 1968: 284; Vervoort, 1968: 88, 115, fig. 41a-c; Gravier, 1970: 116; Schmidt, 1972b: 41, 43, 45; Millard & Bouillon, 1973: 93; Morris & Mogelberg, 1973: 25; Schmidt, 1973a: 284; Millard & Bouillon, 1974: 10; Rho & Chang, 1974: 147; Millard, 1975: 449, fig. 138A-C; Wedler, 1975: 333; Calder, 1976: 169; Mergner & Wedler, 1977: 24, pl. 6 fig. 43, pl. 12 figs 80-81; Calder & Hester, 1978: 91; Millard, 1978: 195; Ljubenkov, 1980: 50; Boero, 1984: 99; Bouillon, 1984b: 106; Bandel & Wedler, 1987: 38; Mergner, 1987: 187.
Lytocarpus crosslandi Ritchie, 1907: 511, pl. 24 fig. 11, pl. 26 figs 2-4.
Lytocarpia philippina; Stechow, 1919c: 132, fig. Z^1.
Macrorhynchia philippina; Stechow, 1923d: 241; Stechow & Müller, 1923: 475; Stechow, 1925a: 258; Vannucci-Mendes, 1946: 587, pl. 6 fig. 71, pl. 7 fig. 65; 1949: 256; Vannucci, 1951b: 107, 108, 110, 112, 115, 117; 1954: 118; Mammen, 1965: 314, figs 110-111; Gravier, 1970: 153, fig. 1a-c; Calder, 1983: 23, fig. 13; Hirohito, 1983: 78, fig. 41a-c; Calder, 1986b: 139, fig. 39; Rees & Vervoort, 1987: 177, fig. 43; Vervoort, 1987: 86; Cairns et al., 1991: 29; Ryland & Gibbons, 1991: 553, fig. 22A-D; Calder, 1993b: 68; Vervoort, 1993: 550; Migotto, 1996: 40, fig. 8e-f: Calder, 1997: 66, fig. 21a-b.
Macrorhynchia urens; Stechow, 1923d: 241.
Not *Lytocarpus philippinus*; Rho, 1969: 165, figs 5-6, pl. 1 fig. 6, pl. 2 fig. 8. [= *Gymnangium gracilicaule* (Jäderholm, 1903)].
Lytocarpus (*Macrorhynchia*) *philippinus*; Boero & Bouillon, 1987: 242, fig. 21.7A.

Material.— **Madeira area**: Stn 3.K04: One colony without gonosome (RMNH-Coel. 28640, two slides 4572).— **Cape Verde Islands**: Stn 6.D07: One colony with two cormoids and a fragment, no gonosome (RMNH-Coel. 28948, slide 4573).— Stn 6.D12: One colony with four cormoids, without gonosome (RMNH-Coel. 28685, two slides 4574).

Description (of colony from Stn 3.K04).— Hydrorhiza tubular, irregularly branched and attached to substrate, from which rise ramified hydrocauli; branches polysiphonic with exception of apical parts of colony. Basal part of primary tube with a row of frontal nematothecae with two apertures, separated from rest of tube by well marked, oblique node. In monosiphonic parts of tube division into internodes separated by oblique nodes visible, each with one hydrocladial apophysis bearing one mamelon on superior surface and two nematothecae: one in the axil and one under apophysis. Nematothecae cone-shaped, with circular apical aperture and one lateral

on adcauline wall. Ramification pinnate or irregular, originating from secondary tubules. Each branch with basal zone composed of series of internodes separated by oblique nodes, each with frontal nematotheca with two apical apertures and one lateral on adcauline wall, except for that on first internode, having only one apical and one lateral aperture. This zone separated from rest of branch by well marked oblique node. From that node onward structure of branch identical with that of hydrocaulus.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of internodes separated by oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrothecae kidney-shaped, two-thirds of adcauline wall adnate, distal third of abcauline wall free; hydrothecal aperture almost parallel to axis of internode, rim with one acute median cusp and one pair of low, rounded lateral cusps. Intrathecal cavity with rounded septum springing from abcauline wall. Lateral nematothecae tubular, adnate to hydrothecal wall for their full length, slightly surpassing hydrothecal rim, each with two apertures: one circular at apex, one basally opening into hydrothecal cavity. Mesial nematotheca tubular, adnate to abcauline wall of hydrotheca up to level of intrathecal septum, with two apertures: one circular at apex, one near abcauline wall just under median marginal cusp. Internode with three perisarc rings: one proximal close to proximal node, one at basal third of adcauline hydrothecal wall, third at level of base of lateral nematothecae. Development of septa much varied, being much less developed and scarcely visible in apical zone of hydrocladia.

Gonosome not present.

Table XIX. Measurements of *Macrorhynchia philippina* in µm:

	Stn 3.K04
Height of colony (in mm)	21-123
Internode of hydrocaulus, length	280-370
Diameter at node	180-220
Hydrocladial internode, length	240-310
Diameter at node	80-110
Hydrotheca, depth	230-270
Diameter at rim	150-180
Mesial nematotheca, length of free part	80-130
Diameter at rim	15-20
Lateral nematotheca, length	150-160
Diameter at rim	20

Discussion.— Described as a subgenus of *Aglaophenia* Lamouroux, 1812, by Kirchenpauer (1872), *Macrorhynchia* was raised to generic level by Stechow (1920) who indicated its identity with *Lytocarpus* Allman, 1883, Kirchenpauer's name having priority. Bedot (1921a) considered *Macrorhynchia* a nomen nudum and used *Lytocarpus* Allman, 1883, but was corrected by Stechow (1923d), who moreover re-instituted the generic name *Nematophorus* Clarke, 1879, for such species of *Macrorhynchia* that have a pseudocorbula, in contradistinction to species with simple gonocladia forming the genus *Macrorhynchia* Kirchenpauer, 1872. *Lytocarpus* was again considered valid

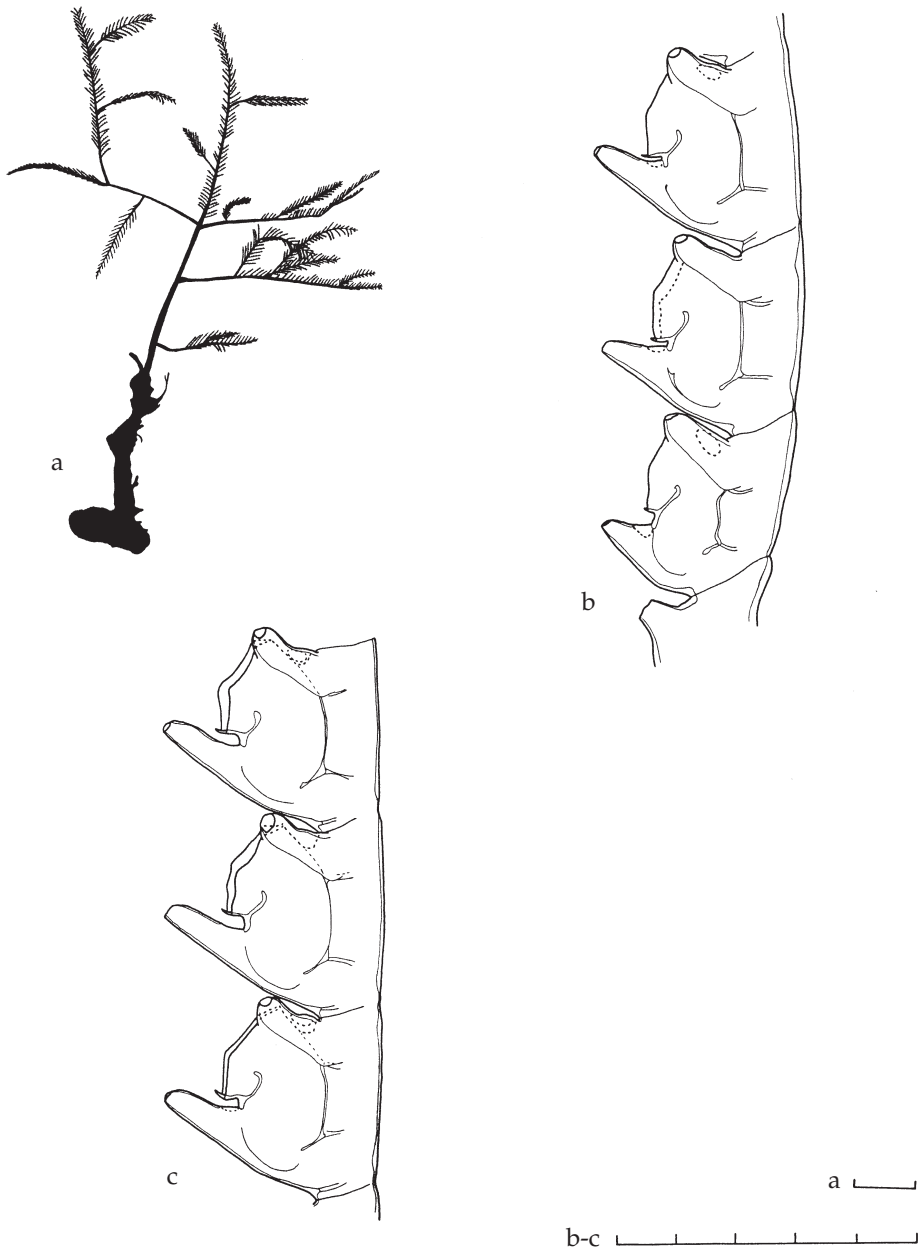


Fig. 46. *Macrorhynchia philippina* (Kirchenpauer, 1872). a, Stn 6.D12, colony; b-c, Stn 3.K04, b, three internodes from basal part of hydrocladium, lateral view; c, three internodes from distal part of hydrocladium, lateral view. Scales: a, 1 cm, b-c, 0.5 mm.

by Bouillon (1985a), but Rees & Vervoort (1987) after examining Stechow's arguments, opted in favour of *Macrorhynchia*, an opinion followed here.

An intrathecal septum in Atlantic material of *M. philippina* was described by Nutting (1900); this induced Billard (1913) to consider an Atlantic and a Pacific subspecies: the first with adcauline septum and without narrowing of the hydrothecal base, the second without adcauline septum and with basally narrowed hydrotheca. However, the Pacific morphotype was recorded from the Atlantic by Van Gemerden-Hoogeveen (1965) and the characters used by Billard to distinguish both subspecies were rejected by Vannucci-Mendes (1946) as being too variable.

Lytocarpus crosslandi Ritchie, 1907, considered a local variety of *Macrorhynchia philippina* by Billard (1913) and by Rees & Thursfield (1965) as a possible subspecies, was put in *M. philippina* by Van Gemerden-Hoogeveen (1965) and Calder (1997) and we concur.

Reproduction.— CANCAP material originates from the months June and October and has no gonosome. Fertile specimens have been described from July (Millard, 1958; Vervoort, 1993) and August (Vervoort, 1993).

Distribution.— *Macrorhynchia philippina* is considered by Millard (1975) and Rees & Vervoort (1987) a circumglobal species in tropical and subtropical seas. In the eastern Atlantic it has been recorded from the Bermudas (Congdon, 1907; Bennitt, 1922; Morris & Mogelberg, 1973, all as *Lytocarpus philippinus*; Calder, 1986b, 1993b, 1997), the coast of North Carolina (Fraser, 1912, as *L. philippinus*) and South Carolina (Nutting, 1900; Calder & Hester, 1978, both as *L. philippinus*; Calder, 1983), the Florida Keys and Tortuga Island (Deevey, 1954, as *L. philippinus*), Jamaica (Nutting, 1900, as *L. philippinus*), Santa Marta, Colombia (Wedler, 1975; Bandel & Wedler, 1987, both as *L. philippinus*) and various localities along the Brazilian coast (Vannucci-Mendes, 1946; 1949; Vannucci, 1951b; 1954; Van Gemerden-Hoogeveen, 1965, all as *L. philippinus*; Migotto, 1996). In the eastern Atlantic it was found at the Cape Verde Islands (Ritchie, 1907, as *Lytocarpus crosslandi*) and the coasts of Guinea Bissau (Billard, 1931c, as *L. philippinus*).

Also recorded from the Suez Canal (Billard, 1926, 1933; Schmidt, 1972b, all as *L. philippinus*), Gulf of Suez (Billard, 1926; Schmidt, 1972b, both as *L. philippinus*) and several localities in the Red Sea (Marktanner-Turneretscher, 1890; Schmidt, 1972b; Bandel & Wedler, 1977, all as *L. philippinus*; Vervoort, 1993)

In the Indian Ocean recorded from the east coast of South Africa (Millard, 1975; 1978, as *L. philippinus*), from Mozambique (Millard, 1958; 1968, as *L. philippinus*), from Zanzibar, Tanzania (Jarvis, 1922, as *L. philippinus*), from the coast of Somalia in the Gulf of Aden (Rees & Vervoort, 1987), from Providence Island (Jarvis, 1922, as *L. philippinus*), the Seychelles (Millard & Bouillon, 1973, as *L. philippinus*), from Cargados Island (Jarvis, 1922, as *L. philippinus*), from the coast of Pakistan (Ritchie, 1910a, as *L. philippinus*), from the south and east coasts of India (Mammen, 1965; Gravely, 1927, as *L. philippinus*) and from Cape Jaubert and Shark's Bay on the coast of western Australia (Jäderholm, 1916b, as *L. philippinus*; Stechow, 1925a).

In the Pacific recorded from the China Sea (Leloup, 1937b, as *L. philippinus*), Malaya (Jäderholm, 1920, as *L. philippinus*), Borneo, the Moluccas and other Indonesian Islands (Pictet, 1893; Billard, 1913, both as *L. philippinus*; Stechow & Müller, 1923; Vervoort, 1941, as *L. philippinus*), the Philippines [Kirchenpauer, 1872, as *Aglaophenia*

(*Macrorhynchia) Philippina*; Hargitt, 1924; Nutting, 1927, both as *L. philippinus*], Korea (Rho & Chang, 1974, as *L. philippinus*), Japan (Hirohito, 1983), Murray Islands (Kirkpatrick, 1890, as *L. philippinus*), east coast of Australia (Bale, 1884, as *Aglaophenia urens*, 1888; Briggs & Gardner, 1931; Pennycuik, 1959, all as *L. philippinus*), New Caledonia (Redier, 1966b, as *L. philippinus*), Santa Cruz Island (Fraser, 1948, as *L. philippinus*), Gilbert Islands (Jäderholm, 1923, as *L. philippinus*), Fiji Islands (Ryland & Gibbons, 1991), Christmas Island (Fraser, 1938b, as *L. philippinus*), Tahiti (Jäderholm, 1903, as *L. philippinus*), Galápagos Islands (Fraser, 1938c; 1948, as *L. philippinus*), Clarion Islands (Fraser, 1938a, as *L. philippinus*), Pacific coast of U.S.A. (Fraser, 1938b; Ljubenkov, 1980, both as *L. philippinus*), Mexico (Fraser, 1948, as *L. philippinus*), El Salvador and coast of Colombia (Fraser, 1938b, as *L. philippinus*), coast of Ecuador (Leloup, 1939b; Fraser, 1948, both as *L. philippinus*) and James Island on the west coast of Chile (Fraser, 1938c, as *L. philippinus*).

Once recorded from the Mediterranean by Marktanner-Turneretscher (1890, as *L. philippinus*), not re-confirmed and considered doubtful by Picard (1958a) and not included by Boero & Bouillon (1993a) in Mediterranean species list.

Bathymetrical distribution oscillating between 1 (Calder, 1997) and 411 m (Billard, 1913).

CANCAP material comes from three localities of which two in the Cape Verde region and one from Madeira, depth 0 and 15 m.

Epibionts.— Stn 3.K04: Algae, Sertulariidae indet.— Stn 6.D07: Tubes of Amphipoda.— Stn 6.D12: Algae, tubes of Amphipoda.

Genus *Nematophorus* Clarke, 1879
Nematophorus clarkei (Nutting, 1900)
(fig. 47)

Lytocarpus clarkei Nutting, 1900: 124, pl. 32 figs 5-7; Bedot, 1921a: 320; 1922: 151; Fraser, 1944a: 416, pl. 92 fig. 406a-e; 1944b: 46; Deevey, 1954: 271; Vervoort, 1959: 302, fig. 50a-c; 1968: 80, fig. 37a-b.
Nematophorus clarkei; Stechow, 1921f: 234; 1923d: 242.
Not *Lytocarpus clarkei*; Bennitt, 1922: 254 [= *Macrorhynchia allmani* (Nutting, 1900)].
Pleurocarpa (*Lytocarpus*) *clarkei*; Von Schenck, 1965: 942.
Not *Macrorhynchia clarkei*; Calder, 1986b: 139, pl. 39 [= *Macrorhynchia allmani* (Nutting, 1900)].

Material.— **Cape Verde Islands**: Stn 6.137: 23 colonies without gonosome (RMNH-Coel. 28912).— Stn 6.146: One colony with three cormoids and a fragment, without gonosome (RMNH-Coel. 28652, two slides 4575).— Stn 6.176: Five colonies without gonosome (RMNH-Coel. 28644, three slides 4576).— Stn 6.D01: One colony without gonosome (RMNH-Coel. 28953, slide 4577).— Stn 6.D02: 18 colonies of which five with gonosome (RMNH-Coel. 28710, four slides 4578, three slides 4579; DEBA-UV, three slides R. 313).— Stn 6.D10: One colony without gonosome (RMNH-Coel. 28649, three slides 4580).— Stn 6.D11: One damaged colony without gonosome (RMNH-Coel. 28646, two slides 4581).— Stn 6.D12: two colonies without gonosome (RMNH-Coel. 28645, slide 4582).— Stn 7.078: One colony with gonosome and a fragment (RMNH-Coel. 28647; DEBA-UV, four slides R. 314).— Stn 7.113: One fragment with gonosome (RMNH-Coel. 28955, four slides 4583).— Stn 7.155: Four colonies with gonosome and two fragments (RMNH-Coel. 28667).

Description (of material from Stn 6.D02).— Hydrorhiza tubular, ramified, adhering to substrate; hydrocauli polysiphonic and branched, in big specimens basal part

covered by hydrorhizal tubes. Stem and branches largely polysiphonic, with exception of apical parts of colony. Monosiphonic parts divided into internodes by oblique nodes, each internode with short hydrocladial apophysis with mamelon on superior surface and two nematothecae: one large axillary nematothecae and a smaller one under apophysis. Nematothecae triangular, cup-shaped, aperture terminal, big, of varied shape. In frontal view nematotheca seems to have two apertures, which at close inspection appear to be connected adcaudally. Ramification of colony alternate or irregular; third order ramification occasionally present. Branches originating from secondary tubules, with basal zone having two to eleven internodes with one frontal nematotheca each. Remainder of branch of same structure as hydrocaulus.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of hydrothecate internodes bearing one hydrotheca and three nematothecae: two lateral and one mesial inferior. Hydrotheca with completely adnate adcauline wall; plane of aperture tilted downwards, rim with four pairs of lateral cusps (of which adcauline pair may be hidden by lateral nematothecae) and one median abcauline cusp, inclined towards hydrothecal cavity. Hydrothecal cavity with adcauline septum. Lateral nematothecae reaching hydrothecal rim and with single apical aperture in basal part of hydrocladium; in distal zone surpassing hydrotheca and with two apertures, one apical, one connecting with hydrothecal cavity. Mesial nematotheca adnate to abcauline wall of hydrotheca; as in lateral nematotheca shorter in basal part of hydrocladium and with one terminal aperture, longer in distal part, and there reaching hydrothecal margin and provided with two apertures: one apical, one near abcauline wall of hydrotheca. Internode with well developed perisarc ring at level of intrathecal septum.

Gonosome found at basal part of a branch, forming a pseudocorbula, composed of basal part of one to five internodes with single nematotheca, a rachis supporting costae alternately curved over gonothecae, forming an open structure, and a continuation of the branch with normally developed hydrocladia. Rachis formed by succession of internodes with oblique nodes, each internode with small apophysis and two nematothecae: one axillar, one under apophysis. Costae inserted on apophyses, composed of several internodes of which first hydrothecate, following two to five with three nematothecae: two lateral and one mesial inferior. Remaining internodes of costa with one or two nematothecae, one being most common number; all nematothecae large and tubular, with circular apical aperture and basal aperture directed towards rachis. Number of costae varies between seven and 16 pairs. Gonothecae globular, inserted on costal internodes that have three nematothecae just above inferior nematotheca.

Variability.— Ramification typically alternate or irregular; one colony from Stn 6.D10 with dichotomous ramification. Pseudocorbula normally developing in basal part of branches, but in Stns 6.D02 and 7.113 also in median and distal zones. Tissue cells with dark pigment as cited by Nutting (1900) are abundant in some and absent in other colonies; they probably relate to the presence of zooxanthellae. However, staining with Lugol's solution unsuccessful because of dark colour of perisarc.

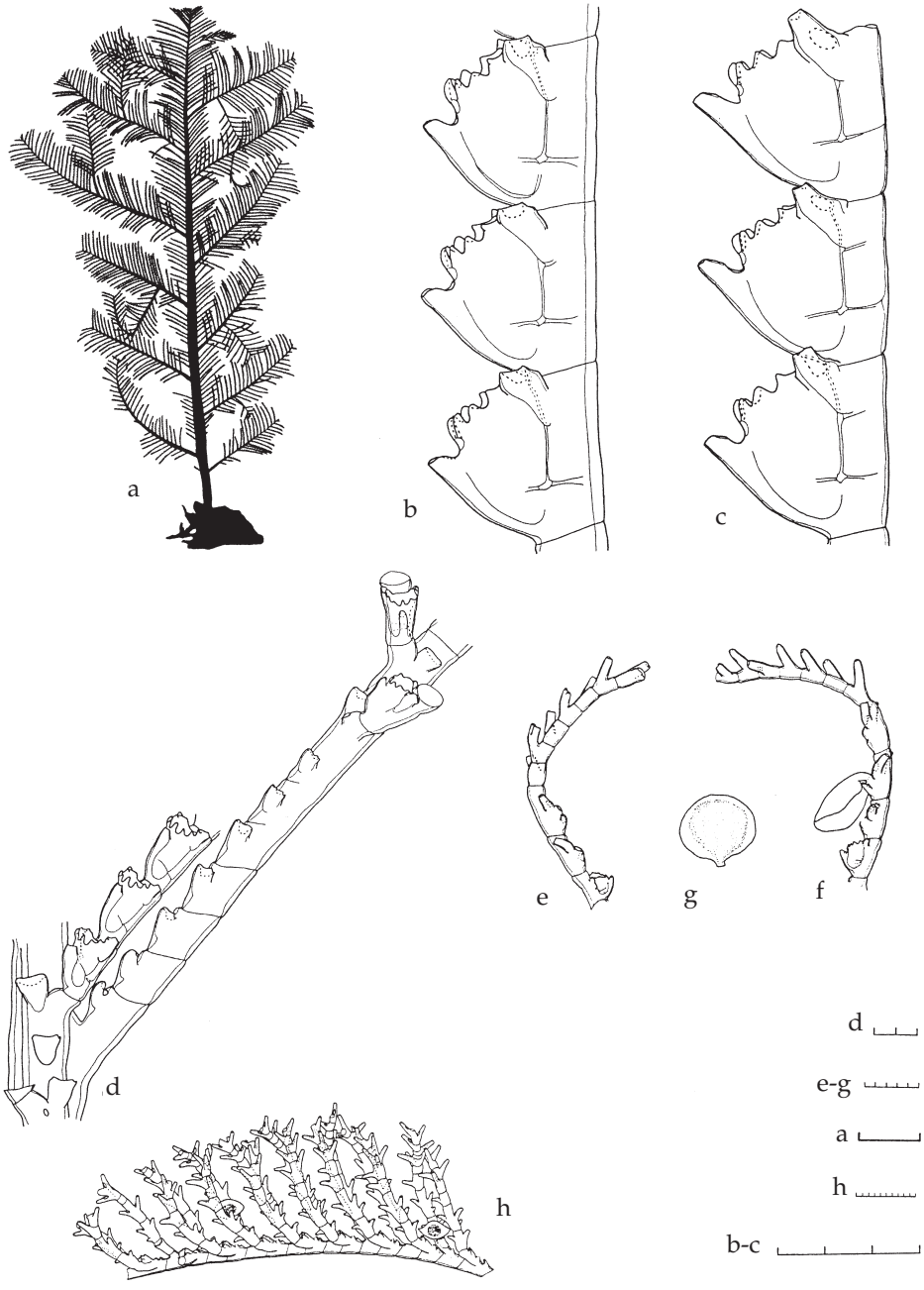


Fig. 47. *Nematophorus clarkei* (Nutting, 1900). a-c, Stn 6.D02, a colony; b, three internodes from basal part of hydrocladium, lateral view; c, three internodes from distal part of hydrocladium, lateral view; d, Stn 7.078, detail of ramification, frontal view; e-g, Stn 7.113, e-f, details of gonocladium; g, gonotheca; h, Stn 7.078, pseudocorbula, lateral view. Scales: a, 1 cm; b-c, 0.3 mm; d, 0.2 mm; e-g, 0.5 mm, h, 1 mm.

Table XX. Measurements of *Nematophorus clarkei* in µm:

	Stn 6.D02	Stn 7.113
Height of colony (in mm)	18-176	138
Internode of hydrocaulus, length	410-500	450-560
Diameter at node *	190-235	160-235
Hydrocladial internode, length	340-360	300-420
Diameter at node	110-150	125-140
Hydrotheca, depth	295-320	280-350
Diameter at rim	190-210	170-200
Mesial nematotheca, length of free part	45-80	50-95
Diameter at rim	20-25	25-30
Lateral nematotheca, length	150-180	150-180
Diameter at rim	35-45	30
Gonotheca, diameter	410-590**	600-800

* Measurements in monosiphonic part of colony.
** Immature gonothecae!

Discussion.— The reasons to place this species in *Nematophorus* Clarke, 1879, have already been explained (p. 101), though this genus was sunk into *Macrorhynchia* Kirchenpauer, 1872, by several authors (Bogle, 1975; Calder, 1997). During this study we have been able to verify that the two genera have quite different gonosomes: in *Macrorhynchia* the gonocladia occur more or less isolated and take the place of one hydrocladium, whereas in *Nematophorus* they are concentrated to form pseudocorbulae. We therefore follow Stechow (1923d) in considering *Nematophorus* a valid genus.

Nutting (1900), when describing *Lytocarpus clarkei* (= *Nematophorus clarkei*), indicated that the species strongly resembles *Nematophorus grandis* Clarke, 1879, from which it differs because the median nematotheca does not reach the hydrothecal rim and has a free distal part. The differences between *N. grandis* (and its variety *unilateralis* Ritchie, 1907) and *N. clarkei* were considered obscure by Vervoort (1959) and he indicated that Nutting's description of *N. grandis* does not correspond with the figures; also Nutting stated the gonosome in that species to be unknown, though figured in pl. 32 figs 2-4. These figures, according to Vervoort (1959), probably represent the gonosome of *N. clarkei*, of which Nutting had fertile material. The gonosome of *N. grandis* was described by Versluys (1899) and it is morphologically similar to that of *N. clarkei*, though there are differences in the structure of the hydrotheca, as the colonies described by Versluys have an oblique upwardly directed intrathecal septum, whereas it is straight in *N. clarkei*. Colonies with oblique intrathecal septum were placed in *Lytocarpus ramosus* (Fewkes, 1881) by Nutting (1900). The material described as *Lytocarpus grandis* by Nutting (1900) and as *L. grandis* var. *unilateralis* by Ritchie (1907) had straight intrathecal septa. The variety *unilateralis* is distinguished from the nominotypical subspecies by the fact that the branches are directed towards one side of the main stem. The material described by Versluys (1899) in our opinion represents a species differing from *N. clarkei* and is probably identical with Nutting's *L. ramosus*, whereas the colonies described by Nutting as *L. grandis* and by Ritchie (1907) as *L. grandis* var. *unilateralis* could be identical with *N. clarkei*. Revision of the type of *Lyto-*

carpus grandis and of the material studied by Nutting and Ritchie seems indicated before drawing final conclusions.

A detailed description of *N. clarkei* was given by Vervoort (1959, as *Lytocarpus clarkei*), based on material from the Cape Verde region, this being the first record of the species from the eastern Atlantic. The CANCAP material resembles that described by Vervoort (1959); in his material some of the costal internodes have double lateral nematothecae, in the CANCAP specimens these always have single nematothecae. Records from Bermuda by Bennitt (1922, as *Lytocarpus clarkei*) and by Calder (1986, as *Macrorhynchia clarkei*) were included in *Macrorhynchia allmani* (Nutting, 1900) by Calder (1997).

Reproduction.— The presence of gonocladia is mentioned by Nutting (1900, in May) and Vervoort (1959, in December, and 1968, in January). The CANCAP material collected in June, August and September is fertile.

Distribution.— *Nematophorus clarkei* has an amphi-Atlantic distribution, though it is more common in the Caribbean area. In the western Atlantic it is known from the Bahamas, Havana and Yucatán (Nutting, 1900, as *Lytocarpus clarkei*), from north of Puerto Rico (Fraser, 1944a, as *L. clarkei*) and from St. Thomas in the Caribbean Sea (Vervoort, 1968, as *L. clarkei*). In the eastern Atlantic it is only known from the Cape Verde Islands (Vervoort, 1959, as *L. clarkei*).

The bathymetrical distribution varies between 23.5 and 360 m (Vervoort, 1968).

CANCAP material originates from 11 localities all situated in the Cape Verde region and was collected between 15 and 248 m depth.

Epibionts.— Stn 6.137: *Filellum serratum* (Clarke, 1879), *Monostaechas quadridens* (McCrady, 1859), *Plumularia setacea* (L., 1758), *Aglaophenia svobodai* spec. nov., Sertulariidae indet., Campanulariidae indet.— Stn 6.146: *Campanularia hincksii* Alder, 1856, Bryozoa.— Stn 6.176: *Plumularia setacea* (L., 1758), Bryozoa.— Stn 6.D11: Tubes of Amphipoda.— Stn 7.078: *Antennella siliquosa* (Hincks, 1877), *Plumularia setacea* (L., 1758).— Stn 7.155: *Plumularia setacea* (L., 1758), Campanulariidae indet.

Genus *Streptocaulus* Allman, 1883
Streptocaulus corneliusi (Ramil & Vervoort, 1992)
(figs 48-49)

Cladocarpus tenuis var. Vervoort, 1985: 292, fig. 3a-c.
Cladocarpus corneliusi Ramil & Vervoort, 1992a: 103, fig. 26a-h.
Cladocarpus sp. Ramil & Vervoort, 1992b: 175, fig. 3.
Streptocaulus corneliusi; Ramil, Vervoort & Ansín, 1998: 23, figs 13-18.

Material.— **Atlantic coast of Morocco and Mauritania**: Stn 2.039: One colony without phylactocarps (unregistered sample).— **Canary Islands and Selvagens Archipelago**: Stn 2.130: Two colonies of which one with phylactocarps and male gonothecae (RMNH-Coel. 28724, two slides 4584).— Stn 4.160: Two colonies of which one with phylactocarp and female gonothecae (RMNH-Coel. 28730, three slides 4585).

Description (of material from Stn 4.160).— Hydrorhiza tubular and interwoven, supporting a polysiphonic, unbranched hydrocaulus. Basal part hydrocaulus smooth, undivided, remainder made up of internodes with weakly indicated, oblique nodes, poorly visible even in younger parts of colony, with cauline nematothecae and

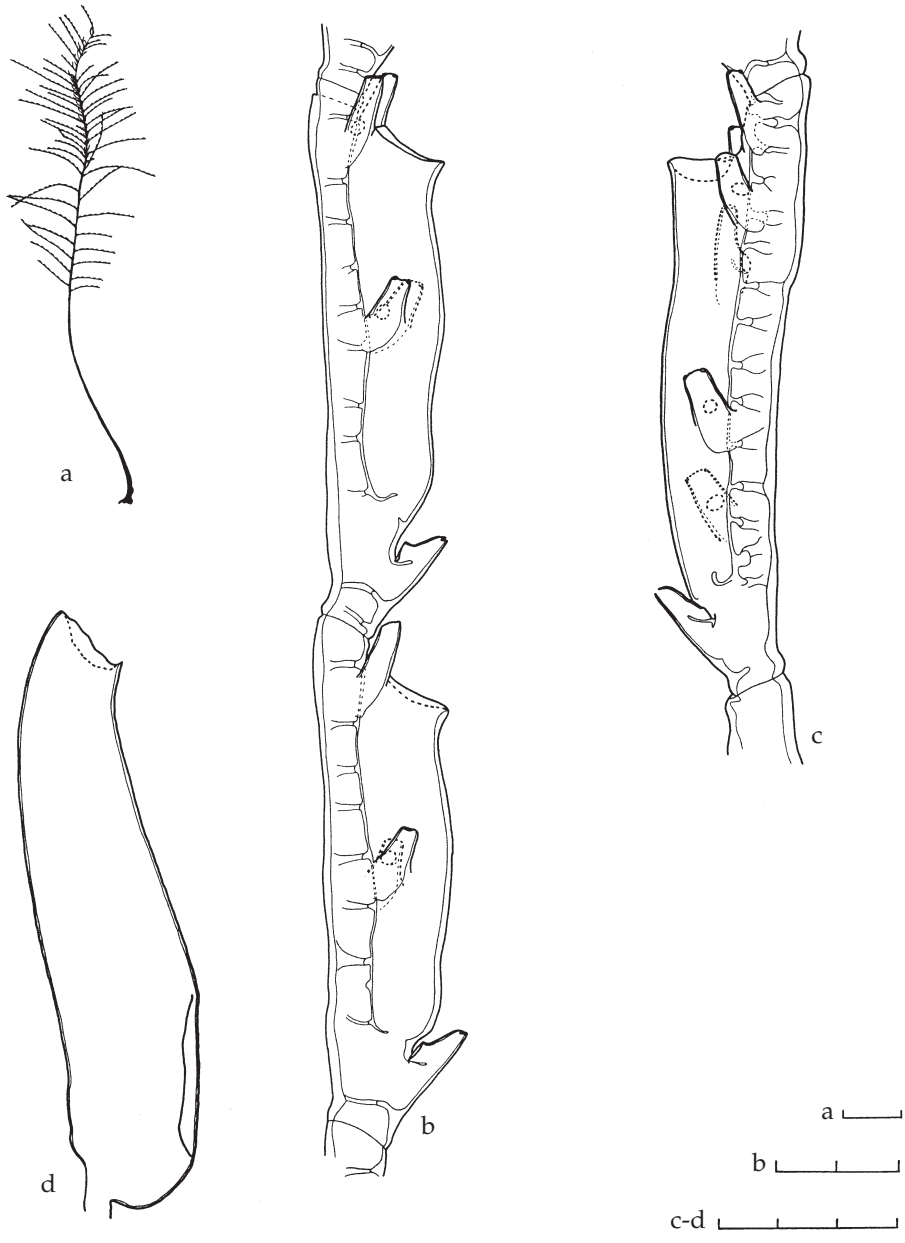


Fig. 48. *Streptocaulus corneliusi* (Ramil & Vervoort, 1992). a-b, Stn 2.130, a, colony; b, two internodes with typical hydrothecae, lateral view; c-d, Stn 4.160, c, hydrotheca with three pairs of lateral nematothecae, lateral view; d, female gonotheca, lateral view. Scales: a, 1 cm; b, 0.2 mm; c-d, 0.3 mm.

Fig. 49. *Streptocaulus corneliusi* (Ramil & Vervoort, 1992). a, Stn 4.160, hydrothecae and phylactocarps with female gonothecae, lateral view; b, Stn 2.130, hydrothecae with phylactocarps with male gonothecae, lateral view. Scales: a-b, 0.5 mm.

apophyses supporting hydrocladia. Five to ten nematothecae below first apophysis; each internode with one apophysis, one nematotheca in the axil and one to four inferior nematothecae. Cauline nematothecae with two apertures: one apical and one basal in adcauline wall; under this aperture an incomplete internal septum.

Hydrocladia alternately directed left and right, composed of succession of

hydrothecate internodes with oblique nodes; each internode with one hydrotheca and five nematothecae: one mesial inferior and two pairs of lateral nematothecae, one pair halfway adcauline wall, one pair near margin. Hydrotheca big, tubular, with adcauline wall completely adnate, slightly concave below first pair of lateral nematothecae, convex at level of first pair of lateral nematothecae and concave again above that pair. Abcauline wall practically parallel with adcauline wall and following its contour. Plane of hydrothecal aperture tilted downward, rim circular, smooth. Mesial inferior nematotheca on internode below hydrotheca, cone-shaped, with small terminal aperture; second aperture basally on adcauline side, below this an incomplete internal septum. Lateral nematothecae with two apertures: one small apical and one basal adcauline aperture, with an incomplete internal septum under that aperture. Second pair of lateral nematothecae projecting above hydrothecal rim. Hydrocladial internodes with 10 to 16 well developed perisarc rings of which one or two basal, eight to 13 behind hydrotheca and one apical.

Phylactocarps paired structures, springing from basal zone of hydrotheca of first hydrocladial internode, each composed of an undivided rachis bearing five to eight pairs of nematothecae. Nematothecae of a pair opposite, large, elongated, with one terminal and one basal aperture and an incomplete septum; small additional apertures may be present. Between two consecutive pairs of nematothecae one to five internal septa. Gonothecae with sexual dimorphism, male gonotheca small and ovoid with apical, circular aperture; female gonotheca bigger, ovoid, terminally truncate and there with circular aperture closed by operculum.

Variability.— A colony from Stn 4.160 has two additional nematothecae on two internodes: one between the two pairs of lateral nematothecae, the other on distal part of internode. In those two internodes the inferior lateral nematothecae are not at the same level (fig. 48c).

Table XXI. Measurements of *Streptocaulus corneliusi* in µm:

	Stn 2.130	Stn 4.160
Height of colony (in mm)	50-78	53-82
Hydrocladial internode, length	770-900	810-940
Diameter at node	90-105	65-90
Hydrotheca, length	520-600	595-730
Diameter at rim	130-195	120-130
Mesial nematotheca, length	120-150	120-170
Diameter at rim	8.5-20	9-20
Lateral nematotheca, length	125-170	130-190
Diameter at rim	30	20-35
Supplementary nematotheca, length	110-180	110-140
Diameter at rim	10-30	10-40
Phylactocarp, length	1540-2180	1640-1920
Male gonotheca, length	310-365	
Maximum diameter	170-210	
Female gonotheca, length		870-990
Maximum diameter		210-345

Discussion.— Ramil & Vervoort (1992b) have made it clear that two types of phylactocarps can be distinguished amongst the various species hitherto brought to *Cladocarpus* Allman, 1874, type *Cladocarpus formosus* Allman, 1874. They suggested that the species with the type of gonosome met with in *C. formosus* and those with unknown gonosome remain in that genus, while those with the type of gonosome described above for *Streptocaulus corneliusi* are transferred to *Streptocaulus* Allman, 1883, as they agree in gonosome structure with that of the type, *Streptocaulus pulcherrimus* Allman, 1883, and described by Quelch (1885). The species here described in *Streptocaulus* all have the type of phylactocarp that in structure resembles a hydrocladium: a segmented or unsegmented rachis with pairs of opposite nematothecae.

Reproduction.— The presence of phylactocarps is mentioned by Ramil & Vervoort (1992a, in April and May) and by Ramil, Vervoort & Ansín (1998, in September and October). The CANCAP material had phylactocarps in June and September. All phylactocarps recorded here were fertile.

Distribution.— Recorded from the Bay of Biscay (Vervoort, 1985, as *Cladocarpus tenuis* var.), from various localities south-west and west-south-west of Cape San Vicente and one locality near Rabat at the coast of Morocco (Ramil & Vervoort, 1992a, as *Cladocarpus corneliusi*), and from Gorringe, Josephine and Ampère Banks (Ramil, Vervoort & Ansín, 1998).

The bathymetrical distribution varies between 182 (Ramil, Vervoort & Ansín, 1998) and 2292 m (Ramil & Vervoort, 1992a).

CANCAP material originates from three localities, one west of Cape Yubi in Morocco and two from the Canary Islands, forming the southern limit of the species. Material was collected between 500 and 1800 m.

Epibionts.— Stn 2.130: Bryozoa.

Streptocaulus dollfusi (Billard, 1924)
(fig. 50)

Cladocarpus dollfusi Billard, 1924: 87, fig. 1; 1934: 229, figs 3-5; Picard, 1958b: 192; Vervoort, 1966a: 149; Patriti, 1970: 53, fig. 72A-C; Van Praët, 1979: 911, fig. 73A-C; Boero & Bouillon, 1993a: 263.
Cladocarpus ventricosus; Vervoort, 1959: 300, fig. 49a-b (not *Cladocarpus ventricosus* Allman, 1877).
Streptocaulus dollfusi; Medel & Vervoort, 1995: 24, figs 9a-b, 10.

Material.— **Atlantic coast of Morocco and Mauritania:** Stn MAU 033: Two colonies, one with phylactocarps (RMNH-Coel. 28769, two slides 4586).— Stn MAU 142: One colony with two epibiontic colonies, without phylactocarps (RMNH-Coel. 28777; DEBA-UV, two slides R. 315).

Description (of material from Stn MAU 033).— Hydrorhiza tubular; hydrocaulus polysiphonic and irregularly branched. Only primary tube bearing apophyses and nematothecae, divided into internodes by indistinct straight or slightly oblique nodes, indicated by perisarc constrictions. Each internode with one small apophysis in distal extremity, one axillary nematotheca and a row of two to five frontal nematothecae below apophysis. Cauline nematothecae with two apertures, one apical and one in adcauline wall.

Hydrocladia absent from basal part of stem, inserted on apophyses and alternately directed left and right, composed of series of hydrothecate internodes with oblique

Fig. 50. *Streptocaulus dollfusi* (Billard, 1924). a-b, Stn MAU 033, a, colony; b, hydrothecae and phylactocarp, lateral view; c, Stn MAU 142, four internodes from distal zone of hydrocladium, lateral view. Scales: a, 1 cm; b-c, 0.5 mm.

nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrothecal adcauline wall fully adnate to internode, intrathecal septum present and springing from convex part of adcauline hydrothecal wall in its lower third; beneath and above insertion of septum wall of hydrotheca concave. Septum reaching middle of hydrothecal cavity, curved backwards apically. Abcauline wall of hydrotheca strongly convex in basal half and straight above, giving hydrotheca a characteristic shape. Hydrothecal aperture slightly tilted downwards, rim smooth or weakly undulated in some hydrothecae; abcauline cusp of varied development always present. Mesial nematotheca under hydrotheca, with two apertures: one apically and one basally in adcauline wall. Lateral nematothecae with terminal aperture doubled and one aperture opening in hydrothecal cavity. Each internode with six to eight perisarc rings, of which one or two behind mesial nematotheca and five or six behind hydrotheca.

Phylactocarps unpaired, springing from hydrothecal base, each composed of six internodes separated by scarcely visible nodes and each with a pair of nematothecae, identical with lateral nematothecae of hydrocladial internodes, occasionally with two apertures. Gonothecae absent.

Variability.— Development of abcauline cusp of hydrotheca variable, from scarcely visible to well developed. In material from Stn MAU 142 distal hydrothecae of apical parts of colony loose their convexity and greatly resemble those of *Streptocaulus sinuosus* (Vervoort, 1966) (fig. 50c).

Table XXII. Measurements of *Streptocaulus dollfusi* in µm:

	Stn MAU 033
Height of colony (in mm)	11-111
Internode of hydrocaulus, length	800-990
Diameter at node	105-130
Hydrocladial internode, length	560-610
Diameter at node	50-70
Hydrotheca, depth	310-390
Diameter at rim	140-160
Mesial nematotheca, length	95-105
Diameter at rim	10-15
Lateral nematotheca, length	110-120
Diameter at rim	25-35
Phylactocarp, length	1280-1290

Discussion.— In morphology the hydrothecae are quite similar to those of *Streptocaulus sinuosus* (Vervoort, 1966), though in *S. dollfusi* the basal half of the hydrotheca is much more convex and the distal half practically straight.

Reproduction.— The presence of phylactocarps was previously mentioned by Medel & Vervoort (1995); the fertile phylactocarp was found in October. Sterile phylactocarps are present in CANCAP material collected in June.

Distribution.— Considered central Atlantic by Picard (1958b), whereas Boero & Bouillon (1993a) refer to an Atlantic-Mediterranean distribution. *Streptocaulus dollfusi*

was recorded from the Atlantic off Chiclana, on the south coast of Spain (Medel & Vervoort, 1995), from various localities along the coast of Morocco (Billard, 1924, 1934; Patriti, 1970, as *C. dollfusi*) and from Senegal and Sierra Leone (Vervoort, 1959; as *Cladocarpus ventricosus* Allman, 1877). From the Mediterranean Picard (1958b) recorded its occurrence in the extreme west and recently Medel & Vervoort (1995) recorded it from off Málaga at the Mediterranean south coast of Spain.

The bathymetrical distribution oscillates between 60 (Medel & Vervoort, 1995) and 380 m (Billard, 1934).

CANCAP material was obtained off the Mauritanian coast between 75 and 114 m.

Epibionts.— Stn MAU 033: *Eudendrium* spec., Nudibranchia and their eggs.— Stn MAU 142: *Streptocaulus dollfusi* (Billard, 1924).

Streptocaulus pectiniferus (Allman, 1883)
(figs 51-52)

Cladocarpus pectiniferus Allman, 1883: 50, pl. 17 figs 1-5; Jäderholm, 1903: 301; Billard, 1910: 47; Bedot, 1921a: 325; 1921c: 54, pl. 6 figs 54-58; 1922: 152; 1923: 224, figs 20-21; Rees & White, 1966: 280; Vervoort, 1966a: 149; Van Praët, 1979: 911, fig. 74; Ramil & Vervoort, 1992a: 114, figs 28a-h, 29a-j, 30a-g; Ramil & Vervoort, 1992b: 173, fig. 2.
Streptocaulus pectiniferus; Ramil, Vervoort & Ansín, 1998: 29, fig. 19.
Not *Cladocarpus pectiniferus*; Pictet & Bedot, 1900: 49 (= *Cladocarpus cartieri* Bedot, 1921).
Aglaophenopsis(?) pharetra Broch, 1918a: 80, fig. 42a-c.

Material.— **Azores area**: Stn 5.068: One colony with phylactocarps and gonothecae (RMNH-Coel. 28904, three slides 4589).— Stn 5.073: One colony without phylactocarps (RMNH-Coel. 29077 = slide 4590).— **Madeira area**: Stn 1.102: One colony with phylactocarps (RMNH-Coel. 28695, three slides 4587).— **Canary Islands and Selvagens Archipelago**: Stn 3.089: One colony with phylactocarps and gonothecae (RMNH-Coel. 29047; DEBA-UV, slide R. 316).— Stn 4.164: Two fragments without phylactocarps (RMNH-Coel. 28976, slide 4588).

Description (of material from Stn 5.068).— Hydrorhiza formed by irregular mass of fine tubules surrounding basal part of unbranched hydrocaulus, polysiphonic in lower part, monosiphonic distally. Primary tube of hydrocaulus with series of frontal nematothecae in basal zone, remainder of tube divided into internodes with scarcely indicated, oblique nodes, visible in apical part of colony as minor perisarc constrictions. Each internode with one distal apophysis, one axillary nematotheca and two to 13 nematothecae below apophysis. Cauline nematothecae with single gutter-shaped aperture.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of hydrothecate internodes with oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca deep, tubular, adcauline wall fully adnate and practically straight, without intrathecal septum; abcauline wall also almost straight, distal portion slightly concave. Hydrothecal aperture slightly tilted downward, rim smooth; no abcauline cusp. Mesial inferior nematotheca below hydrotheca, typically reaching or overreaching hydrothecal base, occasionally separated from hydrothecal base, with two apertures, one apical, one basal in adcauline wall. Lateral nematothecae reaching far beyond hydrothecal rim, with terminal, finely serrate aperture and basal, adcauline aperture. Internodes with seven to 12 well developed perisarc rings.

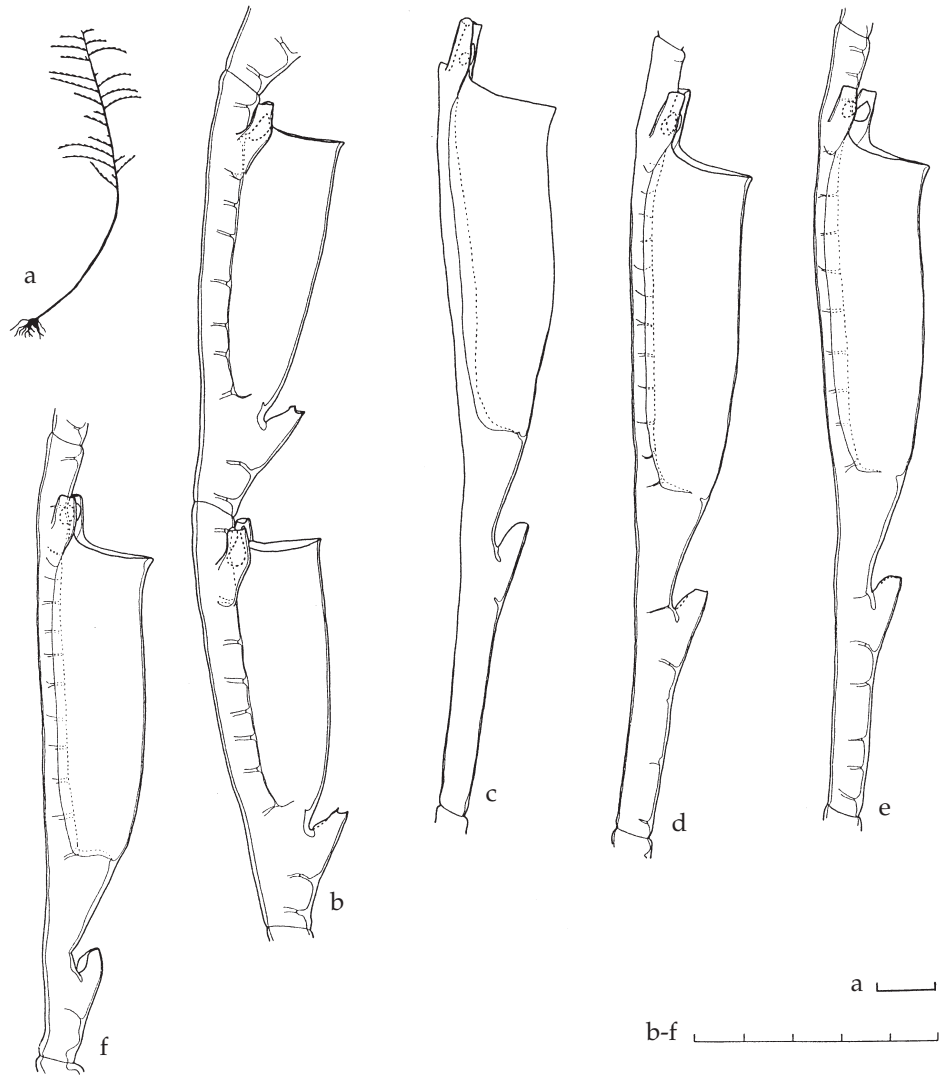


Fig. 51. *Streptocaulus pectiniferus* (Allman, 1883). a, Stn 3.089, colony; b, Stn 5.073, two internodes with typical hydrothecae; c-f, Stn 4.164, internodes from same hydrocladium; all hydrocladia in lateral view. Scales: a, 1 cm; b-f, 0.5 mm.

Phylactocarps occurring in pairs, inserted one on each side of hydrothecal base of first hydrocladial internode and composed each of four to six internodes, of which first three with two to three pairs of nematothecae; apical internodes with single pair. Nematothecae tubular, long, with two apertures: one apical and finely serrate and one oval aperture basally. Moreover, each internode with one or two internal septa. Gonothecae, probably of male sex, placed on rachis, inserting between nematothecae of a pair, elongated ovoid, cut off at top and there with circular aperture.

Fig. 52. *Streptocaulus pectiniferus* (Allman, 1883), Stn 5.068. a, hydrothecae and phylactocarps with gonothecae, lateral view; b, hydrotheca with phylactocarp springing from its base and development of phylactocarp from distal end of internode, lateral view. Scales, a-b, 0.5 mm.

Variability.— Material from Stns 3.089 and 6.164 has long hydrocladial internodes with short mesial nematothecae. A colony from Stn 4.164 has 18 internodal septa and a regenerated hydrocladial internode in which the hydrotheca but not the lateral nematothecae have regenerated; in this case an internode is observed with one hydrotheca, one mesial nematotheca but without lateral nematothecae. A colony from Stn 5.068 has a hydrocladium that after the first hydrotheca is transformed into a phylactocarp (fig. 52b).

Table XXIII. Measurements of *Streptocaulus pectiniferus* in µm:

	Stn 5.068	Stn 4.164
Height of colony (in mm)	23-100	
Internode of hydrocaulus, length	790-1120	
Diameter at node	135-180	
Cauline nematotheca, length	120-130	
Diameter at rim	15-27	
Hydrocladial internode, length	780-900	1240-1630
Diameter at node	90-120	55-70
Hydrotheca, depth	510-580	605-675
Diameter at rim	190-220	180-195
Mesial nematotheca, length	130-180	140-160
Diameter at rim	20-30	25-30
Lateral nematotheca, length	190-220	145-180
Diameter at rim	30-50	30
Phylactocarp, length	1840-3140	
Gonotheca, length	420-550	
Maximum diameter	180-240	

Discussion.— *Streptocaulus pectiniferus* is a variable species (Ramil & Vervoort, 1992a). Our material shows variability in the length of the hydrocladial internodes and the hydrothecae (fig. 51b-f). Because of the structure of the phylactocarps it has been included in *Streptocaulus* Allman, 1883 by Ramil, Vervoort & Ansín (1998).

Reproduction: Bedot (1921c) recorded the presence of (sterile) phylactocarps in August; Ramil and Vervoort (1992a) described fertile phylactocarps from April and sterile phylactocarps from May and June, and Ramil, Vervoort and Ansín (1998) mentioned fertile phylactocarps in October. In the CANCAP collection fertile colonies were observed in May and October, while colonies from March had sterile phylactocarps.

Distribution.— *Streptocaulus pectiniferus* has been recorded from the Atlantic south-west of Iceland (Broch, 1918a, as *Aglaophenopsis (?) pharetra*), from the Azores (Allman, 1883; Jäderholm, 1903, both as *Cladocarpus pectiniferus*), from various localities in the Ibero-Moroccan Gulf, including Cape San Vicente, the Gulf of Cádiz and Casablanca area, and the coast of Morocco (Ramil & Vervoort, 1992a, as *C. pectiniferus*), from Seine Bank (Ramil, Vervoort & Ansín, 1998), and from the Canary Islands (Bedot, 1921c, as *C. pectiniferus*).

In the Mediterranean it has been found near the Strait of Gibraltar and in the Alborán Sea, near the coast of Morocco (Ramil & Vervoort, 1992a, as *C. pectiniferus*).

The bathymetrical distribution varies between 92 (Jäderholm, 1903) and 2292 m (Ramil & Vervoort, 1992a).

The CANCAP material originates from five localities, of which two situated in the Selvagens Archipelago, two near the Azores and one off Madeira, collected between 200 and 500 m.

Epibionts.— Stn 1.102: Bryozoa.

Streptocaulus pulcherrimus Allman, 1883
(figs 53-55)

Streptocaulus pulcherrimus Allman, 1883: 48, pl. 16 figs 1-3; Quelch, 1885: 11, pl. 1 figs 5, 5a, 5b; Nutting, 1900: 129, pl. 34 figs 1-3; Bedot, 1921a: 329; 1921c: 57; 1922: 152; Von Schenck, 1965: 928; Rees & White, 1966: 281; Ramil & Vervoort, 1992b: 175.

?*Streptocaulus pulcherrimus*; Fraser, 1938b: 10, 67; 1938d: 136 (part); 1939c: 161; 1944b: 45; 1948: 289.

Not *Streptocaulus pulcherrimus*; Fraser, 1938d: 136 (the material of Valero Stn 814-38 and Valero Stn 817-38 from north of Hood Island).

Material.— **Cape Verde Islands:** Stn 6.060: A fragment without phylactocarps (RMNH-Coel. 29078 = slide 4591).— Stn 6.062: One colony with one cormoid without phylactocarps (RMNH-Coel. 29079 = slide 4592).— Stn 6.067: 16 colonies without phylactocarps (RMNH-Coel. 28742, 28926, three slides 4593).— Stn 6.069: One colony without phylactocarps (RMNH-Coel. 28786).— Stn 6.070: Seven colonies without phylactocarps (RMNH-Coel. 28737, two slides 4594).— Stn 6.071: One colony without phylactocarps (RMNH-Coel. 28749).— Stn 6.072: Three colonies without phylactocarps (RMNH-Coel. 28761, two slides 4595).— Stn 6.074: 14 colonies without phylactocarps (RMNH-Coel. 28757; DEBA-UV, two slides R. 317).— Stn 6.080: One colony with four cormoids, three with phylactocarps and gonothecae (RMNH-Coel. 28751).— Stn 6.106: Four colonies, three with phylactocarps and gonothecae (RMNH-Coel. 28911, slide 2005, four slides 4596).— Stn 6.114: One fragment in bad condition and without phylactocarps (RMNH-Coel. 28951, slide 4597).— Stn 6.137: 26 colonies, six with phylactocarps and gonothecae (RMNH-Coel. 28772, slide 2007; DEBA-UV, slide R. 318).— Stn 6.139: Ten colonies, six with phylactocarps (RMNH-Coel. 28750, DEBA-UV, two slides R. 319).— Stn 6.148: One colony without phylactocarps and a fragment with phylactocarps (RMNH-Coel. 28760, slide 2010, three slides 4598).— Stn 6.151: One colony with phylactocarps (RMNH-Coel. 28778, slide 4599).— Stn 7.058: 44 colonies, four with phylactocarps (RMNH-Coel. 28901, five slides 4600).— Stn 7.059: 23 colonies without phylactocarps (RMNH-Coel. 28748, 28914).— Stn 7.081: One colony without phylactocarps (RMNH-Coel. 28736, slide 4601).— Stn 7.089: Two colonies without phylactocarps (RMNH-Coel. 28781, two slides 4602).— Stn 7.119: 14 colonies, five with phylactocarps and gonothecae (RMNH-Coel. 28920).— Stn 7.122: Two colonies, one with phylactocarps (RMNH-Coel. 28917, 28919).— Stn 7.126: 12 colonies, four with phylactocarps and gonothecae (RMNH-Coel. 28747, 28906, two slides 4603).— Stn 7.152: Six colonies and two fragments without phylactocarps (RMNH-Coel. 28936).

Description (of material from Stn 7.126).— Hydrorhiza tubular, stem unbranched and polysiphonic, with exception of apical zone of colony. Primary tube of stem with series of frontal nematothecae basally, continued as a series of apophyses, alternately arranged in its basal part and spirally arranged in more distal parts of tube. Central tube, with exception of basal part, divided into internodes by oblique nodes, only visible as perisarc constrictions in younger parts of colony. Each internode with apophyses at distal end. Apophyses with one axillary nematotheca when arranged alternately, with two axillar nematothecae when placed in spiral. Between two successive apophyses two, occasionally up to four cauline nematothecae, each with two circular

Fig. 53. *Streptocaulus pulcherrimus* Allman, 1883. a, Stn 7.081, colony; b-c, Stn 6.137, colonies. Scales: a-c, 1 cm.

apertures, one apical, one basally at adcauline wall; apical aperture sometimes doubled in spiral part of stem.

Hydrocladia inserted on apophyses, alternately directed left and right in basal part of colony, arranged in spiral in distal part, made up by succession of hydrothecate internodes separated by oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca big, with adcauline wall fully adnate, without intrathecal septum, abcauline wall nearly completely straight. Hydrothecal rim smooth, with distinct abcauline cusp, plane of aperture slightly tilted downwards. Mesial inferior nematotheca on internode below hydrotheca, apex reaching or slightly overreaching hydrothecal base, in basal parts of

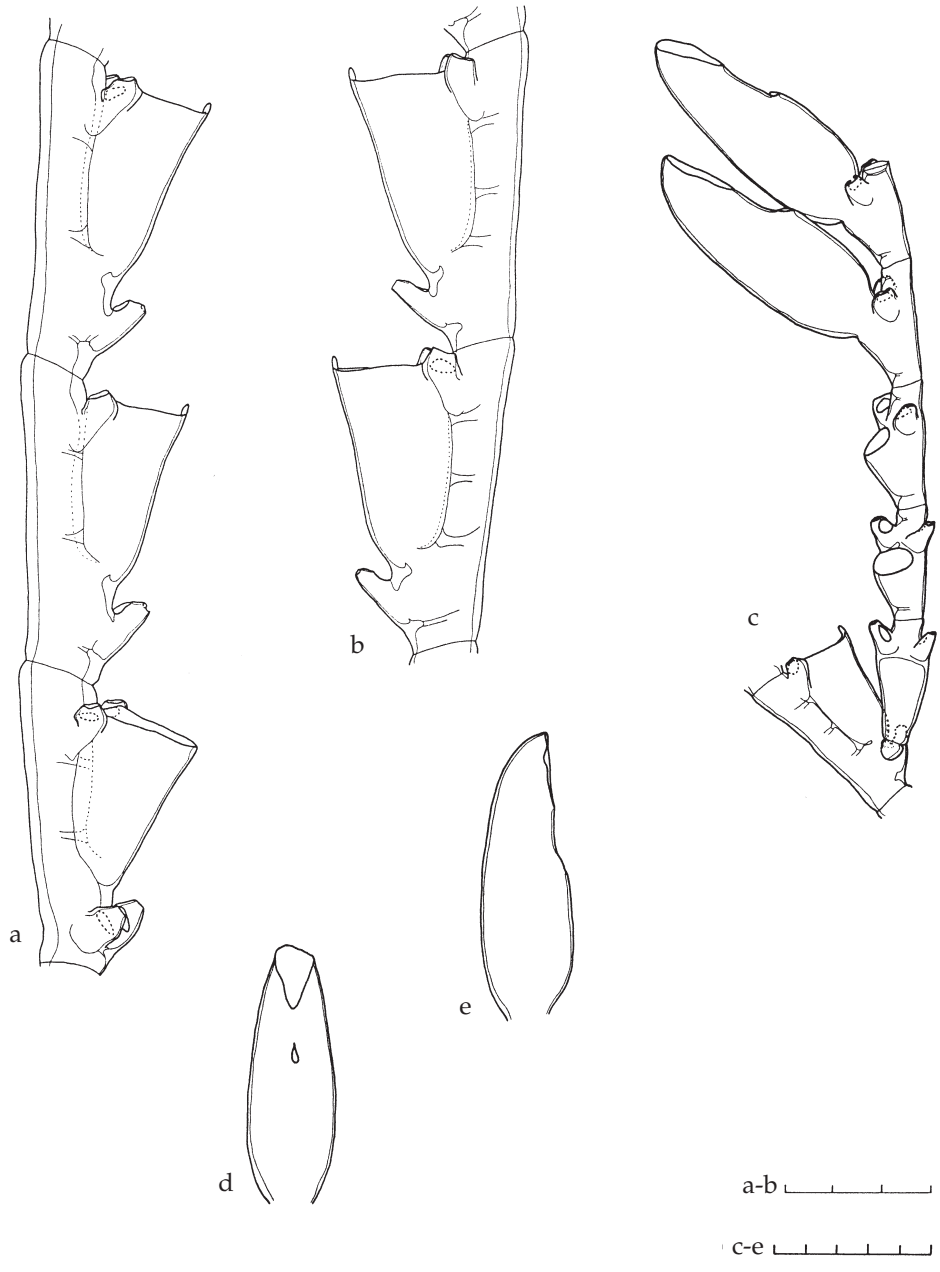


Fig. 54. *Streptocaulus pulcherrimus* Allman, 1883. a-b, Stn 6.072, a, three hydrothecae from basal part of hydrocladium, lateral view; b, two hydrothecae from distal part of hydrocladium, lateral view; c-e, Stn 6.137, c, phylactocarp with gonothecae, lateral view; d, gonotheca, frontal view; e, gonotheca, lateral view. Scales: a-b, 0.3 mm; c-e, 0.5 mm.

hydrotheca occasionally shorter, with two apertures, one apical, one at adcauline wall. In spiral parts mesial nematotheca of first hydrocladial internode doubled and side by side. Lateral nematothecae surpassing hydrothecal rim, with two apertures, one apical, one basally at adcauline side. Internode with one to seven perisarc rings of varied development, one or two below, three or four behind and occasionally one above hydrotheca.

Phylactocarps unpaired, springing from base of hydrotheca, rachis composed of three or four internodes, each with pair of opposite nematothecae with septum in lower part. Gonothecae inserted on rachis, pyriform, with laterally directed, apical, oval aperture and second aperture in median zone.

Variability.— Although in the majority of the material colonies have a basal part with alternate hydrocladia followed by a spiral part, some colonies have alternately arranged hydrocladia only. A certain variability exists in the size of the phylactocarps, although those at Stns 6.139, 6.148 and 7.058 are much wider (figs 54c, 55c). In a colony from Stn 6.148 a phylactocarp originates from an apophysis. In a colony from Stn 7.058 the rachis of a phylactocarp has an internode with three nemathecae: two lateral and one unpaired inferior.

Table XXIV. Measurements of *Streptocaulus pulcherrimus* in µm:

	Stn 7.126
Height of the colony (in mm)	33-332
Internode of hydrocaulus, length	600-890
Diameter at node	210-280
Cauline nematotheca, length	190-210
Diameter at rim	20-30
Hydrocladial internode, length	630-780
Diameter at node	110-190
Hydrotheca, depth without cusp	390-450
Idem, with cusp	450-530
Diameter at rim	245-290
Mesial nematotheca, length	160-190
Diameter at rim	15-25
Lateral nematotheca, length	160-180
Diameter at rim	20-35
Phylactocarp, length	1420-2020
Gonotheca, length	820-910
Maximum diameter	350-360

Discussion.— Fraser (1938b, 1938c, 1948) records this species from the Galápagos Islands, Pacific Ocean, giving neither description nor figures. The material mentioned by Fraser (1938c) as *S. pulcherimus* from north of Hood Islands (Valero Stns 814-38 and 817-38) could be checked and definitely does not belong here. The occurrence of this species in the Pacific, based on records by Fraser, seems questionable but can only be definitively resolved by studying all his material.

Reproduction: CANCAP colonies had fertile phylactocarps in June and September; those observed in August were sterile.

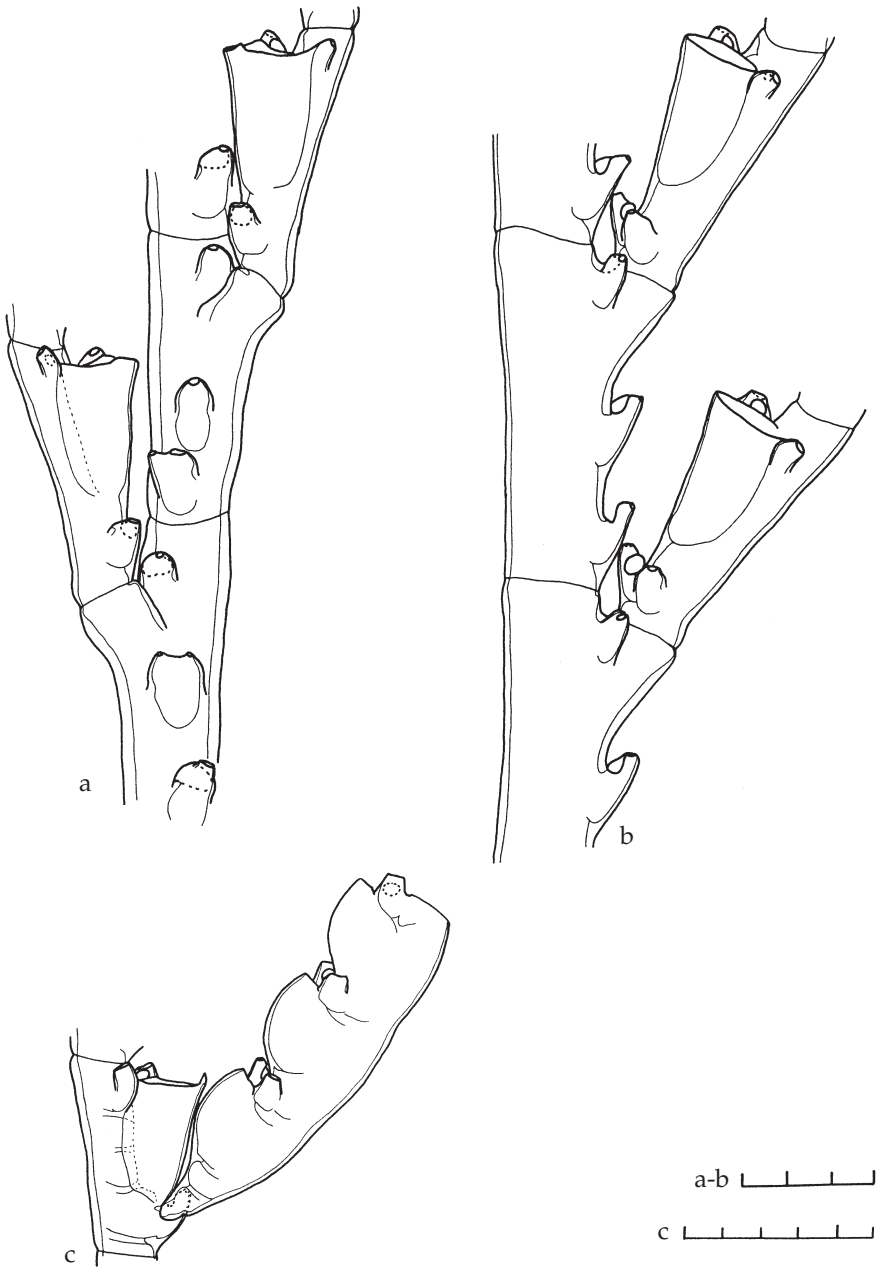


Fig. 55. *Streptocaulus pulcherrimus* Allman, 1883. a-b, Stn 6.074, a, part of axis with two alternately placed apophyses supporting hydrocladia, frontal view; b, part of axis with two apophyses forming part of spiral, supporting hydrocladia, lateral view; c, Stn 7.058, phylactocarp without gonothecae, lateral view. Scales: a-b, 0.3 mm; c, 0.5 mm.

Distribution.— Definite records of *Streptocaulus pulcherrimus* are only known from the Cape Verde Archipelago (Allman, 1883; Quelch, 1885; Bedot, 1921c); other references, with the exception of those by Fraser that we consider doubtful, are based on Allman (1883) and Quelch (1885).

The bathymetrical range is between 91 (Bedot, 1921c) and 914 m (Quelch, 1885).

CANCAP material comes from 23 stations, all in the Cape Verde region, collected between 47 and 930 m.

Epibionts.— Stn 6.062: Foraminifera.— Stn 6.067: *Monostaechas quadridens* (McCrady, 1859), polychaete tubes, Bryozoa.— Stn 6.070: unidentifiable Campanulinidae, *Diphasia* spec., *Clytia* spec.— Stn 6.071: unidentifiable Sertulariidae, *Scalpellum scalpellum* (L., 1767).— Stn 6.072: *Filellum* spec., *Diphasia margareta* (Hassall, 1841), *Clytia paulensis* (Vanhöffen, 1910).— Stn 6.074: *Stegopoma* spec., *Diphasia nigra* (Pallas, 1766), Anthozoa, *Scalpellum scalpellum* (L., 1767).— Stn 6.106: *Monostaechas quadridens* (McCrady, 1859).— Stn 6.114: *Filellum serratum* (Clarke, 1879), *Zygophylax* spec., *Stephanoscyphus* spec.— Stn 6.137: *Filellum serpens* (Hassall, 1848), *Aglaophenia svobodai* spec. nov., *Sertularella* spec.— Stn 6.139: *Filellum* spec., *Antennella secundaria* (Gmelin, 1791).— Stn 6.148: *Filellum serratum* (Clarke, 1879), *Zygophylax* spec., *Diphasia* spec.— Stn 7.058: Algae, *Filellum* spec., *Stegopoma* spec., *Streptocaulus pulcherrimus* Allman, 1883, *Antennella secundaria* (Gmelin, 1791), unidentifiable Sertulariidae, Bryozoa.— Stn 7.059: *Filellum* spec., *Streptocaulus pulcherrimus* Allman, 1883, *Antennella siliquosa* (Hincks, 1877), *Plumularia setacea* (L., 1758), *Diphasia* spec., *Salacia* spec., Bryozoa.— Stn 7.081: Porifera, *Filellum serratum* (Clarke, 1879), *Aglaophenia svobodai* spec. nov., *Antennella secundaria* (Gmelin, 1791), *Sertularella* spec., Bryozoa.— Stn 7.089: *Antennella siliquosa* (Hincks, 1877).— Stn 7.119: *Filellum* spec., *Diphasia* spec., *Clytia* spec., polychaete tubes, *Scalpellum scalpellum* (L., 1767).— Stn 7.122: *Scalpellum scalpellum* (L., 1767).— Stn 7.126: Foraminifera, *Filellum serratum* (Clarke, 1879), *Kirchenpaueria bonnevieae* (Billard, 1906).— Stn 7.152: *Diphasia* spec.

Streptocaulus sinuosus (Vervoort, 1966)
(fig. 56)

Cladocarpus sinuosus Vervoort, 1966a: 155, figs 55-57; Millard, 1975: 428, fig. 132E-H; 1977b: 129, fig. 9A-C; 1978: 177; 1979b: 133; Ramil & Vervoort, 1992a: 128, fig. 34a.
Cladocarpus cf. sinuosus; Gili, Vervoort & Pagès, 1989: 96, fig. 21B.

Material.— **Madeira area**: 1.102: One colony with phylactocarps and gonothecae (RMNH-Coel. 28725, three slides 4604).

Description.— Colony examined has no basal part. Hydrocaulus polysiphonic, unbranched, with primary tube and secondary tubules. Primary tube with oblique nodes separating internodes, only visible in apical part of colony as slight constrictions of perisarc. Apophyses and cauline nematothecae only on internodes of primary tube; each internode with one apophysis in distal part, with axillary nematotheca and two or three nematothecae below apophysis. Cauline nematothecae with two apertures, one apical, one in adcauline wall.

Hydrocladia inserted on apophyses, alternately directed right and left, formed by series of curved internodes with slightly oblique nodes, each with one hydrotheca

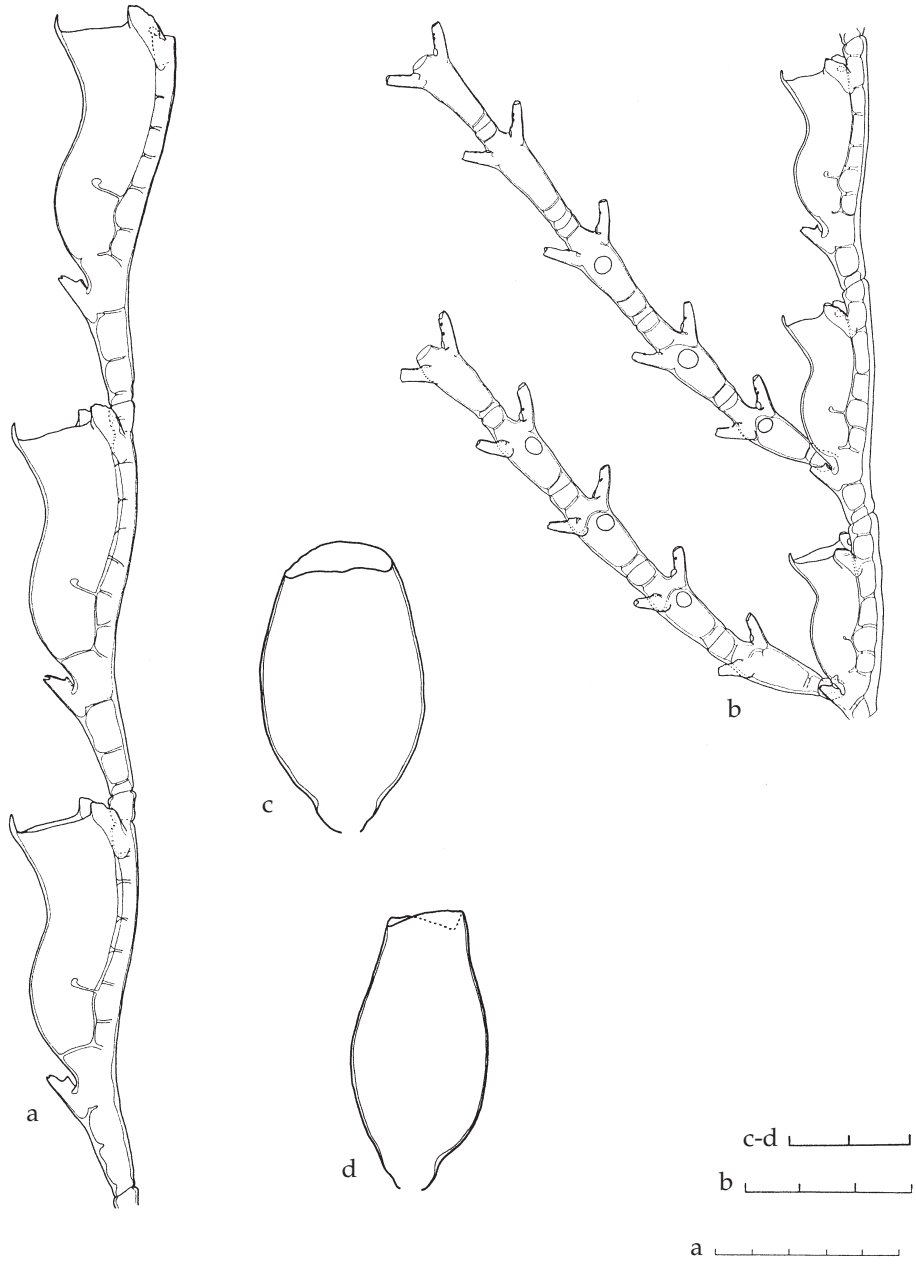


Fig. 56. *Streptocaulus sinuosus* (Vervoort, 1966), Stn 1.102. a, three hydrocladia from distal part of hydrocladium, lateral view; b, hydrothecae and phylactocarps, lateral view; c, gonotheca, frontal view; d, gonotheca, lateral view. Scales: a, 0.3 mm; b, 0.5 mm; c-d, 0.2 mm.

and three nematothecae: one mesial inferior and two lateral. Hydrotheca big, with intrathecal septum springing from adcauline wall at one-third its height; apex of septum curved backwards. Adcauline wall of hydrotheca fully adnate, straight or slightly concave below septum, convex at level of septum and concave above. Abcauline wall S-shaped, strongly convex in basal half and concave above. Hydrothecal aperture slightly tilted downward, hydrothecal rim smooth, with well developed median abcauline cusp. Mesial nematotheca below hydrotheca, sometimes reaching its base. Lateral nematothecae slightly overreaching hydrothecal rim. All nematothecae with terminal and basal, adcauline apertures. Internode with seven to 11 perisarc rings, of which one to three basally, four to seven behind hydrotheca and one or two above.

Phylactocarps unpaired, springing from base of hydrotheca on first or second hydrocladial internode, with four or five internodes with oblique nodes; each internode with pair of opposite nematothecae and one to three septa. Nematothecae big, with two apertures, one apical and finely serrated, one basal; small apertures may occur in between. Gonothecae inserted on internodes, elongated ovoid, with terminal, circular aperture.

Table XXV. Measurements of *Streptocaulus sinuosus* in µm:

	Stn 1.102
Height of colony (in mm)	47
Internode of hydrocaulus, length	650-760
Diameter at node	135-180
Cauline nematotheca, length	85-95
Diameter at rim	12-20
Hydrocladial internode, length	535-720
Diameter at node	38-70
Hydrotheca, depth with cusp	320-410
Idem, without cusp	355-445
Diameter at rim	170-180
Mesial nematotheca, length	100-110
Diameter at rim	10
Lateral nematotheca, length	90-120
Diameter at rim	25-50
Phylactocarp, length	1210-1740
Gonotheca, length	420-480
Maximum diameter	230-260

Discussion.— The species is here placed in *Streptocaulus* on account of the structure of the phylactocarp.

Reproduction.— Occurrence of sterile phylactocarps was recorded by Vervoort (1966, in February) and by Ramil & Vervoort (1992a, in June). Fertile phylactocarps occur in CANCAP material collected in March.

Distribution.— Considered endemic for South Africa by Millard (1975, 1978, as *Cladocarpus sinuosus*). Now known from one locality in the Alborán Sea near the coast of Morocco (Ramil & Vervoort, 1992a, as *C. sinuosus*), the coast of Guinea Bissau (Gili,

Vervoort & Pagès, as *Cladocarpus* cf. *sinuosus*) and from various localities along the coast of South Africa: Agulhas Bank (Millard, 1975, as *C. sinuosus*), East London (Millard, 1979b, as *C. sinuosus*), Durban (Vervoort, 1966a, as *C. sinuosus*) and Natal (Millard, 1977b, as *C. sinuosus*).

The bathymetrical distribution lies between 183 (Millard, 1975) and 680 m (Millard, 1978).

CANCAP material comes from one locality in the Madeira area and was taken at 300 m depth. This record confirms the presence of this species in the Atlantic.

Epibionts.— Stn 1.102: Bryozoa.

Streptocaulus caboverdensis spec. nov.
(figs 58-60)

Material.— **Cape Verde Islands**: Stn 6.020: One colony without phylactocarps (RMNH-Coel. 29080 = slide 4606).— Stn 6.065: Four colonies, one with phylactocarps and three with phylactocarps and damaged gonothecae (holotype) (RMNH-Coel. 29049, two slides 4607).— Stn 6.080: Eleven colonies, one with phylactocarps and gonothecae (RMNH-Coel. 28780, three slides 4608; DEBA-UV, three slides R. 320).— Stn 6.090: One colony with phylactocarps and gonothecae (RMNH-Coel. 28756, two slides 4609).— Stn 7.139: Two colonies, one with phylactocarps (RMNH-Coel. 28711, three slides 4610). All these colonies, with the exception of RMNH-Coel. 29049 (holotype) are paratypes.

Description (of holotype).— Hydrorhiza composed of intertwined mass of tubules; hydrocaulus polysiphonic with exception of apical zone, unbranched. Main tube of young colonies divided into internodes of varied length with little marked, straight nodes, carrying apophyses and cauline nematothecae. In older colonies this division only visible in ultimate part. Series of frontal nematothecae present below first apophysis; no prosegment visible. Each internode with one small apophysis distally and one axillary nematotheca; between two consecutive apophyses four to 12 frontal nematothecae. Cauline nematothecae with two apertures, one apical and slit-shaped, one circular basally facing the stem.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of succession of internodes with oblique nodes, each with one hydrotheca and three to four nematothecae: two lateral and one or two mesial inferior. Hydrotheca deep, adcauline wall fully adnate to internode, abcauline wall almost straight, slightly convex basally. Hydrothecal aperture circular, completely hidden by lateral nematothecae, with well developed median abcauline cusp. Mesial nematotheca on internode below base of hydrotheca, typically reaching hydrothecal base, with two apertures, one slit-shaped apically and one at base of adcauline wall. First hydrocladial internode typically with one mesial nematotheca, succeeding internodes with two, placed one above the other. Lateral nematothecae medially expanded, covering hydrothecal rim, with three to five apertures of which two or three at apex of chimney-shaped protuberance, biggest at adcauline side, with at base small aperture directed towards hydrotheca. Each internode with nine to 18 perisarc rings of varied disposition.

Phylactocarps paired, springing from hydrothecal bases of first two hydrocladial internodes, composed of four internodes maximally with slightly oblique nodes. Each internode with pair of opposite nematothecae and two septa: one in distal part, one apical. Nematothecae tubular, with two apertures: apical one slit-shaped, basal one

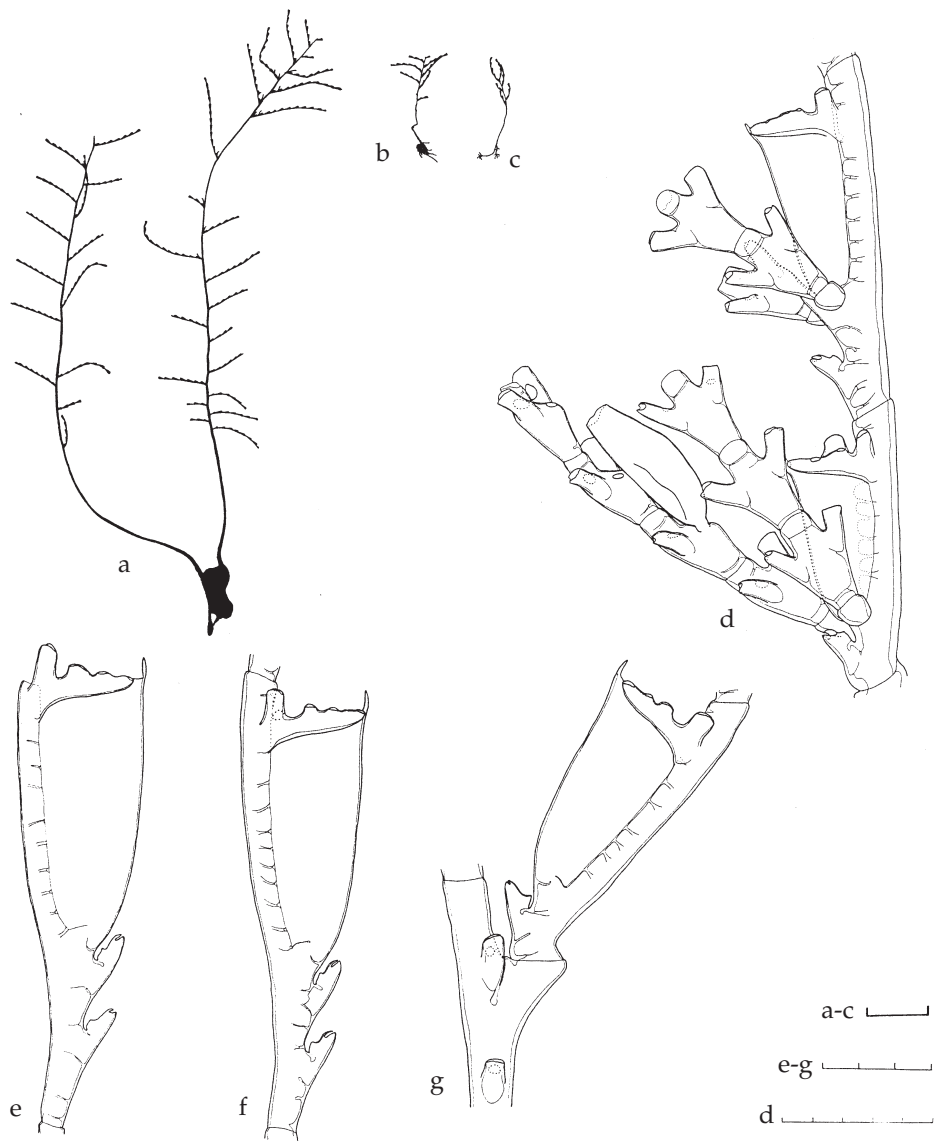


Fig. 58. *Streptocaulus caboverdensis* spec. nov. a, Stn 6.065, colony; b-c, Stn 6.080, colonies; d-g, Stn 6.065, d, hydrothecae and phylactocarps with gonothecae, lateral view; e, internode from distal part of hydrocladium, lateral view; f, internode from median part of hydrocladium, lateral view; g, axial apophysis with first internode of hydrocladium, lateral view. Scales: a-c, 1 cm; d, 0.5 mm; e-g, 0.3 mm.

circular, directed towards rachis. Gonothecae inserted on rachis, ovoid, big, apex truncate and with circular aperture,

Variability.— Development of lateral nematothecae much varied, covering nearly completely the hydrothecal rim (Stn 6.065, fig. 58f) or c. half of it (Stn 6.090, fig. 59e; Stn 7.139, fig. 60a). There are many intermediates between those extremes (Stn 6.020;

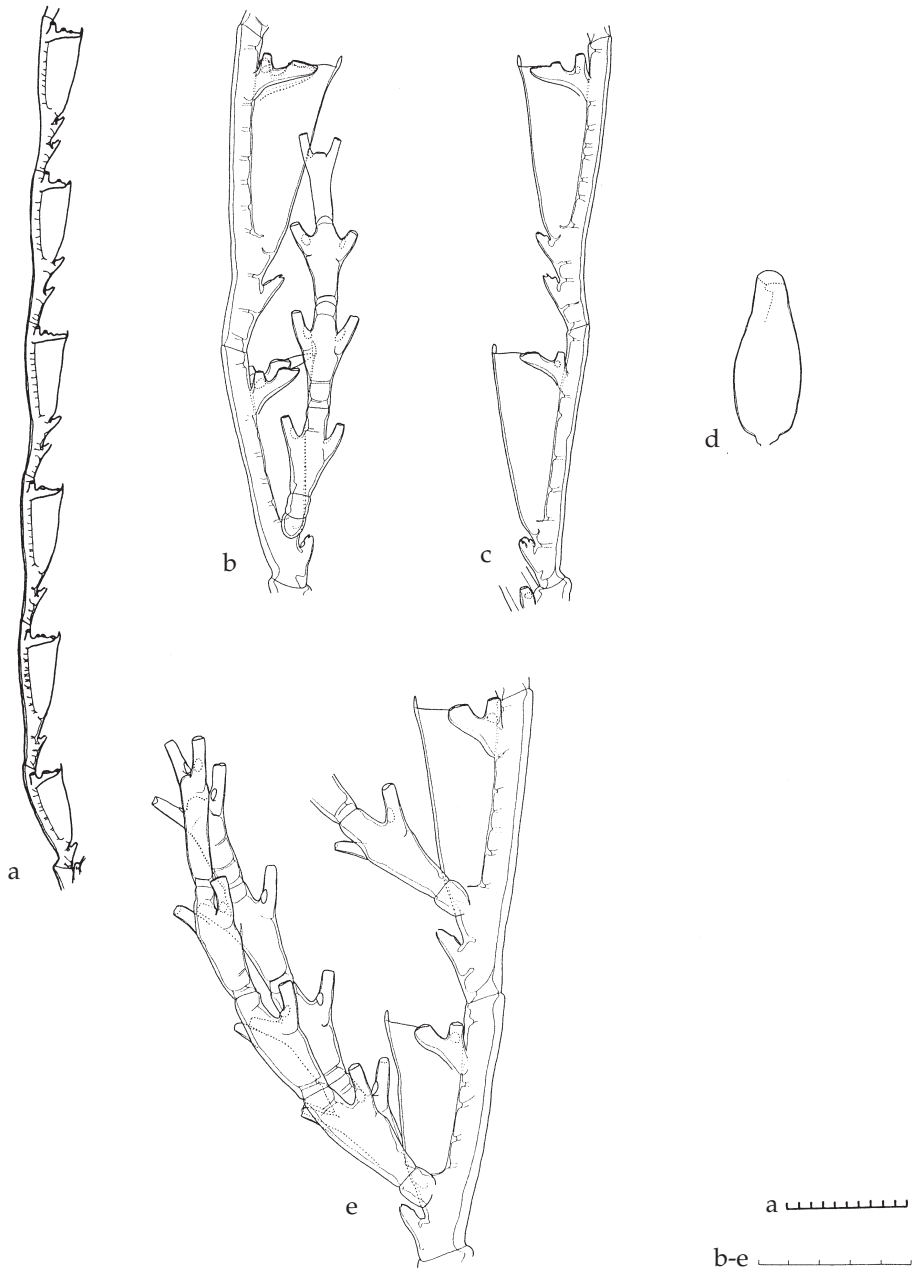


Fig. 59. *Streptocaulus caboverdensis* spec. nov. a, Stn 6.065, hydrocladium, lateral view; b-d, Stn 6.080, b, hydrothecae and phylactocarp, lateral view; c, two internodes from basal part of hydrocladium, lateral view; d, gonotheca, frontal view; e, Stn 6.090, hydrothecae and phylactocarps, lateral view. Scales: a, 1 mm; b-e, 0.5 mm.

Stn 6.080, fig. 59c). Some colonies have one mesial nematotheca in the first three hydrocladial internodes and two in the rest (Stn 6.065, fig. 59a), whereas in others nearly all internodes have only one (Stns 6.090 and 7.139). Some colonies from Stns 6.020, 6.080 and Stn 7.139 have a mesial nematotheca on the first hydrocladial internode with two apical apertures (fig. 59c). A colony from Stn 6.080 regenerated four mesial nematothecae after damage to the basal part of a hydrocladial internode. In a colony from Stn 6.065, finally, a hydrocladium has developed from the point of insertion of a phylactocarp at the base of the hydrotheca on the first hydrocladial internode.

Table XXVI. Measurements of *Streptocaulus caboverdensis* in µm:

	Stn 6.065	Stn 6.080	Stn 6.020	Stn 6.090	Stn 7.139
Height of colony (in mm)	51-128	4-87	26	142	60-150
Internode of hydrocaulus:					
Length	1450-3400	850-1200		1130-1370	2670-3250
Diameter at node	100-110	60-120		130-150	170-180
Cauline nematotheca:					
Length	150-170	100-120**		120-130**	120-150*
Diameter at rim	50-70	30-50**		20-40**	30-40*
Hydrocladial internode:					
Length	870-1350	780-1140	870	800-1160	780-1140
Diameter at node	70-140	60-85	80	80-120	70-170
Hydrotheca:					
Depth (without cusp)	590-740	510-660	510-590	510-770	530-780
Depth (with cusp)	640-800	560-705	550-640	550-820	550-830
Diameter at rim	240-300	240-290	250-280	240-310	250-290
Mesial nematotheca:					
Length	160-190*/140-160**	130-160*	130-145*	160-190*	160-180*
Diameter at rim	10-20*/70-80**	10-15*	10-15*	10-15*	10-15*
Phylactocarps:					
Length	980-1410	1140-1330		1180-1790	1440-2650
Gonotheca:					
Length	500-530	540-560		450-480	660-710
Maximum diameter	180-290	220		220	310-450

* Lateral view
** Frontal view

Discussion.— This species resembles *Cladocarpus alatus* Jarvis, 1922, in morphology of lateral nematothecae and their variability. In that species lateral nematothecae may also cover the hydrothecal rim and have several apertures; though occasionally covering only half that rim or being reduced and having only two apertures. The number of apertures in that species is distinctly related to development of the nematotheca.

Comparison of *Cladocarpus caboverdensis* with the description of *C. alatus* and our observations of a type slide from The Natural History Museum, London, shows differences in a number of characters that though small, in combination seem to be relevant:

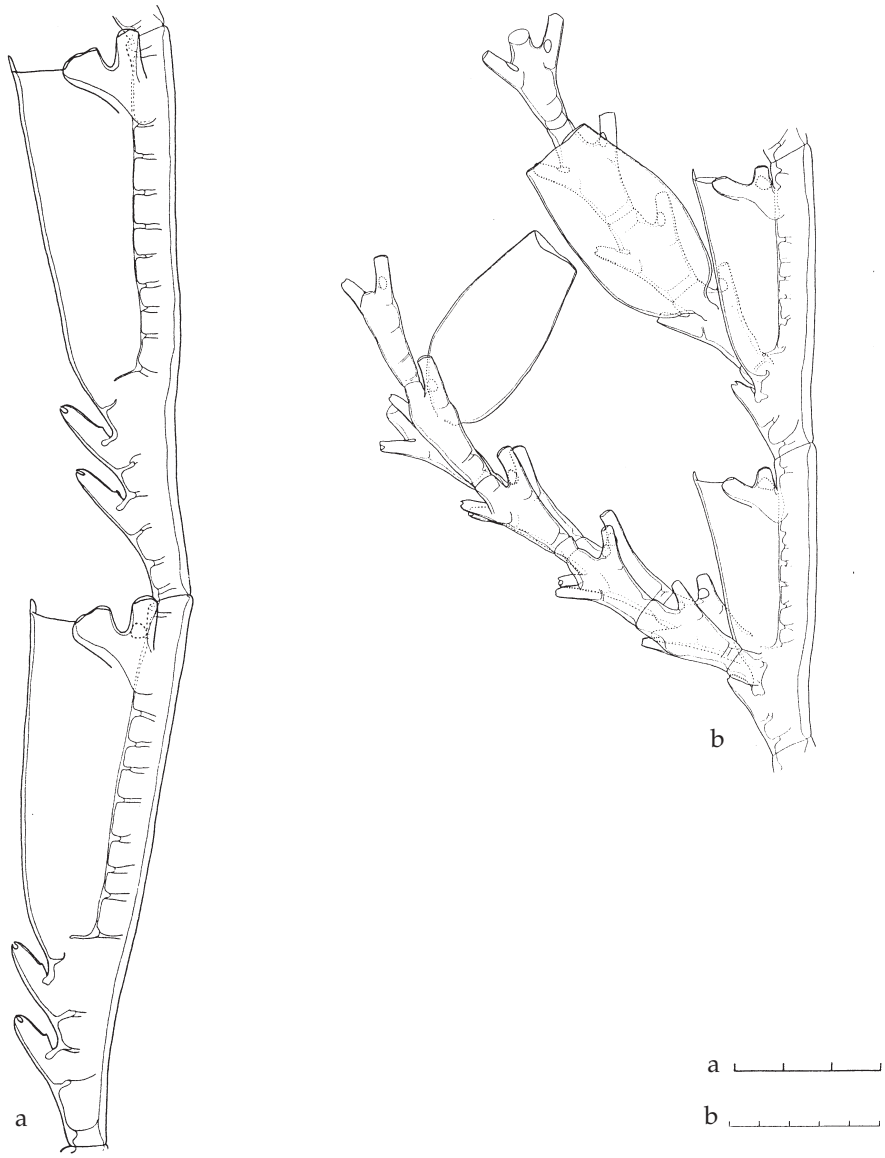


Fig. 60. *Streptocaulus caboverdensis* spec. nov., Stn 7.139. a, two internodes from distal part of hydrocladium, lateral view; b, hydrothecae and phylactocarps with gonothecae, lateral view. Scales: a, 0.3 mm; b, 0.5 mm.

Median abcauline cusp curved inward in *C. alatus*, straight in *Streptocaulus caboverdensis* spec. nov.

Hydrotheca in *C. alatus* of almost same diameter over its entire length, basal part straight; hydrotheca in *Streptocaulus caboverdensis* spec. nov. narrowing, basal part rounded.

C. alatus with short intrathecal septum, absent in *Streptocaulus caboverdensis* spec. nov.

Hydrocladial internode straight in *C. alatus*, curved in *Streptocaulus caboverdensis* spec. nov.

In *C. alatus* the hydrotheca covers more than two-thirds of the hydrocladial internode, leaving only a fraction uncovered below and above; in *Streptocaulus caboverdensis* spec. nov. it occupies slightly more than half of the internodal length (with the exceptions of colonies from Stns 6.090 and 7.139, where it occupies two-thirds).

In *C. alatus* there is always one mesial inferior nematotheca, but in *Streptocaulus caboverdensis* there may be two.

The size of *C. alatus* is much less than that of *Streptocaulus caboverdensis* spec. nov.

The gonosome could not be compared, that of *C. alatus* being unknown. Further more, *C. alatus* is only known from the Indian Ocean, whereas *Streptocaulus caboverdensis* spec. nov. originates from the Cape Verde Islands, making the species widely separated geographically.

Streptocaulus caboverdensis spec. nov. in morphology of hydrotheca and lateral nematothecae resembles material described by Stechow (1925b) as *Cladocarpus distomus* from the Indian Ocean coasts of South Africa; this material was re-described by Millard (1967, 1975). Ramil & Vervoort (1992a) consider this material to differ from *Cladocarpus distomus* Clarke, 1879, and proposed the name *Cladocarpus stechowi* for it; however, because of the structure of the phylactocarps it belongs in *Streptocaulus* where it should stand as *Streptocaulus stechowi* (Ramil & Vervoort, 1992).

Comparing *Streptocaulus caboverdensis* spec. nov. with descriptions and figures of *Cladocarpus distomus* by Stechow (1925b) and Millard (1967, 1975) [= *Streptocaulus stechowi* (Ramil & Vervoort, 1992)] the following differences are apparent:

The hydrotheca of *S. stechowi* is placed on the basal part of the hydrocladial internode; in *Streptocaulus caboverdensis* spec. nov. on the distal part.

The first, superior aperture of the lateral nematotheca in *S. stechowi* is inclined towards the posterior part of the internode; in *Streptocaulus caboverdensis* spec. nov. it is apical. Also, the superior apertures of the lateral nematothecae in *Streptocaulus caboverdensis* spec. nov. are placed on chimney-shaped protuberances, that are absent in *S. stechowi*.

In *S. stechowi* there is one suprahydrothecal nematotheca on the distal part of the internode; this has not been observed in *Streptocaulus caboverdensis* spec. nov.

The number of mesial inferior nematothecae is one in *S. stechowi* and one or two in *Streptocaulus caboverdensis* spec. nov.

The phylactocarps of *Streptocaulus caboverdensis* spec. nov. originate from the hydrothecal base of the first two hydrocladial internodes; in *S. stechowi* these may also occur above the first two hydrocladial internodes.

Considering the differences listed above we consider this material different from both *C. alatus* and *S. stechowi*, and describe it here as *Streptocaulus caboverdensis* spec. nov.

Reproduction.— Fertile phylactocarps are present in material collected in June and September.

Distribution.— Material of this species originates from five stations in the Cape

Verde Archipelago: one west of São Tiago, one east and one south-east of Boa Vista, one south of São Nicolau and one south of Branco and Razo. They were collected between 220 and 1040 m.

Etymology.— The specific name, *caboverdensis*, refers to the locality where this new species was obtained: the Cape Verde Archipelago.

Epibionts.— Stn 6.020: Foraminifera.— Stn 6.065: Foraminifera.— Stn 6.080: Foraminifera, Bryozoa.— Stn 6.090: Gastropod eggs.

Streptocaulus chonae spec. nov.
(fig. 57)

Cladocarpus spec.; Ramil & Vervoort, 1992a: 132, fig. 34b-f.

Material.— **Canary Islands and Selvagens Archipelago:** Stn 2.130: One colony with phylactocarps and one gonotheca (holotype) (RMNH-Coel. 29048, slide 4605).

Description (of holotype).— Hydrorhiza tubular, strongly branched and attached to sediment particles; hydrocaulus polysiphonic basally, unbranched, composed of primary tube and secondary tubules. Primary tube with basal portion provided with series of frontal nematothecae, terminating in prosegment with oblique nodes and one frontal nematotheca. Remainder of primary tube with internodes of varied length and oblique nodes, disappearing in distal part of colony. Each internode with one or two apophyses with axillary nematothecae and a series of frontal nematothecae, number between two consecutive apophyses one to 12, lowest in basal part of stem (typically three), increasing distally. Cauline nematothecae with two apertures: one apical and one in basal part adcauline wall.

Hydrocladia inserted on apophyses, alternately directed left or right, composed of hydrothecate internodes with oblique nodes, each with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca in median zone of internode, triangular, adcauline wall fully adnate; abcauline wall straight. Hydrothecal aperture slightly tilted upwards, rim smooth, with well developed median cusp. Mesial nematotheca on internode some distance below base of hydrotheca and not reaching that base; lateral nematothecae just reaching rim of hydrotheca. All nematothecae of internode with two apertures: one apical, one basal at adcauline wall. Internode with four to nine perisarc ring of varied development: one to three below, three to five behind and one above hydrotheca.

Phylactocarps unpaired, inserted at hydrothecal base, composed of two internodes with oblique nodes, each with opposite pair of small nematothecae and two or three septa: one or two basal and one distal. Nematothecae of first internode placed halfway; those of second placed apically, all with two apertures: one large and apical, one nearly circular at adcauline wall. Only gonotheca observed inserted on rachis between nematothecae of first internode, elongated, truncated at top and there with circular aperture slightly tilted towards rachis.

Variability.— After damage to and regeneration of the basal part of a hydrocladial internode the occurrence of two mesial inferior nematothecae has been observed.

Fig. 57. *Streptocaulus chonae* spec. nov., Stn 2.130. a, colony; b, hydrotheca and phylactocarp with one gonotheca, lateral view; c, three internodes from basal part of hydrocladium, lateral view. Scales: a, 1 cm; b, 0.5 mm; c, 0.3 mm.

Table XXVII. Measurements of *Streptocaulus chonae* in µm:

	Stn 2.130
Height of colony (in mm)	128
Cauline nematotheca, length	200-240
Diameter at rim	25
Hydrocladial internode, length	1410-1750
Diameter at node	130-180
Hydrotheca, depth without cusp	800-890
Idem, with cusp	860-960
Diameter at rim	490-550
Mesial nematotheca, length	180-200
Diameter at rim	14-25
Lateral nematotheca, length	170-210
Diameter at rim	20-50
Phylactocarp, length	1030-1680
Gonotheca, length	1300
Maximum diameter	450

Discussion.— This species greatly resembles *Cladocarpus* spec. described by Ramil & Vervoort (1992a). Comparison shows that the morphology of the trophosome is identical with the exception of small differences in size, that we think are taxonomically unimportant; they have consequently been merged and placed in *Streptocaulus* Allman, 1883, on account of the structure of the phylactocarp.

Reproduction.— A fertile phylactocarp is present in the CANCAP colony collected in September.

Distribution.— Known from one locality south-west of Cape San Vicente, collected at 1523 m depth (Ramil & Vervoort, 1992a, as *Cladocarpus* spec.).

The CANCAP material comes from one station in the Canary Islands region between 1500 and 1800 m depth.

Etymology.— The specific name has been chosen as a dedication to the first author's wife Chon, whom he married recently.

Family Halopteridídae Millard, 1962
Genus *Antennella* Allman, 1877
Antennella campanulaformis (Mulder & Trebilcock, 1909)
(figs 61-62)

Plumularia campanulaformis Mulder & Trebilcock, 1909: 31, pl. 1 figs 6, 9-10; 1911: 115; Stranks, 1993: 9.
Plumularia campanulaformis var. *dubia* Mulder & Trebilcock, 1911: 115, pl. 2 fig. 6; Stranks, 1993: 10.
Antennella campanulaformis; Bedot, 1917a: 125; 1921b: 4; Watson, 1973: 182, figs 43-44; 1975: 170; 1994a: 67; 1996: 78; Schuchert, 1997: 24, fig. 7a-g, tab. 5.
Antenella dubia; Stechow, 1923d: 222; 1925a: 244; Bouillon, Massin & Kresevic, 1995: 48.
?*Antenella siliquosa*; Stechow, 1925a: 245.
Halopteris diaphana; Millard & Bouillon, 1973: 82, fig. 10L-M [not *Halopteris diaphana* (Heller, 1868)].
?*Halopteris glutinosa*; García Corrales et al., 1978: 40, fig. 17; Izquierdo et al., 1986: 50, fig. 1 [not *Halopteris glutinosa* (Lamouroux, 1816)].
Antennella siliquosa; Peña Cantero, 1995: 297, pl. 34 figs a-e [not *Antennella siliquosa* (Hincks, 1877)].

Antennella siliquosa p.p. García Carrascosa, 1981: 255, pl. 23 figs c-e [not *Antennella siliquosa* (Hincks, 1877)].

Material.— **Canary Islands and Selvagens Archipelago**: Stn 2.D08: Three colonies, of which two on algae, one on *Aglaophenia kirchenpaueri* (Heller, 1868), without gonothecae (RMNH-Coel. 29081, two slides 4611).
Additional material: **Madeira**.— Porto Santo, 5-30 m, v. 1993: One colony on algae, with gonothecae.— Porto da Cruz, 28.v.1994: One colony on Ascidia, with gonothecae.

Description (of material from Stn 2.D08).— Monosiphonic, unbranched stems arising from ramified, tubular hydrorhiza. Basal zone with some internodes with transverse nodes, separated from rest of stem by oblique node; ultimate internode with one to three frontal nematothecae. Remainder of stem divided into hydrothecate and athecate internodes by well marked oblique and obscure straight nodes. Thecate internode with basal oblique and distal straight node, one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca cylindrical, adcauline wall free for half its length, angle with internode 30°-45°, straight or slightly concave; abcauline wall with thick perisarc, straight or slightly convex, slightly everted at rim. Hydrothecal rim smooth, circular, tilted downwards, slightly depressed laterally. Hydrothecal walls slightly widening, diameter increasing gradually towards rim. All nematothecae bithalamic; mesial inferior immovable or practically so, reaching base of hydrotheca; basal chamber small, distal chamber bigger, adcauline wall deeply scooped, occasionally as deep as base of chamber. Lateral nematothecae movable, placed on small apophysis on each side of hydrothecal axil, reaching middle of free part adcauline wall, both chambers of nearly same length; distal chamber deeply scooped on both sides, that on side near hydrotheca being deeper. Athecate internodes with one distal nematotheca similar to mesial nematotheca of hydrothecate internodes.

Gonothecae present in material from Porto Santo and Porto da Cruz, Madeira, inserting with short, two-jointed pedicel at hydrothecal base. Female gonotheca flattened, ovoid in outline, narrowing towards base, with oval terminal aperture closed by operculum, with two or three nematothecae near base. Male gonotheca smaller, ovoid, with small apical aperture closed by operculum and one basal nematotheca.

Variability.— The material shows a certain variability in the thickness of the abcauline hydrothecal wall. One colony has an athecate internode with two nematothecae resulting from repair after damage.

Table XXVIII. Measurements of *Antennella campanulaformis* in µm:

	Stn 2.D08
Height of colony (in mm)	3.45-4.55
Length hydrothecate internode	280-360
Length athecate internode	260-400
Diameter at node	45-70
Hydrotheca, length abcauline wall	150-210
Length free part adcauline wall	110-125
Diameter at rim	170-200

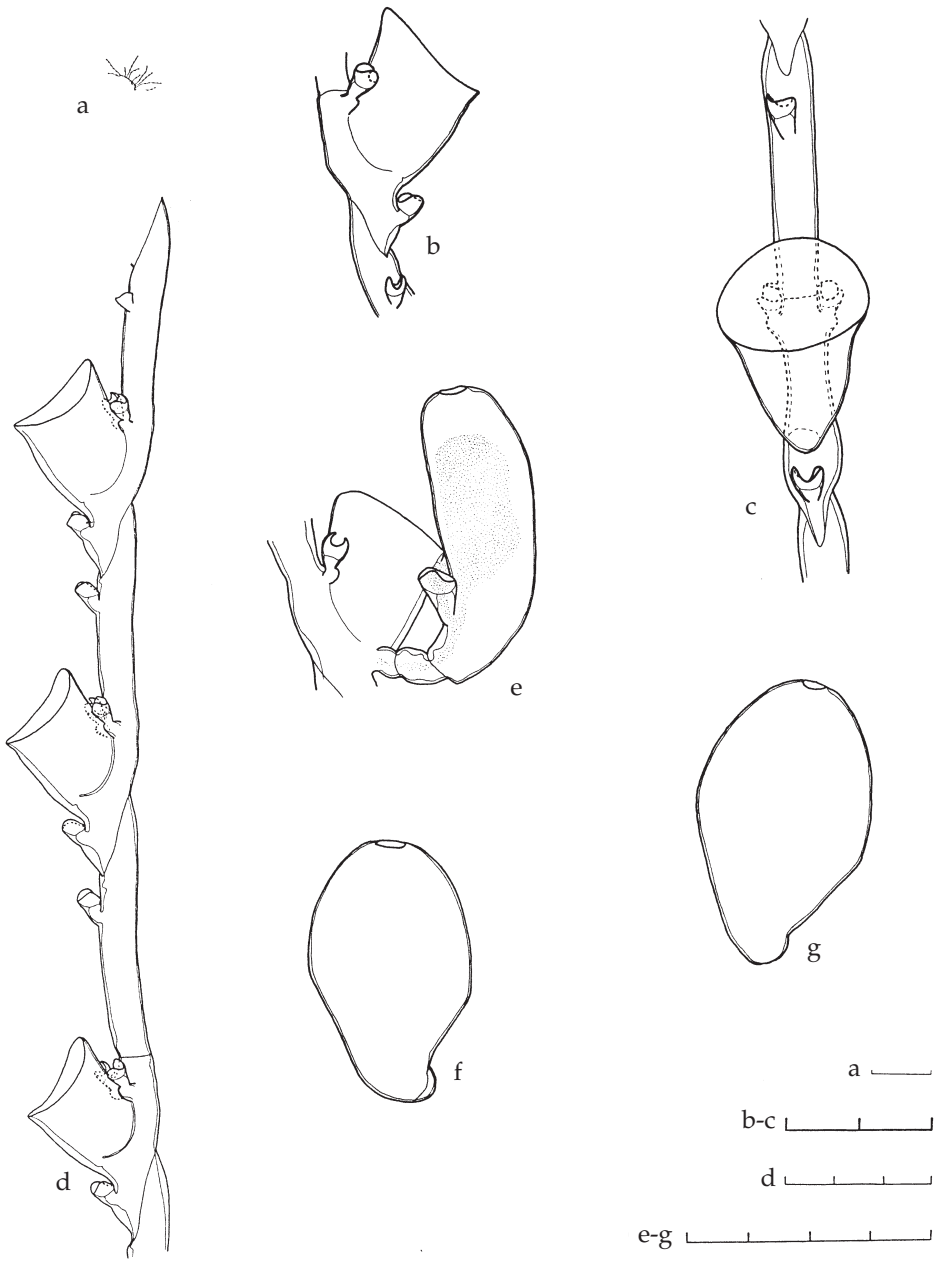


Fig. 61. *Antennella campanulaformis* (Mulder & Trebilcock, 1909). a-d, Stn 2.D08, a, colony; b, hydrotheca with thin abcauline wall, lateral view; c, hydrotheca, frontal view from above; d, internodes, lateral view; e-g, Madeira, Porto da Cruz, e, male gonotheca, lateral view; f, g, male gonothecae, frontal view. Scales: a, 1 cm; b-c, 0.2 mm; d, 0.3 mm, e-g, 0.4 mm.

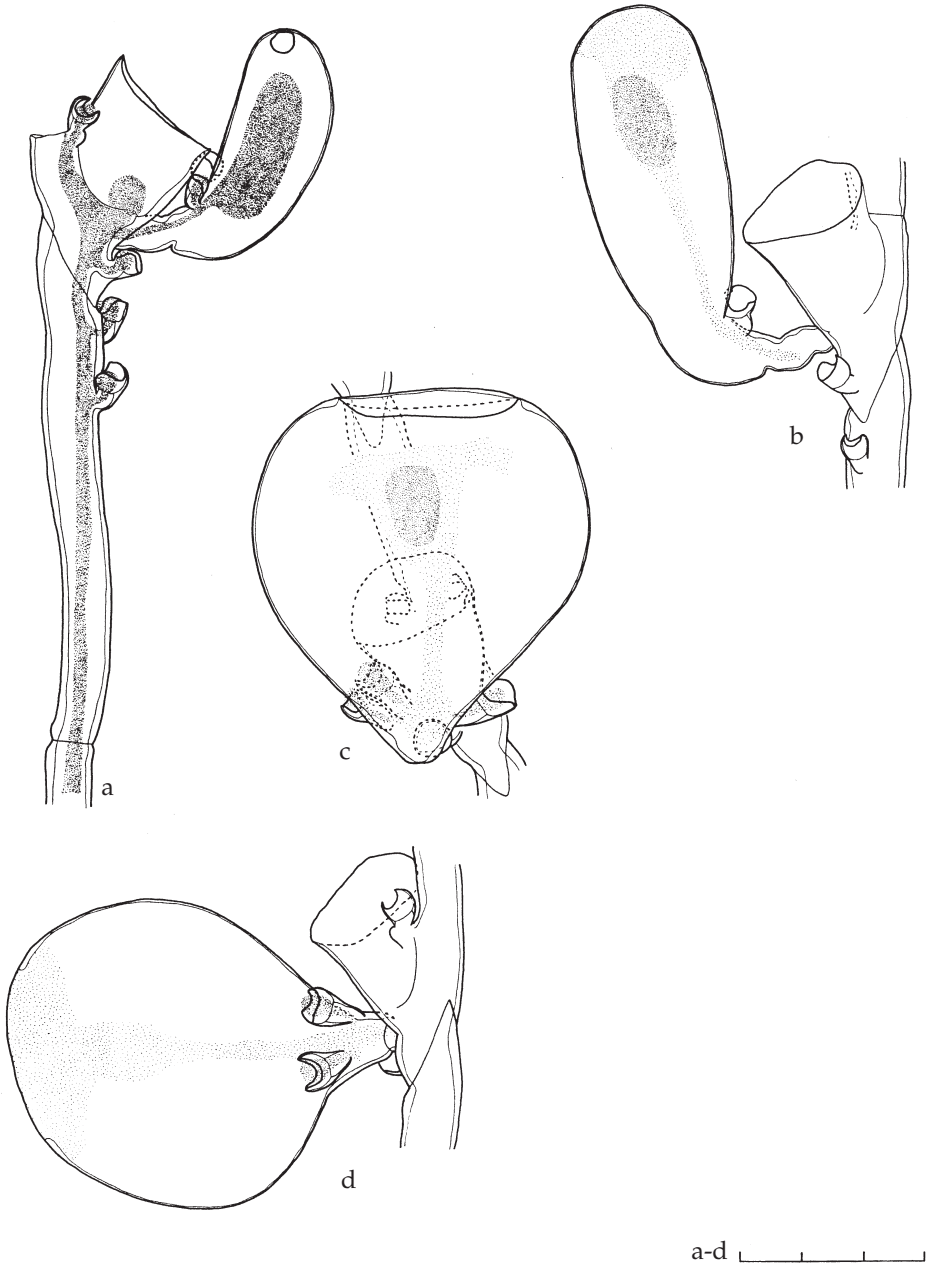


Fig. 62. *Antennella campanulaformis* (Mulder & Trebilcock, 1909). a-b, Madeira, Porto da Cruz. a, basal part of colony with male gonotheca, lateral view; b, female gonotheca, lateral view; c, Madeira, Porto Santo, female gonotheca, frontal view; d, Madeira, Porto da Cruz, female gonotheca, frontal view. Scales: a-d, 0.3 mm.

Discussion.— *Antennella campanulaformis* is characterised by the presence of a single nematotheca on the athecate internodes, by the lateral nematothecae being placed on a small apophysis and also by the morphology of the gonothecae, differing clearly from those of other species of the genus with which it has been confused. Thus, part of the material recorded by García Carrascosa (1981) as *Antennella siliquosa* (pl. 23 figs c-e) clearly belongs to *A. campanulaformis* (athecate internodes with one nematotheca, small lateral nematothecae, gonothecae characteristic of *A. campanulaformis*). Exactly the same details are visible in the material identified by Peña Cantero (1995) as *A. siliquosa*; it has also been included in *A. campanulaformis*.

The material identified as *Halopteris glutinosa* (Lamouroux, 1816) by García Corrales et al. (1978) from the Asturian littoral and by Izquierdo et al. (1986) from the Canary Islands does not belong to *H. glutinosa*, as there is no axillar nematotheca behind the adcauline wall of the hydrotheca (Schuchert, 1997). Judging from the characters of the trophosome it probably belongs to *A. campanulaformis*, although it had no gonothecae.

Medel & Vervoort (1995) included the record of García Corrales et al. (1978) of *Halopteris glutinosa* in *Antennella siliquosa* (Hincks, 1877), based exclusively on the length of the apophyses supporting the lateral nematothecae, a character they consider highly variable. As this material has one nematotheca on the athecate internodes whereas two is typical in *A. siliquosa*, it is here, doubtfully, included in *A. campanulaformis*.

Reproduction.— The CANCAP material was collected in September and was infertile, the additional material, with male and female gonothecae, was collected in May.

Distribution.— Schuchert (1997) indicated that *Antennella campanulaformis* is so far only known from southern Australia and the Seychelles, but its geographical distribution must be much wider. It may have been overlooked because of its small size (maximum height c. 10 mm) and confused with other species. It is now also known to occur in the Mediterranean along the southern coast of Spain (García Carrascosa, 1981, as *Antennella siliquosa*) and at the Chafarinas Islands (Peña Cantero, 1995, as *A. siliquosa*). In the Indian Ocean it has been collected at the Seychelles (Millard & Bouillon, 1973, as *Halopteris diaphana*; Schuchert, 1997) and along the coast of western Australia (Stechow, 1925a; Bouillon, Massin & Kresevic, 1995, as *Antenella dubia*; Watson, 1996). In the Pacific it was recorded from Tasmania (Watson, 1975) and from various localities in south-eastern Australia (Mulder & Trebilcock, 1909, as *Plumularia campanulaformis*, 1911; Watson, 1973, 1994a; Schuchert, 1997). Doubtful records are from the littoral of Asturias, northern Spain (García Corrales et al., 1978, as *Halopteris glutinosa*) and from the Canary Islands (Izquierdo et al., 1986, as *H. glutinosa*, now confirmed by the CANCAP record). Schuchert (in lit.) found the species at Mallorca.

The bathymetrical distribution extends from 1 (Peña Cantero, 1995) to 45 m (Watson, 1973).

Our material comes from a single CANCAP station at the Canary Islands and was collected between 5 and 25 m depth. The additional material originates from Madeira.

Antennella secundaria (Gmelin, 1791)
(fig. 63)

Sertularia secundaria Gmelin, 1791: 3856.

Plumularia secundaria; Kirchenpauer, 1876: 28, pl. 1 fig. 18, pl. 6 fig. 7; Carus, 1884: 18; Marktanner-Turneretscher, 1890: 252, pl. 6 fig. 1; Pictet & Bedot, 1900: 27, pl. 6 fig. 7; Billard, 1906b: 207; Bedot, 1911: 222; Teissier, 1923a: 355; Blackburn, 1938: 316.

Antennella gracilis Allman, 1877: 38, pl. 22 figs 6-7; Nutting, 1900: 77, pl. 13 fig. 5; Stechow, 1909: 85.

Antennella natalensis Warren, 1908: 318, fig. 14A-C.

Antennella secundaria; Stechow, 1909: 84; Billard, 1913: 8, fig. 1, pl. 1 figs 1-3; Bedot, 1917a: 124; Neppi, 1917: 54; Jäderholm, 1919: 20; Stechow, 1919c: 111; Bedot, 1921b: 5; 1921c: 9; Neppi, 1921: 25; Billard, 1927c: 342; Marine Biological Association, 1931: 76; Leloup, 1940b: 21; Fraser, 1944a: 317, pl. 66 fig. 302a-d; Teissier, 1950b: 22; Picard, 1951e: 278; Deevey, 1954: 271; Marine Biological Association, 1957: 49; Millard, 1958: 199; Pennycuik, 1959: 176, pl. 3 figs 4-5; Millard, 1962: 274; Mammen, 1965: 296, fig. 93; Rees & Thursfield, 1965: 158; Teissier, 1965: 27; Van Gemerden-Hoogeveen, 1965: 54, figs 29-31; Von Schenck, 1965: 895, 926, fig. 2b; Rees & White, 1966: 279; Redier, 1967a: 402; Rho, 1967: 345, fig. 5A-B; Cabioch, 1968: 565, 589; Millard, 1968: 254, 273; Vervoort, 1968: 107; Fey, 1969: 402; Hirohito, 1969: 24; Castric-Fey, 1970: 18; Clausade, 1970: 727; Schmidt, 1972b: 41; Castric-Fey, 1973: 214; Millard, 1973: 30; Millard & Bouillon, 1973: 77, fig. 10E; Morris & Mogelberg, 1973: 19, fig. 25a-b; Hirohito, 1974: 28, fig. 12; Michel, 1974: 210; Millard & Bouillon, 1974: 8; Rho & Chang, 1974: 146; Millard, 1975: 332, fig. 107F-L; Vervoort & Vasseur, 1977: 64, fig. 28; Gravier-Bonnet, 1979: 56, fig. 11A-B; Millard, 1979b: 132; Boero, 1981a: 182, 192; 1981c: 197; García-Carrascosa, 1981: 250, pl. 23 figs f-k, pl. 40 figs c-e; Flórez González, 1983: 120, photograph 33; Hirohito, 1983: 58; Boero, 1985a: 136; Boero et al., 1985: 29; Gili & García-Rubies, 1985: 46, fig. 5J; Templado et al., 1986: 98; Bandel & Wedler, 1987: 65; Boero & Fresi, 1986: 145; Roca, 1986: 379, fig. 65; García-Carrascosa et al., 1987: 372; García Rubies, 1987: 146, 149, 151, 153; Rees & Vervoort, 1987: 113, fig. 23a-b; Roca & Moreno, 1987a: 30, figs 29, 54; Ramil, 1988: 391; Gili, Murillo & Ros, 1989: 23; Gili, Vervoort & Pagès, 1989: 83, fig. 11A; Altuna & García Carrascosa, 1990: 85, fig. 81; Cornelius & Ryland, 1990: 152, fig. 4.21; Park, 1990: 84; Calder, 1991b: 223; 1991c: 2068; Cairns et al., 1991: 27; Castric-Fey & Chassé, 1991: 523; Gili & Ballesteros, 1991: 247; Ryland & Gibbons, 1991: 525, fig. 1; Antsulevich, 1992: 215; Cornelius, 1992a: 257; 1992b: 82; García Rubies, 1992: 265; Ramil & Vervoort, 1992a: 143, fig. 37a-d; Álvarez Claudio, 1993: 239, fig. 41A-D; Boero & Bouillon, 1993a: 263; Calder, 1993b: 68; Altuna Prados, 1994a: 236; 1995a: 54; Álvarez Claudio, 1995: 15; Álvarez-Claudio & Anadón, 1995: 239; Medel & Vervoort, 1995: 35, fig. 14a-d; Peña Cantero, 1995: 291, pl. 33 figs a-d; Medel & López-González, 1996: 201; Watson, 1996: 78; Schuchert, 1997: 14, figs 3a-g, 4a-e, tab. 1; Ramil, Vervoort & Ansín, 1998: 31.

Antenella secundaria; Ritchie, 1910a: 14; 1910b: 822; Billard, 1912a: 467; Broch, 1912a: 26, fig. 6; Ritchie, 1912: 219, 223; Broch, 1913: 4, fig. 2; Ritchie, 1913a: 4; Bedot, 1914a: 82, pl. 5 figs 1, 7, 8; 1914b: 120; Ritchie, 1914: 260; Jarvis, 1922: 349; Stechow, 1923b: 17; 1923d: 222; Stechow & Müller, 1923: 473; Prenant & Teissier, 1924: 25; Broch, 1933b: 19, fig. 7; Leloup, 1934c: 15; 1935c: 53; 1937b: 5, 45; 1938b: 18, fig. 13a-b; Fraser, 1944b: 40; Buchanan, 1957: 367, fig. 23; Riedl, 1959: 653; Yamada, 1959: 77; Cabioch, 1965: 55, 57; Gravier, 1970: 116; Patriti, 1970: 57, fig. 81A-B; Schmidt, 1973a: 283; Gili & Ros, 1985: 329; Gili, Ros & Pagès, 1987: 92; Bouillon, Massin & Kresevic, 1995: 48.

Plumularia dubiaformis Mulder & Trebilcock, 1911: 119, pl. 2 fig. 7; Vervoort & Vasseur, 1977: 68.

Antenella (*Plumularia*) *secundaria*; Ritchie, 1913a: 4.

Antennella dubiaformis; Bedot, 1917a: 124.

Antennella paucinoda; Fraser, 1935a: 110, pl. 2 fig. 10 (not *Plumularia paucinoda* Nutting, 1905).

Schizotricha secundaria; Blackburn, 1942: 108.

Polyplumaria secundaria; Picard, 1951f: 261; 1952a: 349; 1955b: 189; 1958b: 192; Costa, 1960: 47; Marinopoulos, 1979b: 120; 1981: 176.

Not *Antennella secundaria*; Vervoort, 1967: 42, fig. 12a-e [= *Halopteris polymorpha* (Billard, 1913)].

Antennella secundaria f. *dubiaformis*; Watson, 1973: 183, figs 45-46.

Halopteris catharina; García Corrales et al., 1978: 47, fig. 20A-C; Estrada, 1979: 79, fig. 15; 1980: 9; Gili i Sardà, 1982: 80, fig. 38B; Urgorri & Besteiro, 1983: 16, 18, 20, 25; Gili, García & Colomer, 1984: 414; Gili & Castelló, 1985: 19, fig. 6D; Gili & García Rubies, 1985: 46, fig. 5H-I; Gili, 1986: 158, figs 4.30a, 4.56f; Izquierdo et al., 1986: 52, fig. 3 [not *Halopteris catharina* (Johnston, 1833)].
Not *Antenella secundaria*; Gili i Sardà, 1982: 79, fig. 38A.
Not *Antennella secundaria*; Gili, 1986: 156, figs 4.30b, 4.57f.
Antennella secundaria p.p. Cornelius, 1995: 121, fig. 28A-C, E-G.

Material.— **Azores area:** Stn 5.096: One damaged colony, without gonothecae [RMNH-Coel. 29084 = slide 4622; RMNH-Coel. 29088 = slide 4630, with *Halopteris catharina* (Johnston, 1833)].— Stn 5.142: Four colonies without gonothecae and one colony on *Nemertesia ramosa* (Lamarck, 1816), with gonothecae (RMNH-Coel. 28698).— Stn 5.D02: One colony with gonothecae (RMNH-Coel. 28719, slide 4623).— **Atlantic coast of Morocco and Mauritania:** Stn MAU 038: One colony on sponge with gonothecae (RMNH-Coel. 29087 = slide 4628).— Stn MAU 072: Two colonies, without gonothecae, on *Nemertesia antennina* (Linnaeus, 1758) (RMNH-Coel. 28913, slide 4629).— **Madeira area:** Stn 1.098: Two colonies on *Lytocarpia myriophyllum* (L., 1758), without gonothecae (RMNH-Coel. 28629, slide 4612).— Stn 1.102: One colony on *Lytocarpia myriophyllum* (L., 1758), with gonothecae (RMNH-Coel. 28630).— Stn 1.114: One colony without gonothecae (RMNH-Coel. 28634, slide 4613).— Stn 3.010: One colony on *Sertularella* spec., with damaged gonotheca (RMNH-Coel. 29082 = slide 4614).— Stn 3.056: One damaged colony on *Lytocarpia myriophyllum* (L., 1758), without gonothecae (RMNH-Coel. 29083 = slide 4615).— **Canary Islands and Selvagens Archipelago:** Stn 3.083: Two colonies, one with gonothecae (RMNH-Coel. 28700, slide 4616).— Stn 3.086: Two colonies on *Lytocarpia myriophyllum*. (L., 1758) (RMNH-Coel. 28639, slide 4617).— Stn 4.138: One colony on hydrorhiza of *Nemertesia ramosa* (Lamarck, 1816), no gonothecae (RMNH-Coel. 28693, slide 4618).— Stn 4.143: One colony with gonothecae on *Aglaophenia tubulifera*. (Hincks, 1861) (RMNH-Coel. 28576).— Stn 4.144: One colony with damaged gonothecae (RMNH-Coel. 28570, slide 4619).— Stn 4.148: One colony, no gonothecae (RMNH-Coel. 28601, 28666, slide 4620).— Stn 4.151: Three colonies, without gonothecae, on *Aglaophenia tubulifera* (Hincks, 1861) (RMNH-Coel. 28789).— Stn 4.152: Four colonies, one with gonothecae (RMNH-Coel. 28657, slide 4621).— Stn 4.153: Six colonies, one with gonothecae (RMNH-Coel. 28574, 28608).— Stn 4.V08: Five colonies, with gonothecae (RMNH-Coel. 28797, 28798, slide 2408).— **Cape Verde Islands:** Stn 6.048: Eight fragments, some with damaged gonothecae (RMNH-Coel. 29085 = slide 4624).— Stn 6.078: One damaged colony, no gonothecae (RMNH-Coel. 28677, slide 4625).— 6.139: One colony on *Streptocaulus pulcherrimus* Allman, 1883, no gonothecae (RMNH-Coel. 28750, slide 4626).— Stn 7.081: One colony on *Streptocaulus pulcherrimus* Allman, 1883, without gonothecae (RMNH-Coel. 29086 = slide 4627).

Description (of material from Stn MAU 038).— Hydrorhiza tubular, branched; hydrocauli monosiphonic, unbranched. Stem with basal zone of two or three internodes with straight nodes, each with two to six frontal nematothecae, separated from rest of stem by oblique node. Remainder of stem formed by succession of hydrothecate and athecate internodes, alternately separated by oblique and straight nodes; hydrothecate internodes with oblique node basally and straight node distally; athecate internodes with straight node basally and oblique node distally. Hydrothecate internodes with one hydrotheca and four nematothecae: one mesial inferior, two lateral and one reduced in axil of free part adcauline wall of hydrotheca. Hydrotheca cylindrical, walls slightly diverging, adcauline wall adnate for c. half its length; abcauline wall straight or slightly convex; hydrothecal margin circular, slightly deepened laterally; rim smooth. Mesial nematotheca not reaching hydrothecal base, adcauline wall deeply scooped. Lateral nematothecae placed on well developed apophyses, one on each side of hydrotheca, not reaching hydrothecal rim, wall of

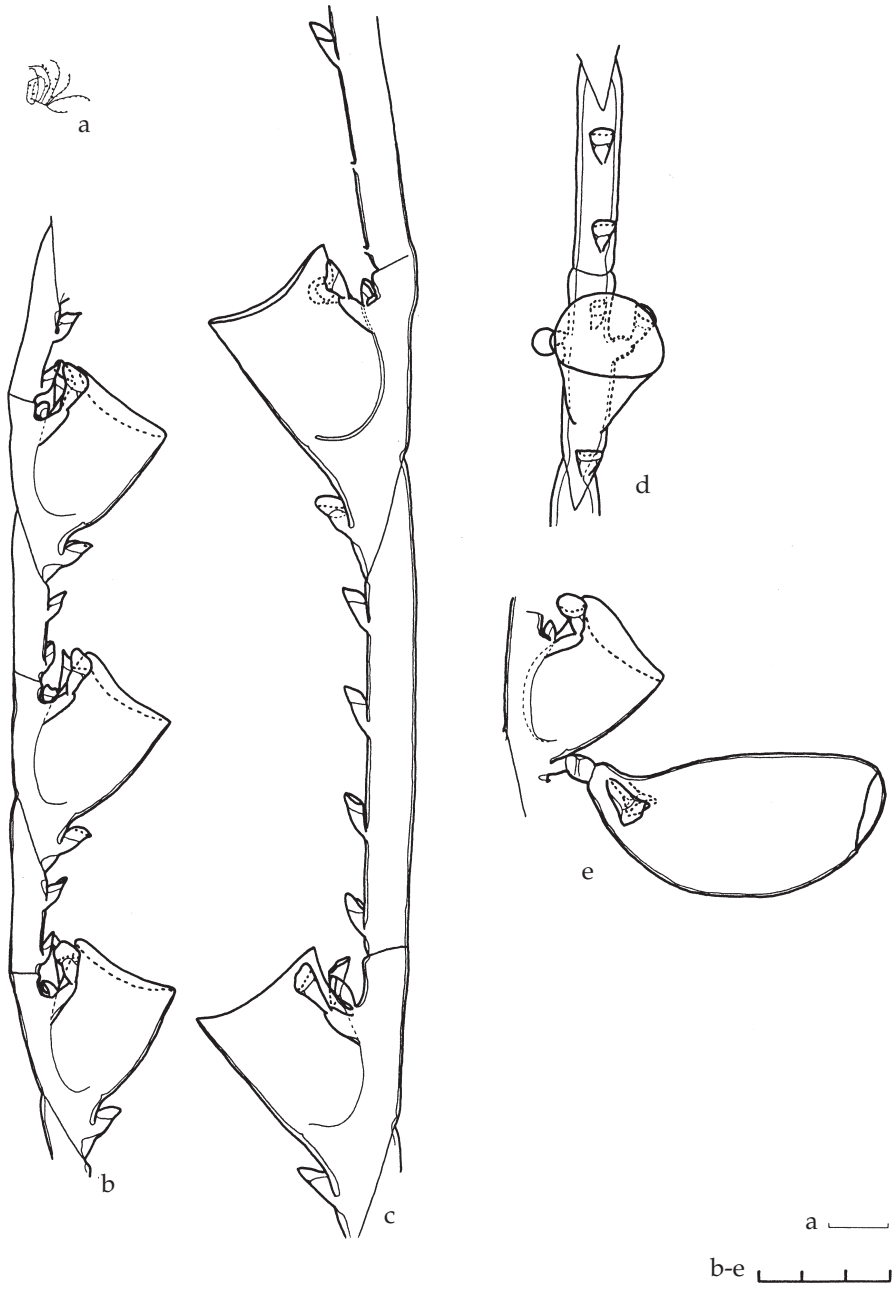


Fig. 63. *Antennella secundaria* (Gmelin, 1791). a, Stn 5.D02, colony; b, Stn MAU 038, internodes, lateral view; c, Stn 6.048, big internodes, lateral view; d-e, Stn MAU 038, d, internodes, frontal view; e, gonotheca, lateral view. Scales: a, 1 cm; b-e, 0.3 mm.

upper chamber facing hydrotheca deeply scooped. Axillar nematotheca small. Athecate internodes with two normally developed nematothecae. All nematothecae bithalamic and movable.

Gonothecae inserted below hydrotheca on short, two-segmented pedicel, pear-shaped, with pair of proximal nematothecae; apex with distal, circular aperture closed by operculum.

Variability.— Number of nematothecae on athecate internodes varies between two and three, occasionally four nematothecae have been observed, always as result of regeneration. Number of nematothecae on internodes of basal part of stem typically between two and four, occasionally as many as seven have been observed. Material from Stn 4.144 had nematothecae on the hydrorhiza. Colonies from Stn 6.048 are of large size and have three or four nematothecae per athecate internode, this material corresponds in size with samples four and five described by Schuchtert (1997) but do not exceed the size limits known for this species.

Table XXIX. Measurements of *Antennella secundaria* in µm:

	Stn MAU 038
Maximum height of colony (in mm)	15
Length hydrothecate internode	320-550
Length athecate internode	210-470
Diameter at node	60-110
Hydrotheca, length abcauline wall	260-300
Length free part adcauline wall	120-150
Diameter at rim	250-280
Gonotheca, length	620-670
Maximum diameter	310-350

Discussion.— Schuchert (1997), after revision of the holotype of *Antennella gracilis* Allman, 1877, could confirm the opinion previously expressed by Stechow (1919a), Cornelius (1995) and Calder (1997) that this species is conspecific with *A. secundaria*. Schuchert (1997) also discussed *Antennella avalonia* Torrey, 1902, but concluded that without inspection of the holotype a definite conclusion on the status of that species could not be reached and he kept both separate. Mulder & Trebilcock (1911) indicated, in the description of *Plumularia dubiaformis*, the presence of an axillar nematotheca but owing to accumulation of dirt could not confirm their presence; in other colonies of this species there appeared to be no axillar nematotheca. Billard (1913) thought *P. dubiaformis* to be conspecific with *A. secundaria* and Bedot (1917a) considered both conspecific since Bale confirmed the presence of an axillar nematotheca in *P. dubiaformis* and saw no difference in the structure of the lateral nematothecae. Watson (1973), in material from Pearson Island, South Australia, and after comparison with Mulder & Trebilcock's (1911) material, found two nematothecae on the athecate internodes and separated the Australian material as *A. secundaria* f. *dubiaformis*. Vervoort & Vasseur (1977) and Schuchert (1997) saw no reason for distinction of this variety and sunk it into the nominal species, a conclusion we have also accepted here. Records of *Halopteris catharina* by García Corrales et al. (1978), Estrada (1979, 1980),

Gili (1982, 1986), Urgorri & Besteiro (1983), Gili, García & Colomer (1984), Gili & Castelló (1985), Gili & García Rubies (1985) and Izquierdo et al. (1986) were relegated to *A. secundaria* by Ramil (1988) and Ramil & Vervoort (1992a) (see discussion of *H. catharina*). Cornelius (1995) included *Antennella siliquosa* (Hincks, 1877) in the synonymy of *A. secundaria*; this species, in our opinion, is clearly different in the shape of the lateral nematothecae, the absence an axillar nematotheca and the shape of the female gonothecae.

Reproduction.— Presence of gonothecae was mentioned by Marine Biological Association (1931), Teissier (1965), Millard (1968), Fey (1969), Gravier (1970), Vervoort & Vasseur (1977), Gravier-Bonnet (1979), Boero & Fresi (1986), Ramil & Vervoort (1992a), Álvarez Claudio (1993), Medel & Vervoort (1995) and Ramil, Vervoort & Ansín (1998); they occurred in all months with the exception of January and December. Fertile CANCAP material was collected in March, May, June and October.

Distribution.— Many authors consider *Antennella secundaria* a cosmopolitan species (Rees & Thursfield, 1965; Millard, 1975; Roca, 1986; Ryland & Gibbons, 1991; Boero & Bouillon, 1993a), with a preference for warm and temperate waters (Gili, Vervoort & Pagès, 1989; Schuchert, 1997). In the eastern Atlantic it has been recorded from the North Sea (Ritchie, 1912, 1913a), the British Isles (Hincks, 1868; Ritchie, 1914; Marine Biological Association, 1931, 1957; Cornelius & Ryland, 1990; Cornelius, 1995), from the English Channel (Ritchie, 1914; Cabioch, 1968), from numerous localities along the French coast near Roscoff (Bedot, 1911, as *Plumularia secundaria*; Billard, 1912a; Bedot, 1914a; Prenant & Teissier, 1924; Teissier, 1950b; Cabioch, 1965; Teissier, 1965; Castric-Fey & Chassé, 1991; Schuchert, 1997), the Glénan Archipelago (Fey, 1969; Castric-Fey, 1970), near Belle-Île (Pictet & Bedot, 1900; Billard, 1906b, both as *Plumularia secundaria*, 1927a), Île d'Yeu (Castric-Fey, 1973), Bay of Biscay (Schuchert, 1997), north and north-west coasts of Spain (Billard, 1906b, as *Plumularia secundaria*; Estrada, 1979, 1980; Urgorri & Besteiro, 1983, all as *H. catharina*; Ramil, 1988; Altuna & García Carrascosa, 1990; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez-Claudio & Anadón, 1995; Schuchert, 1997), Azores (Billard, 1906b, as *Plumularia secundaria*; Bedot, 1921c; Leloup, 1940b; Rees & White, 1966a; Cornelius, 1992b; Schuchert, 1997), Gorringe and Ampère Banks (Ramil, Vervoort & Ansín, 1998), Gulf of Cádiz (Billard, 1906b, as *Plumularia secundaria*; Broch, 1913; Ramil & Vervoort, 1992a), Madeira (Stechow, 1919a), a locality between Madeira and the coast of Morocco (Leloup, 1940b), littoral of Morocco (Billard, 1906b, as *Plumularia secundaria*; Patriti, 1970), Western Sahara (Broch, 1913), near the Cape Verde Islands (Leloup, 1940b), Guinea Bissau (Gili, Vervoort & Pagès, 1989), Ghana (Buchanan, 1957), and South Africa (Millard 1962, 1975). From the western part of the Atlantic it has been recorded at the Bermudas (Morris & Mogelberg, 1983; Calder, 1993b, 1997), Florida (Allman, 1877, as *Antennella gracilis*; Schuchert, 1997), Gulf of Mexico (Deevey, 1954), Dry Tortuga Island (Leloup, 1935c; Deevey, 1954), Havana, Cuba (Nutting, 1900, as *A. gracilis*), from Belice (Calder, 1991b, 1991c), the coast of Colombia (Flórez González, 1983; Bandel & Wedler, 1987), Curaçao (Leloup, 1935c; Van Gemerden-Hoogeveen, 1965), Bonaire (Leloup, 1935c; Fraser, 1944a), and Tortugas (Van Gemerden-Hoogeveen, 1965).

In the Mediterranean it is cited from the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), the Alborán Sea (Templado et al., 1986; Ramil & Ver-

voort, 1992a), Chafarinas Islands (Peña Cantero, 1995), numerous localities in the Spanish littoral (García Corrales et al., 1978, as *H. catharina*; García Carrascosa, 1981; García Carrascosa et al., 1987; Gili, Murillo & Ros, 1989; Gili, Ros & Pagès, 1989; Gili & Ballesteros, 1991; García Rubies, 1992), Balearic Islands (Gili & García Rubies, 1985, as *H. catharina*; Roca, 1986; Roca & Moreno, 1987), the French coast (Stechow, 1919a; Leloup, 1934c; Picard, 1951e, 1951f, 1952d; Costa, 1960, all as *Polyplumaria secundaria*; Clausade, 1970), Algeria (Picard, 1955b, as *Polyplumaria secundaria*), the Italian littoral (Carus, 1884, as *Plumularia secundaria*; Neppi, 1917, 1920; Stechow, 1923d; Riedl, 1959; Boero, 1981a, 1981c, 1985a; Boero & Fresi, 1986), and the Adriatic (Kirchenpauer, 1876; Carus, 1884; Marktanner-Turneretscher, 1890; Pictet & Bedot, 1900, all as *Plumularia secundaria*; Broch, 1912a, 1933b). Also recorded from the Red Sea (Schmidt, 1972a).

In the Indian Ocean it is known from South Africa (Warren, 1908, as *Antennella natalensis*; Millard, 1962, 1968, 1975, 1979b), from Mozambique (Millard, 1958, 1968; Millard & Bouillon, 1974), from Tanzania (Rees & Vervoort, 1987), from Madagascar (Gravier, 1970; Gravier-Bonnet, 1979), from Mauritius Island (Michel, 1974), from Cargados Island (Jarvis, 1922), from the Seychelles (Millard & Bouillon, 1974; Schuchert, 1997), from the South coast of India (Mammen, 1965), from Ceylon (Ritchie, 1913a), the Andaman Islands (Ritchie, 1910a, 1913a), and from the Mergui Archipelago (Ritchie, 1910b, 1913a; Rees & Thursfield, 1965).

Pacific records are from Indochina (Leloup, 1937b), Borneo (Billard, 1913), the Moluccas (Pictet & Bedot, 1900, as *Plumularia secundaria*; Billard, 1913; Stechow, 1919a; Schuchert, 1997), the Aru Islands (Stechow & Müller 1923), from Polynesia (Stechow, 1919a; Vervoort & Vasseur, 1977), the Korean coast (Rho, 1967; Rho & Chang, 1974; Park, 1990), numerous localities in the Japanese littoral (Stechow, 1909; Jäderholm, 1919a; Stechow, 1923b; Leloup 1938b; Yamada, 1959; Rees & Thursfield, 1965; Hirohito, 1969, 1974, 1983), the Kurile Islands (Antsulevich, 1992), the south and east coasts of Australia (Mulder & Trebilcock, 1911, as *Plumularia dubiaformis*; Blackburn, 1942, as *Schizotricha secundaria*; Pennycuik, 1959; Watson, 1973, as *A. secundaria* f. *dubiaformis*) and from the Fiji Islands (Ryland & Gibbons, 1991).

The bathymetrical range extends from 0 (Millard, 1975) to 1250 m (Leloup, 1940).

The CANCAP material originates from 24 stations of which three near the Azores, three in the Selvagens Archipelago, five from Madeira, seven from the Canary Islands, four from the Cape Verde Archipelago and two from the coasts of Mauritania. The depth range at those localities was between 15 and 1000 m.

Epibionts.— Stn 4.153: Sponge, *Filellum serratum* (Clarke, 1879), bivalve, Bryozoa.— Stn 6.048: Foraminifera.— Stn 7.081: Foraminifera.— Stn MAU 038: *Modeeria rotunda* (Quoy & Gaimard, 1827).

Antennella siliquosa (Hincks, 1877)
(fig. 64)

Plumularia siliquosa Hincks, 1877: 148, pl. 12 figs 2-6; Billard, 1906b: 208.

Antenella siliquosa; Billard, 1912a: 468; Ritchie, 1914: 261; Stechow, 1923d: 222; Prenant & Teissier, 1924: 25; ?Stechow, 1925a: 245; Riedl, 1959: 254; Patriti, 1970: 58, fig. 82A-B; ?Bouillon, Massin & Kresevic, 1995: 49.

Antennella simplex; Bedot, 1914a: 84, pl. 5 figs 2-5; 1914b: 120; 1917a: 115; Prenant & Teissier, 1924: 25; Roca, 1986: 386, fig. 66 [not *Halopteris simplex* (Warren, 1907)].

Antenella (*Plumularia*) *siliquosa*; Bedot, 1914b: 120.

Antennella siliquosa; Bedot, 1917a: 125; Stechow, 1919a: 112; Bedot, 1921b: 5; 1923: 220, fig. 12; Teissier, 1950b: 22; Redier, 1965: 378; Rees & Thursfield, 1965: 158; Teissier, 1965: 27; Cabioch, 1968: 548, 579, 686, 695; Robins, 1969: 333; García Carrascosa et al., 1987: 372; Altuna & García Carrascosa, 1990: 85, fig. 82; Boero & Bouillon, 1993a: 263; Medel & Vervoort, 1995: 32, fig. 13a-e; ?Watson, 1996: 78; Schuchert, 1997: 19, fig. 5a-e; Ramil, Vervoort & Ansín, 1998: 31.

Antenella diaphana f. *siliquosa*; Broch, 1933b: 26; Leloup, 1935c: 53.

Polyplumaria siliquosa; Picard, 1958b: 192; Rossi, 1961: 78.

Antennella diaphana f. *siliquosa*; Vervoort, 1959: 286, fig. 43 a-e; ?Redier, 1966b: 89; ?Rho & Park, 1980: 26, pl. 7 figs 4-6.

Halopteris diaphana f. *siliquosa*; García Corrales et al., 1978: 45, fig. 19; Isasi, 1985: 85, fig. 24D-E; Isasi & Saiz, 1986: 70; Ramil & Vervoort, 1992a: 148, fig. 38a.

Antennella siliquosa p.p. García Carrascosa, 1981: 255, pl. 23 figs a-b, pl. 40 figs a-b; Medel & López-González, 1996: 201.

Halopteris diaphana var. *siliquosa*; Altuna & García Carrascosa, 1990: 55.

Not *Antennella siliquosa*; Peña Cantero, 1995: 297, pl. 34 figs a-e [=*Antennella campanulaformis* (Mulder & Trebilcock, 1909)].

Material.— **Atlantic coast of Morocco and Mauritania:** Stn 1.145: One colony with gonothecae (RMNH-Coel. 28708).— Stn MAU 072: One colony with damaged gonothecae (RMNH-Coel. 29123 = slide 4637).— **Canary Islands and Selvagens Archipelago:** Stn 4.151: One colony with damaged gonothecae (RMNH-Coel. 28697).— **Cape Verde Islands:** Stn 6.067: Two colonies on *Aglaophenia svobodai* spec. nov., no gonothecae (RMNH-Coel. 28680).— Stn 6.137: One colony without gonothecae (RMNH-Coel. 28656, slide 4631).— Stn 6.148: One colony with male and female gonothecae (RMNH-Coel. 28950, slide 4642).— Stn 6.164: One colony on Bryozoa, no gonothecae (RMNH-Coel. 28946, two slides 4633).— Stn 6.165: One colony on Bryozoa, no gonothecae (RMNH-Coel. 28949, slide 4634).— Stn 7.058: Two colonies on *Streptocaulus pulcherrimus* Allman, 1883 without gonothecae (RMNH-Coel. 28901).— Stn 7.059: Two colonies on *Streptocaulus pulcherrimus* Allman, 1883, with male and female gonothecae (RMNH-Coel. 28748, 28914, slide 4635).— Stn 7.078: One colony on *Nematophorus clarkei* (Nutting, 1900), without gonothecae (RMNH-Coel. 28937).— Stn 7.089: One damaged colony without gonothecae on *Streptocaulus pulcherrimus* Allman, 1883 (RMNH-Coel. 28781, slide 4636).

Description (of material from Stn 7.059).— Hydrorhiza tubular, branched; stems monosiphonic and unbranched. Basal part of stem composed of one to three internodes with straight nodes, provided with three or four frontal nematothecae, terminal node oblique, separating basal part from succession of hydrothecate and athecate internodes, alternately separated by oblique and straight nodes; thecate internodes with inferior oblique and distal straight node; athecate nodes inferior straight, distal oblique. Straight nodes separating thecate and athecate nodes occasionally badly visible or almost absent. Thecate internodes with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca beaker-shaped, almost cylindrical; adcauline wall adnate for half its length; abcauline wall straight, aperture circular, rim smooth, slightly everted. Mesial inferior nematotheca not reaching hydrothecal base; adcauline wall deeply scooped. Lateral nematothecae placed on small apophyses one on each side of hydrotheca, not reaching hydrothecal rim, rim of superior chamber deeply scooped on both sides, though deepest on adcauline side. No axillary nematotheca. Athecate internodes with two frontal nematothecae. All nematothecae bithalamic.

Gonothecae of both sexes found on same stem. Female gonothecae basalmost, springing from hydrothecal base, elongated sack-shaped, more or less quadrangular

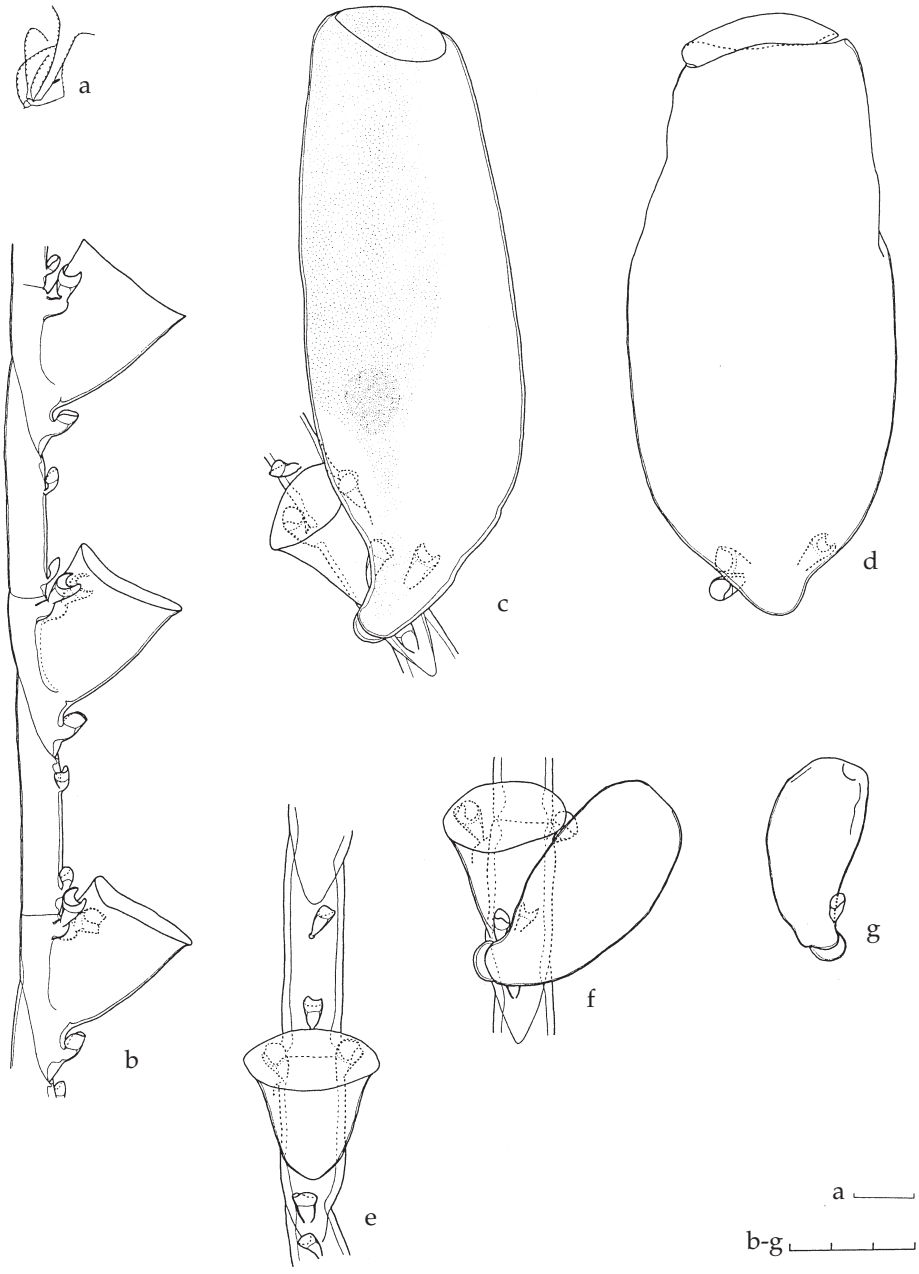


Fig. 64. *Antennella siliquosa* (Hincks, 1877). a, Stn 7.059, colony; b, Stn 6.137, internodes, lateral view; c, Stn 7.059, female gonotheca, latero-frontal view; d-f, Stn MAU 072, d, female gonotheca, posterior view; e, internodes, frontal view; f, male gonotheca, posterior view; g, Stn 7.059, male gonotheca, latero-frontal view. Scales: a, 1 cm; b-g, 0.3 mm.

in cross section, walls straight, aperture circular, slightly tilted, closed by lid, base narrowed, with two to four nematothecae; pedicel short, two-segmented. Male gonotheca smaller, inserted also at hydrothecal base, sack-shaped with rounded top, base narrowed, slightly curved, with one nematotheca; pedicel short, two-segmented.

Variability.— Colonies from Stns 4.151 and 7.059 have regenerated athecate internodes with three or four frontal nematothecae. Colonies from Stns 6.148 and 6.165 have an apical stolon from which developed a new stem of identical colony structure. A colony from Stn 6.148 has a lateral ramification developing from a hydrothecal base. This branch has one basal internode with two frontal nematothecae and continues as a normally developed stem.

Table XXX. Measurements of *Antennella siliquosa* in µm:

	Stn 7.059	Stn 6.137
Maximum height of colony (in mm)	18	6
Length hydrothecate internode	380-450	330-385
Length athecate internode	250-580	290-410
Diameter at node	90-160	90-110
Hydrotheca, length abcauline wall	260-355	280-360
Length free part adcauline wall	120-150	130-160
Diameter at rim	210-275	230-300
Male gonotheca, length*	435	
Maximum diameter*	220	
Female gonotheca, length	1470	

(*) Possibly immature.

Discussion.— This species was described by Hincks (1877) as *Plumularia siliquosa*, but was considered the unbranched form of *Halopteris diaphana* (Heller, 1868) by several authors (Broch, 1933b; Vervoort, 1959). García Carrascosa (1981), Medel & Vervoort (1995), Schuchert (1997) and Calder (1997) pointed out that it is a distinct species of *Antennella* Allman, 1877, a point of view we have followed here. *Antennella simplex* Bedot (1914a) was placed in *Antennella siliquosa* by the same author (Bedot, 1914b). We have indicated above (p. 139) that part of the material described by García Carrascosa (1981) and Peña Cantero (1995) as *Antennella siliquosa* belongs to *Antennella campanulaformis* (Mulder & Trebilcock, 1909). We have reservations concerning the records of this species by Stechow (1925a), Redier (1966b), Rho & Park (1980), Bouillon, Massin & Kresevic (1995) and Watson (1996), being far outside the habitual range of distribution of this species, usually considered Atlantic-Mediterranean. Stechow's (1925a) record of West Australian material with one nematotheca per athecate internode might belong either to *Halopteris campanula* (Busk, 1852) or *Antennella campanulaformis* (Mulder & Trebilcock, 1909) (Schuchert, 1997). Bouillon, Massin & Kresevic (1995) refer to material examined by Stechow (1925a) and Watson (1996) presents a list of species based on Jäderholm (1916b) and Stechow (1924a, 1925a); the identification cannot be properly checked. Redier (1966b) recorded *A. siliquosa* from New Caledonia with a short description that might indicate *A. siliquosa*, but it is also considered

doubtful by Schuchert (1997). The colonies from Korean waters recorded by Rho & Park (1980), judged from the photographs, the size and the shape of the lateral nematothecae, resemble *A. campanulaformis* but as it has no gonothecae it cannot with certainty be referred to that species.

That *Antennella siliquosa* and *Antennella secundaria* (Gmelin, 1791) should be conspecific, as suggested by Cornelius (1995), has been rejected here (cf. discussion of *A. secundaria*, pp. 143-144).

Reproduction.— Gonothecae were mentioned by Billard (1912a), Bedot (1914a), Teissier (1950), Vervoort (1959), Teissier (1965), Robins (1969), Isasi (1985), Medel & Vervoort (1995), and Ramil, Vervoort & Ansín (1998); with the exception of the months of January, February, April, November and December they occurred throughout the year. CANCAP colonies collected in March, June and August are fertile.

Distribution.— *Antennella siliquosa* is considered an Atlantic-Mediterranean species by Boero & Bouillon (1993a) and Schuchert (1997). In the Atlantic it is known to occur at the Scilly Islands (Robins, 1969), Eddystone Rock (Ritchie, 1914; Rees & Thursfield, 1965), English Channel (Cabioch, 1968), Channel Islands (Hincks, 1877, as *Plumularia siliquosa*), several localities in Brittany (Billard, 1912a; Bedot, 1914a, as *Antennella simplex*; Prenant & Teissier, 1924; Teissier, 1950b, 1965; Bouillon, Massin & Kresevic, 1995; Schuchert, 1997), the Basque coast (Isasi, 1985; Isasi & Saiz, 1986, both as *H. diaphana* f. *siliquosa*; Altuna & García Carrascosa, 1990; Medel & López-González, 1996), Ampère Bank (Ramil, Vervoort & Ansín, 1998), the coast of Morocco (Patriti, 1970; Ramil & Vervoort, 1992a, as *H. diaphana* f. *siliquosa*), Guinea (Vervoort, 1959, as *Antennella diaphana* f. *siliquosa*; Schuchert, 1997) and the Gulf of Guinea (Redier, 1965). Leloup (1935c, as *A. diaphana* f. *siliquosa*) records its presence from Aruba in the Caribbean.

In the Mediterranean it has been recorded from the Strait of Gibraltar (Medel & Vervoort, 1995), numerous localities in the Spanish littoral (García Corrales et al., 1978, as *H. diaphana* f. *siliquosa*; García Carrascosa, 1981; García Carrascosa et al., 1987; Medel & López-González, 1996), Mallorca (Roca, 1986, as *Antennella simplex*), the French coast (Billard, 1906b, as *Plumularia siliquosa*; Stechow, 1919a), the Gulf of Genova and the Bay of Naples (Stechow, 1923d; Rossi, 1961) and the Adriatic (Broch, 1933b, as *A. diaphana* f. *siliquosa*).

Doubtful records from the Pacific have been discussed above.

The bathymetrical range is between 1 (Riedl, 1959) and c. 445 m (Billard, 1906b).

CANCAP material originates from 12 localities of which nine in the Cape Verde Archipelago and one near Morocco, the Canary Islands and Mauritania, respectively, collected between 45 and 200 m depth.

Epibionts.— Stn 4.151: *Filellum serratum* (Clarke, 1879).— Stn 6.148: Foraminifera, *Mitrocomella* spec., *Filellum serratum* (Clarke, 1879), *Plumularia* spec.— Stn 7.059: Foraminifera, *Modeeria rotunda* (Quoy & Gaimard, 1827).— Stn MAU 072: Foraminifera, *Obelia dichotoma* (L., 1758).

Antennella confusa spec. nov.
(fig. 65)

Material.— **Cape Verde Islands:** Stn 6.033: One colony with eight stems, one with two gonothecae (paratype) (RMNH-Coel. 29089 = slide 4638).— Stn 6.088: One colony with twelve stems, three with damaged gonothecae (paratype) (RMNH-Coel. 29090 = slide 4639).— Stn 6.119: One colony with four stems,

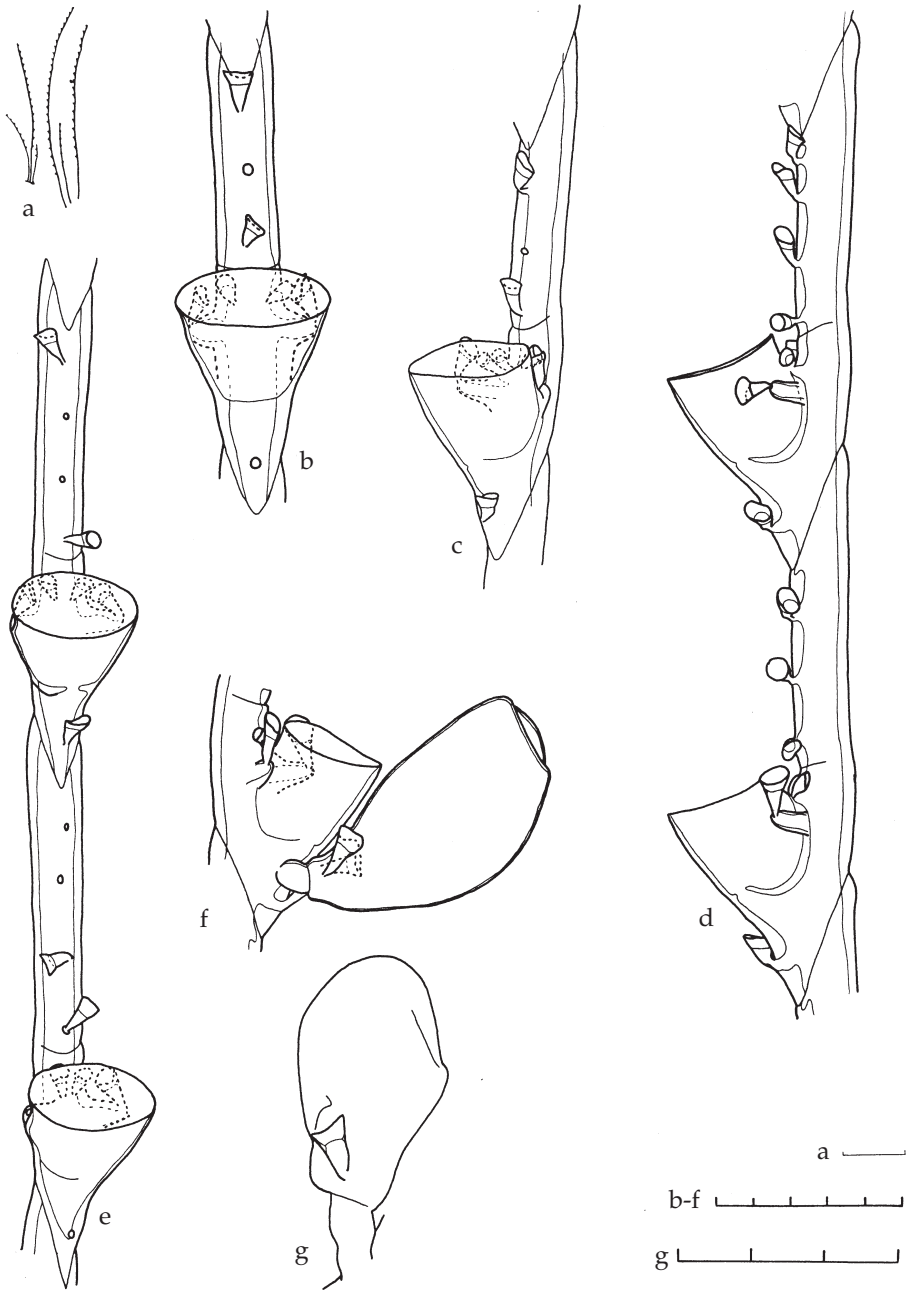


Fig. 65. *Antennella confusa* spec. nov. a, Stn 6.139, colony; b, Stn 6.033, internode, frontal view; c, Stn 6.088, internode with three axillary nematothecae, fronto-lateral view; d, Stn 6.139, internodes, lateral view; e-f, Stn 6.033, e, internodes, frontal view; f, female (?) gonotheca, lateral view; g, Stn 6.088, male (?) gonotheca. Scales: a, 1 cm; b-f, 0.5 mm; g, 0.3 mm.

no gonothecae (not part of type series) (RMNH-Coel. 28944; DEBA-UV, slide R. 321).— Stn 6.139: One colony with gonothecae on calcareous concretion (holotype) (RMNH-Coel. 28915, three slides 4640).

Description (of holotype).— Hydrorhiza tubular, attached to substrate; stems monosiphonic, unbranched. Stem with basal zone divided into several internodes by straight nodes, with exception of ultimate oblique node. Each internode with varied number of frontal nematothecae placed in two rows. Remainder of stem composed of hydrothecate and athecate internodes. Thecate internodes with well marked oblique basal node and straight distal node, scarcely visible in basal part of colony. Each thecate internode with one hydrotheca and five nematothecae: one mesial inferior, two lateral and two in axil of free part of adcauline wall and internode. Hydrotheca deep, cup-shaped; adcauline wall adnate for three-quarters of its length, free part slightly concave; abcauline wall thickened, straight or slightly convex; hydrothecal margin circular, tilted downwards, slightly depressed laterally; rim smooth. Mesial inferior nematotheca not reaching hydrothecal base, adcauline wall of superior chamber deeply scooped. Lateral nematothecae placed on well developed lateral apophyses, reaching or slightly surpassing hydrothecal rim; margin of superior chamber facing hydrotheca deeply scooped, occasionally down to diaphragm. Axillar nematothecae small; adcauline wall of superior chamber almost completely scooped. Athecate internode with three or four nematothecae, structure identical to that of mesial inferior nematotheca. All nematothecae bithalamic and movable.

Gonothecae inserted at hydrothecal base above mesial nematotheca, both sexes found on same stem. Male gonothecae small, ovoid, apically rounded, narrowing basally and there with two nematothecae. Female gonothecae inserted below male ones, pear-shaped, rather strongly curved, with oblique circular aperture closed by operculum; basal part narrowed, with two nematothecae. Pedicel in both sexes short, composed of one internode.

Variability.— Two colonies from Stn 6.088 have three axillar nematothecae on hydrothecate internodes. One colony was observed to have eight nematothecae on athecate internodes as the result of regeneration after damage. One female gonotheca with a two-segmented pedicel was also observed.

Table XXXI. Measurements of *Antennella confusa* spec. nov. in µm:

	Stn 6.139	Stn 6.033
Maximum height of colony (in mm)	34	25
Length hydrothecate internode	620-730	620-670
Length athecate internode	440-810	360-730
Diameter at node	140-200	115-170
Hydrotheca, length abcauline wall	260-300	270-300
Length free part adcauline wall	100-110	100-115
Diameter at rim	290-310	280-310
Female gonotheca, length	680-750	800*
Maximum diameter	330-340	400*
Male gonotheca, length		505*
Maximum diameter		255*

* One measurement only.

Discussion.— In morphology of trophosome and gonosome *Antennella confusa* spec. nov. comes close to *A. secundaria*, but differs by the constant presence of a pair of axillary nematotheca behind the adcauline hydrothecal wall (fig. 65e). Each of these axillar nematothecae is separately inserted on the internode and, though typically placed in the centre, they may be displaced laterally, even in the same colony.

This material should not be confused with *Halopteris catharina*; though in this species there are also two pairs of lateral nematothecae, the second pair is placed at the base of the apophyses of the first pair and not in the axil.

Reproduction.— All fertile material was collected in June.

Distribution.— The species was collected at four stations in the Cape Verde region, between 400 and 591 m.

Etymology.— The specific name '*confusa*' refers to the resemblance with *Antennella secundaria* (Gmelin, 1791) and *Halopteris catharina* (Johnston, 1833) with both of whom the present species can easily be confused; the latin 'confusus' meaning confused, mixed.

Epibionts.— Stn 6.033: Foraminifera, unidentifiable Campanulinidae and Lafoeidae.— Stn 6.088: Foraminifera.— Stn 6.119: Foraminifera.

Genus *Halopteris* Allman, 1877
Halopteris alternata (Nutting, 1900)
(fig. 66)

Plumularia alternata Nutting, 1900: 62, pl. 4 figs 1-2; Fraser, 1912: 381, fig. 48; Stechow, 1912a: 363.
Not *Plumularia alternata*; Billard, 1904b: 484, fig. 4 [= *Halopteris billardi* (Vannucci, 1951)].
Not *Plumularia alternata*; Billard, 1912a: 468, fig. 5 [= *Halopteris diaphana* (Heller, 1868)].
Not *Plumularia alternata*; Billard, 1913: 31 (= *Halopteris platygonotheca* Schuchert, 1997).
Not *Plumularia alternata*; Jarvis, 1922: 345, pl. 25 fig. 16A-B [= *Halopteris peculiaris* (Billard, 1913) p.p.].
Not *Plumularia alternata*; Fraser, 1938b: 62, pl. 14 fig. 71.
? *Plumularia alternata*; Prenant & Teissier, 1924: 25.
? *Plumularia* cf. *alternata*; Gravely, 1927: 16, pl. 3 figs 19-20.
Thecocaulus diaphanus; Vannucci Mendes, 1946: 576, pl. 5 figs 46-47. [Not *Halopteris diaphana* (Heller, 1868)].
Schizotricha billardi p.p.Vannucci, 1951a: 88, pl. 3 figs 19-20 [not *Halopteris billardi* (Vannucci, 1951)].
? *Schizotricha diaphana*; Mammen, 1965: 303, fig. 100 [not *Halopteris diaphana* (Heller, 1868)].
Antennella diaphana diaphana p.p. Van Gemerden-Hoogeveen, 1965: 49, figs 23-28 [not *Halopteris diaphana* (Heller, 1868)].
Halopteris diaphana diaphana; Vervoort, 1968: 58, fig. 27a-c [not *Halopteris diaphana* (Heller, 1868)].
Halopteris diaphana; Cooke, 1975: 100, pl. 5 figs 2-4; Calder, 1991b: 223; 1991c: 2068 [not *Halopteris diaphana* (Heller, 1868)].
Halopteris diaphana p.p. Migotto, 1996: 45, fig. 9d-e; Calder, 1997: 36, fig. 9a-e [not *Halopteris diaphana* (Heller, 1868)].
Halopteris alternata; Schuchert, 1997: 42, fig. 14a-i.

Material.— **Madeira area:** Stn 1.D82: Two colonies without gonothecae (RMNH-Coel. 28586, slide 4642).— **Canary Islands and Selvagens Archipelago:** Stn 4.K12: One colony on sponge, no gonothecae (RMNH-Coel. 29092 = slide 4643).— **Cape Verde Islands:** Stn 6.144: One colony without gonothecae [RMNH-Coel. 28763, slide 4644; DEBA-UV, slide R. 322, with *Halopteris polymorpha* (Billard, 1913)].— Stn 6.D01: One damaged colony, without gonothecae [RMNH-Coel. 29093 = slide 4645, with *Halopteris polymorpha* (Billard, 1913)].

Description (of material from Stn 6.144).— Hydrorhiza tubular and ramified; hydrocauli monosiphonic and unbranched. Stem distinctly geniculated in some colonies, with basal part of two or three internodes with straight nodes and a varied number of frontal nematothecae, separated from remainder of stem by oblique node. Rest of stem composed of internodes separated by oblique nodes; terminal part of stem with some athecate internodes, alternating with thecate internodes, with an inferior transverse and superior oblique node; athecate stem internodes with one frontal nematotheca. Thecate stem internodes each with one hydrotheca and three or four nematothecae: one mesial inferior, two lateral and one small axillary nematotheca, absent on distal part of stem in some colonies. Apophyses alternately directed left and right, supporting hydrocladia. Basal stem internodes may have a pair of apophyses; hydrocladia consequently opposite in such cases. First internode of hydrocladium short, with straight nodes, no nematotheca; second internode with oblique distal node and one frontal nematotheca. Remainder of hydrocladium a succession of thecate and athecate internodes; thecate internodes with inferior oblique and superior straight node, a hydrotheca and three nematothecae: one mesial inferior and a pair of lateral nematothecae on small apophyses on each side of hydrotheca. Hydrotheca deep, cup-shaped, one-third of adcauline wall free and straight; abcauline wall straight, not thickened; walls of hydrotheca slightly diverging, aperture circular, tilted downwards, rim smooth, non-everted. Mesial inferior nematotheca not reaching hydrothecal base, lower chamber much reduced; rim deeply scooped on adcauline side. Lateral nematothecae cone-shaped, not reaching hydrothecal rim; rim circular, not scooped. Axillary nematotheca small, adcauline wall of upper chamber deeply scooped. Athecate internode with straight inferior and oblique superior node, with frontal nematotheca of which adcauline wall slightly scooped. All nematothecae bithalamic and movable with exception of fixed mesial inferior nematotheca.

Variability.— Colonies from Stn 6.144 have three cauline athecate internodes with two nematothecae. In a colony from Stn 1.D82 a branch, identical in structure with a hydrocaulus, springs from the interior of a cauline hydrotheca.

Table XXXII. Measurements of *Halopteris alternata* in µm:

	Stn 6.144
Height of colony (in mm)	3-15
Stem internode, length	500-950
Diameter at node	85-180
Hydrocladial internode, length of basal athecate internode	180-230
Length hydrothecate internode	320-415
Length athecate internode	120-175
Diameter at node	60-90
Hydrotheca, length abcauline wall	205-240
Length free part adcauline wall	70-98
Diameter at rim	190-230

Discussion.— Stechow (1912a) drew attention to the similarity between *Halopteris alternata* (Nutting, 1900) and *Halopteris diaphana* (Heller, 1868) and, though presenting

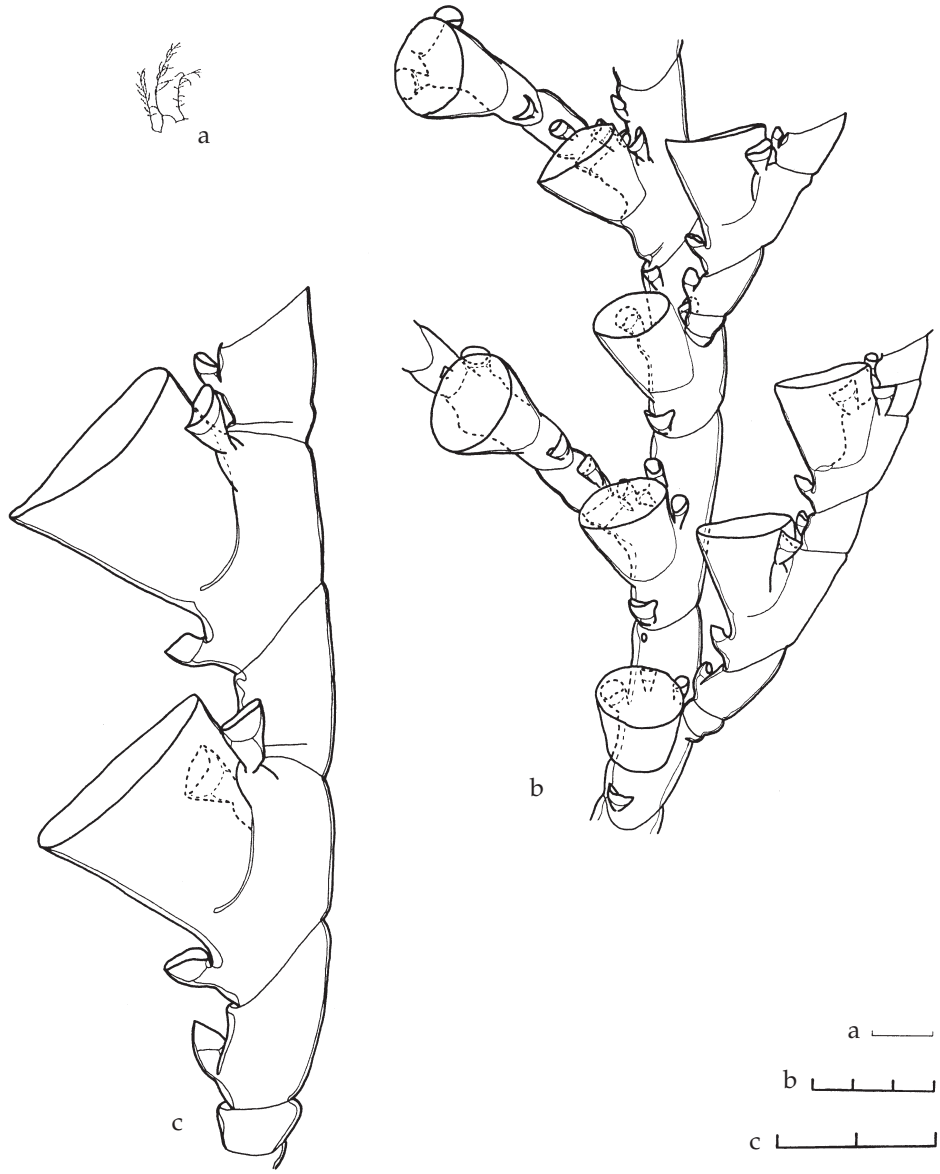


Fig. 66. *Halopteris alternata* (Nutting, 1900). a, Stn 6.144, colony; b-c, Stn 1.D82, b, detail of colony, oblique frontal view; c, hydrocladial internodes, lateral view. Scales: a, 1 cm; b, 0.3 mm; c, 0.2 mm.

some differentiating characters, he did not exclude their being conspecific. Bedot (1914a) reviewed the discriminating characters listed by Stechow (1912a) and concluded that they were insufficient to maintain specific distinction and synonymized *H. alternata* and *H. diaphana*. Neither Stechow (1912a) nor Bedot (1914a) knew the gonosome of *H. alternata*. Schuchert (1997) concluded that both species, though simi-

lar in trophosome, can readily be separated by the shape of the female gonothecae that are fusiform in *H. alternata* and horn-shaped in *H. diaphana*. Both species are present in the CANCAP material and though sterile, have been separated by the following characters:

1. - Hydrocaulus (often) geniculate in *H. alternata*, especially in younger parts; straight in *H. diaphana*.

2. – Segmentation of hydrocaulus homomerous in basal parts and heteromerous in younger and apical parts of *H. alternata*; invariably heteromerous in *H. diaphana*.

3. – Axillary nematotheca present in cauline hydrothecae of *H. alternata*, absent in *H. diaphana*.

4. – One nematotheca in athecate cauline internodes of *H. alternata* whereas two occur in *H. diaphana*. In the CANCAP material of *H. alternata* two such nematothecae only occur after regeneration following damage.

Halopteris platygonotheca Schuchert, 1997 is a species quite similar to *H. alternata* and *H. diaphana*; according to Schuchert (1997) it can only be separated by characters of the female gonotheca. *H. platygonotheca*, however is a species with Indo-Pacific distribution whereas *H. alternata* and *H. diaphana* are Atlantic species.

Gravely (1927) recorded *Plumularia alternata* (=*Halopteris alternata*) from the south coast of India; his figures and description are too incomplete to be conclusive. Mammen (1965) revised Gravely's material and brought it to *Schizotricha diaphana*; figures and description, however, are far from complete and do not exclude confusion with *H. platygonotheca*. Fraser (1938b) recorded material from the Pacific with strongly curved gonothecae and an axillary nematotheca behind the hydrothecae; Schuchert (1997) suspected that this is not *H. alternata* but another species and we concur. Cooke (1975) recorded the presence of *Halopteris diaphana* from the Marshall Islands; this material has homomerous segmentation of the hydrocaulus, an axillary nematotheca behind the cauline hydrothecae and one, occasionally two, supracalycine nematothecae on internodes of the stem. These characters indicate *H. alternata* and we follow Schuchert (1997) in including it in that species. The synonymy presented above also largely follows that given by Schuchert (1997).

Reproduction.— CANCAP material was obtained in March, May and June and is all sterile. Material recorded by Vannucci (1951a) from the Brazilian coast was fertile in December; Schuchert (1997) examined fertile material collected in February and June.

Distribution.— Exact geographical distribution is slightly uncertain because of the great resemblance between *Halopteris alternata* and *Halopteris diaphana*. Schuchert (1997) considered *H. alternata* an Atlantic species, only known from the western Atlantic and cited from North Carolina (Fraser, 1912 as *Plumularia alternata*), from the Gulf of Mexico and north-west of Cuba (Stechow, 1912a, as *P. alternata*), from Belize (Calder, 1991b, 1991c, as *H. diaphana*; Schuchert, 1997), from Jamaica, Tortugas, Puerto Colombia, Aruba, St. Martin, St. John and Bonaire in the Caribbean (Nutting, 1900, as *P. alternata*; Van Gemerden-Hoogeveen, 1965, as *Antennella diaphana diaphana*; Vervoort, 1968, as *Halopteris diaphana diaphana*; Schuchert, 1997) and from São Sebastião and Baía de Santos, Brazil (Vannucci-Mendes, 1946, as *Thecocaulus diaphanus*; Vannucci, 1951a, as *Schizotricha billardi*; Schuchert, 1997).

In the eastern Atlantic it is known from Roscoff (Billard, 1912a; Prenant &

Teissier, 1924, both as *P. alternata*). The record by Billard (1912a) was included by Teissier (1965) and Schuchert (1997) in *H. diaphana* but there is no reference to the record by Prenant & Teissier (1924). We consider the presence of *H. alternata* at Roscoff questionable.

In the Pacific it has been recorded from the Marshall Islands (Cooke, 1975, as *H. diaphana*). The record from the Gulf of Mannar, India, (Gravely, 1927, as *P.* cf. *alternata*) is also considered doubtful (see discussion).

The bathymetrical range is between 0 and 36 m (Nutting, 1900).

CANCAP material comes from four localities of which one near Madeira, one at the Canary Islands and two from the Cape Verde region. The material was taken between 0 and 51 m.

Epibionts.— Stn 1.D82: Algae, unidentifiable athecate.— Stn 6.D01: Algae.

Halopteris carinata Allman, 1877
(fig. 67)

Halopteris carinata Allman, 1877: 33, pl. 19 figs 3-7; Nutting, 1895: 224; 1900: 86; Stechow, 1926: 106; Fraser, 1944a: 360, pl. 78 fig. 351; 1944b: 43; 1947: 14; Deevey, 1954: 271; Vervoort, 1968: 54, 107, fig. 26; Wedler, 1975: 333; Flórez González, 1983: 121, figs 34-35; Bandel & Wedler, 1987: 42; Larson, 1987: 513, fig. 1; Cairns et al., 1991: 27; Calder, 1993: 68; 1997: 34, fig. 8a-b; Schuchert, 1997: 123, fig. 45a-f.

Plumularia carinata; Bedot, 1921b: 26.

Halopteris (Plumularia) carinata; Bedot, 1923: 216, fig. 3A-C.

Material.— **Cape Verde Islands:** Stn 6.D01: One colony on calcareous algae, no gonothecae (RMNH-Coel. 28792; DEBA-UV, slide R. 323).— Stn 6.D02: One colony with one epibiontic colony, with gonothecae (RMNH-Coel. 28787, 28942, three slides 4646).

Description (of material from Stn 6.D02).— Hydrorhiza tubular, composed of a mass of tubules adhering to substrate, with several short apophyses supporting monosiphonic and unbranched axes. Basal part of stem with three to ten internodes separated by straight nodes and five to ten nematothecae in two or three longitudinal series. Remainder of hydrocaulus with basal, slightly oblique node, made up of thecate internodes with slightly oblique nodes. Each cauline internode with one hydrotheca, a lateral apophysis supporting a hydrocladium and seven to nine nematothecae: one mesial inferior, one lateral not reaching hydrothecal rim and placed on opposite side of hydrocladium on a small apophysis adnate to hydrotheca, two reduced, scale-shaped nematotheca behind hydrotheca and three to five supracalycine nematothecae irregularly placed on frontal zone of remaining part of internode. Cauline hydrothecae not strictly in one line, but slightly displaced towards hydrocladial apophysis, deep cup-shaped, with small abcauline marginal cusp but without distinct carina. Apophyses alternately directed left or right, typically with two nematothecae, occasionally with one. First internode of hydrocladia athecate, inferior node straight, distal oblique, typically with one, occasionally with two nematothecae. Rest of hydrocladium numbers c. ten thecate internodes with oblique nodes, each with one hydrotheca and six nematothecae: one mesial inferior, two lateral, two reduced behind hydrotheca and one supracalycine. Hydrotheca deep cup-shaped, widening towards rim, adcauline wall adnate for more than half its length; abcauline

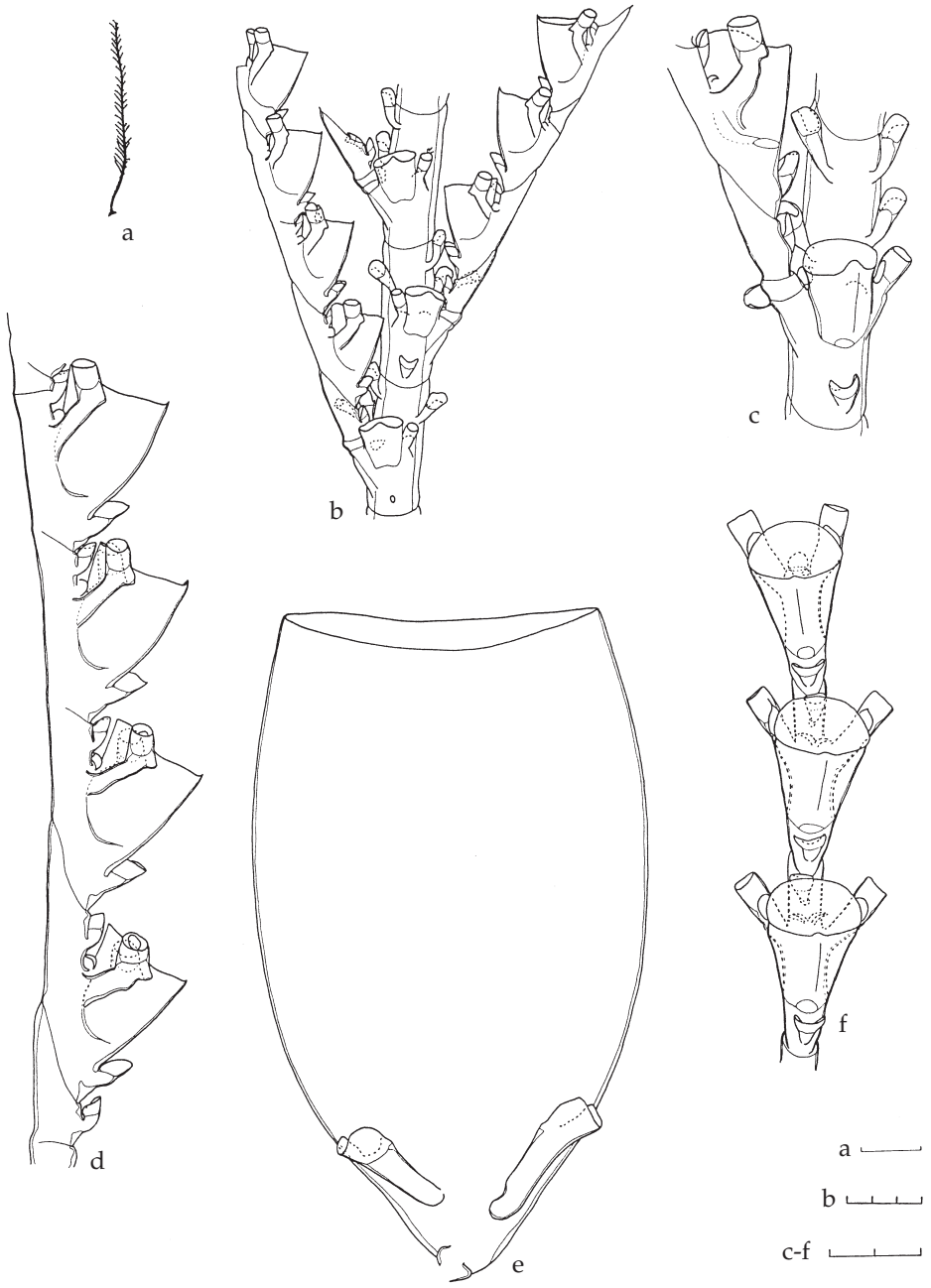


Fig. 67. *Halopteris carinata* Allman, 1877. a-c, Stn 6.D01, a, colony; b, detail of colony, frontal view; c, detail of apophysis, slightly oblique frontal view; d-e, Stn 6.D02, d, hydrocladial internodes, lateral view; e, female (?) gonotheca, frontal view; f, Stn 6.D01, hydrocladial internodes, frontal view. Scales: a, 1 cm; b, 0.3 mm; c-f, 0.2 mm.

wall straight, not thickened, with a minor carina. Hydrothecal aperture circular; rim smooth, with small, rounded abcauline cusp, somewhat curved inwards. Mesial inferior nematotheca just reaching hydrothecal base, immobile, with deeply scooped adcauline wall. Lateral nematothecae short, placed on conspicuous apophyses adnate to hydrothecal wall, projecting above hydrothecal rim, with circular apical and smaller almost circular, basal aperture, directed towards hydrotheca. Axil behind hydrothecal adcauline wall with two small, scale-shaped nematothecae. Movable nematotheca with deeply scooped adcauline wall present on internode above hydrotheca; occasionally this nematotheca placed on separate internode with straight basal node.

Gonothecae inserted on cauline internodes at hydrothecal base on side opposite to apophysis; large, sack-shaped and somewhat compressed, with ovoid apical aperture; basal part narrowed, with pair of well developed nematothecae with deeply scooped rim; pedicel short, one-segmented. Gonothecae empty, sex indeterminate but probably female. Male gonothecae, described by Vervoort (1968) and the only sex known at present, are smaller, curved, ovoid, have no nematothecae and insert on hydrocladial internodes.

Variability.— A colony from Stn 6.D02 has the median part of a hydrocaulus with the hydrocladia turned 90°, probably as the result of change in direction of the water current.

Table XXXIII. Measurements of *Halopteris carinata* in µm:

	Stn 6.D02
Height of colony (in mm)	23-70
Stem internode, length	490-660
Diameter at node	160-490
Cauline hydrotheca, length	190-220
Diameter at rim	180-210
Cauline nematotheca, length	130-170
Diameter at rim	30-40
Hydrocladial internode, length	290-450
Diameter at node	70-90
Hydrotheca, depth	210-270
Length free part adcauline wall	80-110
Diameter at rim	200-230
Mesial infracalycine nematotheca, length	90-110
Diameter at rim	40-60
Mesial supracalycine nematotheca, length	60-90
Diameter at rim	25-45
Gonotheca, length	1390-1470
Maximum diameter	850-890
Gonothecal nematotheca, length	260-310
Diameter at rim	70-80

Reproduction.— Vervoort (1968) mentioned the presence of gonothecae in January; the fertile CANCAP colony was collected in June.

Distribution.— The species is known from various localities in the western

Atlantic: Bermuda (Calder, 1993b, 1997), a locality between Eleuthera and Little Cat Islands in the Bahamas (Nutting, 1900), Florida (Allman, 1877; Stechow, 1926; Deevey, 1954; Schuchert, 1997), Bahía Honda, Cuba (Fraser, 1947), Island Desecheo between the Dominican Republic and Santo Domingo (Larson, 1987), St. Thomas, Virgin Islands (Vervoort, 1968), Bay of Cartagena, Colombia (Flórez González, 1983) and Tortuga Island (Stechow, 1926; Deevey, 1954; Vervoort, 1968).

The bathymetrical distribution lies between 0 (Calder, 1993) and 161 m (Fraser, 1944a).

CANCAP material comes from two Cape Verdian localities and was taken between 15 and 20 m.

Epibionts.— Stn 6.D02: *Halopteris carinata* Allman, 1877.

Halopteris catharina (Johnston, 1833)
(fig. 68)

Plumularia catharina Johnston, 1833: 497, figs 61-62; Marine Biological Association, 1904: 198; Ritchie, 1911: 222; Billard, 1912b: lix-lxi, figs 1-2; Crawshay, 1912: 330; Broch, 1913: 4, fig. 1; Ritchie, 1913a: 1, figs 1-3; Bedot, 1914a: 94, pl. 5 figs 17-19; Stechow, 1919a: 114; Prenant & Teissier, 1924: 25; Broch, 1928a: 62, fig. 51; Marine Biological Association, 1931: 77; Da Cunha, 1940: 112; Kramp, 1942b: 19; Da Cunha, 1944: 32, fig. 14; Fraser, 1944a: 339, pl. 72 fig. 326a-e; 1944b: 39; Da Cunha, 1950: 128; Teissier, 1950b: 23; Williams, 1954: 50; Redier, 1964b: 149; Cabioch, 1965: 56; Teissier, 1965: 27; Cabioch, 1968: 565, 589; Fey, 1969: 403; Castric-Fey, 1970: 19; Von Salvini-Plawen, 1972: 393; Castric-Fey, 1973: 214; ?Morris & Mogelberg, 1973: 19, fig. 26a-b; Saldanha, 1974: 325.

Thecocaulus catharina; Bale, 1915: 294; Von Schenck, 1965: 906, 926, 927, fig. 7.

Schizotricha catharina; Bedot, 1921b: 12; 1921c: 11; Billard, 1931b: 247; Kramp, 1935b: 159, figs 64B1-B2, 65A; 1938d: 36, 63, 68, 72; 1943b: 44; Redier, 1962b: 35; Jägerskiöld, 1971: 64.

Halopteris (Plumularia) catharina; Bedot, 1923: 216, fig. 3.

Antennella catharina; Vervoort, 1942: 300; 1946b: 174, figs 69b, 72; Christiansen, 1972: 303.

Polyplumaria catharina; Picard, 1958b: 192; Marinopoulos, 1979b: 120.

Halopteris catharina; Rees & Thursfield, 1965: 160; Vervoort, 1968: 108; Rees & Rowe, 1969: 21; Robins, 1969: 334; Vervoort, 1972: 236; Gili & Romero, 1983: 36; Aguirrezabalaga et al., 1984: 87, figs 2-3; Gili, Ros & Pagès, 1987: 92; Gili, Murillo & Ros, 1989: 23; Gili, Vervoort & Pagès, 1989: 83, fig. 12A-B; Altuna & García Carrascosa, 1990: 85, fig. 83; Cornelius & Ryland, 1990: 152, fig. 4.23; Cairns et al., 1991: 27; Cornelius, 1992a: 255, 257; 1992b: 99; Ramil & Vervoort, 1992a: 145, fig. 37e-g; Álvarez-Claudio, 1993: 245, fig. 42A-E, pl. 23, photographs A-C; Boero & Bouillon, 1993a: 263; Altuna Prados, 1994a: 234, pl. 44 figs A-E; 1995a: 54; Álvarez Claudio, 1995: 16; Álvarez-Claudio & Anadón, 1995: 239; Bouillon, Massin & Kresevic, 1995: 49; Cornelius, 1995: 126, fig. 29A-F; Schuchert, 1997: 107, fig. 38a-g, tab. 28.

Halopteris catharina p.p. Medel & López-González, 1996: 201.

Not *Halopteris catharina*; García Corrales et al., 1978: 47, fig. 20A-C; Estrada, 1979: 79, fig. 15; 1980: 9; Gili i Sardà, 1982: 80, fig. 38B; Urgorri & Besteiro, 1983: 16, 18, 20, 25; Gili, García & Colomer, 1984: 414; Gili & Castelló, 1985: 19, fig. 6D; Gili & García Rubies, 1985: 46, fig. 5H-I; Gili, 1986: 158, figs 4.30a, 4.56f; Izquierdo et al., 1986: 52, fig. 3 [= *Antennella secundaria* (Gmelin, 1791)].

Halopteris sp.; Roca, 1986: 398, fig. 68.

Not *Halopteris catharina*; Peña Cantero, 1995: 304, pl. 35 figs a-d [= *Halopteris liechtensternii* (Marktanner-Turneretscher, 1890)].

Material.— **Azores area:** Stn 5.044: Two damaged colonies, no gonothecae (RMNH-Coel. 28793, slide 4647).— Stn 5.072: One colony on sponge, with gonothecae (RMNH-Coel. 28795, four slides 4648).— Stn 5.085: Several colonies with gonothecae on *Polyplumaria flabellata* G.O. Sars, 1874 (RMNH-Coel.

28663, 28692).— Stn 5.096: One detached colony without gonothecae [RMNH-Coel. 29088, slide 4630, with *Antennella secundaria* (Gmelin, 1791)].— Stn 5.112: One colony with gonothecae (RMNH-Coel. 28703, two slides 4649).— **Cape Verde Islands:** Stn 7.132: One colony on *Aglaophenia lophocarpa* Allman, 1877, without gonothecae (RMNH-Coel. 28931, slide 4650).

Description (of material from Stn 5.072).— Hydrorhiza tubular, branched; hydrocauli unbranched, monosiphonic, in this material not bearing hydrocladia. Basal part of stem with a varied number of internodes separated by transverse nodes, with exception of last, oblique node; each internode with variable number of nematothecae, maximum 19, in two rows on front of internode. Remainder of stem composed of a succession of thecate and athecate internodes; thecate internodes with oblique basal and straight distal node, reverse in athecate internodes; oblique nodes distinct, straight nodes weak. Thecate internodes with one hydrotheca and five nematothecae: one mesial inferior and two pairs of lateral nematothecae. Hydrotheca cup-shaped, widening towards rim, half of adcauline wall adnate to internode, half free and straight; abcauline wall straight, not thickened. Aperture circular, tilted downward, rim smooth. Mesial inferior nematotheca not reaching hydrothecal base; adcauline wall of distal chamber deeply scooped. Lateral nematothecae on well developed apophyses as long as nematothecae, reaching rim of hydrotheca; rim of apical chamber deeply scooped at side closest to hydrotheca. Second pair of lateral nematothecae inserted on base of apophyses, small, with deeply scooped rim of apical chamber. Athecate internodes with four nematothecae identical to mesial inferior one. All nematothecae bithalamic and movable.

Gonothecae inserted at hydrothecal base, pedicel short, one-segmented. Female gonotheca pyriform, truncated distally and provided with circular aperture closed by lid; basal part narrowing, with two or three nematothecae. Male gonotheca smaller, greatest diameter in middle and narrowing towards both sides; aperture terminal, basal part with one nematotheca.

Variability.— In a colony from Stn 5.112 the number of nematothecae on the athecate internodes varies between two and four and are frontally arranged in two rows. One internode has eight nematothecae after damage and posterior regeneration.

Table XXXIV. Measurements of *Halopteris catharina* in μm:

	Stn 5.072	Stn 5.085
Height of colony (in mm)	3-33	
Length hydrothecate internode	540-760	
Length athecate internode	570-930	
Diameter at node	80-140	
Hydrotheca, length abcauline wall	210-260	
Length free part adcauline wall	110-150	
Diameter at rim	265-320	
Female gonotheca, length	710-820	805-930
Maximum diameter	290-390	310-440
Male gonotheca, length	430-540	
Maximum diameter	190-240	

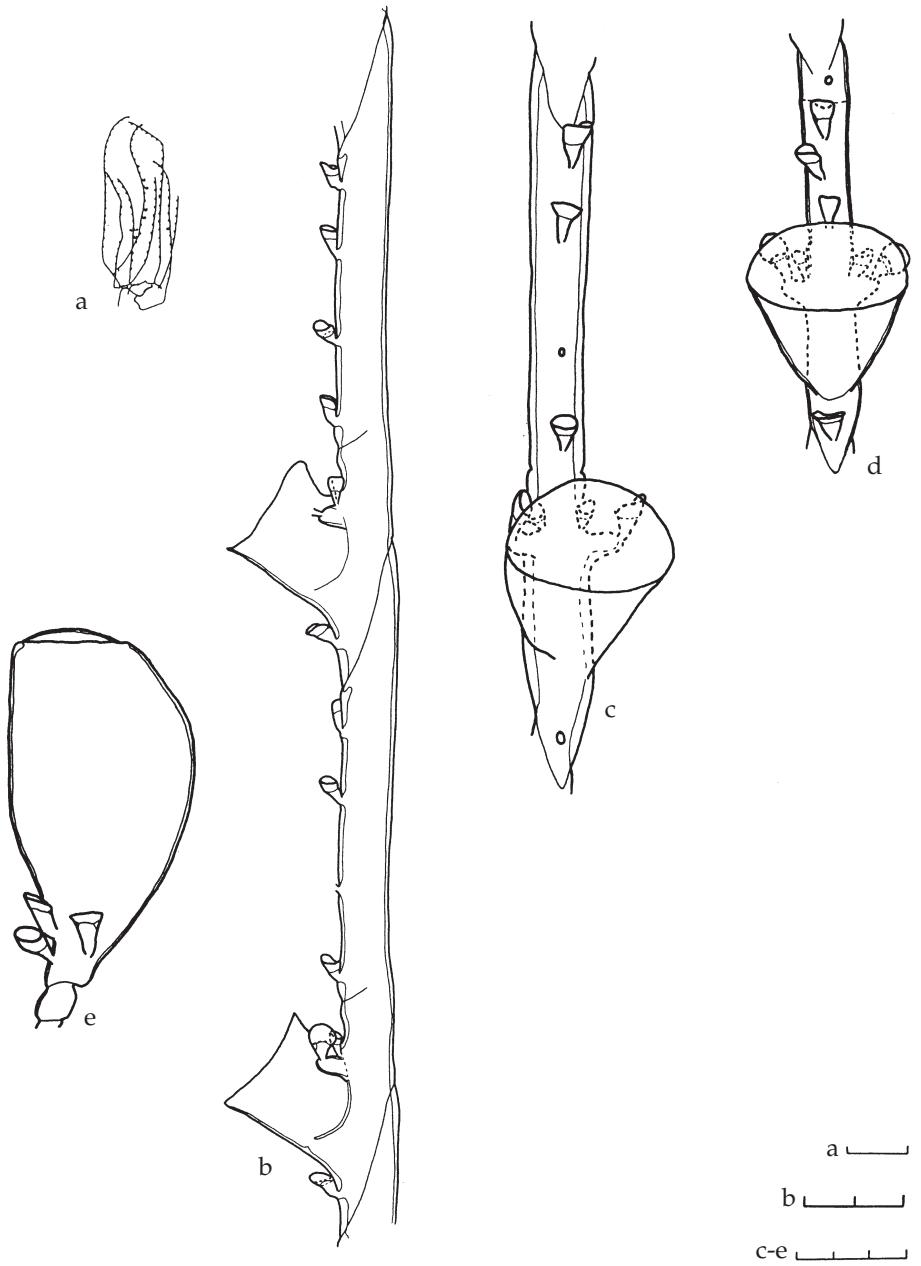


Fig. 68. *Halopteris catharina* (Johnston, 1833). a-c, Stn 5.072, a, colony; b, internodes, lateral view; c, internode, frontal view; d, Stn 5.044, internode, frontal view; e, Stn 5.072, gonotheca, lateral view. Scales: a, 1 cm; b, 0.3 mm; c-e, 0.2 mm.

Discussion.— *Halopteris catharina* differs distinctly from *Antennella secundaria*, even if it has stems without hydrocladia ("*Antennella*" type of colony), as it has two pairs of lateral nematothecae on the thecate internodes and lacks axillary nematothecae as occur typically in *A. secundaria*. However, several records of *H. catharina* in reality relate to *A. secundaria*. Ramil (1988) after revision of material of *H. catharina* recorded by Estrada (1979, 1980) and Urgorri & Besteiro (1983) from Galicia, refers these records to *Antennella secundaria*. Ramil & Vervoort (1992a) indicated that the records of *H. catharina* by García Corrales et al. (1978), Gili (1982, 1986), Gili, García & Colomer (1984), Gili & Castelló (1985), Gili & García Rubies (1985), Izquierdo et al. (1986) all refer to *A. secundaria* as there were four nematothecae on the thecate internodes: one mesial inferior, two lateral and an axillary one behind the hydrotheca. We agree with that conclusion.

The record of *H. catharina* from the Atlantic coast of Morocco by Patriti (1970) is considered doubtful by Ramil & Vervoort (1992a), as only three nematothecae occurred on the thecate internodes: one mesial inferior and two lateral. Morris & Mogelberg (1973) described colonies of *H. catharina* from Bermuda with the same number of nematothecae on the thecate internodes; the record is considered doubtful here. *Halopteris catharina* as described by Peña Cantero (1995) from the Chafarinas Islands belongs in *Halopteris liechtensternii* (Marktanner-Turneretscher, 1890), as the hydrocaulus had homomerous segmentation, the hydrocladia were alternately arranged and two nematothecae of varied development were present above the hydrotheca. *H. catharina* typically has heteromerous segmentation of the stem, the hydrocladia are opposite (at least basally) and there are two pairs of lateral nematothecae; there are no nematothecae above the hydrotheca as occurs in *H. liechtensternii*.

All CANCAP material is devoid of hydrocladia ("*Antennela*" type of colony) but agrees with *H. catharina* in the morphology of hydrocaulus and gonothecae. Also the measurements of our material agree with those given by Ramil & Vervoort (1992a) and Schuchert (1997); the diameter of the hydrothecal rim being slightly larger in the CANCAP specimens[3].

Reproduction: Gonothecae have been observed in nearly all months of the year with the exception of January, March and October-December; data being provided by Marine Biological Association (1904), Da Cunha (1940), Teissier (1950, 1965), Fey (1969), Robins (1969), Ramil & Vervoort (1992a), Álvarez Claudio (1993), Cornelius (1995) and Schuchert (1997). Fertile CANCAP material is from May and June.

Distribution.— Boero & Bouillon (1993a) considered *Halopteris catharina* a cosmopolitan species, but Ramil & Vervoort (1992a) restricted the distribution to temperate and boreal regions of the Atlantic, including the Mediterranean. In the eastern Atlantic it has been recorded from Iceland (Kramp, 1938d, 1943b, both as *Schizotricha catharina*), Trondheimfjord, north-west coast of Norway (Stechow, 1919a, as *Plumularia catharina*; Kramp, 1935b, as *S. catharina*), Faeroe Islands (Kramp, 1935b, as *S. catharina*, 1942b, as *P. catharina*), Oslofjord, south coast of Norway (Christiansen, 1972, as

[3] Dr Peter Schuchert (in litt.) has drawn our attention to the fact that this material greatly resembles *Antennella quadriaurita* (Ritchie, 1909) or might even represent an undescribed species of *Antennella*. So far we have been unable to compare the CANCAP material with undisputed specimens of *A. quadriaurita* so for the present we maintain our initial identification, drawing attention to Dr Schuchert's remark and the discussion of the specimens presented here.

Antennella catharina), west coast of Sweden (Rees & Rowe, 1969; Jägerskiöld, 1971, as *S. catharina*), North Sea (Broch, 1928a, as *P. catharina*), coast of The Netherlands (Vervoort, 1946b, as *A. catharina*), several localities along the British coasts (Marine Biological Association, 1904, 1931; Ritchie, 1911; Crawshay, 1912, all as *P. catharina*; Vervoort, 1942, as *A. catharina*; Cornelius & Ryland, 1990; Cornelius, 1995; Schuchert, 1997), Scilly Islands (Robins, 1969), English Channel (Bedot, 1921c; Billard, 1931b, both as *S. catharina*; Cabioch, 1968, as *P. catharina*), Roscoff (Bedot, 1914a; Prenant & Teissier, 1924; Teissier, 1950b; Cabioch, 1965; Teissier, 1965, all as *P. catharina*; Bouillon, Massin & Kresevic, 1995; Schuchert, 1997), Glénan Archipelago (Fey, 1969; Castric-Fey, 1970, both as *P. catharina*), Isle d'Yeu (Castric-Fey, 1973, as *P. catharina*), Bay of Biscay (Aguirrezabalaga et al., 1984), north coast of Spain (Altuna & García Carrascosa, 1990; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez-Claudio & Anadón, 1995; Medel & López-González, 1996), Portuguese littoral (Da Cunha, 1940, 1944, 1950; Saldanha, 1974, all as *P. catharina*), Gulf of Cádiz (Ramil & Vervoort, 1992a; Medel & López-González, 1996), Azores (Cornelius, 1992b) and coast of Namibia (Gili, Vervoort & Pagès, 1989). In the western Atlantic it has been cited from Bermuda (Morris & Mogelberg, 1973, as *P. catharina*), Sargasso Sea (Broch, 1913, as *P. catharina*), Georgia, U.S.A. (Fraser, 1944a, 1944b, as *P. catharina*; Vervoort, 1972), Caribbean Sea (Vervoort, 1968) and the Strait of Magelhan (Vervoort, 1972).

In the Mediterranean it is known from the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & López-González, 1996), Alborán Sea (Ramil & Vervoort, 1992a; Medel & López-González, 1996), the coast of Catalonia (Gili & Romero, 1983; Gili, Ros & Pagès, 1987; Gili, Murillo & Ros, 1989), Mallorca (Roca, 1986, as *Halopteris* sp.), the French littoral (Redier, 1962b, as *S. catharina*; Bouillon, Massin & Kresevic, 1995) and from Turkey (Marinopoulos, 1979b, as *Polyplumaria catharina*). Stechow (1925b) records its occurrence from the Red Sea.

The bathymetrical range is from 1 (Roca, 1986) to 544 m (Ramil & Vervoort, 1992a).

CANCAP material originates from six localities of which five near the Azores and one in the Cape Verde region and was collected between 52 and 395 m.

Epibionts.— Stn 5.085: Bryozoa.— Stn 5.112: Foraminifera, Bryozoa.— Stn 7.132: Foraminifera, *Filellum serratum* (Clarke, 1879).

Halopteris diaphana (Heller, 1868)
(fig. 69)

Anisocalyx diaphana Heller, 1868: 42, pl. 2 fig. 5.

Plumularia cornu-copiae Hincks, 1872: 389, pl. 21 figs 1-3; Kirchenpauer, 1876: 27, pl. 1 fig. 17, pl. 13 fig. 17.

Plumularia diaphana; Kirchenpauer, 1876: 27, pl. 1 fig. 13; Stechow, 1912a: 363, fig. E; Bedot, 1914a: 89, pl. 5 figs 14-16; Stechow, 1919a: 114; Bennitt, 1922: 254; Prenant & Teissier, 1924: 25; Marine Biological Association, 1931: 77; Fraser, 1944a: 342, pl. 73 fig. 331a-d; 1947: 13; 1948: 277; Teissier, 1950b: 23; Deevey, 1954: 271; Hamond, 1957: 318, fig. 25; 1963a: 667; Teissier, 1965: 27; Fey, 1969: 403; Castric-Fey, 1973: 214; Morris & Mogelberg, 1973: 19, fig. 28a-b; Wedler, 1975: 332.

Plumularia alternata; Billard, 1912a: 468, fig. 5 [not *Halopteris alternata* (Nutting, 1900)].

Schizotricha diaphana; Bedot, 1921b: 12; ?Leloup, 1932c: 163; ?Mammen, 1965: 303, fig. 100.

Thecocaulus diaphanus; Stechow, 1923d: 224; Billard, 1927c: 342; Von Schenck, 1965: 907, fig. 8; Riedl, 1970: 152, pl. 42; Gili & Castelló, 1985: 18, fig. 6E; Gili, 1986: 159, fig. 4.28C-D.

Antennella diaphana f. *typica* p.p. Broch, 1933b: 24.
Antennella diaphana f. *typica*; Leloup, 1935c: 52.
Antenella diaphana; Leloup, 1934c: 15; 1937b: 5, 45.
Not *Thecocaulus diaphanus*; Vannucci Mendes, 1946: 576, pl. 5 figs 46-47 [=*Halopteris alternata* (Nutting, 1900)].
Polyplumaria diaphana; Picard, 1951f: 261; 1958b: 192; Marinopoulos, 1979b: 120.
?*Halopteris diaphana*; Pennycuik, 1959: 177; Ryland & Gibbons, 1991: 528, fig. 3A-E.
Not *Thecocaulus diaphanus*; Riedl, 1959: 654, pl. 11 fig. 7; Gili i Sardà, 1982: 81, fig. 39 [=*Halopteris liechtensternii* (Marktanner-Turneretscher, 1890)].
Not *Antennella diaphana* f. *siliquosa*; Vervoort, 1959: 286, fig. 43 [=*Antennella siliquosa* (Hincks, 1877)].
?*Schizotricha diaphana*; Mammen, 1965: 303, fig. 100.
Not *Antennella diaphana diaphana*; Van Gemerden-Hoogeveen, 1965: 49, figs 23-28.
Not *Halopteris diaphana diaphana*; Vervoort, 1968: 57, fig. 27a-c [=*Halopteris alternata* (Nutting, 1900)].
Halopteris diaphana; Gravier, 1970: 116; Schmidt, 1972b: 41, 44; Boero, 1981a: 182; 1981c: 197; García-Carrascosa, 1981: 259, pl. 24 figs c-f, pl. 37 figs a-c; Boero, 1985a: 136; Gili & García-Rubies, 1985: 48, fig. 5A; Boero & Fresi, 1986: 145; Calder, 1986b: 139, fig. 39; Izquierdo et al., 1986: 51, fig. 2; Roca, 1986: 392, fig. 67; Bandel & Wedler, 1987: 38; Altuna & García Carrascosa, 1990: 85; Cairns et al., 1991: 27; De Oliveira Pires et al., 1992: 5; Boero & Bouillon, 1993a: 263; Calder, 1993b: 68; Altuna Prados, 1994a: 244; 1995a: 54; Bouillon, Massin & Kresevic, 1995: 49; Calder, 1995: 543; Medel & Vervoort, 1995: 37, fig. 15a-c; Peña Cantero, 1995: 311, pl. 36 figs A-D; Medel & López-González, 1996: 202; Migotto, 1996: 45, fig. 9d-e; Watson, 1996: 78; Schuchert, 1997: 47, fig. 15a-h, tab. 11.
Not *Halopteris diaphana*; Millard & Bouillon, 1973: 82, fig. 10L-M [=*Antennella campanulaformis* (Mulder & Trebilcock, 1909)].
Antenella diaphana diaphana; Leloup, 1974: 47, fig. 42.11.
Not *Halopteris diaphana*; Cooke, 1975: 100, pl. 5 fig. 1; Calder, 1991b: 223; 1991c: 2068 [=*Halopteris alternata* (Nutting, 1900)].
Halopteris diaphana diaphana; García Corrales et al., 1978: 42, fig. 18A-C; Flórez González, 1983: 121, photographs 36-37; Isasi, 1985: 85, fig. 24A-C; Isasi & Saiz, 1986: 70.
Not *Halopteris diaphana* f. *siliquosa*; García Corrales et al., 1978: 45, fig. 19; Isasi, 1985: 85, fig. 24D-E; Isasi & Saiz, 1986: 70; Ramil & Vervoort, 1992a: 148, fig. 38a [=*Antennella siliquosa* (Hincks, 1877)].
Not *Halopteris diaphana* var. *siliquosa*; Altuna & García Carrascosa, 1990: 55 [=*Antennella siliquosa* (Hincks, 1877)].
?*Halopteris constricta*; Park, 1990: 83, fig. 5 [not *Halopteris constricta* Totton, 1930 =*Halopteris minuta* (Trebilcock, 1928)].
Halopteris constricta p.p. Migotto, 1996: 44, fig. 9a-c [not *Halopteris constricta* Totton, 1930 =*Halopteris minuta* (Trebilcock, 1928)].
Not *Halopteris diaphana*; Calder, 1997: 36, fig. 9a-e.

Material.— **Canary Islands and Selvagens Archipelago:** Stn 2.D08: fragment of colony without gonothecae (RMNH-Coel. 29094 = slide 4651).

Description (of material from Stn 2.D08).— Material studied consists of small basal part of hydrocaulus with two hydrocladia. Hydrocaulus monosiphonic with short basal zone of three athecate internodes with straight nodes; ultimate internodes with six frontal nematothecae. Rest of hydrocaulus composed of a succession of thecate and athecate internodes with straight and oblique nodes: thecate internodes basally with oblique, distally with straight node; athecate internodes reverse. Thecate internodes with one hydrotheca, one apophysis and three nematothecae: one mesial inferior and two lateral. Hydrotheca deep cup-shaped, widening from base onward, adcauline wall adnate to internode for half its length; abcauline wall straight and not thickened; hydrothecal aperture circular, rim smooth. Apophyses next to hydrothe-

cae, direct under lateral nematotheca, alternately directed left and right, small, without nematothecae. Athecate internodes with two frontal nematothecae. First internode of hydrocladium short, cylindrical, with straight nodes, no nematothecae. Remainder of hydrocladium formed by a succession of thecate and athecate internodes; thecate with basal oblique and distal straight node; athecate reverse. Thecate internodes with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca as in cauline internodes. Mesial inferior nematotheca not reaching hydrothecal base; distal chamber with scooped adcauline wall. Lateral nematothecae placed on small apophyses on both sides of hydrotheca, conical, distal chamber with scooped wall facing hydrotheca, not surpassing hydrothecal rim. Athecate internodes with single frontal nematotheca, identical to mesial inferior one. All nematothecae bithalamic, those of hydrocaulus bigger than those of hydrocladia.

No gonothecae.

Table XXXV. Measurements of *Halopteris diaphana* in µm:

	Stn 2.D08
Height of colony (in mm)	3.6
Stem internodes, length thecate internodes	350-360
Length athecate internodes	250-360
Diameter at node	60-70
Hydrocladial internodes, length thecate internode	280-290
Length athecate internode	250-340
Diameter at node	30-35
Hydrotheca, length abcauline wall	*
Length free part adcauline wall	*
Diameter at rim	*

* These measurements could not be taken owing to paucity of material. In the slide the hydrothecae are in unfavourable position.

Discussion.— *Halopteris tenella* (Verrill, 1874) closely resembles *Halopteris diaphana*, inducing various authors to consider the two conspecific. They are kept separate by Schuchert (1997) because in *H. tenella* the hydrocladia are branched, the hydrocaulus homomerously segmented, and the number of supracalycine nematothecae on the cauline internodes increased. *Halopteris diaphana* as described by Calder (1991b, 1991c) and Migotto (1996), is included in *H. alternata* by Schuchert (1997) after revision of the material concerned. He also considered many records of *H. diaphana*, especially those from outside Europe, doubtful as these were based on a much too wide interpretation of the characters of that species and probably included *Antennella siliquosa*, *H. alternata* and *H. tenella* as inspection of many samples of recorded material has proved. *Halopteris platygonotheca* Schuchert, 1997, can only with certainty be distinguished from *H. diaphana* in the presence of female gonothecae, but so far this species is only known from the Indo-Pacific and occurrence of this species in Atlantic samples seems unlikely. The records of *H. diaphana* from the south of India (Leloup, 1932c) and of *Schizotricha diaphana* (=*H. diaphana*) from Shingle Island, India (Mammen, 1965) have here been considered doubtful as they might relate to *H. platygonotheca* (Schuchert, 1997, see also discussion of *H. alternata*).

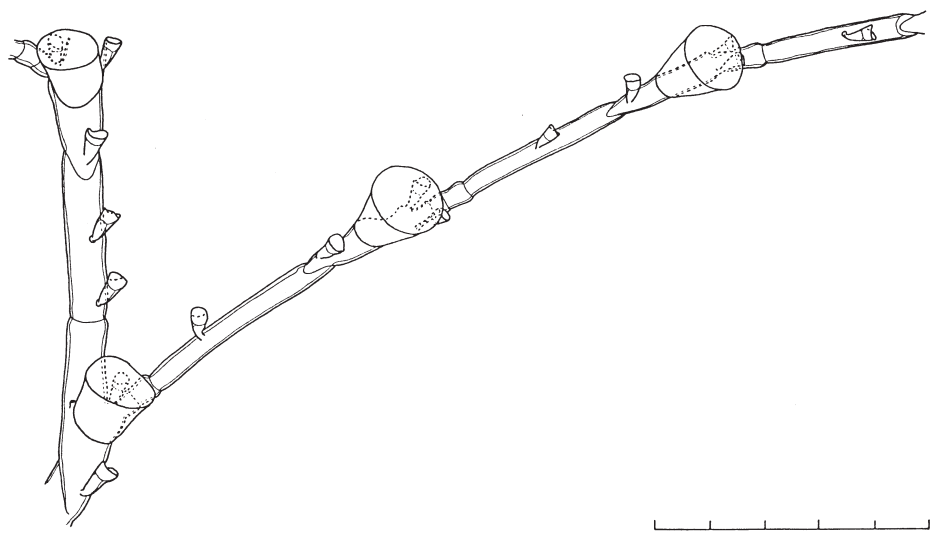


Fig. 69. *Halopteris diaphana* (Heller, 1868), Stn 2.D08. Fragment of a colony, frontal view. Scale: 0.5 mm.

In spite of the absence of gonothecae in the fragmentary CANCAP material we feel certain about its identity. The differences with *H. alternata* have been listed above (p. 155).

Reproduction.— CANCAP material collected in September has no gonothecae. Schuchert (1997) mentioned fertile material from September and November. Fertile material is also known from April (Gili & García Rubies, 1985; Gili, 1986), June (Fey, 1969; Boero & Fresi, 1986; Altuna Prados, 1994a), July (Fey, 1969; Isasi, 1985; Peña Cantero, 1995) and August (Billard, 1927a).

Distribution.— *Halopteris diaphana* is a cosmopolitan species according to Picard (1958b), but Boero & Bouillon (1993a) described its distribution as circumtropical. However, an accurate picture of its distribution is difficult to obtain because of frequent confusion with related species (see above). Schuchert (1997) recently considered all records outside European waters doubtful. Here doubtful records appear from the list of references; others that so far have not proved erroneous by subsequent inspection of the relevant material, are listed below.

In the eastern Atlantic *H. diaphana* has been recorded from the coasts of Great Britain (Hincks, 1872, as *Plumularia cornu-copiae*; Marine Biological Association, 1931, as *P. diaphana*; Hamond, 1957, 1963a, both as *P. diaphana*), from the French littoral (Billard, 1912a; Bedot, 1914a; Prenant & Teissier, 1924, all as *P. diaphana*; Billard, 1927c, as *Thecocaulus diaphanus*; Teissier, 1950b, 1965; Fey, 1969; Castric-Fey, 1973, all as *P. diaphana*; Bouillon, Massin & Kresevic, 1995), from the north coast of Spain (Isasi, 1985; Isasi & Saiz, 1986, both as *H. diaphana diaphana*; Altuna & García Carrascosa, 1990; Altuna, 1994a, 1995a; Medel & López-González, 1996), from the Gulf of Cádiz (Medel & Vervoort, 1995) and from the Canary Islands (Izquierdo et al., 1986). In the western Atlantic it is cited from a locality between the Azores and Bermuda (Leloup, 1935c, as *Antennella diaphana* f. *typica*), from Bermuda (Bennitt, 1922; Morris & Mogel-

berg, 1973, both as *P. diaphana*; Calder, 1986b, 1993b, 1995), from Florida (Deevey, 1954, as *P. diaphana*), from Dry Tortugas (Leloup, 1935c, as *A. diaphana* f. *typica*; Fraser, 1944a; Deevey, 1954, both as *P. diaphana*), from the Gulf of Mexico (Deevey, 1954, as *P. diaphana*), from the coast of Colombia (Wedler, 1975, as *P. diaphana*; Flórez González, 1983, as *H. diaphana diaphana*; Bandel & Wedler, 1987), from Aruba (Leloup, 1935c, as *A. diaphana* f. *typica*; Fraser, 1947, as *P. diaphana*), from Bonaire (Leloup, 1935c, as *A. diaphana* f. *typica*), from Tobago (Fraser, 1947, as *P. diaphana*) and from the Brazilian coast (Oliveira Pires et al., 1992; Migotto, 1996; Schuchert, 1997).

In the Mediterranean it has been found in the Strait of Gibraltar (Medel & Vervoort, 1995; Medel & López-González, 1996), at the Chafarinas Islands (Peña Cantero, 1995), at various localities in the Spanish littoral (García Corrales et al., 1978, as *H. diaphana diaphana*; García Carrascosa, 1981; Gili & Castelló, 1985; Gili, 1986, both as *T. diaphanus*; Medel & López-González, 1996; Schuchert, 1997), at Mallorca (Gili & García Rubies, 1985; Gili, 1986, as *T. diaphanus*; Roca, 1986), at the coast of France (Stechow, 1912a, 1919a, both as *P. diaphana*; Leloup, 1934c, as *A. diaphana*; Picard, 1951f, as *Polyplumaria diaphana*; Schuchert, 1997), along the Italian coast (Stechow, 1923d, as T. *diaphanus*; Boero, 1981a, 1981c, 1985; Boero & Fresi, 1986), in the Adriatic (Heller, 1868, as *Anisocalyx diaphana*; Broch, 1933b, as *A. diaphana* f. *typica*; Riedl, 1970, as *T. diaphanus*; Schuchert, 1997), the coast of Greece (Schuchert, 1997) and Turkey (Marinopoulos, 1979b, as *Polyplumaria diaphana*). Also known from the Gulf of Aden and the Red Sea (Schmidt, 1972b).

In the Indian Ocean reported from south-west of Madagascar (Gravier, 1970), from the Gulf of Mannar, South India (Leloup, 1932a, as *Schizotricha diaphana*) and from the west coast of Australia (Watson, 1996).

Pacific records come from Indochina (Leloup, 1937b, as *A. diaphana*), from the coast of South Korea (Park, 1990, as *P. constricta*), from the east coast of Australia (Pennycuik, 1959), from Fiji (Ryland & Gibbons, 1991), from Clarion Islands (Fraser, 1948, as *P. diaphana*), from Panama (Fraser, 1948, as *P. diaphana*), from Peru (Fraser, 1947, as *P. diaphana*) and from Chile (Leloup, 1974, as *A. diaphana diaphana*).

The bathymetrical distribution oscillates between 0 (Medel & Vervoort, 1995) and 240 m (Roca, 1986).

CANCAP material comes from a single station at the Canary Islands, taken between 5 and 25 m.

Halopteris polymorpha (Billard, 1913)
(fig. 70)

Plumularia polymorpha Billard, 1913: 24, figs 14A-C, 15; Redier, 1966b: 92.

Thecocaulus polymorphus; Bedot, 1921b: 9; Von Schenck, 1965: 928.

Heterotheca polymorpha; Stechow, 1923a: 15.

Antennella polymorpha; Vervoort, 1941: 218.

Halopteris polymorpha; Pennycuik, 1959: 178; Vervoort, 1966a: 132, fig. 35a-d; Millard, 1973: 29; Millard & Bouillon, 1973: 83, fig. 10F-J; 1974: 9; Millard, 1975: 354, fig. 112G-L; 1977b: 107; 1978: 193; 1979b: 132; Hirohito, 1983: 62, fig. 31; Ryland & Gibbons, 1991: 530, fig. 4A-C; Bouillon, Massin & Kresevic, 1995: 49; Schuchert, 1997: 64, figs 20a-f, 21a-h, 22a-h, 23a-f.

Plumularia nuttingi Billard, 1911b: 66, fig. 8.

Plumularia buski; Billard, 1913: 21, fig. 11, pl. 1 fig. 15; Nutting, 1927: 221; Redier, 1966b: 90, pl. 2 figs 1-3, pl. 3 fig. 1.

Halopteris buskii; Vervoort & Vasseur, 1977: 72, figs 30c, 31a-d; Ryland & Gibbons, 1991: 527, fig. 2A-C.
Halopteris buskii p.p. Rees & Vervoort, 1987: 119, fig. 25a-b, tab. 22 (material from Stn 112).
Halopteris buski; Rees & Thursfield, 1965: 160.
Halopteris polymorpha var. *sibogae* Billard, 1913: 25, fig. 16; Millard & Bouillon, 1973: 84, fig. 10K.
Thecocaulus polymorphus var. *sibogae*; Bedot, 1921b: 9.
Antennella secundaria; Vervoort, 1967: 42, fig. 12a-e [not *Antennella secundaria* (Gmelin, 1791)].

Material.— **Cape Verde Islands:** Stn 6.144: One colony on bivalve shell, no gonothecae [RMNH-Coel. 28602, slide 4652; DEBA-UV, slide R. 322, with *Halopteris alternata* (Nutting, 1900)].— Stn 6.D01: Three damaged colonies without gonothecae (RMNH-Coel. 28675).
Additional material.— National Museum of Natural History, Leiden, The Netherlands: Israel Red Sea Expedition: Stn E62/1900, Landing Bay, Entedebir, Dahlak Archipelago, SE of Red Sea, 11.iii.1962: Two colonies without gonothecae. Labelled: *Antennella secundaria* (Gmelin, 1791) (RMNH-Coel 3713).

Description (of material from Stn 6.144).— Hydrorhiza tubular, attached to bivalve shell; hydrocauli monosiphonic, unbranched, basally with series of internodes separated by straight nodes, with a varied number of frontal nematothecae in two rows; terminal node oblique. Remainder of hydrocaulus formed by series of thecate internodes separated by oblique nodes, each internode with one hydrotheca, an apophysis (occasionally two in basal internodes) and seven nematothecae: one mesial inferior, two lateral, two in axil behind hydrothecal wall and two suprahydrothecal. Hydrotheca in middle of internode, deeply cup-shaped, margin slightly scooped laterally, creating the impression of a median abcauline cusp in lateral view. Apophysis next to hydrotheca, alternately directed left and right, opposed in some basal internodes, supporting hydrocladia and devoid of nematothecae. First internode of hydrocladium cylindrical, short, without nematothecae; nodes straight. Second internode with frontal nematotheca; distal node oblique. Rest of hydrocladium a succession of thecate and athecate internodes separated by straight and oblique nodes: basal node of thecate internodes oblique and well marked, distal straight and badly visible in basal parts of hydrocladium; athecate nodes reverse. Thecate internodes with one hydrotheca and four nematothecae: one mesial inferior, two lateral and one in axil behind free part adcauline wall of hydrothecae. Hydrotheca cup-shaped, rather deep; half of adcauline wall adnate, free part straight. Abcauline wall almost straight, with slight undulation apically, this, in combination with slightly laterally scooped rim of hydrotheca creates impression of a low median abcauline cusp. Mesial inferior nematotheca with much reduced basal chamber; apical chamber deeply scooped on adcauline side. Lateral nematothecae on well developed apophyses, reaching or surpassing hydrothecal rim; wall of upper chamber facing hydrotheca slightly scooped. Axillary nematotheca monothalamic or bithalamic, in which case upper chamber much reduced. Athecate internode with one nematotheca resembling mesial inferior nematotheca but with better developed basal chamber. All nematothecae bithalamic, with exception (occasionally) of axillary nematotheca.

Gonothecae absent.

Variability.— In the CANCAP specimens the majority has two axillar nematothecae on the internodes of the hydrocaulus and one on the thecate internodes of the hydrocladia. Colonies with the reverse condition, i.e. one axillar nematotheca on cauline internodes and two on thecate hydrocladial internodes, have also been

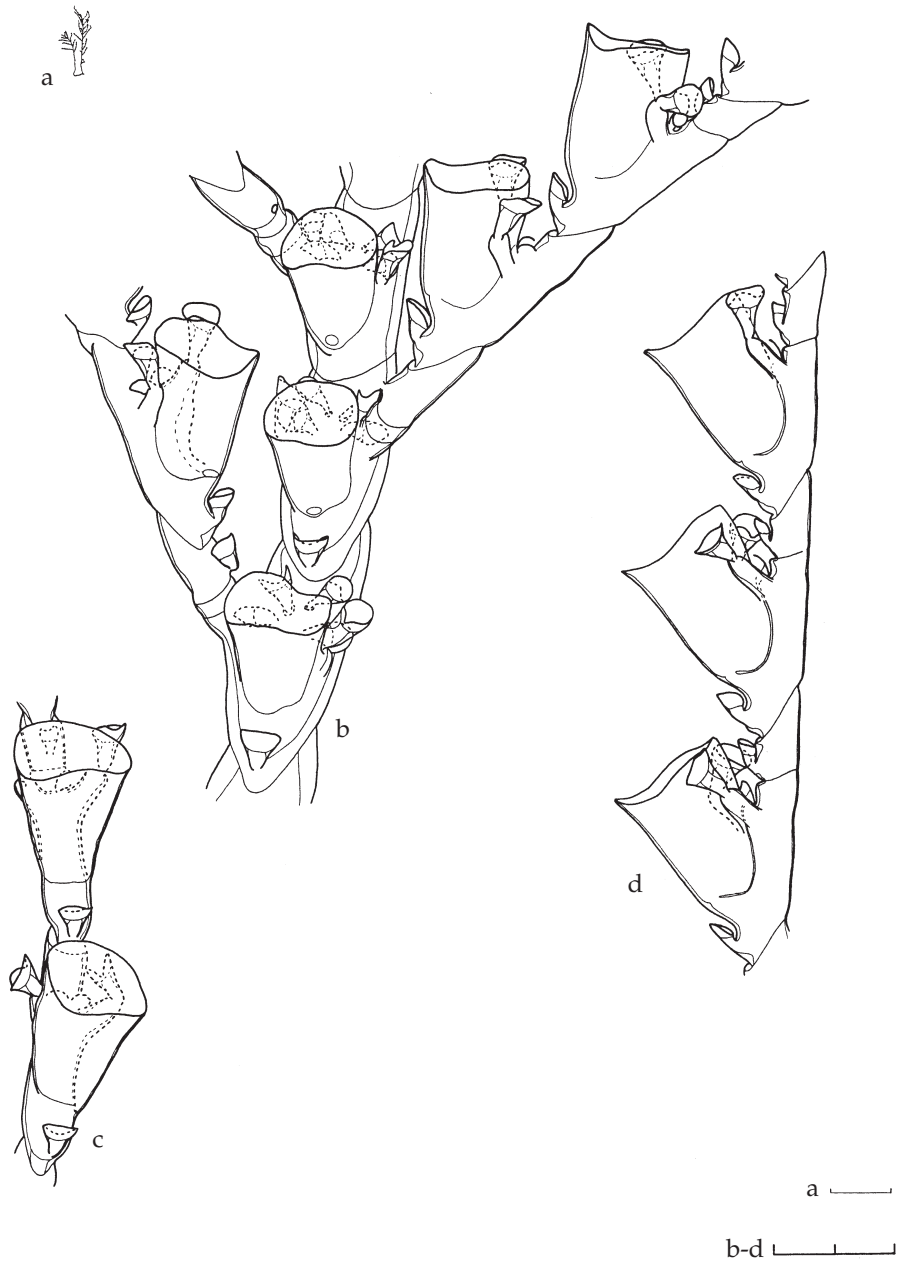


Fig. 70. *Halopteris polymorpha* (Billard, 1913), Stn 6.144. a, colony; b, detail of colony, frontal view; c, hydrocladial internodes, latero-frontal view; d, hydrocladial internodes, lateral view. Scales: a, 1 cm; b-d, 0.2 mm.

observed, as is demonstrated by a colony from Stn 6.144 in which the first thecate internode of each hydrocladium typically has two axillary nematothecae. There is some variability in the place of the supracalycine nematothecae of cauline internodes that can be arranged frontally or be laterally disposed. In some hydrothecae of the colony from Stn 6.144 the abcauline wall is produced into a marginal cusp (fig. 70d) as has also been described by Schuchert (1997) in material from French Polynesia. In the structure of the stem the CANCAP material matches *Halopteris liechtensternii* Marktanner-Turneretscher, 1890, the hydrocladia mach those of *Halopteris polymorpha*. Similar material was found near Banyuls on the French Mediterranean coast (Schuchert, in litt.). However, the presence of a pair of axillary nematothecae above the cauline hydrothecae is not consistent in the CANCAP material; of all described species of *Halopteris* it fits *H. polymorpha* best.

Table XXXVI. Measurements of *Halopteris polymorpha* in µm

	Stn 6.144
Height of colony (in mm)	4-18
Stem internode, length	290-560
Diameter at node	80-150
Hydrocladial internode, length basal athecate internode	100-140
Length thecate internode	240-370
Length athecate internode	70-120
Diameter at node	45-80
Hydrotheca, length abcauline wall	210-235
Length free part adcauline wall	120-135
Diameter at rim	160-190

Discussion.— Schuchert (1997) studied many samples of this species; we largely follow his synonymy.

Reproduction.— The CANCAP material is sterile. Gonothecae are mentioned for February (Ryland & Gibbons, 1991), August (Vervoort & Vasseur, 1977; Schuchert, 1997) and September (Redier, 1966b)

Distribution.— *Halopteris polymorpha* is mainly known from the Indo-Pacific; in the Atlantic it is only known from the Brazilian coast (Schuchert, 1997). It has been recorded from the Indian Ocean coasts of South Africa (Vervoort, 1966a; Millard, 1975, 1977b, 1979b), from Mozambique (Millard & Bouillon, 1974; Millard, 1975), from Zanzibar, Tanzania (Rees & Vervoort, 1987, as *Halopteris buskii*), from the Seychelles (Millard & Bouillon, 1973; Bouillon, Massin & Kresevic, 1995; Schuchert, 1997) and the south coast of Australia (Rees & Thursfield, 1965, as *H. buski*; Redier, 1966b, as *Plumularia buski*). In the Pacific it was recorded from Japan (Hirohito, 1983), from the Philippines (Nutting, 1927, as *P. buski*), from the Sulu Archipelago, the Moluccas and Borneo (Billard 1911b, as *Plumularia nuttingi*; Billard, 1913, as *Plumularia polymorpha*; Vervoort, 1941, as *Antennella polymorpha*; Schuchert, 1997), from the east coast of Australia (Pennycuik, 1959), from Fiji (Ryland & Gibbons, 1991), from Christmas Island, and from Moorea, Polynesia (Rees & Thursfield, 1965, as *H. buski*; Vervoort & Vasseur, 1977, as *H. buskii*; Schuchert, 1997).

The bathymetrical range varies between 0 (Ryland & Gibbons, 1991) and 522 m (Billard, 1913).

The CANCAP material originates from two stations in the Cape Verde region and was taken between 15 and 51 m.

Epibionts.— Stn 6.144: *Hebella* spec., *Filellum serratum* (Clarke, 1879).— Stn 6.D01: Algae.

Genus *Monostaechas* Allman, 1877
Monostaechas quadridens (McCrady, 1859)
(fig. 71)

Plumularia quadridens McCrady, 1859: 199.

Monostaechas dichotoma Allman, 1877: 37, pl. 22 figs 1-5; Bedot, 1921b: 6.

Monostaechas quadridens; Nutting, 1900: 75, pl. 13 figs 1-4; Ritchie, 1907: 508, pl. 25 fig. 4; Fraser, 1912: 380, fig. 46; Jäderholm, 1919a: 20; Bedot, 1921b: 6; Stechow, 1923b: 18; 1925a: 252; Leloup, 1937a: 108, 117, fig. 10A-B; Fraser, 1938b: 10, 61; 1938c: 111; 1938d: 135; 1939c: 161; 1944a: 334, pl. 71 fig. 323a-b; 1944b: 40; 1945: 21; 1948: 274; Deevey, 1954: 271; Pennycuik, 1959: 178, pl. 3 fig. 6; Yamada, 1959: 81; Mammen, 1965: 302, figs 98-99; Rees & Thursfield, 1965: 166; Von Schenck, 1965: 910, 926, fig. 10; Vervoort, 1968: 61, 108, fig. 28a-b; Rho & Chang, 1972: 101, pl. 3 figs 12-13; Millard, 1973: 30; Millard & Bouillon, 1973: 85; Hirohito, 1974: 35, fig. 16a-e; Millard & Bouillon, 1974: 9; Rho & Chang, 1974: 148; Millard, 1975: 365, fig. 117D-F; Calder, 1976: 169; Calder & Hester, 1978: 91; Ljubenkov, 1980: 50; Calder, 1983: 17, fig. 9; Flórez González, 1983: 121; Hirohito, 1983: 65; Rho & Park, 1986: 92; Yamada & Kubota, 1987: 41; Cairns et al., 1991: 27; Park, 1992: 294; Bouillon, Massin & Kresevic, 1995: 50; Hirohito, 1995: 249, fig. 84a-g; Migotto, 1996: 50, fig. 9i; Watson, 1996: 79; Schuchert, 1997: 130, fig. 47a-e.

Monostaechas fisheri f. *simplex* Billard, 1913: 16, fig. 7, pl. 1 fig. 10; Bedot, 1921b: 6.

Monostaechas quadridens f. *stechowi* Leloup, 1935e: 2, figs 2-3.

Antennella diaphana diaphana p.p. Van Gemerden-Hoogeven, 1965: 49 [not *Halopteris diaphana* (Heller, 1868)].

Material.— **Canary Islands and Selvagens Archipelago:** Stn 4.039: One detached colony without gonothecae (RMNH-Coel. 28968).— **Cape Verde Islands:** Stn 6.004: One damaged colony on stone, no gonothecae (RMNH-Coel. 29095 = slide 4653).— Stn 6.062: One colony on bivalve shell, with gonothecae (RMNH-Coel. 28790, four slides 4654).— Stn 6.067: One colony on *Streptocaulus pulcherrimus* Allman, 1883, with male and female gonothecae (RMNH-Coel. 28926, two slides 4655).— Stn 6.074: Two colonies, one on shell fragment, no gonothecae (RMNH-Coel. 28785; DEBA-UV, slide R. 324).— Stn 6.075: Two colonies without gonothecae (RMNH-Coel. 28660, slide 4656).— Stn 6.076: One colony without gonothecae (RMNH-Coel. 29096 = slide 4657).— Stn 6.080: Two colonies with gonothecae (RMNH-Coel. 29097 = two slides 4658).— Stn 6.106: One colony on *Streptocaulus pulcherrimus* Allman, 1883, no gonothecae (RMNH-Coel. 28670, 28911, slide 4659).— Stn 6.137: One colony on *Nematophorus clarkei* (Nutting, 1900) and three detached colonies, no gonothecae (RMNH-Coel. 28783, slide 4660).— Stn 6.148: One colony without gonothecae (RMNH-Coel. 28796).— Stn 6.163: One damaged colony on bivalve shell, no gonothecae (RMNH-Coel. 28952).— Stn 6.176: One colony without gonothecae (RMNH-Coel. 28764, slide 4661).— Stn 7.044: One colony on barnacles, no gonothecae (RMNH-Coel. 28766, slide 4662).— Stn 7.107: One colony with gonothecae (RMNH-Coel. 28932).— Stn 7.112: One damaged colony, no gonothecae (RMNH-Coel. 28957).— Stn 7.152: One young colony on bivalve shell, no gonothecae (RMNH-Coel. 28752, slide 4663).

Description (of material from Stn 6.062).— Hydrorhiza tubular, branched, adhering to substrate; hydrocauli monosiphonic, sympodially branched in one plane. Hydrocaulus formed by succession of internodes separated by straight nodes, each

with a varied number of frontal nematothecae and a distal apophysis supporting a hydrocladium. Each hydrocladium with one long basal athecate internode, with basal straight and distal oblique node and three to five nematothecae on superior part. Remainder of hydrocladium a succession of thecate and athecate internodes; thecate internodes basally with oblique and distally with straight node; athecate internodes reverse; straight nodes often weak. Each thecate internode with one hydrotheca and four nematothecae: one mesial inferior, two lateral and a small axillary nematotheca. Hydrotheca cup-shaped, walls not widening, adcauline wall adnate for half its length, abcauline wall straight, aperture circular, tilted downwards, rim smooth. Mesial nematotheca not reaching hydrothecal base, adcauline wall of upper chamber deeply scooped. Lateral nematothecae on short apophyses on both sides of hydrotheca, not reaching its margin. One much reduced axillary nematotheca behind free part adcauline wall of hydrotheca. Athecate internodes with two frontal nematothecae in one line, resembling infracalycine nematotheca but with better developed distal chamber. All nematothecae bithalamic and movable; axillary nematotheca typically monothalamic and fixed.

Gonothecae inserted laterally at hydrothecal base. Male gonotheca pyriform, curved, distally rounded, basally narrowing, with one nematotheca; pedicel short, one-segmented. Female gonotheca big, inflated sac-shaped, basally narrowed and curved, with two nematothecae; pedicel short, two-segmented. Apical part of gonotheca flattened, with circular opening closed by lid.

Variability.— Majority of deviations from typical structure are the result of damage and posterior regeneration and usually concern the athecate internodes of which the number of nematothecae may increase to four. In a colony from Stn 4.039 a secondary hydrocladium of identical structure develops from one of its (primary) hydrocladia.

Table XXXVII. Measurements of *Monostaechas quadridens* in µm:

	Stn 6.062
Height of colony (in mm)	32
Stem internode, length	1150-1970
Diameter at node	150-230
Length thecate hydrocladial internode	510-610
Length athecate hydrocladial internode	300-550
Diameter at node	100-150
Hydrotheca, length abcauline wall	225-270
Length free part adcauline wall	115-150
Diameter at rim	250-285
Male gonotheca, length	420-490
Diameter	260
Female gonotheca, length	700-770*
Diameter	400-490*

* Measurements of female gonothecae were taken in material from Stn 6.067.

Discussion.— *Monostaechas fisheri* Nutting (1905) differs from *M. quadridens* by the straight hydrocaulus from which rise hydrocladia identical in structure with those of

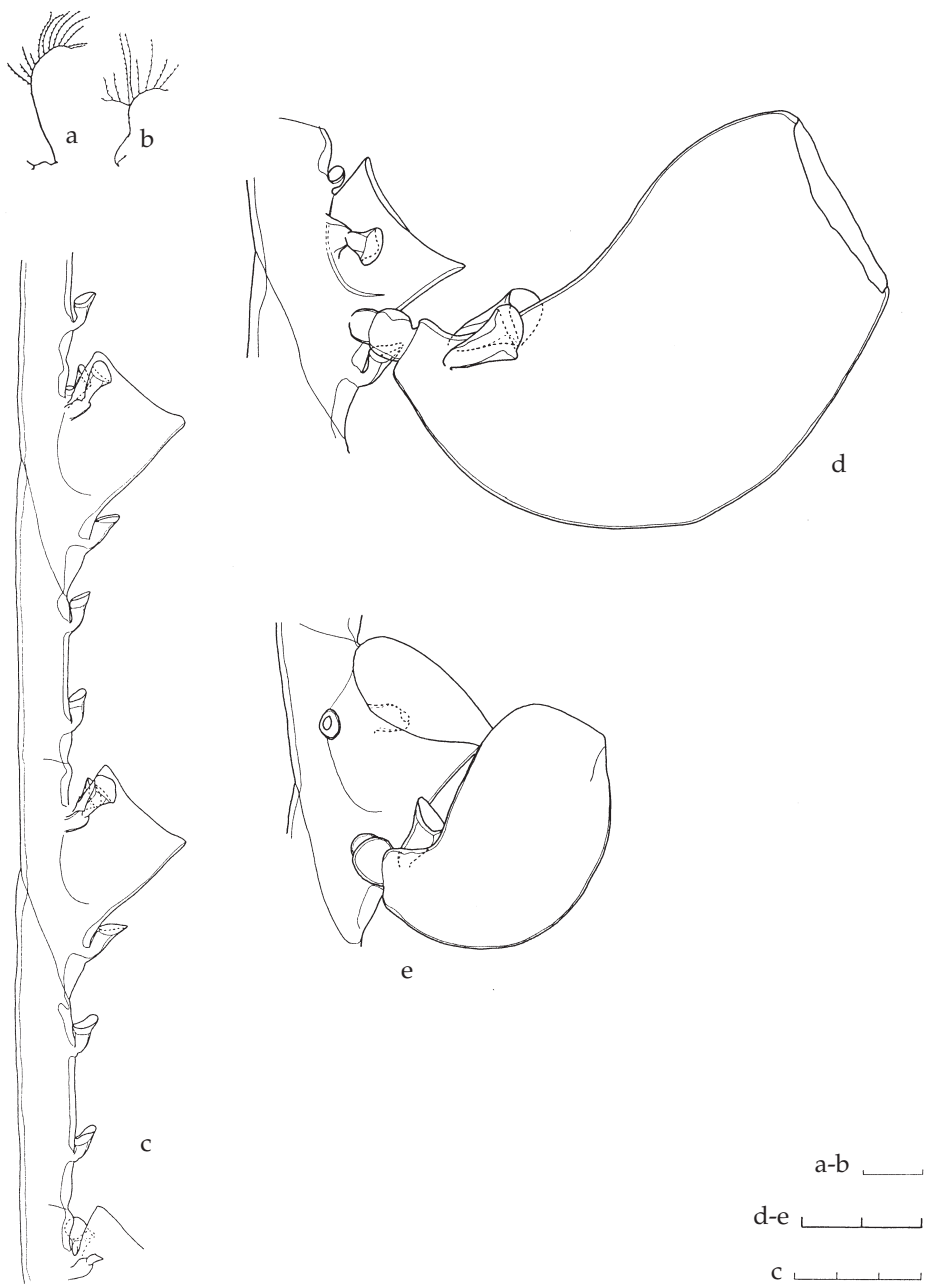


Fig. 71. *Monostaechas quadridens* (McCrady, 1859). a, Stn 7.152, colony; b-c, Stn 6.062, b, colony; c, hydrocladial internodes, lateral view; d-e, Stn 6.067, d, female gonotheca, lateral view; e, male gonotheca, oblique lateral view. Scales: a-b, 1 cm; c, 0.3 mm; d-e, 0.2 mm.

M. quadridens. The differences between the two species are considered doubtful by Bedot (1921b) and Vervoort (1968) and the two are conspecific according to Leloup (1935e), who believed the straight hydrocaulus of *M. fisheri* to be related to age and pointed to the fact that the material of the latter was collected at considerable depth and could have developed without influence of water currents. Calder (1983) keeps both species separate and Schuchert (1997) preferred to separate both species provisionally on characters of the hydrocaulus, pending the study of more material.

Monostaechas quadridens f. *stechowi*, described by Leloup (1935e) to include colonies with three or four nematothecae on the athecate internodes, was sunk into the nominate species by Vervoort (1968), Calder (1983) and Schuchert (1997).

Van Gemerden-Hoogeveen's (1965) *Antennella diaphana diaphana* from New Providence, Bahamas, was brought to *M. quadridens* by Schuchert (1997) after revision of the material.

Reproduction.— Leloup (1937) mentioned occurrence of gonothecae in March, Vervoort (1968) in January, and Schuchert (1997) in June. Fertile CANCAP colonies date from June and August.

Distribution.— *Monostaechas quadridens* is widely distributed in tropical, subtropical and temperate waters of the great oceans (Rees & Thursfield, 1965; Schuchert, 1997). In the Atlantic it is known from the Cape Verde region (Ritchie, 1907; Rees & Thursfield, 1965; Schuchert, 1997), North Carolina (Fraser, 1912, 1944a), the coast of South Carolina (Fraser, 1944a; Calder, 1976; Calder & Hester, 1978; Calder, 1983; Schuchert, 1997), the Bahamas (Schuchert, 1997), Florida (Leloup, 1937a; Deevey, 1954; Schuchert, 1997), Dry Tortuga (Fraser, 1944a; Deevey, 1954), Gulf of Mexico (Deevey, 1954), Colombia (Flórez González, 1983), Virgin Islands (Vervoort, 1968), and Brazil (Rees & Thursfield, 1965; Migotto, 1996).

In the Indian Ocean it has been mentioned from the coasts of South Africa (Millard, 1975), Mozambique (Millard & Bouillon, 1974; Millard, 1975; Bouillon, Massin & Kresevic, 1995), Seychelles (Millard & Bouillon, 1973; Schuchert, 1997), southern India (Mammen, 1965) and the coast of West Australia (Stechow, 1923b; Watson, 1996). In the Pacific it is known from Indonesia (Billard, 1913, as *Monostaechas fisheri* f. *simplex*), the coast of Korea (Rho & Chang, 1972, 1974; Rho & Park, 1986; Park, 1992), Japan (Jäderholm, 1919a; Stechow, 1923b; Yamada, 1959; Rees & Thursfield, 1965; Hirohito, 1974, 1983; Yamada & Kubota, 1987; Hirohito, 1995), Queensland, eastern Australia (Pennycuik, 1959), Eastern Island (Leloup, 1935e, as *Monostaechas quadridens* f. *stechowi*), Clarion Islands (Fraser, 1938b), coast of Canada (Fraser, 1938b), California (Fraser, 1938b, 1948; Ljubenkov, 1980), Mexico (Fraser, 1948) and Ildefonso Island, Chile (Fraser, 1938c).

The bathymetrical range is between 0 (Millard, 1975) and 282 m (Fraser, 1944a).

CANCAP material originates from 17 stations, of which one near the Canary Islands and 16 from the Cape Verde Archipelago and was collected between 45 and 300 m depth.

Epibionts.— Stn 4.039: *Clytia gracilis* (M. Sars, 1850).— Stn 6.004: *Campomma* spec., *Campanularia hincksii* Alder, 1856.— Stn 6.074: Foraminifera, *Clytia paulensis* (Vanhöffen, 1910).— Stn 6.075: *Clytia* spec.— Stn 6.076: Foraminifera, *Filellum serratum* (Clarke, 1879), *Plumularia setacea* (L., 1758).— Stn 6.106: Campanulariidae indet.— Stn 6.137: Foraminifera, *Filellum serratum* (Clarke, 1879).— Stn 7.112: Foraminifera, *Modeeria rotunda* (Quoy & Gaimard, 1827).

Family Kirchenpaueriidae Millard, 1962
Genus *Kirchenpaueria* Jickeli, 1883
Kirchenpaueria bonnevieae (Billard, 1906)
(fig. 72)

Plumularia rubra Bonnevie, 1899: 91, pl. 7 fig. 2 [not *Plumularia rubra* Von Lendenfeld, 1884 = *Halopteris campanula* (Busk, 1852)].
Plumularia elegantula var. Pictet & Bedot, 1900: 28.
Plumularia bonnevieae Billard, 1906b: 203, fig. 14; 1906c: 331; Jäderholm, 1909: 29, 107; Van Praët, 1979: 918, fig. 79.
Plumularia bonneviae; Bedot, 1921b: 26; 1923: 219, 227, fig. 8.
Ventromma bonneviae; Stechow, 1923d: 220.
Kirchenpaueria bonneviae; Billard, 1930a: 80.
Plumularia triangulata Totton, 1930: 225, fig. 61; Billard, 1930a: 80; Ralph, 1961b: 41, fig. 5f-g.
Kirchenpaueria triangulata; Millard, 1962: 292, fig. 6E-J; Vervoort, 1966a: 136, figs 38a-f, 39a-c; Millard, 1967: 184; 1968: 277; 1975: 375, fig. 119E-H; 1977a: 39; 1977b: 107; 1978: 194; Rees & Vervoort, 1987: 129, fig. 27a-d; Dawson, 1992: 17.
Kirchenpaueria bonnevieae; Van Praët, 1979: 918; Ramil & Vervoort, 1992a: 151, figs 39d-g, 40b, e; Bouillon, Massin & Kresevic, 1995: 50; Medel & López-González, 1996: 202; Stepan'yants, Svoboda & Vervoort, 1996: 15; Ramil, Vervoort & Ansín, 1998: 32.

Material.— **Cape Verde Islands**: Stn 7.126: One colony on *Streptocaulus pulcherrimus* Allman, 1883, without gonothecae (RMNH-Coel. 28906, 28933, two slides 4664).

Description.— Hydrorhiza tubular, adhering to stem of *Streptocaulus pulcherrimus* Allman, 1883 and from which rise hydrocauli forming the colony. Hydrocauli monosiphonic, unbranched, inserted on small apophysis of hydrorhiza; basal zone undivided, with one nematotheca, rest of hydrocaulus a succession of internodes separated by slightly oblique nodes. Each internode with basal nematotheca and one distal apophysis on opposite side; nematothecae and apophyses of internodes alternating. Each apophysis with mamelon on superior surface followed by a distal nematotheca.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of thecate internodes with slightly oblique nodes. Each internode with one hydrotheca slightly below middle of internode and two nematothecae: one mesial inferior and one above hydrotheca. Hydrotheca cup-shaped, low, widening distally, adcauline wall fully adnate with internode; abcauline wall straight, aperture circular, occasionally slightly tilted downwards, rim smooth. First hydrocladial internode without mesial inferior nematotheca. All nematothecae movable and monothalamic, club-shaped, narrowing basally, pedicel short; aperture terminal, circular.

No gonothecae.

Variability.— The material at our disposal shows the following variations. An internode of the stem has two cauline nematothecae situated below the apophysis. One hydrocladium has a basal, athecate internode. Two hydrocladia have a mesial inferior nematotheca on the first internode. All these aberration are the result of regeneration after damage.

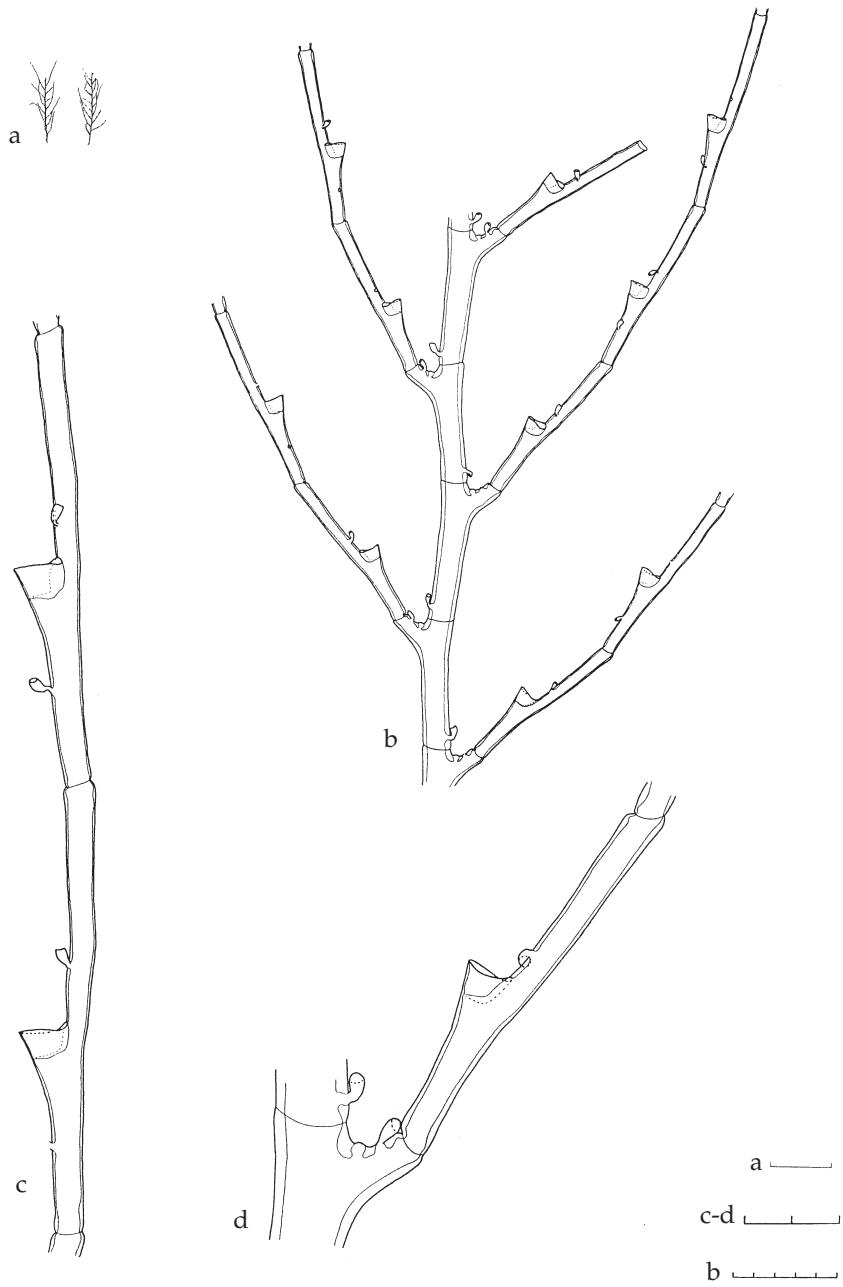


Fig. 72. *Kirchenpaueria bonnevieae* (Billard, 1906), Stn 7.126. a, colonies; b, detail of colony, frontal view; c, hydrocladial internodes, lateral view; d, axial apophysis and first hydrocladial internode, lateral view. Scales: a, 1 cm; b, 0.5 mm; c-d, 0.2 mm.

Table XXXIX. Measurements of *Kirchenpaueria bonnevieae* in µm:

	Stn 7.126
Height of colony (in mm)	5-16
Stem internode, length	550-710
Diameter at node	95-200
Hydrocladial internode, length first internode	650-830
Length following internodes	850-1000
Diameter at node	50-60
Hydrotheca, length abcauline wall	60-80
Length adcauline wall	55-80
Diameter at rim	95-110
Nematotheca, length	55-65
Diameter at rim	20-25

Discussion.— Bedot (1916b, 1921b) included in *Kirchenpaueria* Jickeli, 1883 plumularioid hydroids that have no lateral nematothecae, have a naked sarcostyle above the hydrotheca and of which the mesial inferior nematotheca is monothalamic and fixed. He placed species with two unpaired, monothalamic nematothecae, one above, one below the hydrotheca, as in the present species, in *Plumularia* Lamarck, 1816. However, in a later paper (Bedot, 1923) they were included in *Kirchenpaueria* as these nematothecae never occur in pairs. Stechow (1923d) described *Ventromma* for those species that have an unpaired, monothalamic nematotheca above the hydrotheca, maintaining in *Kirchenpaueria* those species that have a naked sarcostyle above the hydrotheca. Later authors (Millard, 1962; Vervoort, 1966a) did not follow Stechow (1923d) and included *Plumularia triangulata* Totton, 1930 (= *Kirchenpaueria bonnevieae*) in *Kirchenpaueria*; Bouillon (1985) considered *Ventromma* and *Kirchenpaueria* congeneric. In our opinion the presence or absence of a nematotheca to protect the suprahydrothecal nematophore (sarcostyle) is insufficient evidence to separate the two genera so we follow Bouillon (1985) in synonymizing the generic names *Kirchenpaueria* Jickeli, 1883, and *Ventromma* Stechow, 1923d, the older name having priority.

The material examined, though devoid of gonothecae, has all the characters of the trophosome of *Kirchenpaueria bonnevieae* and lived epibiontically on *Streptocaulus pulcherrimus* Allman, 1883; hydroids being the habitual substrate of this species, having been found on *Diphasia alata* (Hincks, 1855) [=*Diphasia pinastrum* (Cuvier, 1830)] (cf. Billard, 1906b); on *Pseudoplumaria marocana* (Billard, 1930) (cf. Billard, 1930a); on *Plumularia tenuissima* Totton, 1930, (cf. Totton, 1930, as *Kirchenpaueria triangulata*); on *Cladocarpus inflatus* Vervoort, 1966 (cf. Vervoort, 1966a, as *Kirchenpaueria triangulata*); on *Cladocarpus dofleini* (Stechow, 1911) (cf. Vervoort, 1966a; Rees & Vervoort, 1987, both as *Kirchenpaueria triangulata*), and on *Lytocarpia myriophyllum* (Linnaeus, 1758) (cf. Ramil & Vervoort, 1992a). Bonnevie (1899) and Pictet & Bedot (1900) did not indicate the substrate of their specimens.

Bonnevie (1899) described *Kirchenpaueria bonnevieae* as *Plumularia rubra*, a name previously used by Von Lendenfeld (1884) for a species later identified as *Halopteris campanula* (Busk, 1852); Billard (1906b) gave Bonnevie's species the name *Plumularia bonnevieae*. Billard (1930a) suggested that *Kirchenpaueria triangulata* (Totton, 1930) and

K. bonnevieae might be conspecific; Rees & Vervoort (1987) considering Billard's proposal, though it necessary first to study Atlantic material before reaching a definite conclusion. Ramil & Vervoort (1992a) after the study of BALGIM material (Atlantic coast of Morocco and the Sea of Alborán), together with that of material from the Bay of Biscay (Monaco collections) found no differences in gonosome, trophosome and measurements and placed *K. triangulata* in the synonymy of *K. bonnevieae*.

Kirchenpaueria ventruosa (Billard, 1911) closely resembles *K. bonnevieae*, but differs, according to Billard (1911) by the presence of a short basal, athecate internode in the hydrocladia and by the nematothecae, that have a swollen distal part. Rees & Vervoort (1987) considered the first character variable and the second of little importance; however, they indicated that a revision of the type is necessary for a definite judgement. Ramil & Vervoort (1992a), after having re-inspected the type, kept both species separate by the following details:

Presence of an athecate basal internode in the hydrocladia is typical in *K. ventruosa* and quite occasional in *K. bonnevieae*.

The hydrotheca of *K. ventruosa* has a characteristic undulation of the adcauline wall, the distal part being slightly concave; adcauline wall longer than abcauline wall, hydrothecal aperture consequently tilted downwards. In *K. bonnevieae* the adcauline wall is straight and shorter than the abcauline wall, the hydrothecal aperture is tilted upwards.

The measurements of *K. ventruosa* are superior to those of *K. bonnevieae*.

Billard (1911, 1913) gave no indication of the substrate on which the colony developed, nor did the inspection of the type provided an indication. *K. bonnevieae* so far has exclusively been found on other hydroids.

Reproduction.— CANCAP material was collected in September and is sterile. Fertile colonies were obtained in February (Vervoort, 1966), April (Millard, 1977), June (Ramil & Vervoort, 1992a), July (Billard, 1906b) and December (Millard, 1968).

Distribution.— In the Atlantic *Kirchenpaueria bonnevieae* has been recorded from the Trondhjem Fjord, Norway (Bonnevie, 1899, as *Plumularia rubra*), from two localities between the Faeroe and Shetland Islands (Bonnevie, 1899, as *P. rubra*), from the Bay of Biscay (Pictet & Bedot, 1900, as *Plumularia elegantula* var.; Billard, 1906b, 1906c, both as *P. bonnevieae*; Ramil & Vervoort, 1992a), from Ampère Bank (Ramil, Vervoort & Ansín, 1998), from the coast of Morocco (Billard, 1930; Ramil & Vervoort, 1992a) and from South Africa (Millard, 1968, 1978, both as *K. triangulata*). Also recorded from one locality in the Alborán Sea, Mediterranean (Ramil & Vervoort, 1992a).

In the Indian Ocean known from the coasts of South Africa (Millard, 1962; Vervoort, 1966a; Millard, 1967; 1975; 1977b; 1978, all as *K. triangulata*), from Mozambique (Millard, 1975, as *K. triangulata*), from Zanzibar, Tanzania (Rees & Vervoort, 1987, as *K. triangulata*), from Oman (Rees & Vervoort, 1987, as *K. triangulata*) and from one locality NW of Kerguelen (Millard, 1977a, as *K. triangulata*).

In the Pacific it is only known from New Zealand (Totton, 1930; Ralph, 1961, both as *P. triangulata*; Dawson, 1992, as *K. triangulata*).

The bathymetrical distribution is between 11 (Millard, 1975) and 1255 m (Ramil & Vervoort, 1992a).

CANCAP material comes from one locality in the Cape Verde region and was taken between 208 and 930 m.

Kirchenpaueria halecioides (Alder, 1859) (fig. 73)

Plumularia halecioides Alder, 1859: 353, pl. 12 figs 1-4; Hincks, 1868: 306, pl. 67 figs 2, 2a-c; Billard, 1902: 536; 1903: 58, fig. 1; 1904a: 180, figs 54-68; Marine Biological Association, 1904: 197; Ritchie, 1907: 508; Linko, 1912: 15; Stechow, 1912a: 363; Fraser, 1914b: 218, 222, pl. 1 fig. 3; Stechow, 1919a: 117; Bedot, 1921b: 27; 1923: 227; Marine Biological Association 1931: 77; Nobre, 1931: 19; Leloup, 1932c: 164; Da Cunha, 1940: 108; Vannucci-Mendes, 1949: 255; Vervoort, 1949: 146; Vannucci, 1951b: 110, 115, 116; Hamond, 1957: 318; Pennycuik, 1959: 179; Hamond, 1963a: 667; Van Gemerden-Hoogeveen, 1965: 64; Von Schenck, 1965: 952, fig. 34b; Vervoort, 1968: 109; Naumov, 1969: 467, fig. 356A-B; Fishelson, 1971: 122; Morris & Mogelberg, 1973: 25; Cooke, 1975: 102, pl. 6 figs 1-2; Wedler, 1975: 332; Morri, 1979b: 170, fig. 4; Cornelius & Garfath, 1980: 286; Flórez González, 1983: 121, photographs 40-41; Bandel & Wedler, 1987: 42.

Anisocalyx bifrons Heller, 1868: 43, pl. 2 fig. 6.

Plumularia halecioides var. *adriatica* Carus, 1884: 18.

Plumularia inermis Nutting, 1900: 62, pl. 5 figs 1, 2, 2a; Fraser, 1912: 382, fig. 50; Bennitt, 1922: 255, figs 3-4; Vannucci-Mendes, 1946: 581, pl. 5 fig. 52.

Plumularia halecioides var. A Billard, 1903: 57; 1904a: 180, figs 57-62, 64, 66-68.

Plumularia halecioides var. V Billard, 1903: 57; 1904a: 180, figs 54-56.

Antennularia pinnata; Bennitt, 1922: 252, fig. 2 (not *Antennularia pinnata* Nutting, 1900).

Ventromma halecioides; Stechow, 1923d: 219; Leloup, 1934c: 15; 1935c: 51; Da Cunha, 1944: 26; 1950: 124; Picard, 1951a: 112; 1951f: 260; 1952a: 349; 1952d: 221; 1958b: 192; Riedl, 1959: 652; Bellan-Santini, 1961: 27; 1962: 192; Rees & Thursfield, 1965: 156; Teissier, 1965: 28; Pérès, 1967: 484; Robins, 1969: 334; Riedl, 1970: 152, pl. 42; Rossi, 1971: 25, fig. 9A-C; Por & Ferber, 1972: 150; Schmidt, 1972b: 41, 42, 43, 45; 1973a: 284; Hirohito, 1974: 15, fig. 20a-d; García Corrales et al., 1978: 51, fig. 23A-B; Gili, 1979: 128; Morri, 1979b: 306; 1979d: 119, 120; 1980a: 161, fig. 4; 1980b: 8; 1980c: 419; Boero, 1981a: 182; 1981b: 112, figs 5a-b, 6a-c; 1981c: 197; 1981d: 5; García Carrascosa, 1981: 246, pl. 22 figs a-c; Morri, 1981a: 193, 194; 1981b: 88, fig. 30a-e, pl. 2 fig. 4; 1981c: 89; Morri & Martini, 1981: 308; Gili i Sardà, 1982: 85, fig. 42; Morri & Bianchi, 1982: 270; Altuna et al., 1984: 135; Morri & Bianchi, 1983a: 190, fig. 6b; Boero, 1984: 103, fig. 8A-B; 1985a: 136; Boero et al., 1985: 29; Gili & García Rubies, 1985: 48, fig. 5F-G; Isasi, 1985: 89, fig. 27A-C; Morri, 1985: 117; Morri & Bianchi, 1985: 119; Boero & Fresi, 1986: 146; Gili, 1986: 153, fig. 4.29B; Isasi & Saiz, 1986: 70; Morri & Boero, 1986: 67, figs 45, 46a-c; Roca, 1986: 370, fig. 63; Barangé & Gili, 1987: 49, fig. 2B-C; Roca & Moreno, 1987b: 48, fig. 3A-B; Ramil, 1988: 408; Gili, Murillo & Ros, 1989: 23; Altuna & García Carrascosa, 1990: 84, fig. 78; Cornelius & Ryland, 1990: 154, fig. 4.23; Piraino & Morri, 1990: 56; Piraino, Morri & Boero, 1990: 386, fig. 2; Calder, 1991b: 223; 1991c: 2068; Cairns et al., 1991: 28; Morri, Bavestrello & Bianchi, 1991: 33; Cornelius, 1992a: 255, 257; 1992b: 83; Kaehler & Hughes, 1992: 329, fig. 2C; Boero & Bouillon, 1993a: 263; Calder, 1993b: 68; Vervoort, 1993b: 550; Altuna Prados, 1994a: 253, pl. 45 fig. D; 1995a: 54; Cornelius, 1995: 172, fig. 41A-D; Medel & Vervoort, 1995: 45, fig. 19a-c; Peña Cantero, 1995: 324, pl. 38 figs a-c; Migotto, 1996: 51, fig. 10a-c; Calder, 1997: 4, fig. 1a-f.

Kirchenpaueria halecioides; Billard, 1926: 98; 1927c: 342; Ansín Agís, 1992: 143, pl. 32 figs A-B.

Plumularia irregularis Millard, 1958: 210, fig. 13A-C; 1979a: 147.

Ventromma halecioides var. *minutus* Mammen, 1965: 295, fig. 92.

Not *Plumularia halecioides*; Vervoort, 1967: 45, fig. 13a-c [= *Plumularia setacea* (Linnaeus, 1758)].

Kirchenpaueria irregularis; Millard & Bouillon, 1974: 9; Millard, 1975: 370, fig. 118D-G.

Not *Ventromma halecioides*; Chas Brínquez & Rodríguez Babío, 1977: 31, fig. 17A-C [= *Kirchenpaueria pinnata* (Linnaeus, 1758)].

Material.— **Madeira area:** Stn 4.173: One colony on bivalve shell, with gonothecae (RMNH-Coel. 28744, slide 4665)

Description.— Hydrorhiza tubular, attached to substrate; hydrocauli polysiphon-

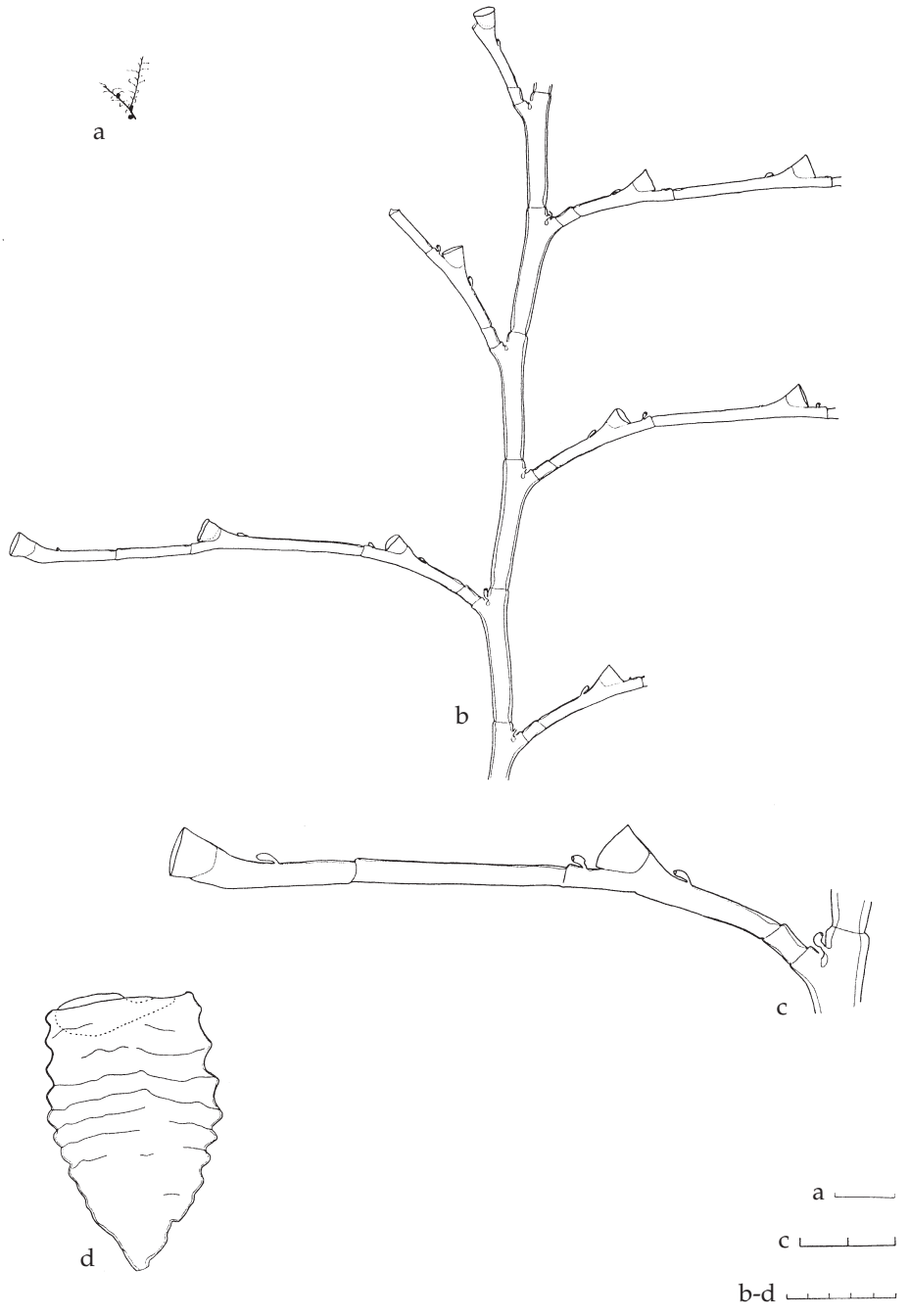


Fig. 73. *Kirchenpaueria halecioides* (Alder, 1859), Stn 4.173. a, colony; b, detail of a colony, frontal view; c, axial apophysis and hydrocladium, lateral view; d, gonotheca, frontal view. Scales: a, 1 cm; b, d, 0.5 mm; c, 0.2 mm.

ic basally and irregularly branched. Stem divided into internodes with straight nodes, each with one small distal apophysis and one small, almost axillar mamelon and one axillary nematotheca just above apophysis. Apophyses, and consequently hydrocladia, inserted thereon, alternately arranged, pointing left or right.

Hydrocladia basally with short athecate internode; remainder a succession of thecate and athecate internodes separated by slightly oblique node. Thecate internodes with a hydrotheca on distal half and two nematothecae: one mesial inferior and one above hydrotheca. Hydrotheca cup-shaped, low, widening distally; adcauline wall free for one-third its length, abcauline wall straight or slightly convex; aperture circular, tilted downwards, rim smooth. Nematothecae small, club-shaped, narrowing basally; aperture terminal, circular. Athecate internodes shorter than thecate ones, without nematothecae. All nematothecae monothalamic and movable.

Gonothecae globular, transversally ribbed over whole length, narrowing towards base and attached to stem internodes by means of short pedicel; distally truncate and with circular aperture closed by lid.

Variability.— Occurrence of athecate internodes in hydrocladia is much varied. In the CANCAP material hydrocladia with only thecate internodes, with regularly alternating thecate and athecate internodes, and with occasional athecate internodes are present in the same colony. Damage followed by regeneration may lead towards the presence of three consecutive athecate internodes at the base of a hydrocladium.

Table XL. Measurements of *Kirchenpaueria halecioides* in µm:

	Stn 4.173
Height of colony (in mm)	3-24
Stem internode, length	460-660
Diameter at node	65-110
Thecate hydrocladial internodes, length first internode	450-540
Length following internodes	750-840
Diameter at node	40-50
Hydrotheca, length abcauline wall	80-100
Length adcauline wall	60-90
Diameter at rim	105-120
Nematotheca, length	50-60
Diameter at rim	15-20
Gonotheca, length	1010-1360
Maximum diameter	660-810

Discussion.— Though many authors (Leloup, 1935c; Picard, 1958b; García Corrales et al., 1978; Cornelius, 1992b, 1995; Boero & Bouillon, 1993; Calder, 1993, 1997; Vervoort, 1993b; Medel & Vervoort, 1995) refer to this species as *Ventromma halecioides*, it is here considered a species of *Kirchenpaueria* Jickeli, 1883 (see discussion on p. 177). *Plumularia inermis* (Nutting, 1900) is considered conspecific with *Kirchenpaueria halecioides* by various authors (Leloup, 1935c; Vervoort, 1968; Calder, 1997). However, Calder (1997) indicated that Fraser's (1938b) Pacific record of *Plumularia inermis* could refer to another species because of the shape of its gonothecae. *Antennu-*

laria pinnata as recorded by Bennitt (1922) was included in *K. halecioides* by Leloup (1935c) and we concur. Also, following García Corrales et al. (1978) and Calder (1997), we believe that *Plumularia irregularis* Millard, 1958 is conspecific with *K. halecioides.* Vervoort's (1967) record of *Plumularia halecioides* from the Gulf of Aqaba, Red Sea, has been referred to *Plumularia setacea* (Linnaeus, 1758) (cf. Vervoort, 1993).

Reproduction.— Gonothecae have been reported in the months March, May-September (Billard, 1902; Isasi, 1985; Gili & García Rubies, 1985; Gili, 1986; Barange & Gili, 1987; Piraino & Morri, 1990, and Medel & Vervoort, 1995). The CANCAP colony bearing gonothecae was collected in June.

Distribution.— *Kirchenpaueria halecioides* is a cosmopolitan species according to Picard (1958b) and Boero & Bouillon (1993a), whereas Vervoort (1993b) referred to a wide distribution in tropical, subtropical and temperate waters of Atlantic and Pacific, also met with in the whole Mediterranean and penetrating in the Suez Canal. Eastern Atlantic records are from the Shetland Islands (Hincks, 1868, as *Plumularia halecioides*), Great Britain (Hincks, 1868; Marine Biological Association, 1904; 1931; Hamond, 1957, 1963a; Cornelius & Garfath, 1980, all as *P. halecioides*; Cornelius & Ryland, 1990; Cornelius, 1995, both as *V. halecioides*), the Channel Islands (Vervoort, 1949, as *P. halecioides*), the French littoral (Billard, 1902, 1903, 1904a, all as *P. halecioides*, 1927a; Teissier, 1965, as *V. halecioides*), the coast of north and north-west Spain (Altuna et al., 1984; Isasi, 1985; Isasi & Saiz, 1986; Ramil, 1988; Altuna & García Carrascosa, 1990, all as *V. halecioides*; Ansín Agís, 1992; Altuna, 1994a, 1995a, both as *V. halecioides*), the Portuguese littoral (Nobre, 1931; Da Cunha, 1940, 1944, all as *P. halecioides*; 1950, as *V. halecioides*), the Gulf of Cádiz (Medel & Vervoort, 1995, as *V. halecioides*), the Azores (Cornelius, 1992b, as *V. halecioides*), the Canary Islands (Stechow, 1912a, as *P. halecioides*), the Cape Verde Islands (Ritchie, 1907, as *P. halecioides*; Rees & Thursfield, 1965, as *V. halecioides*; Naumov, 1969, as *P. halecioides*), and Senegal (Picard, 1951a, as *V. halecioides*). From the American Atlantic coasts it has been cited from Bermuda (Bennitt, 1922; Morris & Mogelberg, 1973, as *P. halecioides*; Calder, 1993, 1997, as *V. halecioides*), from North Carolina (Fraser, 1912 as *Plumularia inermis*), from the Bahamas (Nutting, 1900, as *P. inermis*), from Belice (Calder, 1991b, 1991c, as *V. halecioides*), from the coast of Colombia (Wedler, 1975; Flórez González, 1983; Bandel & Wedler, 1987, as *P. halecioides*), from Venezuela (Hirohito, 1974, as *V. halecioides*), from the Antilles (Leloup, 1935c, as *V. halecioides*), Curaçao (Van Gemerden-Hoogeveen, 1965, as *P. halecioides*), Bonaire and Tortuga (Leloup, 1935c, as *V. halecioides*; Van Gemerden-Hoogeveen, 1965, as *P. halecioides*), and the Brazilian coast (Vannucci-Mendes, 1946, as *P. inermis*, 1949; Vannucci, 1951b, both as *P. halecioides*; Migotto, 1996, as *V. halecioides*).

In the Mediterranean it has been recorded at the Chafarinas Islands (Peña Cantero, 1995, as *V. halecioides*), the Spanish littoral (García Corrales et al., 1978; Gili, 1979; García Carrascosa, 1981; Gili i Sardà, 1982, 1986, all as *V. halecioides*), Algeria (Billard, 1903, 1904a, both as *P. halecioides*), Balearic Islands (Gili & García Rubies, 1985; Gili, 1986; Roca, 1986; Barangé & Gili, 1987; Roca & Moreno, 1987b, all as *V. halecioides*), the French littoral (Stechow, 1919a, as *P. halecioides*; Leloup, 1934c; Picard, 1951f, 1952a, 1952d; Bellan-Santini, 1961, 1962, all as *V. halecioides*), the Italian coast (Stechow, 1923d; Riedl, 1959; Morri, 1979b, 1979d, 1980a, 1980b; Boero, 1981a, 1981b, 1981c, 1981d; Morri, 1981a, 1981b, 1981c; Morri & Martini, 1981; Morri & Bianchi, 1983a;

Boero, 1985a; Morri & Bianchi, 1985; Boero & Fresi, 1986; Morri, Bavestrello & Bianchi, 1991, all as *V. halecioides*), north-west of Sicily (Piraino & Morri, 1990, as *V. halecioides*), the Adriatic (Heller, 1868, as *Anisocalyx bifrons*; Carus, 1884, as *P. halecioides* var. *adriatica*; Riedl, 1970; Morri, 1980c; Morri & Bianchi, 1982, all as *V. halecioides*), the Black Sea (Naumov, 1969, as *P. halecioides*) and the Suez Canal (Fishelson, 1971, as *P. halecioides*; Por & Ferber, 1972; Schmidt, 1972b, both as *V. halecioides*). Fishelson (1971, as *P. halecioides*) and Schmidt (1972b, 1973a, as *V. halecioides*) also records the species from the Red Sea.

In the Indian Ocean it is known from the coasts of South Africa (Millard, 1958, as *Plumularia irregularis*, 1975, as *Kirchenpaueria irregularis*, 1979a, as *P. irregularis*), Mozambique (Millard & Bouillon, 1974; Millard, 1975, both as *K. irregularis*) and the coasts of India (Leloup, 1932c, as *P. halecioides*; Mammen, 1965, as *Ventromma halecioides* var. *minutus*).

In the Pacific it has been cited from Japan (Hirohito, 1974, as *V. halecioides*), eastern Australia (Pennycuik, 1959, as *P. halecioides*) and the Marshall Islands (Cooke, 1975, as *P. halecioides*).

The bathymetrical range is between 0 (Medel & Vervoort, 1995) and 100 m (Morri, Bavestrello & Bianchi, 1991).

CANCAP material originates from one station near Madeira and was taken between 25 and 40 m.

Epibionts.— Stn 4.173: Algae.

Kirchenpaueria pinnata (Linnaeus, 1758)
(fig. 74)

Sertularia pinnata Linnaeus, 1758: 813.

Plumularia pinnata; Hincks, 1868: 295, pl. 65 figs 1, 1a, 1b; Kirchenpauer, 1876: 26, pl. 1 fig. 7, pl. 3 fig. 7; Carus, 1884: 17; Marktanner-Turneretscher, 1890: 253; Thornely, 1894: 8; Billard, 1902: 536; 1904a: 202, figs 74-77; Marine Biological Association, 1904: 199; Arévalo y Carretero, 1906: 85, pl. 14 figs 3, 3bis; Rioja y Martín, 1906: 277; Ritchie, 1907: 541; Théel, 1907: 60; Broch, 1910: 24, fig. 19a-c; Ritchie, 1911: 222; Billard, 1912a: 471; Broch, 1912a: 22; Crawshay, 1912: 331; Ritchie, 1912: 219, 223; Grieg, 1913: 147; Walton, 1913: 106; Rodríguez Rosillo, 1914: 39; Prenant & Teissier, 1924: 26.

Plumularia echinulata Hincks, 1868: 302, pl. 65 figs 2, 2a, 2b; Kirchenpauer, 1876: 28, pl. 1 fig. 10, pl. 3 fig. 10; Carus, 1884: 18; Thornely, 1894: 8, figs 8-10; Billard, 1902: 536; 1904a: 191, fig. 69; Marine Biological Association, 1904: 198; Rioja y Martín, 1906: 277; Ritchie, 1907: 540; 1909: 87; Bedot, 1911: 223; Fraser, 1911: 82; Rodríguez Rosillo, 1914: 39.

Plumularia similis Hincks, 1868: 303, pl. 65 figs 3, 3a, 3b; Kirchenpauer, 1876: 28, pl. 1 fig. 15, pl. 3 fig. 15; Thornely, 1894: 8; Marine Biological Association, 1904: 199; Arévalo y Carretero, 1906: 84, pl. 13 fig. 7; Rioja y Martín, 1906: 277; Ritchie, 1911: 222; Babic, 1913c: 286, figs 2-3; Rodríguez Rosillo, 1914: 39; Nobre, 1931: 19.

Plumularia elegantula G.O. Sars, 1874: 103, pl. 3 figs 9-14; Browne, 1907: 32.

Plumularia Helleri Carus, 1884: 18; Broch, 1912a: 23, fig. 5a-b.

Plumularia helleri; Marktanner-Turneretscher, 1890: 251, pl. 6 fig. 3.

Plumularia hians Marktanner-Turneretscher, 1890: 253, pl. 6 fig. 6.

Plumularia echinulata var. *zostericola* Billard, 1904a: 200, figs 70-71; Arévalo y Carretero, 1906: 84, pl. 13 figs 8, 8bis.

Plumularia echinulata var. *pinnatoïdes* Billard, 1904a: 200, figs 72-73.

Plumularia unilateralis Ritchie, 1907: 541, pl. 2 figs 1, 1_A, 1_B, 1_C.

Plumularia Macleodii Billard, 1914a: 30.

Plumularia pinnata f. *typica* Broch, 1914a: 25.

Kirchenpaueria pinnata; Bedot, 1916c: 645; 1921b: 20; 1923: 221, fig. 16; Stechow, 1923d: 215; Billard, 1927c: 342; Stechow, 1927: 312; Broch, 1928a: 61, fig. 7; 1928b: 115, fig. 17; Totton, 1930: 214, fig. 54c-d; Leloup, 1933c: 27; Kramp, 1935b: 156, fig. 64A_1-A_2; Philbert, 1935d: 28; 1935e: 34; Kramp, 1938d: 35, 60, 63, 68, 72, 77; Da Cunha, 1940: 107, 111, 112; Kramp, 1943b: 44; Da Cunha, 1944: 24, fig. 6; Vervoort, 1946b: 167, figs 69a, 70a-b; Leloup, 1947: 32, fig. 25; Vervoort, 1949: 146; Caspers, 1950: 133; Da Cunha, 1950: 128; Picard, 1951f: 260; Day, Millard & Harrison, 1952: 404; Leloup, 1952a: 189, fig. 109A-B, C^1-C^2; Picard, 1952a: 342, fig. 1B; 1952d: 220; Hamond, 1957: 318; Marine Biological Association, 1957: 49; Millard, 1957: 233; Pérès & Picard, 1958: 118; Picard, 1958b: 192; Millard, 1959: 252; Riedl, 1959: 651; Burdon-Jones & Tambs Lyche, 1960: 7; Swennen, 1961: 209; Millard, 1962: 292; Hamond, 1963b: 12, 15; Cabioch, 1965: 56; De Haro, 1965: 114, photograph 1; Rees & Thursfield, 1965: 153; Rees & White, 1966: 280; Redier, 1967a: 403; Millard, 1968: 254, 277; Vidal, 1968: 189; Rees & Rowe, 1969: 20; Day, Field & Penrith, 1970: 13; Riedl, 1970: 152, pl. 42; Bouillon & Levi, 1971: 221; Jägerskiöld, 1971: 63; Rossi, 1971: 26, fig. 9D-F; Christiansen, 1972: 303; Schmidt, 1972b: 37, 43, fig. 2b, pl. 2D; 1972c: 1; Von Salvini-Plawen, 1972: 393; Edwards, 1973: 585, 587; Houvenaghel-Crèvecoeur, 1973: 2815; Schmidt, 1973a: 286; Saldanha, 1974: 325; Millard, 1975: 372, fig. 119A-D; Williams, 1976: 58; Chas Brínquez & Rodríguez Babío, 1977: 30, fig. 16A-C; Hamond & Williams, 1977: 68; García Corrales et al., 1978: 49, fig. 22A-D; Gili, 1979: 128; Marinopoulos, 1979b: 120; Stepan'yants, 1980: 116; Boero, 1981a: 182; García Carrascosa, 1981: 236; Marinopoulos, 1981: 176; Hirohito, 1983: 65, fig. 33; Urgorri & Besteiro, 1983: 17, 25; Altuna et al., 1984: 135; Blanco, 1984: 278, figs 14-16; Bouillon, 1984b: 106; Gili & Castelló, 1985: 18, fig. 6A-B; Boero & Fresi, 1986: 147; Gili, 1986: 164, fig. 4.29A; Izquierdo et al., 1986: 53, fig. 4; Morri & Boero, 1986: 47, fig. 47a-c; Roca, 1986: 352, fig. 61; García Rubies, 1987: 146, 148, 149; Llobet i Nadal, 1987: 177, fig. 56A-B; García Carrascosa et al., 1987: 371; Roca & Moreno, 1987b: 46, fig. 1A-B; Cornelius, 1988b: 76; Llobet, Gili & Barangé, 1988: 40, fig. 4A; Ramil, 1988: 397; Gili, Murillo & Ros, 1989: 23; Altuna & García Carrascosa, 1990: 84, fig. 79; Cornelius & Ryland, 1990: 152, fig. 4.21; Davoult & Richard, 1990: 194; Piraino & Morri, 1990: 55; Llobet, Gili & Hughes, 1991: 153; Ansín Agís, 1992: 148, pl. 33 figs A-D; Cornelius, 1992a: 255, 257; 1992b: 99; Jensen & Frederiksen, 1992: 64; Ramil & Vervoort, 1992a: 158, fig. 141a-c; Álvarez Claudio, 1993: 259, fig. 44A-D, pl. 25 figs A-D; Boero & Bouillon, 1993a: 264; García Álvarez et al., 1993: 271; Altuna Prados, 1994a: 249, pl. 45 figs A-C; Blanco, 1994: 225, figs 9-10; Altuna Prados, 1995a: 54; Álvarez Claudio, 1995: 16; Álvarez Claudio & Anadón, 1995: 239; Cornelius, 1995: 130, fig. 30A-G; Medel & Vervoort, 1995: 41, figs 17a-d, c'-d', 18a-d; Peña Cantero, 1995: 317, pl. 37 figs a-c; Ramil, Vervoort & Ansín, 1998: 33, figs 20-21.

Kirchenpaueria pinnata f. *typica*; Stechow, 1919a: 107; Broch, 1933b: 27, fig. 9; Kramp, 1942b: 18; Vervoort, 1946b: 170; Teissier, 1950b: 22; 1965: 26; Cabioch, 1968: 642; Fey, 1969: 401; García Carrascosa, 1981: 238, pl. 22 figs d-e; Gili, 1981: 108; 1982: 82, fig. 40; Gili, García & Colomer, 1984: 414; Castric-Fey & Chassé, 1991: 523.

Kirchenpaueria pinnata f. *echinulata*; Stechow, 1919a: 107, figs P^1-S^1; Billard, 1926: 342; Leloup, 1934c: 14; Philbert, 1935c: 18; 1935d: 28; 1935e: 34; Da Cunha, 1944: 24, figs 7-8; 1950: 124; Teissier, 1950b: 24; 1965: 26; García Carrascosa, 1981: 239, pl. 21 figs a-d, pl. 36 figs b-c; Gili, 1981: 108; 1982: 84, fig. 41; Gili, García & Colomer, 1984: 414.

Kirchenpaueria pinnata f. *similis*; Stechow, 1919a: 110; Billard, 1926: 343; 1930: 395; Leloup, 1934c: 14; Da Cunha, 1944: 26, fig. 9; 1950: 124; Teissier, 1950b: 24; 1965: 27; Fey, 1969: 402; García Carrascosa, 1981: 241, pl. 21 figs e-f.

Kirchenpaueria pinnata articulata Billard, 1927c: 343; Da Cunha, 1944: 26; 1950: 124.

Kirchenpaueria pinnata echinulata; Billard, 1927c: 342; Gili i Sardà, 1982: 84, fig. 41.

Kirchenpaueria pinnata similis; Billard, 1927a: 343.

Diplocyathus minutus Leloup, 1930b: 1, figs 1-5; 1934c: 7.

Kirchenpaueria (*Plumularia*) *pinnata*; Marine Biological Association, 1931: 76; Gilson et al., 1944: 234; Newell, 1954: 330; Williams, 1954: 50.

Kirchenpaueria pinnata f. *elegantula*; Broch, 1933b: 27, fig. 9; Vervoort, 1946b: 170; 1959: 289.

Kirchenpaueria pinnata var. *echinulata*; Philbert, 1935d: 28; 1935e: 34.

Kirchenpaueria echinulata; Picard, 1952d: 341, fig. 1A; 1958c: 1; Rossi, 1961: 77; Bellan-Santini, 1962: 192;

Gili, 1979: 128; Marinopoulos, 1979b: 120; Boero, 1981a: 182, 184, 185; Boero & Fresi, 1986: 145; Llobet, Gili & Barangé, 1988: 40, fig. 4F; Llobet, Gili & Hughes, 1991: 153.

Kirchenpaueria pinnata var. *elegantula*; Patriti, 1970: 55, fig. 77A-C.

Ventromma halecioides; Chas Brínquez & Rodríguez Babío, 1977: 31, fig. 17A-C [not *Kirchenpaueria halecioides* (Alder, 1859)].

Kirchenpaueria pinnata f. *equinulata*; Estrada, 1979: 76, fig. 14 (incorrect subsequent spelling).

Kirchenpaueria pinnata f. *minuta*; García Carrascosa, 1981: 243, pl. 21 fig. g, pl. 36 fig. a.

Kirchenpaueria pinnata typica; Gili i Sardà, 1982: 82, fig. 40.

Kirchenpaueria similis; Roca, 1986: 359, fig. 62; Roca & Moreno, 1987b: 46, fig. 2A-B; Cornelius & Ryland, 1990: 152, fig. 4.21; Cornelius, 1995: 135, fig. 31A-F.

Material.— **Madeira area**: Stn 1.102: One colony on sponge, no gonothecae (RMNH-Coel. 28705, two slides 4666).— **Canary Islands and Selvagens Archipelago**: Stn 4.K12: One damaged colony on sponge, no gonothecae (RMNH-Coel. 29098 = slide 4667).

Description (of material from Stn 1.102).— Hydrorhiza tubular, hidden in sponge tissue. Hydrocaulus monosiphonic, unbranched, divided into internodes with straight nodes, with two to five alternating apophyses, number less in basal internodes, increasing distally. Apophyses small, with small circular opening on superior surface; another circular pore on internode just above apophysis, both with a naked sarcostyle.

Hydrocladia inserted on apophyses, alternately directed left and right, composed of a small basal internode and a succession of thecate internodes with oblique nodes. Each thecate internode with one hydrotheca on distal half, one reduced, scale-shaped mesial inferior nematotheca and one naked sarcostyle above free part adcauline hydrothecal wall. Hydrotheca small, cup-shaped, slightly widening from base onwards, adcauline wall almost fully adnate with exception of extreme border; abcauline wall straight, aperture circular, slightly tilted downwards, rim smooth.

No gonothecae.

Variability.— The material from Stn 4.K12 was collected between 0-2 m depth and is much smaller (see table XLI). These colonies have only one apophysis per stem internode, placed on distal half; only one internode with two apophyses has been observed. The hydrocladia have a regular succession of thecate and athecate internodes, though the latter are much smaller and have no nematothecae.

Table XLI. Measurements of *Kirchenpaueria pinnata* in µm:

	Stn 1.102	Stn 4.K12
Height of colony (in mm)	36	3-7
Stem internode, length		300-420
Diameter at node	130-160	50-80
Thecate hydrocladial internodes, length first internode	600-680	220-300
Length following internodes	920-1040	260-310
Diameter at node	70-90	40-55
Hydrotheca, depth	130-160	80-100
Length free part adcauline wall	20-30	30-50
Diameter at rim	140-170	140-150

Fig. 74. *Kirchenpaueria pinnata* (Linnaeus, 1758). a, Stn 4.K12, colony; b-c, Stn 1.102, b, hydrocladial internodes, lateral view; c, detail of colony, frontal view; d-e, Stn 4.K12, d, hydrocladium, lateral view; e, detail of colony, frontal view. Scales: a, 1 cm; b, d, 0.2 mm; c, e, 0.5 mm.

Discussion.— *Kirchenpaueria pinnata* shows variability in the number of hydrocladia per stem internode, the presence or absence of athecate internodes in the hydrocladia, the number of thecate internodes of a hydrocladium, and the presence or absence of spines on the gonothecae. This huge variability brought about the description of several allied species and numerous formae and varieties. Bedot (1916c) when making a study of *Kirchenpaueria* reached the conclusion that a single, much varied species, *Kirchenpaueria pinnata* (Linnaeus, 1758), should be maintained; all other names used to indicate allied species, varieties or formae should be placed in its synonymy. This point of view was shared by many subsequent authors (Millard, 1975; Ramil, 1988; Ramil & Vervoort, 1992a; Medel & Vervoort, 1995 and Peña Cantero, 1995), though others (Roca, 1986; Roca & Moreno,1987b, and Cornelius, 1995) validated two species: *K. pinnata* and *Kirchenpaueria similis* (Hincks, 1861). In our opinion the characters used to separate those two species are quite variable and influenced by environmental conditions. Generally colonies from superficial waters, subjected to considerable water movement, are small, have one apophysis per stem internode and have intermediate athecate internodes in the hydrocladia. Such colonies agree with the concept of *Kirchenpaueria similis* (cf. material from Stn 4. K12 collected between 0 and 2 m). Colonies from deeper water are larger, have big stem internodes with several apophyses and have no athecate internodes in the hydrocladia (cf. material from Stn 1.102, collected at 300 m depth). The presence or absence of spines on the gonotheca was related by Millard (1975) and Medel & Vervoort (1995) to age and sex of the gonothecae.

Reproduction.— The CANCAP specimens are sterile. A review of the literature shows that gonothecae have been reported for all months of the year.

Distribution.— According to Picard (1958b) *Kirchenpaueria pinnata* is a North Atlantic species, whereas Boero & Bouillon (1993b) indicated a tropical Atlantic distribution. Others again, like Redier (1967a), Day, Field & Penrith (1970), Millard (1975) and García Carrascosa (1981) ascribe it a cosmopolitan distribution. In the Atlantic *Kirchenpaueria pinnata* has been recorded from Iceland (Kramp, 1938d, 1943b), the Faeroes (Kramp, 1942b, as *Kirchenpaueria pinnata* f. *typica*; Jensen & Frederiksen, 1992), the Shetland Islands (Hincks, 1868, as *Plumularia pinnata*), the coasts of Norway (G.O. Sars, 1874, as *Plumularia elegantula*; Marktanner-Turneretscher, 1890; Théel, 1907; Broch, 1910; Grieg, 1913, all as *P. pinnata*; Stechow, 1919a, as *Kirchenpaueria pinnata* f. *typica*; Christiansen, 1972), the Swedish west coast (Rees & Rowe, 1969; Jägerskiöld, 1971), Denmark (Stechow, 1927; Broch, 1928a, 1928b; Kramp, 1935b), the North Sea (Ritchie, 1912, as *P. pinnata*; Broch, 1928b; Rees & Thursfield, 1965), Ireland [Hincks, 1868, as *Plumularia similis*; Williams, 1954, as *Kirchenpaueria (Plumularia) pinnata*], numerous localities along the coasts of Great Britain [Hincks, 1868, as *P. pinnata* and *P. similis*; Thornely, 1894; Marine Biological Association, 1904, both as *P. pinnata*, *P. echinulata* and *P. similis*; Ritchie, 1911, as *P. pinnata* and *P. similis*; Crawshay, 1912; Walton, 1913, both as *P. pinnata*; Marine Biological Association, 1931, as *K. (Plumularia) pinnata*; Gilson et al., 1944; Newell, 1954, both as *K. (Plumularia) pinnata*; Hamond, 1957, 1963b; Edwards, 1973; Williams, 1976; Hamond & Williams, 1977; Cornelius, 1988; Cornelius & Ryland, 1990; Cornelius, 1995], the English Channel (Cabioch, 1968, as *K. pinnata* f. *typica*; Davoult & Richard, 1990), the coast of Holland (Leloup, 1933c; Vervoort, 1946b; Swennen, 1961), the Belgian coast (Leloup, 1947, 1952), the Channel

Islands (Philbert, 1935c, as *K. pinnata* f. *echinulata*; Vervoort, 1949), numerous localities along the French coast (Billard, 1902, 1904a, as *P. pinnata* and *P. echinulata*; Bedot, 1911, as *P. echinulata*; Billard, 1912a; Prenant & Teissier, 1924, both as *P. pinnata*; Billard, 1927a; Philbert, 1935d, 1935e; Teissier, 1950b, 1965, Cabioch, 1965, both as *K. pinnata* f. *echinulata* and *K. pinnata* f. *similis*; Fey, 1969, as *K. pinnata* f. *similis*; Houvenaghel-Crèvecoeur, 1973; Castric-Fey & Chassé, 1991, as *K. pinnata* f. *typica*), the Bay of Biscay (Browne, 1907, as *P. elegantula*), off the north and north-west coast of Spain (Arévalo y Carretero, 1906, as *P. pinnata* and *P. similis*; Rioja y Martín, 1906; Rodríguez Rosillo, 1914, both as *P. pinnata*, *P. echinulata* and *P. similis*; Chas Brínquez & Rodríguez Babío, 1977; García Corrales et al., 1978; Estrada, 1979, as *K. pinnata* f. *equinulata*; Altuna et al., 1984; Urgorri & Besteiro, 1983; Ramil, 1988; Altuna & García Carrascosa, 1990; Ansín Agís, 1992; Álvarez Claudio, 1993; García Álvarez et al., 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez-Claudio & Anadón, 1995), the Portuguese littoral (Nobre, 1931, as *P. similis*; Da Cunha, 1940, 1944, 1950; Saldanha, 1974), the Strait of Gibraltar (Medel & Vervoort, 1995), Gorringe Bank (Ramil, Vervoort & Ansín, 1998), the Azores (Rees & White, 1966a), Morocco (Patriti, 1970, as *K. pinnata* var. *elegantula*), the Canary Islands (Izquierdo et al., 1986), Gambia (Vervoort, 1959, as *K. pinnata* f. *elegantula*), the coast of Namibia (Broch, 1914a, as *P. pinnata* f. *typica*), and South Africa (Ritchie, 1907, as *P. pinnata*, *P. echinulata* and *P. unilateralis*, 1909, as *P. echinulata*; Day, Millard & Harrison, 1952; Millard, 1957, 1962; Rees & Thursfield, 1965; Millard, 1968; Day, Field & Penrith, 1970; Millard, 1975). In the western Atlantic it is known from the Argentine coast (Blanco, 1984d, 1994).

In the Mediterranean it has been found in the Alborán Sea (Ramil & Vervoort, 1992a), along the Spanish coasts (De Haro, 1965; García Corrales et al., 1978; Gili, 1979; García Carrascosa, 1981; Gili, 1981, 1982, both as *K. pinnata* f. *echinulata* and *K. pinnata* f. *typica*; Gili, García & Colomer, 1984, as *K. pinnata* f. *echinulata* and *K. pinnata* f. *typica*; Gili & Castelló, 1985; Gili, 1986; García Carrascosa et al., 1987; Llobet, Gili & Barangé, 1988; Gili, Murillo & Ros, 1989; Llobet, Gili & Hughes, 1991), the Balearic Islands (Roca, 1986; Roca & Moreno, 1987b), the French littoral (Stechow, 1919a, as *K. pinnata* f. *similis*; Leloup, 1930b, as *Diplocyathus minutus*, 1934; Picard, 1951f, 1952a, 1952d; Vidal, 1968), the Italian coasts (Carus, 1884, as *P. pinnata* and *P. echinulata*; Marktanner-Turneretscher, 1890, as *P. hians*; Stechow, 1919a, as *K. pinnata* f. *echinulata*, 1923d; Riedl, 1959; Rossi, 1961, as *K. echinulata*; Rees & Thursfield, 1965; Rossi, 1971; Boero, 1981a; Boero & Fresi, 1986), north-west Sicily (Piraino & Morri, 1990), the Adriatic (Carus, 1884, as *P. pinnata* and *P. Helleri*; Marktanner-Turneretscher, 1890, as *P. pinnata* and *P. helleri*; Broch, 1912; Babic, 1913c, as *P. similis*; Stechow, 1919a, as *P. pinnata* f. *echinulata*; Broch, 1933b; Riedl, 1970), the coasts of Turkey (Billard, 1930a, as *K. pinnata* f. *similis*), and the coast of Israel (Picard, 1958c, as *K. echinulata*). Schmidt (1972b, 1972c) records its presence in the Red Sea.

In the Indian Ocean it is cited from the coasts of South Africa (Millard, 1975), and Japan (Hirohito, 1983), New Guinea (Bouillon, 1984b) and the coast of the United States (Fraser, 1911, as *P. echinulata*) in the Pacific Ocean

The bathymetrical distribution is between 0 (García Carrascosa, 1981) and c. 769 m (Álvarez-Claudio, 1995).

CANCAP material has been obtained at two localities, one near Madeira, the other at the Canary Islands; it was taken at 300 m and 0-2 m, respectively.

Family Plumulariidae McCrady, 1859
Genus *Monotheca* Nutting, 1900
Monotheca margaretta Nutting, 1900
(fig. 75)

Monotheca margaretta Nutting, 1900: 72, pl. 11 figs 1-3; Fraser, 1912: 380, fig. 47; Stechow, 1912a: 361; Bennitt, 1922: 254; Vannucci-Mendes, 1946: 578, pl. 5 fig. 48, pl. 6 fig. 54; Picard, 1951a: 113; Wedler, 1975: 332; Calder, 1991c: 2068; 1993b: 68; 1995: 543; Migotto, 1996: 53, fig. 11a-c; Calder, 1997: 11, fig. 2a-d.

Plumularia margaretta; Bedot, 1921b: 28; Leloup, 1935c: 54, fig. 31; ?Fraser, 1938b: 10, 66; ?1938d: 136; 1944a: 348, pl. 74 fig. 337a-e; 1947: 14; ?1948: 282; Deevey, 1954: 271; Leloup, 1960: 230; Van Gemerden-Hoogeveen, 1965: 69; Vervoort, 1968: 110; Morris & Mogelberg, 1973: 21, fig. 30a-c; Defenbaugh, 1974: 119; ?Ljubenkov, 1980: 51; Flórez González, 1983: 121, photographs 42-43; Cairns et al., 1991: 28.

Monotheca margaretta f. *typica* Vannucci-Mendes, 1946: 578, pl. 5 fig. 48, pl. 6 fig. 54; 1949: 250; Vannucci, 1950: 89; 1951a: 89; 1951b: 107, 109, 112, 113.

Monotheca margaretta f. *curta* Vannucci-Mendes, 1946: 578, pl. 5 figs 49-50, pl. 6 fig. 55; Vannucci, 1951b: 110, 111, 116.

Plumularia (Monotheca) margaretta; Buchanan, 1957: 368.

Monotheca oblica; Patriti, 1970: 58, fig. 83B (incorrect subsequent spelling).

?*Plumularia pulchella*; Blanco, 1973: 73, figs 1-3; Genzano, 1990: 50, figs 16-17; Blanco, 1994: 243, figs 34-35; Genzano, 1994: 5.

Not *Plumularia margaretta*; Cooke, 1975: 100, fig. 27.

Plumularia femina García Corrales et al., 1978: 57, fig. 26A-E.

Plumularia pulchella spp. *femina*; Izquierdo et al., 1986: 54, fig. 5A-E.

Monotheca (Plumularia) margaretta; Bandel & Wedler, 1987: 42.

Monotheca pulchella; Medel & Vervoort, 1995: 58, fig. a-d [not *Monotheca pulchella* (Bale, 1882)].

Material.— **Canary Islands and Selvagens Archipelago:** Stn 2.D01: Two colonies with gonothecae (RMNH-Coel. 28566; DEBA-UV, slide R.325).— Stn 2.D04: One colony with gonothecae (RMNH-Coel. 28562, slide 4668).— Stn 2.D08: Three colonies, two with gonothecae and one colony on algae, without gonothecae (RMNH-Coel. 28563, two slides 4669).

Description (of material from Stn 2.D01).— Hydrorhiza tubular, adhering to substrate, provided with nematothecae and perisarc thickenings, giving it an annulated appearance. Nematothecae consist of large pedicel and a short distal, cup-shaped part, separated by a thin diaphragm. Monosiphonic and typically unbranched hydrocauli inserted on small apophyses of hydrorhiza, basally with one internode with two or three nematothecae and continued as a series of internodes with straight nodes. Stem internodes slender, with distal apophysis and one nematotheca at half its length on side opposite from apophysis; apophyses with one mamelon at superior surface and three or four nematothecae: two in the axil and one or two above mamelon. Internodes slightly curved, particularly in younger parts of colony.

Hydrocladia, alternately directed left and right, inserted on apophyses by means of short, athecate basal internode without nematotheca and with one or two internal perisarc rings of which one distal and occasionally a second basal; development of rings much varied, even in same colony. Rest of hydrocladium composed of a single thecate internode with straight basal node, a fairly large hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca with adcauline wall fully

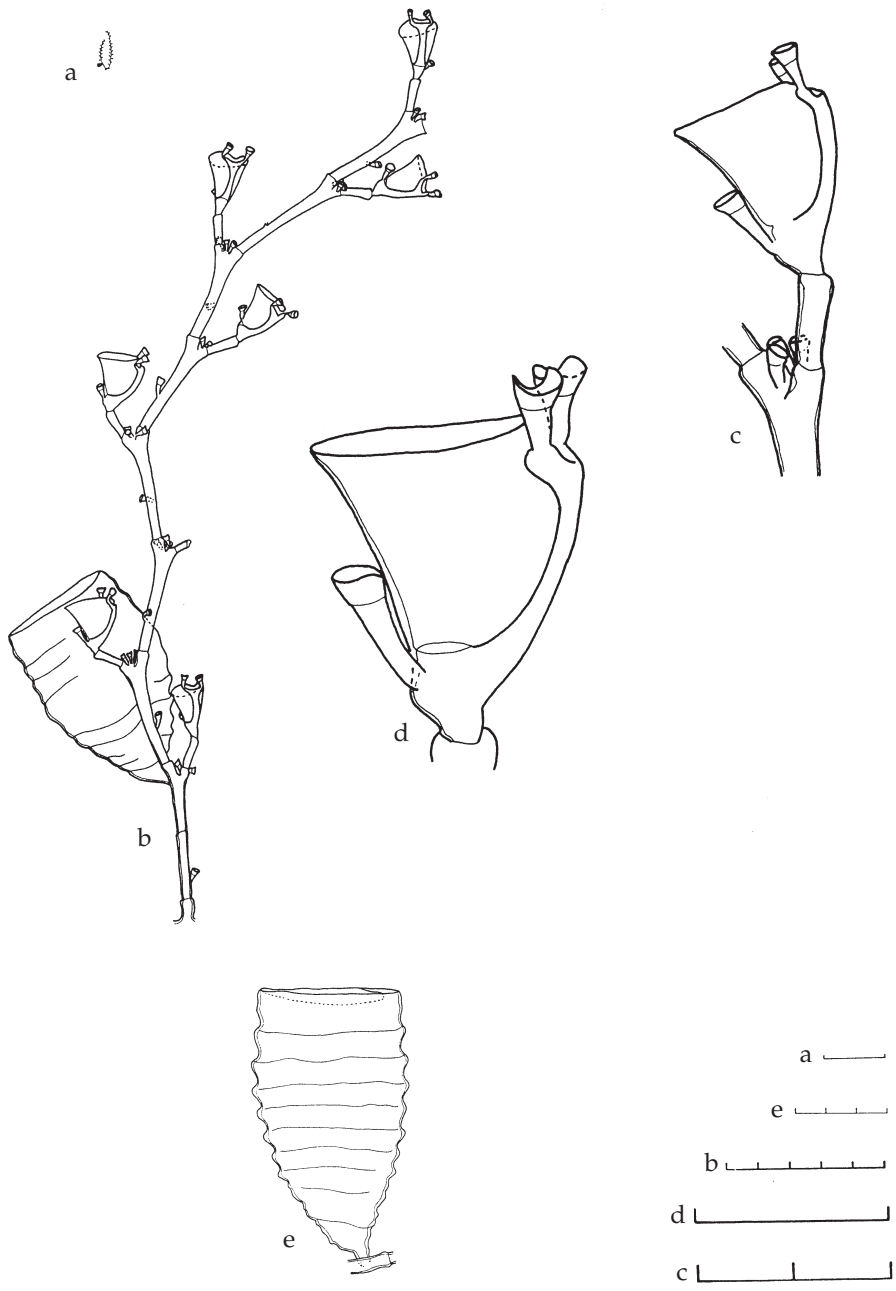


Fig. 75. *Monotheca margaretta* Nutting, 1900. a, Stn 2.D08, colony; b-c, Stn 2.D01, b, detail of colony, posterior view; c, hydrocladium, lateral view; d-e, Stn 2.D08, d, thecate internode, lateral view; e, gonotheca, lateral view. Scales: a, 1 cm; b, 0.5 mm; c, 0.2 mm; d, 0.1 mm; e, 0.3 mm.

adnate and abcauline wall slightly concave; aperture circular and perpendicular to internodal length axis, rim smooth. Mesial nematotheca long, reaching middle of abcauline hydrothecal wall; lateral nematothecae placed on pair of apophyses, one on each side of hydrotheca, shorter than mesial nematotheca but surpassing hydrothecal rim. All nematothecae bithalamic and movable; rim of upper chamber scooped.

Gonothecae inserting on cauline internodes next to apophysis, globular, annulated throughout, top truncated, with circular aperture closed by lid.

Variability.— Some colonies from Stn 2.D01 are branched, the branches originating from the apophyses and in structure identical to hydrocaulus. Distal parts of hydrocaulus in other colonies have developed stolons. A colony from Stn 2.D08 has two or three nematothecae below the hydrocladial apophysis.

Table XLII. Measurements of *Monotheca margaretta* in µm:

	Stn 2.D01
Height of colony (in mm)	13
Stem internode, length	320-385
Diameter at node	30-50
Hydrocladial internode, length thecate	180-200
Length athecate	90-110
Diameter at node	20-40
Hydrotheca, depth	130-150
Length abcauline wall	125-140
Diameter at rim	130-145
Gonotheca, length	710-900
Maximum diameter	380-565

Discussion.— *Monotheca margaretta* differs from other Atlantic species of *Monotheca* by the concave abcauline hydrothecal wall and the annulated gonothecae. The trophosome, however, closely resembles that of *Monotheca pulchella* (Bale, 1882), the only noticeable difference in trophosome being the slight depression in the adcauline hydrothecal wall in *M. margaretta*. There is ample difference in the gonothecae, those of *M. pulchella* being ovoid, with smooth walls and an oblique aperture provided with internal cusps. Also, there are differences in distribution, *M. pulchella* being an Indo-Pacific species, whereas *M. margaretta* is mainly an Atlantic species, though there are some records from the Pacific coast of California (Fraser, 1948) and littoral of Ecuador (Fraser, 1938b, 1938d), these are considered doubtful by Calder (1997). Vannucci-Mendes (1946) after studying material of *M. margaretta* from Brazil differentiated between a forma *typica* and a forma *curta* on account of differences in size and thick perisarc in forma *curta*. Van Gemerden-Hoogeveen (1965) considered those characters too variable for taxonomic conclusions. Vannucci-Mendes (1946) indicated that f. *curta* lives at 0-2 m depth, differences in size and development of perisarc could be explained by habitual strong water movements in that habitat.

Patriti (1970) reported *Monotheca obliqua* (Johnston, 1847) (as *Monotheca oblica*) from the Moroccan coast, but his fig. 83B shows a concave abcauline hydrothecal wall; his fig. 83A corresponds with the gonotheca of *M. obliqua*, but that figure is not

original and it corresponds with the gonotheca of *M. obliqua* as figured by Hincks (1868). The records of *Plumularia pulchella* by Blanco (1973, 1994) and Genzano (1990, 1994) from the Argentine coast have provisionally been placed in *M. margaretta* as the material was sterile. Medel & Vervoort (1995) cited the presence of *M. pulchella* from the Strait of Gibraltar; the gonotheca of that material is annulated and has a wide terminal aperture without internal cusps, so we have included it in *M. margaretta*. We follow Calder (1997) in relegating *Plumularia femina* García Corrales, Aguirre Inchaurbe & González Mora, 1978 and *Plumularia pulchella* spp *femina* of Izquierdo, García Corrales & Bacallado (1986) to *M. margaretta*.

Reproduction.— Gonothecae have been found in March and from May up to and including November (Leloup, 1935a; Izquierdo et al., 1986; Medel & Vervoort, 1995; Migotto, 1996, and Calder, 1997). CANCAP colonies collected in August and September had gonothecae.

Distribution.— *Monotheca margaretta* is a common species in temperate waters of the western Atlantic (Calder, 1997). There it has been recorded from Martha's Vineyard, Rhode Island (Fraser, 1944a, as *Plumularia margaretta*), from the Sargasso Sea (Vanhöffen, 1910, Leloup, 1935c), from Bermuda (Stechow, 1912a; Bennitt, 1922; Morris & Mogelberg, 1973, as *P. margaretta*; Calder, 1993b, 1995, 1997), from North Carolina (Fraser, 1912), off Little Cat Island, Bahamas (Nutting, 1900), from Florida (Deevey, 1954, as *P. margaretta*), from Dry Tortugas (Deevey, 1954, as *P. margaretta*), from the Gulf of Mexico (Defenbaugh, 1974, as *P. margaretta*), from Bahía Honda, north-western Cuba (Fraser, 1947), from Belice (Calder, 1991c), from north of Puerto Rico (Fraser, 1944a, as *P. margaretta*), from Isla Culebra in the Virgin Islands (Fraser, 1944a, as *P. margaretta*), from the coast of Colombia (Wedler, 1975; Flórez González, 1983, as *P. margaretta*), from Aruba (Leloup, 1935c; Van Gemerden-Hoogeveen, 1965, both as *P. margaretta*), from Curaçao (Leloup, 1935c, as *P. margaretta*), from Bonaire (Leloup, 1935c; Van Gemerden-Hoogeveen, 1965, both as *P. margaretta*), from various islands in the Antilles, (Leloup, 1960; Van Gemerden-Hoogeveen, 1965, both as *P. margaretta*), from Brasil (Vannucci-Mendes, 1946, 1949; Vannucci, 1950, 1951a, 1951b, all as *M. margaretta* f. *typica*; Migotto, 1996), from Trinidad (Vannucci, 1950, as *M. margaretta* f. *typica*) and from various localities in coastal Argentine waters (Blanco, 1973; Genzano, 1990; Blanco, 1994; Genzano, 1994, all as *P. pulchella*). In the eastern Atlantic it is know from the Azores (Vanhöffen, 1910; Buchanan, 1957), from the Strait of Gibraltar (Medel & Vervoort, 1995, as *Monotheca pulchella*), from the Canary Islands (Izquierdo et al., 1986, as *Plumularia pulchella* spp. *femina*), from Senegal (Picard, 1951a) and from Accra, Ghana [Buchanan, 1957, as *Plumularia (Monotheca) margaretta*]. In the Mediterranean known from the coast of Murcia, Spain (García Corrales et al., 1978, as *Plumularia femina*).

As indicated above, Pacific records are from the coast of California (Fraser, 1948; Ljubenkov, 1980, both as *P. margaretta*) and the littoral of Ecuador (Fraser, 1938b, 1938d, both as *P. margaretta*); these records are considered doubtful by Calder (1997). The presence of this species in the Pacific needs to be proved by additional material.

The bathymetrical distribution varies between 0 and 73 m (Calder, 1997).

CANCAP material originates from three localities in the region of the Canary Islands and was taken between 5 and 25 m depth.

Epibionts.— Stn 2.D01: Algae.— Stn 2.D08: Algae.

Genus *Nemertesia* Lamouroux, 1812
Nemertesia antennina (Linnaeus, 1758)
(figs 76-77)

Sertularia antennina Linnaeus, 1758: 811.

Cymodocea ramosa Lamouroux, 1816: 212, pl. 7 figs 1a, A.

Antennularia antennina; Hincks, 1868: 280, pl. 61 figs a-e; Allman, 1874: 471; Thornely, 1894: 7; Nutting, 1900: 69, pl. 9 figs 1-2; Billard, 1901a: 68, figs 1-3; 1902: 536; 1904a: 211, figs 80-86; Marine Biological Association, 1904: 197; Arévalo y Carretero, 1906: 82, pl. 13 fig. 4; Billard, 1906a: 179; Rioja y Martín, 1906: 278; Browne, 1907: 33; Théel, 1907: 60; Ritchie, 1911: 221; Crawshey, 1912: 329; Fraser, 1918b: 333, 361; 1921: 44, fig. 104; Van Benthem Jutting, 1922: lxxxvi; Nobre, 1931: 19; Payne, 1931: 743; De Haro, 1965: 116.

Nemertesia antennina; Kirchenpauer, 1876: 29, pl. 2 figs 26, 26a, pl. 3 fig. 26; Verrill, 1879: 18; Carus, 1884: 19; Bedot, 1911: 225; Billard, 1912a: 461; Broch, 1912a: 29, fig. 7; Bedot, 1917b: 42; Neppi, 1917: 53; Stechow, 1919c: 120; Bedot, 1921b: 35; 1921c: 22; 1923: 219, fig. 9; Stechow, 1923d: 229; Prenant & Teissier, 1924: 25; Billard, 1927c: 343; Broch, 1928b: 62; Billard, 1931b: 247; 1931d: 677; Broch, 1933b: 35, figs 12-13; Leloup, 1933c: 10, 27; 1934c: 15; Kramp, 1935b: 165, figs 67B, 68a; Philbert, 1935c: 28; 1935e: 34; Leloup, 1937a: 109, fig. 11; Da Cunha, 1940: 114; Vervoort, 1942: 301; Da Cunha, 1944: 34, fig. 15b; Vervoort, 1946a: 326; 1946b: 179, figs 74a, 75, 76a; Leloup, 1947: 33, fig. 26; Da Cunha, 1950: 129; Teissier, 1950b: 23; Picard, 1951e: 278; Leloup, 1952a: 186, fig. 107A, B1, B2, C, D; Picard, 1955b: 189; Marine Biological Association, 1957: 50; Picard, 1958b: 192; Vervoort, 1959: 297; Costa, 1960: 47; Cabioch, 1961: 19, 26, 30; Ralph, 1961b: 48; Teissier, 1965: 28; Rees & White, 1966: 280; Pérès, 1967: 509; Vidal, 1968: 189; Fey, 1969: 404; Naumov, 1969: 474, fig. 366, pl. 6 fig. 2; Rees & Rowe, 1969: 22; Calder, 1970c: 1541; Patriti, 1970: 46, fig. 63A-C; Riedl, 1970: 152, pl. 42; Guille, 1971: 275; Jägerskiöld, 1971: 63; Rossi, 1971: 27, fig. 10A-C; Christiansen, 1972: 304; Vervoort, 1972: 229; Castric-Fey, 1973: 214; Houvenaghel-Crèvecoeur, 1973: 2815; Saldanha, 1974: 325; Hughes, 1975: 275; Millard, 1975: 381, fig. 121D-E; Williams, 1976: 58; Hamond & Williams, 1977: 69; Estrada, 1979: 82; Gili, 1979: 128; Camp & Ros, 1980: 202; Estrada, 1980: 10; García Carrascosa, 1981: 271, pl. 26 figs c-f, pl. 39 figs d-e; Gili, 1981: 108; Marinopoulos, 1981: 176; Gili i Sardà, 1982: 89, fig. 46; Cornelius, 1983: 154; Urgorri & Besteiro, 1983: 16, 17; Boero, 1984: 97, 98, 103; Gili, García & Colomer, 1984: 414, 423; Bouillon, 1985a: 162; Gili & Ros, 1985: 329; Vervoort, 1985: 291; Boero & Fresi, 1986: 147; Gili, 1986: 161, figs 4.32A-B, 4.57b; Roca, 1986: 310, fig. 55; Templado et al., 1986: 98; García Carrascosa et al., 1987: 371; Hughes, 1987: 172; Gili, Ros & Pagès, 1987: 92; Cornelius, 1988b: 76; Gili, Murillo & Ros, 1989: 23; Altuna & García Carrascosa, 1990: 86; Cornelius & Ryland, 1990: 152, fig. 4.22; Cairns et al., 1991: 27; Castric-Fey & Chassé, 1991: 523; Marano, Ungaro & Vaccarella, 1991: 8; Ramil & Vervoort, 1992a: 163, figs 42a-r, 43a-h; Sommer, 1992: 210; Álvarez Claudio, 1993: 267, fig. 45A-D, pl. 26 figs A-H; Boero & Bouillon, 1993a: 264; Vervoort, 1993: 551; Álvarez Claudio, 1995: 16; Álvarez Claudio & Anadón, 1995: 239; Bouillon, Massin & Kresevic, 1995: 59; Cornelius, 1995: 148, fig. 34A-E; Medel & Vervoort, 1995: 50, figs 21, 23b; Ramil, Vervoort & Ansín, 1998: 35.

Nemertesia (Antennularia) antennina var. *minor* Kirchenpauer, 1876: 51, pl. 2 fig. 23a.

Antennularia irregularis Quelch, 1885: 8, pl. 2 figs 4, 4a, 4b.

Antennularia janini; Marktanner-Turneretscher, 1890: 259, pl. 6 figs 9, 9a [not *Nemertesia janini* Lamouroux, 1816 = *Nemertesia ramosa* (Lamarck, 1816)].

Antennularia octoseriata Jäderholm, 1896: 15, pl. 2 fig. 6.

Antennularia pinnata Nutting, 1900: 71, pl. 5 figs 5-6.

?*Antennularia antennina*; Pictet & Bedot, 1900: 33, pl. 6 figs 4-5.

Antennularia antennina var. à longs articles: Billard, 1901a: 71.

Antennularia antennina var. à 2 dactylothèques par article intermédiaire: Billard, 1901a: 72.

Antennularia antennina var. *longa* Billard, 1904a: 216; 1906b: 210, fig. 15B.

Antennularia Perrieri var. *antennoïdes* Billard, 1904a: 217.

Antennularia Perrieri var. *antennoides*; Billard, 1906b: 212; Stechow, 1909: 82; Arévalo y Carretero, 1906:

82, pl. 13 fig. 3; Rioja y Martín, 1906: 278; Fey, 1969: 404, 408.
Antennularia antennina var. *minor*; Stechow, 1909: 82.
Nemertesia Hartlaubi; Broch, 1913: 4, fig. 4a-b [not *Antennularia hartlaubi* Ritchie, 1907 = *Nemertesia cymodocea* (Busk, 1851)].
Nemertesia irregularis p.p Stechow, 1913c: 93.
Nemertesia irregularis var. *antennoides*; Stechow, 1913c: 94.
Nemertesia irregularis var. *longa*; Stechow, 1913c: 94.
Antenullaria antennina; Rodríguez Rosillo, 1914: 40 (incorrect subsequent spelling).
Nemertesia antennina var. *irregularis* p.p. Bedot, 1917b: 42.
Nemertesia irregularis; Jäderholm, 1919: 23, pl. 5 fig. 7.
Nemertesia antennina var. *irregularis*; Bedot, 1921c: 23; Billard, 1923: 17; Rees & White, 1966: 280; Patriti, 1970: 47, fig. 64A-B; Altuna Prados, 1994a: 257.
Nemertesia antennina irregularis; Billard, 1927c: 343; Vervoort, 1966a: 140 fig. 42a-e.
Nemertesia (Antennularia) antennina; Marine Biological Association, 1931: 78; Newell, 1954: 330; Williams, 1954: 50.
Antennularia antenima; Nobre, 1937: 23 (incorrect subsequent spelling).
Nemertesia perrieri; Vervoort, 1966a: 138, fig. 40a-d [not *Nemertesia perrieri* (Billard, 1901)].

Material.— **Azores area**: Stn 5.044: Four colonies and three fragments, no gonothecae (RMNH-Coel. 28688, 28925).— Stn 5.049: Two damaged fragments without gonothecae (RMNH-Coel. 28971; slide 4677).— Stn 5.077: One colony without gonothecae (unregistered sample).— Stn 5.112: One colony without gonothecae (RMNH-Coel. 29124 = slide 4678).— Stn 5.142: Five colonies and two fragments, no gonothecae (RMNH-Coel. 28699, 28709; DEBA-UV, slide R. 328).— **Atlantic coast of Morocco and Mauritania**: Stn 1.118: Two colonies without gonothecae (RMNH-Coel. 28696, slide 4670).— Stn 3.182: One colony without gonothecae (RMNH-Coel. 28740, two slides 4672).— Stn MAU 039: Two colonies with gonothecae (RMNH-Coel. 28961, three slides 4679).— Stn MAU 049: Seven colonies, of which six with gonothecae (RMNH-Coel. 28903; DEBA-UV, three slides R. 329).— Stn MAU 072: Five colonies, one with gonothecae (RMNH-Coel. 28913, two slides 4680).— Stn MAU 073: Six fragments, one with gonothecae (RMNH-Coel. 29100 = two slides 4681).— **Canary Islands and Selvagens Archipelago**: Stn 2.048: One colony without gonothecae (RMNH-Coel. 28704, slide 4671).— Stn 2.072: One colony without gonothecae (DEBA-UV, slide R. 327).— Stn 4.090: One colony without gonothecae (RMNH-Coel. 29050, two slides 4673).— Stn 4.091: Five colonies without gonothecae (RMNH-Coel. 28734, two slides 4674).— Stn 4.092: One colony and one fragment, no gonothecae (RMNH-Coel. 29099 = slide 4675).— Stn 4.143: One colony without gonothecae (RMNH-Coel. 28728, two slides 4676).
Additional material.— Nationaal Natuurhistorisch Museum (National Museum of Natural History), Leiden, The Netherlands: 04°50′N 02°49′W, 60-65 m, 15.i.1946: One fragment with gonothecae. RMNH-Coel 1309.— Stn 30, Gullmar Fjord, 58°16′N 11°25′E, 03.ix.1963: One colony. RMNH-Coel 2044.— 64°35′N 12°55′W, South of Iceland: Two big colonies. RMNH-Coel 506.— North Adriatic, 20 miles W of Rovinj, 25.iv.1969: Several stems and fragments. RMNH-Coel 8214.— Stn 132/2, North Adriatic insular region, 21.viii.1968: Several fragments. RMNH-Coel 8215.— Stn 200/1, Velebit Channel, North Adriatic, 25.viii.1968: Several fragments. RMNH-Coel 8218.— Galathea Expedition, Stn 74, off Congo River, 05°41′S 11°32′E, 291 m, 07.xii.1950: One small colony without gonothecae, as *Nemertesia perrieri* [not *Nemertesia perrieri* (Billard, 1901)]. RMNH-Coel 3770.— Galathea Expedition, Stn 196, off Durban, 29°55′S 40°20′E, 425-430 m, 13/14.ii.1951: Four fragments, one with gonothecae, as *Nemertesia antennina irregularis*. RMNH-Coel 3734.— Theta, Vema and Yelcho cruises, Stn 15-1, 31°54′N 79°05′W, 413 m, 29.x.1958: One fragment without gonothecae. RMNH-Coel 7188.— Theta, Vema and Yelcho cruises, Sta 17 R.D. 29, 60°27′N 48°31′W, 366-326 m, 04.ix.1961: Two colonies. RMNH-Coel 7187.
The Natural History Museum, London, U.K. Type material of *Antennularia irregularis* Quelch, 1885. Cape Verde Islands, 910 m: One colony with gonothecae. BMNH 1885.7.21.11.

Description (of material from Stn MAU 039).— Hydrorhiza a fairly compact mass

of interwoven stolonal fibres mixed with sediment, anchoring colony in bottom and from which emerge several unbranched, monosiphonic axes, each with a number of internal coenosarc canals. Stem divided into internodes by straight nodes, at times badly visible, each internode with varied number of nematothecae and a verticil of two to five apophyses on distal part; apophyses of two succeeding internodes intersecting, doubling number of vertical rows of apophyses. Length of apophyses varied in same colony, short basally and becoming longer distally. Each apophysis with two axillar nematothecae, one mamelon on superior surface and one unpaired nematotheca on distal part. Occasionally one or two pairs of supplementary nematothecae between mamelon and unpaired distal nematotheca. Internal perisarc ring just under node, of varied development.

Hydrocladia inserted on apophyses, composed of succession of thecate and athecate internodes, separated by oblique nodes of varied inclination. Inferior node of thecate internodes quite oblique; distal node almost straight; reverse condition in athecate internodes. Hydrocladia in basal part of stem inserted on short apophyses and with first internode athecate, with a single nematotheca and two perisarc rings of variable development, one basal, one distal. Hydrocladia in distal part of stem inserted on long apophyses, starting with thecate internode; such internodes with one hydrotheca halfway its length and three nematothecae: one mesial inferior and two lateral. Hydrotheca low, cup-shaped, adcauline wall fully adnate; abcauline wall straight, rim smooth with slight lateral undulation, best developed in distal hydrothecae of hydrocladium; aperture slightly tilted downwards. Basal part of thecate internode with internal perisarc ring of varied development. Athecate internodes with one nematotheca halfway its length and two internal perisarc rings, one basal, one distal; basal ring typically best developed. All nematothecae bithalamic and movable.

Gonothecae inserted on apophyses, near mamelon, up to three per apophysis may be present. Gonotheca ovoid, with short pedicel and ovoid aperture in latero-terminal position, closed by lid.

Variability.— The material inspected varies in development of the perisarc rings of the hydrocladial internodes and number of nematothecae on the athecate internodes, being one or two. Presence of two nematothecae on athecate internodes is either related to youth of the colony or to regeneration after damage; adult colonies without signs of regeneration typically have only one. Variability is observed in the length of the lateral nematothecae of thecate internodes, in some colonies these are quite long (fig. 76b). Atrophied hydrothecae occasionally occur in basal parts of colonies, in which case the thecate internodes still have three nematothecae (one mesial inferior, two lateral); typically the athecate internodes have no nematothecae.

Colonies developing on solid substrate with a thick, tubular hydrorhiza usually have nematothecae on the hydrorhiza; these are absent in colonies developing on a soft bottom where the hydrorhiza is composed of a fine, tangled mass of thin filaments anchoring the colony in the sediment. Colonies from Stns 3.182 and MAU 073 are characterised by the short length of the hydrocladial internodes and the absence of nematothecae on some athecate internodes, but they agree in the remaining characters of *N. antennina*, including the morphology of the gonothecae.

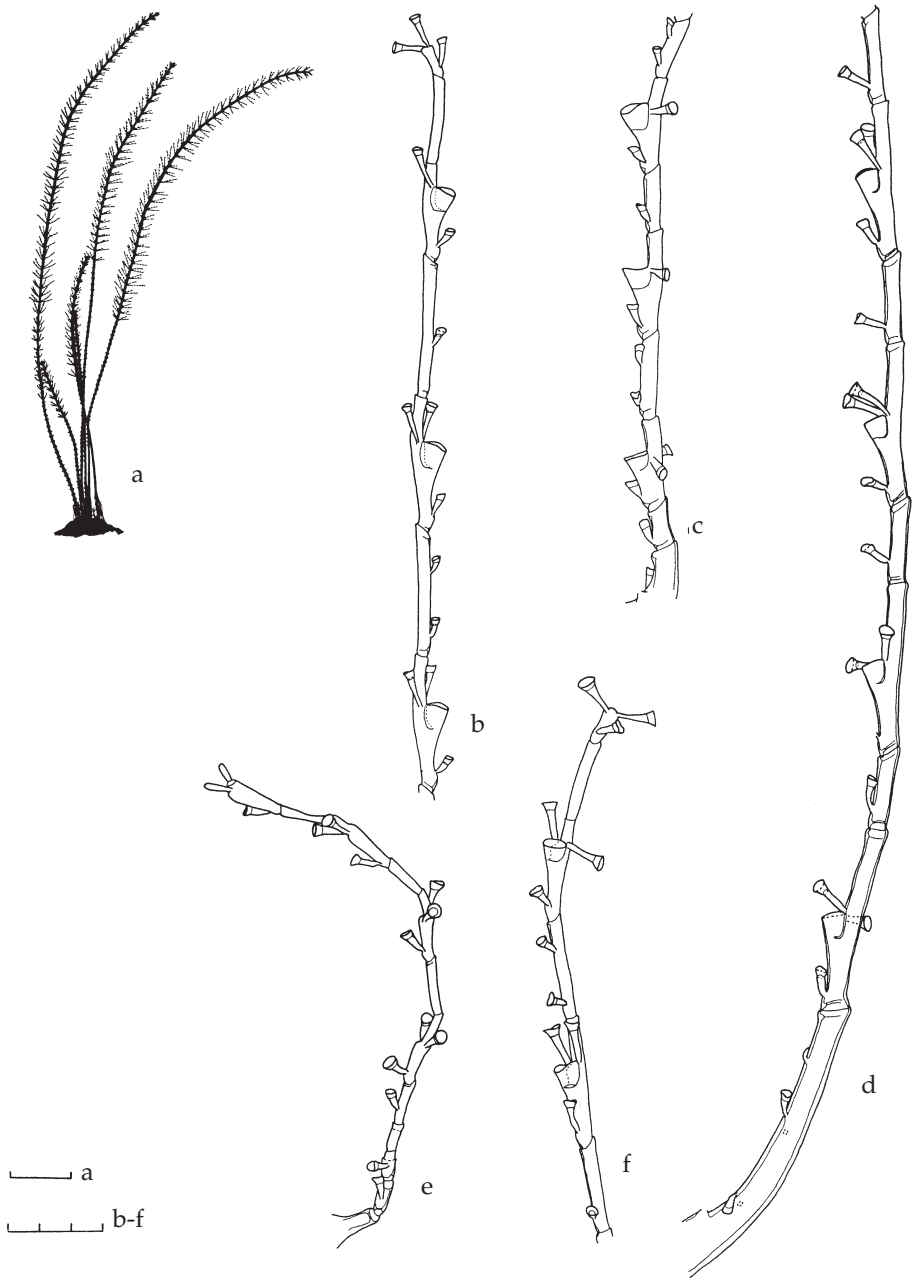


Fig. 76. *Nemertesia antennina* (Linnaeus, 1758). a, Stn 4.090, colony; b, Stn 2.072, hydrocladium with big nematothecae, lateral view; c, Stn MAU 049, hydrocladium with varied number of nematothecae on athecate internodes, lateral view; d, Stn MAU 039, typical hydrocladium, lateral view; e, Stn 4.090, hydrocladium with atrophied hydrotheca, lateral view; f, Stn MAU 039, hydrocladium with varied number of nematothecae on athecate internodes, oblique lateral view. Scales: a, 1 cm; b-f, 0.3 mm.

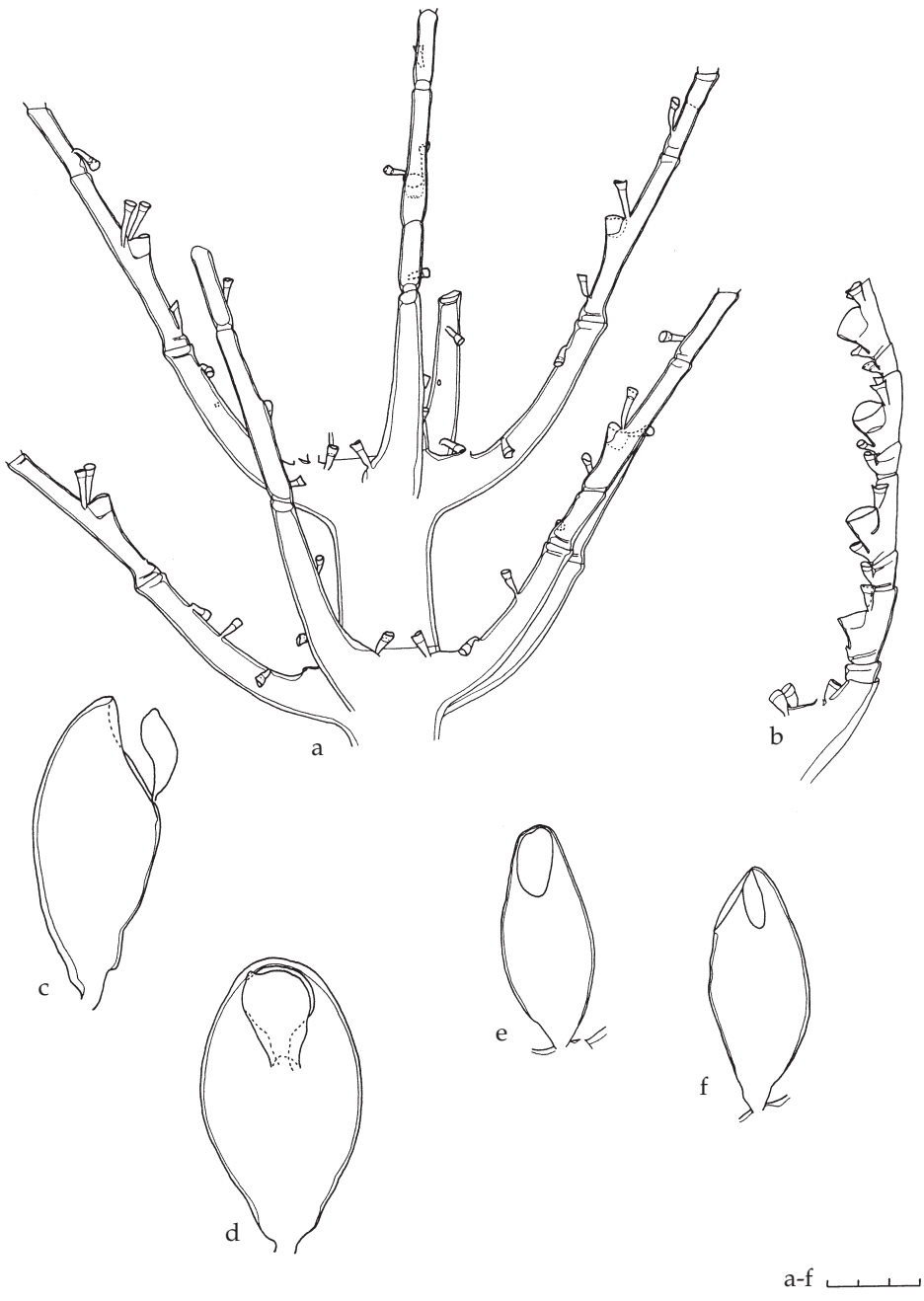


Fig. 77. *Nemertesia antennina* (Linnaeus, 1758). a, Stn MAU 039, detail of colony, frontal view; b-d, Stn MAU 073, b, hydrocladium, lateral view; c, gonotheca, lateral view; d, gonotheca, frontal view; e-f, Stn MAU 039, e, gonotheca, frontal view; f, gonotheca, lateral view. Scales: a-f, 0.3 mm.

Table XLIII. Measurements of *Nemertesia antennina* in µm:

	Stn MAU 039	Stn MAU 073
Height of colony (in mm)	30-53	77-160
Stem internode, length	640-660	630-1050
Diameter at node	300-350	340-520
Basal hydrocladial internode, length	240-245	90
Diameter at node	70-75	80-100
Length thecate internode	435-620	180-310
Length athecate internode	220-340	70-120
Diameter at node	35-60	60-80
Hydrotheca, length abcauline wall	50-60	40-60
Length adcauline wall	60-65	50-70
Diameter at rim	70	90-110
Mesial nematotheca, length	85-110	60-70
Diameter at rim	35-40	35-40
Lateral nematotheca, length	120-150	70-90
Diameter at rim	40-50	45-50
Gonotheca, length	700-840	900-1000
Maximum diameter	270-360	420-520

Discussion.— The variability met with in this species induced previous investigators to describe several new species and a quantity of formae and varieties, largely based on the number of nematothecae per athecate internode (cf. synonymy). Bedot (1917b) revised *Nemertesia* and included in *N. antennina* specimens with monosiphonic hydrocaulus, heteromerous hydrocladia and with one nematotheca per athecate internode. Those differing from that concept by having one or two nematothecae per athecate internode were placed in *N. antennina* var. *irregularis*; those with a constant number of two nematothecae per athecate internode were brought to *Nemertesia perrieri* (Billard, 1901). Ramil & Vervoort (1992a) studied the variability of *N. antennina* in abundant material of the BALGIM expeditions. They concluded that the presence of one or two nematothecae per athecate internode varies so much, even in the same colony, that it is useless as a taxonomic characters, while their conclusions concerning the presence of two such nematothecae tally with ours. Following Stechow (1913c) they kept *Nemertesia irregularis* (Quelch, 1885) separate because of the presence of athecate internodes with two nematothecae (or two consecutive athecate internodes with one nematotheca each), considering *Nemertesia perrieri* a synonym of that species. Study of the type series of *Nemertesia irregularis* (Quelch, 1885) in the collections the The Natural History Museum, London, has convinced us that this species has all the characters of *N. antennina* (Ansín Agís, in prep.), it has therefore been placed in the synonymy of the latter. *Nemertesia perrieri* (Billard, 1901a), a species with two nematothecae per athecate internode and of which the type series has also been studied, is here considered a valid species (Ansín Agís, in prep.). Pictet & Bedot (1900) included in *Antennularia antennina* material that was not described in detail but that, judging from the figures (pl. VI figs 4-5) is characterised by homomerous segmentation of the hydrocladia, though with the presence of an occasional athecate internode, by a var-

ied number of mesial nematothecae (one to three), by a smooth hydrothecal rim slightly tilted downwards and by one suprahydrothecal nematotheca. These characters bring this material closer to *Nemertesia belini* Bedot, 1916 than to *N. antennina*. It is here provisionally included in the latter pending revision of the original material.

Reproduction.— Gonothecae have been observed in nearly all months of the year, March, November and December being excepted (Nobre, 1931; Vervoort, 1959, 1966; Teissier, 1965; Fey, 1969; Boero & Fresi, 1986; Roca, 1986; Ramil & Vervoort, 1992a; Álvarez Claudio, 1993; Medel & Vervoort, 1995, and Ramil, Vervoort & Ansín, 1998). The CANCAP colonies were fertile in June.

Distribution.— *Nemertesia antennina* according to Picard (1958b) is a North Atlantic species, but Roca (1986), Ramil & Vervoort (1992a), Álvarez Claudio (1993), Boero & Bouillon (1993a), Vervoort (1993) and Medel & Vervoort (1995) consider it a cosmopolitan species. In the Atlantic it has been found off Greenland (Naumov, 1969; Vervoort, 1972), near Iceland (Vervoort, 1942; Naumov, 1969), between Iceland and the Faeroes (Vervoort, 1942), the Norwegian coast (Kirchenpauer, 1876; Théel, 1907, as *Antennularia antennina*; Naumov, 1969; Christiansen, 1972), the coast of Sweden (Rees & Rowe, 1969; Jägerskiöld, 1971), Danish coast (Kramp, 1935b), North Sea (Broch, 1928b; Naumov, 1969), Ireland [Williams, 1954, as *Nemertesia (Antennularia) antennina*], off the coasts of Great Britain [Hincks, 1868; Kirchenpauer, 1876; Thornely, 1894; Marine Biological Association, 1904; Ritchie, 1911; Crawshay, 1912, all as *A. antennina*; Marine Biological Association, 1931; Newell, 1954, both as *N. (Antennularia) antennina*; Marine Biological Association, 1957; Hughes, 1975; Hamond & Williams, 1977; Cornelius, 1988; Cornelius & Ryland, 1990; Cornelius, 1995], the coast of Holland (Van Benthem Jutting, 1922, as *A. antennina*; Leloup, 1933c; Vervoort, 1946b), the coast of Belgium (Leloup, 1933c, 1947, 1952a), the English Channel (Billard, 1931b), the Channel Islands (Philbert, 1935c), numerous localities along the French coast (Pictet & Bedot, 1900; Billard, 1902, both as *A. antennina*, 1904a; Bedot, 1911; Billard, 1912a; Prenant & Teissier, 1924; Billard, 1927a, 1931b; Philbert, 1935c, 1935e; Teissier, 1950b; Cabioch, 1961; Teissier, 1965; Fey, 1969; Castric-Fey, 1973; Houvenaghel-Crèvecoeur, 1973; Castric-Fey & Chassé, 1991; Bouillon, Massin & Kresevic, 1995), the Bay of Biscay (Browne, 1907, as *A. antennina*; Bedot, 1921c, as *Nemertesia antennina* var. *irregularis*; Vervoort, 1985), the north and north-west coast of Spain (Allman, 1874, as *A. antennina*; Estrada, 1979, 1980; Urgorri & Besteiro, 1983; Ramil, 1988; Altuna & García Carrascosa, 1990; Álvarez Claudio, 1993; Altuna Prados, 1994a, as *N. antennina* var. *irregularis*; Álvarez Claudio, 1995; Álvarez Claudio & Anadón, 1995), the Portuguese coast (Bedot, 1921c, as *N. antennina* var. *irregularis*; Nobre, 1931, 1937, both as *A. antenima*; Da Cunha, 1940, 1944, 1950; Saldanha, 1974; Bouillon, Massin & Kresevic, 1995), the Azores (Bedot, 1921c, as *N. antennina* var. *irregularis*; Rees & White, 1966a), Madeira (Kirchenpauer, 1876; Marktanner-Turneretscher, 1890, as *Antennularia janini*), the Strait of Gibraltar (Ramil & Vervoort, 1992a), Gorringe and Ampère Banks (Ramil, Vervoort & Ansín, 1998), the coast of Morocco (Billard, 1906b, as *Antennularia antennina* var. *longa*; Patriti, 1970), the Canary Islands (Billard, 1906b, as *Antennularia Perrieri* var. *antennoides*), Western Sahara (Billard, 1901a, 1904a, 1906a, all as *A. antennina*, 1906b; Broch, 1912a; Leloup, 1937a; Vervoort, 1946a), the Cape Verde Islands (Quelch, 1885, as *Antennularia irregularis*), the coast of Mauritania (Billard, 1906a, as *A. antennina*; Billard, 1931d; Vervoort, 1946a; Bouillon, Massin & Kresevic, 1995), Sene-

gal, French Guinea, Ghana (Vervoort, 1959), Congo (Vervoort, 1966a), Atlantic coast of Canada (Fraser, 1918b, 1921, both as *A. antennina*; Calder, 1970c), Georges Bank (Nutting, 1900, as *A. antennina*), North Carolina (Nutting, 1900, as *A. antennina*) and the coast of Georgia (Vervoort, 1972).

In the Mediterranean known from the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), the Alborán Sea (Templado et al., 1986), the Spanish coast (Arévalo y Carretero, 1906; Rioja y Martín, 1906; Rodríguez Rosillo, 1914, as *Antenullaria antennina*; De Haro, 1965; Gili, 1979; Camp & Ros, 1980; García Carrascosa, 1981; Gili, 1981, 1982; Gili, García & Colomer, 1984; Gili & Ros, 1985; Gili, 1986; García Carrascosa, et al., 1987; Gili, Ros & Pagès, 1987; Gili, Murillo & Ros, 1989; Medel & Vervoort, 1995), the Balearic Islands (Roca, 1986), the French coast (Stechow, 1919a; Leloup, 1934c; Picard, 1951e; Costa, 1960; Vidal, 1968; Guille, 1971), Algeria (Picard, 1955b), off the Italian coast (Carus, 1884; Marktanner-Turneretscher, 1890, as *A. janini*; Neppi, 1917; Stechow, 1923d; Rossi, 1971; Boero & Fresi, 1986; Bouillon, Massin & Kresevic, 1995), the Adriatic (Kirchenpauer, 1876; Carus, 1884; Broch, 1912a, 1933b; Riedl, 1970; Marano, Ungano & Vaccarella, 1991) and the coast of Israel (Vervoort, 1993).

Also known from the Indian Ocean coasts of South Africa (Vervoort, 1966; Millard, 1975) and in the Pacific from Indochina (Bouillon, Massin & Kresevic, 1995) and Japan (Stechow, 1909, as *Antennularia antennina* var. *minor*; Jäderholm, 1919a, as *N. irregularis*). The occurrence in New Zealand waters is considered doubtful by Ralph (1961b) and could be due to confusion with *Nemertesia cymodocea* (Busk, 1851) or *Nemertesia elongata* Totton, 1930.

The bathymetrical range is between 0 (Álvarez Claudio, 1995) and 1500 m (Naumov, 1969).

CANCAP material originates from 17 localities of which five near the Azores, one off Morocco, six from the Canary Islands and five from the Mauritanian coast. The bathymetrical range is between 12 and 280 m, with the exception of that from Stn 5.049, collected between 2200 and 2450 m.

Epibionts.— Stn 1.118: *Campanularia hincksii* Alder, 1856.— Stn 2.048: Bivalve.— Stn 2.072: Gastropod eggs, Nudibranchia.— Stn 4.091: *Plumularia setacea* (L., 1758).— Stn 4.092: Bryozoa.— Stn 4.143: Bivalve.— Stn 5.044: *Filellum* spec., *Halopteris catharina* (Johnson, 1833).— Stn 5.077: Tubes of Amphipoda, Bryozoa.— Stn 5.142: *Plumularia setacea* (L., 1758).— Stn MAU 039: *Modeeria rotunda* (Quoy & Gaimard, 1827), Bryozoa.— Stn MAU 049: Unidentifiable athecate.— Stn MAU 072: Algae, *Antennella secundaria* (Gmelin, 1791), *Pseudoplumaria marocana* (Billard, 1930), Bryozoa.— Stn MAU 073: *Obelia dichotoma* (L., 1758), Gastropod eggs.

Nemertesia belini Bedot, 1916
(figs 78-79)

Nemertesia belini Bedot, 1916a: 1; 1917b: 43; 1921b: 35; 1921c: 24, pl. 4 figs 22-30; 1923: 215, fig. 1A-B; Rees & White, 1966: 280; Bouillon, Massin & Kresevic, 1995: 59.

Material.— **Azores area**: Stn 5.010: One detached colony without gonothecae (RMNH-Coel. 28966, slide 4682).— **Cape Verde Islands**: Stn 6.072: Six colonies without gonothecae (RMNH-Coel. 28754; DEBA-UV slide R. 332).— Stn 6.074: One colony without gonothecae (RMNH-Coel. 28762, slide

4683).— Stn 6.076: One colony without gonothecae (RMNH-Coel. 29101 = slide 4684).— Stn 6.078: One colony with gonothecae (RMNH-Coel. 28788, four slides 4685).
Additional material.— Musée Océanographique, Monaco. Campagnes Scientifiques Prince Albert 1er de Monaco: Expedition 1895, Stn 584, 38°31'N-38°30'30"N, 26°49'15"W-26°50'15"W, 845 m, 16.vii.1895: Many colonies, several with damaged gonothecae. MOM 11 0139.— Expedition 1897, Stn 889, 37°57'30"N 29°15'10"W, 208 m, 10.viii.1897: One damaged stem. MOM 11 0170.— Expedition 1905, Stn 2.210, 39°25'N 31°22'30"W, 1229 m, 01.ix.1905: One colony with hydrocladia alternately directed left and right in the basal part, no gonothecae. MOM 11 0199.— Expedition 1903, Stn without number, 32 miles ESE of Punta Este, Pico Island (Azores), 1160 m, 26.ii.1903: Many colonies with gonothecae. MOM 11 0213.

Description (of material from Stn 6.078).— Hydrorhiza tubular, adhering to substrate, giving rise to several monosiphonic, unbranched hydrocauli, divided in internodes by straight nodes, distinctly visible in distal part of stem and each provided with a verticil of two to four apophyses in distal part, arranged decussate and thus doubling the numbers of vertical series of apophyses and several nematothecae distributed under the apophyses. Basal part of axes with decussate pairs of apophyses; in distal parts each verticil composed of four apophyses. Length of apophyses varies, short basally, long distally; each apophysis with two axillar nematothecae, a mamelon on its superior surface and an unpaired distal nematotheca. A long apophysis may have, following the mamelon, a pair of proximal nematothecae and up to three unpaired distal nematothecae.

First internode of hydrocladia in medio-basal part of stem, with short apophyses, short and athecate, provided with a single nematotheca. In medio-distal part, with long apophyses, first internode of hydrocladium is thecate. Hydrocladia composed of succession of thecate internodes with slightly oblique nodes, each with one hydrotheca on distal third, two to four mesial inferior nematothecae, a pair of lateral nematothecae and occasionally a supracalycine nematotheca. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight, aperture perpendicular to internodal length axis or slightly tilted downwards; rim smooth. Athecate internodes occur, distributed without any regularity, bearing one to three nematothecae, usually as the result of node formation in basal part of succeeding thecate internode. All nematothecae bithalamic and movable, with long and narrow basal chamber.

Gonothecae inserted on apophyses, ovoid, narrowing basally into a short pedicel. Aperture latero-terminal, broadly oval.

Variability.— The material inspected varies with regard to length of apophysis, segmentation of the stem, and number of nematothecae per hydrocladial internode; this variability agrees with that described by Bedot (1916a). We observed that the presence of athecate internodes coincided with shortening of the succeeding thecate internode, with the hydrotheca shifting towards the middle and the number of mesial inferior nematothecae reducing; this in our opinion indicates that the athecate internode has been split off from the following, thecate internode.

In the colony from Stn 5.010 the hydrothecal aperture is tilted downwards (perpendicular to internodal length axis typically). The material from Stns 6.072, 6.074, 6.076 and 6.078 has very big nematothecae (tab. XLIV). A colony from Stn 6.078 has an apophysis bearing two hydrocladia; here secondary hydrocladia occur, developing from the interior of a hydrotheca or from an apophysis below the hydrotheca of a primary hydrocladium (fig. 78c).

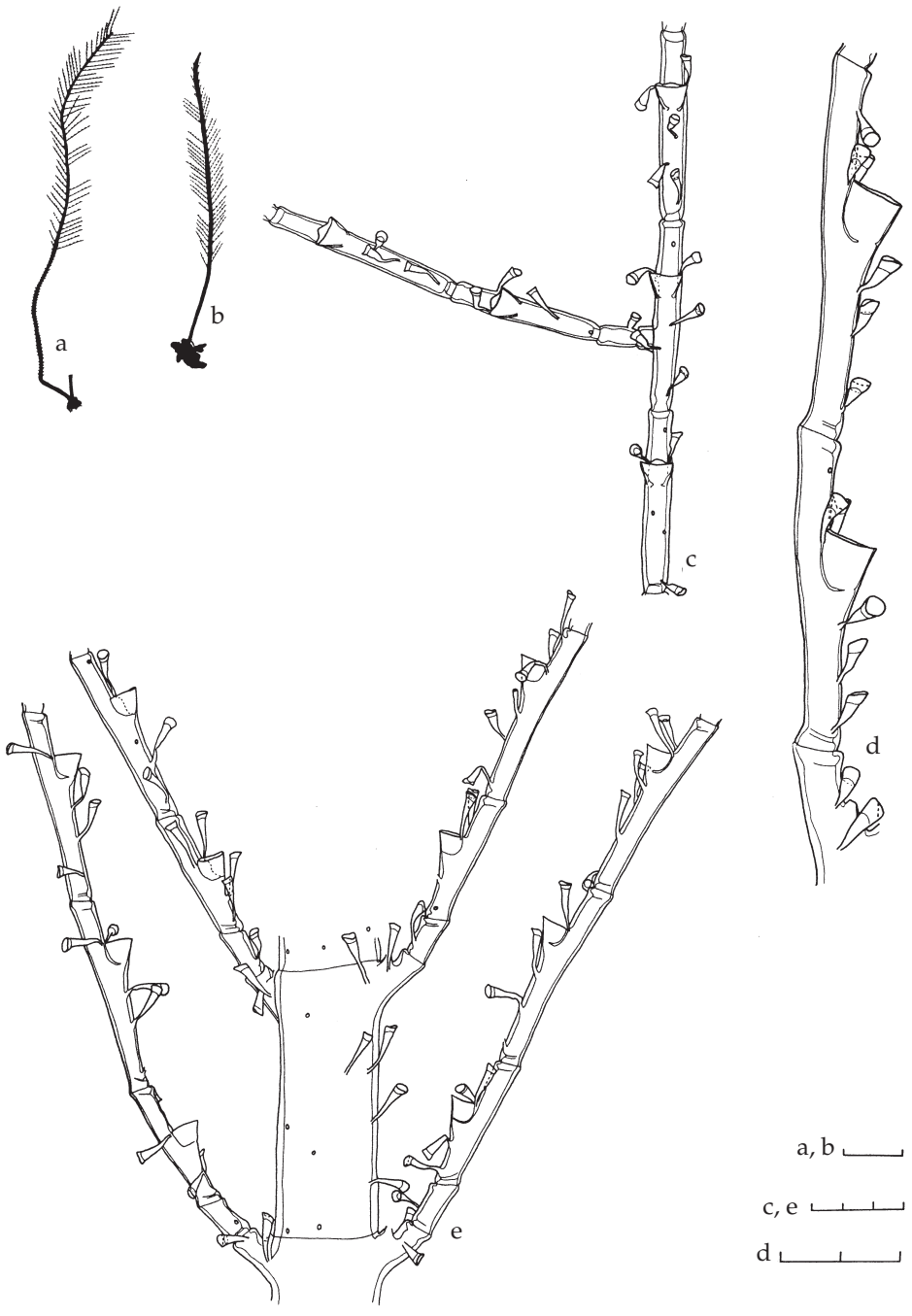


Fig. 78. *Nemertesia belini* Bedot, 1916. a, Stn 6.078, colony; b, Stn 6.074, colony; c, Stn 6.078, branched hydrocladium; d, Stn 5.010, basal part of hydrocladium, lateral view; e, Stn 6.078, detail of colony, frontal view. Scales: a-b, 1 cm; c, e, 0.3 mm; d, 0.2 mm.

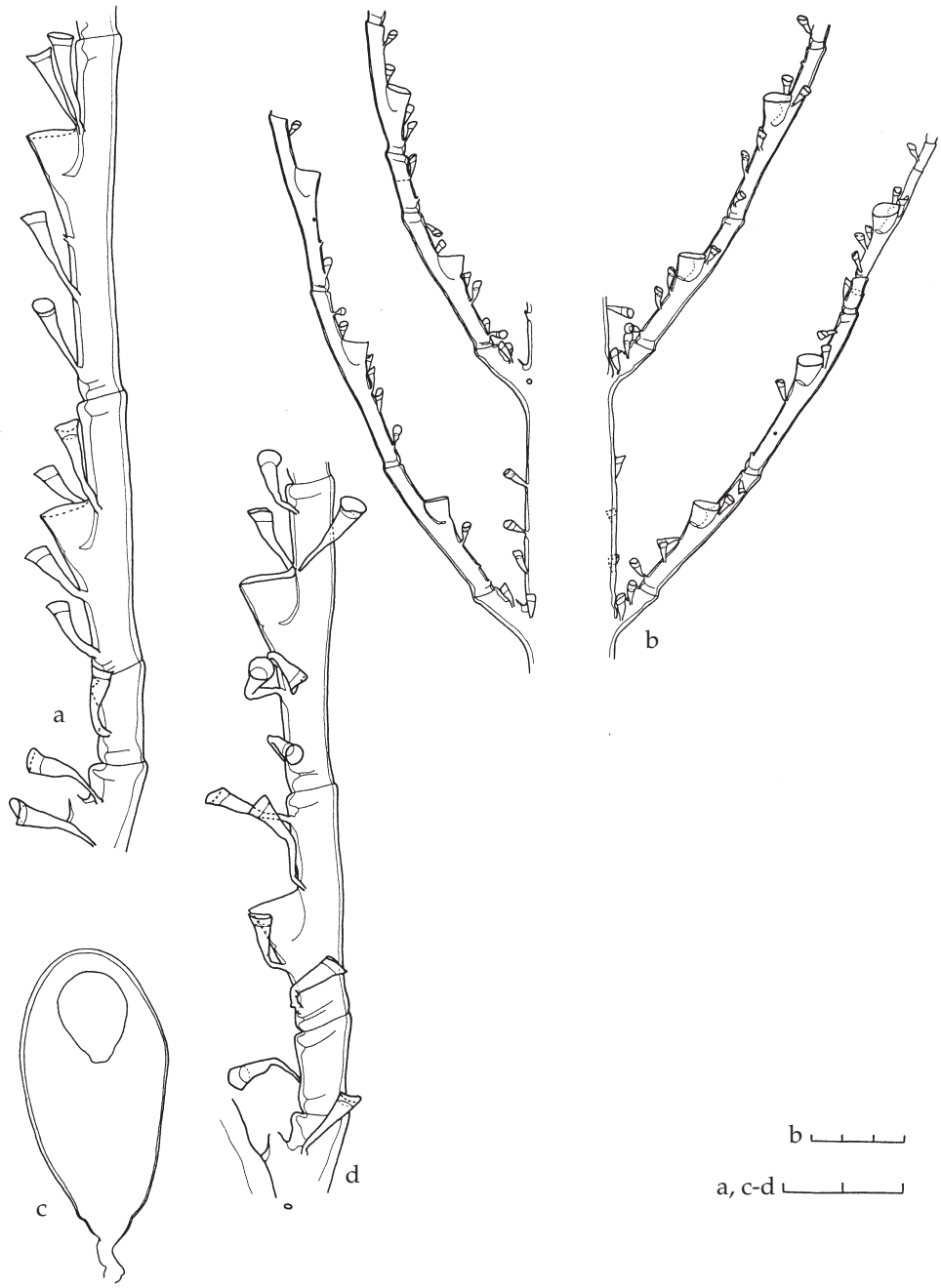


Fig. 79. *Nemertesia belini* Bedot, 1916. a, Stn 6.078, hydrocladium, lateral view; b, Stn 5.010, detail of colony, frontal view; c, Stn 6.078, gonotheca, frontal view; d, Stn 6.072, basal part of hydrocladium, lateral view. Scales: a, c-d, 0.2 mm; b, 0.3 mm.

Table XLIV. Measurements of *Nemertesia belini* in µm:

	Stn 6.078	Stn 5.010	Stn 6.072
Height of colony (in mm)	39-92	55	26-171
Stem internode, length	830-1190	750-870	650-840
Diameter at node	260-370	230-300	350-430
Hydrocladial internode, length first internode	340-470	460-570	320-490
Length following internodes	605-700	550-680	430-540
Diameter at node	50-85	50-80	50-85
Hydrotheca, length abcauline wall	70-80	70-80	70-85
Length adcauline wall	80-90	85-100	80-90
Diameter at rim	85-90	70-90	90-95
Mesial nematotheca, length	120-150	70-90	130-150
Diameter at rim	32-40	30	35-40
Lateral nematotheca, length	130-160	70-80	150-180
Diameter at rim	32-40	35	40-45
Gonotheca, length	440-520		
Maximum diameter	230-240		

Discussion.— Bedot (1916a) indicated that above all *Nemertesia belini* differs from other species of *Nemertesia* by the considerable variability in length of the apophyses, segmentation of the hydrocladia and the number of nematothecae per hydrocladial internode, mesial inferior (one to five) as well as supracalycine, making it difficult to indicate diagnostic characters. An exhaustive study of variability in this species was published later (Bedot, 1921c).

On comparison of our material with the type series (Ansín Agís, in prep.) a fair similarity in external morphology is evident, both in trophosome and gonosome. There are differences in number of supracalycine nematothecae, one to three according to Bedot (1921c), with two the more common number; zero to one in the CANCAP material, one being the usual number. CANCAP material from the Azores seldom has athecate internodes; that from the Cape Verde region has irregularly distributed athecate internodes in the hydrocladia.

Reproduction.— Bedot (1921a) mentioned the presence of gonothecae in February and July; the CANCAP material had gonothecae in June.

Distribution.— *Nemertesia belini* was so far only known from the Azores (Bedot, 1916a; 1921c).

The bathymetrical distribution varied between 208 and 1229 m (Bedot, 1921c).

CANCAP material originates from five localities, of which one near the Azores and four in the Cape Verde region, extending the area of distribution southwards. The material was collected between 91 and 290 m.

Epibionts.— Stn 6.074: *Clytia paulensis* (Vanhöffen, 1910).— Stn 6.076: *Clytia paulensis* (Vanhöffen, 1910).— Stn 6.078: *Zygophylax* spec., *Scalpellum scalpellum* (L., 1767).

Nemertesia falcicula (Ramil & Vervoort, 1992) (fig. 80)

Plumularia falcicula Ramil & Vervoort, 1992a: 180, fig. 46a-h.

Material.— **Canary Islands and Selvagens Archipelago**: Stn 2.119: One colony without gonothecae (RMNH-Coel. 29102 = slide 4686).— Stn 2.130: One colony with gonothecae (RMNH-Coel. 28713, four slides 4687; DEBA-UV, slide R. 334).
Additional material.— Nationaal Natuurhistorisch Museum (National Museum of Natural History), Leiden, The Netherlands: BALGIM Expedition, Stn DR 153, 35°55.8'N 05°35.3'W, 17.vi.1984, 580 m: One colony with gonothecae. Paratype. RMNH-Coel. 26246.

Description (of material from Stn 2.130).— Hydrorhiza tubular, attached to substratum, with numerous nematothecae, supporting one polysiphonic stem from which spring several monosiphonic, unbranched hydrocauli. Polysiphonic stem basally with many nematothecae, identical with those of hydrorhiza, composed of a long, slender stalk supporting a cup-shaped distal chamber, separated from stalk by a thin diaphragm. Hydrocauli divided into internodes by straight, at times obscure nodes; each internode with one to three distal apophyses and one to four nematothecae under apophysis. In basal part of hydrocaulus apophyses in decussate verticils of three; in distal part apophyses alternately directed left and right, form of colony on those parts plumularioid. Each apophysis with mamelon on superior surface, with two axillar and occasionally additional nematothecae above mamelon.

First hydrocladial internode short, athecate, with one nematotheca. Rest of hydrocladium composed of thecate internodes separated by oblique nodes, each with one hydrotheca and four nematothecae: one mesial inferior, two lateral and one supracalycine. Hydrotheca small, placed on lower third of internode, quadrangular in cross section; adcauline wall fully adnate, abcauline wall straight, aperture perpendicular to internodal length axis, rim smooth. Lateral nematothecae inserted on small apophyses near hydrothecal rim. All nematothecae bithalamic and movable.

Gonothecae inserted on apophyses by means of short pedicel. Female gonotheca strongly curved, horn-shaped, with latero-terminal, circular aperture closed by a lid. Male gonothecae slightly curved, sac-shaped, with terminal, circular aperture. Both male and female gonothecae on same colony; female gonothecae in medio-distal part of colony; male gonothecae above female ones in distal part of colony.

Variability.— In the CANCAP specimens the hydrothecal walls in basal parts of the hydrocladia are thickened, thickening diminishing distally and becoming imperceptible. The athecate internode is occasionally absent, becoming fused to either apophysis or the first thecate internode. In the first case there is an additional nematotheca above the mamelon on a lengthened apophysis; in the second case there are two mesial inferior nematothecae on the first thecate internode. Two supracalycine nematothecae may also occur, either on normal internodes or on internodes that have regenerated. Regeneration may also account for the occasional presence of two basal athecate internodes or athecate internode in distal parts of hydrocladia; such internodes usually have one nematotheca.

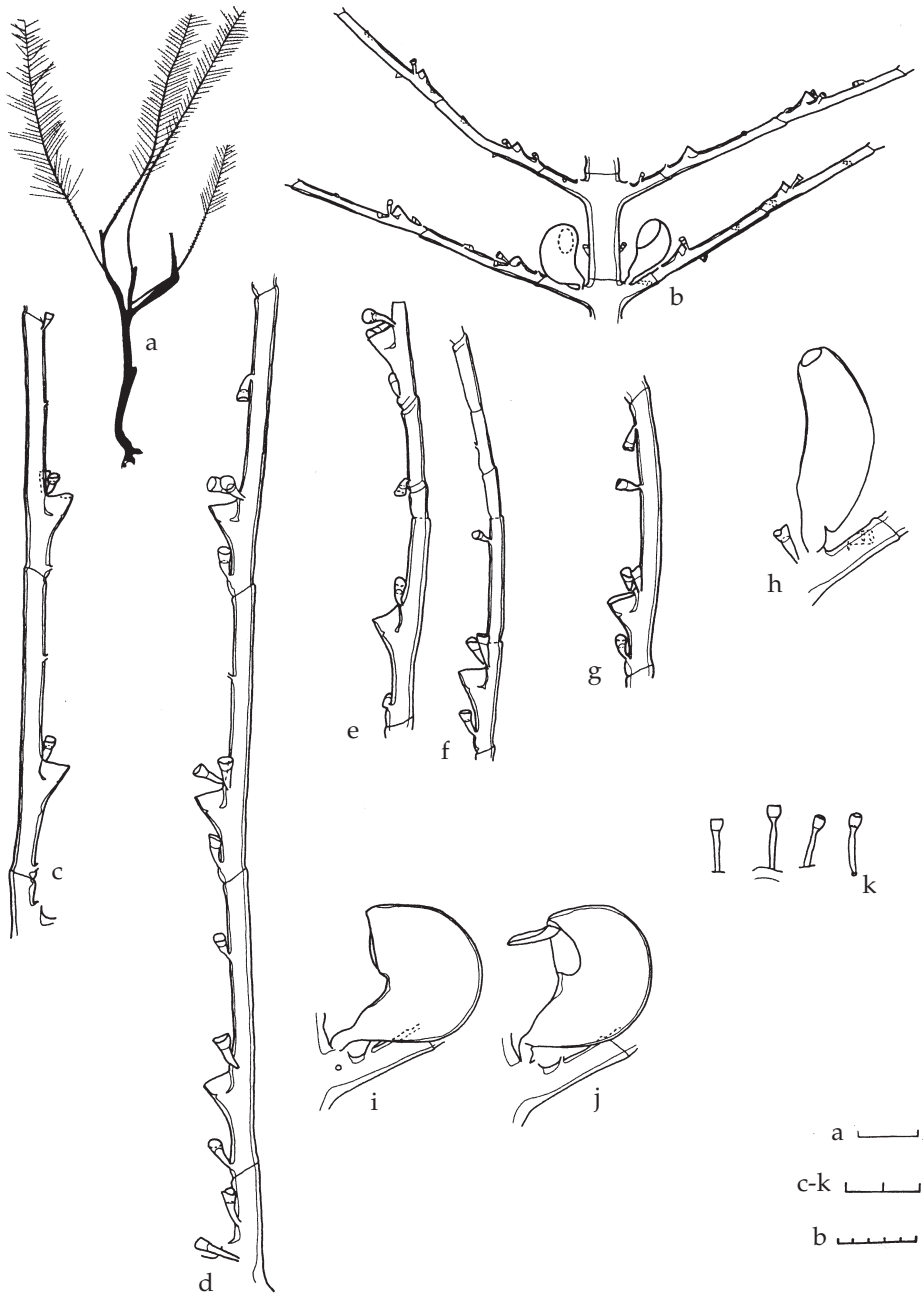


Fig. 80. *Nemertesia falcicula* (Ramil & Vervoort, 1992). a-b, Stn 2.130, a, colony; b, detail of colony, frontal view; c, Stn 2.119, hydrocladium; d-k, Stn 2.130, d, hydrocladium; e-f, damaged hydrocladia with athecate internodes; g, internode with two supracalycine nematothecae; h, male gonotheca; i-j, female gonotheca, c-i in lateral view, j, in latero-frontal view; k, nematothecae from stolonal tubes. Scales: a, 1 cm; b, 0.5 mm; c-k, 0.2 mm.

Table XLV. Measurements of *Nemertesia falcicula* in µm:

	Stn 2.130
Height of colony (in mm)	74-85
Stem internode, length	430-830
Diameter at node	90-200
Basal hydrocladial internode, length	180-230
Diameter at node	55-60
Thecate internode, length	680-950
Diameter at node	45-70
Hydrotheca, length abcauline wall	35-50
Length adcauline wall	40-55
Diameter at rim	70-90
Mesial nematotheca, length	70-80
Diameter at rim	28-35
Lateral nematotheca, length	80-105
Diameter at rim	30-40
Male gonotheca, length	460-550
Maximum diameter	130-260
Female gonotheca, length	410-490
Maximum diameter	240-260

Discussion.— Ramil & Vervoort (1992a), when describing *Plumularia falcicula*, indicated the similarity with *Nemertesia ramosa* (Lamarck, 1816) and *N. ventriculiformis* (Marktanner-Turneretscher, 1890) with regards to the segmentation of the hydrocladia and their arrangement of hydrotheca and nematothecae. However, the plumularioid arrangement of the hydrocladia made them include the species in the genus *Plumularia*. Comparison of the CANCAP material with paratypes of *P. falcicula* shows the complete conformity of these colonies, both in structure of the trophosome as that of the gonotheca. The CANCAP material only differs by the arrangement of the hydrocladia in verticils in basal parts of the stem. We therefore conclude that the material described as *Plumularia falcicula* by Ramil & Vervoort (1992a) had not yet reached full development; the CANCAP colonies and those of the paratype are certainly conspecific. It is necessary, therefore, to remove the species to the genus *Nemertesia* Lamouroux, 1812, where it should stand as *Nemertesia falcicula* (Ramil & Vervoort, 1992). The differences with *Nemertesia norvegica* (G.O. Sars, 1874) and *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890) are discussed later (cf. discussion of *N. ventriculiformis*).

Reproduction.— Ramil & Vervoort (1992a) reported on the presence of gonothecae in June. The fertile CANCAP specimens were taken in September.

Distribution.— *Nemertesia falcicula* was previously known from two localities only: the Strait of Gibraltar and the Alborán Sea near the Moroccan coast (Ramil & Vervoort, 1992a, as *Plumularia falcicula*); bathymetrical distribution 480-580 m (Ramil & Vervoort, 1992a).

CANCAP material comes from two localities near the Canary Islands and was taken between 350 and 1800 m, extending the geographical distribution to the Atlantic and the bathymetrical distribution down to 1800 m.

Nemertesia norvegica (G.O. Sars, 1874) (fig. 81)

Heteropyxis norvegica G.O. Sars, 1874: 104, pl. 3 figs 15-22.
Heteropyxis norwegica; Kirchenpauer, 1876: 7, 19, 29, pl. 2 figs 21, 21a.
Antennularia norvegica; Bonnevie, 1899: 97; Burdon-Jones & Tambs-Lycke, 1960: 6.
Not *Antennularia norwegica*; Billard, 1906b: 217 [= *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890)].
Antennopsis norvegica; Browne, 1907: 33; Bedot, 1921b: 34.
Nemertesia incerta Bedot, 1916a: 2, fig.; 1917b: 44; 1921b: 35; 1921c: 20, pl. 3 figs 19-21; Leloup, 1940b: 22; Vervoort, 1959: 290, figs 44-45a-b; Rees & White, 1966: 280; Bouillon, Massin & Kresevic, 1995: 60.
Nemertesia norvegica; Bedot, 1917b: 45; 1921b: 35; Kramp, 1938d: 70; Christiansen, 1972: 304; Jensen & Frederiksen, 1992: 64; Cornelius, 1995: 152, fig. 35A-E.
Not *Nemertesia incerta*; Fey, 1969: 405, 407, 409 [= *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890)].
Not *Nemertesia incerta*; Vervoort, 1972: 229, fig. 81 (= *Plumularia insignis* Allman, 1883).

Material.— **Azores area**: Stn 5.010: One colony with four stems, of which two with gonothecae (RMNH-Coel. 28765, two slides 4688).
Additional material.— Zoological Museum of the University, Oslo, Norway: Hardangerfjorden, 90-100 fms (= 164-182 m), as *Heteropyxis norvegica* (holotype). Ten colonies and several fragments, with gonothecae. ZMU B.1229.— The Natural History Museum, London, U.K.: Brattholmen Reef, near Bergen, Norway, 80 m, 21.vi.1983. Two colonies with gonothecae. BMNH 1983-11-28-21.— Musée Oceanografique de Monaco: Campagnes Scientifiques Prince Albert 1er de Monaco, holotype of *Nemertesia incerta*: Expedition 1895, Stn 584, 38°31'N-38°30'30"N, 26°49'15"W-26°50'15"W, 845 m, 16.vii.1895: One colony with gonothecae. MOM 11 0152.— Expedition 1895, Stn 600, 38°30'35"N, 28°16'20"W, 349 m, 24.vii.1895: One colony without gonothecae. MOM 11 0154.— Expedition 1897, Stn 866, 38°52'50"N, 27°23'05"W, 599 m, 02.viii.1897: One colony without gonothecae. MOM 11 0161.— Expedition 1902, Stn 1349, 38°35'30"N 28°05'45"W, 1250 m, 19.viii.1902: One colony with gonothecae. MOM 11 0191.— Expedition 1902, Stn 1367, 37°34'N, 28°56'45"W, 563 m, 25.viii.1902: One colony without gonothecae. MOM 11 0191.— Nationaal Natuurhistorisch Museum, Leiden, The Netherlands: Stn 103. Trondheims Leden, N of Adegens Fyr, Norway, 63°40'N, 09°42'E, 330 m, 24.viii.1965: Three colonies, one with gonothecae, as *Nemertesia ramosa* [not *Nemertesia ramosa* (Lamarck, 1816)]. RMNH-Coel. 2503.— Atlantide Expedition: Stn 163, 13°43'N, 17°43'W, 65-89 m, 25.iv.1946: One colony without gonothecae. RMNH-Coel. 1310.

Description (of material from Stn 5.010).— Hydrorhiza tubular, supporting various monosiphonic, unbranched hydrocauli, each with several internal coenosarc tubes. Hydrocaulus divided by straight nodes into internodes of varied length with one to 26 apophyses; one stem nematotheca between two apophyses of one row. Apophyses arranged alternately in one plane, opposite in one plane or in decussate pairs, doubling the number of longitudinal series of apophyses. Each apophysis with one mamelon on superior surface and three nematothecae: two in the axil and an unpaired distal nematotheca. Node between apophysis and first hydrocladial internode may disappear giving rise to a long, thecate apophysis.

Hydrocladia composed of succession of thecate internodes with slightly oblique nodes, each with one hydrotheca on basal half and three nematothecae: one mesial inferior, one lateral on one side of hydrotheca and one supracalycine nematotheca near distal end. Two internal perisarc rings per internode, one basal, one distal; more

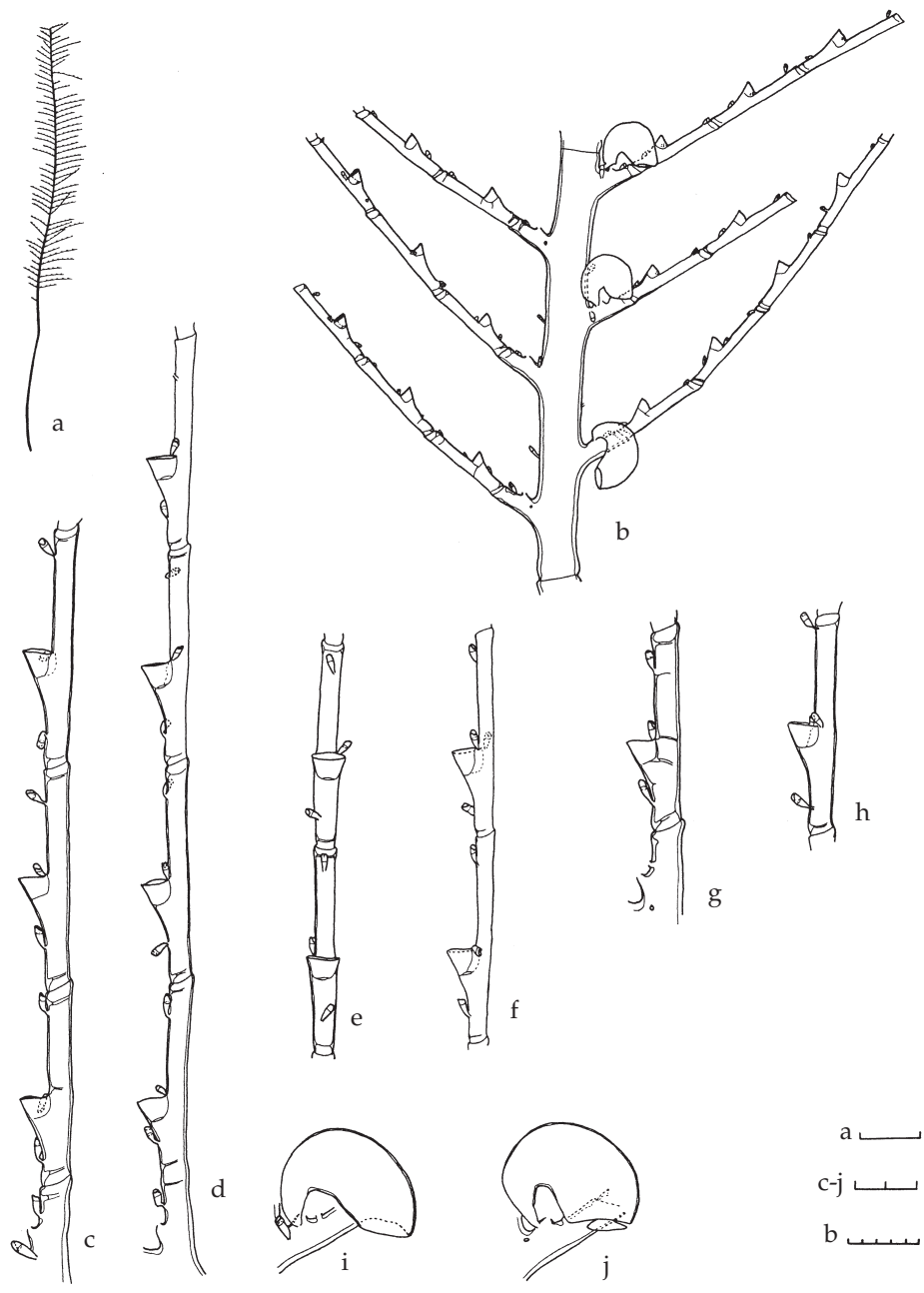


Fig. 81. *Nemertesia norvegica* (G.O. Sars, 1874), Stn 5.010. a, colony; b, detail of colony, frontal view; c, hydrocladium with node between apophysis and first (thecate) internode, lateral view; d, hydrocladium without node between apophysis and first (thecate) internode, lateral view; e, part of hydrocladium, frontal view; f, h, hydrocladial internode with two lateral nematothecae, lateral view; g, hydrocladial internode with septa, lateral view; i-j, gonothecae, lateral view. Scales: a, 1 cm; b, 0.5 mm; c-j, 0.2 mm.

(up to five in all) may occasionally develop. Hydrotheca cup-shaped, adcauline wall fully adnate; abcauline wall straight, aperture circular, perpendicular to internodal length axis or slightly tilted upwards; rim smooth. All nematothecae bithalamic and movable; rim of distal chamber scooped to a varied degree.

Gonothecae inserted on apophyses, single or in groups of two, strongly curved, cornucopia-shaped; aperture terminal and slightly oblique, circular, closed by lid.

Variability.— The more common form of variability is found in the development of the perisarc rings in the hydrocladial internodes (two to five), higher numbers in basal internodes, lower numbers in distal. Internodes with two nematothecae flanking the hydrotheca rarely occur; the typical number of lateral nematothecae is one per internode.

Table XLVI. Measurements of *Nemertesia norvegica* in µm:

	Stn 5.010	Bergen (BMNH 1983.11.28.21)
Height of colony (in mm)	78-112	
Stem internodes, length	variable	variable
Diameter	110-280	250-300
Hydrocladial internode, length	570-760	670-910
Diameter	45-80	40-75
Hydrotheca, length abcauline wall	70-80	70-90
Length adcauline wall	55-70	60-80
Diameter at rim	85-90	65-80
Mesial nematotheca, length	70-90	80-100
Diameter at rim	19-22	30-40
Lateral nematotheca, length	60-70	70-90
Diameter at rim	18-21	30-35
Gonotheca, length	360-450	630-710
Maximum diameter	220-260	210-250

Discussion.— Bedot (1917b, 1921c), based on the descriptions of *N. norvegica* by G.O. Sars (1874) and Bonnevie (1899), gave the followings diagnostic features: hydrocauli polysiphonic and thecate internodes with three nematothecae: one mesial inferior, one just above hydrothecal border and in frontal position and one supracalycine. Inspection of the holotype shows that the hydrocauli in reality are monosiphonic; the typical number of nematothecae on the thecate internodes is three, but the nematotheca associated with the hydrotheca has no frontal position but is found on left or right side, without distinct preference. In two internodes of the holotype two lateral nematothecae, flanking the hydrotheca, have been observed. Exactly the same structure has been observed in the holotype of *Nemertesia incerta* Bedot, 1916a; the gonothecae of that species have the same cornucopia like appearance as found in *N. norvegica*. Both species are therefore considered conspecific; the name *N. norvegica* having priority. This in contradistinction to Fey (1970) who refers *N. incerta* to *N. ventriculiformis* because of similarity of measurements, segmentation of the hydrocladia, structure of the thecate internodes and that of the gonothecae. The gonothecae of *N. ventriculiformis* will be shown later not to have a cornucopia-like appearance, further

evidence to keep this species separate from *N. norvegica* will be presented below. Browne (1907) and Cornelius (1995) refer to the presence of a single coenosarc tube in the stem of *N. norvegica*. The state of preservation of the holotype of that species did not permit accurate observation of that detail. In the holotype of *N. incerta* and in the material of *N. norvegica* from Stn 5.010 several coenosarc tubes inside the stem can be observed. A record of *N. norvegica* from the Mediterranean (Billard, 1906b, as *Antennularia norwegica*) was referred to *N. ventriculiformis* by Ramil and Vervoort (1992a); we concur because Billard (1906b) indicated that the gonothecae of his material resembled those of *Nemertesia ramosa* (as do the female gonothecae of *N. ventriculiformis*).

Reproduction.— Gonothecae were observed by Bedot (1921c) in July and August and by Cornelius (1995) in June. The CANCAP material collected in May bears gonothecae.

Distribution.— *Nemertesia norvegica* is restricted to the north-eastern Atlantic: west coast of Norway (G.O. Sars, 1874, as *Heteropyxis norvegica*; Bonnevie, 1899; Burdon-Jones & Tambs-Lycke, 1960, both as *A. norvegica*; Cornelius, 1995), the Faeroe Islands (Jensen & Frederiksen, 1992), North Sea (Broch, 1903; 1905, as *A. norvegica*; Browne, 1907, as *Antennopsis norvegica*), Great Britain (Cornelius, 1995), northern part of the Bay of Biscay (Browne, 1907, as *Antennopsis norvegica*), Azores (Bedot, 1916a, 1921c, as *N. incerta*) and the coast of Senegal (Vervoort, 1959, as *N. incerta*).

The bathymetrical range is from 65 (Vervoort, 1959) to 1250 m (Bedot, 1916a).

CANCAP material comes from one station near the Azores and was taken at 150 m.

Epibionts.— Stn 5.010: *Halecium* spec., unidentifiable Campanulariidae, Bryozoa.

Nemertesia perrieri (Billard, 1901)
(fig. 82)

Antennularia Perrieri Billard, 1901a: 73; 1904a: 217; Arévalo y Carretero, 1906: 82; Billard, 1906b: 211, fig. 15C; Rioja y Martín, 1906: 278; Stechow, 1909: 81.

Antennularia dendritica Stechow, 1907: 195.

?*Antennularia Perrieri* var. *irregularis*; Stechow, 1909: 83.

Nemertesia perrieri; Bedot, 1917b: 45; 1921b: 35; Billard, 1923: 17; 1927c: 343; Da Cunha, 1940: 113; 1944: 33, fig. 15a; Vervoort, 1946a: 327; Da Cunha, 1950: 129; Vervoort, 1959: 292, fig. 46a; Patriti, 1970: 46, fig. 62; Saldanha, 1974: 325; Álvarez-Claudio, 1993: 273, fig. 46A-C, pl. 27 figs A-C; Álvarez-Claudio & Anadón, 1995: 239.

Not *Nemertesia perrieri*; Vervoort, 1966a: 138, fig. 40; Roca, 1986: 315, fig. 56 [= *Nemertesia antennina* (Linnaeus, 1758)].

?*Nemertesia perrieri*; Gili, Vervoort & Pagès, 1989: 86, fig. 13A-B.

Nemertesia irregularis; Ramil & Vervoort, 1992a: 170, fig. 48a; Álvarez Claudio, 1995: 17; Medel & Vervoort, 1995: 52, figs 22a-c, 23c; Peña Cantero, 1995: 337, pl. 40 figs A-C [not *Nemertesia irregularis* (Quelch, 1885)= *Nemertesia antennina* (Linnaeus, 1758)].

Material.— **Canary Islands and Selvagens Archipelago:** Stn 4.015: One colony without gonothecae (RMNH-Coel. 28593, 28707).— Stn 4.023: Two colonies on fragments of same species, no gonothecae (RMNH-Coel. 28701).— Stn 4.026: One fragmented colony with damaged gonothecae (RMNH-Coel. 28727, slide 4690).— Stn 4.030: Three colonies without gonothecae (RMNH-Coel. 28596, 28732; DEBA-UV, slide 341).— **Atlantic coast of Morocco and Mauritania:** Stn 1.130: One colony with gonothecae (RMNH-Coel. 28739, two slides 4689).— Stn MAU 072: One colony without gonothecae (RMNH-Coel. 29103 = slide 4691).— Stn MAU 080: Two colonies without gonothecae (RMNH-Coel. 28784, two

slides 4692).— Stn MAU 082: One colony without gonothecae (RMNH-Coel. 28758, slide 4693).— Stn MAU 142: Two colonies without gonothecae (RMNH-Coel. 29051, slide 4694).
Additional material.— Muséum National d'Histoire Naturelle, París, France. Expedition Travailleur: Stn DR 47, 28°28'30"N, 18°32'W, Canary Islands, 80 m, 04.viii.1882: Four slides. MNHN 1157, MNHN 1159, MNHN 1161, MNHN 1162. As *Antennularia perrieri*.— Stn DR 48, 04.viii.1882: Three slides. MNHN 1156, MNHN 1158, MNHN 1160. As *Antennularia perrieri*.— Stn Cap Blanc: One slide. MNHN 1163. As *Antennularia perrieri*.— Nationaal Natuurhistorisch Museum, Leiden, The Netherlands: BALGIM Expedition: Stn DW 114, 35°45.5'N, 06°04.2'W, 140/158 m, 11.vi.1984: Two fragments without gonothecae. RMNH-Coel. 26225. As *Nemertesia irregularis* [not *Nemertesia irregularis* (Quelch, 1885) = *Nemertesia antennina* (Linnaeus, 1758)].

Description (of material from Stn 1.130).— Hydrorhiza composed of a mass of intertwining tubules mixed with bottom sediment from which develop several monosiphonic, unbranched hydrocauli, each with several internal coenosarc tubes. Stem divided into internodes by badly visible, straight nodes, each with a verticil of three to four apophyses distally; verticils decussate. No nematothecae visible on stem. Each apophysis with small mamelon on superior surface and four or five nematothecae: two in the axil, one pair above mamelon and one unpaired at distal end of apophysis near node. Hydrocladia inserted on apophyses, in basal parts of colony by means of a short athecate internode with one nematotheca and two internal perisarc rings, in higher parts directly by means of a thecate internode.

Hydrocladia composed of succession of thecate and athecate internodes separated by oblique nodes of varied inclination. Thecate internodes with basally a strongly oblique node and distally an almost straight node; athecate internodes reverse. Each thecate internode with one hydrotheca at c. half its length and three nematothecae: one mesial inferior and two lateral. Hydrotheca small, cup-shaped, adcauline wall fully adnate, abcauline wall straight, aperture perpendicular to internodal length axis or slightly tilted downwards; rim even and smooth. Athecate internodes with two nematothecae, one in lower third, one in upper third. All internodes with two internal perisarc rings of varied development, one near both proximal and distal extremities. All nematothecae bithalamic and movable.

Gonothecae inserted on apophyses on both sides of mamelon by means of short pedicel; shape ovoid, with latero-distal, more or less circular aperture closed by lid.

Variability.— *Nemertesia perrieri* presents little morphological variability, the more important being the varied development of the internal perisarc rings of the internodes, varied even in the same hydrocladium. Damage of a thecate internode and subsequent regeneration leads towards the development of additional athecate internodes each with one nematotheca. Material from Stn 4.030 shows two cases of regeneration after rupture just above the hydrotheca; a supracalycine nematotheca and an athecate internode with one nematotheca have regenerated.

Table XLVII. Measurements of *Nemertesia perrieri* in µm:

	Stn 1.130
Height of colony (in mm)	195-223
Stem internode, length	variable
Diameter at node	540-750

First hydrocladial internode, length	150-185
Diameter at node	85-110
Following hydrocladial internodes, length thecate	340-460
Length athecate	320-430
Diameter at node	40-95
Hydrotheca, length abcauline wall	55-75
Length adcauline wall	60-80
Diameter at rim	90-100
Mesial nematotheca, length	70-80
Diameter at rim	40
Lateral nematotheca, length	100-125
Diameter at rim	40-50
Gonotheca, length	890-1045
Maximum diameter	460-545

Discussion.— As has already been indicated (p: 198) Ramil & Vervoort (1992a) considered *Nemertesia irregularis* (Quelch, 1885) a valid species and included *Nemertesia perrieri* in its synonymy. Comparison of the holotypes of both species proved *N. irregularis* to be conspecific with *N. antennina*, and *N. perrieri* a distinct species, that differs from *N. antennina* by the constant presence of two nematothecae on the athecate internodes (or two consecutive athecate internodes with one nematotheca), by the morphology of the hydrotheca that is wide, low and without lateral undulation and by the absence of nematothecae on the hydrocaulus. However, in the CANCAP material of *N. antennina* some hydrocauli are devoid of nematothecae, probably as the result of handling, but otherwise show all characters of that species. The presence of an athecate basal internode in the hydrocladia is varied in both species. In the synonymy of *N. perrieri* we have largely followed Ramil & Vervoort (1992a), with the exception of *Nemertesia irregularis* (Quelch, 1885). Also we exclude Roca's (1986) record of *N. perrieri* from Mallorca; in her description Roca indicated the regular occurrence of athecate internodes with one nematotheca, a characters valid for *N. antennina* but not for *N. perrieri*.

Reproduction.— Fertility was observed in August (Billard, 1901), in February (Álvarez Claudio, 1933) and in April and July (Medel & Vervoort, 1995). CANCAP material collected in March and May bears gonothecae.

Distribution.— *Nemertesia perrieri* is principally known from the eastern Atlantic and the western Mediterranean, with some isolated records from the Pacific. Atlantic records are from Bay of Biscay south of Belle-Ile (Billard, 1923, 1927a), from Santander (Arévalo y Carretero, 1906; Rioja y Martín, 1906, both as *A. perrieri*), from the coast of Asturias, Spain (Álvarez Claudio, 1993; Álvarez Claudio, 1993, as *Nemertesia irregularis*; Álvarez Claudio & Anadón, 1995), from various localities at the Portuguese coast (Da Cunha, 1940, 1944, 1950; Saldanha, 1974), from the Gulf of Cádiz (Billard, 1906b, as *A. perrieri*), from the coast of Morocco (Ramil & Vervoort, 1992a, as *N. irregularis*; Patriti, 1970), from the Canary Islands (Billard, 1901, 1904a, 1906b, all as *A. perrieri*), from Cape Blanco, Mauritania (Vervoort, 1946a) and from a locality near the coast of Senegal (Vervoort, 1959). In the Mediterranean it was collected in the Strait of Gibraltar, at the coasts of Malaga and Granada (Medel & Vervoort, 1995, as *N. irregularis*) and from the Chafarinas Islands (Peña Cantero, 1995, as *N. irregularis*).

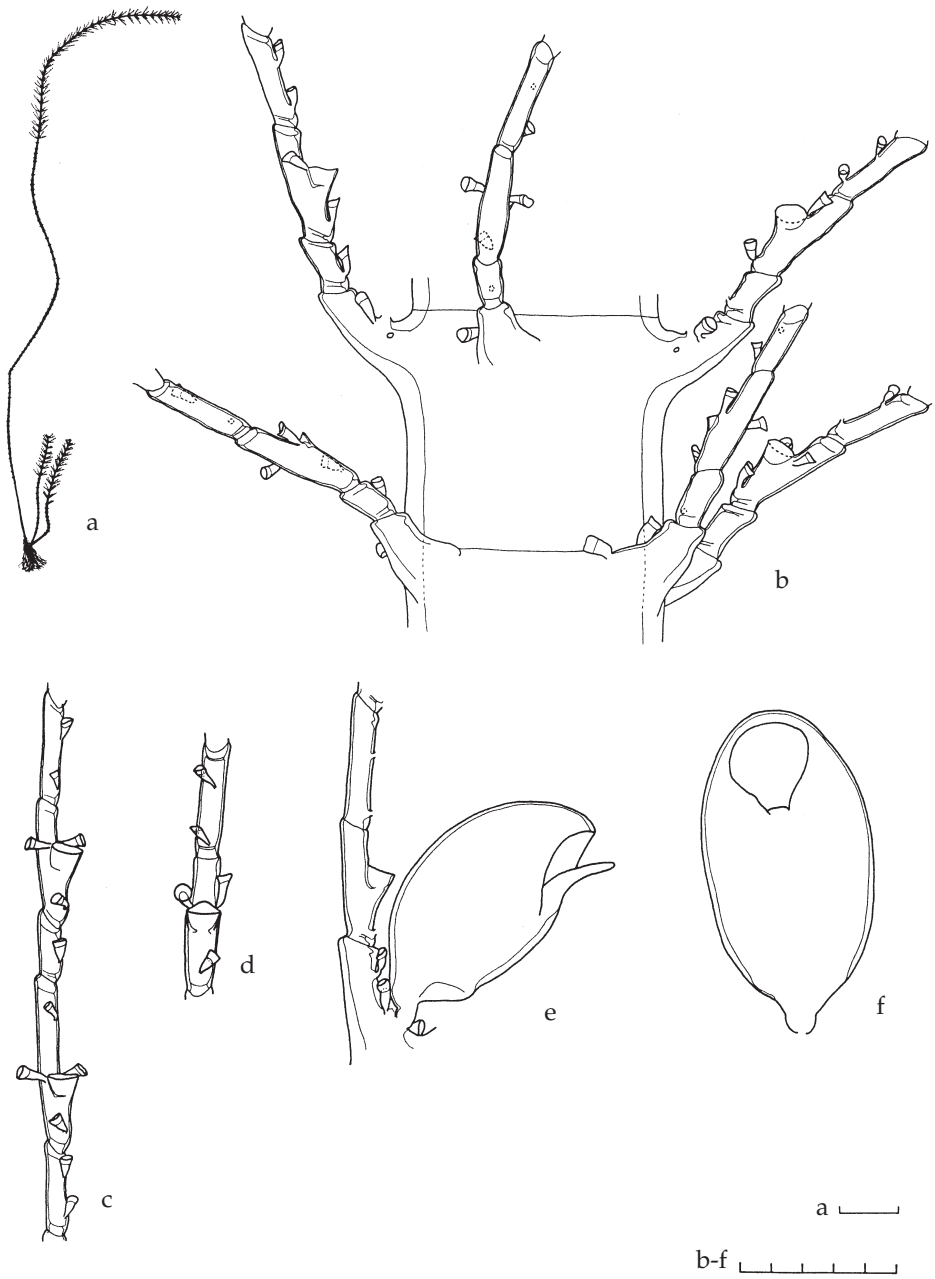


Fig. 82. *Nemertesia perrieri* (Billard, 1901). a, Stn MAU 142, colonies; b-c, Stn 4.030, b, detail of colony, frontal view; c, thecate internode with one supracalycine nematothecae, oblique view; d-f, Stn 1.130, d, hydrocladial internode, frontal view; e, gonotheca, lateral view; f, gonotheca, frontal view. Scales: a, 1 cm, b-f, 0.5 mm.

In the Pacific this species is known from Japanese waters: Sagami Bay (Stechow, 1909, as *Antennularia Perrieri*) and Okinose Bank (Stechow, 1907, as *Antennularia dendritica*).

The bathymetrical range extends from 5 to 291 m (Medel & Vervoort, 1995).

CANCAP material comes from nine localities, of which one near Morocco, four near the Canary Islands and four off the coast of Mauritania, collected at depths between 26 and 273 m.

Epibionts.— Stn 4.023: *Nemertesia perrieri* (Billard, 1901), *Clytia hemisphaerica* (L., 1767).— Stn 4.030: *Clytia hemisphaerica* (L., 1767), Bryozoa.

Nemertesia ramosa (Lamarck, 1816)
(figs 83-84)

Antennularia ramosa Lamarck, 1816: 123; Hincks, 1868: 282, pl. 62 figs a-c; Marktanner-Turneretscher, 1890: 259, pl. 6 fig. 8; Thornely, 1894: 7; Pictet & Bedot, 1900: 34, pl. 6 fig. 6a-b; Billard, 1902: 536; 1904a: 221, figs 86bis, 87-88; Marine Biological Association, 1904: 197; Arévalo y Carretero, 1906: 83, pl. 13 fig. 6; Billard, 1906b: 215; Rioja y Martín, 1906: 278; Browne, 1907: 33; Ritchie, 1911: 222; Crawshay, 1912: 330; Nobre, 1931: 20; Payne, 1931: 743; Nobre, 1937: 23.

Heteropyxis ramosa; Kirchenpauer, 1876: 29, 38, pl. 2 figs 22, 22a.

Antennularia profunda Quelch, 1885: 10, pl. 2 figs 5, 5a, 5b, 5c.

Antennularia variabilis Broch, 1903: 10, pl. 4 figs 22-25.

Antennularia ramosa var. *plumularioides* Billard, 1906b: 215.

Nemertesia ramosa; Bedot, 1911: 226; Billard, 1912a: 461; Broch, 1913: 4, fig. 3; Bedot, 1917b: 46; Broch, 1918a: 66, fig. 32; Stechow, 1919c: 122, fig. V^1b; Bedot, 1921b: 35; 1921c: 18; Prenant & Teissier, 1924: 25; Billard, 1927c: 343; Broch, 1928a: 62; 1928b: 116; Billard, 1931b: 247; Broch, 1933b: 38, fig. 14; Leloup, 1933c: 10, 27; 1934c: 15; Kramp, 1935b: 166, figs 67a, 68b; Philbert, 1935d: 28; 1935e: 34; Leloup, 1937a: 109, fig. 12A-C; Vervoort, 1942: 302; Da Cunha, 1944: 35, fig. 15c; Vervoort, 1946b: 182, figs 74b, 76b, 77; Leloup, 1947: 33, fig. 27; Vervoort, 1949: 147; Da Cunha, 1950: 122, 124, 129; Teissier, 1950b: 23; Picard, 1951f: 261; Leloup, 1952a: 186, fig. 108 A, B^1-B^2, C; Williams, 1954: 50; Picard, 1955b: 189; Marine Biological Association, 1957: 50; Millard, 1957: 235; Picard, 1958a: 192; Costa, 1960: 47; Cabioch, 1961: 18; Millard, 1962: 299, fig. 7A-D; Cabioch, 1965: 56; Rees & Thursfield, 1965: 167; Teissier, 1965: 29; Von Schenck, 1965: 928; Rees & White, 1966: 280; Redier, 1967a: 395; Vidal, 1968: 189; Fey, 1969: 404; Castric-Fey, 1970: 16, fig. 23; Day, Field & Penrith, 1970: 14; Patriti, 1970: 45, fig. 60A-C; Jägerskiöld, 1971: 63; Rossi, 1971: 27; Christiansen, 1972: 304; Houvenaghel-Crèvecoeur, 1973: 2815; Millard, 1975: 386, fig. 122D-H; ?Blanco, 1976: 57, pl. 8 figs 1-6; Williams, 1976: 58; Chas Brínquez & Rodríguez Babío, 1977: 32, fig. 19A-B; Millard, 1977b: 107; Gili, 1979: 128; Millard, 1979b: 133; Van Praët, 1979: 915; García Carrascosa, 1981: 274, pl. 26 figs g-i, pl. 39 figs a-c; Gili, 1981: 108; Gili i Sardà, 1982: 90, fig. 47; Cornelius, 1983: 154; Urgorri & Besteiro, 1983: 16, 17; Bouillon, 1985a: 162; Gili, García & Colomer, 1984: 415; Gili, 1986: 162, figs 4.32C-D, 4.56d, 4.57i; Izquierdo et al., 1986: 58, fig. 7; Templado et al., 1986: 98; García Carrascosa et al.: 372; Gili, Ros & Pagès, 1987: 92; Cornelius, 1988b: 76; Ramil, 1988: 428; Gili, Murillo & Ros, 1989: 23; Gili, Vervoort & Pagès, 1989: 86, fig. 14A-C; Altuna & García Carrascosa, 1990: 86; Cornelius & Ryland, 1990: 154, fig. 4.22; Castric-Fey & Chassé, 1991: 523; Marano, Ungaro & Vaccarella, 1991: 8; Morri, Bavestrello & Bianchi, 1991: 32, 33; Cornelius, 1992b: 83; Ramil & Vervoort, 1992a: 173, fig. 44a-f; Álvarez Claudio, 1993: 278, fig. 47A-D, pl. 28 figs A-G; Boero & Bouillon, 1993a: 264; Vervoort, 1993b: 552; Altuna Prados, 1994a: 260, pl. 46 figs B, D-E; ?Blanco, 1994: 235, figs 26-28; Altuna Prados, 1995a: 54; Álvarez Claudio, 1995: 17; Álvarez-Claudio & Anadón, 1995: 239; Bouillon, Massin & Kresevic, 1995: 60; Cornelius, 1995: 155, fig. 36A-E; Medel & Vervoort, 1995: 48, figs 20a-e, 23a; Peña Cantero, 1995: 342, pl. 41 figs a-e; Medel & López-González, 1996: 202; Ramil, Vervoort & Ansín, 1998: 36.

Not *Nemertesia ramosa*; Billard, 1913: 58, fig. 49; Leloup, 1937b: 47, fig. 32; Vervoort, 1966: 139, fig. 41a-d; Rees & Vervoort, 1987: 133, fig. 28a-b.

Antenullaria ramosa; Rodríguez Rosillo, 1914: 40 (incorrect subsequent spelling).

Nemertesia ramosa var. *plumularioides*; Bedot, 1917b: 46; 1921b: 35; Vervoort, 1959: 293, figs 46b-47a-c; Patriti, 1970: 45, fig. 61A-B; Gili, Vervoort & Pagès, 1989: 87, fig. 15A-B; Altuna & García Carrascosa, 1990: 55.

Nemertesia (Antennularia) ramosa; Marine Biological Association, 1931: 78.

Not *Nemertesia ramosa*: Vervoort, 1972: 234, fig. 83a-b. (= *Plumularia insignis* Allman, 1883).

Not *Nemertesia ramosa* var. *plumularoides*; Aguirrezabalaga et al., 1988: 232, fig. 16B-D. [= *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890)].

Material.— **Azores area:** Stn 5.088: Four colonies with gonothecae (RMNH-Coel. 28921, 28927, slide 4699).— Stn 5.089: Three fragments without gonothecae (RMNH-Coel. 28791, slide 4700).— Stn 5.096: Three fragments without gonothecae (RMNH-Coel. 28922).— Stn 5.111: Two colonies and one fragment, without gonothecae (RMNH-Coel. 29104 = slide 4701).— Stn 5.141: One colony without gonothecae (RMNH-Coel. 29105 = slide 4702).— Stn 5.142: Two colonies and four fragments, one fragment with gonothecae (RMNH-Coel. 28698, 28908).— **Atlantic coast of Morocco and Mauritania:** Stn 1.118: One colony without gonothecae (RMNH-Coel. 28582, 28726).— Stn MAU 072: One colony and several fragments, no gonothecae (RMNH-Coel. 28905, slide 4713).— Stn MAU 142: Five colonies, three epibiontic on *Nemertesia ramosa* (Lamarck, 1816), no gonothecae (RMNH-Coel. 28799, slide 4714).— **Madeira area:** Stn 1.093: Two broken colonies and many fragments, with gonothecae (RMNH-Coel. 28590, 28717, three slides 4695; DEBA-UV, slide R. 342).— **Canary Islands and Selvagens Archipelago:** Stn 2.047: One fragment with immature gonothecae (RMNH-Coel. 28706).— Stn 3.089: Three colonies with immature gonothecae (RMNH-Coel. 28694, three slides 4696).— Stn 4.138: One colony without gonothecae (RMNH-Coel. 28691, slide 4697).— Stn 4.141: One colony without gonothecae (RMNH-Coel. 28712, slide 4698).— Stn 4.148: Five colonies without gonothecae (RMNH-Coel. 28735).— Stn 4.152: One colony and two fragments, without gonothecae (RMNH-Coel. 28733).— **Cape Verde islands:** Stn 6.062: One colony without gonothecae (RMNH-Coel. 28723, slide 4703).— Stn 6.069: Four colonies and 11 fragments of which three with gonothecae (RMNH-Coel. 28721, 28786, two slides 4704).— Stn 6.075: One young colony without gonothecae (RMNH-Coel. 28767, two slides 4705).— Stn 6.080: 14 colonies and one fragment, with gonothecae (RMNH-Coel. 28753, five slides 4706).— Stn 6.104: Two colonies, one with gonothecae (RMNH-Coel. 28720).— Stn 6.108: One colony with damaged gonothecae (RMNH-Coel. 28770, slide 4707).— Stn 6.109: One colony without gonothecae (RMNH-Coel. 29106 = slide 4708).— Stn 6.110: One colony with immature gonothecae (RMNH-Coel. 28773, slide 4709).— Stn 6.137: Two colonies of which one with gonothecae (RMNH-Coel. 28755, slide 4710).— Stn 6.148: Two fragments, with gonothecae (RMNH-Coel. 28759).— Stn 6.174: One colony without gonothecae (RMNH-Coel. 28800, slide 4711).— Stn 6.176: One colony without gonothecae (RMNH-Coel. 28774).— Stn 7.107: One colony without gonothecae (RMNH-Coel. 28930; DEBA-UV, slide R. 343).— Stn 7.115: Three colonies, one with gonothecae (RMNH-Coel. 28938).— Stn 7.119: One colony without gonothecae (RMNH-Coel. 28771, slide 4712).— Stn 7.122: One colony without gonothecae (RMNH-Coel. 28917).— Stn 7.149: Four colonies with gonothecae (RMNH-Coel. 28954).— Stn 7.156: Five colonies, one with gonothecae (RMNH-Coel. 28918).

Additional material.— Nationaal Natuurhistorisch Museum (National Museum of Natural History), Leiden, The Netherlands: Stn 617-R, near of Rovinj, Adriatic, 27.i.1969: One colony. RMNH-Coel. 8209.— Stn XXVII-2, near of Rovinj, 22.vi.1969: Several detached fragments. RMNH-Coel. 8210.— Faeroe Islands, 62°03'N, 06°15'W, 100-110 m, 12.ix.1985: One colony with many ramifications. RMNH-Coel. 27010.— Guinea Bissau, Stn P.214, 11°31'N, 17°02'W, 142-223 m, 10.ii.1985: One colony without gonothecae. RMNH-Coel. 25514. As *Nemertesia ramosa* var. *plumularioides*.— Adriatic, between Lokrum and Dubrovnik, 02.ix.1960: One colony. RMNH-Coel. 1378. As *N. ramosa* var. *plumularioides*.— Unknown locality: One colony. RMNH-Coel. 1379. As *N. ramosa* var. *plumularioides*.— France, off Roscoff, 10.x.1955: One colony. RMNH-Coel. 1380. As *N. ramosa* var. *plumularioides*.— Galicia, Stn 105, Rua Island, Ría de Arousa, 24.vii.1964: several colonies, without gonothecae. RMNH-Coel. 2128. As *N.*

ramosa var. *plumularioides*.— Galicia, Stn 1558, Lobeira, Cambados, Ría de Arousa, 03.ii.1964: One colony with many branches, with gonothecae. RMNH-Coel. 2129. As *N. ramosa* var. *plumularioides*.— Galicia, Stn 1899, Ría de Arousa, 11.viii.1964: One colony and two fragments. RMNH-Coel. 2130. As *N. ramosa* var. *plumularioides*.— Galicia, Stn 1596, 0.3 km NNW Pta Campelo, Ría de Arousa, 18.vii.1964: Three colonies. RMNH-Coel. 2131. As *N. ramosa* var. *plumularioides*.— Galathea Expedition: Stn 188, off Durban, 29°55'S, 31°13'E, 495 m, 02.ii.1951: Two colonies, one with gonothecae. RMNH-Coel. 3735. Identified as *Nemertesia ramosa*, but not that species.— Galathea Expedition: Stn 202. off Natal, 25°20'S, 35°17'E, 575-595 m, 21.ii.1951: One colony, with gonothecae. RMNH-Coel. 3736. Identified as *Nemertesia ramosa*, but not that species.— Atlantide Expedition: Stn 68, 04°38'N 06°18'W, 90 m, 12.i.1946: Two branched colonies with gonothecae. RMNH-Coel. 1234. As *N. ramosa* var. *plumularioides*.— Atlantide Expedition: Stn 70, 04°50'N, 02°49'W, 60-65 m, 15.i.1946: Three branched colonies, without gonothecae. RMNH-Coel. 1240. As *N. ramosa* var. *plumularioides*.— Atlantide Expedition: Stn 153, 10°49'N 16°39'W, 42 m, 16-vi.1946: Three branched fragments, without gonothecae. RMNH-Coel. 1307. As *N. ramosa* var. *plumularioides*.

Description (of material from Stn 4.141).— Hydrorhiza a mass of intertwining tubules adhering to sandy sediment, supporting a polysiphonic, much ramified hydrocaulus with various internal coenosarc tubes; stem distally monosiphonic and there division into internodes with straight, obscure nodes visible; each internode with a varied number of apophyses distally and several nematothecae distributed along internode. Apophyses alternating in one plane, arranged in opposite pairs in one plane or placed in decussate verticils. Each apophysis with well developed mamelon on superior surface and four nematothecae: two in the axil and two near mamelon, occasionally with additional unpaired nematotheca above mamelon. Majority of apophyses with internal, distal perisarc ring of varied development.

Hydrocladia inserted on apophyses, composed of succession of thecate internodes with slightly oblique nodes, each internode with one hydrotheca and four nematothecae: one mesial inferior, two lateral and one supracalycine. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight, aperture circular and tilted upwards; rim smooth. Each internode with two internal perisarc rings at both extremities. All nematothecae bithalamic and movable.

Gonothecae inserted on apophyses by means of short pedicel, elongated ovoid, occasionally slightly curved, with circular latero-apical aperture closed by lid.

Variability.— Regeneration of broken hydrocladia leads towards development of athecate internodes with one nematotheca or rarely two. Development of the internal perisarc rings of the internodes and thickening of the abcauline hydrothecal wall are also subjected to considerable variability, even in the same hydrocladium.

Material from Stns 6.062 and 7.107 is characterised by the presence of alternate apophyses and hydrocladia, or pairs of apophyses and hydrocladia, always in one plane, while the hydrothecal aperture is strongly tilted upwards and the supracalycine nematotheca is usually absent (fig. 84e-g). This material resembles *Nemertesia ramosa* var *plumularioides* (= *Nemertesia ramosa*) from the collections of the National Museum of Natural History, Leiden (see above); this material has the gonothecae characteristic of *N. ramosa* and has been brought to that species.

In the colony from Stn 7.119 the number of supracalycine nematothecae varies between 1 and 3.

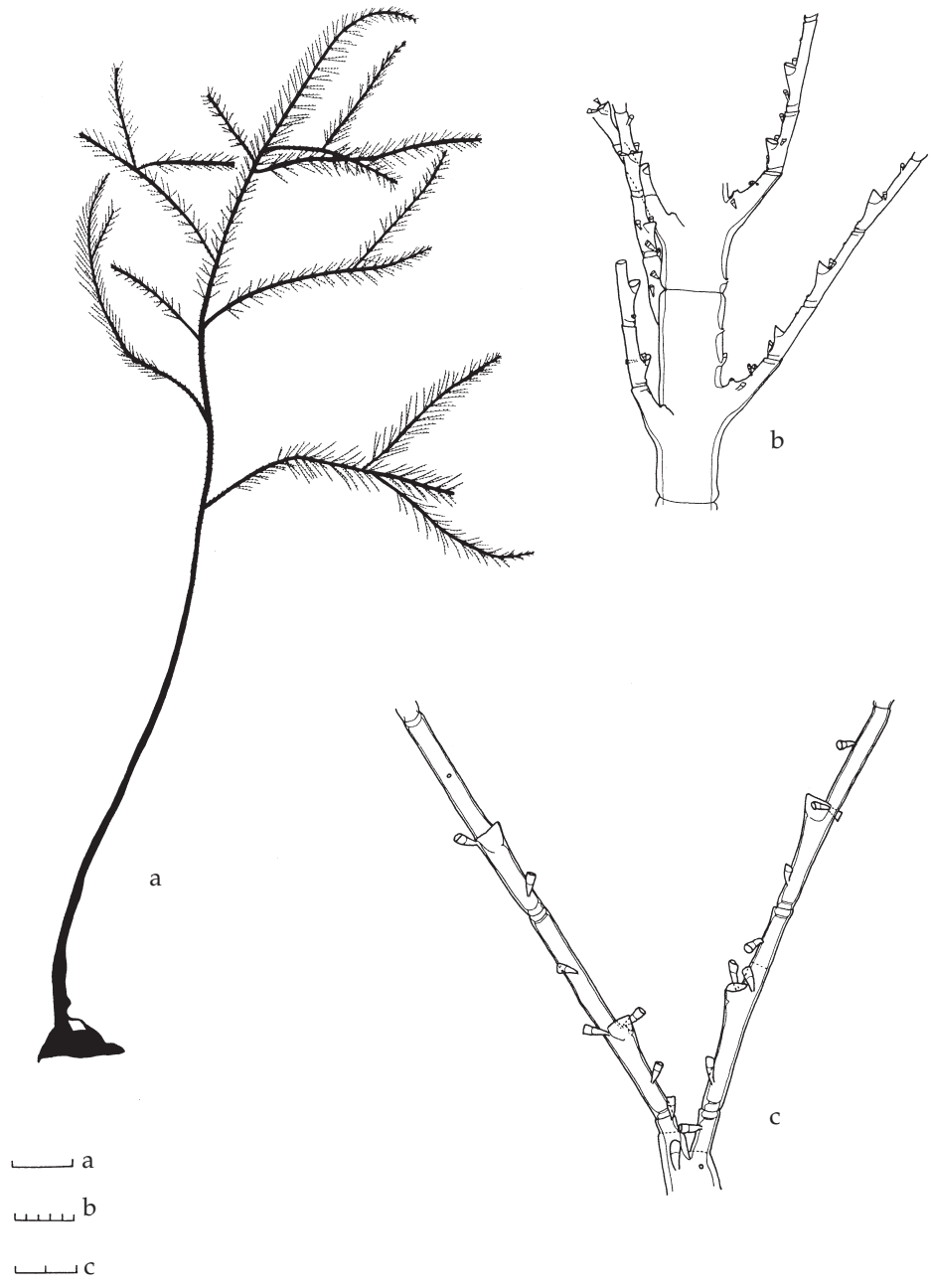


Fig. 83. *Nemertesia ramosa* (Lamarck, 1816). a, Stn 7.149, colony; b, Stn 1.093, detail of colony, frontal view; c, Stn 3.089, apophysis supporting two hydrocladia, frontal view. Scales: a, 1 cm; b, 0.5 mm; c, 0.2 mm.

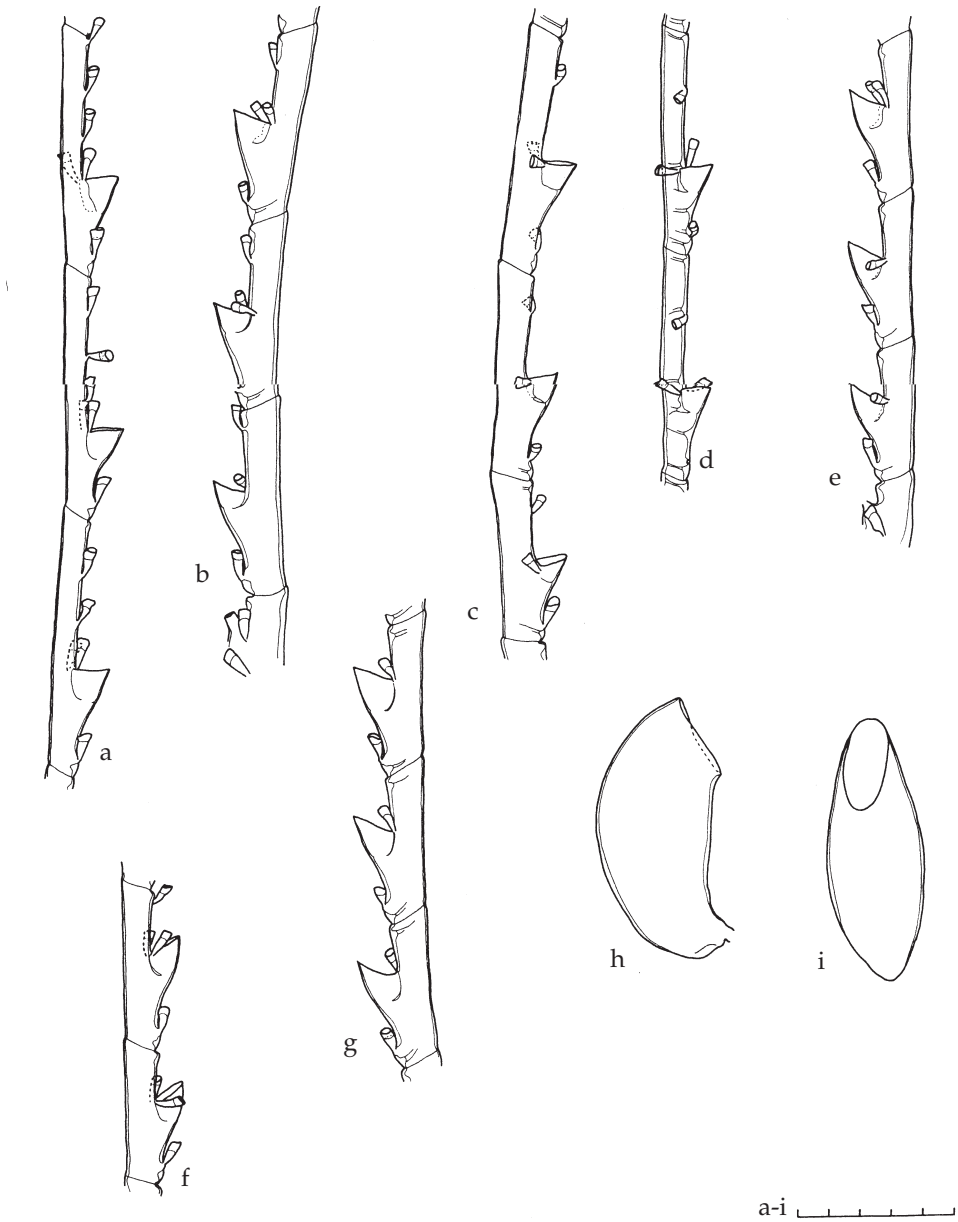


Fig. 84. *Nemertesia ramosa* (Lamarck, 1816). a, Stn 7.119, hydrocladium with two or three supracalycine nematothecae on thecate internodes; b, Stn 6.069, hydrocladium; c, Stn 1.093, hydrocladium; d, Stn 3.089, hydrocladium with well developed internal septa (rings); e-f, Stn 6.062, e, hydrocladium of which internodes have no supracalycine nematothecae; f, hydrocladial internodes with and without supracalycine nematothecae; g, Stn 7.107, hydrocladium of which internodes have no supracalycine nematothecae; all internodes in lateral view; h-i, Stn 1.093, h, gonotheca, lateral view; i, gonotheca, frontal view. Scales: a-i, 0.5 mm.

Table XLVIII. Measurements of *Nemertesia ramosa* in µm:

	Stn 1.093	Stn 3.089	Stn 4.141	Stn 7.119	Stn 6.062	Stn 7.107
Height of colony (in mm)	310	79-153	104	65	119	91
Stem internode, length	950-2350				1070-1200	520-1500
Diameter at node	450-580				430-650	390-630
Hydrocladial internode, length	470-770	660-790	560-710	730-830	390-500	420-500
Diameter at node	60-110	45-75	60-80	65-120	80-120	80-120
Hydrotheca, length abcauline wall	90-110	80-90	80-120	110-130	120-150	140-150
Length adcauline wall	40-80	70-80	70-90	70-110	55-100	80-100
Diameter at rim	100-110	80-90	105-120	115-130	110-130	130-140
Mesial nematotheca, length	90-110	70-80	70-90	100-110	80-100	90-100
Diameter at rim	35-40	30	30-32	40-45	30	35-40
Lateral nematotheca, length	70-90	80-110	70-80	90-110	80-90	80-90
Diameter at rim	35-40	30-35	30	30-40	30-35	35-40
Gonotheca, length	760-880					
Maximum diameter	285-380					

Discussion— Billard (1906b) described *Nemertesia ramosa* var. *plumularioides* to include material with alternately disposed hydrocladia along the whole length of the hydrocaulus. This variety was rejected by Bedot (1921c); Millard (1962) and Vervoort (1972) indicated that probably it represented a growth form of *N. ramosa*. Ramil (1988), after revision of Billard's (1906b) original material concluded that the colonies were polysiphonic and morphologically similar to adult specimens of *Nemertesia ramosa*. The variety has here been placed in the synonymy of the species. The record of *N. ramosa* var. *plumularoides* of Aguirrezabalaga et al. (1988) was placed by Altuna Prados (1994a) in *Nemertesia ventriculiformis* and we concur because the gonothecae are strongly curved and resemble the female gonothecae of the latter. Material described by Vervoort (1972) as *N. ramosa* was referred to *Plumularia insignis* Allman, 1883, by Stepan'yants (1979); Ramil & Vervoort (1992a) also included in that species the material of *N. ramosa* described by Blanco (1976) which she considered identical with that described by Vervoort (1972). However, the colonies described by Blanco (1976) have hydrocladia in alternate arrangement, in pairs, and in verticils, characteristic of *Nemertesia* and not of *Plumularia*. Revision of Blanco's original material seems necessary as the colonies, though undoubtedly belonging to *Nemertesia*, differ from *N. ramosa* by the presence of numerous internal perisarc rings, while the hydrothecae are much deeper and are nearly twice as big as those recorded in the literature (Billard, 1906b; Vervoort, 1959; Gili, Vervoort & Pagès, 1989; Ramil & Vervoort, 1992a). Blanco's (1994) record of *N. ramosa* concerns the same material.

Ramil & Vervoort (1992a), after revision of Indian Ocean material recorded by Vervoort (1966) and Rees & Vervoort (1987) indicated that it does not belong to *N. ramosa* but to another species; they also excluded the records of *N. ramosa* by Billard (1913) from the Malay Archipelago and by Leloup (1937b) from the China Sea from the synonymy of that species.

Vervoort (1993) mentioned *N. ramosa* from Haifa Bay (Israel), but had doubts concerning its identification as the material was sterile and therefore could not properly

be separated from *Nemertesia tetrasticha* (Meneghini, 1845), a species frequently occurring in that region.

The presence of supplementary supracalycine nematothecae in *N. ramosa* was previously described by Billard (1904a), Ramil and Vervoort (1992a), and Ramil, Vervoort & Ansín (1998); we agree with these authors that this occurrence has no taxonomical value and we consequently include the colony from Stn 7.119 in *N. ramosa* (cf. p. 217).

Reproduction.— Gonothecae have been observed in all months of the year with the exception of January, October, November and December (Stechow, 1919; Leloup, 1934; Teissier, 1950, 1965; Picard, 1955; Fey, 1969; Gili, Vervoort & Pagès, 1989; Ramil & Vervoort, 1992a; Álvarez Claudio, 1933; Medel & Vervoort, 1995; Peña Cantero, 1995; Ramil, Vervoort & Ansín, 1998). CANCAP specimens bore gonothecae in March, June, August-October.

Distribution.— *Nemertesia ramosa* according to Redier (1967) and Millard (1975) is a cosmopolitan species, whereas Boero & Bouillon (1993) credit it with a tropical Atlantic distribution. In the Atlantic it has been recorded from the Faeroe Islands (Billard, 1931a; Rees & Thursfield, 1965), the coast of Norway (Marktanner-Turneretscher, 1890, as *Antennularia ramosa*; Kramp, 1935; Christiansen, 1972), the coast of Sweden (Rees & Thursfield, 1965; Jägerskiöld, 1971), the Shetland Islands (Hincks, 1868, as *A. ramosa*), the North Sea (Broch, 1928b; Vervoort, 1942; Rees & Thursfield, 1965; Bouillon, Massin & Kresevic, 1995), Heligoland (Broch, 1928b), Ireland (Williams, 1954), the coasts of Great Britain (Hincks, 1868; Thornely, 1894; Marine Biological Association, 1904, 1957; Ritchie, 1911; Crawshay, 1912, all as *A. ramosa*; Bedot, 1921c; Williams, 1976; Cornelius, 1988; Cornelius & Ryland, 1990; Cornelius, 1995), the Dutch coast (Leloup, 1933c; Vervoort, 1946b), the Belgian coast (Leloup, 1947, 1952a), the English Channel (Bedot, 1921c), numerous localities along the French coast (Marktanner-Turneretscher, 1890; Pictet & Bedot, 1900; Billard, 1902, 1904a, all as *A. ramosa*; Bedot, 1911; Billard, 1912a; Prenant & Teissier, 1924; Billard, 1927a, 1931a; Philbert, 1935c, 1935d; Teissier, 1950; Cabioch, 1961, 1965; Teissier, 1965; Redier, 1967; Fey, 1969; Castric-Fey & Chassé, 1991; Bouillon, Massin & Kresevic, 1995), the Bay of Biscay (Browne, 1907, as *A. ramosa*), the north and north-west coast of Spain (Pictet & Bedot, 1900; Arévalo y Carretero, 1906; Rioja y Martín, 1906; Rodríguez Rosillo, 1914, all as *A. ramosa*; Chas Brínquez & Rodríguez Babío, 1977; Estrada, 1979; Urgorri & Besteiro, 1983; Ramil, 1988; Altuna & García Carrascosa, 1990; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez-Claudio & Anadón, 1995; Medel & López-González, 1996), the coast of Portugal (Nobre, 1931, 1937, both as *A. ramosa*; Da Cunha, 1944, 1950; Medel & López-González, 1996), the Gulf of Cádiz (Billard, 1906b, as *A. ramosa*; Van Praët, 1979; Medel & Vervoort, 1995; Medel & López-González, 1996), the Ampère Bank (Ramil, Vervoort & Ansín, 1998), the Azores (Pictet & Bedot, 1900, as *A. ramosa*; Bedot, 1921c; Rees & White, 1966; Cornelius, 1992b), south of Madeira (Billard, 1906b, as *A. ramosa*), Morocco (Patriti, 1970; Ramil & Vervoort, 1992a), between Madeira and the Canary Islands (Bedot, 1921c), Canary Islands (Izquierdo et al., 1986), Western Sahara (Broch, 1913; Leloup, 1934, 1937a; Bouillon, Massin & Kresevic, 1995), the Cape Verde Islands (Quelch, 1885, as *Antennularia profunda*; Billard, 1906b, as *A. ramosa*), Gambia (Vervoort, 1959, as *N. ramosa* var. *plumularioides*), Guinea Bissau (Gili, Vervoort & Pagès,

1989), the coasts of Guinea, Ivory Coast and Ghana (Vervoort, 1959, as *N. ramosa* var. *plumularioides*), Namibia (Gili, Vervoort & Pagès, 1989), and the coasts of South Africa (Millard, 1957, 1962; Day, Field & Penrith, 1970; Millard, 1975).

In the Mediterranean cited from the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), the Alborán Sea (Templado et al., 1986; Ramil & Vervoort, 1992a), the Chafarinas Islands (Peña Cantero, 1995), the Spanish coast (Arévalo y Carretero, 1906; Rioja y Martín, 1906; Rodríguez Rosillo, 1914, all as *A. ramosa*; Gili, 1979; García Carrascosa, 1981; Gili, 1981, 1982; Gili, García & Colomer, 1984; Gili, 1986; García Carrascosa et al., 1987; Gili, Ros & Pagès, 1987; Gili, Murillo & Ros, 1989; Medel & López-González, 1996), Mallorca (Roca, 1986; Medel & López-González, 1996), the French coast (Stechow, 1919; Leloup, 1934; Picard, 1951c; Costa, 1960; Vidal, 1968; Bouillon, Massin & Kresevic, 1995), Algeria (Picard, 1955), the Italian coast (Neppi, 1921; Rees & Thursfield, 1965; Morri, Bavestrello & Bianchi, 1991; Bouillon, Massin & Kresevic, 1995), the Adriatic (Carus, 1884; Stechow, 1919; Broch, 1933; Marano, Ungaro & Vaccarella, 1991) and Israel (Vervoort, 1993). Occurrence at the Argentine coasts (Blanco, 1976, 1994) is here considered doubtful.

In the Indian Ocean the species is known from the coasts of South Africa (Millard, 1962, 1975, 1977, 1980) and from Mozambique (Millard, 1975).

The bathymetrical distribution extends from 3 (Gili, Ros & Pagès, 1987) to 1425 m (Bedot, 1921c).

CANCAP material comes from 34 stations of which six near the Azores, one near Madeira, one in the Selvagens, one at the Moroccan coast, five from the Canary Islands, 18 from the Cape Verde Archipelago and two from Mauritania. They were taken between 48 and 260 m.

Epibionts.— Stn 1.093: *Filellum* spec., *Clytia gracilis* (M. Sars, 1850).— Stn 3.089: *Scalpellum scalpellum* (L., 1767).— Stn 4.138: *Antennella secundaria* (Gmelin, 1791).— Stn 4.148: Mollusc bivalve, *Aglaophenia tubulifera* (Hincks, 1861), *Clytia gracilis* (M. Sars, 1850), Bryozoa.— Stn 4.152: *Aglaophenia tubulifera* (Hincks, 1861).— Stn 5.088: *Plumularia setacea* (L., 1758), *Clytia hemisphaerica* (L., 1767), Bryozoa.— Stn 5.111: unidentifiable Campanulinidae.— Stn 5.141: Foraminifera.— Stn 5.142: *Filellum* spec., *Antennella secundaria* (Gmelin, 1791).— Stn 6.080: *Filellum* spec., *Zygophylax biarmata* Billard, 1905, unidentifiable Sertulariidae.— Stn 6.104: *Stegopoma* spec.— Stn 6.110: *Filellum serratum* (Clarke, 1879), *Clytia gracilis* (M. Sars, 1850).— Stn 6.137: *Plumularia setacea* (L., 1758).— Stn 6.148: *Modeeria rotunda* (Quoy & Gaimard, 1827), *Filellum* spec., *Plumularia setacea* (L., 1758), *Diphasia* spec., *Campanularia hincksii* Alder, 1858, *Obelia bidentata*, Clarke 1875.— Stn 7.149: *Stegopoma* spec./*Modeeria* spec.— Stn 7.156: *Stegopoma* spec.

Nemertesia ventriculiformis (Marktanner-Turneretscher, 1890) (fig. 85)

Plumularia ventriculiformis Marktanner-Turneretscher, 1890: 256, pl. 6 figs 5, 5a.

Antennularia norwegica; Billard, 1906b: 217 [not *Nemertesia norvegica* (G.O. Sars, 1874)].

Nemertesia (*Antennopsis*) *disticha*; Stechow, 1919a: 120, fig. U[1].

Nemertesia incerta; Fey, 1969: 405, 409 [not *Nemertesia incerta* Bedot, 1916 = *Nemertesia norvegica* (G.O. Sars, 1874)].

Nemertesia ventriculiformis; Castric-Fey, 1970: 12, figs 15-22; Marinopoulos, 1981: 176; Boero & Fresi, 1986: 145; Ramil & Vervoort, 1992a: 177, fig. 45a-h; Altuna Prados, 1994a: 262, pl. 46 figs A, C, F-G, pl. 47 figs A-C; 1995a: 47, 54, fig. 3B-E.

Nemertesia ramosa var. *plumularoides*; Aguirrezabalaga et al., 1988: 232, fig. 16B-D [not *Nemertesia ramosa* var. *plumularioides* Billard, 1906b = *Nemertesia ramosa* (Lamarck, 1816)]

Material.— **Canary Islands and Selvagens Archipelago:** Stn 2.048: One damaged fragment without gonothecae (RMNH-Coel. 28702, slide 4715).— **Cape Verde Islands:** Stn 6.087: One colony with damaged gonothecae (DEBA-UV, slide R. 345).— Stn 7.125: One colony with male and female gonothecae (RMNH-Coel. 29107 = two slides 4716).
Additional material.— Naturhistorisches Museum, Vienna, Austria: Holotype of *Plumularia ventriculiformis* Marktanner-Turneretscher, 1890, Adriatic, 1890: One colony with male and female gonothecae. NHM Inv. 5932.

Description (of material from Stn 7.126).— Hydrorhiza tubular, attached to substratum, supporting monosiphonic, unbranched hydrocauli with several internal coenasarc tubes and divided into internodes of varied length by straight nodes, each internode with one to 19 alternate apophyses arranged in one plane. Hydrocaulus without nematothecae; apophyses with mamelon on superior surface and three nematothecae: two axillary and one unpaired above mamelon.

Hydrocladia inserted on apophyses, in lower part of colony beginning with short athecate internode with one nematotheca, in higher parts immediately with thecate internode. Hydrocladia composed of succession of thecate internodes with slightly oblique nodes; each internode with one hydrotheca on lower half and four nematothecae: one mesial inferior, two lateral and one supracalycine. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight, aperture circular, perpendicular to internodal length axis, rim smooth. Each internode with varied number of internal perisarc rings of variable development. All nematothecae bithalamic and movable.

Gonothecae with sexual dimorphism, inserted on apophyses by means of short pedicel; both male and female gonothecae on same colony. Female gonothecae horn-shaped, one wall convex, the other almost straight; aperture latero-terminal, circular, closed by lid. Male gonotheca smaller and slenderer, less curved, also with circular latero-terminal aperture closed by lid.

Variability.— Athecate internodes may develop in distal parts of hydrocladia, usually resulting from damage followed by regeneration, though sometimes apparently to give hydrocladia a greater flexibility. Such athecate internodes occasionally seem to represent the distal part of the previous thecate internode with its unpaired nematotheca; its has two internal perisarc rings at the extremities. Athecate internodes without nematothecae, in basal parts of hydrocladia, were observed in the colonies from Stn 6.078. Athecate internodes in basal part of hydrocladia and without nematothecae were observed at Stn 6.078.

Table XLIX. Measurements of *Nemertesia ventriculiformis* in µm:

	Stn 6.087	Stn 7.126
Height of colony (in mm)	28-32	No measurement
Stem internode, length	990-2450	1700-3500
Diameter at node	110-140	180-190
First hydrocladial internode, length	170-260	No measurement

Diameter at node	55-70	No measurement
Thecate internode, length	700-990	840-980
Diameter at node	45-60	60-75
Hydrotheca, length abcauline wall	85-100	85-105
Length adcauline wall	80-100	80-100
Diameter at rim	90-110	100-115
Mesial nematotheca, length	60-80	70-85
Diameter at rim	23-25	25-30
Lateral nematotheca, length	60-70	70-80
Diameter at rim	20-23	20-25
Male gonotheca, length	420-440	430-500
Maximum diameter	150-160	120-140
Female gonotheca, length	510-580	520-620
Maximum diameter	230-235	235-260

Discussion.— The CANCAP material of *N. falcicula*, *N. norvegica* and *N. ventriculiformis* is very similar in trophosome but differs distinctly in morphology of the gonothecae.

N. norvegica differs from *N. falcicula* and *N. ventriculiformis* by not showing signs of sexual dimorphism; the gonothecae are strongly curved and cornucopia-shaped (fig. 81i-j); the trophosome, moreover, is characterised by the presence of only one lateral nematotheca on the majority of the thecate internodes (fig. 81c-e), this not being due to damage.

N. falcicula and *N. ventriculiformis* have sexual dimorphism but differ by:

The female gonotheca, though in both species horn-shaped, is more strongly curved in *N. falcicula* (fig. 80i-j).

The male gonotheca in *N. ventriculiformis* has a lateral aperture; it is apical in *N. falcicula*.

The hydrotheca in *N. falcicula* is small, quadrangular in cross section with the wall typically thickened; in *N. ventriculiformis* it is cup-shaped, distinctly bigger and has never such thickened walls.

N. ramosa may occasionally resemble *N. ventriculiformis* but typically has polysiphonic, branched colonies; the abcauline wall of the hydrotheca is better developed than the adcauline, resulting in an upward tilt of the hydrothecal aperture (Ramil & Vervoort, 1992a).

We have indicated above that *N. incerta* is conspecific with *N. norvegica* and not with *N. ventriculiformis* as indicated by Castric-Fey (1970). However, the record of *N. norvegica* from the Mediterranean (Billard, 1906b, as *Antenularia norwegica*) should be referred to *N. ventriculiformis* (Castric-Fey, 1970; Ramil & Vervoort, 1992a). Fey's (1969) record of *N. incerta* concerns the same material as that recorded by Castric-Fey (1970) as *N. ventriculiformis*.

Reproduction.— Gonothecae have been observed in June, July, September and Novermber (Billard, 1906b; Fey, 1969; Boero & Fresi, 1986; Ramil & Vervoort, 1992a). The CANCAP specimens collected in June and September have gonothecae.

Distribution.— *Nemertesia ventriculiformis* has an Atlantic-Mediterranean distribution. In the Atlantic it has been cited from the Glénan Archipelago, Bretagne, France (Fey, 1969, as *N. incerta*; Castric-Fey, 1970), from the Basque coast of Spain (Aguirrez-

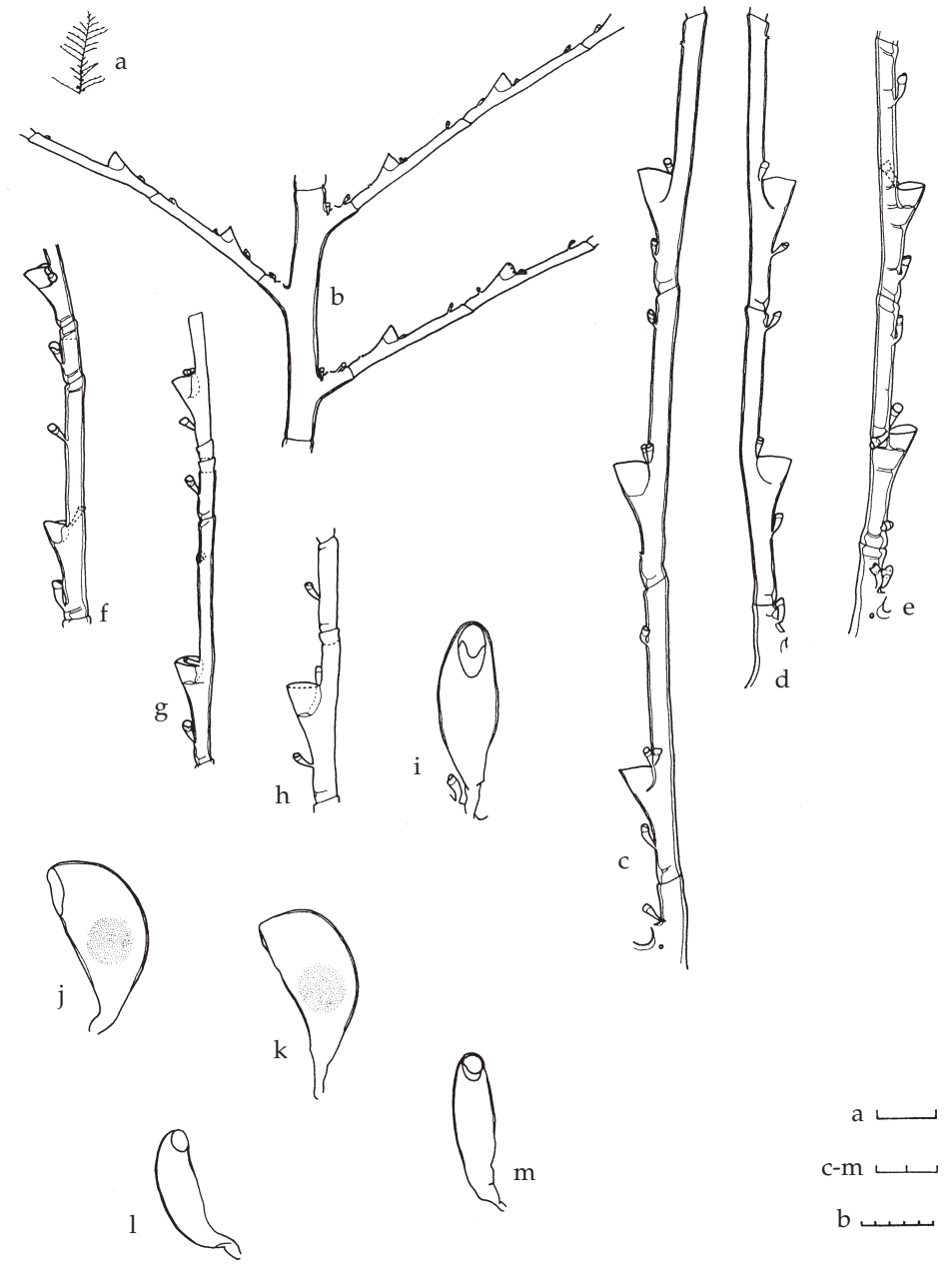


Fig. 85. *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890). a-c, Stn 7.126, a, distal fragment of a colony; b, detail of a colony, frontal view; c, hydrocladium; d, Stn 6.087, hydrocladium; e-g, Stn 2.048, e, hydrocladium with well developed perisarc rings; f-g, regenerated hydrocladia after sustaining damage; h-m, Stn 7.126, h, hydrocladium with athecate internode after regeneration; all hydrocladia in lateral view; i, female gonotheca, frontal view; j-k, female gonothecae, lateral view; l-m, male gonothecae, oblique view; Scales: a, 1 cm; b, 0.5 mm; c-m, 0.2 mm.

abalaga et al., 1988, as *Nemertesia ramosa* var. *plumularoides*; Altuna Prados, 1994a, 1995a), from the Strait of Gibraltar and the coast of Morocco (Ramil & Vervoort, 1992a).

In the Mediterranean found in the Alborán Sea (Ramil & Vervoort, 1992a), the French coast [Billard, 1906b, as *Antennularia norwegica*; Stechow, 1919, as *Nemertesia* (*Antennopsis*) *disticha*], Portofino, Italy (Boero & Fresi, 1986) and the Adriatic (Marktanner-Turneretscher, 1890, as *Plumularia ventriculiformis*).

The bathymetrical distribution oscillates between 10 m (Boero & Fresi, 1986) and 580 m (Ramil & Vervoort, 1992a).

CANCAP material comes from three localities, of which one near the Canary Islands and two in the Cape Verde Archipelago and was collected between 100 and 930 m.

Epibionts.— Stn 2.048: Bivalve mollusc.

Nemertesia anonyma spec. nov.
(fig. 86)

Material.— **Cape Verde Islands:** Stn 6.069: One colony of 23 stems, of which seven with gonothecae (holotype) (RMNH-Coel. 29054, four slides 4720).

Description (of holotype).— Hydrorhiza tubular, adhering to substrate, provided with nematothecae, supporting monosiphonic, unbranched hydrocauli. Stem divided into internodes of varied length by straight nodes, visible over whole length of the stem; no nematothecae. Apophyses placed at distal end of internode, or both distally and in basal half of same internode. Arrangement of apophyses varied, usually alternating and in several planes basally and in decussate verticils of three in distal parts of colony. Apophyses with one mamelon on superior surface and four nematothecae: two axillary and a pair above mamelon.

Hydrocladia composed of a succession of thecate internodes with slightly oblique nodes, but starting with third or fourth thecate internode, athecate internodes begin to appear regularly between thecate internodes. Basal thecate internodes with one hydrotheca on distal half and three or four nematothecae: one or two mesial inferior and two lateral. Thecate internodes much shorter, alternating with athecate ones, hydrotheca placed centrally and with only three nematothecae: one mesial inferior and two lateral. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight; aperture circular, perpendicular to internodal length axis or slightly tilted downwards; rim smooth. Athecate internodes representing basal part of thecate internode, with one nematotheca. All internodes may occasionally have two internal perisarc rings at the extremities. All nematothecae, including those of hydrorhiza, bithalamic and movable.

Gonothecae inserted on apophyses on both sides of mamelon by means of short pedicel; pear-shaped, with circular terminal aperture closed by lid.

Variability.— The occurrence of athecate internodes is quite irregular, in the same colony and in consecutive hydrocladia. Though usually appearing after the third or fourth thecate internode, they may appear earlier (after the second thecate internode) or later (after the eighth internode). Hydrocladia without athecate internodes may alternate with hydrocladia having a regular succession of thecate and athecate inter-

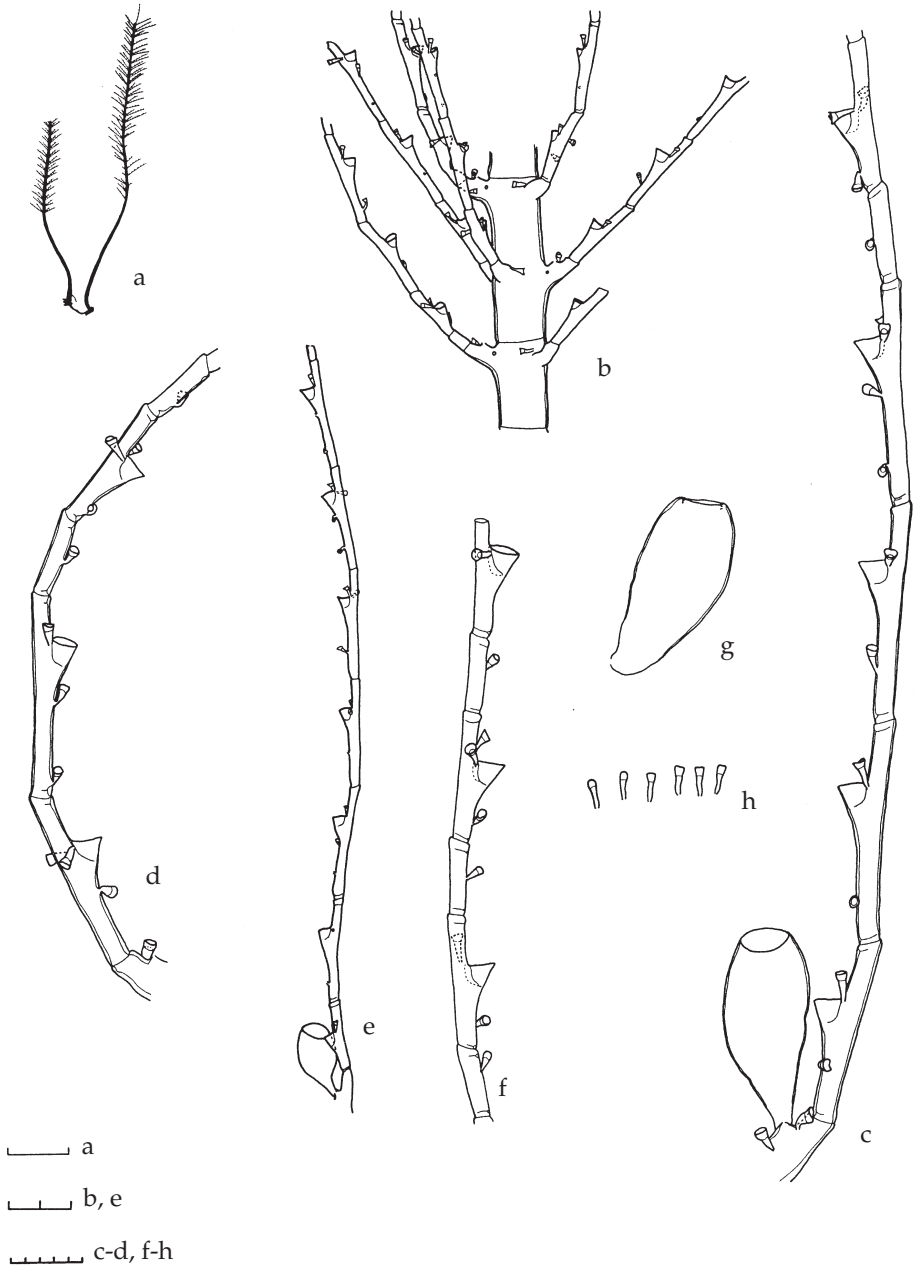


Fig. 86. *Nemertesia anonyma* spec. nov., Stn 6.069. a, colony; b, detail of colony, frontal view; c, basal part of hydrocladium; d, hydrocladium with only two consecutive thecate internodes; e, hydrocladium with exclusively thecate internodes; f, distal part of hydrocladium; all hydrocladia in lateral view; g, gonotheca, lateral view; h, nematothecae from hydrorhiza. Scales: a, 1 cm; b, e, 0.5 mm; c-d, f-h, 0.2 mm.

nodes. Though typically the athecate internodes, when present, have a nematotheca, some have been observed to be without.

Table L. Measurements of *Nemertesia anonyma* spec. nov. in µm:

	Stn 6.069
Height of colony (in mm)	21-58
Hydrorhizal nematotheca, length	90-100
Diameter at rim	25-30
Stem internode, length	430-1360
Diameter at node	300-460
Hydrocladial internode, length thecate internode	320-770
Length athecate internode	180-400
Diameter at node	45-70
Hydrotheca, length abcauline wall	65-90
Length adcauline wall	60-80
Diameter at rim	85-100
Mesial nematotheca, length	75-80
Diameter at rim	30-35
Lateral nematotheca, length	85-100
Diameter at rim	35-42
Gonotheca, length	580-670
Maximum diameter	270-330

Discussion.— *Nemertesia anonyma* spec. nov. is characterised by morphology of the gonothecae, that are pyriform with an apical aperture, and by the irregular segmentation of the hydrocladia. It shows similarity with *Nemertesia tetrasticha* (Meneghini, 1845) but that species is characterised by the decussate, opposite apophyses and hydrocladia, forming four longitudinal rows, and the regular segmentation of the hydrocladia in thecate internodes.

Gonotheca and hydrocladial segmentation set this species apart from all other Atlantic and Mediterranean species of *Nemertesia*.

Reproduction: The CANCAP material was fertile in June.

Distribution.— Collected at a single station in the Cape Verde Archipelago between 76 and 90 m.

Etymology.— The species name 'anonyma' refers to the fact that this well characterized species so far remained unnamed: the Greek 'anonymos' meaning nameless, unknown.

Nemertesia spec. 1
(figs 87-88)

Material.— **Canary Islands and Selvagens Archipelago:** Stn 4.084: One colony without gonothecae (RMNH-Coel. 29052, slide 4717).

Description.— Hydrorhiza a tangled mass of tubules mixed with sediment, supporting an unbranched hydrocaulus, basally polysiphonic and with several internal

coenosarc tubes. Division into internodes not visible; apophyses alternate in basal part, in decussate verticils of three apophyses in higher part; each apophysis with one well developed mamelon on superior surface and four nematothecae: two in the axil and a distal pair above mamelon; in addition an internal perisarc ring near distal extremity and occasionally a second less developed ring near mamelon.

Hydrocladia composed of succession of thecate internodes with slightly oblique nodes, each internode with one hydrotheca on basal third and four to six nematothecae: one or two mesial inferior (typically one), two lateral and one or two supracalycine nematothecae. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight, slightly less developed than adcauline; aperture circular, tilted slightly upwards; rim smooth. Each internode with two to ten internal perisarc rings of varied development. All nematothecae bithalamic and movable. In many instances branched hydrocladia are present, that may also re-branch. Branches originating from hydrotheca of primary or secondary hydrocladium and having same structure. Secondary and tertiary hydrocladium formation initiated by gradual separation of hydrotheca from original internode and development into an apophysis with a mamelon on superior surface; the lateral nematothecae becoming axillary nematothecae (fig. 88c). Secondary hydrocladia placed alternately along both sides of primary hydrocladium or on one side.

Gonothecae absent.

Variability.— Ramified hydrocladia develop in upper half of colony and are accompanied by a considerable change in morphology of the hydrothecae (fig. 88c). Athecate internodes may develop in basal or distal parts of hydrocladia as the result of damage and posterior regeneration; they have one or two nematothecae and two internal perisarc rings near the extremities.

Table LI. Measurements of *Nemertesia* spec.1 in µm:

	Stn 4.084
Height of colony (in mm)	65
Diameter of stem	270-450
Hydrocladial internode, length	840-1090
Diameter at node	40-100
Hydrotheca, length abcauline wall*	70-90
Length adcauline wall	60-80
Diameter at rim	80-90
Mesial nematotheca, length	85-100
Diameter at rim	30-35
Lateral nematotheca, length	90-130
Diameter at rim	30-45

* Measurements taken from normal hydrothecae not in the process of transformation into apophysis.

Discussion.— This material strikes by the presence of branched hydrocladia, a rare occurrence in *Nemertesia*. The material is sterile and restricted to one colony, which makes definite conclusions difficult. Kirchenpauer (1876) described various

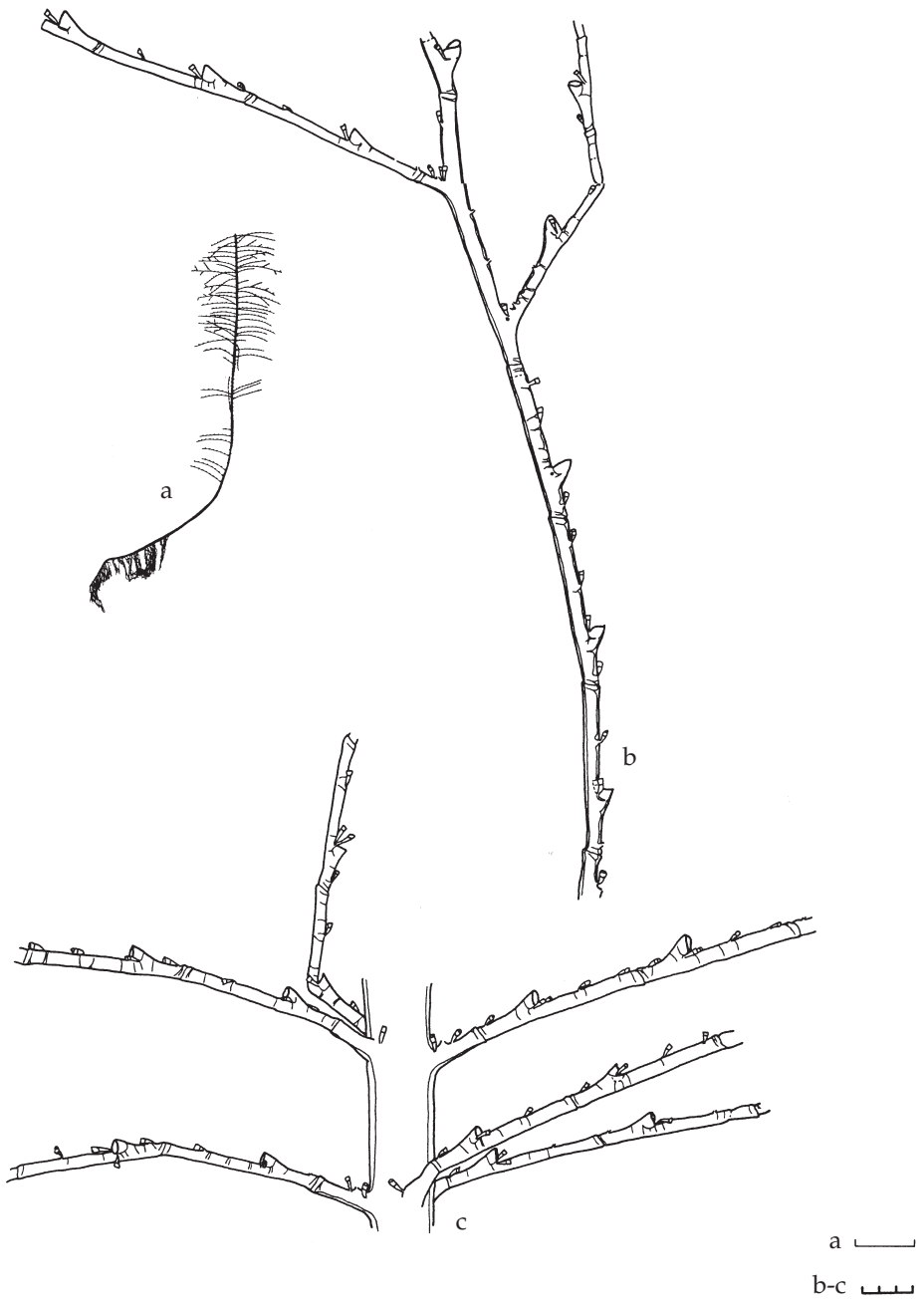


Fig. 87. *Nemertesia* spec. 1, Stn 4.084. a, colony; b, branched hydrocladium, lateral view; c, detail of colony, frontal view. Scales: a, 1 cm; b-c, 0.3 mm.

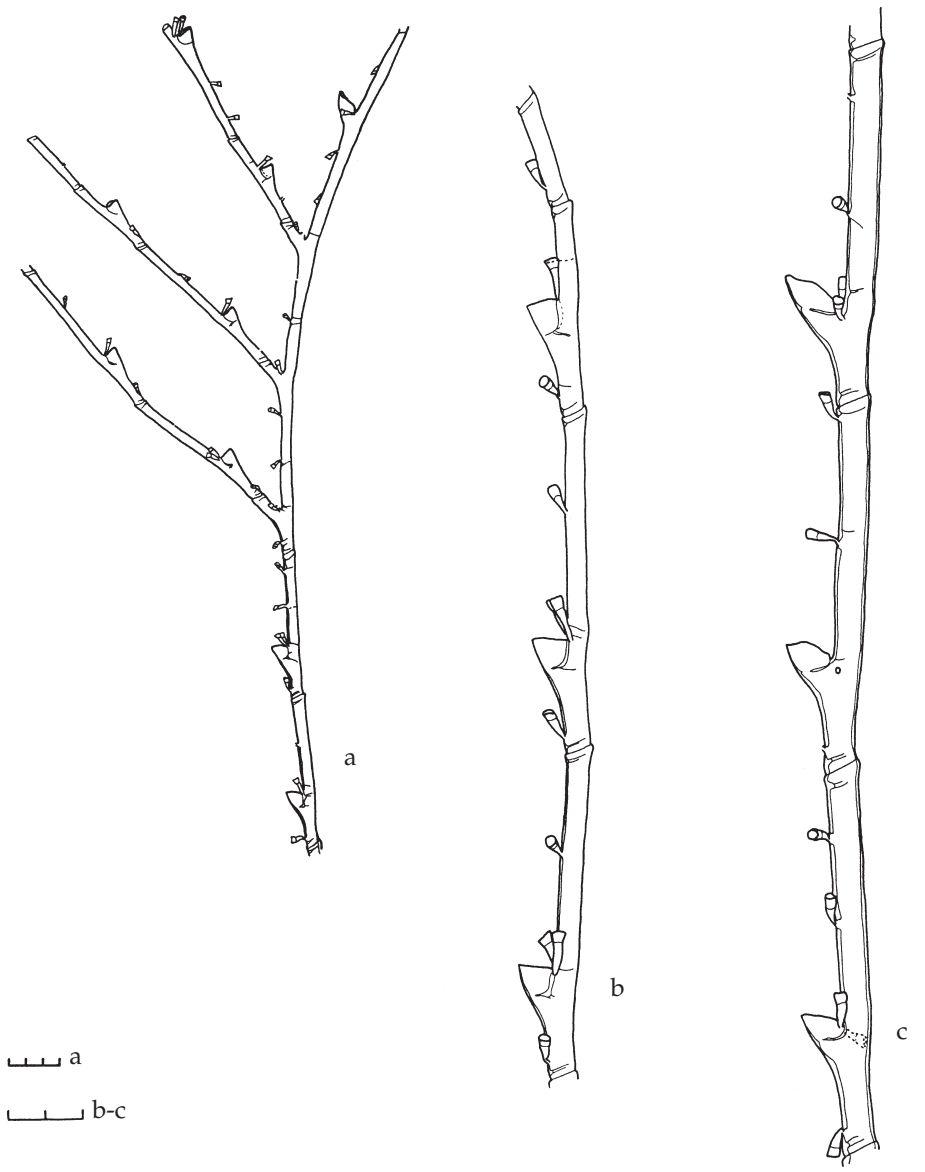


Fig. 88. *Nemertesia* spec. 1, Stn 4.084. a, branched hydrocladium; b, distal part of hydrocladium; c, hydrocladium in the process of transformation into branch, lateral view. Scales: a, 0.3 mm; b-c, 0.2 mm.

species of *Nemertesia* with branched hydrocladia of which the structure differs from the present specimen.

Distribution.— Collected at a single station south-east of Lanzarote, Canary Islands, at 500 m depth.

Nemertesia spec. 2
(fig. 89)

Material.— **Cape Verde Islands**: Stn 6.119: One colony with gonothecae (RMNH-Coel. 29053, two slides 4718).— Stn 6.139: One colony and one fragment, without gonothecae (RMNH-Coel. 29108 = slide 4719).

Description (of material from Stn 6.119).— Hydrorhiza a mass of intertwining tubules supporting a monosiphonic and unbranched hydrocaulus. Hydrorhiza with numerous nematothecae and covering basal part of the stem. Hydrocaulus divided into internodes with straight nodes. Each internode with several nematothecae and two (basal part of stem) to five apophyses (distal part of stem), forming decussate verticils. Each apophysis with mamelon on superior surface, two axillary nematothecae and several distal nematothecae, number dependent upon length of apophysis, subjected to considerable variability even in same colony.

Hydrocladia inserted on apophyses either by means of a short athecate internode with one or two nematothecae and two internal perisarc rings at the extremities, or directly by means of a thecate internode. Hydrocladia composed of succession of thecate and athecate internodes separated by straight or slightly oblique nodes; thecate internodes basally with oblique, distally with straight node; athecate internodes reverse. Thecate internodes with one hydrotheca in basal half and four nematothecae: one mesial inferior, two lateral and one supracalycine. Hydrotheca cup-shaped, adcauline wall fully adnate, abcauline wall straight; aperture circular, tilted downwards, rim smooth. Athecate internodes with two or three nematothecae. All internodes with two internal perisarc rings of varied development, one at each extremity. All nematothecae bithalamic and movable; those on hydrorhiza with a long, slender pedicel and a small apical chamber.

Gonothecae inserted on apophyses by means of short pedicel, big, more or less ovoid, with circular latero-terminal aperture closed by a lid. They resemble those of *Nemertesia antennina* (Linnaeus, 1758).

Variability.— The material from Stn 6.139 is composed of two juvenile colonies and a fragment, all plumularioid and without supracalycine nematotheca; this could be due to regeneration after having received damage. Regeneration of thecate internodes usually leads towards the loss of the supracalycine nematotheca.

Table LII. Measurements of *Nemertesia* spec. 2 in µm:

	Stn 6.119
Height of colony (in mm)	67
Stem internode, length	880-920
Diameter at node	450-490
Hydrocladial internode, length thecate internode	440-770
Length athecate internode	380-520
Diameter at node	35-80
Hydrotheca, length abcauline wall	52-80
Length adcauline wall	80-100
Diameter at rim	80-90
Mesial nematotheca, length	80-100

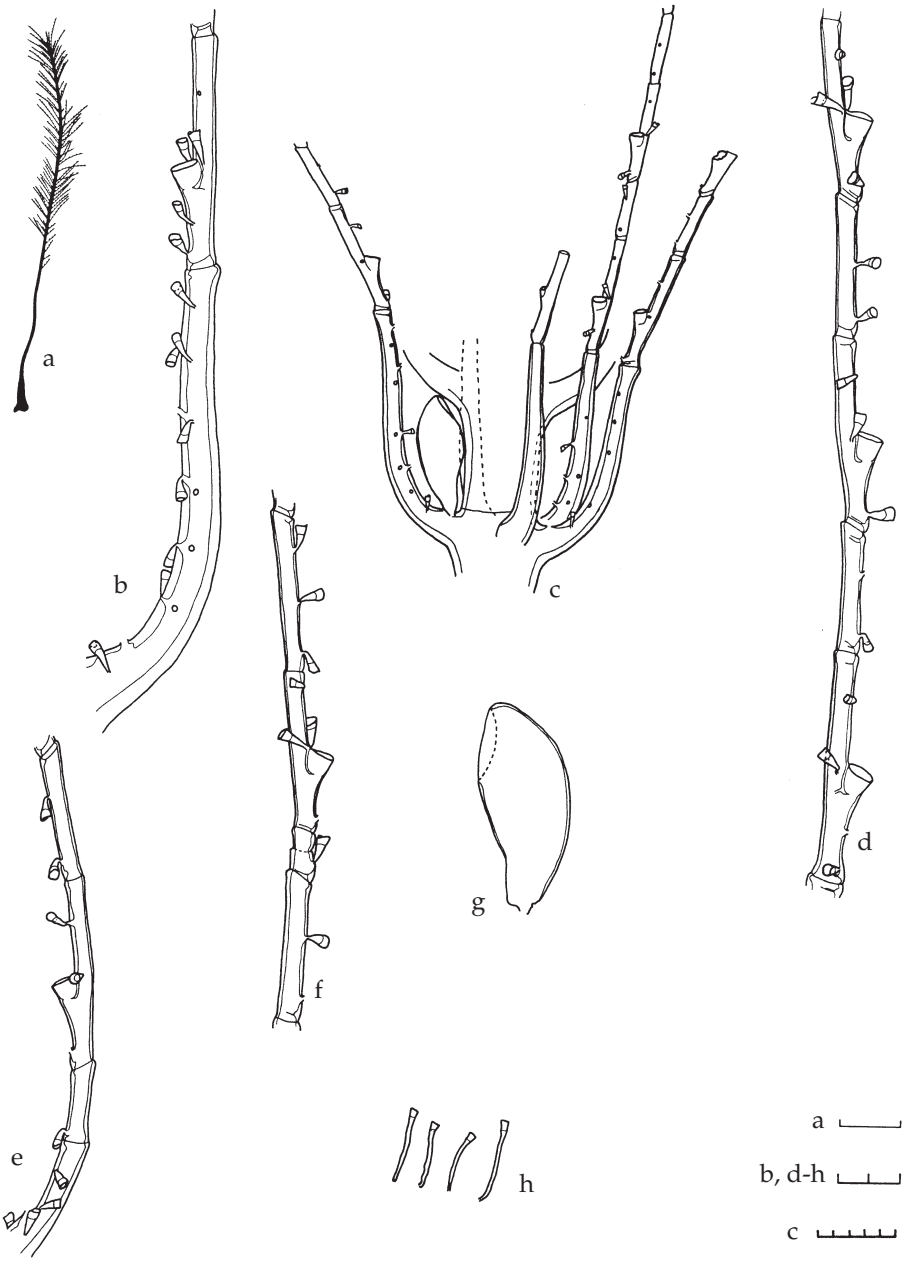


Fig. 89. *Nemertesia* spec. 2., Stn 6.119. a, colony; b, basal part of hydrocladium supported by big apophysis, lateral view; c, detail of colony, frontal view; d, typical hydrocladium, slightly oblique view; e, basal part of hydrocladium with short apophysis, lateral view; f, hydrocladium with three nematothecae on athecate internodes, lateral view; g, gonotheca, lateral view; h, nematothecae from hydrorhiza. Scales: a, 1 cm; b, d-h, 0.2 mm; c, 0.5 mm.

Diameter at rim	28-40
Lateral nematotheca, length	100-110
Diameter at rim	40-46
Gonotheca, length	675-730
Maximum diameter	270-295

Discussion.— This material is characterised by the unbranched stem, the single supracalycine nematotheca and the presence of two or three nematothecae on the athecate internodes. It resembles *Nemertesia perrieri* (Billard, 1901) in the mode of segmentation of the hydrocladia and morphology of hydrothecae and gonothecae, but it differs by having a supracalycine nematotheca and two or three nematothecae on the athecate internodes. *N. perrieri* has no supracalycine nematotheca and always two nematothecae per athecate internode.

It also resembles *Nemertesia antennina* (Linnaeus, 1758), from which it differs in morphology of the hydrotheca (rim smooth, without lateral sinuses) and by the presence of a supracalycine nematotheca; such a nematotheca is of exceptional occurrence in *N. antennina*.

Reproduction.— A CANCAP colony collected in June has gonothecae.

Distribution.— Collected at two stations in the Cape Verde Archipelago, between 396 and 591 m.

Genus *Plumularia* Lamarck, 1816
Plumularia floridana Nutting, 1900
(fig. 90)

Plumularia floridana Nutting, 1900: 59, pl. 2 figs 4-5; Fraser, 1912: 381, fig. 49A-B; Bedot, 1921b: 27; Fraser, 1938b: 64; 1939c: 161; 1944a: 345, pl. 74 fig. 333a-c; Vannucci-Mendes, 1946: 582, pl. 5 fig. 53; Fraser, 1948: 278; Vannucci-Mendes, 1949: 254; Vannucci, 1951b: 109, 111, 113, 115, 117; Deevey, 1954: 271; Vervoort, 1968: 109; Morris & Mogelberg, 1973: 21, fig. 29a-b; Calder, 1976: 169; Calder & Hester, 1978: 91; Ljubenkov, 1980: 51; Calder, 1983: 20, fig. 11; 1990: 446, 448; Cairns et al., 1991: 28; Calder, 1993b: 68; Migotto, 1996: 55, fig. 10d-f; Calder, 1997: 15, fig. 3a-b.

?*Plumularia alicia* Torrey, 1902: 75, pl. 10 figs 96-97; Fraser, 1911: 82; Bedot, 1921b: 26; Fraser, 1937b: 186, pl. 42 fig. 224a-d; 1948: 275; Von Schenck, 1965: 928; Gravier-Bonnet, 1979: 61; Ljubenkov, 1980: 51; Cairns et al., 1991: 28.

Plumularia alicia var. *minuta* Billard, 1927d: 472.

Plumularia sinuosa Fraser, 1938b: 67, pl. 15 fig. 77; 1948: 287, pl. 42 fig. 53; Ljubenkov, 1980: 51.

Plumularia sp. Pennicuik, 1959: 183, pl. 3 fig. 7.

?*Plumularia indica* Mammen, 1965: 300, fig. 96; Gravier-Bonnet, 1979: 61.

Plumularia pennycuikae Millard & Bouillon, 1973: 85, fig. 10N, P; Hirohito, 1974: 39, fig. 18a-c; Millard & Bouillon, 1974: 9; Millard, 1975: 398, fig. 126A-C; 1979a: 147; Rho & Park, 1980: 27, pl. 8 figs 5-7; Hirohito, 1983: 70; Rho & Park, 1986: 98; Park, 1990: 84; Ryland & Gibbons, 1991: 533, fig. 6A-C; Bouillon, Massin & Kresevic, 1995: 61; Gravier-Bonnet & Mioche, 1996: 166.

Plumularia pennycuikai; Park, 1992: 296; 1995: 15 (incorrect subsequent spelling).

Not *Plumularia pennycuikae*; Hirohito, 1995: 275, fig. 95a-b.

Material.— **Canary Islands and Selvagens Archipelago**: Stn 2.D08: One colony growing on algae and *Aglaophenia pluma*, with gonothecae (RMNH-Coel. 28604, slide 4721).

Description.— Hydrorhiza tubular, adhering to substrate; hydrocauli rising at irregular intervals, unbranched, monosiphonic, divided into internodes by straight nodes, geniculate, becoming more distinct distally. First internode of hydrocaulus short, without nematothecae or apophysis, followed by a much longer internode with distal apophysis and two to four nematothecae on opposite wall and below apophysis. Remaining cauline internodes all have one distal apophysis, one nematotheca in middle of opposite wall and an internal perisarc ring of varied development at both extremities. Apophyses small, alternately directed left or right, with mamelon on superior surface and two axillary nematothecae.

Hydrocladia inserted on apophyses, first internode small, athecate, without nematothecae and a perisarc ring at each extremity. Rest of hydrocladium a succession of thecate and athecate internodes, separated by oblique and straight nodes; thecate internodes with basal oblique and distal straight node; athecate internodes reverse. Each thecate internode with hydrotheca in middle and three nematothecae: one mesial inferior and two lateral. Hydrotheca fairly deep, cylindrical; adcauline wall adnate for half its length, free part slightly concave; abcauline wall straight; aperture circular, perpendicular to length axis of hydrotheca, rim smooth. In addition a perisarc ring present near each internodal extremity; occasionally also an incompletely developed third ring behind hydrotheca. Athecate internodes with centrally placed nematotheca and an internal perisarc ring at both extremities. All nematothecae bithalamic and movable.

Gonothecae globular, small, with thin perisarc, inserted on apophyses.

Table LIII. Measurements of *Plumularia floridana* in µm:

	Stn 2.D08
Height of colony (in mm)	3.5-8
Stem internodes, length	340-550
Diameter at node	40-85
First hydrocladial internode, length*	80-170
Diameter at node	30-40
Following hydrocladial internodes, length thecate*	280-310
Length athecate*	280-340
Diameter at node	25-40
Hydrotheca, length abcauline wall	100-145
Length free part adcauline wall	65-80
Diameter at rim	110-140
Mesial nematotheca, length	40-45
Diameter at rim	20
Lateral nematotheca, length	50-60
Diameter at rim	30
Gonotheca, length	150-175
Maximum diameter	115-120

* Measurements taken of wall opposite hydrotheca.

Discussion.— Fraser (1938a) shortly described *Plumularia sinuosa* from the eastern Pacific from sterile material, strongly resembling *Plumularia floridana*. The same

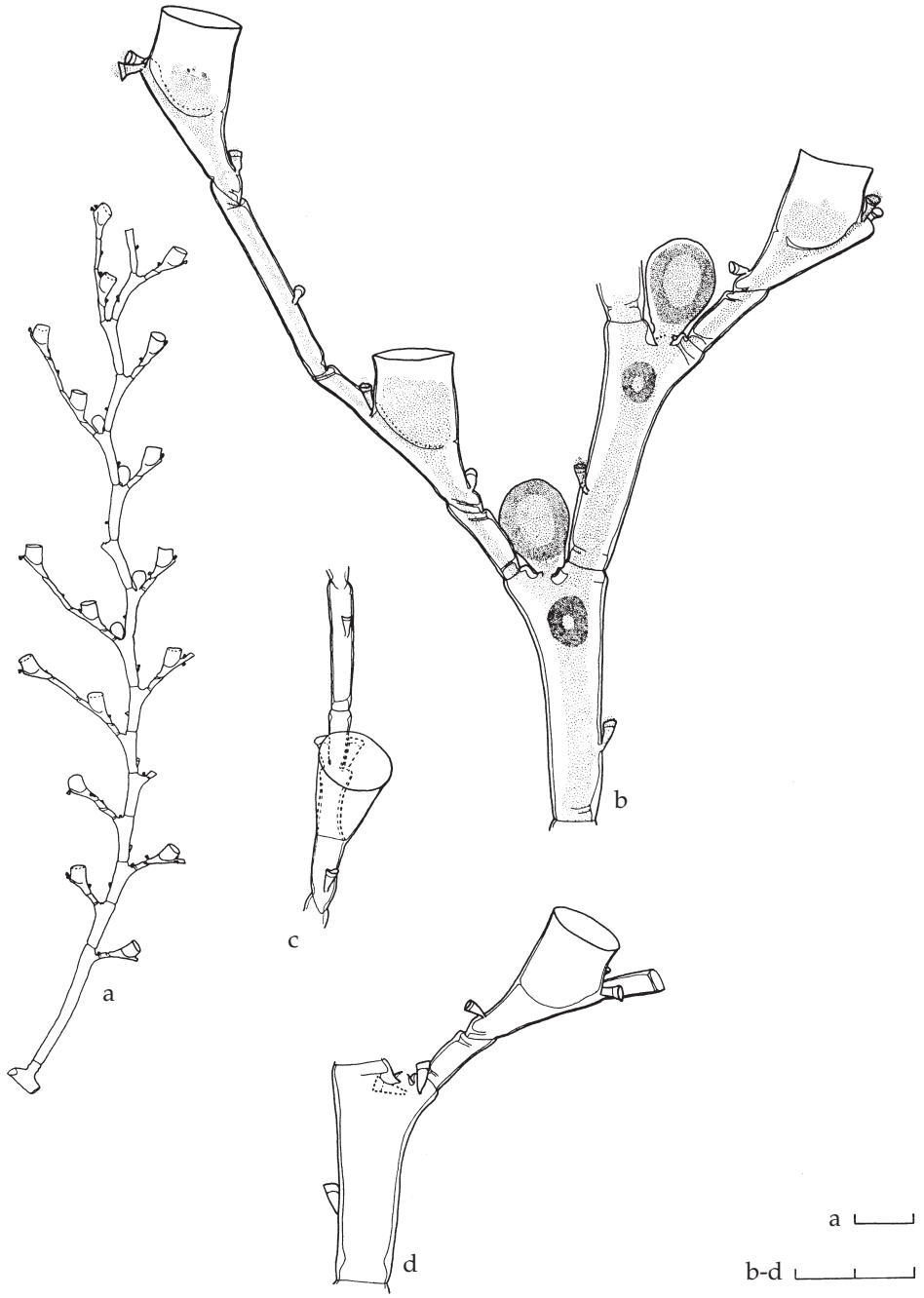


Fig. 90. *Plumularia floridana* Nutting, 1900, Stn 2.D08. a, colony; b, detail of a colony, frontal view; c, hydrotheca, latero-frontal view; d, detail of apophysis, frontal view. Scales: a, 1 cm; b-d, 0.2 mm.

author (Fraser, 1948) later described the gonotheca, that is identical with that of *P. floridana*; both species are evidently conspecific. Pennycuik (1959), studying hydroids from Queensland, described a species resembling *P. floridana* and *P. sinuosa* as *Plumularia* sp.; Millard & Bouillon (1973) described a species of *Plumularia* from the Seychelles identical in structure with Pennycuik's *Plumularia* sp. and named it *Plumularia pennycuikae*. Calder (1997) considered that species conspecific with *P. floridana* and we concur. The record of *Plumularia pennycuikae* from Sagami Bay, Japan (Hirohito, 1995) is here excluded from *P. floridana* because the figures do not fit. Other similar species that Calder (1997) considered as probably conspecific are *Plumularia alicia* Torrey, 1902, *Plumularia alicia* var. *minuta* Billard, 1927 and *Plumularia indica* Mammen, 1965. The principal difference between *Plumularia alicia* and *P. floridana* is the size of the colonies that in *P. alicia* lies between eight and 13 cm whereas *P. floridana* does not surpass three cm. Though differences in size may to a certain extend be explained by environmental condition, the fact that no specimens of both species intermediate in size have so far been described makes us follow Calder (1997) in keeping both species separate for the time being. However, we believe that *Plumularia alicia* var. *minuta* Billard (1927b) from the coast of Camerun should be placed in *P. floridana* as it differs from the nominal species by its small size (10 mm). *Plumularia indica* differs from *P. floridana* by the absence of a basal nematotheca on the stem internodes; the gonothecae are unknown. It is unfortunately impossible to draw definite conclusions concerning this species.

Reproduction: Millard & Bouilon (1973) report on fertile material collected in July and August. The CANCAP material was fertile in September.

Distribution.— *Plumularia floridana* is known from the following Atlantic localities: Delaware coast (Fraser, 1944a), Bermuda (Morris & Mogelberg, 1973; Calder, 1993, 1997), North Carolina (Fraser, 1912), the coast of South Carolina (Calder, 1976; Calder & Hester, 1978; Calder, 1983, 1990), Florida (Nutting, 1900; Deevey, 1954), Dry Tortuga (Deevey, 1954), Gulf of Mexico (Deevey, 1954; Vervoort, 1968) and numerous localities along the Brasilian coast (Vannucci-Mendes, 1946, 1949; Vannucci, 1951b; Migotto, 1996). In the eastern Atlantic known from the coast of Camerun (Billard, 1927b, as *Plumularia alicia* var. *minuta*).

In the Indian Ocean the species is cited from the coast of Mozambique (Millard & Bouillon, 1974; Millard, 1975, both as *P. pennycuikae*), Réunion (Gravier-Bonnet & Mioche, 1996, as *P. pennycuikae*) and the Seychelles (Millard & Bouillon, 1973; Millard, 1975; Bouillon, Massin & Kresevic, 1995, all as *P. pennycuikae*).

From the Pacific it is mentioned from the coast of Korea (Rho & Park, 1980, 1986; Park, 1990, all as *P. pennycuikae*; and 1992, 1995, both as *P. pennycuikai*), various localities in Japanese waters (Hirohito, 1974, 1983, both as *P. pennycuikae*), Bonin Islands (Hirohito, 1974, as *P. pennycuikae*), Queensland, Australia (Pennycuik, 1959, as *Plumularia* sp.), Fiji (Ryland & Gibbons, 1991, as *P. pennycuikae*), Galápagos Islands (Fraser, 1938a), Oregon coast (Fraser, 1938a), several localities along the Californian coast (Torrey, 1902; Fraser, 1911, as *P. alicia*, 1938a, 1948; Ljubenkov, 1980), Mexico (Fraser, 1948), the coast of Panama (Fraser, 1938a, 1948) and Santa Elena Bay, Ecuador (Fraser, 1938a).

The bathymetrical distribution is between 0 and 2775.5 m (Fraser, 1944a); the author stated that the considerable depth (2775.5 m) is probably incorrect and may be due to transport from less deep waters.

The CANCAP material originates from one station near the Canary Islands and was obtained between 5 and 25 m.

Plumularia setacea (Linnaeus, 1758)
(fig. 91)

Sertularia setacea Linnaeus, 1758: 813.
Aglaophenia setacea; Lamouroux, 1816: 172.
Plumularia setacea; Hincks, 1868: 296, pl. 66 figs 1, 1a; Kirchenpauer, 1876: 27, pl. 2 fig. 11, pl. 3 figs 11, 11a-b; Pictet & Bedot, 1900: 28; Billard, 1902: 536; Torrey, 1902: 79, pl. 11 fig. 105; Billard, 1904a: 206, figs 78-79; Marine Biological Association, 1904: 199; Arévalo y Carretero, 1906: 84, pl. 14 fig. 1; Billard, 1906b: 209; Rioja y Martín, 1906: 277; Browne, 1907: 32; Bedot, 1911: 222; Fraser, 1911: 84; Ritchie, 1911: 222; 1911a: 851; Billard, 1912a: 461; Broch, 1912a: 20, fig. 4a-c; Crawshay, 1912: 331; Broch, 1913: 3; Stechow, 1913c: 89; Bedot, 1914a: 86, pl. 5 figs 1-13; Broch, 1914a: 25, pl. 1 fig. 1; Fraser, 1914a: 209, pl. 36 fig. 136A-C; Rodríguez Rosillo, 1914: 39; Stechow, 1919a: 119; Bedot, 1921b: 29; 1921c: 10; Jarvis, 1922: 348; Stechow, 1923d: 226; Bale, 1924: 252, fig. 11a-b; Prenant & Teissier, 1924: 26; Stechow, 1925b: 500; Billard, 1927c: 342; Broch, 1928a: 34; 1928b: 116; Trebilcock, 1928: 24; Teissier, 1930a: 185; Billard, 1931b: 247; Marine Biological Association, 1931: 77; Nobre, 1931: 18; Leloup, 1933c: 27; 1934c: 15; 1935e: 2; Philbert, 1935a: 86; 1935c: 18; 1935d: 28; 1935e: 33; Fraser, 1937b: 191, pl. 44 fig. 231a-c; 1938b: 66; 1938d: 136; Leloup, 1938a: 8; Da Cunha, 1940: 113; Vervoort, 1942: 300; Da Cunha, 1944: 30, figs 12-13; Vannucci-Mendes, 1946: 579, pl. 5 fig. 51; Vervoort, 1946a: 323, fig. 6; 1946b: 175, figs 24f, 73; Leloup, 1947: 33, fig. 25; Vannucci-Mendes, 1949: 254; Da Cunha, 1950: 124, 128; Hodgson, 1950: 43, fig. 73; Rossi, 1950: 214; Teissier, 1950b: 23; Vannucci, 1950: 89, pl. 1 fig. 5; Picard, 1951a: 112; 1951f: 260; Vannucci, 1951b: 106, 108, 109, 111, 113, 115, 117; Day, Millard & Harrison, 1952: 404; Leloup, 1952a: 189, figs $6E^4$, 110A-C; Picard, 1952a: 349; 1952d: 220; Williams, 1954: 50; Picard, 1955b: 188; Day & Morgans, 1956: 301; Buchanan, 1957: 367; Marine Biological Association, 1957: 49; Millard, 1957: 232; 1958: 212; Picard, 1958b: 192; Cabioch, 1961: 30; Rossi, 1961: 77; Swennen, 1961: 209; Millard, 1962: 301; Cabioch, 1965: 56; De Haro, 1965: 109, 116, photograph 4; Teissier, 1965: 28; Millard, 1966: 493; Rees & White, 1966: 281; Vervoort, 1966a: 142, fig. 43a-e; Redier, 1967a: 406; Rho, 1967: 349, fig. 10A-B; Millard, 1968: 254, 278, fig. 5F-H; Vervoort, 1968: 64, 110, fig. 29a-b; Vidal, 1968: 189; Berrisford, 1969: 394; Fey, 1969: 403; Hirohito, 1969: 27; Naumov, 1969: 465, fig. 354A-B; Rees & Rowe, 1969: 22; Day, Field & Penrith, 1970: 14; Patriti, 1970: 54, fig. 75A-C; Riedl, 1970: 152, pl. 42; Jägerskiöld, 1971: 64; Riedl, 1971: 1145; Rossi, 1971: 28, fig. 10G-H; Christiansen, 1972: 303; Schmidt, 1972b: 41, 43; Castric-Fey, 1973: 214; Houvenaghel-Crèvecoeur, 1973: 2815; Millard, 1973: 27, fig. 3A-J; Morton & Miller, 1973: 154, fig. 54.8; Schmidt, 1973a: 283; Hirohito, 1974: 41; Leloup, 1974: 49, fig. 43A-K; Millard & Bouillon, 1974: 9; Saldanha, 1974: 325; Cooke, 1975: 104, pl. 6 fig. 3; Hughes, 1975: 291; Millard, 1975: 399, fig. 124E-K; Wedler, 1975: 332; Blanco, 1976: 54, pl. 7 figs 4-6; Williams, 1976: 58; Chas Brínquez & Rodríguez Babío, 1977: 32, fig. 18A-C; Hamond & Williams, 1977: 68; Vervoort & Vasseur, 1977: 76, fig. 32a-b; García Corrales et al., 1978: 53, fig. 24A-C; Marinopoulos, 1979b: 120; Morri, 1979b: 306; Ljubenkov, 1980: 51; Morri, 1980b: 8; Boero, 1981a: 182; García Carrascosa, 1981: 262, pl. 24 figs a-b, pl. 36 fig. d; Gili i Sardà, 1982: 88, fig. 45; Flórez-González, 1983: 121, photographs 44-45; Aguirrezabalaga et al., 1984: 135; Altuna et al., 1984: 135; Gili & Castelló, 1985: 18, fig. 6C; Gili & García-Rubies, 1985: 48, fig. 6A; Isasi, 1985: 86, fig. 25A-C; Boero & Fresi, 1986: 145; Calder, 1986b: 139; Gili, 1986: 163, fig. 4.30C; Isasi & Saiz, 1986: 70; Morri & Boero, 1986: 66, fig. 44a-b; Roca, 1986: 341, fig. 60; Bandel & Wedler, 1987: 38; Llobet i Nadal, 1987: 188, fig. 61; Aguirrezabalaga et al., 1988: 230; Ramil, 1988: 435; Gili, Murillo & Ros, 1989: 23; Gili, Vervoort & Pagès, 1989: 89, fig. 17B; Altuna & García Carrascosa, 1990: 86, fig. 88; Cornelius & Ryland, 1990: 154, fig. 4.22; Cairns et al., 1991: 28; Castric-Fey & Chassé, 1991: 523; Gili & Ballesteros, 1991: 247; Ansín Agís, 1992: 158, pl. 35 figs A-C; Cornelius, 1992a: 255; 1992b: 83; Genzano & Zamponi, 1992: 55, fig. 23; Park, 1992: 296; Ramil & Vervoort, 1992a: 191, fig. 47f-i; Álvarez Claudio, 1993: 290, fig. 49A-C, pl. 30 figs A-F; Boero & Bouillon, 1993a: 264; Altuna Pra-

dos, 1994a: 267; Blanco, 1994: 244, figs 38-41; Genzano, 1994: 5; Watson, 1994a: 67; Altuna Prados, 1995a: 54; Álvarez Claudio, 1995: 17; Álvarez-Claudio & Anadón, 1995: 239; Bouillon, Massin & Kresevic, 1995: 62; Cornelius, 1995: 158, fig. 37A-E; Hirohito, 1995: 278, fig. 95c-d; Medel & Vervoort, 1995: 56, fig. 24a-d; Park, 1995: 16; Peña Cantero, 1995: 349, pl. 42 figs A-B; Brinckmann-Voss, 1996: 95, 96; Calder & Cornelius, 1996: 167; Medel & López-González, 1996: 203; Watson, 1996: 79; Calder, 1997: 17, fig. 4a-d: Ramil, Vervoort & Ansín, 1998: 37.

Plumularia setacea p.p. Nutting, 1900: 56, pl. 1 figs 1-4; Stechow, 1912a: 362; Bennitt, 1922: 256; Fraser, 1944a: 352; Deevey, 1954: 271; Rees & Thursfield, 1965: 162.

Plumularia multinoda Allman, 1885: 157, pl. 26 figs 4-6.

Plumularia corrugata Nutting, 1900: 64, pl. 6 figs 1-3; Fraser, 1911: 82; 1914a: 205, pl. 35 fig. 133A-D.

?*Plumularia palmeri* Nutting, 1900: 65, pl. 6 figs 4-5; Fraser, 1911: 84, pl. 7 figs 3-4.

Plumularia milleri Nutting, 1905: 951, pl. 5 fig. 1, pl. 12 figs 6-7; Stechow, 1919a: 119.

Plumularia setacea f. *typica*; Broch, 1918a: 56; 1933b: 34; Vervoort, 1946b: 175.

Plumularia setacea var. *microtheca* Broch, 1918a: 56; 1933b: 34.

Plumularia setacea var. *elongata* Bedot, 1921c: 10, pl. 1 fig. 1; Rees & White, 1966: 281.

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

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

Plumularia halecioides; Vervoort, 1967: 45, fig. 13a-c [not *Kirchenpaueria halecioides* (Alder, 1859)].

Not *Plumularia corrugata*; Bennitt, 1922: 255; Fraser, 1944a: 341; Morris & Mogelberg, 1973: 19; Defenbaugh, 1974: 101, fig. 14 (= *Plumularia strictocarpa* Pictet, 1893).

Material.— **Azores area:** Stn 5.044: Several colonies with gonothecae (RMNH-Coel. 28659, 28688).— Stn 5.088: Many colonies, several with gonothecae, on *Nemertesia ramosa* (Lamarck, 1816) (RMNH-Coel. 28580, 28927).— Stn 5.130: Two colonies on *Aglaophenia acacia* Allman, 1883, without gonothecae (RMNH-Coel. 29112 = slide 4728).— Stn 5.142: One colony growing on *Nemertesia antennina* (Linnaeus, 1758), with gonothecae (RMNH-Coel. 28699).— **Atlantic coast of Morocco and Mauritania:** Stn 1.118: One colony on *Aglaophenia acacia* Allman, 1883, with gonothecae (RMNH-Coel. 28582).— Stn 3.182: One colony with immature gonothecae (RMNH-Coel. 28584, slide 4725).— Stn MAU 063: Two colonies with immature gonothecae (RMNH-Coel. 28665, slide 4738).— Stn MAU 072: Two colonies with gonothecae, one on *Pseudoplumaria marocana* (Billard, 1930) (RMNH-Coel. 28655, slide 4739).— Stn MAU 117: One colony without gonothecae (RMNH-Coel. 29115 = slide 4740).— **Madeira area:** Stn 1.D82: 19 colonies with gonothecae (RMNH-Coel. 28568, two slides 4722).— Stn 1.102: One colony on *Lytocarpia myriophyllum* (Linnaeus, 1758), with gonothecae (RMNH-Coel. 28621, 28630).— Stn 1.114: Four colonies, of which two with gonothecae (RMNH-Coel. 29109 = two slides 4723).— **Canary Islands and Selvagens Archipelago:** Stn 2.119: Two colonies on *Aglaophenia* spec., with damaged gonothecae (RMNH-Coel. 29110 = slide 4724).— Stn 3.083: One colony on *Aglaophenia lophocarpa* Allman, 1877, no gonothecae (RMNH-Coel. 28700).— Stn 3.090: One colony with gonothecae (RMNH-Coel. 28618).— Stn 4.003: One colony on *Aglaophenia kirchenpaueri* (Heller, 1868), no gonothecae (RMNH-Coel. 29111 = slide 4726).— Stn 4.017: One young colony without gonothecae (RMNH-Coel 28974).— Stn 4.019: Two colonies on *Aglaophenia kirchenpaueri* (Heller, 1868), with gonothecae (RMNH-Coel. 28592).— Stn 4.091: One damaged colony on *Nemertesia antennina* (Linnaeus, 1758), with gonothecae (RMNH-Coel. 28734).— Stn 4.143: One colony with gonothecae (RMNH-Coel. 28576, slide 4727).— Stn 4.D07: Three colonies with gonothecae (RMNH-Coel. 28956)— **Cape Verde Islands:** Stn 6.075: Several colonies on *Lytocarpia myriophyllum* (Linnaeus, 1758), with gonothecae (RMNH-Coel. 28641, slide 4729).— Stn 6.076: Four colonies, of which two epibiontic on *Lytocarpia myriophyllum* (Linnaeus, 1758) with gonothecae, one on *Aglaophenia svobodai* spec. nov. without gonothecae and one young colony developing on *Monostaechas quadridens* (McCrady, 1859) (RMNH-Coel. 28776).— Stn 6.080: Five colonies on *Lytocarpia myriophyllum* (Linnaeus, 1758), with gonothecae (RMNH-Coel. 28668, slide 4730).— Stn 6.084: One colony on bivalve shell and two fragments, with immature gonothecae (RMNH-Coel. 29113 = slide 4731).— Stn 6.131: One colony without gonothecae (RMNH-Coel. 28673).— Stn 6.137: Five colonies, of which three on *Nematophorus clarkei* (Nutting, 1900)

(RMNH-Coel. 28912) and two on *Nemertesia ramosa* (Lamarck, 1816) (RMNH-Coel. 28755, slide 4732), with gonothecae.— Stn 6.144: One damaged fragment without gonothecae (unregistered sample).— Stn 6.148: Four colonies growing on *Nemertesia ramosa* (Lamarck, 1816), of which three with gonothecae (RMNH-Coel. 29114 = slides 2009, 4733).— Stn 6.164: One colony on Bryozoa, with gonothecae (RMNH-Coel. 28768, two slides 4734).— Stn 6.165: One colony with gonothecae (RMNH-Coel. 28945).— Stn 6.176: Two colonies, one with gonothecae, the other damaged and without gonothecae (RMNH-Coel. 28644).— Stn 6.D01: Two colonies, one on calcareous algae, the other on sponge and with gonothecae (RMNH-Coel. 28676, two slides 4735).— Stn 6.D02: One colony on algae, with gonothecae (RMNH-Coel. 28738, two slides 4736).— Stn 7.059: Two damaged colonies, one on *Streptocaulus pulcherrimus* Allman, 1883, without gonothecae (RMNH-Coel. 28958).— Stn 7.078: One damaged colony on *Nematophorus clarkei* (Nutting, 1900), with gonothecae (RMNH-Coel. 28937).— Stn 7.132: One colony with gonothecae (RMNH-Coel. 29055 = slide 4737).— Stn 7.155: Two colonies on *Nematophorus clarkei* (Nutting, 1900), no gonothecae (RMNH-Coel. 28667).

Description (of material from Stn 6.D01).— Hydrorhiza tubular, attached to substrate, supporting monosiphonic, unbranched hydrocauli. Stem inserted on small apophysis on hydrorhiza, composed of succession of internodes separated by straight nodes, each with distal apophysis and one nematothecae in middle of opposite wall. Internal perisarc rings may occur at both extremities. Apophyses alternately directed left and right, with a small mamelon on superior surface, one axillar nematotheca, and occasionally an imperfect perisarc ring at distal end.

Hydrocladia inserted on apophyses, pointing left or right and slightly frontally. First internode of hydrocladium short, without nematothecae and with median internal perisarc ring. Rest of hydrocladium a succession of thecate and athecate internodes separated by straight and oblique nodes; thecate internodes with basal oblique and distal straight node; athecate internodes reverse. Thecate internodes with one hydrotheca and three nematothecae: one mesial inferior and two lateral. Hydrotheca in middle of internode, cup-shaped, adcauline wall fully adnate, abcauline wall straight and slightly shorter than adcauline wall; hydrothecal aperture slightly tilted downwards; rim smooth. Thecate internodes also with two internal perisarc rings at both extremities, an incomplete ring may be present behind hydrothecal base. Athecate internodes with one nematotheca halfway their length and two internal perisarc rings, one basal, one distal. All nematothecae bithalamic and movable.

Gonothecae inserted on apophyses by means of short pedicel, bottle-shaped, narrowing distally into a neck of varied length with a circular, apical aperture.

Variability.— Epibiontic colonies tend to loose certain characters as for instance the reduction of one or both lateral nematothecae or the disappearance of the node between thecate and athecate internodes. Epibiontic colonies usually are smaller, as for instance in the material from Stn MAU 072, developing on *Pseudoplumaria marocana* (Billard, 1930). The colony from Stn 7.132, collected at a depth of 395 m, is bigger than all other colonies measured (table LIV). Material from Stn 4.003 has several athecate internodes with two nematothecae and colonies from Stns 6.148 and 7.132 have numerous internal perisarc rings in the internodes and two axillar nematothecae on the apophyses (fig. 91c).

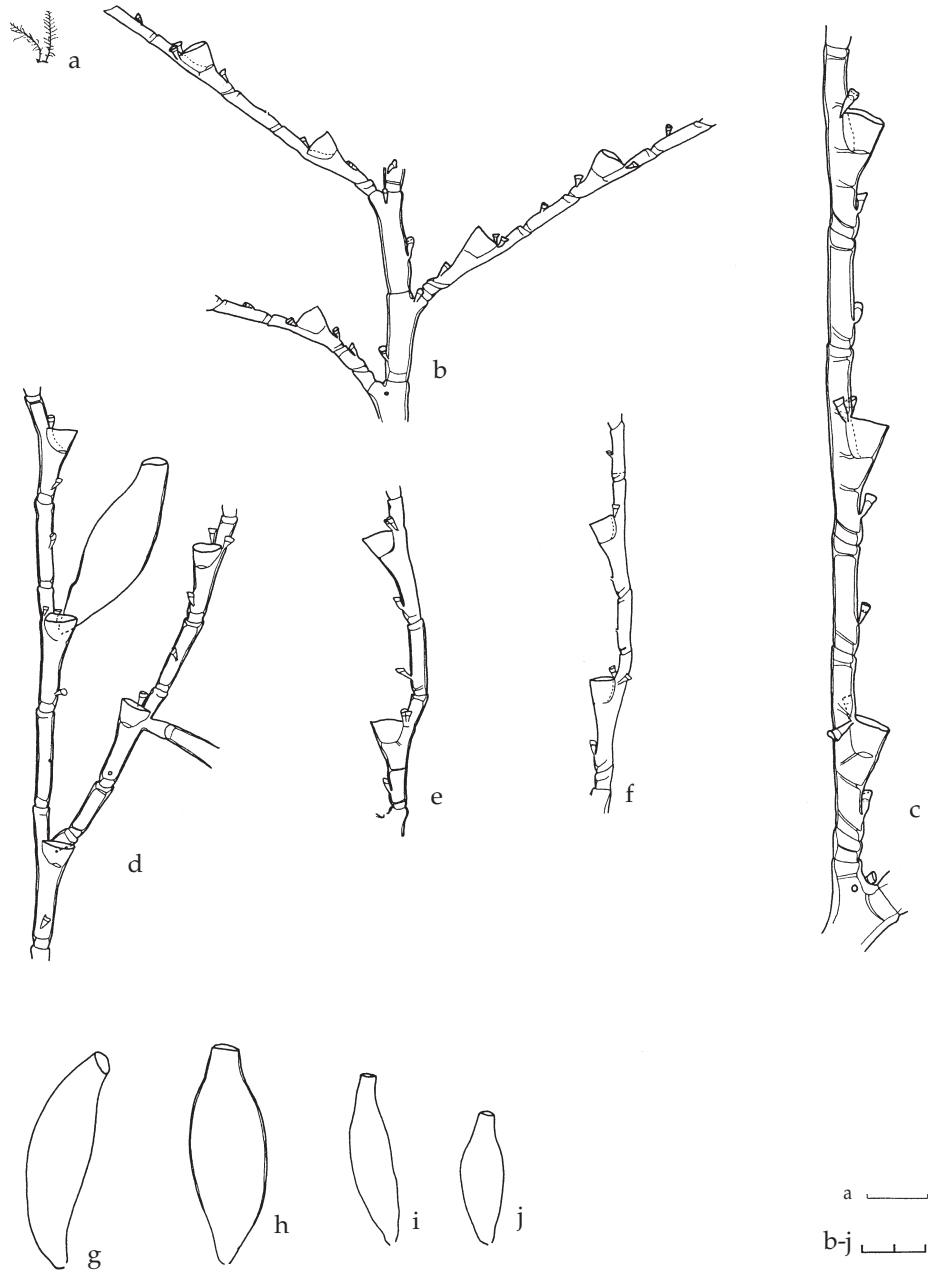


Fig. 91. *Plumularia setacea* (Linnaeus, 1758). a-b, Stn 6.D01, a, colony, b, detail of colony, frontal view; c, Stn 7.132, hydrocladium with well developed perisarc rings, lateral view; d-e, Stn MAU 072, d, aberrant hydrocladium, oblique view; e, hydrocladim, lateral view; f-g, Stn 6.D01, f, hydrocladium, lateral view; g, gonotheca; h-j, Stn MAU 072, gonothecae. Scales: a, 1 cm; b-j, 0.2 mm.

Table LIV. Measurements of *Plumularia setacea* in µm:

	Stn 6.D01	Stn 6.137	Stn 7.132	Stn MAU 072
Height of colony (in mm)	9-11		37-97	3.2-6.8
Stem internode, length	220-370	450-600	380-870	310-420
Diameter at node	50-110	90-285	120-190	40-50
First hydrocladial internode, length	60-90	40-110	85-110	
Diameter at node	40-55	45-65	85-100	
Following hydrocladial internodes, length thecate	280-370	350-450	540-645	330-380
Length athecate	140-240	205-320	335-385	190-260
Diameter at node	30-45	40-60	60-80	30-40
Hydrotheca, length abcauline wall	70-88	70-90	90-115	70-90
Length adcauline wall	75-92	75-95	100-140	70-80
Diameter at rim	85-100	90-110	115-135	95-100
Mesial nematotheca, length	50	55-65	70-80	45-50
Diameter at rim	20-25	25-30	30-40	20-22
Lateral nematotheca, length	40-50	50-60	70-90	40-50
Diameter at rim	20-30	25-30	30-40	20-25
Gonotheca, length	700	840-970	700-780	390-700
Maximum diameter	200-230	310-365	190-330	130-250

Discussion.— *Plumularia multinoda* Allman, 1885, *Plumularia corrugata* Nutting, 1900 and *Plumularia milleri* Nutting, 1906 have been included in *Plumularia setacea* by previous authors (Bedot, 1914a; Bale, 1924; Vannucci-Mendes, 1946; Vervoort, 1966; Medel & Vervoort, 1995, and Calder, 1997) and we concur. Calder (1997) included several records of *Plumularia corrugata* in *Plumularia strictocarpa* Pictet, 1893, along with some of the material of *Plumularia setacea* recorded by Nutting (1900), Stechow (1912), Fraser (1944a), Deevey (1954) and Rees & Thursfield (1965). *Plumularia lagenifera* Allman, 1885, was identified as *P. setacea* by Bedot (1914a), who after the study of abundant material of the latter from Roscoff reached the conclusion that length of hydrocladial internodes, thickening of perisarc and number and development of internal perisarc rings are so variable in this species as to have no taxonomical value. However, Bedot (1914a) does not refer to the shape of the hydrotheca, that according to Allman (1885) is low, wide and swollen. Bale (1924) agrees with Bedot (1914a) as far as the variability of *P. setacea* is concerned but indicated that *P. lagenifera* differs from *P. setacea* in morphology of the hydrothecae and internodes; he also pointed out that Bedot's (1914a) figure of the hydrotheca of *P. setacea* is much different from that of *P. lagenifera*. Millard (1957) re-described *P. lagenifera* and stated that though the species resembles *P. setacea*, it differs by the abcauline wall of the hydrotheca, being convex and narrowing towards the rim. Recently *P. lagenifera* and *P. setacea* have been synonymized by Medel & Vervoort (1995) without further motivation. In our opinion the two species are clearly distinct and have been kept separate here, following in this respect Bale (1924), Millard (1957) and Calder (1997). The position of *Plumularia palmeri* Nutting, 1900 is considered unclear by Calder (1997) as Fraser (1914a) included the species in *Plumularia lagenifera* whereas Torrey (1902), Bedot (1914a, 1921b) and Vervoort (1946a, 1966) placed it in *P. setacea*. *Plumularia diploptera* Totton, 1930 from New Zealand, is said by its author to resemble closely

Plumularia setacea, from which it differs by the presence of two nematothecae on the apophyses. Additional characters were supplemented by Ralph (1961):

- Hydrocladia placed more distinctly in one plane and not latero-frontal, as in *P. setacea*.

- Frequent absence of basal perisarc rings in the internodes of the hydrocaulus, said to occur typically in *P. setacea*.

- Presence of an internal perisarc ring in the thecate internode at the hydrothecal base, supposed to be rare in *P. setacea*.

However, Rees & Vervoort (1987), after revision of the type series of *P. diploptera* in NHM and as shown in their figure 29, found a considerable variability in number and development of the internal perisarc rings. Similar variability in *P. setacea* had previously been described by Bedot (1914a) in Roscoff material. Vannucci-Mendes (1946), in Brazilian material of *P. setacea*, noticed occasional occurrence of a perisarc ring under the hydrotheca as well as one to three additional rings between hydrotheca and base of internode. Ramil & Vervoort (1992a) also studied that variability in Atlantic material and reached the conclusion that in view of the great variability in that development the sole remaining difference between *P. setacea* and *P. diploptera* was the presence of one axillar nematotheca on the apophysis in the former and the presence of a pair in the latter. Recently Calder (1997), basing himself on the differences between both species listed by Ralph (1961) found his Bermuda material to be intermediate having two or more nematothecae on each apophysis and the hydrocladia laterally disposed in the same plane. The CANCAP material from Stns 6.148 and 7.132 as indicated above approaches *P. diploptera* (fig. 91c). However, considering the facts outlined above and bearing in mind the variability of the characters used to separate between both species, we believe that this material cannot be separated from the remaining CANCAP material and we have therefore placed *P. diploptera* Totton, 1930 in the synonymy of *Plumularia setacea* (Linnaeus, 1758).

Reproduction.— Gonothecae have been observed all the year round and have been reported by many authors, amongst which Billard (1902); Marine Biological Association (1904, 1931); Stechow (1913); Bedot (1921c); Billard (1927a); Teissier (1930, 1950, 1965); Millard (1957); Rho (1967); Fey (1969); Christiansen (1972); Chas Brínquez & Rodríguez Babio (1977); Isasi (1985); Cornelius (1995); Medel & Vervoort (1995); Calder (1997) and Ramil, Vervoort & Ansín (1998). CANCAP material bearing gonothecae was collected in March, May, June, August-November.

Distribution.— According to numerous authors (Vannucci-Mendes, 1946; Leloup, 1947; Picard, 1958a; Ralph, 1961; Rossi, 1961; Redier, 1967; Berrisford, 1969; Millard, 1975; García Carrascosa, 1981; Isasi, 1985; Roca; 1986; Boero & Bouillon, 1993; Blanco, 1994) *Plumularia setacea* is a cosmopolitan species, with the exception so far of the Antarctic region. In the eastern Atlantic it has been found near Iceland (Broch, 1918), the Faeroes (Naumov, 1969), the Shetland Islands (Rees & Thursfield, 1965), the coast of Norway (Bonnevie, 1899; Christiansen, 1972), the coast of Sweden (Rees & Rowe, 1969; Jägerskiöld, 1971), Heligoland (Broch, 1928a), North Sea (Broch, 1928a, 1928b; Vervoort, 1942; Rees & Thursfield, 1965), Ireland (Williams, 1954), numerous localities along the coast of Great Britain (Hincks, 1868; Marine Biological Association, 1904; Ritchie, 1911; Crawshay, 1912; Marine Biological Association, 1931, 1957; Rees & Thursfield, 1965; Hamond & Williams, 1977; Cornelius & Ryland, 1990; Bouillon,

Massin & Kresevic, 1995; Cornelius, 1995), the Dutch coast (Leloup, 1933c; Vervoort, 1946b; Swennen, 1961), the Belgian coast (Leloup, 1947, 1952a; Bouillon, Massin & Kresevic, 1995), the Channel Islands (Philbert, 1935a, 1935b), numerous localities along the French coast (Billard, 1902, 1904a, 1906b; Bedot, 1911; Billard, 1912a, 1927a, 1931a; Bedot, 1914a; Prenant & Teissier, 1965; Teissier, 1930, 1950, 1965; Philbert, 1935c, 1935d; Cabioch, 1961, 1965; Redier, 1967; Fey, 1969; Castric-Fey, 1973; Castric-Fey & Chassé, 1991; Bouillon, Massin & Kresevic, 1995), the Bay of Biscay (Browne, 1907), many localities at the north and north-west coast of Spain (Arévalo y Carretero, 1906; Rioja y Martín, 1906; Rodríguez Rosillo, 1914; Chas Brínquez & Rodríguez Babío, 1977; García Corrales et al., 1978; Estrada, 1979; Aguirrezabalaga et al., 1984; Altuna et al., 1984; Isasi, 1985; Isasi & Saiz, 1986; Aguirrezabalaga et al., 1988; Ramil, 1988; Altuna & García Carrascosa, 1990; Ansín Agís, 1992; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez-Claudio & Anadón, 1995; Medel & López-González, 1996), the Portuguese coast (Nobre, 1931; Da Cunha, 1940, 1944, 1950; Saldanha, 1974; Bouillon, Massin & Kresevic, 1995; Medel & López-González, 1996), the Gulf of Cádiz (Billard, 1906b), the Strait of Gibraltar (Broch, 1913; Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), Gorringe and Ampère Banks (Ramil, Vervoort & Ansín, 1998), Azores (Pictet & Bedot, 1900; Bedot, 1921c; Rees & White, 1966; Cornelius, 1992b), Madeira (Billard, 1906b; Patriti, 1970), the coast of Morocco (Billard, 1906b; Patriti, 1970), Western Sahara (Vervoort, 1946a), the Cape Verde Islands (Bedot, 1921c), Senegal (Picard, 1951a, Patriti, 1970), the coast of Guinea Bissau (Gili, Vervoort & Pagès, 1989), Ghana (Buchanan, 1957), Angola (Broch, 1914; Bouillon, Massin & Kresevic, 1995), the coast of Namibia (Broch, 1914; Gili, Vervoort & Pagès, 1989), South Africa (Stechow, 1925b; Day, Millard & Harrison, 1952; Millard, 1957, 1962, 1966, 1975; Berrisford, 1969; Day, Field & Penrith, 1970; Bouillon, Massin & Kresevic, 1995) and a mid-Atlantic locality (32°11′00″N, 34°10′00″W, Rees & Thursfield, 1965). At the Atlantic coasts of America it is mentioned from Bermudas (Calder, 1986, 1997; Calder & Cornelius, 1996), Bahamas (Nutting, 1900), Bahamas Strait (Stechow, 1925b), Florida coast (Nutting, 1900; Stechow, 1912; Deevey, 1954), Dry Tortugas (Deevey, 1954), Gulf of Mexico (Stechow, 1912; Deevey, 1954), north-west of Cuba (Stechow, 1912), Virgin Islands (Vervoort, 1968), coast of Colombia (Wedler, 1975; Flórez González, 1983; Bandel & Wedler, 1987), coast of Brazil (Nutting, 1900; Vannucci-Mendes, 1946, 1949; Vannucci, 1951b), Trinidad (Vannucci, 1950), coast of Argentine (Genzano & Zamponi, 1992; Blanco, 1994; Genzano, 1994) and Tierra de Fuego (Blanco, 1976).

In the Mediterranean cited from the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), Alborán Sea (Ramil & Vervoort, 1992a), Chafarinas Islands (Peña Cantero, 1995), numerous localities along the Spanish coast (De Haro, 1965; García Corrales et al., 1978; García Carrascosa, 1981; Gili i Sardà 1982, 1986; Gili & Castelló, 1985; Llobet i Nadal, 1987; Gili, Murillo & Ros, 1989; Gili & Ballesteros, 1991; Medel & López-González, 1996), Balearic Islands (García Carrascosa, 1981; Gili & García Rubies, 1985; Roca, 1986), coast of France (Stechow, 1919; Leloup, 1934; Rossi, 1950; Picard, 1951c, 1952a, 1952b; Vidal, 1968; Bouillon, Massin & Kresevic, 1995), Algeria (Picard, 1955), Italian coast (Stechow, 1923d; Rossi, 1950, 1961, 1971; Morri, 1980b; Boero, 1981a; Boero & Fresi, 1986), Adriatic (Broch, 1912, 1933; Rossi, 1950; Riedl, 1970), Turkey (Marinopoulos, 1979). Also, Suez Canal (Schmidt, 1972a) and Red Sea (Vervoort, 1967, as *Plumularia halecioides*; Schmidt, 1972a).

In the Indian Ocean recorded from the coasts of South Africa (Day & Morgans,

1956; Millard, 1958, 1968, 1973, 1975; Vervoort, 1966), Mozambique (Millard & Bouillon, 1974; Bouillon, Massin & Kresevic, 1995), Tanzania (Jarvis, 1922), Mergui Archipelago and Christmas Islands (Rees & Thursfield, 1965) and the south-west coast of Australia (Watson, 1996).

In the Pacific mentioned from the Korean coast (Rho, 1967; Park, 1992, 1995), Japan (Stechow, 1913, 1925b; Rees & Thursfield, 1965; Hirohito, 1969, 1995), Bonin Islands (Hirohito, 1974), Moluccas (Stechow, 1919), Australia (Ritchie 1911; Rees & Thursfield, 1965; Watson, 1994a), Tasmania (Hodgson, 1950), New Zealand coast (Allman, 1885, as *Plumularia multinoda*; Bale, 1924; Trebilcock, 1928; Totton, 1930, as *Plumularia diploptera*; Ralph, 1961; Morton & Miller, 1973), Marshall Islands (Cooke, 1975), Polynesia (Vervoort & Vasseur, 1977), Easter Island (Leloup, 1935b; Bouillon, Massin & Kresevic, 1995), Hawaii (Nutting, 1905, as *Plumularia milleri*), Kodiak Island (Naumov, 1969), Galápagos Islands (Fraser, 1938a), coast of Canada (Fraser, 1911, 1914a, 1937; Brinckmann-Voss, 1996), coast of the United States (Nutting, 1900; Torrey, 1902; Fraser, 1911, 1937; Stechow, 1923d; Leloup, 1938a; Ljubenkov, 1980; Bouillon, Massin & Kresevic, 1995), Mexican coast of the Gulf of California (Fraser, 1938c), coast of Chile (Stechow, 1919; Leloup, 1974; Bouillon, Massin & Kresevic, 1995) and Magalhan Strait (Leloup, 1974).

The bathymetrical distribution lies between 0 (Medel & Vervoort, 1995) and 604 m (Ramil & Vervoort, 1992a).

CANCAP material comes from 38 stations of which four near the Azores, three near Madeira, three in the Selvagens Archipelago, one off Morocco, six near the Canary Islands, four off Mauritania and 17 in the Cape Verde Archipelago. The material was obtained between 0 and 395 m.

Epibionts.— Stn 1.D82: Algae.— Stn 6.137: *Filellum serratum* (Clarke, 1879)— Stn 6.164: Bryozoa.— Stn 6.D01: Algae.— Stn 6.D02: Algae.— Stn 7.059: Foraminifera, *Filellum serratum* (Clarke, 1879), *Modeeria rotunda* (Quoy & Gaimard, 1827); Bryozoa.— Stn 7.132: Foraminifera.

Plumularia spec.
(fig. 92)

Material.— **Azores area:** Stn 5.072: One colony on sponge, no gonothecae (RMNH-Coel. 29116 = three slides 4741).— Stn 5.085: One colony without gonothecae (RMNH-Coel. 28741, slide 4742).— **Cape Verde Island:** Stn 6.050: One young colony on *Aglaophenia lophocarpa* Allman, 1877, no gonothecae (RMNH-Coel. 29117 = slide 4743).— Stn 6.062: One colony on bivalve shell, with one gonotheca (RMNH-Coel. 29118 = slide 4744).— Stn 6.069: One damaged colony without gonothecae (RMNH-Coel. 29119 = slide 4745).— Stn 6.074: One colony with damaged gonothecae (RMNH-Coel. 28902, three slides 4746).— Stn 6.076: Two colonies, one with gonothecae (RMNH-Coel. 28775; DEBA-UV, two slides R. 351).— Stn 6.078: Two colonies with gonothecae (RMNH-Coel. 28745, slide 4747).— Stn 6.148: Two young colonies on *Antennella siliquosa* (Hincks, 1877), no gonothecae (RMNH-Coel. 29120 = slide 4748).— Stn 7.058: One colony with immature gonothecae (RMNH-Coel. 28939, slide 4749).

Description (of material from Stn 6.074).— Hydrorhiza tubular, attached to substratum; hydrocauli unbranched, monosiphonic, inserted on short apophysis; first internode short, with straight node, without nematothecae or hydrocladia. Rest of stem a succession of internodes with straight nodes, each internode provided with one distal apophysis and two series of frontal nematothecae; series under apophysis

composed of two or three nematothecae; series on wall opposite apophysis has three or four nematothecae. Stem straight, slightly geniculate in youngest parts. Apophyses alternately directed left and right, each with mamelon on superior surface, slightly displaced laterally, and two axillar nematothecae.

Hydrocladia fronto-laterally disposed, basal internode short, athecate, without nematotheca, occasionally with internal perisarc ring of varied development and oblique distal node. Rest of hydrocladium composed of thecate and athecate internodes with oblique nodes. Thecate internode with hydrotheca on distal half and four nematothecae: two mesial inferior and two lateral. Hydrotheca cup-shaped, widening towards rim; adcauline wall fully adnate; abcauline wall straight, slightly shorter than adcauline wall, aperture circular, slightly tilted downwards; rim smooth or with minor lateral concavity. Both extremities of thecate internode with internal perisarc ring of much varied development, even in same hydrocladium. Athecate internodes with single median nematotheca and two perisarc rings at extremities of much varied development. All nematothecae bithalamic and movable.

Gonothecae inserted on apophyses with short pedicel, elongated ovoid, with a short neck with circular apical aperture.

Variability.— The colonies obtained at Stns 5.072, 5.085 and 6.078 have athecate internodes with two nematothecae; these are also bigger and longer than the remaining material (see tab. LV). The colony from Stn 6.050 has athecate internodes with three nematothecae. Regeneration after damage may lead to the development of thecate internodes with up to four mesial inferior nematothecae; if the damage concerns the base of a hydrocladium, the basal athecate internode may develop a nematotheca.

Table LV. Measurements of *Plumularia* spec. in µm:

	Stn 6.074	Stn 6.076	Stn 5.072
Height of colony (in mm)	30-86	35-92	5-92
Stem internodes, length	670-770	570-700	550-1190
Diameter at node	190-230	190-310	130-230
First hydrocladial internode, length	90-125	80-120	70-100
Diameter at node	105-110	85-90	55-70
Following hydrocladial internodes: length thecate	480-630	530-600	480-610
Length athecate	190-280	220-250	370-490
Diameter at node	60-100	70-95	35-60
Hydrotheca, length abcauline wall	85-115	85-95	65-95
Length adcauline wall	90-120	90-100	70-100
Diameter at rim	110-140	110-125	110-125
Mesial nematotheca, length	70-90	80-90	70-85
Diameter at rim	38-40	30-45	30-35
Lateral nematotheca:, length	70-80	70-80	60-70
Diameter at rim	32-42	30-50	30-33
Gonotheca, length	1140-1235	1095-1400	
Maximum diameter	400-510	370-490	

Discussion.— The present specimens differ from *P. setacea* (Linnaeus, 1758) because in that species the internodes of the stem have a single basal nematotheca on

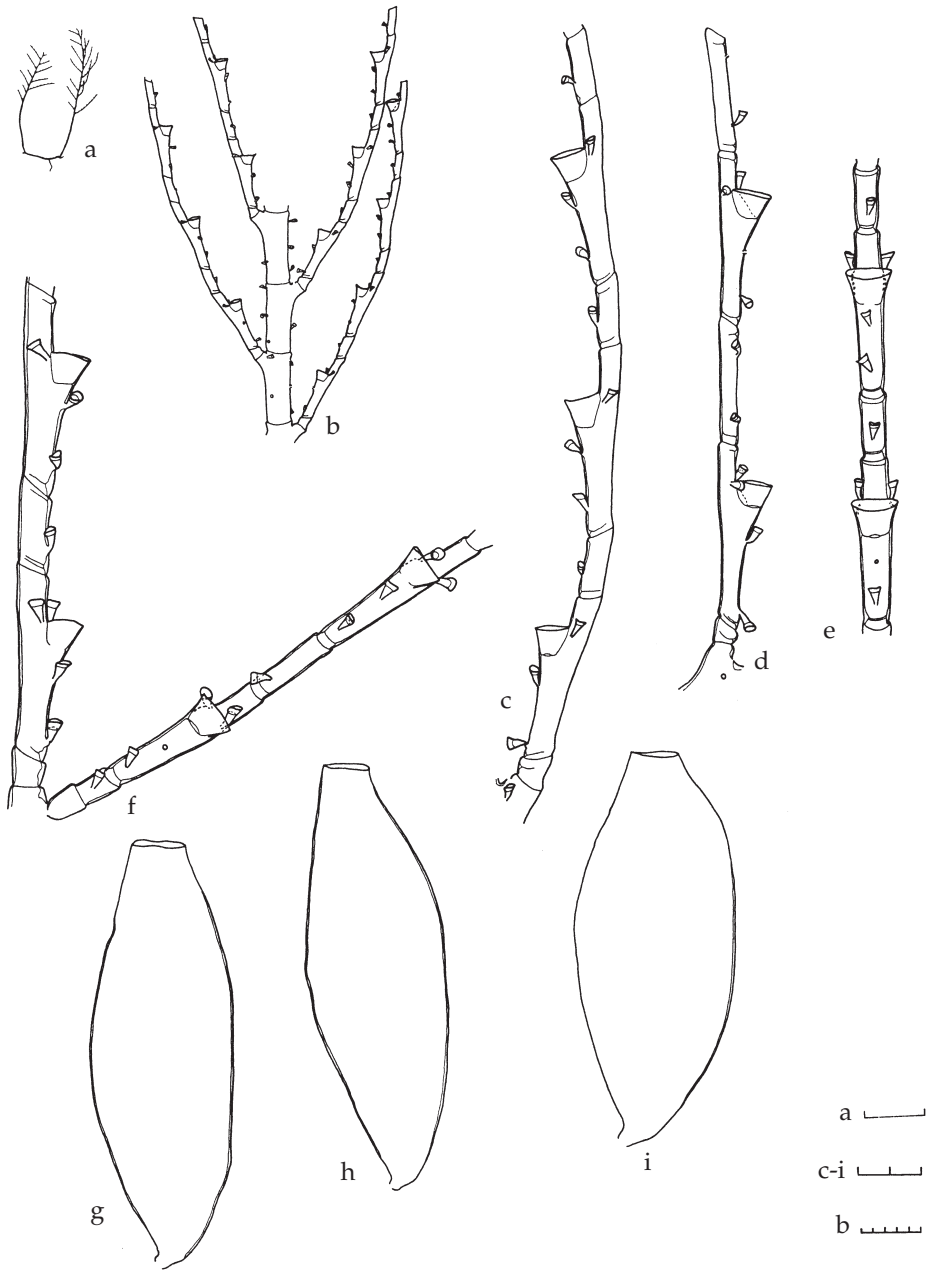


Fig. 92. *Plumularia* spec. a, Stn 6.078, colonies; b-c, Stn 6.076, b, detail of colony, frontal view; c, typical hydrocladium, lateral view; d, Stn 5.072, hydrocladium with two nematothecae on athecate internodes, lateral view; e, Stn 6.076, hydrocladium, frontal view; f, Stn 6.074, apophysis supporting two hydrocladia, lateral view; g-h, Stn 6.076, gonothecae; i, Stn 6.074, gonotheca. Scales: a, 1 cm; b, 0.5 mm; c-i, 0.2 mm.

the wall opposite the apophysis and the thecate internodes have a single mesial inferior nematotheca. *Plumularia* spec. has two frontal rows of nematothecae in the stem internodes; the thecate internodes have two mesial inferior nematothecae. The gonothecae of *Plumularia* spec. are distinctly bigger.

Plumularia antonbruuni Millard, 1967 also has two mesial inferior nematothecae on the thecate internodes but differs from *Plumularia* spec. because the stem internodes have a single nematotheca; the basal part of the hydrocladia has thecate internodes, the distal part thecate and athecate internodes with one nematotheca. Such athecate internodes represent the basal portion of the thecate internodes, that have a single mesial inferior nematotheca left. In *Plumularia* spec. the hydrocladia are made up of a regular succession of thecate and athecate internodes; the thecate internodes always having two mesial inferior nematothecae.

Reproduction.— Gonothecae were observed on colonies collected in June and August, the latter being immature.

Distribution.— This material comes from ten stations, of which two near the Azores and eight in the Cape Verde Archipelago, collected between 69 and 315 m, with the exception of that from Stn 6.050, coming from 1100-1200 m.

Epibionts.— Stn 5.072: *Zygophylax biarmata* Billard, 1906.— Stn 5.085: Bryozoa.— Stn 6.074: *Epizoanthus* spec., *Diphasia nigra* (Pallas, 1766), *Clytia paulensis* (Vanhöffen, 1910).— Stn 6.076: *Halecium tenellum* (Hincks, 1861), *Diphasia* spec., *Campanularia hincksii* Alder, 1856.— Stn 6.078: *Filellum serratum* (Clarke, 1879).

Genus *Polyplumaria* G.O. Sars, 1874
Polyplumaria flabellata G.O. Sars, 1874
(figs 93-94)

Polyplumaria flabellata G.O. Sars, 1874: 13, pl. 2 figs 16-22; Pictet & Bedot, 1900: 28, pl. 7 figs 1-6; Billard, 1906b: 218, figs 16-17A-D; Bedot, 1911: 225; Ritchie, 1911: 223, fig. 6; Crawshey, 1912: 33; Bedot, 1921b: 15; 1921c: 14, pl. 1 fig. 5; Prenant & Teissier, 1924: 25; Broch, 1928a: 61; Marine Biological Association, 1931: 78; Kramp, 1935b: 162, fig. 66A; 1938d: 37, 63, 68, 73; Leloup, 1940b: 22; Vervoort, 1942: 301; Kramp, 1943: 44; Da Cunha, 1944: 28, fig. 10; Kramp, 1947b: 15; Da Cunha, 1950: 124; Teissier, 1950b: 24; Marine Biological Association, 1957: 50; Rees & Thursfield, 1965: 165; Teissier, 1965: 28; Rees & White, 1966: 281; Vervoort, 1966a: 134, fig. 37a-d; Cabioch, 1968: 655, 686; Patriti, 1970: 56, fig. 80A-D; Edwards, 1973: 586; Aguirrezabalaga et al., 1984: 89; Altuna & García Carrascosa, 1990: 86, fig. 87; Cornelius & Ryland, 1990: 154, fig. 4.23; Ramil & Vervoort, 1992a: 193, fig. 50a-g; Álvarez Claudio, 1993: 297, fig. 50A-C, pl. 31 figs A-J; Altuna Prados, 1994a: 269; 1995a: 54; Álvarez Claudio, 1995: 17; Álvarez Claudio & Anadón, 1995: 239; Bouillon, Massin & Kresevic, 1995: 62; Cornelius, 1995: 163, fig. 38A-D; Medel & Vervoort, 1995: 61-63, fig. 26a-c; Medel & López-González, 1996: 203.

Diplopteron insigne Allman, 1874: 470, pl. 68 figs 2, 2a-2c; Bedot, 1921b: 15.

Polyplumaria pumilla Allman, 1883: 31, pl. 4 figs 7-8.

Polyplumaria cantabra Arévalo y Carretero, 1906: 89, pl. 15 fig. 1, pl. 16 figs 1-2, pl. 17 fig. 1, pl. 18 figs 1-2; Rioja y Martín, 1906: 278; Rodríguez Rosillo, 1914: 40.

Polyplumaria flavellata; Arévalo y Carretero, 1906: 97, pl. 14 fig. 4, pl. 19; Rioja y Martín, 1906: 277; Rodríguez Rosillo, 1914: 40 (incorrect subsequent spelling).

Polyplumaria Billardi Bedot, 1921b: 15; 1921c: 14, pl. 1 figs 4, 8-9, pl. 2 figs 12-16, pl. 3 figs 17-18; Da Cunha, 1944: 29; 1950: 124; Bouillon, Massin & Kresevic, 1995: 62.

Not *Polyplumaria flabellata* p.p. Gili, Vervoort & Pagès, 1989: 91 [= *Pseudoplumaria marocana* (Billard, 1930)].

Material.— **Azores area**: Stn 5.010: Six broken colonies and many fragments, without gonothecae (RMNH-Coel. 28715, five slides 4752).— Stn 5.044: Four colonies and several fragments, with gonothecae (RMNH-Coel. 28688, 28743).— Stn 5.056: Three colonies, of which one with gonothecae (RMNH-Coel. 28731, two slides 4753).— Stn 5.059: Three colonies and several fragments, no gonothecae (RMNH-Coel. 28714, slide 4754).— Stn 5.075: Three colonies without gonothecae (RMNH-Coel. 28924).— Stn 5.085: One colony and many fragments, with gonothecae (RMNH-Coel. 28909, two slides 4755).— Stn 5.086: One broken colony with several gonothecae (RMNH-Coel. 28722, slide 4756).— Stn 5.142: Seven colonies and five fragments, no gonothecae (RMNH-Coel. 28923).— Stn 5.153: One fragment with gonothecae (RMNH-Coel. 28746; DEBA-UV, slide R. 352).— Stn 5.166: One colony with gonothecae (RMNH-Coel. 28907, slide 4757).— Stn 5.194: One damaged fragment without gonothecae (unregistered sample).— **Atlantic coast of Morocco and Mauritania**: Stn 1.145: Eight colonies and several fragments, with gonothecae (RMNH-Coel. 28603, 28716, two slides 4751).

Description (of material from Stn 5.085).— Hydrorhiza a mass of perisarc tubules, supporting a polysiphonic and branched hydrocaulus; branches polysiphonic, in opposite pairs, in same plane as the stem, each branch originating from secondary tube. Branches may re-branch several times in identical fashion and always in same plane. Principal tube of stem, as that of branches, divided into internodes of varied length, with oblique nodes and one to five hydrocladial apophyses and several nematothecae. Apophyses alternate, each with well developed mamelon on superior surface and two axillary nematothecae. Between two consecutive apophyses there are two to four nematothecae.

Hydrocladia inserted on apophyses, first internode athecate, with frontal nematotheca; distal node oblique. Remainder of hydrocladium a succession of thecate internodes with oblique nodes. Each internode with one hydrotheca and five nematothecae: one mesial inferior, two lateral and two supracalycine nematothecae. Hydrotheca cylindrical with parallel walls, adcauline wall adnate for half its length, abcauline wall straight; aperture circular, tilted downwards, rim smooth. Mesial inferior nematotheca surpassing hydrothecal base; lateral nematothecae inserted on small apophyses on both sides of hydrotheca and typically reaching hydrothecal rim, occasionally surpassing. Supracalycine nematothecae frontally disposed on distal part of internode. All nematothecae bithalamic and movable; unpaired nematothecae deeply scooped on adcauline side. Primary hydrocladia typically with secondary hydrocladium, springing from base of hydrotheca on first thecate internode, curving towards primary hydrocladium. Secondary hydrocladium with long athecate internode with three frontal nematothecae; rest of hydrocladium as in primaries. Occasionally tertiary hydrocladia develop of same structure as secondary and springing from the base of its first hydrotheca.

Gonothecae inserted on apophyses by means of short pedicel, pear-shaped. Aperture almost terminal, slightly laterally displaced, circular, closed by lid. Basal part with six to nine nematothecae of varied size.

Variability.— Number and disposition of supracalycine nematothecae on hydrocladial internodes variable; one supracalycine nematotheca has been observed and when two are present they frequently are not frontally arranged but are displaced laterally. Similar variability has recently been described by Ramil & Vervoort (1992a).

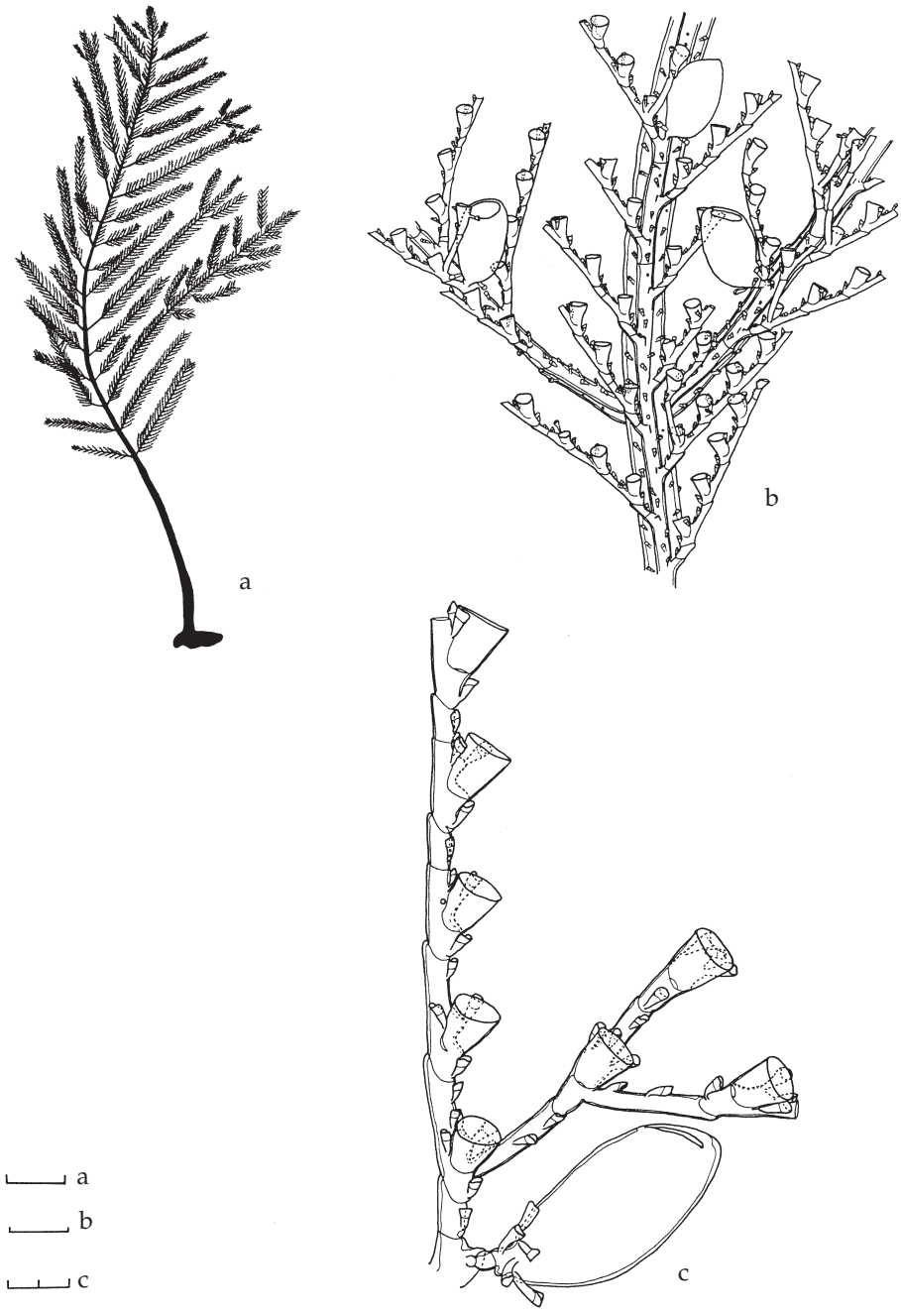


Fig. 93. *Polyplumaria flabellata* G.O. Sars, 1874. a, Stn 5.142, colony; b, Stn 5.085, detail of colony, frontal view; c, Stn 5.153, branched hydrocladium, oblique view. Scales: a, 1 cm; b, 0.5 mm; c, 0.2 mm.

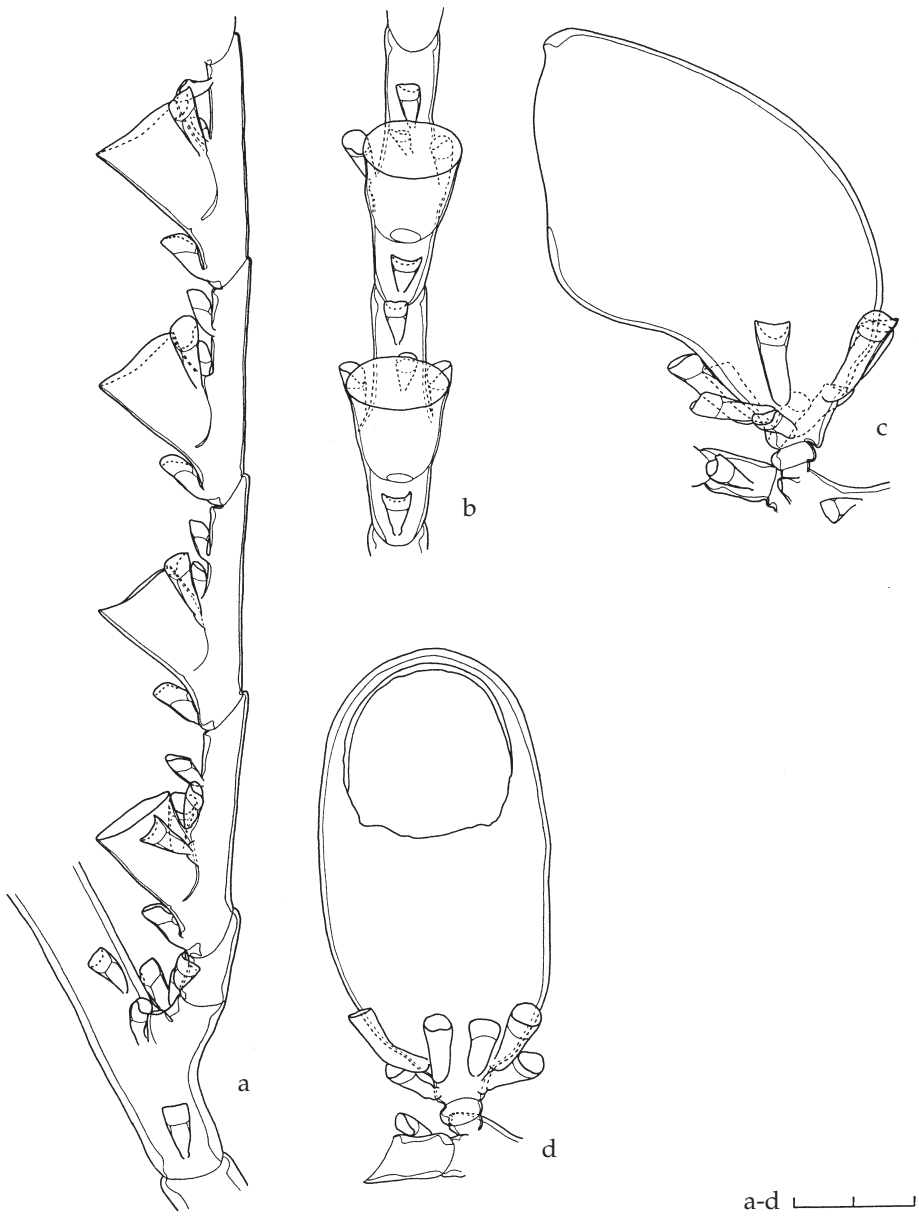


Fig. 94. *Polyplumaria flabellata* G.O. Sars, 1874. a, Stn 5.085, apophysis and hydrocladium, lateral view; b, Stn 5.153, hydrocladial internodes, frontal view; c-d, Stn 5.085, c, gonotheca, lateral view; d, gonotheca, frontal view. Scales: a-d, 0.2 mm.

Table LVI. Measurements of *Polyplumaria flabellata* in µm:

	Stn 5.085
Height of colony (in mm)	295
Stem internode, length	Very variable
Diameter at node	Very variable
Hydrocladial internode, length	335-390
Diameter at node	55-70
Hydrotheca, depth	150-200
Length free part adcauline wall	60-90
Diameter at rim	130-170
Mesial nematotheca, length	80-90
Diameter at rim	40-45
Lateral nematotheca, length	90-110
Diameter at rim	40-50
Supracalycine nematotheca, length	60-70
Diameter at rim	30-35
Gonotheca, length	650-780
Maximum diameter	375-450
Gonothecal nematotheca, length	110-180
Diameter at rim	45-60

Discussion.— Material identified as *Polyplumaria flabellata* by Gili, Vervoort & Pagès (1989), and deposited in the National Museum of Natural History, Leiden, was revised by Ramil & Vervoort (1992a) and placed in *Pseudoplumaria marocana* (Billard, 1930).

Reproduction.— Gonothecae have been reported for the months of May-August (Allman, 1883; Pictet & Bedot, 1900; Arévalo y Carretero, 1906; Teissier, 1950, 1965, and Ramil & Vervoort, 1992a). The CANCAP material was fertile in March, May and June.

Distribution.— *Polyplumaria flabellata* is widely distributed in the Atlantic (Ramil & Vervoort, 1992a). It has been recorded from Iceland (Kramp, 1938, 1943), the coast of Norway (G.O. Sars, 1874; Vervoort, 1942), the coast of Danmark (Kramp, 1935), the North Sea (Broch, 1928b), off the coast of Great Britian (Ritchie, 1911; Crawshay, 1912; Marine Biological Association, 1931, 1957; Rees & Thursfield, 1965; Cornelius & Ryland, 1990; Cornelius, 1995), the English Channel (Bedot, 1921c; Bouillon, Massin & Kresevic, 1995), numerous localities off Brittany (Bedot, 1911; Prenant & Teissier, 1924; Teissier, 1950, 1965; Bouillon, Massin & Kresevic, 1995), the Bay of Biscay (Pictet & Bedot, 1900; Billard, 1906b; Edwards, 1973), the north and north-west coast of the Iberian Peninsula (Allman, 1874, as *Diplopteron insigne*; Arévalo y Carretero, 1906; Rioja y Martín, 1906; Rodríguez Rosillo, 1914, as *P. cantabra*; Aguirrezabalaga et al., 1984; Altuna & García Carrascosa, 1990; Álvarez Claudio, 1993; Altuna Prados, 1994a, 1995a; Álvarez Claudio, 1995; Álvarez Claudio & Anadón, 1995; Medel & López-González, 1996), off the Portuguese coast (Bedot, 1921c, as *Polyplumaria Billardi*; Da Cunha, 1944, 1950; Bouillon, Massin & Kresevic, 1995; Medel & López-González, 1996), Azores (Allman, 1883, as *Polyplumaria pumilla*; Pictet & Bedot, 1900; Billard, 1906b; Bedot, 1921c; Leloup, 1940; Rees & White, 1966; Bouillon, Massin & Kresevic,

1995), the Gulf of Cádiz (Medel & López-González, 1996), the Strait of Gibraltar (Ramil & Vervoort, 1992a; Medel & Vervoort, 1995), various localities off the coast of Morocco (Kramp, 1947; Patriti, 1970; Ramil & Vervoort, 1992a) and off the mouth of the Congo river (Vervoort, 1966). In the Mediterranean only found in the Alborán Sea (Ramil & Vervoort, 1992a).

The bathymetrical range is between 44 (Ritchie, 1911) and 1378 m (Ramil & Vervoort, 1992a).

CANCAP material comes from 12 localities of which 11 near the Azores and one off Morocco. The depths varied between 60 and 196 m, with the exception of Stn 5.194 where material of this species was taken between 2149 and 2476 m.

Epibionts.— Stn 1.145: *Diphasia pinastrum* (Cuvier, 1830), *Clytia paulensis* (M. Sars, 1850), *Obelia dichotoma* (L., 1758) tubes of Polychaeta, Bryozoa.— Stn 5.044: *Halopteris catharina* (Johnston, 1833).— Stn 5.056: *Obelia bidentata* Clarke, 1875.— Stn 5.085: *Halopteris catharina* (Johnston, 1833), *Plumularia setacea* (L., 1758), Bryozoa.— Stn 5.086: Gastropod eggs, bivalve mollusc.

Genus *Pseudoplumaria* Ramil & Vervoort, 1992
Pseudoplumaria marocana (Billard, 1930)
(fig. 95)

Plumularia marocana Billard, 1930a: 79, fig. 1; Patriti, 1970: 54, fig. 76A-B; Van Praët, 1979: 926, fig. 99; Ramil & Vervoort, 1992a: 186, figs 48b-d, 49a, b.

?*Polyplumaria Billardi* var. *deloni* Bedot, 1921c: 17, pl. 1 figs 7, 10-11; Patriti, 1970: 56, fig. 79A-B.

Polyplumaria flabellata p.p. Gili, Vervoort & Pagès, 1989: 91, fig. 19.

Pseudoplumaria marocana; Ramil & Vervoort, 1992c: 491, fig. 3a-d; Medel & Vervoort, 1995: 63, figs 27, 28a-b; Medel & López-González, 1996: 203; Ramil, Vervoort & Ansín, 1998: 38.

Material.— **Atlantic coast of Morocco and Mauritania**: Stn MAU 072: One colony and two fragments, no gonothecae (RMNH-Coel. 28655, three slides 4758).

Description.— Hydrorhiza tubular, adhering to substrate, supporting polysiphonic and branched hydrocauli. Branches polysiphonic, opposite and in same plane as the stem, originating from secondary tubules running on dorsal side of main tube of hydrocaulus. This main tube divided into internodes of varied length with straight nodes, each internode with two to eight alternate apophyses and a variable number of nematothecae. Each apophysis with one well developed, big mamelon on superior surface and two axillary nematothecae; one nematothecae between two consecutive apophyses. Secondary tubules with many nematothecae; nematothecae on primary and secondary tubules bithalamic and immobile.

Hydrocladia inserted on apophyses, alternately directed left and right of stem or branch, first internode athecate and short, with one nematotheca; distal node oblique. Remainder of hydrocladium a succession of thecate internodes with oblique nodes; each internode with one hydrotheca and four nematothecae: one mesial inferior, two lateral and one in axil behind free part adcauline hydrothecal wall. Hydrotheca deep cup-shaped, of uniform diameter, adcauline wall adnate for c. half its length, free part straight, abcauline wall straight; hydrothecal aperture circular, perpendicular to hydrothecal length axis, rim smooth. Mesial inferior nematotheca bithalamic, immov-

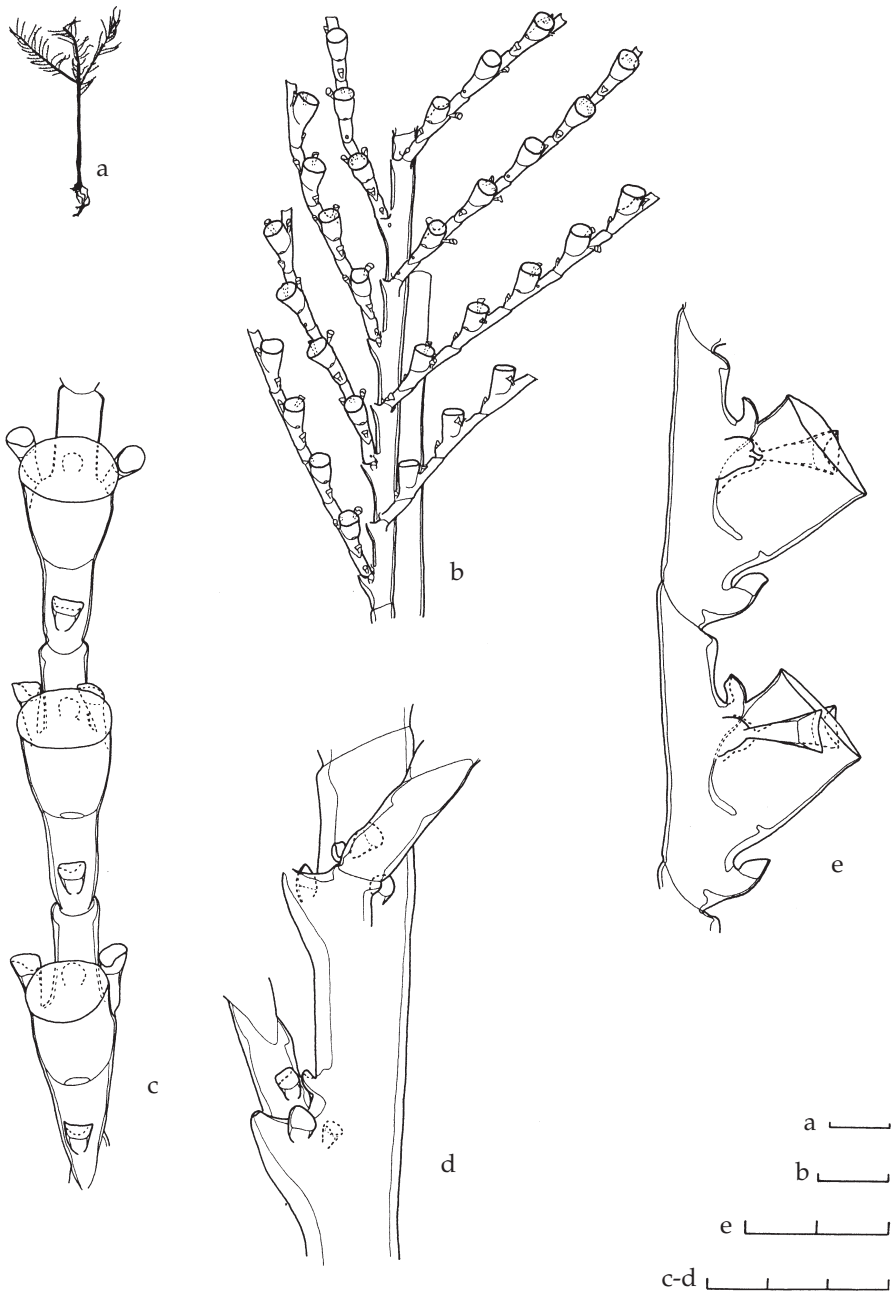


Fig. 95. *Pseudoplumaria marocana* (Billard, 1930), Stn MAU 072. a, colony; b, detail of colony, oblique view; c, hydrocladial internodes, frontal view; d, detail of apophyses, oblique view; e, hydrocladial internodes, lateral view. Scales: a, 1 cm; b, 0.5 mm, c-d, 0.3 mm; e, 0.2 mm.

able; lateral nematothecae inserted on small apophyses on both sides of hydrotheca, conical, bithalamic and movable. Axillar hydrotheca much reduced, scale-shaped.

Gonothecae absent.

Table LVI. Measurements of *Pseudoplumaria marocana* in μm:

	Stn MAU 072
Height of colony (in mm)	35-91
Athecate internode, length	220-270
Diameter at node	85-90
Thecate internode, length	330-450
Diameter at node	60-80
Hydrotheca, depth	170-195
Length free part adcauline wall	70-95
Diameter at rim	150-180
Mesial nematotheca, length	50-60
Diameter at rim	30-40
Lateral nematotheca:	80-115
Diameter at rim	50-60

Discussion.— This species was placed in *Pseudoplumaria* by Ramil & Vervoort (1992c) because of the presence of nematothecae on the gonothecae. This genus differs from *Polyplumaria* by the absence of branched hydrocladia (Ramil & Vervoort, 1992c).

The CANCAP material is generally smaller than that recorded by Ramil & Vervoort (1992a), but it agrees in morphological characters. The size difference could result from the difference in depth between the two collections, the CANCAP material being collected between 28 and 52 m, that described by Ramil & Vervoort (1992a) came from between 356 and 1378 m depth.

Reproduction.— CANCAP material taken in June has no gonothecae. Billard (1930) described fertile material collected in Juli; Ramil & Vervoort (1992c) found such material in October.

Distribution.— The species is restricted to the eastern Atlantic where it has been found south-west of Cape San Vicente (Ramil & Vervoort, 1992a, as *Plumularia marocana*, 1992c), the Atlantic coasts of the Strait of Gibraltar (Medel & Vervoort, 1995), Ampére Bank (Ramil, Vervoort & Ansín, 1998), several localities off the coast of Morocco (Billard, 1930; Patriti, 1970; Ramil & Vervoort, 1992a, all as *P. marocana*) and Guinea Bissau (Gili, Vervoort & Pages, 1989, as *Polyplumaria flabellata*).

The bathymetrical distribution is between 27 (Medel & Vervoort, 1995) and 1378 m (Ramil & Vervoort, 1992a).

CANCAP material was taken at a single station off Mauritania between 28 and 57 m depth.

Epibionts.— Stn MAU 072: *Plumularia setacea* (L., 1758).

Pseudoplumaria spec.
(figs 96-97)

Material.— **Canary Islands and Selvagens Archipelago:** Stn 2.130: One colony with a damaged, immature gonotheca (RMNH-Coel. 28573, two slides 4759).

Description.— Hydrorhiza absent; hydrocaulus polysiphonic, with one polysiphonic ramification, originating from a secondary tubule. Principal tube of stem and branch divided into internodes of varied length with oblique nodes, only visible in distal part of stem and branch; each internode with three to six alternate apophyses and a varied number of nematothecae. Apophyses with big, well developed mamelon on superior surface and two nematothecae in the axil; between two consecutive apophyses there are two to four nematothecae; secondary tubules with numerous nematothecae.

Hydrocladia inserted on apophyses, alternately directed left or right on stem and branch; first internode short, with one nematotheca and oblique distal node. Remainder of hydrocladium a succession of internodes separated by oblique nodes, visible only in first two or three internodes; in following internodes there is only the indication of a node under mesial inferior hydrotheca. Each internode with one hydrotheca and six nematothecae: one mesial inferior, two lateral and three supracalycine. Hydrotheca more or less cup-shaped, deep, adcauline wall almost fully adnate; abcauline wall straight, aperture circular, tilted downwards; rim smooth. Mesial inferior nematotheca slightly surpassing hydrothecal base; lateral nematothecae inserted on small apophyses at one third of hydrothecal length from rim, distinctly surpassing that rim. Supracalycine nematothecae placed in one row. All nematothecae conical, bithalamic and movable.

Only gonotheca present is damaged and immature, springing from a hydrocladial apophysis; it is swollen, ovoid, with greatest diameter in middle and it has no nematothecae.

Variability.— Some hydrocladial internodes have four supracalycine nematothecae. Cauline internodes, after damage and subsequent regeneration, have one apophysis only.

Table LVII.Measurements of *Pseudoplumaria* spec. in µm:

	Stn 2.130
Height of colony (in mm)	59
First athecate internode, length	330-400
Diameter at node	90-110
Following hydrocladial internode, length	670-800
Diameter at node	80-110
Hydrotheca, depth	170-220
Length free part adcauline wall	10-15
Diameter at rim	125-160
Mesial nematotheca, length	70-100
Diameter at rim	36-50
Lateral nematotheca, length	85-120
Diameter at rim	38-52

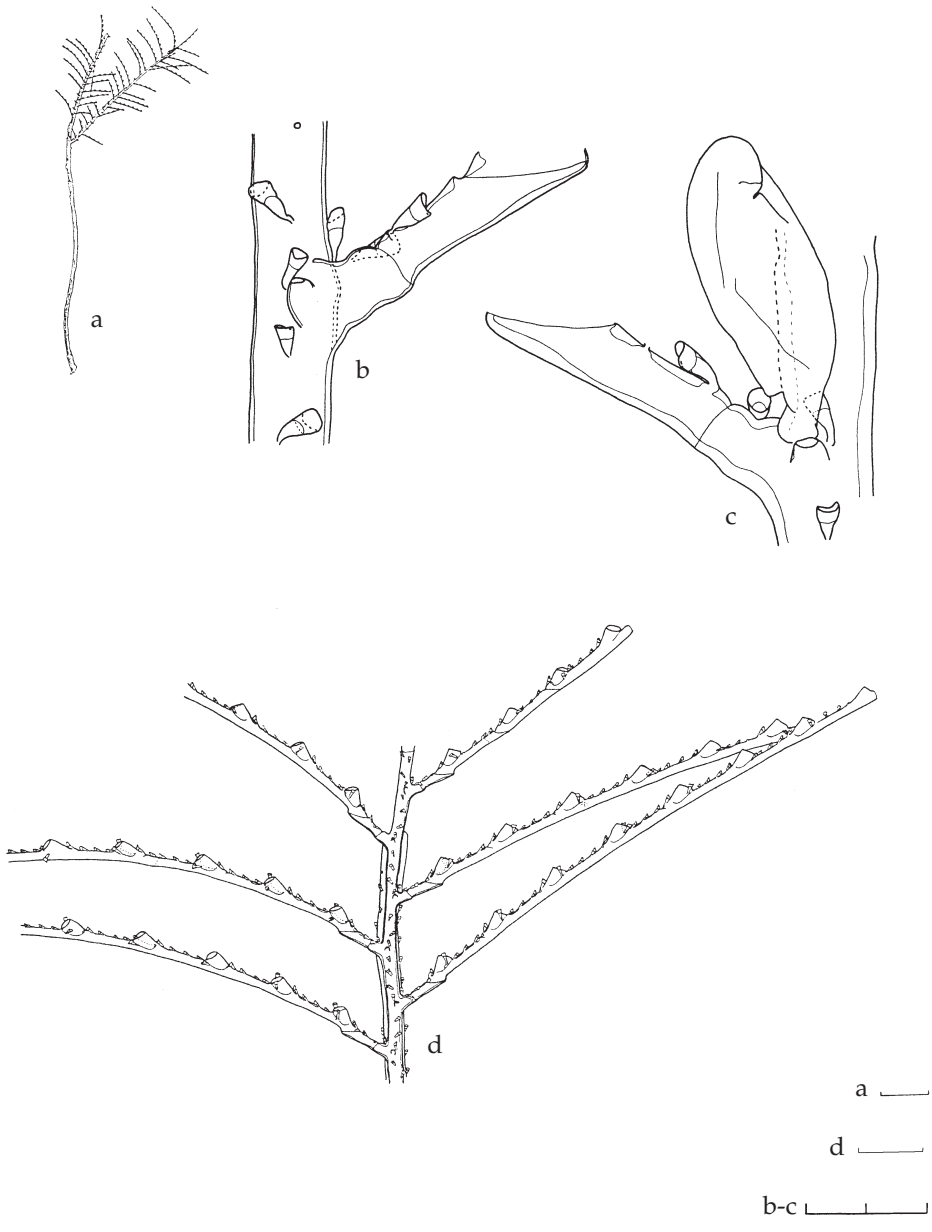


Fig. 96. *Pseudoplumaria* spec., Stn 2.130. a, colony; b, detail of apophysis, lateral view; c, apophysis with damaged gonotheca, lateral view; d, detail of colony, frontal view. Scales: a, 1 cm; b-c, 0.2 mm; d, 0.5 mm.

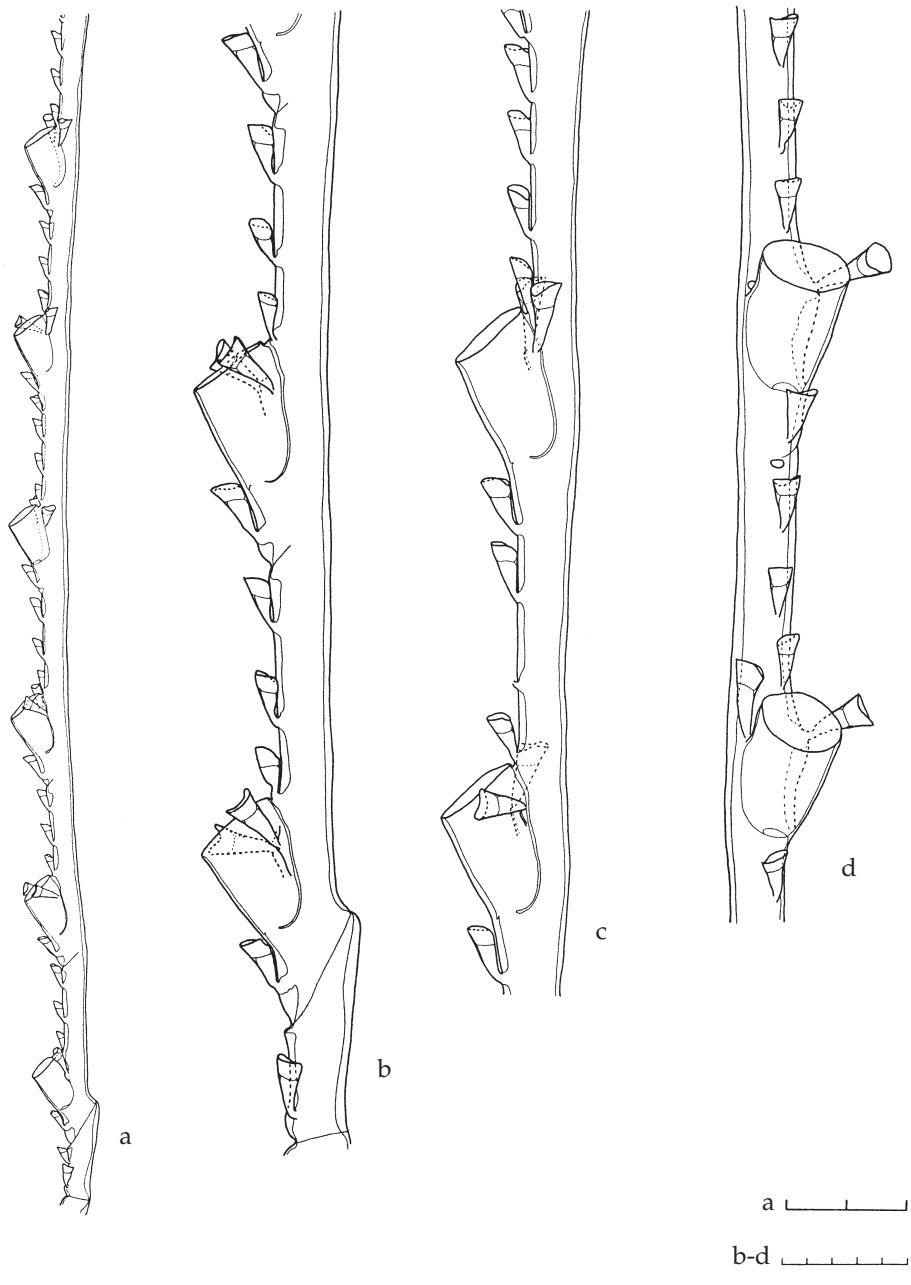


Fig. 97. *Pseudoplumaria* spec., Stn 2.130. a, hydrocladium, lateral view; b, basal part of hydrocladium, lateral view; c, distal part of hydrocladium, lateral view; d, part of hydrocladium, latero-frontal view. Scales: a, 0.5 mm; b-d, 0.2 mm.

Supracalycine nematotheca, length	70-100
Diameter at rim	40
Gonotheca, length*	480
Maximum diameter*	200

* Immature and damaged gonotheca.

Discussion.— This material has only a single immature and damaged gonotheca; presence or absence of nematothecae cannot unambiguously be stated. Yet we consider it to belong in the genus *Pseudoplumaria* because of the strongly polysiphonic hydrocaulus and branches and the presence of a big, well developed mamelon on the apophyses. The absence of branched hydrocladia excludes the genus *Polyplumaria* with which it shows similarity. Two species have so far been ascribed to *Pseudoplumaria*: *Pseudoplumaria marocana* (Billard, 1930) and *Pseudoplumaria sabinae* Ramil & Vervoort, 1992. From those species the present material differs by the morphology of the hydrotheca, that has the adcauline wall almost completely adnate and by the number and disposition of the nematothecae on the hydrocladial internodes: one mesial inferior, two lateral and three supracalycine. In *P. marocana* half the adcauline hydrothecal wall is free and four nematothecae occur on the thecate internodes: one mesial inferior, two lateral and one reduced, scale-shaped axillary nematotheca; exceptionally there is a fifth nematotheca on the distal part of the internode. In *P. sabinae* the adcauline hydrothecal wall is one-third free and the thecate internodes have six to eight nematothecae: one mesial inferior, two pairs of lateral nematothecae and two or three supracalycine.

Reproduction.— Gonothecae are present on material collected in September.

Distribution.— *Pseudoplumaria* spec. has been collected at one station near the Canary Islands between 1500 and 1800 m.

Unidentifiable material

Antennella/Halopteris spec.

Azores area: Stn 5.153:. Much damaged material; identification impossible (RMNH-Coel. 29091 = slide 4641).

Nemertesia spec.

Canary Islands and Selvagens Archipelago: Stn 4.090: Damaged colony without gonothecae (RMNH-Coel. 28729). This material is similar to *Nemertesia ramosa* (Lamarck, 1816) as the colony is branched; no hydrocladia.

Plumularia spec.

Cape Verde Islands: Stn 6.048: Damaged fragment without gonothecae. This material is plumularioid and has therefore been included in this genus, but it may also be a young colony of *Nemertesia* (RMNH-Coel. 29125 = slide 4750).

Biogeographical considerations

The distribution patterns considered in this chapter are based on the zoogeographical groups discussed by Boero & Bouillon (1993), with some modifications proposed by Altuna Prados (1994a) and Peña Cantero (1995).

Of the total number of 46 species, belonging to the superfamily Plumularioidea and discussed in the present report, 43 have been listed in table LVIII and their main geographical distribution is indicated. Two species, *Aglaophenia trifida* L. Agassiz, 1862, and *Cladocarpus alatus* Jarvis, 1922, that do not occur in the area studied but have been discussed, five new species, *Aglaophenia svobodai* spec. nov, *Streptocaulus caboverdensis* spec. nov., *S. chonae* spec. nov., *Antennella confusa* spec. nov. and *Nemertesia anonyma* spec. nov. as well as those identified at generic level, have not been included in table LVIII.

Antennella secundaria (Gmelin, 1791) and *Plumularia setacea* (Linnaeus, 1758), usually considered cosmopolitan species, have been included here in the circumglobal group, because they have not been collected in Antarctic waters.

Table LVIII. The geographical distribution of the various species discussed. **CG**: circumglobal; **CT**: circumtropical; **AA**: amphi-Atlantic; **BA**: boreo-Atlantic; **EA**: Eastern Atlantic; **AM**: Atlantic-Mediterranean; **E**: endemic; **NC**: non classifiable.

Aglaophenia acacia Allman, 1883	AA
Aglaophenia kirchenpaueri (Heller, 1868)	AM
Aglaophenia latecarinata Allman, 1877	CT
Aglaophenia lophocarpa Allman, 1877	AA
Aglaophenia octodonta (Heller, 1868)	AM
Aglaophenia parvula Bale, 1882	CT
Aglaophenia picardi Svoboda, 1979	AM
Aglaophenia pluma (Linnaeus, 1758)	CG
Aglaophenia tubulifera (Hincks, 1861)	EA
Gymnangium sinuosum (Fraser, 1925)	AA
Lytocarpia distans (Allman, 1877)	AA
Lytocarpia myriophyllum (Linnaeus, 1758)	AA
Macrorhynchia philippina (Kirchenpauer, 1872)	CT
Nematophorus clarkei (Nutting, 1900)	AA
Streptocaulus corneliusi (Ramil & Vervoort, 1992)	AM
Streptocaulus dollfusi (Billard, 1924)	AM
Streptocaulus pectiniferus (Allman, 1883)	BA
Streptocaulus pulcherrimus Allman, 1883	E
Streptocaulus sinuosus (Vervoort, 1966)	EA
Antennella campanulaformis (Mulder & Trebilcock, 1909)	NC
Antennella secundaria (Gmelin, 1791)	CG
Antennella siliquosa (Hincks, 1877)	AM
Halopteris alternata (Nutting, 1900)	AA
Halopteris carinata Allman, 1877	AA
Halopteris catharina (Johnston, 1833)	AA
Halopteris diaphana (Heller, 1868)	CT
Halopteris polymorpha (Billard, 1913)	CT
Monostaechas quadridens (McCrady, 1859)	CG
Kirchenpaueria bonnevieae (Billard, 1906)	NC

Kirchenpaueria halecioides (Alder, 1859) ..... CT
Kirchenpaueria pinnata (Linnaeus, 1758) ..... CG
Monotheca margaretta Nutting, 1900 ..... AA
Nemertesia antennina (Linnaeus, 1758) ..... CG
Nemertesia belini Bedot, 1916 ..... E
Nemertesia falcicula (Ramil & Vervoort, 1992) ..... AM
Nemertesia norvegica (G.O. Sars, 1874) ..... BA
Nemertesia perrieri (Billard, 1901) ..... NC
Nemertesia ramosa (Lamarck, 1816) ..... EA
Nemertesia ventriculiformis (Marktanner-Turneretscher, 1890) ..... AM
Plumularia floridana Nutting, 1900 ..... CT
Plumularia setacea (Linnaeus, 1758) ..... CG
Polyplumaria flabellata G.O. Sars, 1874 ..... EA
Pseudoplumaria marocana (Billard, 1930) ..... AM

Analysis of the geographical distribution patterns of the species listed shows two main groups. The first group (37%) includes species with a wide distribution (circumglobal, circumtropical and non classifiable) whereas the second group (63%) is formed by species with an Atlantic and Atlantic-Mediterranean distribution, the highest percentages relating to amphi-Atlantic and Atlantic-Mediterranean species.

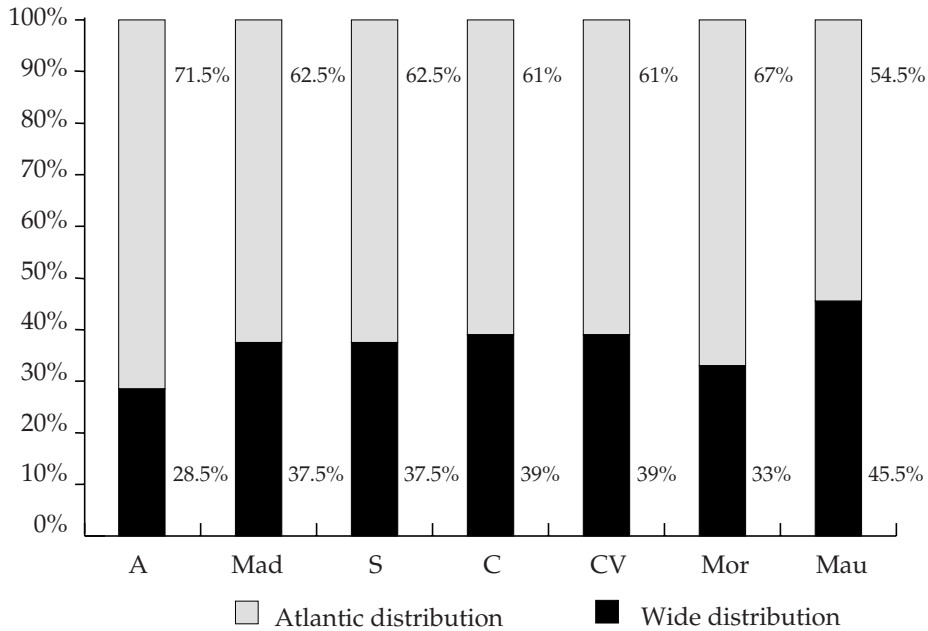
Table LIX. Geographical distribution of species recorded from each region of the area studied. **A**: Azores; **Mad**: Madeira; **S**: Selvagens; **C**: Canary Islands; **CV**: Cape Verde Islands; **Mor**: Morocco; **Mau**: Mauritania; **N**: number of species.

	A		Mad		S		C		CV		Mor		Mau	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
CG	4	29	4	25	3	37.5	5	22	3	17	1	±11	3	27.5
CT	0	0	2	12.5	0	0	2	8.5	3	17	1	±11	1	9
AA	3	21.5	4	25	2	25	5	22	6	33	2	±22	2	18
BA	2	14	1	6	1	12.5	0	0	0	0	0	0	0	0
EA	3	21.5	3	19	1	12.5	2	8.5	1	5.5	2	±22	0	0
AM	1	7	2	12.5	1	12.5	7	30.5	2	11	2	±22	4	36.5
E	1	7	0	0	0	0	0	0	2	11	0	0	0	0
NC	0	0	0	0	0	0	2	8.5	1	5.5	1	±11	1	9
Total	14	100	16	100	8	100	23	100	18	100	9	±100	11	100

Table LIX shows that species with a wider geographical distribution have the highest percentage in Mauritania (45.5%) and the lowest in the Azores (29%); in the remaining regions the percentage is similar, c. 37%. However, there are some differences among the regions of the CANCAP area as far as species with an Atlantic distribution are concerned. Amphi-Atlantic species have a high percentage in the Cape Verde Islands (33%), while in the remaining area it is c. 22%, with the exception of Mauritania where it is lower, not reaching 20%. Boreo-Atlantic species are only present in the Azores (14%), Madeira (6%) and the Selvagens archipelago (12.5%) whereas eastern Atlantic species show a high percentage in Morocco (±22%) and the Azores

(21.5%) but are absent in Mauritania. Species with Atlantic-Mediterranean distribution have the highest percentages in Mauritania (36.5%), Canary Islands (30.5%) and Morocco (±22%), being lowest in the Cape Verde Islands (11%) and the Azores (7%).

Graph 1. Geographical distribution of species recorded from each region split in two groups: species with a wide distribution and species with Atlantic distribution. (Legends in table LIX).



Noteworthy is the importance of species of Plumularioidea with an Atlantic distribution in the area under study, as well as the low percentage of endemism (4.5%), that is only represented by two species: *Streptocaulus pulcherrimus* Allman, 1883 and *Nemertesia belini* Bedot, 1916. The species of the superfamily Plumularioidea lack a medusa stage and a higher percentage of endemism might have been expected considering the considerable distance from the continental coasts. Though in southern England and north-western France as well as at the Atlantic coast of the Iberian Peninsula there are no endemic species, this percentage is ±14 in the Mediterranean (Boero & Bouillon, 1993) and ±30 at the South African coast (Millard, 1975). Nevertheless, although a medusa stage is important for rapid distribution of the species, in the opinion of Boero & Bouillon (1993) the distribution of hydroid species does not depend on their modes of dispersal, but rather on their limits of environmental tolerance.

Several authors (Rees & White, 1966; Briggs, 1974; Cornelius, 1992b) emphasize the influence of hydrographical conditions on the composition of the fauna in the Macaronesian area. The Azores current, a water mass considered an extension of the Gulf Stream, has its origin in the transition zone between this current and the North Atlantic current, it moves east along the 35°N parallel and reaches the continental

slope of Morocco (Klein & Siedler, 1989; Fernández & Pingree, 1996). Though the connection between the Azores and the North Equatorial currents is not clear, the Azores current moves south towards Madeira and joins the Canary current (Fernández & Pingree, 1996), that has influence over the remainder of the area studied. Moreover, the Equatorial countercurrent, originating in the western Atlantic, affects the Cape Verde Islands (Briggs, 1974). Other currents with influence in this region are the bottom current (beneath 2000 m) coming from the North Atlantic and the mid-water current (between 600 and 2000 m) originating from the Mediterranean and reaching the Azores (Cornelius, 1992b).

The Equatorial countercurrent distinctly influences the coastal fish populations of the Cape Verde Islands (Briggs, 1974). The presence of this current may explain the high number of amphi-Atlantic species in these islands.

Rees & White (1966), when discussing the Azores hydroid fauna, emphasize that the littoral fauna of these islands contains many forms common to both sides of the Atlantic whereas the deep water species have a wider distribution in deep strata of the Atlantic. In their opinion many of the species collected at the Azores seem to belong to a fauna that could have been dispersed by oceanic circulation while attached to floating substrates (rafting). Cornelius (1992b) considered it quite unlikely that species with a short-lived dispersive stage can independently reach island coasts, but he indicated that for hydroids lacking medusa stage, rafting seems the only feasible way of reaching these islands.

Acknowledgements

In the course of our research of the material and the preparation of the manuscript we received help from various sources. We are grateful to the authorities of the institutes that helped us by the loan of material. We are ,amongst others, most grateful to the following scientists: Dale Calder, Royal Ontario Museum, Toronto, Canada; the late Koos den Hartog, National Museum of Natural History, Leiden, The Netherlands, whose sad and untimely death happened during the last stages of the preparation of the manuscript; Leen van Ofwegen, National Museum of Natural History, Leiden, and Armin Svoboda, Ruhr Universität, Bochum, Germany.

References

Only those not listed in Vervoort, 1995, are mentioned here.

Agassiz, L., 1862. Contributions to the natural history of the United States of America, 4: 1-380.— Boston.

Agassiz, A., 1865. North American Acalephae. In: Illustrated Catalogue of the Museum of Comparative Zoology, at Harvard College, 2: 1-234, figs.— Cambridge, Mass.

Alder, J., 1859. Descriptions of three new species of sertularian zoophytes.— Ann. Mag. nat. Hist., (3)3: 353-356.

Allman, G.J., 1874. Report on the Hydroida collected during the expedition of H.M.S. "Porcupine".— Trans. Zool. Soc. Lond., 8(8): 469-481, pls 65-68.

Allman, G.J., 1877. Report on the Hydroida collected during the exploration of the Gulf Stream by L.F. De Pourtalès, assistant United States Coast Survey.— Mem. Mus. Comp. Zoöl., 5(2): 1-66, pls 1-34.

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

Allman, G.J., 1885. Description of Australian, Cape, and other Hydroida, mostly new, from the collection of Miss H. Gatty.— J. Linn. Soc. Lond., Zool., 19: 132-160.

Álvarez-Claudio, C., 1995. Some records of the superfamily Plumularioidea L. Agassiz, 1862 (Cnidaria, Hydrozoa) from the Bay of Biscay.— Misc. Zool., 18: 9-20.

Álvarez Claudio, C. & N. Anadón, 1995. Hidrozoos bentónicos de la plataforma y el talud continentales de Asturias (mar Cantábrico). In: Actas del IV Coloquio internacional sobre Oceanografía del Golfo de Vizcaya, 1995: 237-240, fig. 1.

Ansín Agís, J.A., 1992. Hidrozoos de la Ría de Vigo. Tesis de Licenciatura, Universidad de Vigo: 1-282, pls 1-60.

Ansín Agís, J.A., in prep. Notes on the species of the leptolid genus *Nemertesia* Lamouroux, 1812 (Cnidaria, Hydrozoa, Leptolida).

Arévalo y Carretero, C., 1906. Contribución al estudio de los Hidrozoarios españoles existentes en la Estación de Biología marítima de Santander.— Mems Soc. esp. Hist. nat., 4(3): 79-109, pls 13-19.

Bale, W.M., 1882. On the Hydroida of South-Eastern Australia, with descriptions of supposed new species, and notes on the genus *Aglaophenia*.— J. microsc. Soc. Vict., 2(1): 15-48, pls 12-15.

Bale, W.M., 1884. Catalogue of the Australian hydroid zoophytes: 1-198.— Australian Museum, Sydney.

Bale, W.M., 1887. The genera of the Plumularidae, with observations on various Australian hydroids.— Trans. Proc. R. Soc. Vict., 23: 73-110.

Bale, W.M., 1888. On some new and rare Hydroida in the Australian Museum collection.— Proc. Linn. Soc. N.S.W., (2)3(2): 745-799, pls 12-21.

Billard, A., 1901a. Note sur l'*Antennularia antennina* Lin. et sur l'*A. perrieri* n. sp.— Bull. Mus. Hist. nat. Paris, 7: 68-75, figs 1-3.

Billard, A., 1901b. Note sur la *Polyplumularia flabellata* G. O. Sars. et sur l'*Halicornaria ferlusi* n. sp.— Bull. Mus. Hist. nat. Paris, 7: 117-121, figs.

Billard, A., 1902. Les hydroïdes de la Baie de la Hougue.— Bull. Mus. Hist. nat. Paris, 8(7): 531-536.

Billard, A., 1903. Note sur les variations du *Plumularia halecioides* Alder.— Bull. Mus. Hist. nat. Paris, 1903(2): 57-62.

Billard, A., 1904a. Contribution à l'étude des Hydroïdes (multiplication, regeneration, greffes, variations).— Annls Sci. nat., Zool. (8)20: 1-251, pls 1-6.

Billard, A., 1904b. Hydroïdes récoltés par M. Ch. Gravier dans le Golfe de Tadjourah.— Bull. Mus. Hist. nat. Paris, 10: 480-485, figs.

Billard, A., 1906a. Hydroïdes. In: Mission des pêcheries de la côte occidentale d'Afrique, III.— Actes Soc. linn. Bordeaux, 61 [= (7)1]: 173-180, figs.

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

Billard, A., 1906c. Note sur les Hydroïdes du Travailleur et du Talisman.— Bull. Mus. natn. Hist. nat. Paris, 12: 329-334.

Billard, A., 1907. Hydroïdes de Madagascar et du Sud-Est de l'Afrique.— Archs Zool. exp. gén., (4)7(8): 335-396, pls 25-26.

Billard, A., 1910. Revision d'une partie de la collection des hydroïdes du British Museum.— Annls Sci. nat., Zool. (9)11: 1-67.

Bonnevie, K., 1899. Hydroida. In: Den Norske Nordhavs-Expedition 1876-1878, 26, Zoologi: 1-104, pls 1-8, 1 map.

Brinckmann-Voss, A., 1996. Seasonality of hydroids (Hydrozoa, Cnidaria) from an intertidal pool and adjacent subtidal habitats at Race Rock, off Vancouver Island, Canada. In: S. Piraino, F. Boero, J. Bouillon, P.F.S. Cornelius & J.M. Gili, eds, Advances in hydrozoan biology.— Scientia Marina, 60(1): 89-97, figs 1-5, tabs 1-3.

Broch, H., 1903. Die von dem norwegischen Fischereidampfer «Michael Sars» in den Jahren l900-1902 in dem Nordmeer gesammelten Hydroiden.— Bergens Mus. Aarb., 1903(9): 1-14, pls 1-4, tab. 1.

Broch, H., 1910. Die Hydroiden der Arktischen Meere.— Fauna Arctica 5(1): 127-248, figs 1-46, pls 2-4.

Browne, E.T., 1907. The Hydroids collected by the «Huxley» from the north side of the Bay of Biscay in August 1906.— J. mar. biol. Ass. U.K., n. ser. 8(1): 15-36, pls 1-2.

Calder, D.R., 1997. Shallow-water hydroids of Bermuda: (Superfamily Plumularioidea).— Life Sci. Contr. R. Ontario Mus., 161: 1-85, figs 1-21.

Calder, D.R. & P.F.S. Cornelius, 1996. *Plumularia* Lamarck, 1816 (Cnidaria, Hydrozoa): proposed conservation by the designation of *Sertularia setacea* Linnaeus, 1758 as the type species.— Bull. zool. Nom., 53(3): 167-170.

Carus, J.V., 1884. Prodromus faunae mediterraneae sive descriptiones animalium Mare Mediterranei incolarum quam comparata silva rerum quatenus innotuit adiectis locis et nominibus vulgaribus eorumque auctoribus in commodum zoologorum, pars 1: 1-524.— Stuttgart.

Castric, A., A. Girard, & C. Michel, 1991. Roches sous-marines de Bretagne. Flore et faune fixées. Laboratoire de Biologie Marine, Concarneau: 1-116, figs.— Brest.

Clarke, S.F., 1879. Report on the Hydroida collected during the exploration of the Gulf Stream and Gulf of Mexico by Alexander Agassiz, 1877-78. In: Reports on the dredging operations of the U.S. coast survey str. "Blake".— Bull. Mus. comp. Zoöl. Harv. Coll., 5(10): 239-252, pls 1-5.

Congdon, E.D., 1907. The hydroids of Bermuda. - Proc. Am. Acad. Arts Sci., 42: 463-485, figs.

Cornelius. P.F.S., 1995. North-West European Thecate Hydroids and their Medusae. Part 2. Sertulariidae to Campanulariidae. In: R.S.K. Barnes & J.H. Crothers, eds, Synopses of the British Fauna (New Series), 50: i-vii, 1-386, figs 1-71.

D'Orbigny, 1839-46. Zoophytes. In: Voyage dans l'Amérique méridionale, executé pendant les années 1826-1833, 5(4): 7-28, pls 1-13 (1846).

Estrada, B., 1979. Contribución al estudio de la epifauna sesil del litoral gallego. Hidropólipos: 1-93, figs 1-24. Tesina de Licenciatura, Univ. Santiago, Inédita.

Fernández, E. & Pingree, R.D., 1996. Coupling between physical and biological fields in the Nord Atlantic Subtropical front Southeast of the Azores.— Deep-Sea Research, 43(9): 1369-1393.

Fewkes, J.W., 1881. Report on the Acalephae. In: Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Caribbean Sea, in 1878, 1879, and along the Atlantic coast of the United States, during the summer of 1880, by the U.S. Coast Survey Steamer Blake.— Bull. Mus. comp. Zoöl. Harv., 8: 127-140, pls 1-4.

Gili, J.M., 1979. Cnidarios bentónicos de las islas Medes (Girona).— Res. 1er Simp. Est. Bentos Marino, 2: 123-147.

Gili, J.M., A. García & P.L. Colomer, 1984. Els cnidaris bentònics de les illes Medes. In: Els sistemes Naturals de les Illes Medes: 407-427.— Barcelona.

Gmelin, J.F., 1791. In: C. Linnaeus, Systema naturae. Thirteenth edition, edited by J.F. Gmelin. Vol. 1, part 6 (Vermes): 3021-3910.— Lipsiae.

Hargitt, C.W., 1908. Notes on a few coelenterates of Woods Hole.— Biol. Bull. mar. biol. Lab. Woods Hole, 14(2): 95-120.

Hartog, J.C. den, 1984. An introduction to the CANCAP-project of the Dutch Rijksmuseum van Natuurlijke Historie (RMNH), with special reference to the CANCAP-VI expedition (1982) to the Cape Verde Islands.— Cour. Forsch. Inst. Senckenberg, 68: 5-15.

Hartog, J.C. den & M.S.S. Lavaleye, 1981. Report on a shore collecting trip to the Azores (12 September - 1 November 1979), including a list of collecting stations.— Bocagiana, 61: 1-15.

Heller, C., 1868. Die Zoophyten und Echinodermen des Adriatischen Meeres.— Verh. k. Zool. Bot. Ges. Wien, 18, Beilage: 1- 88, pls 1-3.

Hincks, T., 1861. A catalogue of the zoophytes of South Devon and South Cornwall.— Ann. Mag. nat. Hist., (3)8: 152-161; 251-262; 290-297; pls 6-8.

Hincks, T., 1868. A history of the British hydroid zoophytes. Volume 1: i-lxviii + 1-338, frontispiece, figs 1-45; volume 2: pls 1-67.— London.

Hincks, T., 1872. Contributions to the history of the Hydroida.— Ann. Mag. nat. Hist., (4)10: 385-395, pls 20-21.

Hincks, T., 1877. Contributions to the history of the Hydroida.— Ann. Mag. nat. Hist., (4)19: 148-l52, pl. 12.

Jäderholm, E., 1896. Ueber aussereuropäische Hydroiden des zoologischen Museums der Universität Upsala.— Bih. K. svenska VetenskAkad. Handl., 21, Afd. 4(6): 1-20, pls 1-2.

Jäderholm, E., 1903. Aussereuropäischen Hydroiden im schwedischen Reichsmuseum.— Ark. Zool., 1: 259-312, pls 12-15.

Jäderholm, E., 1909. Northern and arctic Invertebrates in the collection of the Swedish State Museum (Riksmuseum). IV. Hydroidea.— K. svenska VetenskAkad. Handl., 45(1): 1-124, pls 1-12.

Johnston, G., 1833. Illustrations in British zoology.— Mag. nat. Hist., 6: 497-499.

Kingsley, J.S., 1910. A synopsis of the fixed hydroids of New England.— Tufts Coll. Stud., 3(1): 13-38, pls 2-8.

Kirchenpauer, G.H., 1872. Ueber die Hydroidenfamilie Plumularidae einzelne Gruppen derselben und ihre Fruchtbehälter. I. *Aglaophenia*.— Abh. Geb. Naturw. Hamburg., 6(2-3): 1-58, pls 1-8.

Kirchenpauer, G.H., 1876. Ueber die Hydroidenfamilie Plumularidae, einzelne Gruppe derselben und ihre Fruchtbehälter. II. *Plumularia* und *Nemertesia*.— Abh. Geb. Naturw. Hamburg, 6(2): 1-59, pls 1-8.

Kirkpatrick, R., 1890. Hydroida and Polyzoa. In: Reports on the zoological collections made in Torres Straits by professor A.C. Haddon, 1888-1889. Hydroida and Polyzoa.— Scient. Proc. R. Dubl. Soc., n. ser. 6: 603-626, pls 14-17.

Klein, B. & G. Siedler, 1989. On the origin of the Azores Current.— J. Geophysical Research, 94: 6159-6168.

Kühn, A., 1909. Sprosswachstum und Polypenknospung bei den Thecaphoren. Studien zur Ontogenese und Phylogenese der Hydroiden.— Zool. Jb., Anat. 28: 387-476, pls 17-22.

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

Lamouroux, J.V.F., 1816. Histoire des polypiers coralligènes flexibles vulgairement nommés zoophytes: i-xxxiv, 1-560, pls 1-19.— Caen.

Land, J. van der, 1987a. Report on the CANCAP-project for marine biological research in the Canarian - Cape Verdean region of the North Atlantic Ocean. Part I. List of stations.— Zool. Verh., Leiden 243: 1-94.

Land, J. van der, 1987b. TYRO Mauritania-II 1988. CNROP, Nouadhibou – RMNH, Leiden – ITZ, Amsterdam + Univ. Brussels – Univ. Leiden: 1-17.— Leiden.

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

McCrady, J., 1857, 1859. Gymnopthalmata of Charleston Harbor.— Proc. Elliott Soc. nat. Hist., 1: 103-104 (1857); 105-221, pls 8-12 (1859).

Marine Biological Association, 1904. Plymouth marine invertebrate fauna. Being notes of the local distribution of species occurring in the neighbourhood.— J. mar. biol. Ass. U.K., n. ser. 7(2): 155-298, chart. (Hydroida: 187-200).

Marktanner-Turneretscher, G., 1890. Die Hydroiden des k.k. naturhistorischen Hofmuseums.— Annln naturhist. Hofmus., 5: 195-286, pls 3-7.

Medel, M.D. & P.J. López-González, 1996. Updated catalogue of hydrozoans of the Iberian Peninsula and Balearic Islands, with remarks on zoogeography and affinities. In: S. Piraino, F. Boero, J. Bouillon, P.F.S. Cornelius & J.M. Gili, eds, Advances in hydrozoan biology.— Scientia Marina, 60(1): 183-209, figs 1-2, tabs 1-3.

Meneghini, G., 1845. Osservazioni sull'ordine delle Sertulariee della classe dei Polipi.— Memorie R. Ist. veneto Sci., 2: 183-199, pls 12-14. (Separately: Venezia, 1845).

Migotto, A.E., 1996. Benthic shallow-water hydroids (Cnidaria, Hydrozoa) of the coast of São Sebastiao, Brazil, including a checklist of Brazilian hydroids.— Zool. Verh., Leiden 306: 1-125, figs 1-16, tabs 1-3.

Mulder, J.F. & R.E. Trebilcock, 1909. Notes on Victorian Hydroida, with descriptions of new species.— Geelong Nat., (2)4(1)(37): 29-35, pl. 1.

Nutting, C., 1895. Narrative and preliminary report of Bahama Expedition.— Bull. Lab. nat. Hist. State Univ. Iowa, 3(1-2): 1-251, pls.

Nutting, C., 1900. American hydroids. Pt. 1. The Plumularidae. Spec.— Bull. U.S. natn Mus., 4(1): 1-285, pls 1-34.

Nutting, C., 1905. Hydroids of the Hawaiian Islands collected by the steamer Albatross in 1902.— Bull. U.S. Fish Commn, 23(3): 931-959, pls 1-13.

Peña Cantero, A.L., 1995. Hidrozoos bentónicos de las Islas Chafarinas: faunística, ecología, biocenología y biogeografía: 1-589, pls 1-61, tabs. Memoria presentada para optar al Título de Doctor en Biología, Universitat de València.

Pictet, C., 1893. Étude sur les Hydraires de la Baie d'Amboine. In: M. Bedot & C. Pictet, Voyage dans l'Archipel Malais.— Revue suisse Zool., 1: 1-64, pls 1-3.

Pictet, C. & M. Bedot, 1900. Hydraires provenant des campagnes de l' "Hirondelle" (1886-1888).— Résult. Camp. scient. Prince de Monaco, 18: 1-59, pls 1-10.

Polo, L., I. Olivella, C. Gili, R. Anadón, J. Carbonell, C. Altimira & J.D. Ross, 1979. Primera aportación a la sistemática de la flora y fauna bentónicas del litoral de San Ciprián de Burela (Lugo, Galicia). In: Ier Simposio de Bentos: 333-374.

Quelch, J.J., 1885. On some deep-sea and shallow-water Hydrozoa.— Ann. Mag. nat. Hist., (5)16: 1-20, pls 1-2.

Ramil, F., W. Vervoort & J.A. Ansín, 1998. Report on the Haleciidae and Plumularioidea (Cnidaria, Hydrozoa) collected by the French SEAMOUNT 1 Expedition.— Zool. Verh., Leiden 322: 1-42, figs 1-22.

Rioja y Martín, J., 1906. Datos para el conocimiento de la fauna marina de España. Celentéreos de la estación de Biología de Santander.— Boln R. Soc. esp. Hist. nat., 6(*6)*: 275-280.

Ritchie, J., 1907. On collections of the Cape Verde Islands marine fauna, made by Cyril Crossland of St Andrews University, July to September 1904. The Hydroids.— Proc. zool. Soc. Lond., l907: 488-514, pls 23-26.

Ritchie, J., 1909. Supplementary Report on the Hydroids of the Scottish National Antarctic Expedition.— Trans. Roy. Soc. Edinburgh, 47(4): 65-101.

Ritchie, J., 1910a. The hydroids of the Indian Museum. 1. The deep-sea collection.— Rec. Indian Museum, *5*: 1-30, pl. 4.

Ritchie, J., 1910b. The marine fauna of the Mergui Archipelago, Lower Burma, collected by J.J. Simpson and R.M. Rudmose-Brown. The hydroids.— Proc. zool. Soc. Lond., 1910: 799-825, pls 76-77.

Roca Martínez, I., 1986. Estudio de los Cnidarios Bentónicos de las aguas costeras de Mallorca: 1-510, figs 1-18. Memoria presentada y leida en la Universitat de les Illes Balears el 27 de Mayo de 1986. Universitat de les illes Balears, Facultat de Ciencies, Palma de Mallorca.

Sars, G.O., 1874. Bidrag til Kundskaben om Norges Hvdroider.— Forh. VidenskSelsk. Kristiania, 1873: 91-150, pls 2-6.

Sars, M., 1857. Bidrag til kundskaben om middelhavets Littoral-Fauna, Reisebemaerkninger fra Italien. I Classis: Polypi.— Nyt Mag. Naturvid., 9: 110-164, pls 1-2.

Schuchert, P., 1997. Review of the family Halopteridídae (Hydrozoa, Cnidaria).— Zool. Verh., Leiden 309: 1-162, figs 1-51.

Stechow, E., 1907. Neue japanische Athecata und Plumularidae aus der Sammlung Dr Doflein.— Zool. Anz., 32: 192-200.

Stechow, E., 1909. Hydroidpolypen der japanischen Ostküste. 1. Theil. Athecata und Plumularidae. In: F. Doflein, Beiträge zur Naturgeschichte Ostasiens.— Abh. math. phys. Kl. bayer. Akad. Wiss., suppl. 1(6): 1-111, pls 1-7.

Stepan'yants, S.D., A. Svoboda & W. Vervoort, 1996. Problema bipolyarsnosti na materiale Medusozoa (Cnidaria). The problem of bipolarity, with emphasis on the Hydroidea (Cnidaria, Hydrozoa).— Russki gidrobiol. Zh., 1996: 5-34, fig. 1.

Théel, H., 1907. Om utvecklingen af Sveriges zoologiska hafsstation Kristineberg och om djurlifvet i angränsande haf och fjordar.— Ark. Zool., 4(5): 1-136, pls 1-5, maps 1-3.

Thornely, L.R., 1894. Supplementary report upon the hydroid zoophytes of the L.M.B.C. district.— Trans. Lpool biol. Soc., 8: 1-8, pl. 9.

Torrey, H.B., 1902. The Hydroida of the Pacific coast of North America.— Univ. Calif. Publs Zool., 1(1): 1-104, pls 1-11.

Torrey, H.B., 1904. The hydroids of the San Diego region. In: Contributions from the laboratory of the marine biological Association of San Diego, I.— Univ. Calif. Publs Zool., 2(1): 1-43, figs 1-23.

Torrey, H.B. & A. Martin, 1906. Sexual dimorphism in *Aglaophenia*.— Univ. Calif. Publs Zool., 3(4): 1-47.

Vanhöffen, E., 1910. Die Hydroiden der Deutschen Südpolar-Expedition 1901-1903.— Dt. Südpol.-Exped., 11 (= Zool., 3): 269-340, figs.

Verrill, A.E., 1879. Preliminary chek-list of the marine Invertebrata of the Atlantic coast, from Cape Cod to the Gulf of St. Lawrence: 1-32.— New Haven, Connecticut.

Versluys, J.J., 1899. Hydraires calytoblastes recueillis dans la Mer des Antilles, pendant l'une des croisières accomplies par le comte R. de Dalmas sur son Yacht Chazahe.— Mém. Soc. Zool. France, 12: 29-58, figs 1-24.

Vervoort, W., 1995. Bibliography of Leptolida (non-Siphonophoran Hydrozoa, Cnidaria).— Zool. Verh., Leiden 301: 1-432.

Wallace, W.S., 1909. A collection of hydroids made at the Tortugas, during May, June and July, 1908. In: A.G. Mayer, Department of marine biology.— Yb. Carnegie Instn Wash. 7: 136-138.

Warren, E., 1908. On a collection of hydroids, mostly from the Natal coast.— Ann. Natal Mus., 1(3): 269-355, pls 45-48.

Watson, J.E., 1996. Distribution and biogeographic relationship of the hydroid fauna of the Australian West coast: a preliminary account. In: S. Piraino, F. Boero, J. Bouillon, P.F.S. Cornelius & J.M. Gili, eds, Advances in hydrozoan biology.— Scientia Marina, 60(1): 75-83, figs 1-2, tabs 1-3.