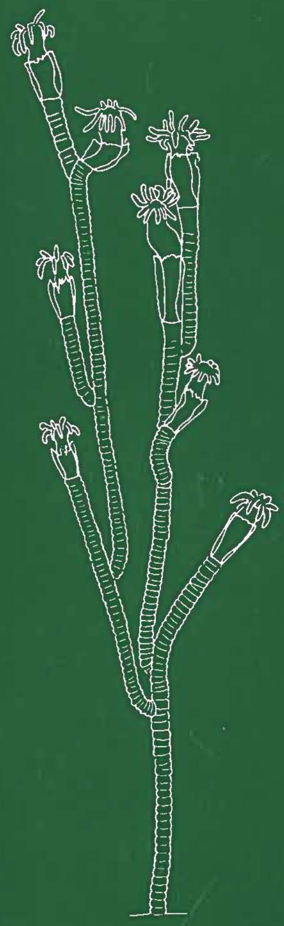
MEDDELELSER OM GRØNLAND

Hydroids of Greenland and Iceland (Cnidaria, Hydrozoa)

Peter Schuchert



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Contents

Abstract • **5**
Introduction • **6**
Material and Methods • **7**
Systematic Part • **8**
Acknowledgements • **159**
References • **160**
Appendix 1 • **172**
Appendix 2 • **176**
Appendix 3 • **178**
Index • **179**

Dedicated with much love to my wife Christine,
in appreciation of all her direct and indirect support
which enabled me to pursue my studies on hydrozoan systematics.

Abstract

Schuchert, Peter, 2001. Hydroids of Greenland and Iceland (Cnidaria, Hydrozoa). Meddelelser om Grønland, Bioscience 53. Copenhagen, The Danish Polar Center, 2001. 184 pp.

All species of thecate and athecate hydroids (excl. Stylasteridae) from Greenland and Iceland are reviewed. The revision is based predominantly on new material collected during various expeditions, but also on types and material used by previous authors. It includes also samples from the north of Greenland (Pearyland), a locality from which no hydrozoans were known so far. These samples produced the northernmost records for hydroids (82°N): *Obelia longissima*, *Lafoea dumosa*, and *Boreohydra simplex*.

The genus *Clava* is transferred to the Family Hydractiniidae. The name Cordylophoridae Lendenfeld, 1885 is used for the remaining species formerly held in the same family as *Clava*. The gonophores of *Halisiphonia arctica* are free medusae. *Halisiphonia* is therefore removed from the Lafoeidae and referred to the family Hebellidae Fraser, 1912.

New records for Greenland are: *Boreohydra simplex* Westblad, 1937; the polyp phase of *Euphysa aurata* Forbes, 1848; *Eudendrium islandicum* Schuchert, 2000; *Acaulis primarius* Stimpson, 1854; *Campanulina pumila* (Clark, 1875); *Sertularia schmidti* Kudelin, 1914; *Sertularia similis* Clark 1877; *Thuiaria articulata* (Pallas, 1766); and *Thuiaria sachalini* Kudelin, 1914.

New records for Iceland are: *Rhizogeton nudum* Broch, 1903; *Rhizorhagium roseum* Sars, 1874; *Hydractinia allmanii* Bonnevie, 1898; *Coryne loveni* (M. Sars, 1846); *Sarsia producta* (Wright, 1858); *Filellum serratum* (Clarke, 1879); *Halecium birulai* Spassky, 1929; and *Symplectoscyphus bathyalis* Vervoort, 1972.

Key words: Greenland, Iceland, benthic hydroids, Hydrozoa, taxonomy, systematics, new records, distribution, revision.

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Introduction

The origins of research on marine hydroids of Greenland and Iceland date back to the 18th century. The first Icelandic hydroids were described by Olafson & Povelsen in 1772 (cited after Kramp 1938) and only a few years later Fabricius (1780) recorded the first hydroids from western Greenland. The first records from eastern Greenland, which is more difficult to access, became known almost one century later (see Kramp 1943). Investigations were sporadic during most of the 19th century (see Kramp 1914, 1938) but intensified at the turn to the 20th century (Levinsen 1893, Saemundsson 1899, 1902, 1911). The first decades of the 20th century then saw many important contributions, e. g. by Broch (1916, 1918) and Kramp (1911-1963). Kramp (1914) compiled the history for Greenland and he lists all previous records. Likewise, Kramp (1938) reviewed all hydroid species known from Iceland. Since Kramp's studies, only few publications dealing with Greenlandic or Icelandic hydroids appeared (e. g. Vervoort 1942, Ólafson 1975).

Recently, several large, new collections from Greenland and Iceland were made available to me, which I used to revise the hydroid fauna of this region. A revision was certainly necessary as many species listed by Kramp (1914, 1938) have changed their name or are now regarded as synonyms. Additionally, the reviews of Kramp give mostly neither descriptions nor figures and they are rather useless for identifying species. Nowadays, we are lucky to have Cornelius' (1995 a & b) excellent monographs on the thecate hydroids of the British Isles and continental north-western Europe. These monographs, which include also many species present at Greenland and Iceland, make identifications of thecate hydroids also amenable to the non-specialist. However, there is no such study available for the athecate hydroids, and Greenland and Iceland harbour thecate hydroids not treated by Cornelius. The goal of this publication is therefore to provide a faunal inventory, a revision of the species involved, and an identification aid. In order to make the publication as independent as possible from older publications, all encountered species are described and depicted wherever possible.

The hydroid faunas of Greenland and Iceland are very similar and certainly deserve being treated together, despite the presence of some species more typical for warmer waters along the southern parts of Iceland. Some initial results on the Icelandic hydroids as well as an introduction to the BIOICE collection have already been published (Schuchert 2000).

The new material from Greenland also included hydroids from the northern end of the island (see Just 1970), a region never examined for hydroids before. With this material from Jørgen Brønlund Fjord it was possible to document the northernmost hydroids known so far. The species found were: *Obelia longissima, Lafoea dumosa, Boreohydra simplex,* and a hydroid tentatively identified as *Halitholus yoldiaarcticae.*

Material and Methods

The new material on which most of this study is based is in the collections of the Icelandic Museum of Natural History (BIOICE material, see Tendal 1998), the Zoological Museum of Copenhagen (ZMUC, various expeditions, see appendix 2) and the Zoological Museum of Oslo (Hoels expedition material). Some material was also collected by myself during a stay at Sandgerði, Iceland. All material was returned to the original museums, but some reference micro-slides were also deposited in the Geneva Museum of Natural History.

Wherever possible, all species are described and depicted. This was done on one hand to have a study that is largely independent of older publications, and on the other to document differences to material from other regions of the world. Figures with magnification higher than 20 times were usually drawn with a *camera lucida*. It is thus possible to make direct measurements in the given figures and therefore only few measurements were made. Actual size is usually only of minor importance in hydrozoan taxonomy as the values can vary so drastically, attributable to the large phenotypic – and possibly genotypic – variability of these animals. For the figures typical specimens were chosen or the extent of variation is also depicted.

Taxonomy

Definitions and explanations of technical terms used in this study can be found in Millard (1975), Cornelius, (1995 a & b), and Schuchert (1996). Nematocysts of preserved material were examined by immersing the material in 50% lactic acid.

Most of the definitions also agree with Cornelius (1995a & b). The few species of Stylasteridae, although belonging to the Anthoathecata, are not treated here. Cairns (1986a), Zibrowius & Cairns (1992) and Zibrowius (in press) should be consulted for recent revisions of the stylasterid fauna of the North Atlantic.

If not stated otherwise, the scopes of the supraspecific taxa used here correspond to Millard (1975), Bouillon (1985), Cornelius (1995a & b) and Schuchert (1996).

List of abbreviations

f	ratio of length of free adcauline part of hydrotheca and hydrothecal diameter
ICZN	International Code of Zoological Nomenclature
IMNH	Icelandic Museum of Natural History
IRSNB	Institut Royal des Sciences Naturelles, Bruxelles
MHNG	Muséum d'Histoire Naturelle Genève, Switzerland
r	ratio of length and breadth of nematocysts
s	ratio of shaft and capsule length in discharged heteroneme nema-tocysts
SMNH	Swedish Museum of Natural History, Stockholm, Sweden
ZMB	Zoological Museum Bergen, Norway
ZMO	Zoological Museum Oslo, Norway
ZMUC	Zoological Museum Copenhagen, Denmark

Systematic Part

Order Anthoathecata

Suborder Filifera

Family Hydractiniidae (emended)

DIAGNOSIS – colonial hydroids, hydrorhiza either tubes that are covered with perisarc, or encrusting and covered by naked coenosarc, or forming a calcareous skeleton. Hydrorhiza frequently with spines, sometimes growing to erect structures, sometimes forming erect protective tubes. Gastrostyles absent. Hydranths without pedicels, naked, polymorphic or not. Gastrozooids with one or more whorls of filiform tentacles, or with scattered tentacles on the distal half of the body. Gonozooids with one or more whorls of oral tentacles, or without tentacles and mouth. Dactylozooids, when present, with no tentacles, not arranged into cyclosystems. Gonophores produced on gonozooids. Reproduction by fixed sporosacs, medusoids, or free medusae (modified after Bouillon, Medel & Peña Cantero 1997).

REMARKS – the scope of the family Hydractiniidae has recently been redefined by Bouillon, Medel & Peña Cantero (1997) by removing the medusa-based genera *Hansiella* and *Tregoubovia*. By comparing carefully a number of species they could further show that the former genera *Stylactaria* Stechow, 1921, *Podocoryna* Sars, 1848 and others must be merged into the genus *Hydractinia* van Beneden, 1841. Such a view has also been expressed by various other authors (e.g. Naumov 1969, Schuchert 1996) and the emendation is here accepted too. However, it was necessary to modify the diagnosis to exclude the family Stylasteridae, an apparently close relative of the Hydractiniidae (see Cairns 1983 to 1987). Most Stylasteridae possess a gastrostyle, a skeletal process under the hydranth. This character and the presence of cyclosystems allows us to separate them from the Hydractiniidae. Furthermore, species producing gonophores from the hydrorhiza were also excluded. This only concerns the species *Stylactaria sagamiensis* Hirohito, 1988. The adult medusae of this species are unknown and it had only provisionally been included in the Hydractiniidae. It is here referred to the family Cytaeididae. The development of gonophores on the body of the hydranths is clearly a plesiomorphic condition within the Hydrozoa. Unfortunately, there is no clear synapomorphy known for the Hydractiniidae and future revisions are likely.

The family diagnosis of Bouillon, Medel & Peña-Cantero (1997) also embraces *Clava multicornis* and it is here also included in the Hydractiniidae. The reasons for this are discussed under remarks for the family Cordylophoridae. Inclusion of the genus *Clava* within the Hydractiniidae, however, causes a major taxonomic problem in that the name Hydractiniidae L. Agassiz, 1862 becomes a junior synonym of Clavidae McCrady, 1859. Applying the rules of priority, the taxon Clavidae would thus take a meaning different from that understood for decades. This would cause much confusion and seriously undermine taxonomic stability. Therefore, a case will be made to the Commision on Zoological Nomenclature for a reversal of precedence (Hydractiniidae given precedence over its senior synoynm Clavidae) by invoking article 23.9.3 of the ICZN. Although only after a ruling of the commission the name Hydractiniidae can be used validly, article 23.9.3 of the ICZN also states that the junior name can be maintained while the case is being considered. Therefore, the name Hydractiniidae is used here. The inclusion of the genus *Clava* does not significantly change the traditional concept of this taxon (while Clavidae has completely changed).

Useful characters to distinguish the Hydractiniidae of Greenland and Iceland are given in Table 1.

Clava multicornis (Forskål, 1775)
(Fig. 1)
Hydra multicornis Forskål, 1775: 131, pl. 26, fig. B b.
Clava multicornis – Hincks 1868: 2, pl. 1 fig 1; Allman 1871: 246, pl. 2 figs 1-2; Broch 1916: 38, fig. K, pl. 1 fig. 5 Naumov 1969: 195, fig. 65; Edwards & Harvey 1975: 879, synonymy.
Clava squamata – Hincks 1868: 4, pl. 1 fig. 2; Allman 1871: 243, pl. 1; Kramp 1914: 976; Kramp 1938: 8; Ólafsson 1975: 7, fig. 3.
Type locality – coast of Denmark.
Material Iceland – ZMUC, as *Clava squamata*, Reykavík, det. Saemundsson, 03.04.1897, 5-7 m – Sandgerði, several living colonies, coll. 3.5.2000 by author, intertidal, fertile, dispersed and clustered colonies.

Description – colonies stolonal, hydranths either dispersed or clustered to tufts. Stolons do not coalesce, but can form a tight meshwork. Hydranths 10-20 mm, very slender (diameter 0.5 mm), base with collar of thin perisarc, hypostome large, dome-shaped, 20-40 filiform tentacles, scattered, confined to a band in distal part of hydranth. Gonophores arise in a dense collar below tentacles, up to 50 of variable developmental stages, initially clustered into groups. Gonophores are sessile sporosacs without canal system. Female sporosacs produce mostly 1 egg, occ. 2 eggs. Eggs develop into planula in sporosac.

Remarks – earlier authors distinguished sometimes two species, *Clava multicornis* and *Clava squamata*. *Clava squamata* had clustered hydranths, while *C. multicornis* had dispersed polyps. However, the two forms are only environmentally induced variants of the same species (Edwards & Harvey 1975).

Clava multicornis has been the subject of several ecological and behavioural studies, e. g. Williams (1965), Kinne & Paffenhöfer (1966), Paffenhöfer (1968), Aldrich et al. (1980), Orlov (1996a).

Distribution – temperate waters of European and North American coasts, Faroe Islands, Iceland (NESW), Mediterranean, Barent Sea, White Sea. It is known from all around Iceland, occurring in depths from the low water mark to 163 m, frequently on fucoid algae and gastropod shells (Broch 1916, Kramp 1938). It is not known from Greenland, but it is likely to occur there too (see also discussion in Kramp 1914).

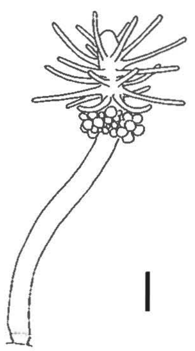

Figure 1. Clava multicornis *(Forskål, 1775); one hydranth with gonophores, after material from Scotland (MHNG INVE27333), scale bar 1mm.*

Hydractinia borealis (Mayer, 1900)
(Fig. 2A-B)
Lymnorea borealis Mayer, 1900: 6, pl. 5 figs 16-18.
Limnorea norvegica Broch, 1905: 5.
Podocoryne borealis – Kramp 1959: 101, fig 67; Edwards 1972: 111, figs 4-6.
Hydractinia borealis – Schuchert 2000:415.
Type locality – Eastport, Maine, USA.
Material Iceland – BIOICE 2313, growing on cauli of *Tubularia indivisa*, with medusae buds – Sandgerði, living colony on gastropod shell inhabited by *Pagurus berhardus*, medusae cultivated until onset of gonad maturation (27 days at 10-12°C).

Description – stolonal colonies, stolons in young colonies or at colony margin reticulate and composed of perisarc covered tubules, later coalescing to a stolonal plate covered by naked coenosarc tissue. Few shallow spines (0.2 mm) present, not in groups. Gastrozooids about 4-5 mm, fusiform body, large dome-shaped hypostome, two very closely set whorls of tentacles, 10-16 in number, unequal in length, alternately pointing upward or horizontal, base of hydranth sometimes sitting on shallow, calotte-shaped perisarc beaker, may be absent in some colonies. Gonozooids smaller and more slender than feeding zooids, 4-10 tentacles, below tentacles one whorl of up to 10 medusae buds. Medusa after liberation 0.8 mm, with 6-8 tentacles, four perradial and 2-4 interradial ones, the latter shorter, 4 larger marginal bulbs, interradial bulbs absent or inconspicuous, manubrium simple, square in cross-section, without any trace of gonads. Nematocysts of polyps: microbasic euryteles (2 sizes), desmonemes.

Adult medusa 3-4 mm high (reportedly up to 5 mm), sightly wider than high, jelly thicker at apex, no gastric peduncle. Four relatively broad radial canals and a circular canal, 16-30 tentacles of unequal length, perradial and interradial bulbs largest, without ocelli. Manubrium spans about 2/3 of subumbrella, cross-section distinctly cross-shaped to square, with 4 perradial, long, oral lips. Oral lips branched at least once and ending in clusters of cnidophores. Cnidophores long cells bearing at distal end an elongated eurytele. Gonads oblong pads on manubrium in interradial positions. No medusae budding. Nematocysts: in tentacles shorter microbasic euryteles and desmonemes, on oral lips elongated euryteles.

Additional information – tentaculozooids can be present on colonies growing on shells inhabited by hermit crabs (Edwards 1972).

Remarks – medusae released from a colony on a hermit crab were cultivated to near maturity (Fig. 2B). The hydroid was indistinguishable from *H. carnea* as there were no basal perisarc beakers. These beakers did even not form after the polyps were culti-

Table 1. Distinguishing characters for the polyp phase of the Hydractiniidae, continued page 11

character	***H. carica***	***H. echinata***	***H. ingolfi***	***H. monocarpa***	***H. sarsii***	***H. serrata***
gonophores	sporosacs	sporosacs	sporosacs	sporosacs	sporosacs	sporosacs
radial canals	absent	absent	absent	absent	absent	absent
gonophores with tentacles	no	no	no	absent	no	no
gonophores with marginal bulbs	no	no	no	no	no	no
egg number	5-6	5-6	>50	50	6-8	1
tentacles of gonozooid	0-8	reduced, wart-like nematocyst clusters	0	absent	like gastrozooid	0-4, stumps
origin of gonophores	upper half of hydranth	upper half of hydranth	upper half of hydranth	upper half of hydranth	upper half of hydranth	base of gonozooid
number of gonophores	3-7	2-10	1	1	2-4	1-5
tentacles of gastrozooid	1 whorl	1 whorl	1 whorl	1 whorl	1 whorl	1 whorl
spines	0.3-0.5, smooth, rounded tip	0.5-2 mm, ridges with prickles	absent	1.5 mm, needle-like	0.1-1 mm, smooth, conical	1.2 mm, with serrated edges
stolons coalesced	yes	yes	no	yes	yes	yes
basal perisarc beaker	absent ?	absent	present	absent	absent	absent
relative gonozooid size	–	–	–	–	0.8-1	1/3
hypostome shape	dome	dome	trumpet	dome	nipple, capitate	dome

vated on glass. The newly released medusa differed from those of *H. carnea* in having up to 8 tentacles, longer manubrial lips, and a distinctly cross-shaped to square cross-section of the manubrium. During further development a third and fourth cycle of tentacles formed as well as the characteristic branched mouth lips (Fig 2B), which allowed an unambiguous identification. The single preserved BIOICE sample was identified as *H. borealis* due to its growth on *Tubularia*, the perisarc beaker at the base of the hydranths, the newly released medusa with eight well developed tentacles and the absence of gonad tissue (comp. Edwards 1972). Although characteristic for this species, the basal perisarc beakers (see Fig. 2) are difficult to observe and may be absent as observed in the living colony from Sandgerði. The medusae buds of this colony had only four visible marginal bulbs. Without information on the medusae, such colonies are therefore indistinguishable from *Hydractinia carnea*. It may thus be that *H. borealis* has been misidentified repeatedly as *H. carnea*.

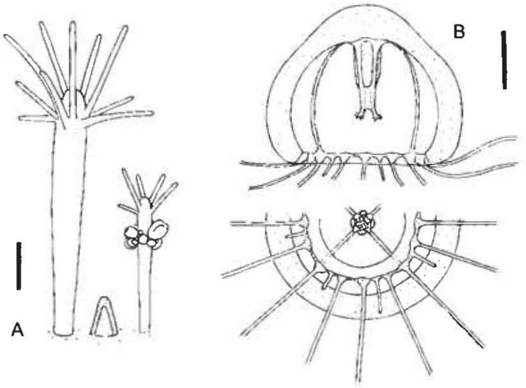

Figure 2. Hydractinia borealis *(Mayer, 1900); after living material from Sandgerði, Iceland. A, polyp phase with gastrozooid, spine and gonozooid, scale bar 0.5 mm. B, medusa phase, subadult, note that most tentacles are not shown in full length, scale bar 1 mm.*

character	*C. multicornis*	*H. borealis*	*H. carnea*	*H. allmanii*	*H. arctica*
gonophores	sporosacs	free medusa	free medusa	medusoid	medusoid?
radial canals	absent	present	present	present	present?
gonophores with tentacles	no	yes	yes	short	no
gonophores with marginal bulbs	no	yes	yes	yes	no
egg number	1, occ. 2	medusa immature at release	medusa immature at release	100	ca 10
tentacles of gonozooid	gonozooids identical to gastrozooids	present, fewer than in gastrozooids	present, fewer than in gastrozooids	4, range 0-6, short	0-6
origin of gonophores	upper half of hydranth	upper half of hydranth	upper half of hydranth	upper half of hydranth	upper half of hydranth
number of gonophores	20-50	2-8	2-10	1-2	2
tentacles of gastrozooid	scattered in distal 1/4	1 whorl	1 whorl	1 whorl	3 whorl
spines	absent	0.2 mm, not grouped	0.2 -0.5 mm, not grouped	0.1, occ. 1 mm, slender	absent
stolons coalesced	no	yes	yes	yes	no
basal perisarc beaker	present, fine	present or absent	absent	present, shallow	present
relative gonozooid size	identical	1/2	1/2	1/2	1/2
hypostome shape	dome	dome	dome	dome	trumpet

DISTRIBUTION – the medusa of has been found around the British Isles, Shetland, in the North Sea, off the European continental coasts from Belgium northwards to southern Norway, south coast of Iceland, and at Eastport, USA (Edwards 1972). It is not known to occur at Greenland.

***Hydractinia carnea* (M. Sars, 1846)**

in part *Podocoryna carnea* M. Sars, 1846: 4, pl. 1 figs 7-18, not pl. 2 figs 5-11.
Hydractinia carnea – Kramp 1938: 9; Naumov 1969: 219, figs 51c & 87.
Podocoryne carnea – ? Kramp 1914: 987; Kramp 1961: 68; Kramp 1959: 101, fig. 65; Edwards 1972: 122, figs 7-9.
TYPE LOCALITY – Norway.

DIAGNOSIS – *Hydractinia* with stolonal plate covered by naked coenosarc, few small spines, no perisarc beaker at base of hydranths. Gonozooids smaller than gastrozooids, tentacle number reduced. Spiral zooids or tentaculozooids present or not. Gonophores released as free, immature medusa. Adult medusa 1-2 mm, 6-8 tentacles (rarely 10), manubrial lips not branched, no ocelli.

DESCRIPTION – for figures and description see Edwards (1972). See also under *H. borealis*, a similar species also releasing free medusae.

REMARKS – for a reliable identification of *H. carnea* polyps, the liberated medusa must be cultivated (see *H. borealis*). Edwards (1972, as *Podocoryne carnea*) gives an excellent account on the morphology, taxonomy, distribution and habitats. It is very likely that a number of hydroid stage records for *H. carnea* are actually incorrect and some records of this species could as well have been *H. borealis*. Furthermore, the species limits of *H. carnea* are not so clear (see also Schuchert 1996). The population of the Mediterranean and the French Atlantic up to Brittany have at maturity four tentacles only and are perhaps a distinct species named *H. exigua* (see Edwards 1972, Cerrano *et al.* 1998).

As discussed above, polyp colonies of *H. borealis* are sometimes indistinguishable from *H. carnea* and some or all previous Icelandic records of *H. carnea* may actually have been *H. borealis*. The medusa stage of *H. carnea* is not known from Iceland and all records of this species are for the polyp phase. It is thus possible that *H. carnea* does not occur at Iceland at all. Cultivation experiments must be performed to confirm the presence of *H. carnea* for Iceland.

DISTRIBUTION – reliable records are from northern Norway to British Isles, others problematic. Depth range 0-50 metres. At Iceland, Kramp (1932) recorded it all around the island, but some or all records may actually refer to *H. borealis*. It is not known to occur at Greenland.

***Hydractinia allmanii* Bonnevie, 1898**

(Fig. 3A-C)
Hydractinia allmanii Bonnevie, 1898: 485, pl. 26 figs 36-37; Bonnevie 1899: 47, pl. 1 fig. 1.
Hydractinia ornata Bonnevie, 1898: 485, pl. 26 fig. 41; Kramp 1914: 989; Kramp 1943: 9; Rees 1956d: 112, revision.
Hydractinia allmani – Jäderholm 1902: 8; Jäderholm 1908: 7, pl. 1 fig. 5, pl. 2 figs 2-5; Jäderholm 1909: 49; Kramp 1914: 988; Kramp 1943: 8; Rees 1956c: 352, pl. 11 figs 1-7; Rees 1956d: 111; Naumov 1969: 220, figs 88.
TYPE LOCALITY – 67.40°N 8.97°E, 827 m
MATERIAL GREENLAND – Hoels stations 1024, one shell of *Colus* spec. tightly covered with male colony, mature –1016, three *Colus* shells tightly covered with female colonies – "Kap Farvel" station 48, male colony, with long spines.
MATERIAL ICELAND – BIOICE 2629, on shell of *Colus holboelli* (Gastropoda), fertile female, spines short.

DESCRIPTION – colonies growing in dense and large colonies on gastropod shells, preferably *Colus* spec. Hydrorhiza coalesced into a stolonal plate, no perisarc cover, spines either small and smooth or up to 1 mm high needle-like tubes, basal plate without prickles. Polyps dimorphic with gastrozooids and gonozooids, tentaculozooids and spiral zooids unknown. Gastrozooids very large, 5-10 mm (max. 15 mm) sitting on a very shallow basal perisarc beaker, body below tentacles often slightly thinner, hypostome large and dome-shaped, one whorl of 10-16 tentacles, hypostome with a broad band studded with nematocysts. Gonozooids only about half the height of the gastrozooids, with 4 (range 0-6) short tentacles, region above gonophores often thinner, hypostome densely studded with nematocysts. Gonozooids also have a shallow perisarc beaker at base. Gonophores arise in upper third of gonozooid, normally two in opposite position, one small, the other mature. Mature gonophores about 1.0-1.2 mm, spherical or slightly oblong. Gonophores are medusoids but remain fixed. Medusoids with thin jelly, swollen manubrium with a length of 2/3 of the bell, velum present, four distinct radial canals and 8 rudimentary marginal bulbs or tentacles. Fully mature gonophores have eight rudimentary tentacles, four perradial larger and four smaller interradial ones. Gonads cover manubrium and nearly entirely fill the subumbrella. Mature females with up to 100 eggs in one layer. Nematocysts: ? isorhiza, on hypostome of both zooid types, (14-16)x(4-5) µm; ? heteronemes, on tentacles of both zooid types, (9-11)x(3-4) µm; desmonemes, tentacles of gastrozooids only, (6-7)x(3-4) µm.

Remarks – this species was re-described by Rees (1956c) and it is well characterised. Rees (1956c) mentions that male and female gonophores occurred in the same colony. This was not observed in the colonies examined here. It would be rather astonishing if *Hydractinia allmanii* were hermaphroditic. It seems more likely that Rees had two different clones growing on the same shell.

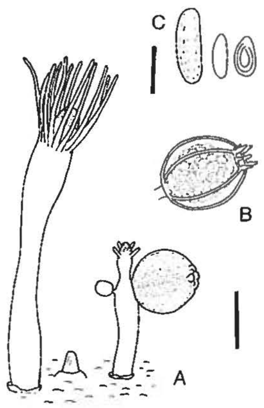

Figure 3. Hydractinia allmanii *Bonnevie, 1898; Hoels 1024. A, part of colony with gastrozooid (left), spine (middle), and male gonozooid (right), scale bar 1 mm. B, female medusoid, same scale as A. C, nematocysts, ? isorhiza, ? heteroneme, desmoneme, scale bar 10 µm.*

Naumov (1969) recorded it from a variety of gastropod shells, but Rees (1956d) found them on *Colus curtus* only (mentioned as *Sipho curtus* (Jeffreys)). *Hydractinia allmanii* can grow all over the shell and attain extremely dense colonies.

Rees (1965d) examined type material of both *Hydractinia allmanii* and *H. ornata* Bonnevie, 1898 and concluded that they only differ in the degree of maturity and that they therefore must be considered conspecific.

Hydractinia allmanii is usually described as having short spines only. One colony from Cape Farewell had very long spines (1 mm), but otherwise it had the typical medusoid gonophores with short tentacles. This shows that not too much weight should be placed on the size of the spines, as they can be very variable in many species.

Ecology – epizooic on gastropod shells, preferably of the genus *Colus* (syn. *Sipho*) (Family Buccinidae), in depths of 3-1500 m, mainly between 40 and 250 m. Water temperatures -1.2 to 2.7 °C (Rees 1956c).

Distribution – Norway, eastern Greenland, Spitsbergen, arctic seas north of Russia, Sea of Okhotsk, Kuriles (Naumov 1969). Recorded here for Iceland for the first time.

Hydractinia arctica **(Jäderholm, 1902)**
(Fig. 4)
Stylactis arctica Jäderholm, 1902: 5, pl. 1 figs 1-2.
Stylactis arctica – Kramp 1914: 986.
Hydractinia (*Stylactis*) *arctica* – Kramp 1932a: 12, figs 3-4.
Hydractinia arctica – Bouillon, Medel & Peña Cantero 1997: 467, table 1.

TYPE LOCALITY – 14.82°N 72.70°W, 2000 m, on shell of the buccinid gastropod *Mohnia mohni* Friele.

TYPE MATERIAL EXAMINED – SMNH, 3 colonies on gastropod shells, some with gonozooids.

MATERIAL GREENLAND – ZMUC, "Godthaab" station 135, material of Kramp (1932a), few infertile hydranths on *Eudendrium planum*, identification uncertain.

DESCRIPTION – colonies growing on gastropod shells, stolons ramified, anastomosed, not coalesced, mesh loose, covered by perisarc, without spines. Gastrozooids about 2 mm high, on shallow basal perisarc beaker, club-shaped, broadest in region of tentacles, hypostome high, thick, cylindrical to trumpet-shaped, studded with nematocysts, below hypostome 18-22 filiform tentacles in 2-3 whorls. Gonozooids much smaller than gastrozooids (1/4), tentacles reduced to few stumps, with 2 spherical gonophores. Gonophores with ring canal and likely also radial canals. Female gonophores with about 10 eggs. Nematocysts: desmonemes, on tentacles, 6x4 µm; microbasic euryteles, on tentacles, (8.5-9.5)x(2.5-3.0) µm, s ~ 0.9; microbasic mastigophores, on hypostome, (12-14)x(4-5) µm, s ~ 0.9.

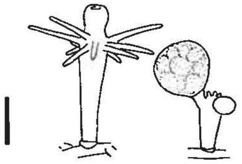

Figure 4. Hydractinia arctica *(Jäderholm, 1902); after type material, scale bar 0.5 mm, left gastrozooid, right gonozooid.*

REMARKS – the type material of *H. arctica* consists in three quite abraded colonies on gastropod shells. The re-examination revealed some interesting facts that help to reevaluate this species. The tentacles of the gastrozooids are in two to three quite separate whorls. One of the colonies is perhaps a male and a split gonophore suggested the presence of a ring canal and radial canals. Unfortunately, the presence of these canals could not be seen with absolute certainty, but they are very likely present. It was also possible to estimate the egg number of one female gonophore. Microscopic examination of some detached hydranths showed the presence of three types of nematocysts. All three could also be seen discharged in a few cases. *Hydractinia arctica* has a characteristic hypostome (Fig. 4A). Histological sections made by Kramp (1932a, fig. 4) suggested that this shape is not a fixation artifact, but due to a thickened gastrodermal layer. Bouillon, Medel & Peña Cantero (1997) considered this to be a characteristic trait of the species. These authors also considered *Hydractinia ingolfi* Kramp, 1932 as conspecific with *H. arctica*. With the additional information available, this seems now less likely. The gonophores of *Hydractinia ingolfi* are cryptomedusoids without a canal system and they contain numerous eggs, much more than *H. arctica*. Both are deep-water species and only few samples are known so far. According to Kramp (1932a), both species differ in the degree of the reduction of the gonozooids. This is, however, as outlined by Bouillon, Medel & Peña Cantero (1997), a clearly insufficient character to separate species within the genus *Hydractinia*. Both species could nevertheless also differ in their host preference, as *H. ingolfi* has been found so far on ophiurids only, while *H. arctica* occurs on gastropod shells. The identification of infertile *H. arctica* by Kramp (1932a), his material was re-examined here, is highly insecure.

DISTRIBUTION – eastern Greenland.

Hydractinia carica Bergh, 1887

(Fig. 5A-C)

Hydractinia carica Bergh, 1887: 331, pl. 28 fig. 1; Broch 1916: 48, pl. 1 fig. 11; Fraser 1944: 77, pl. 13 fig. 53; Rees 1956c: 355, figs 1-2, synonymy; Naumov 1969: 221, fig. 89; Calder 1972: 223, pl. 2 fig. 2.

Hydractinia minuta Bonnevie, 1898: 487, pl. 26 fig. 38

TYPE LOCALITY – Petuchoffskoi Schar, Kara Sea, 15 m.

TYPE MATERIAL EXAMINED – syntypes, ZMUC, Kara Sea, on *Buccinium groenlandicum*.

DESCRIPTION – colonies forming encrusting hydrorhiza covered by naked coenosarc, few high, conical spines (0.3-0.5 mm) with rounded tips, stolonal plate without prickles. Gastrozoids extended up to 2.5 mm, with a single whorl of 12 to 16 (up 22) tentacles. Hypostome without belt of nematocysts, high, nipple-shaped. Spiral zooids unknown. Gonozooids initially same size as gastrozooids and with at least 8 tentacles, becoming gradually reduced to very short stumps without tentacles, hypostome tightly covered with nematocysts. Gonophores 3-7 in number, in one whorl in upper 2/3 of gonozooid. Gonophores cryptomedusoids, females without radial canals, with manubrium, with 5-6 large eggs. Nematocysts: desmonemes and two other types, probably heteronemes.

REMARKS – Broch (1916) and Rees (1956c) re-examined type material of *Hydractinia carica* Bergh, 1887 and *H. minuta* Bonnevie, 1898. Both concluded that they must be conspecific. Rees (1956c) also re-described *H. carica*, but unfortunately made contradictory statements. In his diagnosis (p. 356) he describes the gonophores as ".. with 4 radial canals and rudiments of tentacles..", while later (pp. 358 and 359) he describes the female gonophores of the type material as having no radial canals. Bonnevie (1899: 48) describes the female gonophores as without radial canals. Perhaps Rees saw radial canals in the male gonophores, but such a sexual polymorphism is unusual and would rather indicate the presence of two species. Re-examination of the type material gave no indication of the presence of such canals, however, no histological sections were made.

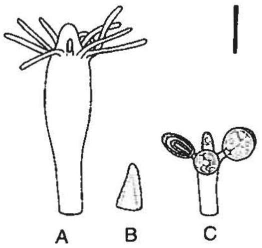

Figure 5. Hydractinia carica *Bergh, 1887; type material, scale bar 0.5 mm. A, gastrozooid. B, spine. C, female gonozooid with three sporosacs of different developmental stages.*

Hydractinia carica can be distinguished from the similar *H. echinata* by its smaller polyps (about half the size), the smooth spines, and the absence of warty nematocyst clusters on the gonozooids. It even more resembles *H. sarsii*, the only difference being the reduced gonozooids. However, this is a character of limited value for discriminating *Hydractinia* species (Bouillon, Medel & Peña Cantero 1997).

DISTRIBUTION – Kara Sea, Barents Sea, Spitsbergen, western Greenland, Norway near Bergen. Not known from Iceland. The species favours shells of the various northern species of *Buccinium* as a substratum. The bathymetric range is 0 to 120 m.

Hydractinia echinata Fleming, 1828

(Fig. 6A-G)

Alcyonium echinatum Fleming, 1828: 517.

Hydractinia echinata – Allman 1871: 220, 345, pl. 15, pl. 16 figs 10-11; Kramp 1914: 987; Broch 1916: 46, fig. N, pl. 1 figs 9-10; pl. 1 fig. 9-10; Kramp 1938: 10; Naumov 1969: 223, fig. 91.

TYPE LOCALITY – British Isles

MATERIAL EXAMINED – no Icelandic or Greenlandic material seen, the description is derived from living material collected by myself at Roscoff (France), on shells inhabited by various species of hermit crabs, collected 2.6.2000, preserved as MHNG INVE29281.

DESCRIPTION – colonies growing mostly on gastropod shells inhabited by hermit crabs, but also reported on other solid substrata, forming an encrusting hydrorhiza covered with naked coenosarc, with numerous up to 2 mm high spines, numerous prickles in stolonal plate and on spines. Spines variable in size and shape, mostly with characteristic spiny ridges (Fig. 6G). Hydranths large (up to 5-8 mm fully extended), large dome-shape hypostome, 15-20 tentacles in two very closely set whorls. The tentacles of the upper whorl usually longer than the ones of the lower whorl, length quite variable. Spiral zooids (Fig. 6E) present most often at outer rim of shell opening, distal end covered with knobs of wart-like nematocyst clusters. Tentaculozooids occasionally present, long and slender, without nematocyst clusters. Gonozooids thinner and shorter than gastrozooids, without tentacles, these reduced to mere knobs covering distal end. Gonozooids with several gonophores in one whorl, dioecious, male white, female orange. Gonophores spherical, about 0.4 mm, sessile sporosacs without radial or circular canal, without tentacles, with spadix. Female gonophores with 6-8 eggs. Nematocysts: desmonemes (5-6)x(3) µm; microbasic euryteles (7-9)x(2.5-3) µm; larger microbasic euryteles present only in gonozooids, (14-16)x(5-6) µm.

REMARKS – *Hydractinia echinata* was once believed to be a widespread species, but the elegant genetic investigations of Buss & Yund (1989) proved that former North American records of this species refer actually to at least three species that are morphologically hardly distinguishable. They are, however, host specific. Records of *H. echinata* for the Pacific by Naumov (1969) should therefore also be treated cautiously. If possible, all new records of *Hydractinia* should be accompanied by an identification of the host species.

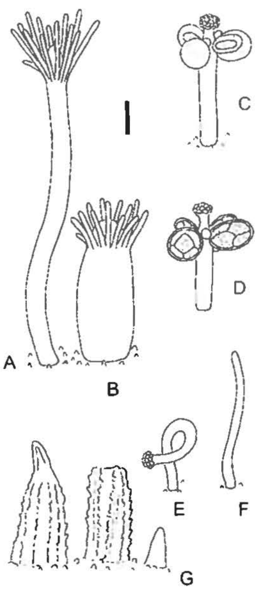

Figure 6. Hydractinia echinata *Fleming, 1820; after life, scale bar 0.5 mm. A, extended gastrozooid. B, contracted gastrozooid. C, male gonozooid. D, female gonozooid. E, spiral zooid. F, tentaculozooid. G, different spine forms.*

DISTRIBUTION – European coasts, Mediterranean, arctic seas, western Greenland, Iceland (NE), not known from the Faroe Islands. There are only few records for Greenland and Iceland of this otherwise common hydroid. The absence from the west and south coast of Iceland and the Faroe Islands is rather enigmatic, particularly in view of the otherwise broad distribution in NW Europe.

Hydractinia ingolfi Kramp, 1932

Hydractinia (*Stylactis*) *ingolfi* Kramp, 1932a: 13, figs 5-6.

Styactaria ingolfi – Namikawa 1991: 810.

Hydractina ingolfi – Svoboda, Stepanjants, & Smirnov 1995: figs 3.1b, 3.2d, 3.4; Bouillon, Medel & Peña Cantero 1997: 467.

TYPE LOCALITIES – southern Greenland, south and south-west of Iceland (see Kramp

1932a), on *Homalophiura tesselata* (Verrill) (Echinodermata, Ophiuridae), below 2100 m.

Diagnosis – *Hydractinia* species living on ophiurids, stolons not coalesced, anastomosed to network, covered by perisarc. Hydranths dimorphic. Gastrozooids with trumpet-shaped to cylindrical hypostome, 15-17 tentacles. Gonozooids reduced, without tentacles. Gonophores large cryptomedusoids, females with > 50 eggs.

Description – see Kramp (1932a).

Remarks – contrary to the opinion of Bouillon, Medel & Peña Cantero (1997), *H. ingolfi* is most likely not conspecific with *H. arctica* (see there). Unfortunately, no new material of this deep water species could be examined.

Distribution – southern Greenland, south and south-west of Iceland (Kramp 1932a).

***Hydractinia monocarpa* Allman, 1876**

(Fig. 7A-C)

Hydractinia monocarpa Allman, 1876: 254, pl. 10 figs 1-3; not Jäderholm 1908: 8, pl. 1 fig. 6, pl. 2 figs 6-9; not Kramp 1932a: 16 [= *H. serrata*]; not Rees 1956c: 359, pl. 12 figs 8-11; not Naumov 1969: 222, fig. 90; Calder 1972: 225, pl. 2 fig. 3.

Type locality – Spitsbergen, on *Trophon clathrus*.

Type material examined – ZMUC, loc. Spitsbergen, on 2 cm shell of *Trophon clathratus* L.

Description – (after type material) colonies growing on gastropod shells, forming encrusting hydrorhiza covered by naked coenosarc. Gastrozooids up to 3 mm, hypostome short and dome-shaped, about 12 tentacles in one whorl. Gonozooids small, reaching only about 1 mm in height, tentacles absent. Gonophores develop near middle of gonozooid, 1 per gonozooid, spherical. Gonophores develop into sessile sporosacs without canal system, spadix present, females with about 50 eggs. Spines numerous, not grouped, high and slender, often needle-like, up to 1.5 mm, hollow, straight or curved, some with undulated ridges, spines overgrown by living tissue except for the tip.

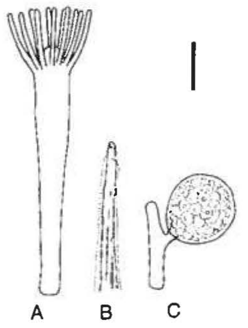

Figure 7. Hydractinia monocarpa *Allman, 1847; after type material, scale bar 0.5 mm. A, gastrozooid, B, spine, C, gonozooid with female sporosac.*

Remarks – as the only record of this species for Greenland was Kramp (1932a) and this material is here referred to *H. serrata*, *H. monocarpa* is neither known to occur at Greenland nor at Iceland. The distribution of this species, however, suggests that it may also occur at Greenland.

The type material of *H. monocarpa* could be examined (Fig. 7A-C). Contrary to Jäderholm (1908), Rees (1956), and Naumov (1969) I was unable not find any radial canals in the female gonophores (Rees did not examine type material). Also Allman (1876) and Calder (1972) do not mention radial canals. Jäderholm (1908) identified material from the Russian Arctic Seas as *H. monocarpa*, although he initially thought that it could be a new species. His material differed from typical *H. monocarpa* by having gonozooids with short tentacles, the sporosacs arising from the base of the gonozooids (comparable to *H. serrata*), the presence of four radial canals, and the branched and more stout spines. I think that Jäderholm's colonies did not belong to *H. monocarpa*. It does also not belong to *H. serrata* due to the sporosacs with radial canals and the large number of eggs. I therefore think that the material of Jäderholm, Rees, and Naumov belong to different, probably new species.

DISTRIBUTION – Spitsbergen and Newfoundland (Canada). Unknown from Greenland and Iceland, but can be expected to occur here (see above).

Hydractinia sarsii Steentrup, 1850

(Fig. 8)
in part *Podocoryna carnea* M. Sars, 1846: 7 pl. 2 figs 5-11, not pl. 1 figs 7-18.
Podocoryne sarsii Steenstrup, 1850: 33.
Stylactis sarsii – Allman 1871: 303.
Hydractinia sarsii – Bonnevie 1898: 486, pl. 26 fig. 42; Bonnevie 1899: 45; Broch 1916: 45, map M, pl. 1 fig. 12; Kramp 1938: 9.
TYPE LOCALITY – Norway.
MATERIAL GREENLAND – SMNH 24724, Godthaab, 22 m, 20.10.1884, det. Broch, on leg of crab, fertile female.
MATERIAL ICELAND – ZMUC, Seyðisfjörður, possibly material of Broch (1916), infertile, smooth spines, identification doubtful – ZMUC, 64.08°N 15.53°W, 47 m, 2.08.1904, det. Kramp, non-reproductive, identification doubtful.

DESCRIPTION – colonies with an encrusting stolonal plate covered by naked coenosarc. Stolonal plate provided with up to 1 mm high spines and numerous prickles, spines conical, smooth, ends closed, sometimes in clusters. Gastrozooids 2-3 mm, with about 20 tentacles in an indistinct whorl, hypostome nipple-shaped to slightly capitate, without belt of nematocysts. Spiral zooids absent. Gonozooids like gastrozooids or only slightly smaller, with one whorl of 3-6 gonophores. Gonophores sporosacs, without radial canals, with 6-8 eggs. Nematocysts: desmonemes, (5-6)x(3-3.5)μm; heteronemes (8-11)x(3-4.5) μm.

REMARKS – in his original description of *Podocoryna carnea*, Sars (1846) lumped two species: the rather well known *H. carnea* mentioned above and a species with sessile sporosacs. This material was later assigned to *Podocorne sarsii* by Steenstrup (1850). Bonnevie (1898) was able to re-examine Sars' original material and transferred the species to the genus *Hydractinia*. Unfortunately, there are no good figures of this species besides the ones in Sars (1846). Although the species seems valid, a thorough re-description based on new material is needed. *Hydractinia sarsii* is distinguished from similar species with sporosacs lacking radial canals by the almost fully developed gonozooids. In nearly all other species they have their tentacles reduced. However, the degree of gonozooid reduction is of limited value for discriminating *Hydractinia* species (Bouillon, Medel & Peña Cantero 1997).

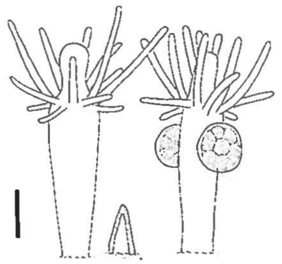
Figure 8. Hydractinia sarsii *Steenstrup, 1850; SMNH 24724, scale bar 0.5 mm, gastrozooid, spine, and gonozooid with female sporosacs.*

Hydractinia sarsii, especially infertile material, has often been confounded with *H. carnea*. Except for the type of gonophores, both species resemble each other very closely. See also discussion under *H. carica*.

DISTRIBUTION – Faroes, Bergen in Norway, Godthaab Fjord at the west coast of Greenland, Iceland (east, south, and west coast) (Kramp 1938).

Hydractinia serrata Kramp, 1943

(Fig. 9A-C)
Hydractinia monocarpa – Kramp 1932a: 16.
[not *Hydractinia monocarpa* Allman, 1847]
Hydractinia serrata Kramp, 1943: 9, figs 1-3; Naumov 1969: 223, fig. 92.
TYPE LOCALITY – Lindenows Fjord, East Greenland, 25-35 m.

Material Greenland – ZMUC, labelled *Hydractinia monocarpa*, "Godthaab" station 107, 15.8.1928, 165 m, described by Kramp (1932a).

Description – (in part after Kramp 1943) dense colonies growing on gastropod shells, preferably of the genus *Buccinium*, forming encrusting hydrorhiza covered by naked coenosarc. Gastrozooids 0.5-3 mm, hypostome short and dome-shaped, 12-13 tentacles in one whorl. Gonozooids small, reaching only about 0.5 mm in height, stubby, tentacles reduced to 0-4 short stumps. Gonophores develop near base of gonozooid or even from stolonal plate close to gonozooid, 1-4 per gonozooid, pear-shaped. Gonophores develop into sessile sporosacs without canal system, spadix present, females with one egg only. Spines numerous, not grouped, high and slender, up to 1.2 mm, usually with four longitudinal ridges, their edges irregularly serrated, overgrown by living tissue except for the tip. Nematocysts: desmonemes, microbasic euryteles with discharged shaft longer than capsule.

Remarks – material identified by Kramp (1932a) as *Hydractina monocarpa* was re-examined for this study and it obviously belongs to *Hydractina serrata*. The sporosacs arise closely to the base of the gonozooids, sometimes even from the stolonal plate (Fig. 9C). This is highly characteristic for *H. serrata*. The spines also showed the serrated ridges, although not too much weight should be laid on this character to distinguish this species from *H. monocarpa* (comp. Figs 7B and 9B).

Distribution – Greenland (east and west coast), Barents Sea, not known from Iceland.

Family Cordylophoridae Lendenfeld, 1885

Diagnosis – Anthoathecata with polyps bearing scattered filiform tentacles. Gonophores grow either below the hydranth body, or directly from the stolons, or from stolonal blastostyles with perisarc covered pedicels. Free medusa where present with four mouth lips, four simple radial canals, juveniles with four tentacles, adults with many tentacles, with adaxial ocelli.

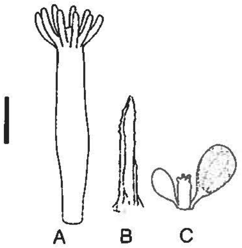

Figure 9. Hydractinia serrata *Kramp, 1943; "Godthaab" station 107, scale bar 0.5 mm. A, gastrozooid. B, spine, note serrated ridges. C, male gonozooid, note origin of sporosacs near base of hydranth or from basal plate.*

Remarks – the family name Cordylophoridae Lendenfeld, 1885 is here used for an assemblage formerly known as Clavidae. The genus *Clava*, with its possible sole valid species *Clava multicornis*, clearly fits into to the Hydractiniidae and is probably not related to other hydroids with scattered tentacles here placed into the Cordylophoridae. The reasons are given in the following.

The development of gonophores on the body of the hydranths is clearly a plesiomorphic condition within the Hydrozoa. It is the only way of gonophore production in the orders Limnomedusae, Leptomedusae and the majority of Anthomedusae. Some Anthomedusae of the suborder Filifera, however, have shifted the site of gonophore development to the perisarc covered part of the pedicels or their equivalent, some even further down to the stolons. This is a clear synapomorphy that reveals a clade within the Filifera, comprising the families Pandeidae, Bougainvilliidae, Cytaeididae and some smaller groups. However, this synapomorphy also shows that the family Clavidae as used up to now is most probably polyphyletic. All members of this family, with the exception of *Clava multicornis*, have their gonophores shifted either to the perisarc covered region of the pedicels, the stolons, or to blastostyles arising from the stolons. Only

Clava multicornis develops its gonophores below the zone of tentacles and thus fits perfectly the definition of the family Hydractiniidae as given by Bouillon, Medel & Peña-Cantero (1997). Molecular sequence analysis also supports this view (C. Cunningham, pers. comm.). Several other members of the Hydractiniidae also have scattered tentacles like *Clava multicornis* and there is no morphological gap at all. Without transferring *Clava* to the Hydractiniidae, this family and the Clavidae in the old sense are inseparable. Scattered tentacles also occur in other families of the Filifera (see e. g. Boero & Bouillon 1989) and they are therefore most probably homoplasies.

Because *Clava* was the type genus of the family Clavidae McCrady, 1859, the latter name cannot be used anymore for the species formerly placed in the same family as *Clava*. I therefore propose to use the family name Cordylophoridae Lendenfeld, 1885 for these remaining species. While Cordylophoridae was originally founded as a subfamily by Lendenfeld (1885), under the Principle of Coordination in zoological nomenclature (ICZN, Article 36), Lendenfeld is also deemed to have established names at all other ranks of the family group (Cordylophorioidea, Cordylophoridae, Cordylophorini, etc.) when he erected the name Cordylophorinae. As already stated by Calder (1988), the former concept of the family Clavidae - now Cordylophoridae – is in need of a comprehensive revision. Such a revision is, however, beyond the scope of this publication and many details have yet to be investigated. Some genera like *Merona* and *Tubiclava* will need re-evaluation and more information on the development of their blastostyles is needed. Both have gonophore on bastostyles arising from the stolons, but the homologies of the blastodstyles to normal hydranths are unclear.

The family Cordylophoridae is closely related to the Pandeidae, but they differ in the morphology of the medusa phase (adaxial versus abaxial ocelli, four versus two tentacles in juveniles).

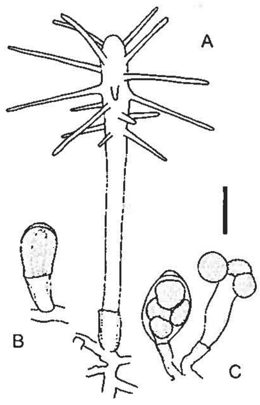

Figure 10. Rhizogeton nudum *Broch, 1909; A-B from western Greenland, C from Cape Farewell; scale bar 0.5 mm. A, polyp and stolons, note fine perisarc beaker at base. B, young male sporosac arising directly from stolons. C, female sporosacs, left one with intact envelope, right one with shed envelope, eggs are attached to spadix.*

***Rhizogeton nudum* Broch, 1909**
(Fig. 10A-C)
Rhizogeton nudum Broch, 1909: 137, fig. 1; Kramp 1911: 362; Calder 1972: 223, pl. 2 fig. 1; ? Millard 1975: 75, fig. 24E; Jones 1992: 721, fig. 1; Schuchert 1996: 21.
Rhizogeton nudus – Dons 1912: 53, figs A-C; Kramp 1914: 977; Kramp 1932b: 6.
TYPE LOCALITY – Spitsbergen.
MATERIAL GREENLAND – ZMUC, N. Strømfjord, 46-48 m, 27.06.1911, with male sporosacs, material of Kramp (1932b) – "Kap Farvel" stations 1, fertile – 74, fertile – 95, fertile – 112, fertile.
MATERIAL ICELAND – living colonies on *Mytilus* and epizoic barnacles, with male sporosacs, Kevlavík harbour, collected May 2000, preserved as MHNG INVE29022.

DESCRIPTION – colonies stolonal, stolons creeping, branching and anastomosing. Hydranths up to 3 mm in height, rod-shaped to slightly clavate, with about 15 filiform tentacles scattered in distal third of hydranth, tentacle length unequal, hypostome large, dome-shaped. At base of hydranth a short beaker of very fine perisarc. Gonophores arise from stolons and develop into sessile sporosacs without canal system, with spadix, with short pedicel enveloped in thin peri-sarc. Female sporosacs spherical, with 3-5 eggs, at maturity the sporosac envelope disappears but the eggs and the developing embryos stick to the spadix. Male sporosacs oblong to spherical.

Remarks – the perisarc beaker at the base of the hydranths is very fine and only visible in a compound microscope.

Distribution – Greenland (west and east coast), Iceland (first record, east coast), Spitsbergen, Brittany to Norway, North-eastern Canada, ? South Africa, ? Argentina, ? India. Some records from outside the North Atlantic may be incorrect.

Family Pandeidae

***Amphinema biscayana* (Browne, 1907)**

(Fig. 11A-D)

Bimeria biscayana Browne, 1907: 19, pl. 1 figs 4-5.

Amphinema biscayana - Schuchert 2000:415, fig 3.

Type locality – Gulf of Biscay, east Atlantic Ocean, 48.12°N 08.22°W, 751 metres.

Material Iceland – BIOICE stations 2855, about 20 colonies, 1 cm to 4 cm – 2556, 2 colonies of 1 cm – MHNG INVE25967, 1 colony of 3 cm in alcohol, 1 slide preparation with medusae buds, both derived from BIOICE 2855.

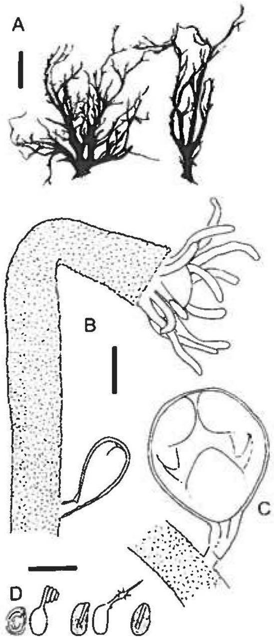

Figure 11. Amphinema biscayana *(Browne, 1907); BIOICE 2855. A, typical colony forms, scale bar 1 cm. B, hydranth with pseudohydrotheca and young medusa bud, scale bar 0.2 mm. C, advanced stage of medusa bud, same scale as B. D, nematocysts: desmoneme, same discharged, microbasic eurytele, same discharged, heteroneme found only in medusa stage, scale bar 10 µm.*

Description – colonies erect, up to 4 cm high, grey, stem and branches stout, silt covered. Very thin stolons forming a dense rooting structure (rhizoid) for anchoring in soft substrata, rhizoid length may reach 2 cm. Alternatively, stolons can be creeping on solid substrata. Colony highly polysiphonic, branching profusely, distal part monosiphonic. Polysiphonic part thick (up to 3 mm), composed of a thick (0.4 mm) axial tube surrounded by thinner (0.1 mm), tightly packed parallel auxiliary tubes. Axial tubes of side branches originate from an auxiliary tube of main branch and not from main axial tube. Only in most distal monosiphonic parts, the axial tube is branching. Distal monosiphonic outgrowths as thick as axial tubes, composed of long main branches (1 cm) with mostly short side branches, all with hydranths. Some hydranths on short pedicels also grow out of auxiliary tubes on lower polysiphonic parts of colony. Hydranths covered by adhering pseudohydrotheca that ends below tentacle whorl, infested with fine silt particles. Hydranth with cylindrical body, one whorl of 10 to 12 filiform tentacles, hypostome conical. Some hydranths bent back. Gonophores arise singly, far below hydranths in perisarc covered zone. Young gonophores pear-shaped, older ones spherical, enclosed in thin perisarcal envelope. Gonophores develop into normal medusae. Oldest medusae observed had a simple manubrium without appendages, four broad radial canals, two opposite tentacle bulbs were strongly developed and large, elongated, conical, presumably without ocelli, each large bulb with one long tentacle without desmonemes. Other pair of perradial bulbs small or absent. Between larger tentacles (presumably at interradial positions) two very small tentacules (totally 4), their tips provided with desmonemes. Nematocysts of polyp (size and shape see Figure 11D): desmonemes; asymmetric microbasic euryteles. Nematocysts of medusa: like polyp and additional egg-shaped heteronemes.

REMARKS – see Schuchert (2000) for a discussion. The allocation to the genus *Amphinema* is only provisional as the adult medusa is unknown.

DISTRIBUTION – *Amphinema biscayana* is only known from its type locality and from south of Iceland.

? *Halitholus yoldiaarcticae* (Birula, 1897)

(Fig. 12)

? *Halitholus cirratus* Hartlaub, 1913: 274; Kramp 1959: 119, fig. 117; Kramp 1961: 101; Kramp 1968: 45, fig. 116.

Perigonimus yoldia-arcticae Birula, 1897: 88, pl. 10 fig. 3; Jäderholm 1909: 45; Kramp 1914: 896; Kramp 1943: 14; Naumov 1969: 200, fig. 67.

TYPE LOCALITY – Spitsbergen, North Atlantic.

MATERIAL GREENLAND – ZMUC, Independence Fjord, Pearyland, 82.13°N 30.70°W 26-34 m, coll. T. Schiøtte 6.08.1995, on several small bivalves (*Yoldiella*), no gonophores – ZMUC, Independence Fjord, Pearyland, 82.11°N 29.92°W, 35-40 m, coll. T. Schiøtte 4.8.1995, on several small bivalves (*Yoldiella*), no gonophores.

DESCRIPTION – colonies stolonal, growing on shells of the bivalve *Yoldiella*, cauli 1-2 mm high, covered by wrinkled perisarc. Hydranth fusiform, 0.4 mm long, covered by pseudohydrotheca which ends below origin of tentacles, hypostome dome-shaped. One whorl of 6-10 long tentacles.

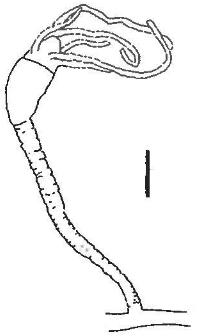

Figure 12. ? Halitholus yoldiaarcticae *Birula, 1897; Greenland, Independence Fjord, scale bar 0.2 mm.*

REMARKS – *Perigonimus yoldiaarcticae* Birula, 1897 is at present not sufficiently described as its life cycle is unknown. Birula's polyp could belong to many species of Bougainvilliidae or Pandeidae (see also under *L. abyssi* and *L. octona*). Therefore, the present material was only tentatively assigned to this species. Naumov (1969) thought that Birula's polyp was conspecific with *Halitholus cirratus* Hartlaub, 1913. Although this appears plausible, it is unclear whether Naumov's claims were based on rearing experiments starting with polyps on *Yoldiella* shells. As I doubt this to be that case, I cannot follow Naumov in synonymising *Halitholus cirratus* with *Perigonimus yoldiaarcticae*. However, the frequent association with the bivalve *Yoldiella*, its arctic occurrence, and its ability to tolerate brackish waters may nevertheless lead to a re-evaluation of *P. yoldiaarcticae* once its life cycle is elucidated.

Rees (1956b) showed that the genus *Perigonimus* is invalid and cannot be used anymore. Accordingly, *Perigonimus yoldiaarcticae* had to be transferred to a new genus. However, in the absence of any life-cycle information, the allocation to any other genus can be only a mere guess. But because it is at least somewhat probable that Naumov is right in synonymising *P. yoldiaarcticae* with

Halitholus cirratus, Birula's species is here allocated provisionally to the genus *Halitholus*. Life cycle studies are obviously needed to resolve this taxonomic problem.

Putative material of *Halitholus yoldiaarcticae* was found during this study on *Yoldiella* shells originating from Independence Fjord at the northern tip of Greenland. Hydrozoans from such high latitudes (82° N) have never been recorded until now. Interestingly, salinity can be reduced in these northern fjords (Just 1970), notably also at the localities where the present samples came from.

DISTRIBUTION – Russian arctic seas, Spitsbergen, eastern and northern Greenland.

Leuckartiara abyssi (G. O. Sars, 1874)

Perigonimus abyssi G. O. Sars, 1874: 126, pl. 5 figs 27-30; Broch 1916: 53, fig. Q; Kramp 1943: 13; Naumov 1969: 202, fig. 70.

Leuckartiara abyssi – Rees 1938: 19, fig. 6a-d; Rees 1956d: 113.

TYPE LOCALITY – Norway, Hvitingsø, 80-200 fathoms on *Dentalium dentale*.

DESCRIPTION – see Rees (1938).

REMARKS – *Leuckartiara abyssi* is at present insufficiently described and not recognisable. Rees (1938) cultivated the youngest stages of the medusa, although his identification must be considered only tentative. Later Rees (1956d) re-examined the type material and designated a type specimen.

Leuckartiara octona (Fleming, 1823)

Geryonia octona Fleming, 1823: 299.

Perigonimus repens – Broch 1916: 52, fig. P; Kramp 1938: 11.

Leuckartiara octona – Rees 1938: 11, fig. 3-5; Russell 1953: 188, pl. 11 figs 5-6, pl. 12. fig. 3, pl. 30-31, text figs 91-96; Kramp 1959: 121, fig. 119; Kramp 1961: 105; Millard 1975: 123, figs 41a-d; Arai & Brinckmann-Voss 1980: fig. 29; Pagès *et al.* 1992: 10, 12, fig. 11; Ramil & Vervoort 1992a: 21; Schuchert 1996: 68, fig. 40a-b; Migotto 1996: 16, fig. 3e-g.

TYPE LOCALITY – Bell Rock, Scotland.

DESCRIPTION – see Rees (1938) or Cornelius, Manuel & Ryland (1995); for the medusa see Russell (1953).

REMARKS – the polyp phase of *Leuckartiara octona* alone cannot be identified with sufficient reliability. Information on the mature medusa is necessary for a secure identification of *L. octona*. Numerous records of *Leuckartiara octona*, however, were made as *Perigonimus repens*, often enough from sterile material. They must all be considered unreliable. *Perigonimus repens* has also been recorded from all around Iceland, but as Kramp (1938) noted, only the records of the south coast are perhaps referable to *Leuckartiara octona*. The adult medusa of this species is only known to occur off the south coast (Kramp 1938).

DISTRIBUTION – polyp: England, South Africa. For substrata see Rees (1938). Medusa: European coasts from Portugal to Lofoten, Iceland (V), North America from Labrador to Cape Cod, Mediterranean, west Coast of Africa, Tristan da Cunha, India, Malayan Archipelago, north-eastern Australia, Low Archipelago, China, Japan, Vancouver, Chile, New Zealand (Schuchert 1996). As mentioned above, at Iceland it occurs probably only along the south coast, mostly in shallow waters. *Leuckartiara octona* is not known from Greenland.

Family Bougainvilliidae

Bougainvillia muscus (Allman, 1863)

Perigonymus muscus Allman, 1863: 12.

Bougainvillia ramosa – Kramp 1938: 10; Russell 1953: 153, pl. 8 fig. 1, pl. 9 figs 4-5, text. figs 74A-C, Kramp 1959: 109, fig. 91; Kramp: 1961: 81; Vannucci & Rees 1961: 53.

Bougainvillia muscus – Calder 1988: 24, figs 19-20, synonymy; Schuchert 1996: 31, fig. 15a-e.

TYPE LOCALITY – Torquay, Devon, Great Britain.
DESCRIPTION – see Russell (1953), Calder (1988), or Schuchert (1996).

REMARKS – no material of *B. muscus* could positively be identified in the available collections. As already stressed by Schuchert (1996), polyp material of this species can only be reliably identified if the medusa is cultivated.

Kramp (1938) reported *Bougainvillia muscus* (as *B. ramosa*) polyps from the south-east coast of Iceland. He could see medusa buds in his preserved material and was rather sure about his identification, but was nevertheless surprised to find this species so far north. As he first thought to have a colony of *Dicoryne conferta* (Alder, 1857) his colony must have been rather sparsely branched (see Fig. 13). It is thus thinkable that Kramp's material could have been *Bougainvillia britannica* Forbes, 1848. The polyps of this species also form slightly branched colonies and occur on shells of the gastropod *Aporrhais pespelecani* (L.) (Edwards 1964). Kramp's material was also growing on this species and the life cycle of *B. britannica* was not known in 1938. Furthermore, the medusa of *Bougainvillia britannica* is known to occur along southern Iceland (Kramp 1959). The presence of *Bougainvillia muscus* in Icelandic waters is thus at best uncertain and needs reconfirmation.

DISTRIBUTION – circumglobal in warm or temperate waters, perhaps distributed by ships or other floating objects. Absent from Greenland.

Dicoryne conferta (Alder, 1856)

(Fig. 13)
Eudendrium confertum Alder, 1856a: 354, pl. 12 figs 5-8.
Bougainvillia conferta – Broch 1916: 50, fig. O.
Dicoryne conferta – Ashworth & Ritchie 1915: 266, pl. 8 fig. 16; Kramp 1938: 11; Naumov 1969: 218, fig. 86; Millard 1975: 101, fig. 34E-J; Cornelius, Manuel & Ryland 1995: 83, fig. 4.8.
TYPE LOCALITY – Cullercoats, Great Britain.
MATERIAL ICELAND – BIOICE 2004, male colony on gastropod shell, max. 8 mm in height.

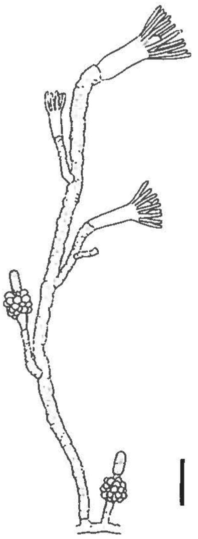

Figure 13. Dicoryne conferta *(Alder, 1856); BIOICE 2004, stem with 3 feeding zooids and two gonozooids, scale bar 0.5 mm.*

DESCRIPTION – colonies forming reticulate stolons from which arise stems to a height of 8 mm (max. 25 mm, Millard 1975). Colonies stolonal or branched, with up to 6 hydranths per stem, branching irregular, branches arise at acute angles and continue nearly parallel to the sister branch. Perisarc cover wrinkled, loose, diameter increases distally. Persiarc terminates below hydranths, but contracted hydranths can slightly retract into perisarc tube. Zooids dimorphic with gastrozooids and gonozooids. Gastrozooids up to 2 mm, very large dome-shaped to conical hypostome. Below hypostome one whorl of 10-12 filiform tentacles. Gonozooids arise either from stems or stolons, with perisarc covered pedicels, hydranth body pear-shaped, with oblong distal region densely studded with nematocysts, below a belt of tightly clustered gonophores. Gonophores spherical, released as swimming sporosacs. Sporosacs oblong, completely ciliated, with two small tentacle-like processes at end, spadix present. Female sporosacs with two eggs. Nematocysts: on tentacles of gastrozooids heteronemes (6-6.5) x (2.5-3) µm and desmonemes (3-3.5) x (2.5-3) µm; on gonozooids heteronemes of two sizes, (7-8) x (4) µm and (8-9) x (5-6) µm.

Remarks – for a reliable identification of *Dicoryne* species, either released sporosacs or female sporosacs on the gonozooid must be examined. There are several species known in this genus, but only two are adequately known (comp. Asworth & Ritchie 1915). *Dicoryne conferta* (Alder, 1857) has sporosacs with two tentacle-like processes and female sporosacs normally have two eggs. The liberated sporosacs of *Dicoryne conybearei* (Allman, 1864) have normally one tentacule and females ones have one egg only. As the tentacule number may be variable in some populations (see Schuchert 1996), only the number of eggs is diagnostic for species identification.

The only sample examined for this study was a male and as usual in preserved material it was very difficult to see the tentacules. Although they could not be seen with absolute certainty, the present sample had most probably sporosacs with two tentacules, thus conforming better with *D. conferta*.

Distribution – Barents Sea, eastern Canada, Europe, Mediterranean, South Africa (Millard 1975). At Iceland known from the south-east and west to north-west coast, but it is not known from the south coast of Iceland (see Broch 1916, Kramp 1938 for more precise data). It is not known from Greenland, but can be expected to occur there.

Rhizorhagium roseum Sars, 1874

(Fig. 14A-B)
? *Atractylis coccinea* Wright, 1861: 130.
Rhizorhagium roseum G. O. Sars, 1874: 96; Rees 1938: 8; Calder 1972: 225, pl. 2 fig. 4.
Garveia groenlandica Levinsen, 1893: 13; Kramp 1911: 363, pl. 25 fig. 6; Kramp 1914: 989; Broch 1916: 55.

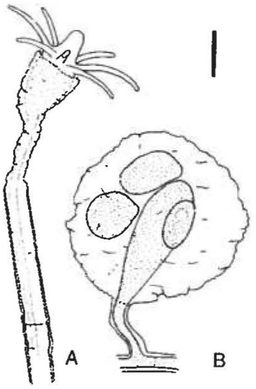

Figure 14. Rhizorhagium roseum *Sars, 1874; BIOICE 2530, scale bar 0.2 mm. A, hydranth with pseudohydrotheca and distal part of caulus. B, sporosac with spadix bearing one egg and two developing embryos.*

Perigonimus sarsii Bonnevie, 1898: 6, pl. 1 fig. 3; Rees 1956b: 113.
Wrightia coccinea – Russell 1907: 53, fig. 54.
Perigonimus roseus – Jäderholm 1909: 46, pl. 3 fig. 7; Kramp 1914: 985; Broch 1916: 54. fig. R; Kramp 1932a: 17; Kramp 1932b: 6; Naumov 1969: 205, fig. 73.
Type locality – Norway, Mangerfjord, Bongnestrømmen, on *Tubularia indivsa* (Rees 1956b).
Material Greenland – "Kap Farvel" stations 62, fertile, on hydroid – 88, on polychaete tubes – 91, fertile, on hydroid – 100, fertile – 101, fertile, on hydroid.
Material Iceland – BIOICE stations 2528, on hydroid – 2530, with sporosacs containing developing planulae, on hydroids.

Description – colonies stolonal or rarely branched once, stolons ramified. Stems up to 8 mm high, enclosed in perisarc that is mostly smooth, but can have some corrugated regions. Perisarc continues distally as thin, wrinkled membrane that covers body of hydranth as pseudohydrotheca. Hydranth spindle-shaped, 0.5-0.7 mm in height, with 6-10 (normally 8) filiform tentacles. Hypostome high, thin, characteristically nipple-shaped. Gonophores spherical, developing from stolons on short pedicel covered by perisarc. Main body enclosed by wrinkled membrane, with a club-shaped spadix on which eggs develop. Eggs are fertilised within gonophoral envelope and develop then within membrane into planulae.

Remarks – although the nipple-shaped hypostome is observable in fully grown hydranths only, it is so characteristic that *Rhizorhagium roseum* is relatively easy to identify. Although the shape of the hypostome is prone to some variation in other hydroids, the nipple-shaped hypostome of *R. roseum* is a constant feature. The unique shape of the hypostome was also the reason why Calder (1988) excluded from the genus *Rhizorhagium* all similar species that have a dome-shaped hypostome (see also Schuchert 1996).

Atractylis coccinea Wright, 1861 was based on infertile material and it should be regarded not recognisable (see Russell 1907). Russell's (1907) *Wrightia coccinea* from Scotland, however, obviously belongs to *R. roseum*. Broch (1918) re-examined the type material of *Garveia groenlandica* Levinsen, 1893 and found it to be inseparable from *R. roseum*. Likewise, Rees (1956d) re-examined the type material of *Perigonimus sarsii* Bonnevie, 1898 and synonymised it with *R. roseum*.

The finding of *R. roseum* in the BIOICE collection represent the first record of this species for Iceland. The two records came from off the north-west corner and the localities fit well into the distribution of this species.

Distribution – Norway, Greenland (east and west coast), Iceland (west coast), Scotland, Barents Sea, White Sea, north-eastern Canada, Alaska.

Family Eudendriidae

Remarks – species identification in this family relies predominantly on nematocyst morphology (see Watson 1985, Schuchert 1996). Although it is possible to examine nematocysts of preserved material, dredged material sometimes lacks soft tissue and is much fragmented. This was also the case for many samples of the BIOICE collection and an identification was impossible. Useful characters to distinguish the Eudendriidae of Greenland and Iceland are given in Table 2.

Eudendrium annulatum Norman, 1864

(Fig. 15A-C)

Eudendrium annulatum Norman, 1864: 83, pl. 9 figs 1-2; Hincks 1868: 83, pl. 15 fig. 1; Allman 1871: 338; Bonnevie 1898: 42, pl. 26 figs 31-33; Jäderholm 1909: pl. 4, figs 3-4; not

Table 2. Distinguishing characters of the species found in the region under investigation (may not be valid outside the region)

character	*E. annulatum*	*E. capillare*	*E. islandicum*	*E. rameum*	*E. ramosum*	*E. planum*	*E. arbuscula*
stem polysiphonic	yes	no	no	yes	yes	yes	yes
completely annulated	yes	no	no	no	no	no	no
reduction of male gonozooid	complete	strong to complete	none or slight	none or slight	none or slight	unknown	complete
reduction of female gonozooid	complete	moderate	none or slight	slight to complete	none or slight	complete	complete
overgrowth by stolonal tubes	yes	no	no	no	no	no	only in Greenland material
with macrobasic heteronemes	no	no	yes, eurytele	no	no	yes	no
with large microbasic heteronemes	yes, shaft 1.4 x capsule length	no	no	mastigophore, shaft spans 3/5 of capsule	mastigophore, shaft spans 1/2 of capsule	no	euryteles with distinctly swollen shaft

Kramp 1914: 993; Broch 1916: 62, map T; Kramp 1932b: 7; Kramp 1938: 13; Naumov 1969: 265, fig. 134.

Type locality – Burraforth, Shetland Islands, Great Britain.

material Greenland – "Littoral" station 48.

material Iceland – BIOICE 2000, infertile 3 cm high colony.

Description – (after BIOICE material and Broch 1916) colonies reaching 10 cm in height, shrubby in appearance, stem thick, polysiphonic, branches mostly monosiphonic, branching irregular, straggling, branches often curved and of uneven length. All tubes comparatively thick (0.2-0.4 mm), annulated throughout except for stolons. Base of colony overgrown with contorted, stolon-like tubules forming a cover. Hydranths typical for genus, with about twenty tentacles. Perisarc originates as thin film in well defined groove in middle of hydranth body. Gonophores on atrophied hydranths. Male gonophores densely grouped on pedicel, one-chambered, with distal accumulation of nematocysts. Female gonophores have an unbranched spadix and form grape-like clusters on entirely atrophied polyps or on perisarc covered pedicels. Nematocysts: smaller heteroneme (7-8)x(3-4) mm, r=2.0-2.7, almond-shaped, predominantly on tentacles, corresponds presumably to a microbasic eurytele; larger microbasic eurytele, (20-23)x(9-9.5) mm, r=2.2-2.6, oval, in belt above perisarc groove of hydranth body, discharged capsule with shaft about 1.4 times long as capsule, thick, shaft in undischarged capsule placed all along side and coiled for half turn at end of capsule.

Remarks – *Eudendrium annulatum* Normann, 1864 is one of the few species of this genus that can be identified even without knowing the gonophores. It's shrubby colony form, the characteristic complete annulation, and the overgrowth of contorted tubules make it rather distinct. A similar covering was sometimes seen in material here allocated to *E. arbuscula*. In the latter species, the covering is a rather smooth, tightly woven network of anastomosed stolon-like tubes (see below). The nematocysts of *E. annulatum* are here described for the first time. The large microbasic eurytele is also characteristic and will help to identify the species unambiguously.

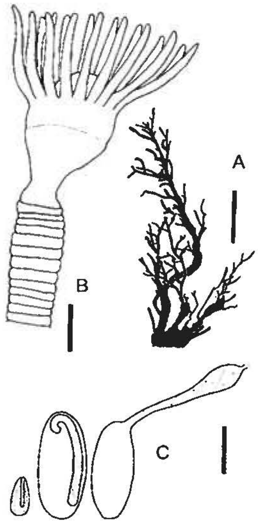

Figure 15. Eudendrium annulatum *Norman, 1864; BIOICE 2000. A, colony silhouette, scale bar 5 mm. B, hydranth, note origin of perisarc at middle of hydranth (dotted), scale bar 0.2 mm. C, nematocysts: smaller heteroneme, larger microbasic eurytele, same discharged, scale bar 10 µm.*

Distribution – not so frequent but widely distributed: northern parts of British Isles, Iceland (south and east coast), western Greenland, Norway, Jan Mayen, arctic seas to Bering Sea, Sea of Okhotsk, Pacific side of Kuriles, Japan (Naumov 1969).

Eudendrium capillare Alder, 1856

(Fig. 16A-F)

Eudendrium capillare Alder, 1856a: 355, pl. 12 figs 9-12; Hincks 1868: 84, pl. 14 fig. 2; Kramp 1914: 993; ? in part Broch 1916: 62, map U; not Kramp 1932a: 18; not Kramp 1932b: 7; in part Kramp 1938: 13; Naumov 1969: 263, fig. 132; Millard 1975: 82, fig. 27E-J; Calder, 1988: 41, fig. 30-32, synonymy; Hirohito 1988: 77, figs

24g-h, 25; Marinopoulos 1992: 60; Ramil & Vervoort 1992a: 18, fig. 1b-c.
Eudendrium parvum Warren, 1908: 272, fig. 1, pl. 45 figs 1-45.
Eudendrium tenellum – Kramp 1914: 991.
TYPE LOCALITY – Northumberland, Great Britain.
MATERIAL GREENLAND – "Kap Farvel" stations 21, fertile – 82, fertile – 90, on hydroid – 103, fertile – 117, on hydroid, fertile.

DESCRIPTION – colonies small, height up to 15 mm, shoots 2-3 times branched, branches thin (0.10-0.12 mm) and some quite long, all ending in relatively small hydranths (size 0.4 mm), tentacle number 20-22. Female gonophores (Fig. 16C) develop on body of initially only somewhat smaller hydranths with shortened tentacles, one whorl of up to 8 gonophores with a simple, curved spadix. Hydranth bearing the gonophores later reduced to a variable degree, spadices shed. Fully mature eggs can also be attached to perisarc covered zone of pedicels due to a complete reduction of the initial hydranth and the subsequent regeneration of a new hydranth. Male gonophores on a strongly atrophied hydranth (Fig. 16D), hydranth sometimes nearly completely reduced (Fig. 16E). Male gonophores 6-12 in one circle or tuft, with one spherical chamber. Nematocysts: only one type present, microbasic eurytele, (6-7)x(3-4) µm.

REMARKS – as for most *Eudendrium* species, for a correct identification of *Eudendrium capillare* it is essential to examine its nematocysts. This has not been done until recently and most older records must be regarded doubtful. This also holds true for Icelandic and Greenlandic records, and some or most older records of *Eudendrium capillare* were actually based on *Eudendrium islandicum*. For further discussions and differences of these two species see under *E. islandicum*.

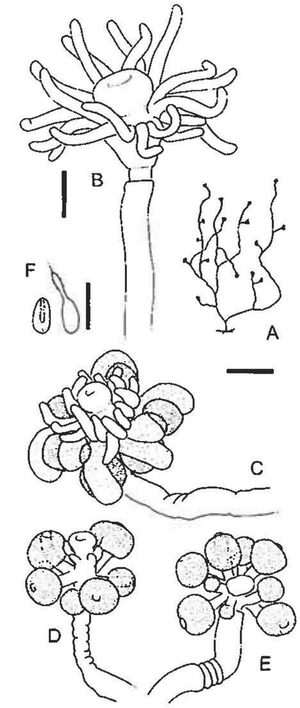

Figure 16. Eudendrium capillare *Alder, 1856; Greenland, Cape Farewell. A, silhouette of a mature colony, scale bar 0.5 cm. B, normal hydranth, scale bar 0.2 mm. C, female gonozooid with only slightly atrophied hydranth, oocytes stippled dark, spadices stippled lightly, same scale as B. D, male gonozooid with reduced hydranth still bearing some tentacle rudiments, same scale as B. E, male sporosacs encircling an almost completely reduced hydranth (centre), same colony as D, same scale as in B. F, cnidome: microbasic eurytele, undischarged and discharged, scale bar 10 µm.*

The material of *E. capillare* from Cape Farewell agreed well with existing descriptions of this species. The only difference noted was that the male gonophores had one chamber only and their hydranths were often recognisable, although strongly reduced (Fig. 16D). Millard (1975) and Calder (1988) found 1-3 chambers and only completely atrophied hydranths.

A sample from Stykkisholm mentioned Broch (1916) as *E. capillare* was re-examined for this study (material of ZMUC). While the morphology of these infertile colonies agree with the concept of *E. capillare*, they had two different types of nematocysts, one being a large heteroneme resembling the ones of *E. rameum*. The material thus does not belong to *E. capillare*. Perhaps it belongs to a so far undescribed species or a young *E. ramosum*.

Distribution – reportedly nearly cosmopolitan, but only identifications using nematocyst information are reliable. Reliable records are from Europe, the Mediterranean, Bermudas, and South Africa. Saemundsson (1902), Kramp (1914), Broch (1916) and Kramp (1933) recorded *E. capillare* also from Iceland and Greenland, but some of their material was misidentified. No material of this species was in the comprehensive BIOICE collection. The occurrence in Icelandic waters is thus not certain. Its presence in Greenland waters, however, is here confirmed by several samples from Cape Farewell.

Eudendrium islandicum Schuchert, 2000

(Fig. 17A-D)

Eudendrium islandicum Schuchert, 2000: 417, fig 4.

Type Locality – Iceland, 66.306°N 19.205°W, 86-88m.

Type Material examined – holotype IMNH 1999.08.17.2, BIOICE 2168, 9.7.1992, 4 cm colony with female gonophores – paratype, IMNH 1999.08.17.2, BIOICE 2330, 63.083°N 11.333°W, 452-453 m, 3.5.1993, fertile

Material Greenland – ZMUC, lille Fiskebanke, 29.09.1930, 53 m, "Dana" station 4286, det. Kramp as *E.* ? *capillare* – ZMUC, 66.25°N 56.38°W, 187-190 m, coll. 1.8.1975, fertile – ZMUC, 66.25°N 56.38°W, 187-190 m, coll. 01.08.1975 – Bank. unders. station 5299 – Just & Vibe 1968 station 21 – "Kangamiut" stations 1 – 5 – 6 – 9 – "Kap Farvel" stations 42, fertile – 90, fertile – 91, fertile – 93, fertile – 95, fertile – 112 – 117, fertile.

Material Iceland – BIOICE stations 2002 – 2004 – 2005 – 2008 – 2009 – 2056 – 2097 – 2161, fertile – 2313 – 2328 – 2574 – 2579, fertile – 2583 – 2591 – 2592, with female gonophores – 2660 – 2790.

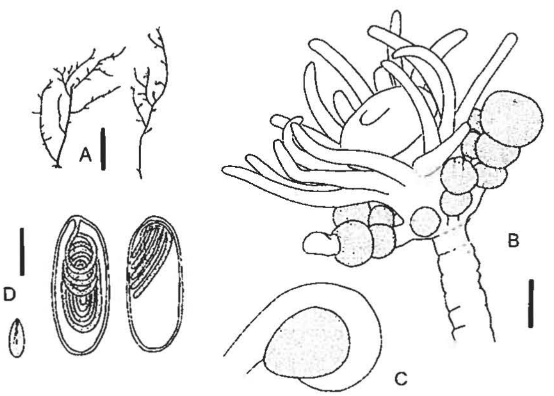

Figure 17. Eudendrium islandicum *Schuchert, 2000. A, colony forms, type material, scale bar 1 cm. B, male gonozooid with gonophores (stippled), Greenland, Cape Farewell scale bar 0.2 mm. C, young female gonophore with simple spadix, BIOICE 2592, same scale as B. D, BIOICE 2592, nematocysts, from left to right: microbasic eurytele, macrobasic euryteles in different views, scale bar 10 µm.*

Description – colonies up to 7 cm, irregularly branched, shape often elongate with long stem and short branches. Hydrorhiza creeping, branching tubes. Stem strictly monosiphonic, mostly smooth but occasional annulations present, diameter about 0.2 mm. Branches about 0.15 mm in diameter, with occasional stretches of annulations, especially near origin. Hydranth pedicels also annulated at origin, sometimes corrugated distally, total length up to 2 mm. Perisarc of stem brown to yellowish, branches characteristically yellowish-brown. Hydranths typical for genus, 0.7 mm, with 20-25 tentacles. Female gonophores develop in one whorl on body of a normally developed hydranth, gonophores initially with a simple curved spadix. Hydranth can be reduced with ongoing gonophore maturation. Older female gonophores on pedicels of hydranths, without spadix and covered by thin periderm capsule. Male gonophores 2-3 (mostly 2) chambered, arising as single whorl from lower part of the body of either normally developed or only very slightly reduced hydranths (Fig. 17B). Nematocysts: A) smaller microbasic eurytele, mainly on tentacles, almond shaped, (7-8)x(3-4) mm, r = 2.0-2.7. B) macrobasic eurytele, size (26-27)x(10-14) mm, r = 2.0-2.7, s > 9, with short, helically arranged barbs along the whole length of the shaft. The shaft in the undischarged capsule is coiled several times (more than 5 times). Viewing the capsule from the side, the shaft fills only about half of the capsule (Fig. 17D last figure). Coiling pattern depends on angle of view and varies also between individual capsules.

Remarks – the characteristic large macrobasic eurytele renders *Eudendrium islandicum* rather easily identifiable among the *Eudendrium* species of the region, but the colony morphology of *E. islandicum* resembles *E. capillare* Alder, 1856. Some earlier Icelandic and Greenland records of *Eudendrium capillare* given by Broch (1916) and Kramp (1938) may therefore actually belong to *Eudendrium islandicum*. *Eudendrium islandicum* not only differs from *E. capillare* by its large macrobasic eurytele, but also by their gonozooids. The male sporosacs *Eudendrium islandicum* grow on fully developed or only slightly reduced hydranths, while those of *E. capillare* have their tentacles completely atrophied (comp Fig. 17B and Fig. 16D-E). *Eudendrium capillare* forms also much smaller shoots and has smaller dimension as *E. islandicum*. In a sample from Cape Farewell, both species were found together growing on the same hydroid stem. The difference in dimensions and colour was immediately visible (comp Figs 17B and 16B).

One specimen from Greenland identified by Kramp as possibly belonging to *E. capillare* could be examined. It has the characteristic nematocysts of *E. islandicum* and is here referred to this species. Broch (1916) noted that one of his colonies resembling *E. capillare* had its male gonophore on intact hydranths. This is more typical for *E. islandicum* rather than *E. capillare*. Unfortunately most samples of Broch and Kramp identified as *E. capillare* are not available anymore.

Distribution – Iceland (many records from north coast, several from east coast, one record from west coast), Greenland (first records by this study; Cape Farewell, Fiskebanke, Bylot Sound), depths 40-996 m. Occurrence along east coast of Greenland can be expected, but so far there are no records.

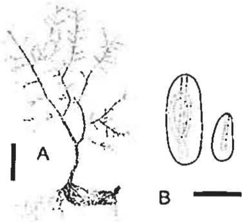

Figure 18. Eudendrium planum *Bonnevie, 1898. A, colony form, after Kramp (1932a), scale bar 2 cm. B, undischarged nematocysts of this material: large macrobasic heteroneme, small microbasic heteroneme, scale bar 10 µm.*

***Eudendrium planum* Bonnevie, 1898**

(Fig. 18 A-B)

Eudendrium planum Bonnevie, 1898: 483, pl. 26 figs 28-30; Stechow 1909: 29; Kramp 1932a: 20, figs 9-11, 31; Calder & Vervoort 1998: 9, fig. 2a-b.

Type locality – unknown, most probably Norway (Kramp 1932a).

Material Greenland – ZMUC, Exp. station 135, 1200 m, material described by Kramp (1932a).

Description – (after examined material) colonies up to 20x10 cm, branching in one plane with branching points rather far apart, polysiphonic stem and main branches. Finer branches originate roughly at right angle. Perisarc smooth apart from stretches of annulations at origin of branches. Female gonophores sporosacs, arranged in tuft at end of caulus, without hydranth. Nematocysts: microbasic eurytele, (10-11)x(4-5) µm; heteroneme, not seen discharged, shaft in undischarged capsule folded and thus longer than capsule, (19-21)x(6.5-8.0) µm.

Remarks – *Eudendrium planum* cannot be recognised with sufficient reliability because the nematocysts of the type material remain unknown. Previous authors based their identification mostly on the planar growth of the colony, which can hardly be accepted as a character of great value as it is often induced by prevailing currents. The arrangement of the female sporosacs in a tuft at the end of a branch is somewhat unusual and might be the only trait to recognise the species with some certainty. The finer branches originate nearly at right angles, which may be another diagnostic trait of this species. The here observed sizes of nematocysts deviate considerably from the sizes observed by Calder & Vervoort (1998), although the types could be the same. More investigations are clearly needed to obtain more information of this deep water species.

DISTRIBUTION – deep waters of Norway, Mid Atlantic ridge, western Greenland, not known from Iceland.

***Eudendrium rameum* (Pallas, 1766)**
(Fig. 19A-D)
Tubularia ramea Pallas, 1766: 83.
Eudendrium rameum – Hincks 1868: 80, frontispiece; Allman 1888: 334, pl. 2; Motz-Kossowska 1905; Kramp 1914: 990; Broch 1916: 57. fig. S; Fraser 1937: 42, pl. 7 fig. 31; Kramp 1938: 13; Kramp 1943: 15; Fraser 1944: 71, pl. 11 fig. 47; Yamada 1954: 7, fig. 6; Naumov 1969: 264, fig. 133; Calder 1972: 226, pl. 2 fig. 7; not Hirohito 1988: 84, fig. 30a-c; Marinopoulos 1992: 58.
TYPE LOCALITY – Mediterranean.
MATERIAL GREENLAND – "Kangamiut" station 2, fertile male – "Kap Farvel" station 100.
MATERIAL ICELAND – BIOICE stations 2080, with female gonophores – 2094 – 2099 – 2168 – 2185 – 2325 – 2343 – 2348, with male gonophores – 2360 – 2379 – 2410 – 2431 – 2462 – 2524 – 2706.

DESCRIPTION – colonies 4 to 10 cm (up to 20 possible), much branched, stem and branches polysiphonic, terminal branches simple. Short stretches of perisarc annulation frequent, especially at bases of branches. Hydranths typical for genus, with 20-24 tentacles. Female gonophores initially produced on slightly reduced hydranths, which may later be completely reduced and eggs are ultimately attached along perisarc covered zone of terminal branches. Young female gonophores with simple spadix which is later shed. Male gonophores on normal, tentacle bearing hydranth which is not or only slightly reduced after maturation of the gonads. Male gonophores in dense whorl around body of hydranth, with one or two chambers, without terminal nematocyst cluster. Nematocysts: microbasic eurytele of tentacles, (7-9)x(3-4) mm, r = 1.8-2.3, s ~ 0.8; microbasic mastigophore, on body and in coenosarc, (16-23)x(7-10) mm, r = 2.0-2.4, s ~ 1, shaft in undischarged capsule spanning 4/5 of capsule, discharged shaft nearly isodiametric, only at origin somewhat constricted, with short spines in spiral lines.

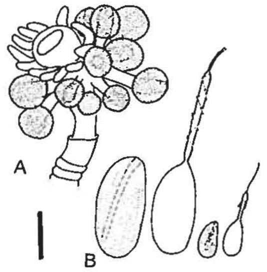

Figure 19. Eudendrium rameum *(Pallas, 1766). A, hydranth with male gonophores, BIOICE 2348, scale bar 0.2 mm. B, nematocysts: microbasic mastigophore, same discharged, microbasic eurytele, same discharged, BIOICE 2379, scale bar 10 μm.*

REMARKS – Marinopoulos (1992) identified the large heteroneme of *Eudendrium rameum* as microbasic eurytele, although he did not depict it discharged. It was possible to examine several discharged capsules in the present material and all had shafts that did not widen distally. Admittedly, it is often difficult to distinguish eurytele and mastigophore and some observed capsules indeed approached the eurytele condition. New material from the Mediterranean (type locality) should be examined. Hirohito (1988) did not observe large nematocysts in his Japanese material. I therefore doubt that his material belonged to *Eudendrium rameum*.

Distribution – widely distributed in temperate and cold waters. Mediterranean, Europe, North Atlantic, arctic seas, Bering Sea, Sea of Okhotsk, Kerguelen Islands (Broch 1916, Naumov 1969, Millard 1977). At Iceland known all around the island, at Greenland recorded from the east and west coast.

***Eudendrium ramosum* (Linnaeus, 1758)**
(Fig. 20)
Tubularia ramosa Linnaeus, 1758: 804.
Eudendrium ramosum – Hincks 1868: 82, pl. 13; Allman 1871: 332, pl. 13; Broch 1916: 59; Fraser 1937: 42, pl. 7 fig. 32; Kramp 1938: 12; Kramp 1943: 16; Fraser 1944: 72, pl. 12 fig. 48; Yamada 1954: 27; Naumov 1969: 266, fig. 135; Millard 1975: 85, fig. 31A-D; Millard & Bouillon 1973: 32, fig. 31A-D; Ramil & Vervoort 1992a: 20; Watson 1985: 191, figs 29-34; Hirohito 1988: 87, figs 30d-e, 31a-c, pl. 2 fig. C; Marinopoulos 1992: 59.
Type locality – Kentish shore, United Kingdom.
Material Greenland – "Kangamiut" station 6, with female gonophores on normal hydranth.
Material Iceland – BIOICE stations 2006, fertile – 2168, fragmented polysiphonic colony with long terminal parts monosiphonic, no gonophores, most hydranths lost – 2154, fragments of colony, no gonophores or hydranths.
Other Material examined – MHNG INVE 25956, Mediterranean, Naples, 1892, 8 cm high female colony – Banyuls-sur-Mer, collected by author October 1991, 3 cm colony, infertile.

Description – colonies up to 12 cm, with polysiphonic stem and polysiphonic major branches from which issue monosiphonic branches that are themselves branched several times. In typical forms, these monosiphonic branches are quite long, sometimes even forming the larger part of the colony.

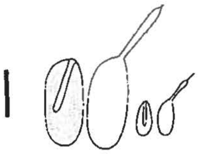

Figure 20. Eudendrium ramosum *(Linnaeus, 1758); BIOICE 2168, nematocysts: large microbasic eurytele, same discharged, small microbasic eurytele, same discharged, scale bar 10 µm.*

Tubes are annulated at their origins, but otherwise smooth. Hydranths typical for genus with about 20 tentacles. Without nematophores. Female gonophores are borne on the body or the pedicels of hydranths that are either fully developed or only somewhat reduced as compared to sterile polyps. The spadix is unbranched and later shed. Male gonophores (not seen, described acc. literature) are seated round normal or slightly atrophied polyps, with 2-3 chambers, without terminal nematocyst cluster. Nematocysts: microbasic eurytele of tentacles, (7-9)x(3-4) µm, r = 2.1-2.7, s ~ 0.7; microbasic eurytele on hydranth body, shaft in undischarged capsule about half of capsule length, shaft discharged leaving at 45° to axis of capsule, tapering slowly towards base, approaching sometimes mastigophore condition, (15-21) x(5.5-9.5) µm, r = 2.0-2.4, s = 0.6-0.7.

Remarks – the morphology and size of the nematocysts of the northern samples agreed rather well with typical material from the Mediterranean, except for the larger capsules from the Mediterranean that sometimes had a more bean-shaped outline. Like in *Eudendrium rameum*, it was often difficult to decide whether the large capsule was either an eurytele or a mastigophore. In this respect, the European material seems to differ from South African (Millard 1975) and Australian (Watson 1985) populations of *E. ramosum*. In both southern hemisphere populations the discharged capsule has a shaft with a conspicuous terminal swelling and it is discharged sideways (90°). In the material examined here it discharged at an angle of about 45°.

Eudendrium ramosum and *E. rameum* resemble each other closely and are sometimes difficult to separate. Examination of nematocysts, however, allowed a rather secure distinction of the material examined here, as the shafts of the large heteroneme is shorter in *Eudendrium ramosum*, this in the undischarged and discharged capsule as well (comp Figs 19B and 20). The long monosiphonic branches issuing from polysiphonic branches are quite typical for *E. ramosum* too, however, only observable in intact, fully grown colonies. The material from Iceland and Greenland did not always show the typical colony form. One sample from Greenland ("Kangamiut" 6), deviated particularly from this colony form and resembled more *E. rameum*. The nematocysts, however, matched clearly the other samples of *E. ramosum* and it had female gonophores on normal hydranths.

DISTRIBUTION – reportedly cosmopolitan, but as reliable identifications need nematocyst examination, many older records are doubtful. Reliable records are known from Europe, Mediterranean, South Africa, and Australia. Present at Iceland (north, east, and south coast) and western Greenland.

Eudendrium tenellum Allman, 1877

Eudendrium tenellum Allman, 1877: 8, pl. 4 figs 3-4; Kramp 1911: 365; not Kramp 1914: 991; Fraser 1937: 43, pl. 8 fig. 3; Kramp 1943: 16; Yamada 1954: 17, fig. 15; Calder 1972: 226, pl. 2 fig. 8.

TYPE LOCALITY – Double-Headed Shot Key, Florida.

TYPE MATERIAL EXAMINED – MCZH, few fragments left.

MATERIAL GREENLAND – ZMUC, 62.97°N 50.87°W, 47 m, 21.06.1909, material of Kramp (1914).

REMARKS – Allman (1877) described *E. tenellum* from infertile material without hydranths, he was even not sure whether it was an *Eudendrium*. This species – although it has been repeatedly identified by other authors – must certainly be considered unrecognisable. It was thought to be conspecific with *E. capillare* by Naumov (1969), but other authors like Calder (1972) kept it distinct from *E. capillare* on account of its nonreduced male gonozooids.

I have examined type material of this species. There are only few fragments left containing only little soft tissue. There is apparently only one type of nematocyst present like in *E. capillare*. However, as stated above, the species must be considered unrecognisable at present. It may even be that *E. tenellum* was based on fragments of a larger colony.

Kramp (1914) recorded *E. tenellum* from Greenland. I could re-examine his material and I found one type of nematocyst only. The colony was rather small, nearly stolonal, and the mature (spadix shed) female gonophores were borne on only slightly reduced hydranths. Identical material was encountered again during this study and referred to *Eudendrium capillare* (see there).

Eudendrium cf. *arbuscula* Wright, 1859

(Fig. 21A-B)

Eudendrium arbuscula Wright, 1859: 113, pl. 9 figs 5-6; Hincks 1868: 84, pl. 14 fig. 1; Marques & Vervoort 1999: 16.

Eudendrium arbusculum – ? Hamond 1957: 300, figs 7-8; Calder 1972: 225, pl. 2 fig. 5.

Eudendrium rigidum Allman, 1876; Kramp 1926b: 242, synonym.

Eudendrium wrighti Hartlaub, 1905: 547, new name; Broch 1916: 60, fig. T, pl. 1 fig. 7; Marinopoulos 1992: 55, fig. 1.8.

? *Eudendrium caricum* Jäderholm, 1908: 5, pl. 1 fig. 4, pl. 2 fig. 1; Kramp 1932a: 19, fig. 8a-b.

TYPE LOCALITY – Firth of Forth, Great Britain.

MATERIAL GREENLAND – "Kap Farvel" stations 1, fertile, 22 cm colony, male gonophores on completely atrophied hydranths – 117 – 135, fertile.

DESCRIPTION – colonies erect, 5-22 cm, much branched, stem and branches polysiphonic, thinning out to monosiphonic. Monosiphonic branches mostly smooth, some annulations at origin of side branches. Stem and larger branches can be covered by smooth layers of a tightly anastomosed network of stolon-like tubes. Hydranths typical for genus, 20-22 tentacles, with distinct basal groove, above this groove a broad belt of tightly set nematocysts. Male gonophores one chambered, occasionally two-chambered, young ones with distinct terminal nematocyst pad which is reduced or absent in more mature gonophores. Male gonophores arise in dense tuft at the end of a small branch, hydranth completely atrophied. Female gonophores not seen (see Calder 1972 for description). Nematocysts: microbasic euryteles on tentacles, (7-9)x(3-4) µm; microbasic euryteles on hydranth body, (14-17)x(6.5-7.5) µm, discharged shaft thick and strongly swollen in distal half, with spines, s = 0.8-0.9, unexploded capsule egg-shaped, shaft about 2/3 length of capsule.

REMARKS – Marques & Vervoort (1999) outlined the reasons why the name *E. arbuscula* for this species must be preferred over *E. wrighti*.

The identification of the above described material from Cape Farewell must be regarded as tentative only. New material of *E. arbuscula* from the type locality must be examined and the species re-described thorougly as the existing descriptions are too vague. The material examined here differed from other description of this species by forming much larger colonies (up to 22 cm versus 5 cm) and by having the characteristic terminal nematocyst pad of the male gonophores reduced at later stages. Another peculiarity was the unusual covering of the stem by one or more layers of tightly anastomosed stolon-like tubules. Like similar structures found in *E. annulatum*, these layers are derived from stolons that anastomosed in one layer and thus form a tight mesh-like covering resembling the bark of a tree. In *E. annulatum*, this layer, however, is not smooth but gnarled. The surface of this mesh of the present material is quite smooth, the gaps nearly obliterated. The extent of covering by these layers is rather variable from colony to colony. Otherwise the colonies matched descriptions given by other authors, especially Hincks (1868) and Calder (1972).

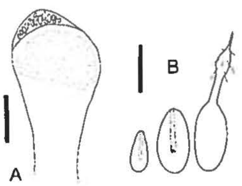

Figure 21. ? Eudendrium *cf.* arbuscula *Wright, 1859; Greenland, Cape Farewell. A, young male gonophore with distal pad containing nematocysts, scale bar 0.1 mm. B, nematocysts: small microbasic eurytele, larger microbasic eurytele, same discharged, note distinct swelling of shaft, scale bar 10 µm.*

The presently used scope of *E. arbusculum* is quite vague and relies mostly on the presence of the terminal nematocyst pad in the male gonophores, the polysiphonic stem, and the belt of nematocysts around the body of the hydranths, characters also found in many other *Eudendrium* species. Hincks (1868), Broch (1916, as *E. wrighti*) and Calder (1972) described the male gonozooids as completely atrophied, while Hamond (1957) found normally formed ones. Whether this reflects morphological variation of one species or is due to lumping of more than one species remains unknown.

Broch (1916) and Marinopoulos (1982) depicted nematocysts of this species. The ones found in this study (Fig. 21B) matched quite well Broch's in size and appearance, while the ones of Marinopoulos are different. The latter author - although it is not clear how he obtained his information - found much larger euryteles (21-31 µm in length) that had a constricted shaft in the undischarged capsule. I did not observe this in the Greenland material.

All these discrepancies lead me to suspect that the various records of *E. arbuscula* refer to more than one species. New investigations on material from the type locality are thus clearly needed. It is probable that the present Greenland material belongs a different species. However, the lack of information on the female gonophores retained me from proposing a new species.

DISTRIBUTION – in view of the insufficient information available, most identifications are tentative only. Reported from: Northwestern Europe, ? Mediterranean, ? Spitsbergen, ? Greenland, Canada. Not recorded from Iceland.

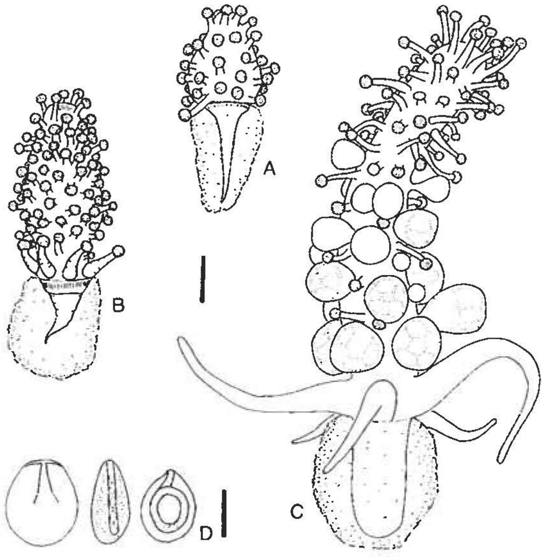

Figure 22. Acaulis primarius *Stimpson, 1854; Icelandic material. A, youngest specimen seen, scale bar 0.5 mm. B, intermediate size specimen with beginning transformation of most proximal tentacles, same scale as A. C, mature female, filiform tentacles fully developed, same scale as A. D, nematocysts: stenotele, heteroneme, desmoneme, scale bar 10 µm.*

Suborder Capitata

Family Acaulidae

***Acaulis primarius* Stimpson, 1854**

(Fig. 22A-D)

Acaulis primarius Stimpson, 1854: 10, pl. 1 fig. 4; Fraser 1944: 87, pl. 15 fig. 62; Westblad 1947: 13, figs 6-8; Berrill 1952: 17, fig. 6; Bouillon 1971: 342, pl. 4.

Acaulis primaris – Naumov 1969: 243, fig. 112.

TYPE LOCALITY – Grand Manan, Bay of Fundy, Canada.

MATERIAL GREENLAND – Bank. unders. stations 5294 – 5304.

MATERIAL ICELAND – BIOICE stations 2002 – 2096, one specimen, immature – 2124, 4 specimen, 2 with gonophores – 2201, 2 fertile specimens – 2221, 1 fertile specimen – 2451, 2 damaged specimen, fertile.

DESCRIPTION – solitary hydroids, up to 6 mm, living partially embedded in sediment. Body divided into basal part (1/5 of height) and distal part. Basal part conical to cylindrical, distal part cylindrical. Both parts separated by one whorl of 5-8 thick, conical tentacles covered evenly with nematocysts. Basal part surrounded by thick jelly which is infested with detritus on its outside. Distal part of hydranth with about 50 scattered capitate tentacles. Distal end rounded and with mouth opening. Gonophores arise on lower part of region with capitate tentacles, but are not associated with the latter. Gonophores are sessile sporosacs without a canal system but with spadix. Nematocysts: stenoteles, (18-21)x(14-17) µm; heteronemes, (16-20) x(7-10.5) µm, r = 1.8-2.3; desmonemes, (12-15.5) x(8.5-10.5) µm.

Development: young hydranths have no filiform tentacles, only capitate ones. During growth, the lowest capitate tentacles become elongated and thicker, the nematocyte free region of the tentacle is subsequently covered by nematocytes (see Fig. 22A-B) The development of the gonophores can begin before the filiform tentacles have completed their transformation.

REMARKS – this is the first record of *Acaulis primarius* Stimpson, 1854 for Greenland, although the present record lies within the known range of this species (see below).

Berrill (1952) showed that the filiform tentacles develop by a transformation of capitate tentacles. The change can take place even after the beginning of gonophore formation. This can be rather confusing, as other similar species are known that lack filiform tentacles, namely *Acaulis ilonae* Brinckmann-Voss, 1965 and *Acauloides ammisatum* Bouillon, 1965. While the Mediterranean *Acaulis ilonae* is well known and distinct, adult specimens of *Acauloides ammisatum* are unknown. At present, it is distinguished from *Acaulis primarius* only by its smaller size and its attachment to sand grains. It is still possible that *A. ammisatum* is only a juvenile stage of *A. primarius*.

DISTRIBUTION – New England, New Brunswick, north-west coast of Norway, White Sea (Fraser, 1944; Naumov, 1969), Kristineberg (Sweden; see Bouillon, Massin, and Kresevic 1995), Iceland (all around island, Schuchert 2000 and this study), western Greenland (this study).

Boreohydra simplex **Westblad, 1937**

(Fig. 23A-B)

Boreohydra simplex Westblad, 1937: 1, figs 1-4; Rees 1938: 37; Hult 1947: 455; Westblad 1947: 1-13, figs 1-4, pls 1-2; Nyholm 1951: 531, text fig, pl. 1 figs 1-4; Westblad 1953: 351, figs 1-2; Calder 1974: 1555; Bozhenova et al. 1989: 11; Petersen 1990: 148.

TYPE LOCALITY – Tromsø and Ramfjord, Norway.

MATERIAL GREENLAND – ZMUC, Jørgen Brønlund Fjord, 2 samples with several specimen, also MHNG INVE28447.

DESCRIPTION – hydroids solitary, composed of hydranth body and conical stalk. Hydranth body spindle-shaped, height 0.8-1.5 mm, diameter about 0.3 mm, hypostome short and rounded, surrounded by 3-4 short, stubby tentacles, slightly capitate by a concentration of nematocysts at their distal ends. On hydranth body 50-60 scattered nematocysts clusters, variable in size, 3-15 capsules per cluster, clusters slightly elevated and wart-like. Hydranth body at base tapering and turning into stalk. Stalk 0.4-1 mm long, conical, constantly tapering into fine tip at its end, stalk covered by wrinkled perisarc. Cnidome: stenoteles (17-19)x(16) µm; desmonemes, (16-17)x(9-11) µm, discharged with four coils; isorhizas (17-20) x(4.5-5.5) µm.

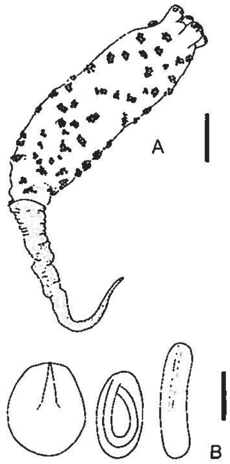

Figure 23. Boreohydra simplex *Westblad, 1937; Greenland, Pearyland. A, polyp, scale bar 0.2 mm. B, cnidome: stenotele, desmoneme, isorhiza, scale bar 10 µm.*

ADDITIONAL DETAILS – (after Westblad 1947 and Nyholm 1951) polyp multiplies by transverse fission, produces gonophore-like outgrowths without germ-cells, eggs are found in epidermis and not associated with a gonophore. Polyps live in fine mud.

REMARKS – Westblad (1947) supplemented the first description by further anatomical and ecological details. He observed buds that he interpreted as gonophores, however he could not find germ cells in them. Later, Nyholm (1951) observed eggs in the epidermis and concluded that the germ cells of this species are not collected in sporosacs, but remain in the epidermis like in *Hydra*. Petersen

(1990) interpreted the gonophore-like outgrowths observed by Westblad (1947) as incipient polyp buds. More work is clearly needed to reveal the nature of these buds.

Boreohydra simplex is here recorded for the first time for Greenland. Remarkably, the findings come from the extreme north of Greenland. It is well possible that this polyp is much wider distributed than previously known, but it has either been overlooked due to its small size or misidentified as a worm due to its form, which is rather atypical for a hydroid.

Distribution – bipolar, northern and southern Atlantic Ocean, probably quite frequent, but often overlooked. Recorded from Norway to Sweden, Great Britain, Iceland (north and east coast), north-eastern Canada, White Sea, and northern Greenland (this study), South Georgia (Westblad 1953, Calder 1974, Bozhenova et al. 1989).

Family Candelabridae

***Candelabrum phrygium* (Fabricius, 1780)**

(Fig. 24)

Lucernaria phrygia Fabricius, 1780: 343.

Myriothela arctica M. Sars, 1850: 126.

Myriothela phrygia – Kramp 1914: 980; Broch 1916: 19, Fig. C, pl. 1 figs 3 & 8; Naumov 1969: 261, figs 130-131.

Candelabrum phrygium – Kramp 1932a: 5; Segonzac & Vervoort 1995: 45, figs 2e-f, 3E-F, table 1.

Type locality – Greenland.

Material Greenland – ZMUC, collection date and exact locality unknown, two well preserved polyps, one male, one female.

Description – solitary polyp, contracted adults about 2 cm, capable of very long extension (30 cm after Broch 1916), worm-like, attached to solid substrata by means of thin, basal processes. Each process ends in a slight terminal swelling and a thin disk of periderm. Upper 3/4 of polyp densely covered by numerous short, hollow, capitate tentacles. At basal quarter of polyp arise many (>10) unbranched blastostyles, 2-3 mm long. Blastostyles bear sessile sporosacs, the two sexes on different polyps. At distal end of blastostyles 4-6 short, stubby tentacles. Male sporosacs about 0.4-0.6 mm when mature, spherical, without radial canals, up to 6 of different developmental stages per blastostyle. Females with up to 4 sporosacs per blastostyle, maximally two mature, others in development, spherical, no radial canals, maximal size around 1.2 mm, presumably one egg per sporosac that develops into a young polyp with several (>10) capitate tentacles, hence viviparous.

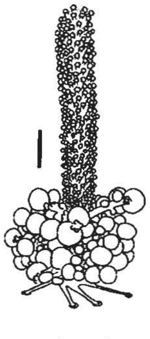

Figure 24. Candelabrum phrygium *(Fabricius, 1780). Female specimen from Greenland, scale bar 2 mm.*

Remarks – closer examination of a detached blastostyle made it clear that some sporosacs contain young polyps. *Candelabrum phrygia* is thus viviparous.

Contrary to the observations of Segonzac and Vervoort (1995), the basal processes were attached to the substrate by small periderm disks. It is probable that such disks are not always formed and their formation depends on the type of substrate.

Distribution – arctic parts of Atlantic and Pacific Oceans, Barents Sea, Kara Sea, Greenland (east and west coast), Iceland (north coast). In the Atlantic it also penetrates boreal waters, though there usually at greater depths (Segonzac & Vervoort 1995).

Family Corymorphidae

Corymorpha glacialis M. Sars, 1859
(Fig. 25)

Corymorpha glacialis M. Sars, 1859; Broch 1916: 32; Kramp 1938: 8; Naumov 1969: 231, figs 99-100.
Amalthea islandica Allman, 1876: 396.

TYPE LOCALITY – Varanger Fjord, Norway.

TYPE MATERIAL EXAMINED – syntypes, ZMO, (see Bonnevie 1898: 476).

MATERIAL GREENLAND – Bank. unders. station 5303, with typical medusoids.

MATERIAL ICELAND – BIOICE stations 2539, fertile – 2562, two mature male polyps, about 4 cm, somewhat damaged but otherwise well preserved.

DESCRIPTION – Solitary hydroids, 4 cm in height (max. 10 cm after Naumov 1969), white to cream coloured (preserved material). Long cylindrical caulus covered by thin perisarc reaching up to base of hydranth body, with slightly swollen basal end. In this swollen region numerous papillae and rooting filaments. Tissue in caulus with numerous longitudinal canals along periphery. Hydranth body with broad base, flask shaped. One aboral whorl of about 40 long (2 cm) filiform, laterally compressed tentacles, and three or more whorls of short (1-2 mm) filiform oral tentacles. Gonophores arise from 20-30 blastostyles developed just above aboral tentacles. Blastostyles thick, mostly unbranched, although occasional branching into two arms is possible. Gonophores develop along blastostyles either solitarily or in clusters. Gonophores fixed medusoids, spherical, with manubrium, with four radial canals and rudimentary tentacle bulbs.

ADDITIONAL DETAILS – According to Naumov (1969), the development of the eggs takes place in the gonophore and finally young polyps are liberated.

REMARKS – in 1876, Allman described *Amalthea islandica* from Eyjafjörður, Iceland. Broch (1916) re-examined Allman's material and material of *Corymorpha glacialis* and concluded that they must be conspecific, a view also shared by the present author. *Corymorpha glacialis* has very long aboral tentacles. Although this is by no means a good diagnostic character alone, their length is rather conspicuous.

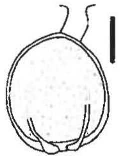

Figure 25. Corymorpha glacialis *M. Sars, 1859. Mature male gonophore, note the presence of radial canals, scale bar 0.2 mm.*

Some gonophores of the present material had four distal elevations that proved to be rudiments of tentacle bulbs. They had also a thickened epidermis with nematocytes. Such structures might have been seen by Allman (1876) and interpreted as rudimentary tentacles, an assertion contested by Broch (1916). The radial canals may be difficult to see. In the type series they are not visible and Bonnevie (1898) could see them only in histological sections. In the examined material from Iceland the distal part were, however, clearly visible (Fig. 25)

DISTRIBUTION – Iceland (north and east coast), Faroe Islands, Spitsbergen, Norway, White Sea, Barents Sea, Kara Sea, Laptev Sea. The record from Greenland by Levinsen (1893) as *Amalthea islandica* was in fact *Corymorpha groenlandica* (Broch 1916). One new specimen from Greenland (Fiskebanke), however, clearly belongs to this species and confirms it's occurrence at Greenland.

Corymorpha groenlandica (Allman, 1876)
(Fig. 26A-B)

Monocaulus groenlandica Allman, 1876: 257, pl. 9 figs 7-8.
Lampra atlantica Bonnevie, 1899: 20, pl. 2 fig. 4, pl. 4 fig. 1.

Lampra purpurea Bonnevie, 1899: 2020, pl. 2 fig. 4, pl. 4 fig. 1.
Lampra socia Swenander, 1904: 6, pl. figs 1-3.
Lampra arctica Jäderholm, 1909: 41, pl. 1 fig. 9-10.
Corymorpha Spitsbergensis Broch, 1909: 140.
Corymorpha groenlandica – Kramp 1914: 984; Broch 1915: 11, pl. 4 figs 16-19; Broch 1916: 33, fig. I, pl. 2 figs 14-15; Kramp 1938: 8; Naumov 1969: 232, fig. 101; Calder 1972: 220, pl. 1 fig. 2.

TYPE LOCALITY – Nuuk (Godthaab), Greenland.

TYPE MATERIAL EXAMINED – holotype, ZMUC.

MATERIAL GREENLAND – "Kap Farvel" station 142, fertile.

MATERIAL ICELAND – BIOICE stations 2019 – 2056 – 2107 – 2126 – 2137 – 2140, fertile – 2142 – 2161 – 2177 – 2150, about 40 specimen, reaching 2 cm in size, some fertile – 2152, about 50 specimen, reaching 2 cm in size, some fertile – 2315, fertile – 2316, fertile – 2318, fertile – 2320, fertile – 2326, fertile – 2337, about 10 juvenile specimens – 2358, fertile – 2454 – 2493, 5 juvenile specimens – 2501 – 2509 – 2520 – 2522, fertile – 2524, fertile – 2568, fertile – 2574 – 2575 – 2594, fertile – 2642, fertile – 2673 – 2675 – 2676, fertile – 2765 – 2749, fertile – 2751 – 2823, fertile – 2824.

DESCRIPTION – Solitary hydroids, mature 1.5-10 cm in height. Long caulus, increasing in diameter towards basal end, covered by filmy wrinkled perisarc. Basal end with numerous tangled, thin filaments. Visible perisarc ends below upper end of caulus and thus delimits a distal neck region of the caulus. Hydranth body broadly flask-shaped. Aboral whorl of 20-35 rather thin tentacles, bases continued as ridges on hydranth body. Oral tentacles rather short, about the same number as aboral ones, in 2-4 closely set whorls, innermost tentacles small, outer ones longer. Gonophores arise from blastostyles developing just above aboral tentacles, blastostyles much less in number than aboral tentacles. Blastostyles contractile, simply rod-shaped and not branched, bearing 6-10 gonophores. Gonophores pear-shaped to spherical, sporosacs without traces of radial canals, circular canal, or tentacles. Females with 8-10 eggs. Colour: hydranth body, gonophores, blastostyles and caulus intensively orange to orange-brown.

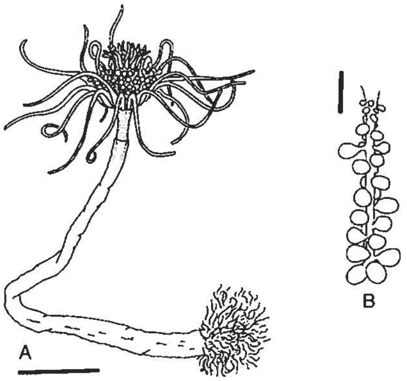

Figure 26. Corymorpha groenlandica *(Allman, 1876). A, nearly mature animal, scale bar 1 cm. B, blastostyle of mature animal, BIOICE 2568, scale bar 2 mm.*

REMARKS – *Corymorpha groenlandica* is rather conspicuous due to its intense orange or brick-red colour. The colour is also present in long preserved animals and hardly fades (Naumov 1969). However, the holotype material has lost its colour. Some of the smaller, infertile specimens encountered during this study were therefore identifiable only due to their colour. Gonophore development starts at a relative early stage, thus even hydranths of 1.5 cm height may bear blastostyles with developing sporosacs. Like other *Corymorpha* species, *Corymorpha groenlandica* seems to continue its growth even after the onset of gonophore production. This results in animals with very differing size and tentacle numbers.

Broch (1918) revised the numerous *Corymorpha* species known from the north Atlantic and put forward good arguments that a number of nominal species are actually conspecific with *Corymorpha groenlandica.* These species mainly differ in the number of tentacles, number of blastostyles and size, all together traits that are rather unsuitable to discriminate different species.

Calder (1972) thinks that *Rhizonema carnea* Clark, 1877 is possibly conspecific with *C. groenlandica*. Considering only the original description of Clark (1877), this view is supportable, but Clarke (1903) re-described his material, although he did not use the name again. The clustered gonophores of Clarke's figures suggest that the two nominal species are separable. Unfortunately, Clarke could not describe the nature of the gonophores. The colour of his specimens were "coral-red", thus approaching *C. groenlandica*. *Corymorpha carnea* has also been described from Japan by Stechow (1909) and Hirohito (1988) as having medusoid gonophores, but Hirohito somewhat hesitated to follow Stechow. The Japanese population had only red bodies while their tentacles were white.

DISTRIBUTION – Greenland (Davis Strait, Cape Farewell), Iceland (all around island, rare at west coast), Spitsbergen, Faroe Islands, Norway, Barents Sea, Laptev Sea, Liverpool Bay, Beaufort Sea (Calder 1972). Depth, usually deeper than 100 m, depth range at Iceland: 120-1253 m.

Corymorpha nutans M. Sars, 1835
(Fig. 27)

Corymorpha nutans M. Sars, 1835: 6, pl. 1 fig. 3; Hincks 1868: 127, pl. 22 fig. 2; Allman 1871: 388, pl. 19; Broch 1916: 31, fig. G; Broch 1918: 174; Kramp 1938: 7; Naumov 1969: 226, figs 93-94; Brinckmann-Voss 1970: 12, text figs. 6-8, pl. 2 fig. 3; Petersen, 1990: 152, fig. 18.
Steenstrupia nutans – Russell 1953: 84, figs 35A-D, 36, 37A-C, pl. 3 fig. 1, pl. 34 fig. 2, synonymy; Kramp 1959: 86, fig. fig. 32; Kramp 1961: 45.
TYPE LOCALITY – coast of Norway.
MATERIAL EXAMINED – ZMUC, Denmark, Frederikshavn, 1.3.1931, coll. P. Kramp, 12 fertile specimens – France Roscoff, several living, mature medusae from plankton, May 2000.

DESCRIPTION – hydroid solitary, up to 10 cm in height. Hydrocaulus stout, with longitudinal canals, towards base a region with papillae followed by end with numerous tangled rooting filaments. Perisarc a thin, membranous tube. Hydranth vasiform, distinctly separated from caulus, with up to 60 aboral tentacles in one whorl. Aboral tentacles long, laterally compressed. Around mouth of hydranth up to 100 oral tentacles in several closely set whorls. Gonophores develop on blastostyles that develop in one whorl just distal to the aboral tentacles. Blastostyles with short side branches bearing clusters of up to 20 gonophores. Gonophores without envelope, will develop into medusae.

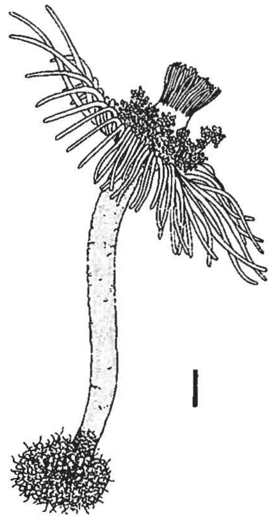

Figure 27. Corymorpha nutans *M. Sars, 1835; Denmark, Frederikshavn; with medusae buds, rooting filaments with entangled sand grains, scale bar 2 mm.*

Mature medusa 5-6 mm high, 3-4 mm wide, with a conical apical projection and a long, narrow apical canal. Manubrium about as long as bell cavity, upon short, broad gelatinous peduncle, manubrium often with oil droplet; gonad surrounding entire length of manubrium. Four broad radial canals and ring canal present. Only one moniliform tentacle. Other three bulbs rudimentary, no ocelli. Bell and radial canals yellowish.

ECOLOGY – polyp lives rooted in the bottom, and may be found in silty sand, clean sand, and clean shell gravel. Asexual reproduction takes place by polyp budding.

REMARKS – the polyp stage is very distinct when bearing medusae buds.

DISTRIBUTION – polyp common along the coasts of north-western Europe from northern France to Lofoten and the Norwegian coast, present also in the Mediterranean and Black Sea, never found at the Faroes and Greenland. It mainly occurs in depths of less than 100 metres (Kramp 1938, Naumov 1969). Around Iceland the occurrence of this typically boreal species is restricted to the two great gulfs at the west coast (for a map see Broch 1916).

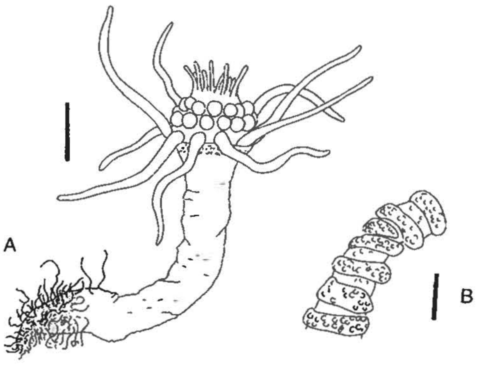

Figure 28. Gymnogonos crassicornis *Bonnevie, 1898, BIOICE 2233. A. whole animal, not all rooting filaments shown, scale bar 1 mm. B, part of aboral tentacles, scale bar 0.2 mm.*

***Gymnogonos crassicornis* Bonnevie, 1898**
(Fig. 28A-B)

Gymnogonos crassicornis Bonnevie, 1898: 481, pl. 25 figs 1-11; Kramp 1933: 12; Kramp 1949: 200, fig. 8.

TYPE LOCALITY – Norway, Trondheimfjord, Beian, 400 m.

MATERIAL ICELAND – BIOICE 2233, one animal with gonophores.

DESCRIPTION – solitary hydroid, about 6 mm in height, with thick, conical caulus that intergrades directly into hydranth without forming a neck region. Caulus bent, slightly swollen at lower end, covered by filmy persisarc, lower end darker due to adhering sediment particles, this region also with numerous entangled rooting filaments. Rooting filaments end in small statocyst with gastrodermal statoliths. Perisarc terminates just below aboral tentacles. Below aboral tentacles a belt with distinct papillae in about three transverse rings. Hydranth swollen, broadly urn-shaped, with a whorl of 13 aboral tentacles and two closely set whorls of oral tentacles around mouth. Aboral tentacles contracted about 2 mm long, with nematocysts concentrated in somewhat indistinct annular thickenings (moniliform). Oral tentacles about 20 in number, much shorter than aboral ones, of variable length, some with indistinct terminal swelling. Gonophores sessile sporosacs, spherical, about 30 in two rings between oral and aboral tentacles, attached directly to hydranth body by thin tissue strand.

REMARKS – this corymorphid hydroid certainly belongs to the genus *Gymnogonos* due to the absence of a neck region (see Petersen 1990). It fits rather well the description of Bonnevie (1898) for *Gymnogonos crassicaulis,* although Bonnevie's specimen had a size of 15 mm. Kramp (1933) gives some further details on Bonnevie's specimen and describes a similar species, *Corymorpha obvoluta* from eastern Greenland. The latter species differs from *Gymnogonos crassicaulis* in being larger (32 mm), having no rooting filaments, and clustered gonophores that are oblong and not spherical. Petersen (1990) referred both to the genus *Gymnogonos.* Both species are extremely rare and the present record for *Gymnogonos crassicaulis* is the second finding only. Contrary to the assumption of Kramp (1948), the nematocyst arrangement of the aboral tentacles is – although somewhat indistinct – moniliform (see Fig. 28B), thus like in *Gymnogonos obvolutus.*

DISTRIBUTION – rare, so far only known from its type locality in Norway. The present finding is the second one for this species. It was found off the south-west corner of Iceland in a depth of about 209 metres. Unknown from Greenland.

***Gymnogonos obvolutus* (Kramp, 1933)**

Corymorpha obvoluta Kramp, 1933: 4, figs 1-9; Rees 1938: 29; Kramp 1943: 7; Kramp 1949: fig. 5.

Gymnogonos obvolutus – Petersen, 1990: 148, fig. 16A (type).

TYPE LOCALITY – Kangerlussuaq, south-eastern Greenland (68.33°N 32.33°W), 175 m.

DESCRIPTION – see Kramp (1933, 1949).

REMARKS – for differences to *G. crassicornis* see remarks for the latter species.

DISTRIBUTION – Greenland, found only once.

***Branchiocerianthus reniformis* Broch, 1918**

Branchiocerianthus reniformis Broch, 1918: 176, pl. 1 figs 2-5.

TYPE LOCALITY – 65.23°N 55.70°W, 791 m, Greenland.

TYPE MATERIAL EXAMINED – holotype, ZMUC, "Ingolf" station 28.

DESCRIPTION – see Broch (1918) for figures and description.

REMARKS – this very large and unique hydroid is only known from it first description by Broch (1918). The heart-shaped hydranth body makes it immediately recognisable.

DISTRIBUTION – extremely rare, western Greenland.

***Euphysa aurata* Forbes, 1848**

(Fig. 29)

Euphysa aurata Forbes, 1848: 71, pl. 13 fig. 3; Russell 1953: 90, figs 35E, 38-39, pl. 3 fig. 2; Kramp 1959: 85, fig. 29; Kramp 1961: 36; Brinckmann-Voss 1970: 16, figs 12-15.

Corymorpha annulicornis M. Sars, 1859; Rees 1938: 25, figs 8-9, life cycle.

Corymorpha aurata – Naumov 1969: 228, figs 95-96.

TYPE LOCALITY – Brassay Sound, Shetland Islands.

MATERIAL GREENLAND – Bank. unders. station 5294, one specimen.

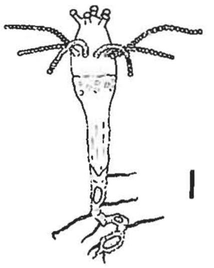

Figure 29. Euphysa aurata *Forbes, 1848; Greenland, Store Fiskebanke, scale bar 0.3 mm.*

DESCRIPTION – solitary hydroid, 3 mm in height, club-shaped, distal end swollen, basal part conical, ensheathed in film-like perisarc, oblong bodies budding from basal end. Perisarc thin, transparent, with several anchoring filaments. Hydranth body near distal end of perisarc with several flat papillae. In upper quarter of hydranth one whorl of about 14 moniliform tentacles. Around mouth about 5 short, stubby capitate tentacles. Medusae buds absent. For a description of the adult medusa see Russell (1953).

REMARKS – this is the first record of the polyp phase for Greenland. The medusa of this species, however, was already known to occur here (Kramp 1959).

DISTRIBUTION – (medusa and polyp) western Greenland, north-western Europe, Russian Arctic Seas, Mediterranean, Massachusetts Bay, ? Argentina. So far not known from Iceland, but its range suggests that it also occurs here.

Family Tubulariidae [1]

***Bouillonia cornucopiae* (Bonnevie, 1898)**

Tubularia cornucopia Bonnevie, 1998: 474, pl. 26 fig. 20; Jäderholm 1902: 5; Kramp 1914: 983.

not *Tubularia cornucopia* – Broch 1916: 29 = *Stephanoscyphus simplex*.

Bouillonia cornucopia – Petersen 1990: 176, fig. 28.

TYPE LOCALITY – Spitsbergen, 77.97°N 10.17°W, 2438 m.

DESCRIPTION – for a description see Petersen (1990).

REMARKS – no material of this species could be examined. This is a rare deep water species

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[1] The Greenlandic Zyzzyzus robustus Petersen, 1990 also belongs here.

with all previous records being in depths of 2000 to 3213 m.

Distribution – Norway, Spitsbergen, northeastern Greenland.

Ectopleura ***larynx*** **(Ellis & Solander, 1786)**
(Fig. 30A-E)
Tubularia larynx Ellis & Solander, 1786: 31; Allman 1871: 406, pl. 21; Saemundsson 1902: 51; Broch 1916: 27, map F; Kramp 1938: 7; Naumov 1969: 239, fig. 109; Brinckmann-Voss 1970: 31, synonymy; Millard 1975: 35, fig. 15H-J.
[not *Acharadria larynx* Wright, 1863 = *Ectopleura wrighti* Petersen, 1979]
Ectopleura larynx – Petersen 1990: 170; Schuchert 1996: 109, fig. 65a-b.
Type locality – British Isles.
Material Iceland – BIOICE stations 2201 – 2501, with male gonophores – 2531 – 2597 – 2562.
Other Material examined – ZMUC, Denmark, Frederikshavn, 7.08.1973, 0.5 m, coll. K. Petersen, fertile – MHNG INVE25959, Mediterranean, Sète canal, several mature females.

Description – colonial tubularid hydroids, up to 50 mm tall, arising from ramified stolons. Cauli normally not branching, but with apparent branching caused by settling of larvae on stems of older polyps. Perisarc of stem firm, with some irregular annulations which may be more or less pronounced. Hydranth vasiform with long hypostome, with one oral whorl of 20-22 filiform tentacles adnate to hypostome and forming longitudinal ridges over distal half of hypostome, one aboral whorl of 20-25 long filiform tentacles. Neck region below hydranth with groove from which a filmy perisarc which is secreted, this groove at some distance from distal end of neck region, thus forming a collar (Fig. 30B). Gonophores born on blastostyles that may be branched or not. Blastostyles arising distal to aboral tentacles, reaching lengths like the one of the tentacles, usually shorter. Gonophores remain fixed as sporosacs, up to 0.6 mm long, oval to spherical, without radial canals. Older female gonophores with four closely-set distal processes, either as mere bulges, lamellar, or horn-like. Spadix can protrude out of gonophore. Embryos develop inside female gonophore. Male gonophores more oval, with a distal thickening of epidermis.

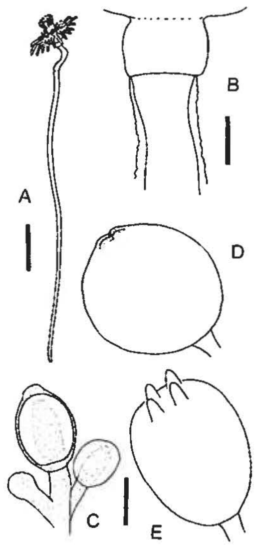

Figure 30. Ectopleura larynx *(Ellis & Solander, 1786); A-C BIOICE 2501. A, one polyp, scale bar 0.5 mm. B, neck region showing origin of perisarc in groove below end of caulus, characteristic for the genus* Ectopleura*, scale bar 0.2 mm. C, male gonophores, same scale as B. D, female gonophore from Mediterranean material, same scale as B. E, female gonophore from Denmark.*

Remarks – although the BIOICE material matched well the descriptions of *Ectopleura larynx* (Ellis & Solander, 1786), the identifications must be regarded as tentative. *Ectopleura larynx* closely resembles *Ectopleura crocea* (L. Agassiz, 1862) (syn. *Tubularia mesembryanthemum* Allman, 1871). Both species can only reliably be distinguished by their female gonophores (Schuchert 1996). While *E. larynx* has female gonophores with only four processes (see Fig. 30D-E), *E. crocea* has eight laterally compressed ridges (comp. Schuchert 1996). The processes in *E. larynx* can be of variable size (see Figs 330D-E). *Ectopleura crocea* is so far not known to occur in Icelandic waters, but might well be present as it is widely known from North America, Europe, Mediterranean, South Africa, and New Zealand.

DISTRIBUTION – common along the boreal coast of North America and Europe, Mediterranean, White Sea, Barents Sea, Sea of Okhotsk, Sakhalin and Kuriles, New Zealand, mostly in shallow waters above 35 metres (Naumov 1969, Schuchert 1996), but also reported from 845 m on the mid-Atlantic Ridge near the Azores (Calder & Vervoort 1998). Broch (1916) and Kramp (1933) give many Icelandic records of this species, with a notable majority in the west of the island. The BIOICE samples also came only from the west and north-west coasts, from depths of 72-630 meters. It is not known from Greenland.

Hybocodon prolifer L. Agassiz, 1862

Coryne fritillaria Steenstrup, 1842: 11.
Hybocodon prolifer L. Agassiz, 1862: 243, pl. 23a figs 10-11, pl. 25 fig. 19; Mayer 1910: 38, pl. 2 fig. 1, pl. 3 fig. 3, text. fig. 10; Fraser 1937: 54, pl. 2 fig. 46; Fraser 1944: 106, pl. 18 fig. 78; Russell 1953: 79, pl. 3 figs 3-4, text figs 34, synonymy; Kramp 1959: 86, fig. 33; Kramp 1961: 43; Arai & Brinckmann-Voss 1980: 10, fig. 4; Petersen 1990: 192, fig. 37; Schuchert 1996: 113, fig. 68a-e.
Auliscus pulcher Saemundsson, 1899: 425, pl. 4.
Diplura fritillaria – Saemundsson 1902: 51.
Tubularia pulcher – Broch 1916: 22, pl. 2 fig. 16.
Tubularia prolifer – Kramp 1938: 7; Naumov 1969: 233, figs 102-105.
Tubularia christinae – Naumov 1969: 236, fig. 106.
TYPE LOCALITY – Nahant, Massachusetts, USA.

DIAGNOSIS – tubularoid hydroids growing partially embedded in sponges. Oral tentacles in two whorls, perisarc originates just below hydranth and covers the whole caulus, thus no neck region. Gonophores liberated as immature medusae. Adult medusa bilaterally symmetrical with one marginal bulb much larger than the others, sometimes with medusae budding from large bulb. Exumbrella with meridional nematocyst tracks. For more detailed descriptions and figures see Russell (1953) or Schuchert (1996).

REMARKS – this species was originally reported from Iceland as *Auliscus pulcher* Saemundsson, 1899. Kramp (1926) carefully compared *Auliscus pulcher* with *Hybocodon prolifer* and concluded that both must be conspecific. This is quite evident from Saemundsson's figures (1899) and is here accepted too.

DISTRIBUTION – the medusa is widely distributed in the north Atlantic and Pacific, known from Newfoundland to Chesapeake Bay, western and eastern Greenland, Iceland (north and west coast), north-west Europe from English Channel to Beren Island, Bering Sea, Sea of Okhotsk, Hokkaido to Kamchatka, Alaska, Puget Sound, New Zealand (Schuchert 1996). The polyp is known from the east coast of North America, Plymouth on the south coast of England, Iceland, and New Zealand. The polyp normally lives in shallow waters.

Tubularia indivisa Linnaeus, 1758

(Fig. 31A)
Tubularia indivisa Linnaeus, 1758: 1301; Hincks 1868: 115, pl. 20; Allman 1871: 400, pl. 20; Saemundsson 1902: 51; Kramp 1914: 981; Broch 1916: 24, fig. D, pl. 1 fig. 4; Kramp 1938: 5; in part Naumov 1969: 237, fig. 108; Petersen 1990: 196.
Tubularia simplex Alder, 1862: 232, pl. 8 figs 3-4; Naumov 1969: 237, fig. 107.
Tubularia obliqua Bonnevie, 1898: 24.
MATERIAL ICELAND – ZMUC, Vestmannaeyjar, 15.05.1897, det. Saemundsson, fertile female – BIOICE stations 2508, young gonophores present – 2168, young gonophores present – 2154 – 2156, juvenile – 2154, much damaged – 2313, numerous stems – 2490 – 2491 – 2509 – 2516 – 2520 – 2524 – 2526 – 2527 – 2528 –

2530 – 2531 – 2533 – 2564 – 2574 – 2579 – 2601 – 2603.

DESCRIPTION – hydroid solitary but growing in characteristic clusters with entwined basal parts of cauli. Hydrocaulus 3-10 cm (reportedly up to 20 cm), coenosarc with peripheral canals and one larger central one, perisarc firm, annulations rare or absent, neck region with inflated, filmy perisarc originating at joint of hydranth and caulus (thus without collar). Hydranth flask-shaped, with one aboral whorl of 20-35 fairly long tentacles and several closely set whorls of 40-60 oral tentacles, these continued on hydranth as longitudinal ridges. Gonophores developing on up to 12 long unbranched blastostyles originating distal to aboral tentacles. Each blastostyle with up to 30 gonophores of variable size. Gonophores not released, medusoid or sporosacs. Female medusoids ovate to globular, with rounded distal end, with four radial canals of unequal length and a circular canal, circular canal, opening shifted to side, thus rendering symmetry bilateral. Eggs develop to actinula within gonophore and have developed oral and aboral tentacles at time of liberation. Male gonophores not seen, after Petersen (1990) sporosacs without canal system, oval or globular.

REMARKS – for a reliable identification of *E. indivisa*, at least for Greenland, the mature female medusoids must be known. *Tubularia regalis* differs from *T. indivisa* by having meridional crests on its female medusoids (see. Fig. 31A-B). *Tubularia regalis* can be larger and taller than *T. indivisa*, but the size ranges of both overlap largely. Naumov (1969) regarded the two species as conspecific. I think that they are distinct species, but many records of *T. indivisa* from Greenland may actually refer to the more arctic *T. regalis*. Many arctic records of *T. indivisa* are based on male or infertile material.

Tubularia regalis is so far not known from Iceland, so perhaps the Icelandic BIOICE material belongs likely to *T. indivisa*, although most material had no female medusoids.

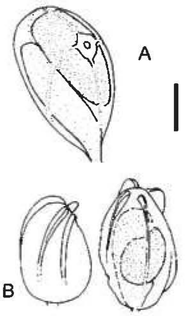

Figure 31. A, Tubularia indivisa *Linnaeus, 1758; female medusoid, from Iceland, scale bar 0.5 mm. B,* Tubularia regalis *Boeck, 1860; two female medusoids, Greenland, Kvanefjord, same scale as A, medusoid left shown opaque, note presence of crests.*

DISTRIBUTION – very widely distributed in the northern parts of the Atlantic and Pacific Oceans, also present in the Mediterranean (Boero & Bouillon 1993) and in arctic seas north of Russia (Naumov 1969). It is rather common along European shores, normally in depths of 10 to 300 m, but also in rock pools. Kramp (1914) summarises the records for western Greenland. Apparently there are no records from eastern Greenland. At Iceland it is known from several localities along the west and east coast. The BIOICE samples came from localities along the west and north coast, depth range 87 to 152 m.

***Tubularia regalis*, 1860**
(Fig. 31B)

Tubularia regalis Boeck, 1860: 114, pl. 8.; Kramp 1914: 982; Broch 1916: 25, fig. E; Kramp 1932b: 6; Kramp 1943: 7; Calder 1972: 222, pl. 1 fig. 3; Petersen 1990.

Tubularia variabilis Bonnevie, 1898: 471, pl. 25 fig 12.

? *Tubularia borealis* Clark, 1877; Calder 1972: 222.

Tubularia indivisa in part Naumov, 1960: 237.

TYPE LOCALITY – Belsund, Spitsbergen.

MATERIAL GREENLAND – ZMUC, 61.97°N 49.33°W, 26.06.1912, det. P. Kramp, fertile females – "Kap Farvel" station 103, fertile.

DIAGNOSIS – like *Tubularia indivisa*, but usually larger. Female medusoids with 3-6 crests (see Fig. 31B). For a complete description see Calder (1972).

REMARKS – *Tubularia regalis* is larger than *Tubularia indivisa*, but their size ranges overlap largely. So, the only reliable character to distinguish both species is the morphology of the female medusoid gonophores (Fig. 31). The radial canals of the female medusoid of *T. regalis* had variably 3-6 radial canals, corresponding to the number of crests.

DISTRIBUTION – arctic species, known from western and esatern Greenland, Spitsbergen, eastern Canada, Barents Sea, White Sea, Kara Sea (Calder 1972). Not known from Iceland.

Family Corynidae

REMARKS – for a reliable identification of many Corynidae that produce a free medusa the adult medusa must be obtained by rearing experiments. Although the fertile polyps of the species known to occur in the region under investigations can be distinguished (see Table 3), there exist many other *Sarsia* species with identical polyps and they are potentially present at Greenland or Iceland.

Coryne hincksii Bonnevie, 1898

(Fig. 32A-C)

Coryne hincksii Bonnevie, 1898a: 492, pl. 27, fig. 48-49; Rees 1956d: 109; Calder 1972: 222, pl. 1 fig. 6.

TYPE LOCALITY – Hammerfest, Norway 183 m.

MATERIAL GREENLAND – Bank. unders. station 5291 – "Kap Farvel" stations 114 – 117.

DESCRIPTION – colony reaching 2 cm, stems branching 1-3 times, 0.25-0.3 mm in diameter, perisarc thick, mostly smooth, occasionally corrugated, but not annulated. Hydranths 1.5-2.2 mm in height, 0.4 mm in diameter, spindle shaped, 16-22 scattered capitate tentacles, oral tentacles 4-6, without filiform tentacles. Gonophores are sessile sporosacs, 4-12 developing independently of the tentacles in lower half of hydranth, sometimes up to three sporosacs clustered, stalk of sporosacs longer than in other *Coryne* species. Sporosacs oblong, up to 1 mm in length and 0.70-0.75 mm wide when fully developed, at distal end a clearly visible ring canal of narrow diameter, radial canals only occasionally visible, spadix distinct, without bulbs or tentacle rudiments. Nematocysts: stenoteles of two size classes, (16-18)x(11-12) µm and (28-29)x(18-20) µm.

Table 3. Distinguishing characters for polyps of the Corynidae of Greenland and Iceland.

character	*C. pusilla*	*C. hincksii*	*C. lovenii*	*S. eximia*	*S. producta*	*S. tubulosa*
isorhiza in polyp phase	no	no	yes	no	no	yes
capitate tentacles confined to upper half of hydranth	no	no	yes	no	yes in fertile polyps	yes
filiform tentacles present	no	no	no	no	yes	no
gonophores below capitate tentacles	no	no	yes	no	yes or replacing them	yes
gonophores in upper axil of tentacles	yes	no	no	yes	no	no
gonophores released as free medusa	no	no	no	yes	yes	yes
gonophores with radial canals	no	sometimes	yes	yes	yes	yes
gonophores with circular canal	no	yes	yes	yes	yes	yes
gonophore with marginal bulbs	no	no	yes	yes	yes	yes
gonophore with ocelli	no	no	no	yes	yes	yes

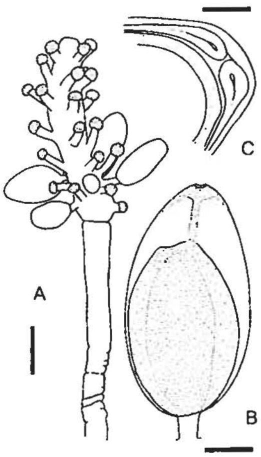

Figure 32. Coryne hincksii *Bonnevie, 1898; Greenland, Cape Farewell. A, terminal hydranth with male sporosacs, scale bar 0.5 mm. B, male sporosac, perhaps not fully mature, note presence of radial canals near distal end, some shrinking of the interior tissues might have occurred during fixation, scale bar 0.2 mm. C, optical cross-section of the tip of a young gonophore, the circular canal is clearly visible, scale bar 0.1 mm*

REMARKS – *Coryne hincksii* differs from the similar *Coryne pusilla* in developing its gonophores independently from the tentacles. *Coryne pusilla* carries them in the upper axils of the tentacles. Furthermore, *Coryne hincksii* has sporosacs with a distinct circular canal and the sporosacs are longer and more elongated. Additionally, the perisarc of *Coryne pusilla* is often annulated, which is, however, not a diagnostic trait.

The radial canals of *C. hincksii* could only be seen in a minority of the sporosacs. There were not always four canals present in these cases, sometimes two only. It seems that the radial canals in this species are only occasionally formed, or more likely they are often so narrow that they cannot be seen properly with ordinary microscopic techniques. Bonnevie (1898) described this species as having radial canals. Rees (1956a) re-examined her type material and was unable to find the radial canals. Calder (1972), examining Canadian material, found only occasionally radial canals, just like my own observations on material from Greenland. This variability certainly explains the discrepancy of Bonnevie's and Rees' observations.

DISTRIBUTION – Norway, Canada, Greenland (west coast and Cape Farewell). Not known from Iceland, but may occur there.

Coryne lovenii (M. Sars, 1846)

(Fig. 33)

Syncoryne ramosa – Lovèn 1836: 321, pl. 6 figs 19-24

Syncoryne lovenii M. Sars 1846: 2 footnote.

Syncoryne loveni – Russell 1953: text fig. 23B, pl. 2 fig. 5.

Sarsia loveni – Edwards 1978: 310, fig. 6.

Coryne loveni – Broch 1916: 15, fig. A, pl. 1 fig. 2, pl. 2 fig. 13.

Coryne lovenii – Naumov 1969: 257, fig. 12

MATERIAL GREENLAND – "Kap Farvel" station 34, fertile – ZMUC, Godthaab, 26.06.1895, material of Broch (1916), fertile.

MATERIAL ICELAND – living colonies collected by author south of Sandgerði, 7.05.2000, on rocks at low tide level, infertile, cultivated at 10-12°C until maturation of medusoid (29.05.2000).

DESCRIPTION – colonies arising from creeping, ramified, tubular stolons. Stems can form dense mats. Colonies stolonal or erect, erect shoots irregularly branched a few times, reaching 3 cm in height. Length of branches very unequal, but often comparatively long. Perisarc annulated over stretches, especially at origin of branches, otherwise smooth or corrugated, not thick, colour yellowish. Hydranth 1.5-2 mm in length, spindle-shaped with broadest diameter near middle, near lower third an annular thickening of the epidermis, hypostome large. About 12-18 capitate tentacles arranged in more or less distinct whorls. Tentacles rather long, tapering. One oral whorl of 4-6 tentacles, and normally two (occasionally three) additional whorls of tentacles, tentacle positions in each whorl alternate with the

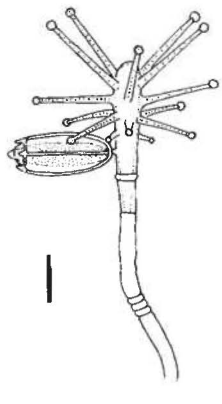

Figure 33. Coryne lovenii *(M. Sars, 1846); after live material from Sandgerði, Iceland, scale bar 0.5 mm.*

ones of adjacent whorls, tentacles of most proximal whorl often shorter than more distal ones. No filiform tentacles. Gonophores arise just below basalmost tentacles, mostly one per hydranth, but up to three are possible. Some hydranths are reduced with continued growth of gonophore and only a mere blastostyle may remain (reproductive exhaustion). Gonophores remain fixed as medusoids, reaching 1 mm in length, diameter in living material about half the length. Medusoid elongate bell-shaped, attached by thick peduncle, jelly thin. Gonophores have four distinct radial canals, a ring canal, and four bulbs with rudimentary tentacles, bulbs without ocelli. Manubrium present, shorter or longer than bell. Gonads voluminous, encircling manubrium completely and filling nearly bell cavity.

REMARKS – due to the reduced medusa without tentacles that is not released, this species is here provisionally allocated to *Coryne*.

SUBSTRATES – polyp on stones, from low watermark to 200 m.

DISTRIBUTION – western and southern Greenland, White-, Barents-, Norwegian-, and North Seas, western part of Baltic seas to Cattegat Strait, Scotland. Here recorded the first time for Iceland.

Coryne pusilla **Gaertner, 1774**

(Fig. 34A-B)

Coryne pusilla Gaertner, 1774: 40, pl. 4 fig. 8; Broch 1916: 16, map B; Stechow 1919: 5, fig. A; Kramp 1938: 4; Brinckmann-Voss 1970: 51, fig. 57; Calder 1972: 223, pl. 1 fig. 7; Millard 1975: 51, figs 19F-G; Boero 1981: 187, fig. 1C-D; Hirohito 1988: 33, fig. 10a-e; Schuchert 1996: 119, fig. 72a-d, synonymy.

Coryne vermicularis – Saemundsson 1902: 50, 71; Jäderholm 1909: 39, pl. 1 fig. 4; Broch 1916: 16.

TYPE LOCALITY – ? Cornwall (after Allman 1871).

MATERIAL ICELAND – ZMUC, Reykjavík, leg. Saemundsson, det. Broch, 2 cm colony .

OTHER MATERIAL EXAMINED – IRSNB, no. 27.838, France, Roscoff, coll. J. Bouillon June 1966.

DESCRIPTION – hydroid forms erect colonies, shoots branching several times, reaching 3 cm in height. Perisarc with smooth and annulated stretches, annulated stretches frequent, occasionally completely annulated. Hydranth up to 3 mm high, spindle shaped, with 20 or more scattered capitate tentacles covering the whole hydranth. Gonophores develop into sessile sporosacs, 5-10 gonophores per hydranth, about 0.5 mm in size. Sporosacs develop in lower 2/3 of hydranth in upper axil of tentacles, without any canals, with spadix. Nematocysts: stenoteles of two size classes.

REMARKS – Saemundsson (1902) reported *Coryne vermicularis* as a new record for Iceland. Broch (1916) re-examined his material and found that this species represents only a phase of the natural movement of the polyps of *Coryne pusilla*.

DISTRIBUTION – all European coasts, Mediterranean, South Africa, Indian Ocean, Korea, Japan, New Zealand (Schuchert 1996). At Iceland known from the region around Reykjavik, occurring on littoral algae. Kramp (1938) mentions that it also occurs at Greenland.

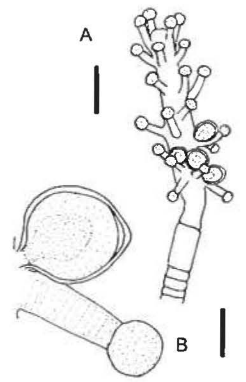

Figure 34. Coryne pusilla *Gaertner, 1774; France, Roscoff. A, hydranth with sporosacs, scale bar 0.5 mm. B, tentacle with male sporosac in upper axil, scale bar 0.1 mm.*

Sarsia eximia (Allman, 1859)

Coryne eximia Allman, 1859: 141; Kramp 1911: 362; Petersen 1990: 211, fig. 43A-C.
Sarsia eximia – Russell 1938d: 150, figs 8-12; Russell 1953: 50, text fig. 17A, 18A-B, plate 2 fig. 3; Kramp 1959: 79, fig. 15; Kramp 1961: 27; Millard 1975: 52, fig. 20A-D; Brinckmann-Voss 1989: 688, figs 5-6; Schuchert 1996: 125, figs 77a-h, 78.
not *Syncoryne eximia* – Saemundsson 1902: 50.
Type locality – Great Britain.

Description – polyp phase forms erect colonies, variably branching and reaching 3 cm in height. Perisarc with smooth and annulated stretches. Hydranth up to 2 mm high, spindle shaped, with 20 or more scattered capitate tentacles covering the whole hydranth. Gonophores are released as free medusae. Medusae buds develop in lower 2/3 of hydranth in upper axil of tentacles, 5-15 buds per hydranth. Nematocysts: stenoteles of two size classes. For adult medusa see Russell (1953) or Schuchert (1996).

Remarks – the polyp of *S. eximia* has been reported to occur at Iceland (Reykjavík, Vestmannaeyjar) by Saemundsson (1902). Kramp (1938) referred this material to *C. pusilla*. Greenlandic records of Kramp (1911, 1914) based on infertile material were later referred by him (1943) to *S. tubulosa* (as *Coryne sarsii*). Infertile material, however, is not properly identifiable. The presence of *S. eximia* at Iceland is thus uncertain and probably it does not occur there. It is also not known from Greenland.

Distribution – north European costs, British Isles, Mediterranean, North America, New Zealand, South Africa.

Sarsia producta (Wright, 1858)
(Fig. 35)

Coryne cerberus Gosse, 1853: 222, pl. 14 figs 4-6; Rees 1938: 37.
Stauridia producta Wright, 1858a: 283, pl. 7, figs 6-8; Hartlaub 1895: 142, pl. 7 figs 1-19, pl. 8 figs 1-8, pl. 9 figs 1-2, 6.
Sarsia producta – Kramp 1959a: 80, fig 19; Kramp 1961: 34; Brinckmann-Voss 1970: 67, figs 77-78; West: 1974: 5, figs 1-2; Brinckmann-Voss 1989: 688, tables 2-3, fig 7; Orlov 1996b: 329, figs 8.
Stauridium productum – Hincks 1868: 68, pl. 12 fig 1; Allman 1871: 371, pl. 17 figs 11-12; Rees 1938: 37, fig 11.
Stauridosarsia producta – Russell 1953: 64, figs 26A-C, 27A-B; Kramp 1961: 33; West 1974: 5, figs 1-2.
Coryne producta – Petersen 1990: 211;
not *Coryne producta* – Migotto 1996: 21, fig 5d-g.
Type locality – Firth of Forth, Scotland.
Material Iceland – one living colony growing on *Hyas araneaus*, collected from Sandgerði harbour, May 2000, infertile, cultivated at 10°C for several months.
Other Material examined – ZMUC, Denmark, north of harbour of Frederikshavn, 0.2 m depth, on *Halichondria*, polyps and young medusae.

Description – polyp colonies stolonal, perisarc smooth or wrinkled, thin, pedicels 0.5-3 mm. Hydranths 1.0-1.8 mm, diameter 0.15-0.23 mm, clavate with. One whorl of 4 oral tentacles, 2-3 additional whorls of lower capitate tentacles, whorls distinct, normally 4 tentacles per whorl but 5 possible, lowest whorl can be somewhat indistinct, tentacle

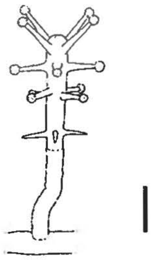

Figure 35. Sarsia producta *(Wright, 1858); after life, scale bar 0.5 mm.*

positions in adjacent whorls alternate. At lower third a single whorl of 4-6 filiform tentacles, shorter than capitate ones, always present. Young hydranths will develop filiform tentacles immediately after the oral tentacles have formed, thus before formation of the other capitate tentacles. Gonophores not seen. For adult medusa see Russell (1953) or Brinckmann-Voss (1988).

REMARKS – although most infertile corynids are difficult or impossible to identify, *Sarsia producta* has some features that allow it to be identified with some degree of certainty: the three rather precise whorls of four capitate tentacles that are in strictly alternate positions, the filiform tentacles that are always present, and the formation of the filiform tentacles just after the oral capitate tentacles have developed. In most other Corynidae with filiform tentacles these are normally formed after the development of lower capitate tentacles. This is the first record of *S. producta* for Iceland, but Iceland lies well within the known range of this species.

DISTRIBUTION – England, Heligoland, France, Bay of Biscay, New England, White Sea, western Iceland, not in the Mediterranean (see Brinckmann-Voss 1970). Not known from Greenland.

Sarsia tubulosa (M. Sars, 1835)

Oceania ? tubulosa M. Sars 1835: 25, pl. 5 fig. 11.
Syncoryna Sarsii Loven, 1836: 176, pl. 8.
Syncoryne Sarsii – Saemundsson 1902: 50.
Coryne eximia – Kramp 1914: 979; Kramp 1943. [not *Sarsia eximia* (Allman, 1859)]
Coryne sarsii – Broch 1916: 14; Kramp 1943: 6; Kramp 1938: 5.
Coryne mirabilis L. Agassiz, 1862: 189, pl. 17-18; Kramp 1914: 978.
Sarsia tubulosa – Mayer 1910: 53, pl. 3 figs 2-5, pl. 4 figs 1-2; Kramp 1933: 15; Russell 1953: 55, figs 21, 22A-B, 23A; Kramp 1959: 78, Fig. 10; Kramp 1961: 32; Brinckmann-Voss 1970: 66; Arai & Brinckmann-Voss 1980: 25, fig. 12; Miller 1982: 153, figs 3A, 4A, 4C.
Coryne tubulosa – Naumov 1969: 252, figs 36, 122, 123, pl. 29 fig. 6.

TYPE LOCALITY – Norway.

MATERIAL GREENLAND – ZMUC, as *Coryne sarsii*, 67.22°N 53.90°W, polyp colonies on *Fucus*, intertidal, with gonophores below tentacles.

DESCRIPTION – hydroid phase forms colonies with creeping, tubular stolons. Colonies stolonal or sparingly branched (up to second order), reaching heights of 15 mm. Perisarc smooth, occasionally corrugated but not truly annulated. Hydranths spindle-shaped, 1.0-2.6 mm in height. Tentacles capitate, 12-20, confined to the distal half of the hydranth, scattered or in indistinct whorls. Filiform tentacles absent. In lower half of the hydranth an annular thickening of the epidermis. Gonophores arise in an irregular whorl in the middle of the hydranth and below the tentacles, 1-8 per hydranth. Gonophores are released as free, immature medusae. Nematocysts of polyp (Bouillon 1974): basitrichous isorhizas, stenoteles. For adult medusa see Russell (1953).

REMARKS – polyp material alone is not reliably identifiable because information on the medusa phase is essential.

DISTRIBUTION – circumpolar, coastal boreal and arctic waters, medusa very common. The medusa is also frequently found at Greenland and Iceland. The polyp phase has been reported from near Reykjavík, where it occurs frequently at the beach (Kramp 1938, as *Coryne sarsii*).

Order Leptothecata

Family Tiarannidae

***Modeeria rotunda* (Qoy & Gaimard, 1827)**
(Fig. 36)
Dianaea rotunda Quoy & Gaimard, 1827: 181, pl. 6a figs 1-2, medusa.
Modeeria formosa Forbes, 1848: 70, pl. 7 fig. 1.
Campanularia fastigiata Alder, 1860: 73, pl. 5 fig. 1.
Calycella fastigiata – Hincks, 1868: 208, pl. 39 figs 3, 3a.
Campanulina pedicellaris Bonnevie, 1899: 74.
Rotundula brochii Hartlaub, 1917: 411, figs 341-3.
Tiaranna rotunda – Kramp 1968: 61, fig. 159; Russell 1953: 219, figs 117-119.
Modeeria rotunda – Edwards 1973: 573, figs 1-3, life cycle; Millard 1975: 137, fig. 45A; Ramil & Vervoort 1992a: 29, fig. 4a-b; Cornelius 1995b: 109, fig. 24; Schuchert 2000.
Stegopoma fastigiatum – Levinsen 1893: 176, pl. 6 fig. 8; Jäderholm 1909: 78, pl. 8 fig. 1; Kramp 1911: 383; Kramp 1914: 1007; Kramp 1943: 28; Ralph 1957: 850, fig. 8n-o; Vervoort 1959: 234, fig. 10; Naumov 1969: 341, fig. 206; Leloup 1974: 7, fig. 5.
Type locality – Strait of Gibraltar.
Material Greenland – "Kangamiut" station 5.
Material Iceland – BIOICE stations 2431, fertile – 2463, fertile – 2849, fertile.

Description – colony stolonal, stolons creeping. Hydrotheca 1-1.6 mm high, diameter about 0.3 mm, cylindrical, transparent, smooth, tapering below into smooth, non-annulated pedicel of very variable height. Aperture closing by plated operculum in form of a gabled roof, with straight ridge above and sides of hydrotheca continuing up at each end. Gonotheca resembles hydrotheca, but somewhat larger, short or no pedicel. Gonophores released as free, immature medusae. For adult medusae see Russell (1953) or Cornelius (1995a).

Distribution – boreal to tropical parts of the Atlantic and Indo-Pacific Oceans. The hydroid also penetrates Arctic and Antarctic regions (Ramil & Vervoort 1992a). For more details see the latter study or Cornelius (1995a). Present also along eastern and western Greenland. The present records from Iceland are from off the south coast in depths of 133-1214 m.

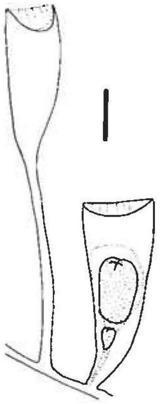

Figure 36. Modeeria rotunda *(Quoy & Gaimard, 1827); BIOICE 2849, hydrotheca and gonotheca containing developing medusae, scale bar 0.5 mm.*

***Stegopoma plicatile* (M. Sars, 1863)**
(Fig. 37A-E)
Lafoea plicatilis M. Sars, 1863: 31.
Stegopoma caricum Levinsen, 1893: 37.
Lictorella (?) *operculata* Hartlaub, 1904: 12, pl. 1 figs 6-7.
Stegopoma plicatile – Kramp 1913: 15, figs 1-2; Kramp 1914: 1006; Broch 1918: 26, fig. 8; Kramp 1932b: 8; Kramp 1943: 27; Vervoort 1966: 112, fig. 13; Naumov 1969: 341, fig. 207, pl. 2 fig. 2; Calder 1970: 1517; Vervoort 1972: 43; Edwards 1973: 590; Cornelius 1995a: 114, fig. 25.
Type locality – Norway.
Material Greenland – ZMUC, Kangaamiut, 480 m, coll. 29.08.1957 – "Kangamiut" stations 2 – 3 – Grønland" 1975 stations 25 – 55 – "Kap Farvel" stations 48, fertile – 56 – 108 – 128 – Just & Vibe 1968 station 68.
Material Iceland – BIOICE stations 2085 – 2114 – 2117 – 2124 – 2136 – 2137 – 2185 – 2303 – 2315 – 2316 – 2317, with gonotheca – 2318, with gonotheca, a permanent slide was made

from this material (MHNG INVE 25508) – 2319 – 2320 – 2321 – 2323 – 2327 – 2330 – 2346 – 2361 – 2362, with gonotheca – 2364, with gonotheca – 2418 – 2493 – 2514 – 2575, with gonotheca – 2583 – 2591 – 2610 – 2613 – 2662 – 2744, with gonotheca – 2813 – 2824.

DESCRIPTION – colonies 2-15 cm in height, somewhat irregularly branched but strong tendency to ramification in one plane. Hydrorhiza a tangled mass of root-like stolons. Stems and branches highly polysiphonic, only most distal branches monosiphonic, no distinct segmentation. Branches rather straight, not geniculate. Hydrothecae originate from all tubes, two types discernible: adnate and free ones. Adnate ones about 1 to 1.4 mm in length, without pedicel and adnate at base then curving away from branches. Free hydrothecae smaller or similar in size as adnate ones, with very short corrugated pedicel, body straight or curved. All hydrothecae originally with operculum, but the latter often eroded. Operculum roof-shaped in two rounded embayments of the hydrothecal margin, valves with parallel lines. Hydranths elongate, high conical hypostome and 10 to 12 tentacles. Gonotheca 3-5 mm in size, cylindrical, truncated end with opening when mature, proximal part tapering, either completely adnate to a branch or free. Gonotheca contains one simple gonozooid with one or two elongated gonophores. Gonophores develop into medusae.

ADDITIONAL INFORMATIONS – The gonothecae normally have an operculum similar to the one found on the hydrothecae (see Kramp 1913), but just like the ones of the hydrothecae it is apparently frequently lost.

REMARKS – see also Schuchert (2000), who described the contents of the gonotheca for the first time. Unexpectedly for such a large hydroid colony, it produces a free medusa. The youngest stages compare favourably with the ones of *Modeeria rotunda*.

The taxonomic history of *Stegopoma plicatile* is rather uncomplicated. Broch (1918) re-examined the type specimen of *Stegopoma caricum* Levinsen, 1893 and concluded that it must belong to *S. plicatile*. Hartlaub (1904) described *Lictorella* (?) *operculata* from the Bellingshausen Sea (Antarctica). Hartlaub's illustrations (1904: pl. 1, figs 6-7) and his description, however, perfectly agree with the present concept of *S. plicatile*. Following Vervoort (1966), *L. operculata* is here seen as indistinguishable from *S. plicatile*. Edwards (1973) reviewed all species of the genera *Stegopoma* Levinsen, 1893 and *Stegolaria* Stechow, 1913. Although he admitted that both genera are hardly separable, he kept them separate pending further information on the respective life cycles. He thought that *Stegolaria* might perhaps be distinct on account of its non-pedicellate, not narrowed, partly adnate hydrothecae. The latter arguments, however, are hardly convincing. *Stegolaria geniculata* (Allman, 1888) (type species of the genus, see Edwards 1973: 593; Millard 1977b: 106, Fig. 3; Ramil & Vervoort 1992a: 32, Fig. 4c-e; Calder & Vervoort 1998: 13, Fig. 4a-b) particularly resembles *Stegopoma pli-*

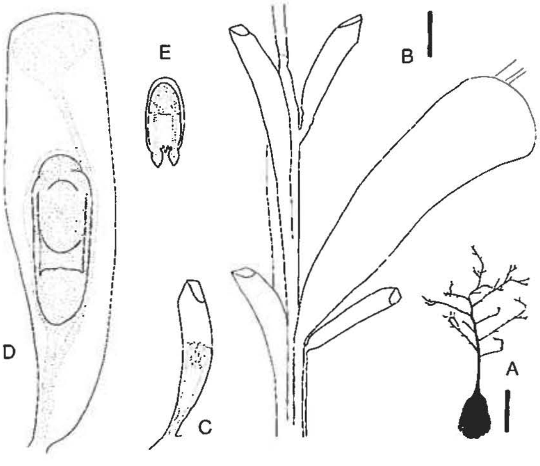

Figure 37. Stegopoma plicatile *(M. Sars, 1863); B-D BIOICE 2317, E BIOICE 2575. A, silhouette of colony, scale bar 1 cm. B, part of branch with gonotheca without opening, scale bar 0.5 mm. C, hydrotheca with hydranth, same scale as B. D, gonotheca with developing medusa, same scale as B. E, medusa dissected out of gonotheca, magnification about half of D.*

catile, differing mainly in the shape of the gonotheca. In view of the possible differing life cycles (Edwards 1973), it seems preferable to retain both genera until more knowledge allows a more appropriate genus allocationgg.

DISTRIBUTION – predominantly circumarctic, from western and eastern Greenland, Iceland (north, south, and east coast), through the Norwegian Sea, Barents Sea, Kara Sea, Siberian Sea, Sea of Okhotsk, Bering Sea, northern Canada, and Vancouver Island (Edwards 1973). Known also from New Zealand, Antarctica, far southern America, and the Philippines, depth range 15-1940 m, usually 75-500 m, on muddy bottoms (Naumov 1969, Vervoort 1972, Edwards 1973). This species was considered rare for Iceland by Broch (1918) and he depicted only one record in the region around Iceland. Interestingly, *S. plicatile* was found rather abundantly during this study.

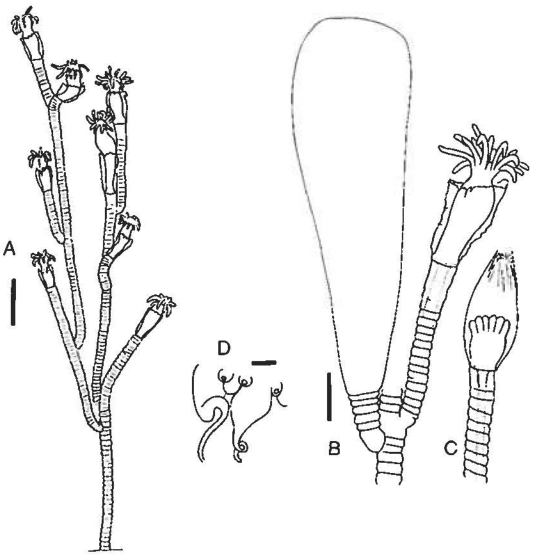

Figure 38. Eutonina indicans *(Romanes, 1876); BIOICE 2189, modified after Schuchert (2000). A, one shoot, scale bar 0.5 mm. B, part of branch with gonotheca, scale bar 0.2 mm. C, young hydranth with intact hydrotheca, same scale as B. D, margin of young medusa showing two perradial bulbs with tentacles, one smaller bulb between them, and statocysts with concretions, same scale as B.*

Family Eirenidae

REMARKS – taxon limits are unclear in the families Eirenidae, Lovenellidae, Phialellidae, Campanulidae and others not presented here. The polyp phase in these groups is mostly small and inconspicuous, hence the classification is based primarily on the medusa phase, if such a one is present. The whole group of medusae-producing Leptothecata is in urgent need of a taxonomic revision. Species that produce medusae are often not identifiable with hydroid material alone.

Eutonina indicans (Romanes, 1876)

(Fig. 38A-D)

Tiarops indicans Romanes, 1876: 525.

Eutonina socialis Hartlaub, 1897: 506, pl. 20 figs 19-20, pl. 22 figs 1, 3, 4, 6.

Eutonina indicans – Russell 1953: 374, figs 240-245, pl. 22 fig. 2, synonymy; Werner 1968: 384, figs 1 -15; Arai & Brinckmann-Voss 1980: 110, figs 62-63; Cornelius 1995a: 234, fig. 54; Schuchert 2000:421, fig 6.

Eirene indicans – Naumov 1969: 346, figs 210-211.

TYPE LOCALITY – Cromarty Firth, Scotland.

MATERIAL ICELAND – BIOICE stations 2187, with gonothecae – 2189, numerous stems, with gonothecae, some growing on polychaete tubes made from sand – 2193, with gonothecae.

DESCRIPTION – Colonies arising from ramified, creeping stolons. Stems erect, up to 10 mm in height, branching with 4-10 terminal hydranths. Perisarc of stems and branches annulated throughout, about 0.11-0.13 mm in diameter, side branches originate at right angles and then immediately bend upwards, producing slender shoots with most branches more or less parallel, branches rather long. Branches end in diaphragm above which there is a ring of desmocytes along the inside of the hydrotheca. Hydrothecae thin, often crinkled, young ones about 0.5 mm in height, with cylindrical base and conical operculum; elements of operculum ill defined, irregular; older hydrothecae often torn and wrinkled, operculum and distal part eroded away. Hydranths comparatively large, contracted up to 1 mm, body swollen in middle, narrower below tentacle region, amphicoronate tentacles, conical or flat hypostome. Older hydranths, even contracted, are larger than the hydrotheca. Gonothecae originate from stems, one to four per shoot, on annulated pedicels. Gonotheca 1.5-2 mm in length, club-shaped with flat, truncated end, sometimes slightly curved, perisarc thin. Gonozooid with four medusae buds of progressive age towards distal end, most distal medusa fills nearly last third of gonotheca. Young medusa spherical, with four large perradial bulbs bearing tentacles and four small interradial bulbs without tentacles, between each pair of bulbs a statocyst (8 in total) with one concretion. For a description of the adult medusa, see Cornelius (1995a), Werner (1968a) or Russell (1953).

Remarks – see discussion in Schuchert (2000).

Distribution – the medusa of *Eutonina indicans* is known from the southern North Sea, to north of Iceland and mid-Norway. The species extends into the Baltic Sea at least to the Sound of Fehmarn, near Kiel Bay. It was also recorded from Alaska and the Pacific coast of Canada and California, from the Kurile Islands, Kamtchatka, Japan, and from India. The hydroid is known from nature only from California (Cornelius 1995a). In the present Icelandic material it was found in 22-26 m depth on sandy bottoms, possibly growing on polychaete tubes. The three findings lie closely together at the north coast (entrance of Eyjafjör›ur). The species is not known to occur at Greenland.

Family Lovenellidae

Lovenella producta (G. O. Sars, 1874)

(Fig. 39)

Calycella producta G. O. Sars, 1874: 118, pl. 5 figs 6-8.

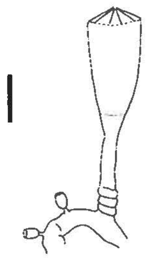

Figure 39. Lovenella producta *(G. O. Sars, 1874); BIOICE 2710, note presence of nematothecae on stolons (lower left), scale bar 0.2 mm*

Lovenella producta – Fraser 1937: 96, pl. 19 figs 102a-c; Fraser 1944: 175, pl. 31 fig. 149a-c; Cornelius 1995a: 166, fig. 37; Schuchert 2000:423.

Type locality – Norway.

Material Iceland – BIOICE stations 2442 – 2710.

Description – colony stolonal. Stolons ramified, giving rise at irregular intervals to hydrothecae on pedicels of very variable length. Pedicels mostly smooth, but some annulation often present, especially at base. Hydrotheca, height 0.4-0.5 mm, walls thin, widest at operculum, tapering towards below and at base merging imperceptibly into pedicel. Operculum low, conical, formed by about 10 or more triangular flaps, delimited from hydrothecal wall by more or less distinct crease line. At base of hydrotheca a very fine, horizontal diaphragm. Stolons bear numerous nematothecae, about 80 µm high, wine-glass shaped, on short pedicel, body egg-shaped with distal end cut away for opening, filled with large nematocysts.

Remarks – the gonotheca and the life cycle of this species remain unknown. The samples from Iceland were found growing on hydroids.

Distribution – Norway, western Sweden, arctic Canada to Gulf of Maine. Pacific side of North America from arctic to south at least to north-west USA (Cornelius 1995b). The Icelandic localities were on the south and west coast. Not known from Greenland, but the known range suggests that it can be found there too.

Family Phialellidae

Opercularella lacerata (Johnston, 1847)
(Fig. 40)

Campanularia lacerata Johnston, 1847: 111, pl. 28 fig. 3.
Campanulina lacerata – not Kramp 1914: 1010 [= *C. pumila*]; not Kramp 1932b: 8 [= *C. pumila*]; Naumov 1969: 336, fig. 202; Ólafsson 1975: 9, fig. 11.
Campanulina turrita – in part or entirely Broch 1918: 31.
[not *Campanulina turrita* Hincks, 1868]
Opercularella lacerata – Hincks 1868: 194, pl. 39 fig. 1; Calder 1970: 1514, pl. 3 fig. 4; Cornelius 1995a: 173, fig. 38.

TYPE LOCALITY – St. Andrews and Berwick Bay, Scotland.

MATERIAL GREENLAND – ZMUC, as *Campanulina turrita*, Holsteinsborg Harbour, 8.07.1895, material mentioned by Broch (1918), bears gonothecae with male sporosacs.

DESCRIPTION – colony erect, branched, up to 12 mm. Shoots slender, irregularly annulated and spirally grooved throughout, hydrothecae on short, 2-5 ringed hydrothecal pedicel, pedicels shorter than hydrotheca, tapering towards top. Hydrothecae 0.3-0.5 mm in height, normally widest in middle, tapering slightly above and below, topped by conical operculum of up to 12 pointed valves not demarcated by basal crease-line. Hydrotheca with diaphragm basally. Gonotheca borne on short pedicels arising from main stem, branches and stolons, cylindrical, 0.5-0.7 mm in length, 0.22-0.30 mm in diameter, distal end truncate. Female gonothecae develop acrocysts with brooded planulae. According to Hartlaub (1897) the gonotheca contains 8-12 eggs.

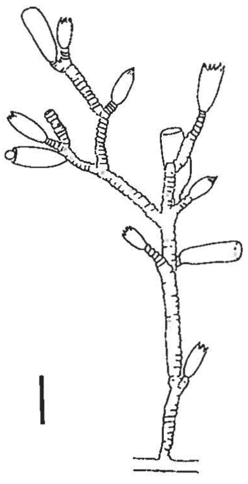

Figure 40. Opercularella lacerata *(Johnston, 1847); male colony from Greenland, scale bar 0.5 mm.*

REMARKS – *Opercularella lacerata* resembles closely the hydroid stage of *Phialella quadrata*, but while the former forms gonothecae with sporosacs, the latter releases a free medusae. The hydroids of both species can be distinguished using microscopic details. The main distinguishing characters are the short hydrothecal pedicels in *O. lacerata* with up to 5 rings (pedicels in *P. quadrata* are often longer than the hydrothecae and have more than 5 rings) and the size of the hydrothecae which is larger in *O. lacerata* (0.3-0.5 mm versus up to 0.25 mm in *P. quadrata*). Cornelius (1995b) offers a table with more differing details that can be used to distinguish sterile material of the two species, although sterile material can be difficult or impossible to identify. *Phialella quadrata* is not known to occur in the region under investigation, but it might be present at southern Iceland or Greenland.

One of the two samples identified by Broch (1918: 31) as *Campanulina turrita* Hincks, 1868 was re-examined for this study. The sample is a profuse colony growing on a seaweed (Fig. 40). Gonothecae are also present and they are filled with male sporosacs. This material evidently belongs to *Opercularella lacerata*.

DISTRIBUTION – reliable records, all so far from the North Atlantic Ocean, on European coastline ranging from the Mediterranean to the White Sea. Also present in Baltic Sea. Identification difficulties make the assessment of possible Indo-Pacific records difficult and the species may or may not occur there (Cornelius 1995a). Kramp (1938) revised the Icelandic records of this species. Correctly identified material is only known from Reykjavík. Records from Greenland are confined to the west coast.

Family Campanulinidae
***Campanulina panicula* G. O. Sars, 1874**
(Fig. 41)
Campanulina panicula G. O. Sars, 1874: 95, pl. 5 figs 9-13; Kramp 1941: 1, figs 1-5; Cornelius 1995a:190, fig. 43.
Campanulina denticulata Clarke, 1907: 12, pl. 8.
Opercularella panicula – Leloup 1974: 4, fig. 3; Ramil & Vervoort 1992a: 25, fig. 3a-d; Hirohito 1995: 91, fig. 25d-e.
Opercularella denticulata – Gili, Vervoort & Pagès 1989: 76, fig. 6a.
TYPE LOCALITY – Oslofjord near Dröbak, Norway, 90-100 m.
MATERIAL ICELAND – BIOICE 2303, infertile.

DESCRIPTION – Colony delicate, comprising single or small clusters of monosiphonic, straight, smooth, unbranched and gradually tapering main stems with a terminal hydrotheca, height up to 3 cm. Hydrothecae on stem, single or in short branched clusters with up to four hydrothecae. Hydrothecae often directed laterally in one plane, but branched clusters often also characteristically directed towards frontal side. Hydrotheca conical, approx. 0.5 mm long, tapering basalward into pedicel, with diaphragm marking junction of the two; operculum conical, about 20 segments, without crease line delimiting it basally from hydrothecal wall. Pedicels rather long, length variable but normally as long as hydrotheca, origin with one to two rings. Gonotheca (after literature, not seen in present material) long, cylindrical, about 6-8.5 times as long as broad, with short ringed pedicel, end either open and truncated or with operculum similar to the ones of the hydrothecae.

REMARKS – For more a detailed description and taxonomic history of this species see Ramil & Vervoort (1992a).

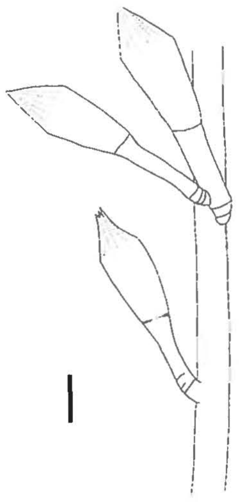

Figure 41. Campanulina panicula *(G. O. Sars, 1874); BIOICE 2303, part of stem, scale bar 0.2 mm.*

DISTRIBUTION – Norway, Skagerrak, west of Hebrides, West coast of Ireland, Bay of Biscay, Spain, western Mediterranean, Morocco, southern Africa, between Seychelles and Ceylon, Japan, California and Gulf of California, Peru, in depths of 70-5200 m, but mostly below 500 m, (Vervoort 1966; Leloup, 1974; Gili *et al.*, 1989). The present specimen is from south-west of Iceland, in a depth of 606 metres, on sandy-muddy bottom. Not known from Greenland.

***Campanulina pumila* (Clark, 1875)**
(Fig. 42A-B)
Opercularella pumila Clark, 1875: 61, pl. 9 figs 3-5.
Opercularella nana Hartlaub, 1897: 502, pl. 20 figs 9-11; Naumov 1969: 333, fig. 200.
Campanulina birulai Linko, 1912: 53, 58; Naumov 1969: 334, synonym
Campanulina lacerata – Kramp 1914: 1010; Kramp 1932b: 8
[not *Opercularella lacerata* (Johnston, 1847)]
Campanulina pumila – Cornelius 1995a: 193, fig. 44.
TYPE LOCALITIES – Portland (Maine) and off Montauk Point (Long Island).

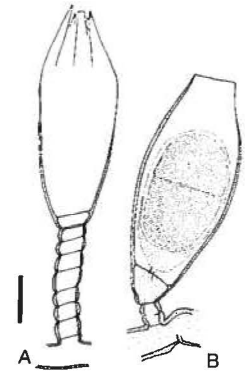

Figure 42. Campanulina pumila *(Clark, 1875); Greenland, Strømfjord, scale bar 0.1 mm. A, hydrotheca. B, gonotheca with gonophore and two eggs.*

Material Greenland – ZMUC, Ndr. Strømfjord, 31.07.1911, 21-24 m, described as *Campanulina lacerata* by Kramp (1914).

Description – colonies stolonal. Hydrotheca on short, spirally sculptured pedicel. Hydrotheca cylindrical to tapering, broadest at aperture, with operculum composed of about 10 triangular flaps occupying distal 1/4 of hydrotheca, not demarcated below by crease-line, at base of hydrotheca a thin diaphragm. Height of hydrotheca 0.2-0.4 mm. Gonothecae arise directly from stolons, elongate egg-shaped, about 0.5 mm, distal end truncate with opening, with short, twisted pedicel. At base of gonotheca a thin diaphragm delimiting a basal chamber. Gonophores are sessile sporosacs. Females with two eggs (Fig. 42B).

Variation – erect shoots with up to 5 hydranths may occur (Cornelius 1995a), dimensions of hydranths and gonothecae of colonies from warmer waters seem to be smaller.

Remarks – re-examination of Greenland material identified by Kramp (1914) as *Campanulina lacerata* clearly proved that it belongs to *Campanulina pumila*. Kramp's colony (see Fig. 42A) is purely stolonal and has the characteristic female gonothecae with two eggs (*Opercularella lacerata* has 8-12 eggs according to Hartlaub (1897)). The material agrees very well with Clark's (1875) original description and Hartlaub's description of *O. nana*. The description of Kramp (1932b) also leaves no doubt that his material was *C. pumila*.

Calycella gracilis Hartlaub, 1897 is quite similar to *Campanulina pumila*, but has distinct crease lines at the base of its opercular valves (see Calder 1970). Both species are probably widely spread, but have either been overlooked due to their minute size, or misidentified as only fertile material is reliably identifiable.

Distribution – New England, western Green-land (new record), Great Britain, Netherlands, Heligoland, southern Baltic Sea. Not known from Iceland, but is likely to occur there.

Campanulina turrita Hincks, 1868

Campanulina turrita Hincks, 1868: 190, pl. 36 fig. 2; Levinsen 1893: 181; not Broch 1918: 31.

Type locality – Ireland

Remarks – this species is not recognisable because information on the mature medusa is necessary to identify *Campanulina* species with biphasic life-cycles. Rees (1939) thought that *Campanulina turrita* produces a medusa of the genus *Aequorea*. *Campanulina turrita* has been reported from Greenland by Levinsen (1893) and Broch (1918). At least one of the records of Broch (1918) actually refers to *Opercularella lacerata*. See comments under this species.

Calycella syringa (Linnaeus, 1767)

(Fig. 43)

Sertularia volubilis Pallas, 1766: 122.

Sertularia syringa Linnaeus, 1767: 1311.

Lafoea pygmaea Hincks, 1868: 205, pl. 40 fig. 3.

Campanulina syringae – Broch 1909b: 164, fig. 22.

Calycella syringa – Hincks 1868: 206, pl. 39 fig. 2; Kramp 1914: 1013; Broch 1918: 32, fig. 10; Kramp 1938: 30; Fraser 1937: 91, pl. 19 fig. 96; Kramp 1943: 28; Fraser 1944: 166, pl. 30 fig. 138; Naumov 1969: 332, fig. 198; Calder 1970:

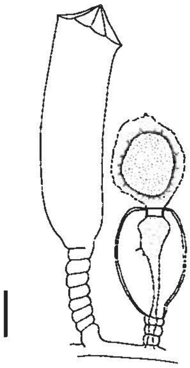

Figure 43. Calycella syringa *(Linnaeus, 1758); BIOICE 2679, scale bar 0.1 mm, hydrotheca (left) and gonotheca. The gonotheca has an acrocyst with a developing embryo.*

1516: pl. 3 fig. 7; Ólafsson 1975: 10, fig. 12; Cornelius 1995a: 186, fig. 42.
Calicella syringae – Kramp 1932b: 9; Hirohito 1995: 79, fig. 22c-g.
MATERIAL GREENLAND – "Kap Farvel" stations 59, on hydroid – 91, on hydroid, fertile – 147, on Bryozoa.
MATERIAL ICELAND – BIOICE stations 2000, on hydroid – 2203, on hydroid – 2249, on hydroid, fertile – 2679, on seaweed, fertile – 2824, on hydroid.

DESCRIPTION – stolonal colonies growing often on other animals and on algae. Hydrothecae with cauli, total height up to 0.7 mm. Caulus shorter or as long as hydrotheca, with oblique annulation. Hydrotheca cylindrical, straight or slightly curving, rim sometimes slightly flaring, rim with low, rounded embayments. Operculum conical, formed by 8-10 triangular flaps, each with crease line at site where attached to hydrotheca. Gonotheca arises directly from stolons, 0.2-0.3 mm, egg-shaped with truncate end, on short, ringed pedicel. Eggs develop outside of gonotheca in acrocyst, 1-3 per cyst.

DISTRIBUTION – northern circumglobal in temperate and cold waters; known from European coast including the Mediterranean, northern Canada, Greenland (west and east coast), Iceland (all coasts), Faroes, Spitsbergen, Barents Sea, White Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea, Sea of Okhotsk, Japan, Bering Sea, Alaska to California (Fraser 1937, Fraser 1944, Naumov 1969, Cornelius 1995a). Normally epizoically, in particular on hydroids.

Cuspidella humilis (Alder, 1863)

Campanulina humilis Alder, 1863: 239.
Cuspidella humilis – Hincks 1868: 2089, pl. 39 fig. 4; Broch 1918: 29; Kramp 1938: 28.
REMARKS – Icelandic material of *Cuspidella humilis* was identified by Saemundsson (1911), Broch (1918), and Kramp (1938). However, it is now clear that this hydroid refers to a number of quite different hydrozoan species, all only distinctive in their medusa phase (comp. Cornelius 1995a). Thus, most "*Cuspidella*"-like hydroids can only be identified if their full life-cycle is known.

Cuspidella procumbens Kramp, 1911

(Fig. 44)
Cuspidella procumens Kramp, 1911: 384, pl. 24 figs 2-6; Kramp 1914: 1010; Kramp 1932a: 26, fig. 12a; Kramp 1932b: 7; Kramp 1933: 14; Kramp 1943: 26; Calder 1970: 1514, pl. 3 fig. 3.
TYPE LOCALITY – north-east Greenland.
MATERIAL GREENLAND – ZMUC, Kap Bismarck, 30-40 m, 4.9.1907, "Danmark" Station 71a, material mentioned in Kramp (1911).

DESCRIPTION – colonies stolonal, growing epizoically, stolons creeping and ramified, about 55 µm thick, smooth or irregularly wrinkled. Hydrotheca 0.5-0.6 mm, diameter 0.12-0.15 mm, proximal part adnate to substratum, distal half bent upwards. Operculum formed by 8-14 triangular valves forming a cone, valves not delimited from hydrotheca by crease line. Gonotheca unknown.

REMARKS – see under *Cuspidella humilis.*

DISTRIBUTION – western and eastern Greenland, north-eastern Canada.

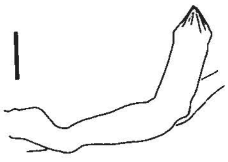

Figure 44. Cuspidella procumbens *Kramp, 1911; Greenland, Cape Bismarck, scale bar 0.2 mm.*

Cuspidella grandis Hincks, 1868

Cuspidella grandis Hincks, 1868: 210, pl. 40, fig. 4; Kramp 1914: 1009; Kramp 1932a: 25; Kramp 1932b: 7; Kramp 1943:26d; Rees 1941; Naumov 1969: 326, fig. 193, ? = *Mitrocomella polydiademata*.

Remarks – see under *Cuspidella humilis*.

Lafoeina maxima Levinsen, 1893

(Fig. 45)

Lafoeina maxima Levinsen, 1893: 182, pl. 4 figs 9-12; Kramp 1914: 1010; Broch 1918: 30, fig. 9; Kramp 1932b: 8; Kramp 1938: 29; Kramp 1943: 27; Naumov 1969: 340, fig. 205, pl. 4 fig. 1; Calder 1970: 1516, pl. 3 fig. 8; Crowell 1982: 246, figs.

Keratosum complexum Hargitt, 1909: 379, figs 8-10; Crowell 1982: 246.

Type locality – Greenland.

Type Material examined – ZMUC, leg. Levinsen.

Material Greenland – "Kap Farvel" station 14 – Just & Vibe 1968 stations 16 – 20 – 26 – 27 – 1968 35 – ZMUC, 64.02°N 52.67°W, 54 m, coll. 28.07.1926 – "Kangamiut" stations 1 – 3 – 4 – 5 – 6 – 9 – 10 – Hoels 1067 – Bank. unders. station 2.

Material Iceland – BIOICE stations 2180 – 2185.

Description – colony sponge-like, without hydrocladia, consisting of a branched or unbranched stem reaching 15 cm in height. Stem thickness within one shoot rather uniform. Hydrorhiza a tangled mat of stolons. Stems polysiphonic, round in cross section, densely covered by hydrothecae and nematothecae. Colonies can also be stolonal and produce a stolonal mat, this in young colonies or adjacent to erect colonies. Hydrotheca without pedicel, cylindrical, often bent, 0.5-0.8 mm in length, with a conical operculum consisting of many triangular valves. Whole operculum well demarcated from hydrotheca, but without crease line. Nematothecae in the form of thin tubes, numerous between hydrothecae, isodiametric and terminal end not swollen, distal end rounded, opening terminal if present, terminal end of coenosarc with numerous (about 50) elongated nematocysts (basitrichous isorhiza, about 14 µm long).

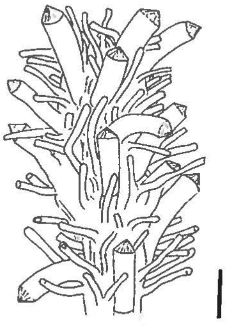

Figure 45. Lafoeina maxima *Levinsen, 1893; BIOICE 2185, terminal part of stem, scale bar 0.5 mm.*

Remarks – erect *Lafoeina maxima* colonies are rather unique in their sponge-like appearance and they are immediately identifiable. Young, stolonal colonies are prone to be confounded with *L. tenuis* (see below). Crowell (1982) re-examined the type material of Levinsen and he gives additional information on growth and development of *Lafoeina maxima*. He was also able to show that *Keratosum complexum* Hargitt, 1909 from Massachusetts is conspecific with *Lafoeina maxima*.

The contents of the gonothecae are not well known. Perhaps they contain sporosacs (Crowell 1982). As the type species of *Lafoeina*, *L. tenuis* may produce medusae (see Calder 1991), it may be necessary to place *L. maxima* in another genus. Calder (1991) proposed to use *Keratosum maximum*. As also the life cycle of *L. tenuis* is imperfectly known, I prefer to wait with a revision.

The gonotheca depicted in Naumov (1969) do not agree with his description and the ones given by other authors. It is usually described as resembling a normal hydrotheca, but being larger.

DISTRIBUTION – western and eastern Greenland, Cape Cod, Iceland (north coast only), Norway, Spitsbergen, Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea, Sea of Okhotsk, Sea of Japan, Bering Sea, Alaska, northern Canada.

Lafoeina tenuis G. O. Sars, 1874

Lafoeina tenuis G. O. Sars, 1874: 95, pl. 5 figs 1-5; Hincks 1874: 150; Kramp 1914: 1011; Naumov 1969: 339, fig. 204; Cornelius 1995a: 197, fig. 45.

DESCRIPTION – see Cornelius (1995a).

REMARKS – no material of this species could be identified among the examined material. *Lafoeina tenuis* was reported to occur at western Greenland by Hincks (1874) and Kramp (1914). *Lafoeina tenuis* can easily be confounded with stolonal colonies of *L. maxima*, a species which is common along the coast of western Greenland. And it may well be that both authors mistook stolonal colonies of *L. maxima* as *L. tenuis*. I think the records of *L. tenuis* for Greenland are not reliable.

The trophosomes of both species are, however, clearly distinguishable using microscopic traits. The nematothecae of *L. tenuis* have a slight terminal swelling and a lateral opening, while those of *L. maxima* are not swollen and their opening (if present) was observed to be at the end. The hydrothecae of *L. tenuis* are smaller (0.2-0.5 versus 0.5-0.8 mm). Crowell (1982) also thinks that the number of nematocysts in the nematothecae differ considerably (up to 6 in *L. tenuis*, 50 in *L. maxima*).

The life cycle of *L. tenuis* is only imperfectly known. Perhaps it includes a medusa. Important discussions on *L. tenuis* are also found in Bouillon (1971), Calder (1991) and Cornelius (1995a).

Figure 46. Cuspidella quadridentatum *(Hincks, 1874); Eriksfjord, scale bar 0.2 mm.*

DISTRIBUTION – north Atlantic Ocean, ? western Greenland.

Cuspidella quadridentatum (Hincks, 1874)

(Fig. 46)

Cuspidella quadridentatum Hincks, 1874: 149, pl. 8 figs 17-20.

Tetrapoma quadridentatum – Kramp 1911: 385, pl. 24 fig. 15; Kramp 1914: 1015; Broch 1918: 34; Kramp 1911: 385, pl. 24 fig. 15; Kramp 1932b: 9; Kramp 1943: 29; Naumov 1969: 333, fig. 199; Calder 1970: 1517, pl. 3 fig. 10; Leloup 1974: 7.

TYPE LOCALITY – Greenland.

MATERIAL GREENLAND – ZMUC, Greenland, Eriksfjord, 35-70 m, 2.9.1912, material mentioned in Kramp (1932b) – Bank. unders. station 5304.

DESCRIPTION – colonies stolonal, hydrorhiza tubular, smooth. Hydrotheca deeply cup-shaped, with rounded bottom, height 0.5-0.7 mm, sharply delimited from spirally sculptured caulus, caulus 0.15-0.25 mm. Operculum formed by 4 triangular valves in the form of a pyramid, with creaseline basally. Hydrothecal margin with four shallow teeth at the corners of the valves. Gonotheca unknown.

DISTRIBUTION – arctic circumpolar, known from western and eastern Greenland, eastern Canada, Spitsbergen, Barents Sea, White Sea, Kara Sea, Sea of Okhotsk, coasts of New Siberian Islands, Chile. Not known from Iceland.

Family Hebellidae

Halisiphonia arctica Kramp, 1932

(Fig. 47A-B)

Halisiphonia arctica Kramp, 1932a: 37, figs 17-20.

TYPE LOCALITY – 74.68°N 70.50°W, 1200 m, Baffin Bay, Greenland.

TYPE MATERIAL EXAMINED – holotype, ZMUC, "Godthaab" station 135, on *Eudendrium planum*.

DESCRIPTION – colony stolonal, stolons branching and anastomosing, covered by thin perisarc. Hydrothecae large (up to 1 mm from diaphragm to margin), cylindrical to conical, below gradually passing into a peduncle of very variable length, peduncle 0-3 mm long, smooth except near base where there is a distinct annulation. Margin of hydrotheca slightly everted, smooth, often renovated. A very delicate diaphragm is present at the base of the hydrotheca. Gonotheca very large (3 mm), shovel-shaped, much compressed, distal end truncate and open, at base short, spirally coiled pedicel. Gonophores develop into medusae. Adult medusa unknown.

REMARKS – re-examination of the type colony revealed an interesting fact possibly overlooked by Kramp. Two of the four examined gonothecae contain soft tissue and is quite obvious that the gonophores will develop into medusae (see Fig. 47B).

Halisiphonia arctica resembles closely *H. megalotheca* Allman, 1888 and both could be conspecific (for a revision, description and references of *H. megalotheca* see Vervoort 1966 or Rees & Vervoort 1987). The only difference appears to be the more elongate gonotheca in *H. arctica*. However, it seems advisable to wait with any synonymisation until the adult medusae are known.

Boero, Bouillon & Kubota (1997) reviewed all species of *Hebella* and revised the genus. As *Halisiphonia arctica* is now known to have a medusa in its life cycle, it seems inseparable from *Hebella* and it could be assigned to it. However, as the adult medusae might be completely different, we have to wait for the discovery until we can revise the genera. Nevertheless, *Halisiphonia* and *Hebella* should be removed from the family Lafoeidae and placed into their own family Hebellidae Fraser, 1912. There appears to exist no synapomorphy uniting the Lafoeidae and the Hebellidae. The similarity of the hydrothecae is probably a plesiomorphy as such hydrothecae occur in the other families too. Already Fraser (1912) proposed to place *Hebella* and similar genera into their own family.

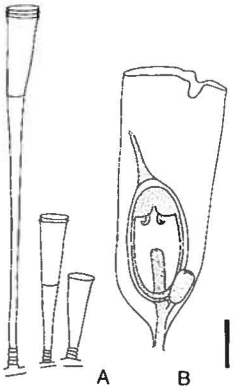

Figure 47. Halisiphonia arctica *Kramp, 1932; type colony, scale bar 0.5 mm. A, hydrothecae, note variability of pedicel length. B, gonotheca with two medusae buds of unequal developmental stages.*

DISTRIBUTION – known from type locality only.

Family Lafoeidae

Acryptolaria conferta (Allman, 1877)

(Fig. 48A-B)

Cryptolaria conferta Allman, 1877: 17, pl. 2 figs 6-10.

Grammaria conferta – in part Broch 1918: 17.

Acryptolaria conferta – Totton 1930: 164, fig. 19a-b; Ralph 1958: 315, fig. 4a-g; Millard 1975: 169, fig. 56; Calder 1991: 33, figs 19-20, synonymy; Hirohito 1995: 104, fig. 29c-d, pl. 6 fig. C.

Acryptolaria conferta conferta – Ramil & Vervoort 1992a: 41, fig. 7a-b.

Acryptolaria conferta minor Ramil & Vervoort, 1992a: 43, fig. 8a-c, 9a-c.

Acryptolaria conferta australis – Vervoort 1966: 115, fig. 15; Rees & Vervoort 1987: 37, fig. 6e.
TYPE LOCALITY – off Cuba.
TYPE MATERIAL EXAMINED – MCZ Harvard, possible syntype type material in jar with *Sertularella amphorifera* Allman, 1877.
MATERIAL ICELAND – BIOICE stations 2107 – 2257 – 2288 – 2291 – 2691 – 2700 – 2701 – 2706 – 2707 – 2797 – 2849.

DESCRIPTION – colonies erect, up to 4 cm in height, irregularly branched, polysiphonic, distal parts monosiphonic. Hydrothecae in two rows, alternately directed left and right. Hydrotheca smoothly tubular, basally slightly narrowing, curved away from axis, adcauline wall adnate for about half its length. Hydrothecal rim circular, slightly everted, opening held at about 60° with axis, often with renovations. Gonothecae not observed, according to Ramil & Vervoort (1992a) aggregated into coppiniae on stem or branches, composed of closely packed, adnate, amphora-shaped gonothecae. There are no protective structures or elongated tubules between gonothecae, but occasionally the aperture of a normal hydrotheca is visible between the gonothecae. Female gonothecae with acrocyst.

REMARKS – *Acryptolaria conferta* shows variations that prompted some authors to provide names for these varieties. The variety *australis* has overlapping hydrothecae. Millard (1975) noted, that the two forms are connected by all possible intermediates. Ramil & Vervoort (1992a) proposed a new subspecies *Acryptolaria conferta minor* for a form with smaller hydrothecae. This variety did not intergrade with their other material. There are several conditions necessary for a population to gain the status of a subspecies (see Mayr & Aslock 1991). Important in this context is that subspecies populations cannot be contained within another subspecies population. As Ramil & Vervoort's morphotypes occur sympatrically, they are either only variants (genotypic or phenotypic), or they are two separate species. Only population genetic methods can give us valid answers to this question. For time being, it is thus advisable to regard the morphotype as a variant only, namely as *Acryptolaria conferta* var. *minor*.

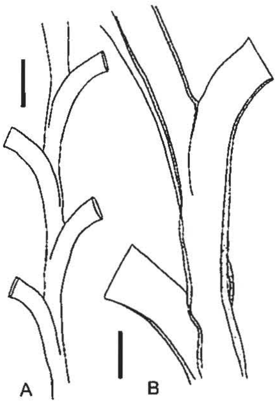

Figure 48. Acryptolaria conferta *(Allman, 1877); BIOICE 2849. A, terminal branch, scale bar 0.5 mm. B, higher magnification, scale bar 0.1 mm.*

The Icelandic material conformed with none of the two variants of Ramil & Vervoort (1992a). While the length of the free part of the adcauline wall (0.35-0.40 mm, without renovations) was within the range of the variant *minor*, the diameter of the hydrothecae was above the range of both var. *conferta* and var. *minor* (at rim 0.24-0.28 mm). The type material had hydrothecal diameters of 0.32-0.44 mm. For Bermudian material Calder (1991) gives a size range of 282-308 mm for the orifice diameter. There is thus a considerable variation between and in-between populations and hydrothecal size.

Kramp (1932a) re-examined material identified by Broch (1918) as *A. conferta* and found it to be composed of *A. conferta* and *Grammaria borealis*.

DISTRIBUTION – *Acryptolaria conferta* is generally considered to be a cosmopolitan species, living in the deeper to deep water strata (Ramil & Vervoort 1992a). The Icelandic material came from localities off the north, south-west, and south coast, depths 905-1400 m. The species is also known to occur at eastern and western Greenland.

***Filellum serpens* (Hassall, 1848)**
(Fig. 49A-B)
Campanularia serpens Hassall, 1848: 2223.
Coppinia mirabilis Hassall, 1848; 2223.
Coppinia arcta - Hincks 1868: 219, pl. 41, fig 5.
Grammaria serpens – Kramp 1914: 1027; Broch 1918: 16, fig. 4; Vervoort 1959: 235, fig. 11.
Filellum serpens – Hincks 1868: 214, pl. 41 fig 4; Kramp 1932b: 11; Kramp 1938: 25; Kramp 1943: 23; Calder 1970: 1522, pl. 4 fig. 9; Cornelius 1975: 378, fig. 2, synonymy; Cornelius 1995a: 254, fig. 58; Peña Cantero, Garcia Carrascosa, & Vervoort 1998: 302.
Type locality – Dublin, Ireland.
Material Greenland – "Kap Farvel" stations 74 – 91 – "Kangamiut" stations 2 – 4 – 5 – 6 – 10 – ZMUC, Godthaab, 100 m, 25.07.1955.
Material Iceland – BIOICE stations 2185, with coppinia – 2201 – 2203 – 2204 –BIOICE 2239 – 2245 – 2313 – 2314, with coppinia – 2330 – 2349 – 2350 – 2356 – 2377, with coppinia – 2490 – 2493 – 2508 – 2511 – 2514 – 2524 – 2530 – 2533 – 2558, with coppinia – 2710.
Other Material examined – MHNG INVE 28759, France, Roscoff, coll. Bedot 22.6.1910, on *Abietinaria abietina*, with several coppiniae.

Description – colonies simple, minute, stolonal, sessile hydrothecae, stolons creeping, ramified. Hydrothecae tubular, 0.4-0.6 mm, diameter 0.1 mm, adnate to stolons or substrate for 1/2 to 2/3, smooth, free part curving upward, margin sometimes slightly everted, often with widely spaced renovations. Gonothecae clustered in dense coppiniae, all lateral walls tightly adnate, height about 0.6 mm, polygonal cross-section, apperture on distinct neck. Between gonothecae many tubes, diameter like hydrothecae, length 1.5 mm, irregularly shaped, not branching, either curving horizontally in middle and overarching gonothecae like dense canopy, or nearly straight and giving coppinia a spiny appearance. Embryos develop in acrocysts.

Remarks – for a recent discussion of the genus and its species see Peña Cantero, Garcia Carrascosa, & Vervoort (1998).

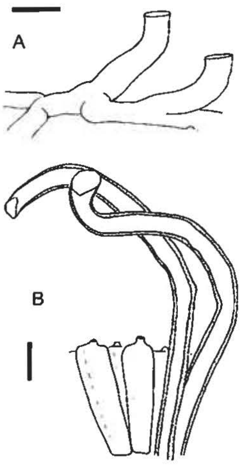

Figure 49. Filellum serpens *(Hassall, 1848); Greenland, Cape Farewell. A, stolons and two hydrothecae, scale bar 0.2 mm. B, MHNG INVE28759, France, Roscoff, dissociated coppinia with gonothecae and two accessory tubes, scale bar 0.2 mm.*

Distribution – cosmopolitan in coastal waters throughout the major oceans from the tropics to the polar seas, mostly on other hydroids, very often on *Abietinaria abietina*. Also present all around Iceland and western and eastern Greenland.

***Filellum serratum* (Clarke, 1879)**
(Fig. 50)
Lafoea serrata Clarke, 1879: 242, pl. 4 fig. 25.
Reticularia serrata – Ralph 1958: 312, figs 2j, 3a.
Filellum serratum – Leloup 1974: 8; Millard 1975: 178, fig. 59A-C; Calder 1991: 36, fig. 21; Rees & Vervoort 1987: 39; Ramil & Vervoort 1992a: 54; Hirohito 1995: 110, fig. 31a-c; Peña Cantero, Garcia Carrascosa, & Vervoort 1998: 304, figs 1-2.
Type locality – Cuba.
Material Iceland – BIOICE 2424, also slide MHNG INVE 27655.

Diagnosis – like *Filellum serpens*, but horizontal part of hydrotheca with several fine ridges or lines.

Remarks – *Filellum serratum* is primarily distinguishable from *F. serpens* by the striations on its hydrotheca (Fig. 50). Clarke

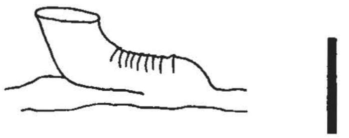

Figure 50. Filellum serratum *(Clarke, 1879); BIOICE 2424, same scale as A.*

based his first description on infertile material and coppiniae of *Filellum serratum* have been described only a few times. Peña Cantero, Garcia Carrascosa, & Vervoort (1998) described coppiniae from Mediterranean material and it had branched tubes, which would constitute another difference to *Fillelum serpens*. However, other authors like Millard (1975) found unbranched tubes. More fertile material, notably also from the type locality, must clearly be examined in order show whether these differences are intraspecific variations or due to lumping two different species with striated hydrotheca.

DISTRIBUTION – north-western Atlantic, Mediterranean, Indian Ocean, New Zealand, Chile, South Africa; 5-900 m. The species is herewith also newly recorded from Iceland. The locality lies on the south coast. It is not known from Greenland.

Grammaria abietina **(M. Sars, 1850)**
(Fig. 51A-C)
Campanularia abietina M. Sars, 1850: 139.
Grammaria robusta Stimpson, 1854: 9, pl. 1 fig. 3.
Grammaria ramosa Alder, 1856a: 361, pl. 14 figs 1-4.
Grammaria stentor Allman, 1888: 48, pl. 23 figs 1 & 1a; Naumov 1969: 305, figs 46E, 173, pl. 2 fig. 1.
Grammaria magellanica Allman, 1888: 48, pl. 23 figs 2 & 2a-b; Vervoort 1972: 58, fig. 16b.
Grammaria insignis Allman, 1888: 49, pl. 23 figs 3 & 2a-b.
Grammaria intermedia Pfeffer, 1889: 53.
Grammaria abietina f. *typica* Broch, 1918. 18.
Grammaria abietina f. *brevicyatha* Broch, 1918: 18, fig. 5.
Grammaria abietina – Kramp 1914: 1030; Kramp 1932b: 11; Kramp 1938: 26; Kramp 1943: 24; Naumov 1969: 306, figs 20, 46F, 174, pl. 1 fig. 3; Calder 1970: 1523, pl. 5 fig. 1; Vervoort 1972: 56, in part (?) Cornelius 1975b: 382, fig. 3, synonymy; Cornelius 1995a: 257, fig. 59 (? not 59b); Calder & Vervoort 1998: 27, fig. 13.

TYPE LOCALITY – Bergen, Norway, 55-75m.

MATERIAL GREENLAND – ZMUC, 66.62°N 56.50°W, 335-360 m, 3.08.1975 – Hoels 1107 – "Kangamiut" station 10 – "Kap Farvel" stations 11 – 14 – 21 – 22 – 45 – 62 – 82 – 87 – 95 – 135 – 142 – 148.

MATERIAL ICELAND – BIOICE stations 2005 – 2056 – 2074 – 2099 – 2126, with coppinia – 2128 – 2168 – 2245 – 2293 – 2313 – 2314 – 2328 – 2331 – 2332 – 2346 – 2350 – 2351 – 2352 – 2356 – 2359 – 2360 – 2374 – 2377 – 2381– 2490 – 2491 – 2493 – 2524, with coppinia – 2533 – 2594 – 2512 – 2564 – 2527 – 2530 – 2562 – 2599 – 2606 – 2678 – 2820 – 2821 – 2824.

DESCRIPTION – colony erect, 4-15 cm. Hydrorhiza rhizoid or creeping. Main stem and branches thick, polysiphonic to the very tips, branching irregular or imperfectly pinnate, often in one plane, branches tapering abruptly at their origin, ends distinctly blunt. Stem and branches consist of a main tube bearing the hydrothecae in four to eight longitudinal rows embedded in stolon-like accessory tubes. Hydrothecae much exserted, diameter 0.25-0.30 mm, tubular, variably outward-curving, opening plane inclined towards distal end or parallel to branch axis, rims even, circular, often renovated, frequently slightly flaring, junction of hydrotheca with main tube mostly hidden by accessory tubes. If hydrothecae in four rows, these often in sub-opposite pairs. Gonothecae aggregated in coppiniae on stem or branches. Coppiniae composed of tightly packed, elongated gonothecae which are overarched by a dense network of branched, thin accessory tubules (nematophorous ramules).

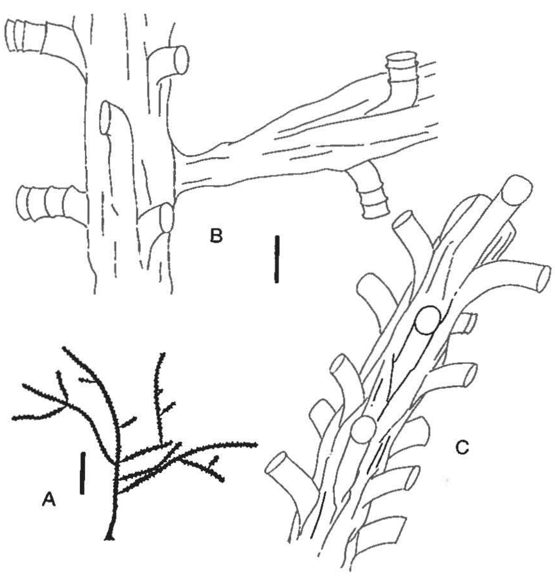

Figure 51. Grammaria abietina *(M. Sars, 1850). A, silhouette of typical colony, BIOICE 2351, scale bar 1 cm. B, stem and basal part of branch, note characteristic thin origin of side branch, BIOICE 2126, scale bar 0.5 mm. C, terminal end of side branch, note blunt, polysiphonic end, same scale as B.*

REMARKS – colonies of *G. abietina*, also rather small ones, are nearly always very polysiphonic, a trait that helps to distinguish them from *G. borealis*. Even the distal ends of branches are polysiphonic and in undamaged specimens they end rather bluntly (see Fig. 51 C). In *Grammaria borealis* – in contradistinction – large parts of the distal ends are monosiphonic and the bases of its hydrothecae are normally not hidden by the accessory tubes. In *G. abietina*, the connection of the branches with the stem are also often characteristic as they taper rapidly to half of the diameter found more distally (Fig. 51B). This was not observed in *G. borealis*. In two samples from Iceland (BIOICE 2346 and 2493), *G. abietina* co-occurred with *G. borealis*. In these cases, the difference was rather obvious and it was not difficult to assign them to two separate species.

The coppinia of *G. abietina* resembles the one of *L. dumosa* (see Fig. 54B), but the aggregate is more protected by a dense mat of branched accessory tubules that form a canopy-like layer around the gonothecae.

Cornelius (1975b) examined several nominal *Grammaria* species like *G. ramosa* Alder, 1856, *G. magellanica* Allman, 1888, *G. stentor* Allman, 1888, and *G. insignis* Allman, 1888 and regarded them as conspecific, an opinion also expressed by other authors (e. g. Vervoort 1972). Cornelius' view is also adopted here, but some of his pictures of (1975b: Fig. 3, 1995b: fig. 59b) of a *G. abietina* from Norway are not so typical and conform more to the concept of *G. borealis* as adopted here (see below).

DISTRIBUTION – *Grammaria abietina* has a circumpolar occurrence, ranging southward to the North Sea, to southern New England, and to the Azores (Calder & Vervoort 1998). However, it is absent from the English Channel. It was also reported from the southern hemisphere (Crozet Islands, Falkland Islands, Tierra del Fuego, Patagonia, Argentina, as *G. magellanica*). It occurs in depths of 10-1500 m. Present also at western and eastern Greenland and all around Iceland.

***Grammaria borealis* (Levinsen, 1893)**

(Fig. 52A-D)

Cryptolaria borealis Levinsen, 1893: 13, pl. 5 fig. 21; Kramp 1914: 1032; Naumov 1969: 302, figs 46D, 169.

Cryptolaria triserialis Fraser, 1913: 170, pl. 42 figs1-2.

? *Grammaria scandens* Stechow, 1913

Grammaria conferta – in part Broch 19818: 17.

Acryptolaria triserialis – Fraser 1944: 213, pl. 42 fig. 194.

Grammaria borealis – Kramp 1932a: 34, figs 15-16; Kramp 1938: 27; Vervoort 1972: 56, fig. 16a, Hirohito 1995: 113, fig. 32a-b, pl. 7 fig. B.

TYPE LOCALITY – Davis Street, Greenland.

MATERIAL ICELAND – BIOICE stations 2097 – 2154 – 2156 – 2168 – 2327 – 2332 – 2346 – 2348 – 2349 – 2352 – 2353 – 2493 – 2514 – 2597 – 2823 (all samples without coppiniae).

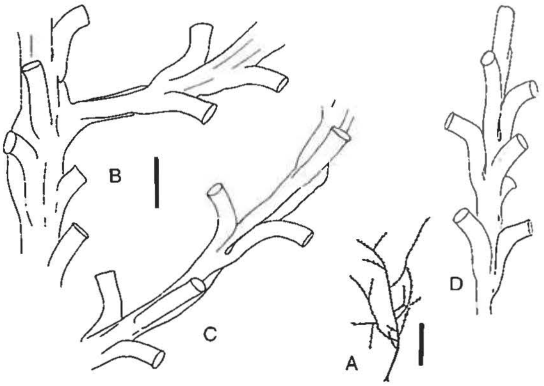

Figure 52. Grammaria borealis *Levinsen, 1893. A, silhouette of typical colony, BIOICE 2353. scale bar 1 cm. B, stem and base of side branch, both polysiphonic, BIOICE 2597, scale bar 0.5 mm. C, polysiphonic branch, BIOICE 2823, same scale as B. D, distal end of branch, monosiphonic, BIOICE 2597, same scale as B.*

DESCRIPTION – colony erect, up to 5 cm. Main stem and branches thin, polysiphonic in larger colonies, but distal regions always monosiphonic, branching irregular, often in one plane; branches and stems of rather uniform diameter. Stem and branches consist of a main tube bearing the hydrothecae in three to four longitudinal rows, in polysiphonic part accompanied by few stolon-like accessory tubes. Hydrothecae around 70 mm long, tubular, variably outward-curving, opening plane inclined towards distal end or parallel to branch axis, rims even, circular, often renovated, frequently slightly flared, junction of hydrotheca with main tube mostly visible. If hydrothecae in four rows, these often in sub-opposite pairs. Gonothecae are unknown.

REMARKS – *Grammaria borealis* resembles *G. abietina*, but in its macroscopic appearance it is more gracile than the latter. More distinguishing characters are discussed under *G. abietina*. Although rare intermediate forms (or juvenile *G. abietina* ?) occur, *G. borealis* is here kept separate. Following Kramp (1932), *Cryptolaria triserialis* Fraser, 1913 is here also regarded as conspecific with *G. borealis*. The triseriate arrangement of the hydrothecae is more rare, but it can occur in the same colony along with the more common tetra-seriate arrangement.

Kramp (1932) also re-examined material described by Broch (1918) as *Grammaria conferta* and found that some colonies actually belonged to *G. borealis*, while others were indeed *Acryptolaria conferta*.

DISTRIBUTION – *Grammaria borealis* occurs in the North Atlantic, Nova Scotia, western Greenland, all around Iceland, Barents and Kara Sea, Japan, depths of 36-314 m.

Grammaria immersa Nutting, 1901

(Fig. 53)

Grammaria immersa Nutting, 1901: 178, pl. 21 figs 5-6; Kramp 1914: 1031; Broch 1918: 22; Fraser 1937: 117, pl. 24 fig. 124; Kramp 1938: 27; Kramp 1943: 24; Calder 1970: 1523, pl. 5 fig. 2; Hirohito 1995: 113, fig. 32c, pl. 7 fig. c.

Grammaria immersa immersa Naumov, 1969: 307, fig. 46G, 175A, pl. 4 fig. 1.

? *Grammaria gracilis* Stimpson, 1854; Calder 1970: 1523.

TYPE LOCALITY – St. Paul Harbour, Kadiak, Alaska.

MATERIAL GREENLAND – "Kap Farvel" stations 22 – 91, with coppinia – 100, with coppinia.

DESCRIPTION – colonies erect, up to 7 cm high and 5 cm broad, frequently but irregularly branching, often in one plane, branches only slightly thinner than stem, polysiphonic to the very tips, end of branches blunt, branches tapering at their origin. Stem and branches bear hydrothecae in eight longitudinal rows embedded in stolon-like accessory tubes. Hydrotheca tubular, diameter 0.16-0.2 mm, only most distal end outward-curving, exserted for a distance measuring less than one diameter, opening plane inclined towards proximal end or parallel to branch axis, rims even, circular, junction of hydrotheca with main tube mostly hidden by accessory tubes. Gonothecae aggregated in coppiniae on stem or branches. Coppiniae large, composed of tightly packed, 0.5 mm high, adnate, poly-

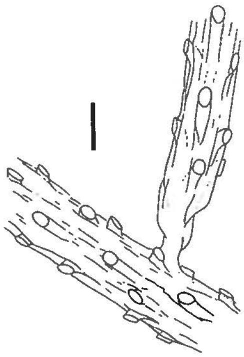

Figure 53. Grammaria immersa *Nutting, 1901; Greenland, Cape Farewell; stem and side branch (top), scale bar 0.5 mm.*

gonal gonothecae with truncate end. Interspersed between gonothecae simple, straight or curved, up to 1 mm high tubules.

REMARKS – *Grammaria immersa* is distinguished from the other *Grammaria* species of the present area by its more sunken hydrothecae. They protrude not more than the equivalent of one diameter of a hydrotheca (Fig. 53). There is also a nearly twofold difference in the diameter of the hydrothecae. The tubes of the coppinia apparently also differ from *G. abietina*. They were un-branched in the material of *G. immersa* examined here, while they were branched in *G. abietina*. In the sample of "Kap Farvel" station 22, both species were found together and the difference between the two was very obvious.

DISTRIBUTION – western and eastern Greenland, Arctic Ocean, Bering Sea, North Atlantic Ocean (Faroes, Spitsbergen, Iceland), Japan. There is only one record from Iceland from Sey›isfjör›ur (Saemundsson 1911, Broch 1918).

Lafoea dumosa (Fleming, 1820)

(Figs 54A-D, 55, 56)

Sertularia dumosa Fleming, 1820: 84.

Campanularia fruticosa M. Sars, 1850: 138.

Campanularia gracillima Alder, 1856a: 361, pl. 14 figs 5-6.

Lafoea pocillum Hincks, 1868: 204, pl. 40 fig. 2; Naumov 1969: 295, figs 46A & 161.

Lafoea grandis Hincks, 1874: 148, pl. 6 figs 1-2.

Calycella obliqua Hincks, 1874: 149, pl. 4 figs 4-5.

Lafoea gracillima – Broch 1909b: 156, figs 17-18; Broch 1918: 9, fig. 2; Kramp 1932b: 9; Kramp 1938: 24; Kramp 1943: 20; Ralph 1958: 310, figs 1y & 2a-c; Vervoort 1966: 125, fig. 28; Calder 1970: 1524, pl. 5 fig. 5; Leloup 1974: 10.

Lafoea dumosa – Hincks 1868: 200, pl. 41 figs 1 & 1a; Broch 1909b: 156, fig. 16; Broch 1918: 7, fig. 1; Kramp 1938: 23; Ralph 1958: 310; Millard 1975: 185; Calder 1970: 1524, pl. 5 fig. 3; Cornelius 1975b: 385, fig. 4, synonymy; Rees & Vervoort 1987: 40, figs 7-8; Ramil & Vervoort 1992a: 55; Cornelius 1995a: 261, fig. 60; Hirohito 1995: 126, fig. 36a-c, pl. 8 fig. A

Lafoea fruticosa – Broch 1909b: 158, fig. 19; Broch 1918: 12, fig. 3; Kramp 1932b: 9; Kramp 1938: 24; Kramp 1943: 21; Calder 1970: 1524, pl. 5 fig. 4; Millard 1975: 187 fig. 61A-F.

Toichopoma obliquum – Broch 1909b: 210, fig. 20; Kramp 1911: 374, pl. 20 fig. 4, pl. 23 figs 5-8, pl. 24 fig. 1; Kramp 1914: 1025; Broch 1918: 15; Kramp 1932a: 33; Kramp 1932b: 10; Kramp 1943: 25.

TYPE LOCALITY – Arbroath, Scotland.

MATERIAL GREENLAND – Hoels stations 1025* – 1051* – 1081 – 1087 – 1119* – Just & Andersen 1966 stations 44 – 69 – "Grønland" 1975 stations 15* – 25* – 52 – 54 – 55 – "Kap Farvel" stations 1 – 11 – 16 – 21 – 22 – 23 – 25 – 40 – 42 – 45 – 54 – 55 – 58 – 59 – 62 – 74 – 83 – 88 – 90 – 91 – 93 – 95 – 100* – 112* – 114 – 117 – 128 – 138 – 141 – 142 – 147 – Just & Schiøtte 1983 stations 6 – 8* – 20 – 23 – Just & Vibe 1968 stations 18 – 20 – 29 – 30 – 35 – 40 – 66 – "Kangamiut" stations 1 – 2 – 3 – 4 – 5 – 6 – 6 – 8 – 9 – 10* – Bank. unders. stations 5291 – 5291 – 5291 – 5293 – 5306 – ZMUC, Skovfjord (Narssaq), 21.09.1946 – ZMUC, Greenland, 25.06.1976 – ZMUC, Kangaamiut, 480 m, 29.08.1957 – ZMUC, Jakobshavn, Rodebay 380-390 m, 23.7.1949 – ZMUC, 67.12°N 56.40°W, 200 m, 11.8.1975 – ZMUC, 76.68° 18.58°W, Øresund, 38-56 m – ZMUC, 66.40°N

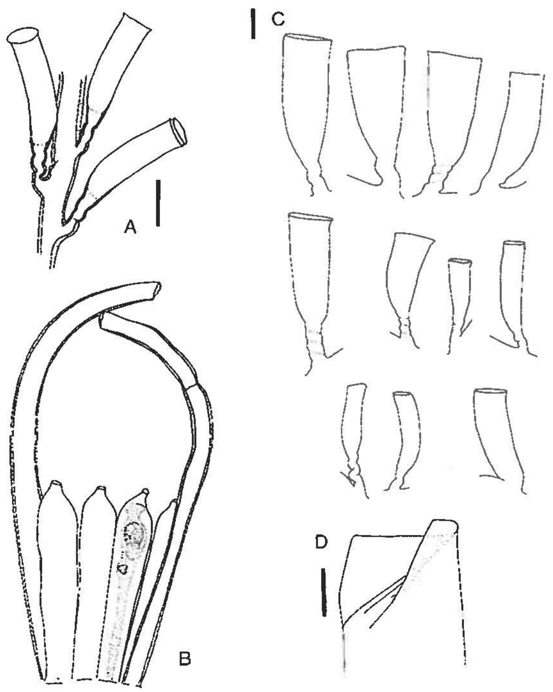

Figure 54. Lafoea dumosa *(Fleming, 1820). A, part of branch with three hydrothecae, BIOICE 2126, scale bar 0.2 mm. B, gonothecae and accessory tubes from coppinia, BIOICE 2126, same scale as A. C, variation of hydrothecal shape, size, and pedicel; all depicted hydrothecae are from colonies with the large sized isorhiza, scale bar 0.2 mm. D, rim of hydrotheca with pseudo-operculum, "Godthaab" station 29, scale bar 50 µm.*

55.38°W, 200-222 m, 3.08.1975 – ZMUC, 66.00°N 56.12°W, 200-204m, 1.08.1975 – ZMUC, as *Toichopoma obliqua,* Kap Bismarck, 4.09.1907, material of Kramp 1911, with coppinia – ZMUC, Egedesminde, material of Broch 1918* – ZMUC, as *Toichopoma obliqua,* "Godthaab" station 29, material of Kramp 1932a*.

(Samples examined for their nematocysts are marked either with * when having large isorhizas, or with † when having the small isorhiza, often there were several colonies per sample, thus both forms could sometimes be found in a single sample.)

Material Iceland – BIOCE samples 2001 – 2002, with coppinia – 2003 – 2004 – 2005 – 2006 – 2008 – 2009 – 2010 – 2012 – 2018 – 2021 – 2022 – 2056* – 2067 – 2071 – 2074 – 2075* – 2088 – 2090* – 2091 – 2093 – 2094 – 2096* – 2097 – 2099, with coppinia* – 2102 – 2103 – 2107 – 2119 – 2122 – 2124 – 2126, with coppinia* – 2128 – 2129 – 2129 – 2132 – 2134 – 2135 – 2136 – 2137 – 2139 – 2140 – 2142 – 2147 – 2150 – 2152 – 2154 – 2156 – 2164 – 2166 – 2167 – 2168 – 2170* – 2174 – 2175 – 2178 – 2180 – 2185 – 2219 – 2229 – 2237 – 2241 – 2247 – 2249 – 2262 – 2265 – 2271 – 2272 – 2273 – 2293 – 2303 – 2313† – 2314*† – 2315 – 2316* – 2317 – 2318 – 2319 – 2320 – 2325 – 2327 – 2328 – 2330 – 2332 – 2346 – 2348 – 2349 – 2351 – 2352 – 2356 – 2358 – 2359 – 2360 – 2361 – 2362 – 2370 – 2371 – 2374 – 2376 – 2377 – 2380 – 2381 – 2382 – 2403 – 2415 – 2435 – 2441 – 2475 – 2490*† – 2493 – 2495, with coppinia* – 2499 – 2501 – 2502 – 2506, with coppinia – 2508 – 2509 – 2511 – 2512 – 2514 – 2516 – 2520 – 2522 – 2524 – 2524 – 2526 – 2526 – 2528*† – 2530*† – 2531*† – 2533 – 2559 – 2562 – 2564 – 2568 – 2570 – 2573 – 2574 – 2575* – 2581 – 2582 – 2583* – 2588 – 2591 – 2592 – 2594 – 2595 – 2597 – 2599 – 2601 – 2603 – 2608 – 2610 – 2612 – 2613* – 2615 – 2616 – 2618 – 2624 – 2629 – 2631 – 2632 – 2635 – 2642 – 2652 – 2655* – 2660 – 2662 – 2665 – 2668 – 2672 – 2673 – 2675 – 2675 – 2678 – 2710 – 2713 – 2719 – 2720 – 2743 – 2744 – 2751 – 2756 – 2757 – 2768 – 2774 – 2777 – 2787 – 2789 – 2792, with coppinia – 2824 – 2849 – 2880 (for * and † see remark above).

Other material examined – New Zealand, Kaikoura, 100 m, coll. P. Schuchert May 1994* – south Kurile Islands, 201 m, coll. Naumov 4.9.1949, Zoological Institute St. Petersburg* – MHNG INVE25650, Gulf of Gascogne, 240 m, with coppinia† – MHNG INVE25648, Roscoff † – MHNG INVE25649, Naples † (for * and † see remark above).

Description – colony stolonal, erect, or a combination of both. Erect, perhaps simply older, colonies loosely and irregularly branched, 1-10 cm in height, polysiphonic, component tubes parallel, each bearing hydrothecae at irregular intervals, arising from all sides of branches. Hydrothecae very variable in size and shape, sometimes even

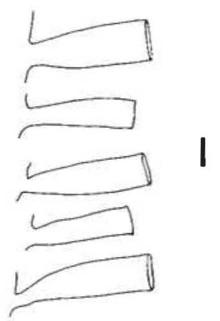

Figure 55. Lafoea dumosa *(Fleming, 1820). Shapes of hydrothecae from colonies with the small size isorhiza capsule, scale bar 0.2 mm.*

within the same colony, 0.5-1.1 mm in depth, cylindrical to inverted conical, tapering below into pedicel, or pedicel absent and directly joined to branch, thus sessile. Hydrothecal margin mostly smooth, but occasionally finely serrated, rim sometimes slightly everted. Hydrotheca either straight or slightly curved. Pedicel of variable length, sometimes up to 1/2 length of hydrotheca, frequently twisted. Operculum and diaphragm absent, but slight annular thickening may indicate base of hydranth. Gonothecae clustered into coppiniae, about 0.8 mm high, densely aggregated so that side walls become adnate, distal end rounded with aperture on a distinct neck. Interspersed between gonothecae are vertical accessory tubules, about twice the height of the gonothecae, unbranched, with open end, recurving over surface of coppinia.

Remarks – *Lafoea dumosa* has a complicated taxonomic history, which is apparently not fully resolved. Even among colonies from the same locality, there are often very distinct morphotypes, mostly differing in size and shape of the hydrothecae, and presence or absence of a hydrothecal pedicel (comp. Fig. 54C). It is understandable that these obvious differences were attributed to the presence of different species. However, comparing enough material, all forms will ultimately intergrade and they are not objectively identifiable, a fact also observed in the material examined here. Some authors, e. g. Millard (1975) recognised two major forms, the stalkless *L. dumosa* (Fleming, 1820), and the pedicellate *L. fructicosa*. But it is of particular importance to note that Fleming's original description referred most probably to a form with stalked hydrothecae and not as commonly assumed to a form without pedicels (Cornelius 1975b). Some recent studies therefore appropriately recognised only one species (Cornelius 1975b, Rees & Vervoort 1987). However, examination of nematocysts of many colonies revealed that two separate species could be involved nevertheless. *Lafoea* species possess two types of nematocysts: a small capsule that could not be classified (approx. 6 mm length, size not much variable), and a much larger isorhiza. The latter is found predominantly in a belt below the tentacles. I found that *Lafoea dumosa* species with a distinct pedicel nearly always had an isorhiza with a length above 21 µm (mean = 23.6, s. dev. = 1.7, n = 202, 23 colonies) (Fig. 54C), while colonies with clearly sessile hydrothecae generally had isorhizas below 16 µm (mean 14.0, s. dev. = 0.95, n = 64, 9 colonies) (Fig. 56). For these comparisons, not only material from Iceland was used, but also samples from Brittany, the Mediterranean, the Kurile Island, and New Zealand. Unfortunately the correlation between absence of pedicel and larger nematocyst size was not perfect, as in one case a colony from Iceland with sessile hydro-thecae (BIOICE 2821, hydrotheca in Fig. 54C, last row, last specimen) had large isorhizas, while one colony from Naples with an indistinct pedicel (Fig. 55, last in row) had a small isorhiza. Thus, while the morphologies of the hydrotheca is not a reliable feature to distinguish morphotypes because they are intergrading, it appears that two different morphotypes can be distinguished using nematocyst size (Fig. 56). I am strongly inclined to regard the two morphotypes as representatives of two different species. However, it appears somewhat premature to suggest a new

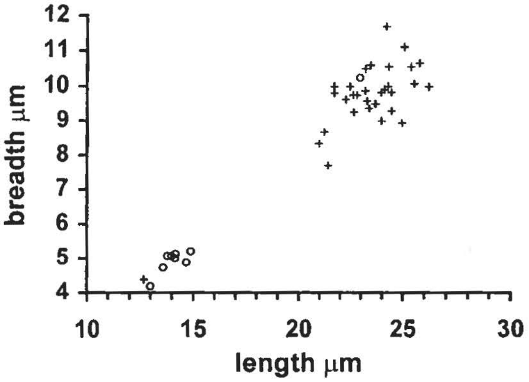

Figure 56. Lafoea dumosa *(Fleming, 1820). Graph of length versus breadth of the isorhiza capsules. All values are mean values from 5-10 capsules. The values from all individual capsules resulted in an identical distribution (not shown). The sign + refers to colonies with hydrothecae having a pedicel, the o sign to colonies having hydrothecae without pedicels. The size distribution is clearly split into two separate clusters, correlating strongly, but not absolutely, with presence or absence of a pedicel.*

hydroid species based solely on a nematocyst size difference. Additionally, no material from the type locality of *L. dumosa* could be examined. I prefer to wait until further independent data – like mitochondrial DNA sequences – will confirm the existence of two separate species. In view of the variation seen in the hydrothecal shapes, the situation could be even more complicated. An interesting detail is, nevertheless, that colonies with sessile hydrothecae were rather rare in the Icelandic material and absent in material from Greenland.

Some authors, notably Broch and Kramp, regarded *Lafoea obliqua* as a valid species (as *Toichopoma obliquum*). It differs from *Lafoea dumosa* in having a *pseudo-operculum*. This operculum is obtained by tucking in one side of the hydrothecal margin (Fig. 54D). This form is frequently found in Greenlandic waters, but not always all hydrothecae of a colony have this infolding and these are thus perfectly like *L. dumosa*. There is also no difference in all other aspects, including the coppinia. Naumov (1969) thinks that the pseudo-operculum of *L. obliqua* is nothing but an artifact and he synonymises it with *L. dumosa*. While I think that the pseudo-operculum formation is not due to the collection procedure, but is present in living colonies, I am convinced that *L. obliqua* must be synonymised with *L. dumosa*. Otherwise it would be difficult to account for the normal hydrothecae that occur in so called colonies of *L. obliqua*.

DISTRIBUTION – cosmopolitan, subtidal to maximal reported depths of 3940 m (Cornelius 1995a).

Zygophylax brownei Billard, 1924

(Fig. 57A-C)

? *Lafoea halecioides* Allman, 1874: 472, pl. 66 figs 1, 1a.
Lictorella halecoides – Pictet & Bedot 1900: 4, 16, pl. 3 figs 4-5.
Lafoea pinnata – Browne 1907: 16, 18, 2-29; Billard 1923, 14, fig. 1A
[not *Zygophylax pinnata* (G. O. Sars, 1874)]
Zygophylax Brownei Billard, 1924: 64.
Zygophylax brownei – Rees & Vervoort 1987: 76; Ramil & Vervoort 1992a: 65, 13a-d, 14a-c; Schuchert 2000: 423, fig 7.
not *Zygophylax brownei* – Millard 1977b: 106, 114, fig. 4.

TYPE LOCALITY – Bay of Biscay, 47.33°N 06.17°W, "Tanche" Station 294, 186 m (Ramil & Vervoort 1992a, lectotype).

MATERIAL ICELAND – BIOICE 2348, several plumes growing on old *Eudendrium* stem, with coppinia.

DESCRIPTION – colonies up to 2 cm high, branched, stem and some branches polysiphonic. Polysiphonic branches also bear hydrothecae, these arise from several tubes and not just one main tube. Monosiphonic parts with occasional nodes. Hydrothecae alternate, sitting on short apophysis on lateral sides of axis, hydrothecae in one plane or more often slightly inclined towards frontal. Hydrothecae about 0.5 mm in depth (diaphragm to opening) and with a diameter of

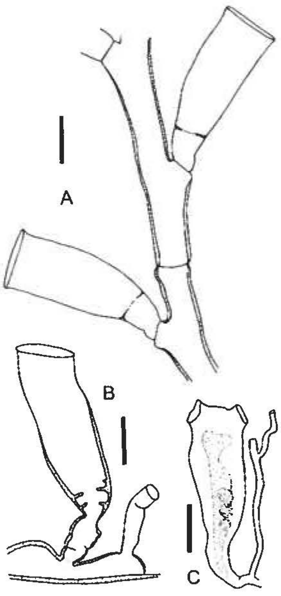

Figure 57. Zygophylax brownei *Billard, 1921; BIOICE 2348. A, internodes with two hydrothecae, scale bar 0.2 mm. B, hydrotheca and putative nematothecae in polysiphonic part of colony, scale bar 0.2 mm. C, gonotheca, presumably male, with branched accessory tubes, scale bar 0.5 mm.*

0.25-0.3, more or less cylindrical but often asymmetric as adcauline side usually more convex than abcauline one, margin slightly but distinctly everted. Hydrotheca narrows basally almost imperceptibly into pedicel, pedicel about 0.15-0.25 mm in length, at border of pedicel a transverse diaphragm, sometimes several ones. Pedicels below diaphragm often curved or kinked (Fig. 57A), but straight ones also occur. Nematothecae very scarce, only one found (Fig. 57 B), cylindrical. Holes or scars of lost nematothecae also not observed. Gonothecae aggregated into coppinia, but individual gonothecae not adnate. Between gonothecae thin, erect, branched accessory tubules, reaching the same height as the gonothecae, sometimes beyond, diameter nearly isodiametric, without nematothecae. Gonothecae 0.6-0.9 mm in height, irregularly club-shaped with broad end up; distal end with two lateral, opposed apertures on short necks. Distal part of gonothecae often damaged or perhaps eroded naturally. Gonothecae contain a reduced gonozooid with three spherical packets in a longitudinal row, presumably male gonads.

Remarks – the presence of branched, accessory tubes in the coppiniae makes this species immediately distinguishable from Z. *pinnata*, although infertile material might hardly be separable. For further discussions see Schuchert (2000).

For the diagnosis of the genus see Cornelius (1995a). For important revisions and reviews see Rees & Vervoort (1987), Ramil & Vervoort (1992), Altuna-Prados & Alvarez-Claudio (1993).

Distribution – known from Bay of Biscay (134 to 753 m). The present material was found between Iceland and the Faroes in 405 metres depth, growing on an *Eudendrium* species. It is not known from Greenland.

Zygophylax levinseni (Saemundsson, 1911)

Lictorella levinseni Saemundsson, 1911: 86, fig. 2.

Zygophylax biarmata – Broch 1918: 24; Kramp 1938: 28.

[*not Zygophylax biarmata* Billard, 1905]

Zygophylax elegantula Leloup, 1940: 11, pl. 1 fig. 8; Rees & Vervoort 1987: 78;

Zygophylax levinseni – Ramil & Vervoort 1992a: 78, figs 18a-d, 19a-f; Calder & Vervoort 1998: 35, fig. 17a-c.

Type locality – 9 miles SSE of Vestmannaeyjar, 63.21°N 20.10°W, 510 m (Kramp 1938).

Description – for figures and descriptions see Ramil & Vervoort (1992a).

Remarks – no material of this species could be examined. Broch (1918) and Kramp (1938) thought that *Lictorella levinseni* Saemundsson, 1911 was conspecific with *Zygophylax armata* Billard, 1905. While examining Atlantic material, Ramil & Vervoort (1992a) found that *Zygophylax levinseni* is a valid species, and that *Zygophylax elegantula* Leloup, 1940 is a junior subjective synonym. *Zygophylax levinseni* has frequent nematothecae, elongated hydrothecal pedicels and gonothecae with two long, recurved terminal necks. These characteristics render it well distinct from its congeners of the region. Broch's (1918) record of *Zygophylax armata* was based only on the type material of *Zygophylax levinseni*. The latter being now recognised as a valid species, there remains thus no record of *Z. armata* for Iceland.

DISTRIBUTION – South of Iceland (type locality), Bay of Biscay, Mid-Atlantic Ridge, Azores, Morocco, Cape Verde Islands, in depths of 183 to 3657 m (Ramil & Vervoort 1992a, Calder & Vervoort 1998). Not known from Greenland.

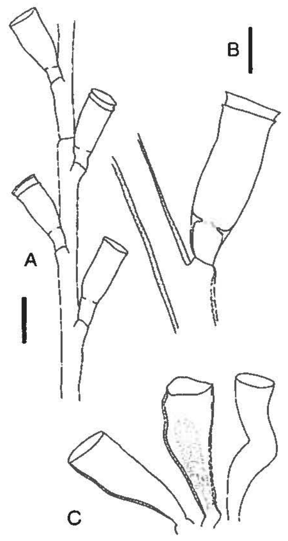

Figure 58. Zygophylax pinnata *(G. O. Sars, 1874). A, distal, monosiphonic branch with hydrothecae, BIOICE 2766, scale bar 0.5 mm. B, hydrotheca, BIOICE 2339, scale bar 0.2 mm. C, female gonothecae, BIOCE 2766, same scale as A.*

Zygophylax pinnata (G. O. Sars, 1874)

(Fig. 58A-C)

Lafoea pinnata G. O. Sars, 1874: 116, pl. 4 figs 25-28.

Zygophylax pinnata – Vervoort 1942: 289; Rees & Vervoort 1987: 54, synonymy; Cornelius 1995a: 266, fig. 61.

Lictorella pinnata – Broch 1909a: 202, figs 4-6; Kramp 1914: 1026; Broch 1918: 22, fig. 7; Kramp 1932b: 11; Naumov 1969: 309, fig. 176 pl. 3 fig. 1.

TYPE LOCALITY – Norway, Hardanger Fjord, 165-183 m.

MATERIAL GREENLAND – ZMUC, Christianshaab, 380-410 m, 22.07.1949 – ZMUC, 60.92°N 46.07°W, Skovfjord (Narssaq), 300 m, 15.06.1947, fertile 15 cm colony – ZMUC, Skovfjord (Narssaq), 21.09.1946.

MATERIAL ICELAND – BIOICE stations 2330 – 2366 – 2420 – 2766, 15 cm colony with gonothecae.

DESCRIPTION – colonies erect, large, up to 15 cm, tendency to branch in one plane, with thick polysiphonic stem and branches from which arise thin, monosiphonic hydrocladia. Hydrocladia with occasional nodes. Most hydrothecae on monosiphonic branchlets, rarely on stem and thicker branches. Hydrothecae arranged in two rows along hydrocladia, alternately on left and right, rows slightly displaced towards anterior side, each hydrotheca on short apophysis directed towards distal. Hydrotheca bell-shaped to cylindrical, tapering at base, aperture at right angle, circular, diameter 0.2-0.25 mm, margin sometimes slightly flaring, smooth, often renovated; at lower fourth of hydrotheca a distinct iris-like diaphragm, depth of calyx from diaphragm to margin 0.5-0.6 mm, pedicel below diaphragm mostly straight, not kinked. Nematothecae absent. Gonothecae arise clustered on stem or thick branches, not in contact with each other; either cone to funnel-shaped with open truncated end, straight or curved, about 0.7 mm long, or 1.2 mm long, with closed distal region and with 2-3 lateral apertures on short, straight necks. Accessory tubules not present in coppinia.

REMARKS – the examined samples of *Zygophylax pinnata* generally agreed well with the good description given in the reference section above. Gonothecae of *Zygophylax pinnata* have been described by Bonnevie (1898), Broch (1909) and Naumov (1969). The gonothecae of one coppinia described by Bonnevie had three openings, while another coppinia had funnel-shaped gonothecae. Bonnevie (1898) thought the latter were immature, but Cornelius (1995a) suspects that the difference might also be attributable to a sexual dimorphism. Such a sexual dimorphism is known for the genus (Rees & Vervoort 1987). Both types of gonothecae could also be observed in the present material. The funnel-shaped gonothecae had a large terminal opening (Fig. 58C), just like the ones depicted by Bonnevie (1898). Contrary to Bonnevie's illustration they were rather closely packed, but still without adnate walls. It seems likely, however, that their distal parts are actually eroded and would normally more look like the gonothecae with lateral openings on short necks (comp. Fig. 57C).

Zygophylax pinnata as conceived here (and Cornelius 1995a), does not have nematothecae. This seems to be the only reliable diagnostic character allowing to separate non-reproductive material from *Z. brownei*. Rees & Vervoort (1987: 54) reported the rare presence of nematothecae for *Z. pinnata*. I suspect that these colonies with nematothecae could have been *Z. brownei*.

DISTRIBUTION – western and eastern Greenland, all aoround Iceland, Faroes, Norway, Barents Sea, one isolated report for Scotland. Records for Indian Ocean and Pacific need reconfirmation.

Family Haleciidae

REMARKS – several *Halecium* species of the region under investigation can only be identified properly if gonothecae are present. The female gonothecae are often very characteristic and their presence allows a reliable identification. Particularly small, monosiphonic, and infertile colonies are mostly not identifiable, as they could also be juvenile specimens of larger, polysiphonic colonies.

Halecium beanii (Johnston, 1838)

(Fig. 59A-D)

Thoa beanii Johnston, 1838: 120, pl. 7 figs 1-2.

Halecium scutum Clark, 1877: 14, pl. 4 figs 13-14; Broch 1918: 39, figs 14; Kramp 1938: 31; Calder 1970: 1509, pl. 2 figs 2-3; Cornelius 1975b: 391, synonym.

Halecium boreale Lorenz, 1886: 26, pl. 1 figs 1-2.

Halecium beringi Naumov, 1960: 449, figs 337-338; Naumov 1969: 484, figs 337-338; Antsulevich, 1987: 107.

Halecium beanii – Kramp 1914: 998; Broch 1918: 38, fig. 13; Kramp 1938: 31; Vervoort 1942: 283; Ralph 1958: 332, fig. 10a-b, e-k; Vervoort 1959: 224, fig. 6; Vervoort 1966b: 103, fig. 3; Naumov 1969: 483, figs 19G-H, 336; Vervoort 1972: 30, figs 6-7; Ólafsson 1975: 9, fig. 14; Cornelius 1975b: 391, fig. 5, synonymy; Millard 1975: 144, fig. 47A-E; Rees & Vervoort 1987: 23, fig. 4a-b; Cornelius 1995a: 267, fig. 62; Hirohito 1995: 17, fig. 3d-f, pl. 1 fig. A.

TYPE LOCALITY – Scarborough, Yorkshire, England.

MATERIAL GREENLAND – "Kap Farvel" stations 55, fertile – 128, fertile – "Kangamiut" stations 1 – 2, fertile – 3 – ZMUC, Greenland, 350 - 500 m, 11.09.1957 – ZMUC, Holsteinsborg, 165 m, 8.07.1971, fertile.

MATERIAL ICELAND – BIOICE stations 2005 – 2234 – 2320, small fragment with male gonothecae, identification uncertain – 2328 – 2331, with male gonothecae – 2342 – 2420, small colony, identification uncertain – 2424 – 2524 – 2597 – 2710 – 2745 – 2749.

DESCRIPTION – colonies erect, up to 10 cm, imperfectly pinnate to shrubby, some colonies perfectly planar. Main stem and branches polysiphonic, thinning out to end monosiphonic. Internodes roughly equal, nodes oblique, can be indistinct. Hydrothecae on alternate sides at distal end of segments, pedicel of hydrotheca very short, not delimited from hydrocladium, hydrotheca thus nearly sessile. Hydrotheca held oblique to branch axis, very shallow, diameter 0.15-0.2 mm,

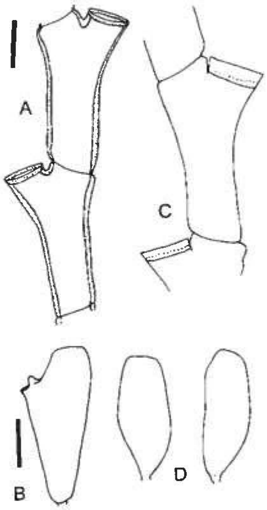

Figure 59. Halecium beanii *(Johnston, 1847); A-B Greenland, Holsteinsborg, C-D BIOICE 2331. A, part of hydrocladium, scale bar 0.2 mm. B, female gonotheca, polyps protruding out of opening not shown, scale bar 0.2 mm. C, part of hydrocladium, same scale as A. D, two male gonothecae, same scale as B.*

depth 20-40µm, with refringent nodules, no pseudodiaphragm, rim of hydrotheca often renovated. Male gonotheca club- to oblong sac-shaped, 1.4 mm long. Female gonotheca club-shaped, 1.6 mm long, with opening at side, opening approximately in middle, on distinct neck, opening often with lip-like process of variable size un upper side. Female gonotheca with 2 protruding polyps.

REMARKS – *Halecium beanii* (Johnston, 1847) and *Halecium scutum* Clark, 1877 resemble each other very closely, differing only in the presence of a lip-like process on the gonothecal opening (Fig. 59B). However, Broch's (1918) figures of different female gonothecae show a intergradation with the form said to be typical for *H. beanii*. Despite this, he kept the species separate, later followed by Kramp (1938) and Calder (1970). Naumov (1969) and Cornelius (1995a) considered them conspecific. This opinion is also adopted here, at least provisionally. More material from Iceland, where both morphotypes occur, is needed to establish the validity of *H. scutum*.

Halecium beanii can be difficult to distinguish from *H. sessilis*. Distinguishing characters are discussed under *H. sessilis*.

DISTRIBUTION – *Halecium beanii* as presently conceived is nearly cosmopolitan in temperate and cold waters. At Iceland it is known to occur along the west, south, and east coast, and from localities between Iceland and the Faroes, depth range 12-846 m. At Greenland it is only known from the west coast.

Halecium birulai Spassky, 1929

(Figs 60A-D, 61A-C)

Halecium birulai Spassky, 1929: 18, pl. 3 figs 13-15; Naumov 1969: 491, fig. 346.

? *Halecium undulatum* – Calder 1970: 1511, figs 8-9.

TYPE LOCALITY – Murmansk coast, Barents Sea.

MATERIAL ICELAND – BIOICE stations 2135, 2 cm, polysiphonic, with male gonothecae (also MHNG INVE25355) – 2337, many fragmented stems, monosiphonic, with male and female gonothecae (male also MHNG INVE 25640).

DESCRIPTION – colonies up to 2 cm, monosiphonic or polysiphonic, irregularly ramified. Monosiphonic parts zigzag, segments long, mostly smooth, occasional double bulges flanking the nodes, nodes often indistinct. Primary hydrotheca on short pedicel (hydrophore). Hydrotheca diameter at diaphragm about 0.12 mm, depth 60 µm, walls oblique and strongly recurved, with refringent nodules just above diaphragm. Below diaphragm at level of branching point an internal annular thickening or pseudodiaphragm (60B, D). This pseudodiaphragm is very variable, often asymmetric with the part opposite the side branch reduced, thus forming a comma-like process into the segment lumen (Fig. 60D, left; Fig. 61A & C). Secondary hydrothecae often present. Gonothecae on stems. Female gonotheca lentil-shaped, height up to 1.6 mm, breadth somewhat smaller, much flattened, edge with

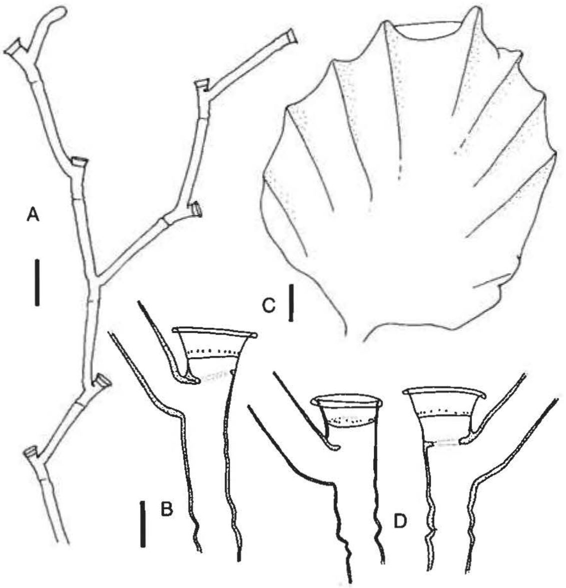

Figure 60. Halecium birulai *Spassky, 1929. A-C BIOICE 2337, D BIOICE 2135. A, part of stem, note geniculate appearance, scale bar 0.5 mm. B, hydrotheca, note pseudodiaphragm at level of side branch, scale bar 0.1 mm. C, female gonotheca in broad view, note radiating keels, scale bar 0.2 mm. D, two hydrotheca, note variability of pseudodiaphragm , same scale as B.*

broad spines, most distal pair largest, others gradually shallower towards proximal. The most distal pair of spines flanking an oblong aperture. From the tip of each spine originate radial keels that run along both flat sides of the gonotheca towards the short pedicel, keels decreasing in height towards proximal so that they become invisible in the middle of the gonotheca. Planulae develop in gonotheca. Male gonotheca 0.8x0.7 mm, longer than broad, flattened for about 1/2 of the breadth, margin rugose and irregular, with two spines flanking the aperture, these spines can be very variable in height, occasionally one is missing. Flat side of gonotheca with indistinct radial lines, much less distinct than in female or absent.

REMARKS – *Halecium birulai* is a rare species and this is the first record for this species outside the Russian seas. Naumov (1969) described *H. birulai* as polysiphonic, with colony sizes up to 4.5 cm. The present material suggests that also small monosiphonic colonies can occur. However, the available material was fragmented and polysiphonic part were perhaps lost during the collection procedure. The female gonotheca (Fig. 60C) renders *H. birulai* immediately recognisable. Male material is more difficult to identify, but the gonotheca with two shallow spines and the flattened shape help to identify the species. In contrast, infertile material is difficult or impossible to distinguish from *H. textum*, *H. tenellum*, *H. minutum* and *H. labrosum*. The long segments and the small colony size help to distinguish polysiphonic colonies from *H. labrosum* (comp Figs 60A and 65A). Additionally, in the present material the pseudodiaphragm of *H. birulai* was always at the level of the origin of the side branch (Fig. 60B, D; Fig. 61A, C). In *Halecium labrosum* it is above the origin of the side branch (Fig. 65 B). *Halecium minutum* has characteristically deep hydrothecae and the pseudodiaphragm – if present – is also above the level of the origin of the side branch. *Halecium tenellum* probably forms no pseudodiaphragm (Fig. 70B-D). *Halecium textum* has its pseudodiaphragm perhaps variably at both positions, but it can often be distinguished from *H. birulai* due to the annulated perisarc (see Figs 60A and

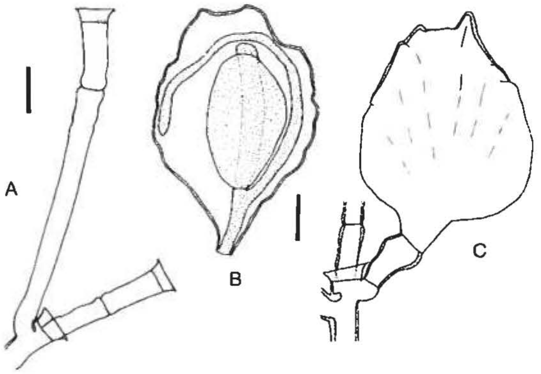

Figure 61. Halecium birulai *Spassky, 1929; BIOICE 2337, scale bars 0.2 mm. A, part of stem. B, male gonotheca in transparent view with gonad tissue, note that this gonotheca is perhaps not yet fully mature, note also the tissue strand overarching the spadix. C, empty male gonotheca of same branch, note variation of shape.*

71A-G). Nevertheless, juvenile colonies or infertile fragments of all these species are better not identified to the species level.

Material from north-eastern Canada identified by Calder (1970: pl. 2 fig. 9) as *H. undulatum* had a gonotheca closely resembling to the one depicted in Fig. 61C. This gonotheca does not agree with the current concept of *H. undulatum* and I suspect that Calder's fertile material belonged to *H. birulai*.

DISTRIBUTION – very rare species, so far known only from the Barents Sea. The new records are from off north and south Iceland, in depths of 418 to 1099 m. Possibly it is also present at north-eastern Canada.

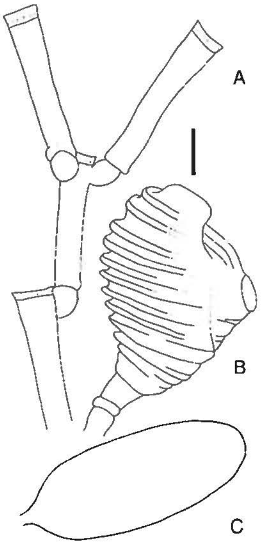

Figure 62. Halecium curvicaule *Lorenz, 1886; scale bar 0.2 mm. A, BIOICE 2134, part of stem. B, BIOICE 2134, female gonotheca. C, male gonotheca, BIOICE 2006.*

***Halecium curvicaule* Lorenz, 1886**
(Fig. 62A-C)

Halecium curvicaule Lorenz, 1886: 25, pl. 2 figs 1-2; Broch 1909b: 150, figs 9-11, pl. 2 fig. 2; Kramp 1914: 1000; Broch 1918: 41, fig. 16; Kramp 1932b: 18; Kramp 1938: 32; Kramp 1943: 31; Naumov 1969: 480, fig. 333; Calder 1970: 1502. pl. 1 figs 1-2.

Halecium kuekenthali Marktanner-Turneretscher, 1895: 428, pl. 11 figs 3, 12-13, pl. 13 fig. 6; Jäderholm 1909: 59, pl. 5 figs 10-11; Kramp 1938: 32.

? *Halecium mirabile* Schydlowsky, 1902: 233, pl. 3 figs 25-26; Broch 1918: 42; Naumov 1969: 479, fig. 322.

Halecium repens Jäderholm, 1908: 16, pl. 2 figs 19-20; Broch 1918: 42.

TYPE LOCALITY – Jan Mayen, North Atlantic.

MATERIAL ICELAND – BIOICE stations 2006, fertile male – 2134, with female gonothecae.

DESCRIPTION – colonies erect, monosiphonic, reportedly also polysiphonic, stems up to 2 cm. Stolons creeping, ramified. Branches of erect colonies arise singly or in opposite pairs from a spherical apophysis, curving abruptly upwards and usually terminating distally in a hydrotheca, branches long, straight or slightly s-shaped, perisarc thin, smooth, with bulge above apophysis. Hydrothecae shallow, diameter about 0.15 mm, depth 20-50 µm, walls mostly straight but some everted ones can be present, with ring of refringent nodules. Female gonothecae laterally compressed, bilaterally symmetric, about 1 mm, with numerous pronounced horizontal ribs on one side and a lateral conical process with an opening where two polyps protrude, contains four eggs. Male gonotheca spindle-shaped to oval, about 1 mm, surface smooth, rounded distal end.

REMARKS – besides the typical female gonothecae (Fig. 62B), *Halecium curvicaule* Lorenz, 1886 has a characteristic spherical apophysis from which branches originate and then normally point sharply upwards (Fig. 62A). This makes the species rather easily recognisable in the fauna under investigation. *Halecium curvicaule* is somewhat unusual in the size range of fertile colonies: 1-15 cm. The considerable morphological variation of this species has been studied in detail by Dons (1912). The variation observed encompassed also two other arctic species, namely *Halecium mirabile* Schydlowsky, 1902 and *Halecium repens* Jäderholm, 1907, which Dons (1912) regarded as conspecific with the present species. This view has been adopted by most subsequent authors, except Naumov (1969), who kept *Halecium mirabile* distinct. Presumably, Naumov regarded it as valid due to the small size and mostly stolonal colonies. No final decision seems possible at the moment.

Halecium kuekenthali Marktanner-Turneretscher, 1895 from Jan Mayen agrees well with the present concept of *H. curvicaule* and both are here seen as conspecific.

Halecium dichotomum Allman, 1888 from South Africa resembles *H. curvicaule* and parallels the latter species not only in its microscopic structure, but also its extensive variability (see Millard 1975). Notable differences between the two are only the corrugated male gonothecae and the lower number of eggs in the female gonotheca. Perhaps also the opening of the female gonothecae is different.

Distribution – typically arctic species known to occur in northern Canada, western and eastern Greenland, Iceland (north, east, and west coast), Norway north of 69° N, Jan Mayen Island, Spitsbergen, Barents Sea, White Sea, Kara Sea, Laptev Sea, in depths of 15-212 m. The present material was from northern and southern Iceland. This record increases the depth range of this species to 500 m.

Halecium groenlandicum Kramp, 1911

(Fig. 63A-B)

Halecium groenlandicum Kramp, 1911: 367, pl. 22 figs 1-4; Kramp 1914: 1002; Kramp 1932a: 54; Kramp 1932b: 17; Kramp 1943: 31; Naumov 1969: 494, fig. 348, pl. 17 fig. 2; Calder 1970: 1506, pl. 1 figs 3-5.

Halecium polytheca Linko, 1911: 73, fig. 15, pl. 1 fig. 4.

Type locality – eastern Greenland, sound between Renskaer and Maroussia, 50-100 m, hard bottom.

Type material examined – ZMUC, "Danmark" station 95a.

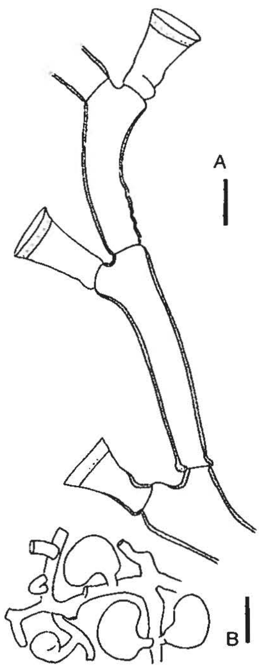

Figure 63. Halecium groenlandicum *Kramp, 1911; type material. A, part of distal branch, scale bar 0.2 mm. B, rhizome with gonothecae, scale bar 0.5 mm.*

Material Greenland – ZMUC, Ndr. Strømfjord, 24.07.1911, 33-50 m, material mentioned in Kramp (1914), infertile.

Description – colonies erect, reportedly up to 10 cm. Stem and large branches polysiphonic, distal branches monosiphonic. Terminal branches with segments of irregular length, often more than one hydrotheca between two nodes. Normal segments curved or straight, walls either smooth or with undulations, at distal end of segment an apophysis bearing the hydrotheca, distinct node between apophysis and hydrotheca. Hydrotheca on long hydrophore (pedicel), the latter markedly conical, often with corrugated base. Hydrotheca shallow, walls straight, oblique, diameter at level of diaphragm 0.18-0.20 mm, depth 40-50 µm, with ring of refringent nodules above diaphragm. Secondary, tertiary and higher order hydrothecae often present (pseudohydrocaulus formation). Gonothecae develop on characteristic, tangled rhizome. Rhizome develops from stolons at base of stems, forming a three-dimensional network of stolon-like tubules, end of tubules open. Gonothecae of very variable shape, about 0.6 mm, sac-shaped, on small pedicel, strongly recurved so that opening faces toward tube of origin (Fig. 63B).

Remarks – the tangled rhizome formation bearing the gonothecae is certainly the most unique feature of this species.

Distribution – quite rare, strictly arctic; western and eastern Greenland, eastern Canada, arctic seas north of Russia, Bering Seas, Sea of Okhotsk, Kuriles. Not known from Iceland.

Halecium halecinum **(Linnaeus, 1758)**

(Fig. 64A-B)

Sertularia halecina Linnaeus, 1758: 809.

Halecium halecinum – Broch 1909b: 144, figs 4-5; Broch 1918: 36, figs 11-12; Kramp 1938: 30; Kramp 1943: 29; Naumov 1969: 482, figs 16K, 335, pl. 17 fig. 3; Ólafsson 1975: 8, fig. 13; Cornelius 1975b: 393, fig. 6, synonymy; Millard 1975: 150, fig. 49A-H; Cornelius 1995a: 279, fig. 63.

Type locality – Whitstable, Kent, England.

MATERIAL Iceland – BIOICE stations 2204 – 2245 – 2313 – 2350 – 2442 – 2537 – 2591 – 2594 – 2821 (all infertile).

Other material examined – MHNG INVE 26671, France, Roscoff, coll. Sept. 1995, about 100 m, no gonothecae.

Description – colonies erect, stiff, up to 10 cm, always regularly pinnate. Side branches alternate, straight, evenly spaced, at constant angle of 40-60° to main stem, some secondary branching possible. Stem and main branches polysiphonic, thinning out to final monosiphonic branches which are straight to slightly flexuose. Segments equal, nodes approximately transverse. Hydrothecae alternate, sessile, short, walls straight, often with renovations, with refringent nodules, calyx diameter at rim 0.13-0.15 mm. Gonothecae not observed, after Cornelius (1995a) male gonotheca club-shaped, aperture terminal. Female gonotheca oblong in side view, tapering below, distally having terminal aperture on one side and with right-angled "shoulder" on other side, 1-4 eggs, 1-3 polyps protruding from aperture.

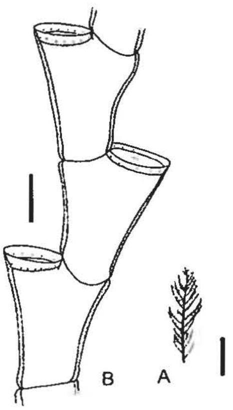

Figure 64. Halecium halecinum *(Linnaeus, 1758); MHNG INVE26671. A, part of colony, note typical arrangement of side branches, scale bar 1 cm. B, part of distal branch, scale bar 0.1 mm.*

Remarks – although the BIOICE specimens were all infertile, they could quite reliably be identified due to the characteristic colony form: stiff stem and branches, branches straight and regular, nearly one plane, all forming similar angles with the stem (Fig. 64A). The microscopic morphology resembles *H. beanii* (comp. 64B and 59A).

Distribution – recorded from the eastern and western Atlantic Ocean from Spitsbergen, all Europe, to South Africa, including the Mediterranean Sea, Marocco and Gambia; and from eastern Greenland to Caribbean coast of Colombia. In the eastern Pacific Ocean known from Alaska, Puget Sound, and California; in the western Pacific from the Sea of Okhotsk, Japan, and Moluccas (Fraser 1937, Naumov 1969, Cornelius 1995a). The occurrence at Iceland is restricted to a region spanning from the north-west over the west and the south of the island.

Halecium labrosum Alder, 1859

(Fig. 65A-D)

Halecium labrosum Alder, 1859: 354, pl. 13; Hincks 1868: 225, fig. 27, pl. 44 fig. 1; Broch 1909b: 148, figs 7-8, pl. 2 fig. 4; Kramp 1914: 999; Broch 1918: 45, fig. 19; Kramp 1932b: 18; Kramp 1938: 33; Kramp 1943: 30; Naumov 1969: 489, figs 16B, 343, pl. 16 fig. 2; Cornelius 1975: 396, fig. 7, synonymy; Cornelius 1995a: 282, fig. 64.

Halecium crenulatum Hincks, 1874: 150, pl. 8 figs 21-23; Saemundsson 1902: 70; Rees & Thursfield 1965: 107, synonym.

? *Halecium delicatulum* – Ramil & Vervoort 1992a: 82, fig. 20a-c.

[not *Halecium delicatulum* Coughtrey, 1876]

Type localities – Northumberland coast, Moray Firth and Shetland (Cornelius 1975).

Material Greenland – ZMUC, "Godthaab" station 29b, material of Kramp (1932a), with male gonothecae – ZMUC, "Ingolf" station 33, material of Broch (1918), infertile – ZMUC, "Tjalfe" station 465, 62.97°N 50.87°W, with male gonothecae – ZMUC, Cape Bismarck, 76.70°N 18.50°W, 40-60 m, 2.9.1907, material of Kramp (1914), fertile – ZMUC, Holsteinsborg, 120-200 m, 1907.1953, fertile – ZMUC, 66.25°N 56.38°W, 187-190 m, 1.8.1975 – "Kangamiut" stations 2, fertile – 6 – 8 – 10 – "Kap Farvel" stations 74 – 101 – 135, fertile – "Grønland" 1975 stations 25, fertile – 54, fertile – 55 – Bank. unders. stations 5306, fertile – 5306, fertile.

Material Iceland – BIOICE stations 2099, fertile – 2170 — 2524 – MHNG INVE29030, Gar›ur, coll. 8.05.2000 by author, examined alive, infertile.

Other Material examined – ZMUC, Faroe Islands, Vestmanhavn, 25.09.1926, det. Kramp, with male gonothecae - IRSNB, IG 27838, France, Roscoff, coll. J. Bouillon Sept. 1961, 4 cm colony, infertile – MHNG INVE 26525, USA, Friday Harbour, July 1996, fertile male.

Description – colonies erect, 1-5 cm, irregularly branched, all but final branches polysiphonic. The finer side branches inserted alternately with upward curve near base. Nodes transverse or oblique, segments of unequal length, segment walls either smooth or wavy. Hydrotheca on prominent pedicel (hydrophore) at distal end of segments, not delimited by node or constriction although regeneration and secondary regrowth can feign nodes. Hydrophore cylindrical, 2-5 times as high as hydrotheca itself, joined obliquely to the segment, overtopping segment end. Hydrotheca 0.11-0.15 mm diameter and 25-50 µm deep, margin usually strongly everted, secondary hydrothecae frequent. Gonothecae without polyps. Female obovate, flattened (paddle-shaped), up to 1.7 mm long and 0.9 mm broad, on short pedicel, with small opening at distal end, open-

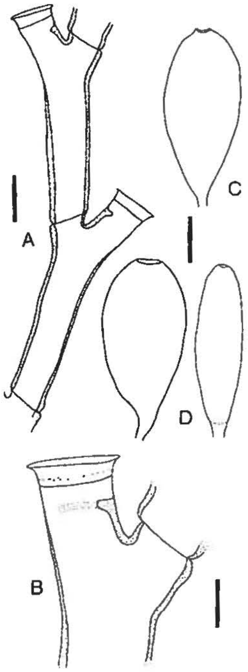

Figure 65. Halecium labrosum *Alder, 1859; BIOICE 2099, all from same colony. A, two internodes, note absence of corrugation, scale bar 0.2 mm B, hydrotheca, note pseudo- diaphragm below true diaphragm, scale bar 0.1 mm. C, female gonothecae with typical distal aperture, scale bar 0.5 mm. D, female gonotheca with simple aperture, left seen from flat side, right seen from narrow side, same scale as C.*

ing sometimes on very small neck (Fig. 65C). Male gonotheca somewhat smaller than female, similar in shape or more rounded.

Remarks – the female gonothecae observed here (Fig. 65C-D) differed slightly from the one described by Cornelius (1975) and even more from the one depicted in Cornelius (1995a). The gonothecae of the present material (Greenland, Iceland) were more oval and flattened. Compared to Cornelius' figures, they also had either no or a much smaller terminal neck (comp Fig. 65C). However, according to Cornelius (1975) such a variation seems usual. Further differences were that the perisarc was often smooth, the nodes oblique, and the degree of flaring of the hydrothecae often quite variable. While some older hydrothecae had sometimes nearly straight walls, the youngest ones had always strongly everted rims. It can sometimes rather difficult to distinguish non-reproductive material of this species and from *H. muricatum*. The absence of a constriction at the base of the hydrotheca, however, appears to be a good character to separate them (comp. Figs 65A-B and 68A).

I had difficulties separating material described as *H. delicatulum* by Ramil & Vervoort (1992a) from *H. labrosum*. *Halecium delicatulum*, a species originally described from New Zealand has female gonothecae that have two prominent horns flanking the aperture (after examination of New Zealand material, MHNG INVE26669, coll. P. Schuchert, Wellington 1994). These horns are not apparent in the figures of Ramil & Vervoort and I suspect that their material was *H. labrosum* or *H. mediterraneum* Weisman, 1883.

Distribution – preferably in colder waters, sporadically in more southern localities, recorded widely in the North Atlantic and parts of the northern Pacific Ocean. In Europe it occurs from northern Norway to Galicia, the Azores and the Mediterranean. At Iceland known from scattered localities all around the island. Known also to occur at the east and west coast of Greenland.

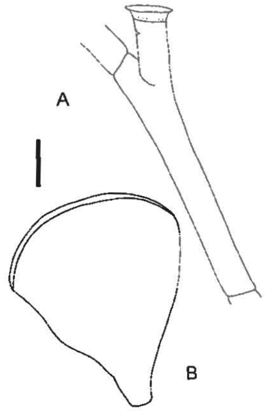

Figure 66. Halecium laeve *Kramp, 1932; after type material, A, segment of distal part of colony, scale bar 0.2 mm. B, female gonotheca with gonad tissue in frontal view, same scale as A.*

Halecium laeve Kramp, 1932

(Fig. 66A-B)

Halecium laeve Kramp 1932b: 15, figs 2-5.

Type locality – Bredefjord, West Greenland, 365 m.

Type material examined – ZMUC, leg. Kramp.

Description – colonies erect, up to 7 cm, branching, stem and branches polysiphonic, terminal branches monosiphonic, soft and limp when out of water. Polysiphonic parts composed of 1-2 hydrothecae bearing main tube and several plain tubes. Segments long and slender (Fig. 66A), of equal width throughout, completely smooth, nodes oblique. The hydrothecae are placed near the distal end of the segments, on long, cylindrical hydrophore arising at acute angle from segment without constriction, hydrophore end over-tops segment end. Hydrotheca shallow (depth about 1/4 to 1/3 of diameter), everted, with ring of refringent nodules. Pseudohydrocauli consisting of 3-5 hydrothecae are developed from almost all primary hydrothecae. Female gonotheca fan-shaped, about 0.75x0.9 mm, strongly flattened, distal end curved and open, lateral sides converging to stalk. Male gonothecae unknown.

REMARKS – a rare species, only known from its first description. Contrary to Kramp (1932b), polysiphonic parts have not just one hydrotheca bearing tube, but there can be at least two, perhaps more. *Halecium laeve* could be an aberrant *H. labrosum*.

DISTRIBUTION – only known from western Greenland.

***Halecium minutum* Broch, 1903**
(Fig. 67A-F)
Halecium minutum Broch, 1903: 4, pl. 1 figs 1-4; Broch 1909b: 153, figs 13-15; Kramp 1913: 5; in part Broch 1918: 50, map fig. 22; Kramp 1932b: 19; Kramp 1938: 34; Kramp 1943: 33; Fraser 1944: 196, pl. 37 fig. 175; Calder 1970: 1508, pl. 1 fig. 9.
[not *Halecium minutum* Motz-Kossowska, 1911 = *Halecium conicum* Stechow, 1919]
Halecium corrugatum – Naumov 1969: 488, fig. 342.
[not *Halecium corrugatum* Nutting, 1899]
TYPE LOCALITIES – 62.27°N 6.10°W, 110 m and 64.28°N 14.73W, 450 m (see Broch 1903).
TYPE MATERIAL EXAMINED – ZMB, syntypes no. 13310 & 13559, both infertile.
MATERIAL GREENLAND – "Kap Farvel" stations 62 – 128 – Bank. unders. station 5299 – "Grønland" 1975 station 38, fertile female – "Kangamiut" station 1, fertile female.
MATERIAL ICELAND – ZMUC, *Halecium minutum*, Djúivogur, coll. 1.8. 1898, 8 fathoms (15 m), on *A. filicula*, infertile, described by Broch (1918) – ZMUC, *Halecium minutum*, Hvalsfjord, coll. 30.6.1904, 46 m, Thor station 167, infertile, described by Broch (1918) – ZMUC, *Halecium minutum*, Skagi, coll. 29.8.1904, 40 m, Thor station 278, infertile, described by Broch (1918) – ZMUC, *Halecium tenellum*, 64.28°N 14.73°W, 85 m, coll. 23.9.1902, infertile, described by Kramp (1938) – BIOICE stations 2004 – 2511 – 2533 – 2537, fertile female – 2548, fertile female.

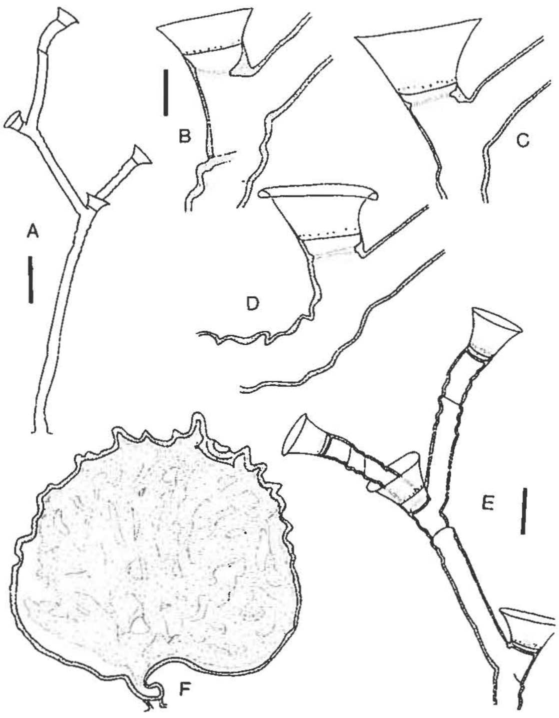

Figure 67. Halecium minutum *Broch, 1903. A, typical stem from syntype material, scale bar 0.5 mm. B-C, hydrothecae from syntype material, note variation and pseudodiaphragm, scale bar 0.1 mm. D, hydrotheca, Djúivogur, note strongly everted rim, same scale as B. E, part of stem, BIOICE 2548, scale bar 0.2 mm. F, female gonotheca seen from flat side, same scale as A.*

DESCRIPTION – colonies forming up to 2 cm high shoots, monosiphonic. Sometimes a pseudostem formed by a bundle of stolons can be present. Stems geniculate, nodes mostly obliterated, normally only one branch originating below previous hydrotheca. Some parts of the stem with strongly undulated perisarc, other regions smooth. Hydrotheca on hydrophore of about equal height as the hydrotheca itself. Hydrotheca mostly very deep, depth reaching dimension of diameter of diaphragm, walls much everted or diverging, with ring of refringent nodules slightly above level of diaphragm. Below diaphragm frequently an annular thickening (pseudodiaphragm). Pseudodiaphragm often asymmetric with adcauline part thicker and broader (Fig. 67B-C). Female gonothecae developing on stolons, female gonotheca 2-3 mm in diameter, lentil-shaped (strongly flattened), distal half of margin with several well formed spines. Planulae develop within gonotheca. Male gonotheca not seen, after Broch (1903) and Naumov (1969) about 1 mm, oval, sometimes with two processes at distal end, developing on stolons and stem.

REMARKS – *Halecium minutum* Broch, 1903 is a small species with a characteristic female gonotheca (large, 2-3 mm, on stolons, much flattened and with marginal spines, Fig. 67F). Naumov (1969) regarded it as conspecific with *Halecium corrugatum* Nutting, 1899. Nutting described this species from Puget Sound (Pacific Ocean), but had infertile material only. Fraser later described the gonotheca (summarised in Fraser 1937), which is apparently not flattened and has no spines. While Naumov's (1969) figure of *H. corrugatum* is most likely *H. minutum*, I think that the two species should be regarded distinct until more information on the extent of variation is known for both morphotypes. Calder (1970) also argues in favour of two separate species.

Halecium minutum usually has characteristically deep hydrothecae, which are normally as deep or deeper than the dimension of the basal diameter (Fig. 67A-E). However, even in the syntype material the depth is variable (comp. Figs 67B-C). The trophosome of *H. minutum* resembles somewhat *H. textum* (comp. Figs 67A-E and 71A-G), while the gonosome is clearly different. Dealing with infertile material only, the occurrence of deep hydrothecae is diagnostic for *H. minutum*, while a frequent trichotomous branching may be characteristic for *H. textum*. But infertile or fragmented material of *Halecium* species should be identified with due reservations only.

Some infertile material identified by Kramp (1938) as *H. tenellum* has very deep hydrothecae and undulated perisarc. I think it is more probable that it belongs to *H. minutum*, although a reliable identification is not possible.

DISTRIBUTION – an arctic species penetrating into boreal waters. Known from Nova Scotia, eastern and western Greenland, Iceland (north, east, and west coast), Spitsbergen, Norway, Murman Coast, Bering Sea.

Halecium muricatum (Ellis & Solander, 1786)

(Fig. 68A-B)

Sertularia muricata Ellis & Solander, 1786: 59, pl. 7 figs 3-4,.
in part *Halecium filiforma* Alder, 1862: 315
Halecium muricatum – Broch 1909b: 146, fig. 6; Kramp 1914: 996; Broch 1918: 43, figs 17-18; Kramp 1932b: 18; Kramp 1938: 33; Kramp 1943: 30; Naumov 1969: 492, fig. 347, pl. 16 fig. 1; Cornelius 1975b: 402, fig. 10; Millard 1975: 153, fig. 50A; Cornelius 1995a: 288, fig. 66.

TYPE LOCALITY – Aberdeen, Scotland (Cornelius 1975b).

MATERIAL GREENLAND – Hoels stations 1016, fertile – 1018, fertile – 1025, fertile – "Grønland" 1975 stations 38, fertile – 55, fertile – "Kangamiut" stations 1 – 2 – 3 – 4 – 6 – 8 – "Kap Farvel" stations 11, fertile – 14 – 16, fertile – 21, fertile – 42 – 54, fertile – 55, fertile – 58 – 60, fertile – 74, fertile – 88 – 90, fertile – 91 – 100, fertile – 101 – 114, fertile – 128, fertile – 139, fertile – Just & Vibe 1968 station 20, fertile – ZMUC, Øresund, 76.68°N 18.58°W, 38-56 m, fertile – ZMUC, "Godthaab" 139, 71.35°N 54.48°W, 47 m, 3.9.1928 – ZMUC, Fyllas Banke, fertile – ZMUC, 66.53°N 56.32°W, 191-195 m, 3.08.1975.

MATERIAL ICELAND – BIOICE stations 2056, fertile – 2097 – 2168, fertile – 2185, identification somewhat uncertain – 2320, identification somewhat uncertain – 2352 – 2353 – 2358 – 2377, fertile – 2380, fertile – 2442 – 2493 – 2506 – 2512 – 2528 – 2533 – 2537 – 2710, identification somewhat uncertain – MHNG INVE

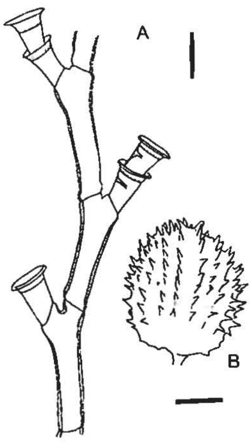

Figure 68. Halecium muricatum *(Ellis & Solander, 1786); BIOICE 2380. A, distal part of branch with three segments, note the node delimiting the apophysis from the hydrophore of the hydrotheca, scale bar 0.2 mm. B, female gonotheca with characteristic spines, scale bar 0.5 mm.*

29028, Gar›ur, coll. 8.05.2000 by author, examined alive, infertile.

Description – colonies large, reaching sizes up to 20 cm, more usually 5 cm, branching generally in one plane, main stem and branches rather straight but branching irregular, all but terminal branches polysiphonic, often stem and major branches thick and remaining branches thin. Segment lengths quite uniform in one region, nodes transverse or oblique, if oblique successively inclined right and left. Segments elongate, with apophysis at distal end for attachment of hydrotheca. Hydrothecae alternate, on the monosiphonic branches distinctly demarcated from apophysis by deep node or constriction. Hydrotheca on long hydrophore (pedicel), hydrophore length about four times or more the depth of the hydrotheca, wall converging slightly towards below. Diaphragm diameter 0.1-0.14 mm, depth of hydrotheca 30-50 µm, wall oblique, strongly everted or even inrolled, ring of refringent nodules present close to level of diaphragm, below diaphragm sometimes an asymmetric pseudodiaphragm formed by an annular perisarc thickening, secondary hydrothecae with pedicels frequent. Gonothecae develop on stem and thicker branches, male and female said to be identical, short pedicel, without polyps, ovate to rounded, slightly compressed, diameter 1-1.5 mm, with characteristic 10-16 rows of pointed spines.

Remarks – while the gonotheca of *H. muricatum* is very characteristic (Fig. 68B), non-reproductive or eroded colonies of this species are occasionally difficult to distinguish from *Halecium labrosum*. But in *H. muricatum* the pedicel of the hydrotheca is normally delimited by a deep node from the apophysis of the hydrocladium (Fig. 68A), while *H. labrosum* has no such node (Fig. 65A-B).

Distribution – northern-temperate to arctic, in Europe reaching south to British Isles, in America to Cape Hatteras. Known also from all Siberian Seas and Alaska (Fraser 1937, Fraser 1944, Naumov 1969, Cornelius 1995a). Found at all parts of the Icelandic coast, as well as frequently from eastern and western Greenland.

Halecium sessile Norman, 1867
(Fig. 69)

Halecium sessile Norman, 1867: 205; Saemundsson 1911: 102; Fraser 1944: 201, pl. 37 fig. 178; Ralph 1958: 331, figs 9h-i, 10c-d; Vervoort 1966b: 100, fig. 1; Cornelius 1975b: 406, fig. 11, synonymy; Millard 1975: 154, fig. 48K-M; Ramil & Vervoort 1992a: 85, fig. 20d; Cornelius 1995a: 292, fig. 68; Hirohito 1995: 28, fig. 7e-h.
Halecium plumulosum Hincks, 1868: 227, pl. 64 fig. 1; Cornelius 1975b: 406, synonym.
Halecium articulosum Clark, 1875: pl. 10 fig. 6; Kramp 1938: 32; Vervoort 1942: 283; Fraser 1944: 185, pl. 33 fig. 159.
Type locality – "deep water in the Minch", between Outer Hebrides and Scotland.
Material Iceland – ZMUC, 63.35°N 17.25°W, 109 m, 10.07.1905, det. Saemundsson, without gonothecae.

Figure 69. Halecium sessile *Norman, 1867; Iceland, monosiphonic part of branch, scale bar 0.2 mm.*

DESCRIPTION – (in part after Cornelius 1995b) colonies either monosiphonic (up to 5 cm), or polysiphonic (up to 30 cm); all sizes branching, larger colonies comprising a stout central stem with loosely pinnate arrangement of gently curving, monosiphonic side-branches which may branch again resulting in loosely bushy, elongate colony. Tall colonies drooping limply when out of water. Internodes approximately uniform but becoming shorter distally, segments comparatively short, hydrophore distal, usually parallel with segment, not delimited by node. Hydrotheca usually at approximately 90° to segment axis, alternately on left and right side. Hydrotheca very shallow (25-40 µm, 1/4 or less of diameter), walls straight, divergent, rim even, not flaring; hydrothecal renovations frequent, resulting in short chains of sessile hydrothecae. Side branches inserted alternately, each on hydrophore, associated hydrotheca consequently axillary. Male gonotheca tubular, slightly curved, aperture terminal. Female gonotheca kidney-shaped, with tubular aperture at concave side, with two projecting gonophoral polyps. Planula brooded within female gonotheca.

REMARKS – Kramp (1938) recorded *Halecium articulosum* Clark, 1875 near the Vestmannaeyjar. Cornelius (1975b) re-examined this material and the type material *of H. articulosum* and found it mostly identical to *H. sessile*. Consequently, Cornelius then regarded both nominal species as conspecific. In Cornelius (1995b), however, he had again some reservations, but continued to see them as conspecific.

Distinguishing *H. sessilis* and *H. beanii* can be difficult. The elongated colony form, the more regular branching, the sessile, horizontal hydrothecae, and the horizontal nodes are characteristic for *H. sessilis*. *Halecium beanii* has more irregular colonies that are usually smaller, the hydrothecae are held obliquely and are often on a slightly exsert hydrophore, the nodes are mostly oblique (comp. Figs 59A-B and 69). Nevertheless, a re-evaluation of both species seems necessary.

DISTRIBUTION – nearly cosmopolitan, for detailed records see Vervoort (1966). At Iceland recorded from the south coast (Kramp 1938, Vervoort 1942). Not known from Greenland.

Halecium tenellum Hincks, 1861

(Fig. 70A-E)

Halecium tenellum Hincks, 1861: 252, pl. 6 figs 1-4; Hincks 1868: 226, pl. 45 fig. 1; Kramp 1914: 1004; in part Broch 1918: 46, figs 20- 21; Kramp 1932b: 19; in part Kramp 1938: 8; Kramp 1943: 32; Vervoort 1959: 229, fig. 8; Vervoort 1966: 102, fig. 2; Naumov 1969: 490, fig. 344; Cornelius 1975b: 409, fig. 12, synonymy; Millard 1975: 156, fig. 50F-L; Calder 1991: 22, fig. 14; Ramil & Vervoort 1992a: 90, fig. 21f-g; Cornelius 1995a: 296, fig. 69; Hirohito 1995: 29, fig. 8a-c; Migotto 1996: 34, fig. 6h.

TYPE LOCALITY – Salcombe Bay, England.

MATERIAL ICELAND – BIOICE stations 2110 – 2168, with male gonothecae – 2678, with male gonothecae.

DESCRIPTION – colonies erect, up to 1 cm, mostly less, delicate, monosiphonic, irregularly branched. Stem irregularly zigzag, branches usually straight, long and narrow, perisarc smooth. Nodes mostly distinct and

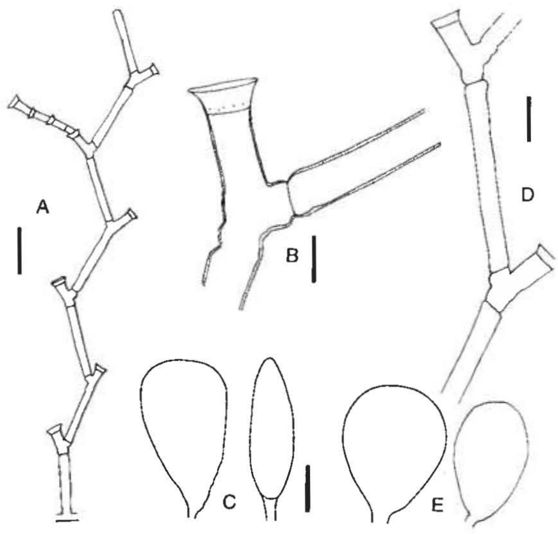

Figure 70. Halecium tenellum *Hincks, 1861; A-C BIOICE 2168, D-E BIOCE 2678. A, part of colony, scale bar 0.5 mm. B, hydrotheca and branching point, scale bar 0.1 mm. C, male gonotheca, left in broad view, right in side view, scale bar 0.2 mm. D, part of stem, scale bar 0.2 mm. E, two gonothecae seen in broad view, note shape variation compared to figure C, same scale as C.*

regular, delimiting short segments with a hydrotheca and long intersegments without hydrotheca, some nodes can be indistinct. Hydrotheca often on prominent pedicel (hydrophore), the latter tubular, 2-4 times as high as the hydrotheca. Hydrotheca about 0.1-0.12 mm in diameter, depth 50 µm, walls oblique, rim much flaring, with internal ring of refringent nodule, diaphragm thin, no pseudodiaphragm. Male gonothecae rounded to oval, flattened, smooth surface, height around 0.5 mm.

Additional information – the hydranths are very long compared to other *Halecium* species, the female gonotheca is similar to the male one, but broader (Cornelius 1998).

Remarks – the present material was only hesitatingly allocated to *H. tenellum*. The male gonothecae observed in the Icelandic samples deviate somewhat from the figures and description given by Hincks (1861), Cornelius (1995a), and Millard (1975), in as they are broader and not fusiform.

Hamond (1957) found that some of the Icelandic records of *Halecium tenellum* were perhaps misidentified and he referred them to *Halecium undulatum* Billard, 1921. *Halecium undulatum*, resembles *H. tenellum*, but the former has extensive stretches of undulated perisarc while *Halecium tenellum* has nearly always smooth internodes. I re-examined some of Broch's and Hamond's material and tentatively agree that it is likely not *H. tenellum*. This material is here, however, assigned to *Halecium textum* Kramp, 1911 and not *H. undulatum* (see below).

Distribution – near cosmopolitan, but identifications sometimes uncertain (see Calder 1991). Records from western and eastern Greenland uncertain. At Iceland recorded from all around the coast, but many records are apparently invalid. Present records came from the north of the island.

***Halecium textum* Kramp, 1911**

(Figs 71A-G, 72A-B)

Halecium textum Kramp, 1911: 368, pl. 21 figs 5-6; Kramp 1914: 1003.

Halecium tenellum – Jäderholm 1909: 27, pl. 4 fig. 12, in part Broch 1918: 46, figs 20-21; in part Kramp 1932b: 19; in part Kramp 1938: 8; in part Kramp 1943: 32; Fraser 1944: 201, fig. 179.

? *Halecium undulatum* Billard, 1922: 137, fig. 3.

Halecium undulatum – in part Calder 1970: 1510, pl. 2 figs 5-8, not 9 (? = *H. minutum*); Hamond 1957: 304, figs 12-13; Cornelius 1995a: 198, fig. 70.

Type locality – Maroussia, eastern Greenland, 160-180 m (Kramp 1911).

Material Greenland – "Kap Farvel" stations 93, large, tangled colony, with male gonothecae – 130.

Material Iceland – BIOICE stations 2003, with female gonothecae – 2006, with male gonothecae, profuse colony – ZMUC, labelled as *Halecium tenellum*, Stykkishólmur, 23.6.1897, 56 m, material mentioned in Broch

(1918) and Hamond (1957), two tubes, with female gonothecae – ZMUC, labelled as *Halecium tenellum*, "Thor" Station 167, Hvalfjord, 46 m, 30.6.1904, material mentioned in Broch (1918) and Hamond (1957) – ZMUC, labelled as *Halecium tenellum*, "Ingolf" station 87, 65.03°N 23.93°W, 207 m (110 fathoms), material mentioned in Broch (1918: fig. 20) and Hamond (1957), with mature male gonothecae.

OTHER MATERIAL EXAMINED – ZMUC, labelled as *Halecium tenellum*, Faroes, 6 miles N by W of Store Kalsø, 113 m (60 fathoms), 25.5.1899, material mentioned in Broch (1918) and Hamond (1957) – ROMIZ, as *Halecium undulatum*, Canada, "Calanus" stations 59-66 and 333, Hudson Bay and Stait, part of material described by Calder (1970).

DESCRIPTION – colonies reaching 2 cm in height, monosiphonic stems irregularly branched, polytomies frequent, mostly two branches originating below a hydrotheca (Fig. 71A, C), the two branches not in one plane. Larger colonies form a tangled mass. Branches curve sharply upwards, with occasional and irregularly occurring nodes. Perisarc strongly undulated over stretches, but smooth stretches also present. Hydrotheca on hydrophore (pedicel) of about equal length as hydrothecal depth. Hydrotheca diameter 0.1 mm at base, depth 30-50 µm, margin distinctly everted or even rolled in, diaphragm fine, refringent granules present but comparatively flat and inconspicuous. Below diaphragm frequently a pseudodiaphragm, variable in form and position, either formed as a horizontal or oblique annular thickening or as a mere process at the origin of the apophysis. Gonothecae borne on branches, dioecious. Female gonotheca about 1 mm long, oblong, in side view only half as thick, narrow truncated end with oval aperture (Fig. 72A). Male gonotheca slightly smaller, spindle shaped, not much flattened, form somewhat variable, gonad fills gonotheca nearly completely (Fig. 72B).

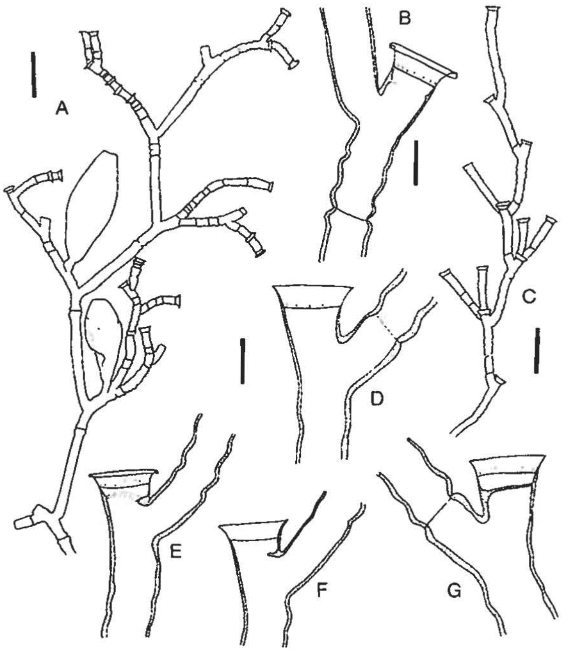

Figure 71. Halecium textum *Kramp, 1911; A-B BIOICE 2006, C-G Stykkisholm, Iceland. A, part of shoot with two gonothecae (presumably male), scale bar 0.5 mm. B, hydrotheca, scale bar 0.1 mm. C, part of colony, scale bar 0.5 mm. D-G, hydrothecae and branching point below, note variation, especially of pseudodiaphragm (absent in D), same scale as B.*

REMARKS – the trophosome of the Icelandic material described above matched perfectly the pictures and description of the original description of *Halecium textum* Kramp, 1911, so that there is little doubt on their conspecificity. *Halecium textum* is a little known species, perhaps due to the fact that Kramp (1943) synonymised it with *H. tenellum*, although without providing arguments. Unfortunately, the type material of *H. textum* could not be found at the ZMUC. *Halecium textum* is here seen distinct from *H. tenellum* based on the following differences: the colonies are larger and more profuse (some even forming a tangled mass), the frequent stretches of strongly annulated perisarc, the very frequent occurrence of two side branches below a hydrotheca, the occurrence of a pseudodiaphragm, and the shorter hydrophore. Otherwise both species are quite similar, notably also the gonothecae (compare Millard 1975).

Hamond (1957) re-examined numerous North Atlantic specimens formerly identified as *H. tenellum* and referred them to *H. undulatum* Billard, 1922. Hamond's material also included material from Iceland and the Faroes formerly assigned to *H. tenellum* by Broch (1918). This material was re-examined for this study and is here referred to *H. textum*. Already Broch (1918) suspected that his material was in fact *H. textum* and not *H. tenellum*.

In the original description of *Halecium undulatum*, Billard (1922) distinguished this species from *Halecium textum* Kramp, 1911 only through its finer diaphragm and the absence of refringent granules. All later authors describing *H. undulatum* (Hamond 1957, Calder 1970, Cornelius 1995b, and examination of type material by myself) found desmocytes and the thickness of the diaphragm can hardly be used as character to separate species. The proximity of the Icelandic localities to the type locality of *H. textum* (eastern Greenland) can also be taken as an argument that the Icelandic material is better referable to *H. textum* than to *H. undulatum* (type locality: Ostende, Belgium). The type material of *H. undulatum* was examined for this study (*Halecium undulatum*, MNHN Paris, nos. HL152 through 154, loc. Ostende, 3 slides). The colonies are infertile, 1-2.5 cm high, much branched, without pseudodiaphragm, with strongly annulated perisarc, hydrothecal diameters at base 75-110 µm, two branches originating below same hydrotheca present, but infrequent. Without gonothecae, this material is not properly identifiable. It could as well be *H. textum* or a juvenile *H. labrosum* as suspected by Cornelius (1975). I tend to opt for the second hypothesis. The lack of a pseudodiaphragm in the type material of *H. undulatum* retained me from synonymising it with *H. textum*.

Hamond (1957) was wrong in identifying the sex of the gonothecae of some of his samples. While some indeed were female as he thought (Fig. 72A), some are doubtlessly male (Fig. 72B). It is normally very difficult to investigate the tissue structure in unstained material, but by clearing the gonotheca with 50 % lactic acid the structure of the tissue can seen much better and it reaches a transparency almost like in living material. This clearing is reversible by washing out the acid. Using this method, an identification of the sex is much more reliable and it was used for the present samples.

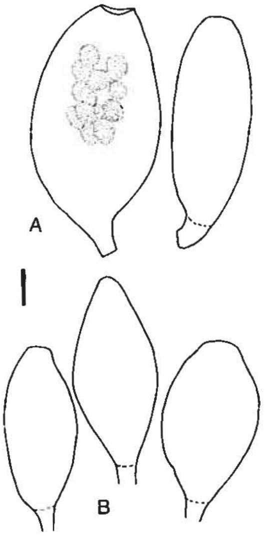

Figure 72. Halecium textum *Kramp, 1911; scale bar valid for all figures equals 0.2 mm. A, female gonothecae, Stykkisholm, Iceland; at left female gonotheca with eggs, at right same gonotheca from side. C-E, male gonothecae, note variation of shape; first two specimens from "Ingolf" Station 87, third one at right from Faroe Islands.*

Fraser's (1944) figure of *H. tenellum* matches rather well the present material assigned to *H. textum*. The annulation of the perisarc in Fraser's material suggests that he did not have *H. tenellum* but *H. textum*.

The trophosome of *H. textum* and *H. minutum* can occasionally be difficult to distinguish. They differ, however, in the morphology of their gonothecae. The female gonothecae of *Halecium minutum* are very large (2-3 mm), lenticular, and they have spines along their margin. Furthermore, the hydrothecae of *H. minutum* are normally very deep (Fig.

67C-E), although some variation – meaning shorter hydrothecae – can occur. For more details see under *H. minutum* and *H. birulai* above.

Kramp 1914 thought that the Japanese *H. crinis* Stechow, 1914 might be a synonym of *H. textum*, but Hirohito (1995) found male gonothecae of *H. crinis* and they appear different from the ones observed here form *H. textum*.

ECOLOGY – found mostly growing on other hydroids.

DISTRIBUTION – northern boreal, found at eastern and western Greenland, north-eastern Canada, western Iceland, Faroes. Records of *H. undulatum* from the British Isles, the North Sea, Sweden, and Norway could also be *H. textum*.

Family Sertulariidae

REMARKS – many Sertulariidae have an ectodermal pad on the inside of the hydrotheca, more precisely on the upper adcauline side. The pad is tightly studded with large nematocysts. This feature has been noted by other investigators (e. g. Vervoort 1972: Fig. 64b), but rarely used in descriptions. It occurs in many members of the family and may constitute a good synapomorphy for a subtaxon. It was found to be present in *Abietinaria abietina, A. fusca, Sertularia argentea, Sertularia cupressina, Sertularia tenera* (massive!), *Thuiaria articulata, T. carica, T. thuja, T. alternitheca*. It appears to be absent in *Diphasia fallax, D. rosacea, Dynamena pumila, Sertularella polyzonias*, and *S. rugosa*. A closer ultrastructural study including more species would certainly be rewarding.

***Abietinaria abietina* (Linnaeus, 1758)**
(Fig. 73)
Sertularia abietina Linnaeus, 1758: 808.
Abietinaria abietina – Broch 1918: 117, fig. 62; Kramp 1932b: 12; Kramp 1938: 48, fig. 3; Vervoort 1942: 293; Kramp 1943: 36; Naumov 1969: 404, figs 13C, 16E, 19A, 264, pl. 3 fig. 2; Calder 1970: 1525, pl. 5 fig. 6; Ólafsson 1975: 10, fig. 19; Cornelius 1979: 251, fig. 4; Cornelius 1995b: 24, fig. 2.
Diphasia abietina – Kramp 1914: 1054.

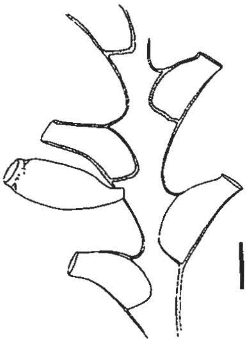

Figure 73. Abietinaria abietina *(Linnaeus, 1758); BIOICE 2185, part of branch with gonotheca, scale bar 0.5 mm.*

TYPE LOCALITY – south coast of England (Cornelius 1979).

MATERIAL GREENLAND – "Kangamiut" stations 1 – 2, fertile – 3 – 4 – 5 – 6 – 8 – 10 – "Kap Farvel" stations 45 – 55 – 74 – 87, fertile – 91 – 95 – 100 – 101, fertile – "Grønland" 1975 stations 25 – 52 – 54 – ZMUC, Fyllas Banke – ZMUC, 66.62°N 56.50°W, 335-360 m, 3.08.1975 – ZMUC, 66.53°N 56.32°W, 191-195 m, 3.08.1975 – ZMUC, 66.25°N 56.38°W, 187-190 m, 1.08.1975 – ZMUC, 68.82°N 51.18°W, 100 m, 25.07.1955.

MATERIAL ICELAND – BIOICE stations 2001 – 2002, fertile – 2003, fertile – 2143 – 2185 – 2189 – 2197 – 2198 – 2204 – 2234 – 2239, fertile – 2245 – 2327 – 2328 – 2331 – 2332 – 2346 – 2359 – 2360 – 2377 – 2381 – 2501 – 2526 – 2527 – 2528, fertile – 2533 – 2537 – 2545 – 2556 – 2558 – 2559 – 2562 – 2564 – 2601 – 2821 – MHNG INVE19023, Gar›ur, coll. 8.05.2000 by author, examined alive, fertile.

DESCRIPTION – colonies erect and sturdy, 5-12 cm, pinnate, monosiphonic, colour of living colonies amber to honey. Stem slightly flexuose, thicker than branches. Stem only with occasional nodes. Hydrocladia straight, equally and somewhat widely spaced, alternate, with some secondary branching. Hydrothecae of stem and branches similar, biseriate, alternate to subopposite. Hydrotheca flask-shaped, bulbous below, 1/5-1/2 adnate, about 0.9 mm in depth, opening circular, diameter about 0.3 mm, angle of opening with branch axis 45-90°, rim smooth, one circular operculum attached to abcauline side of rim, upper wall of hydrotheca often S-shaped in side view, abcauline wall concave. Gonothecae on hydrocladia, oblong, tapering below, about 1.3 mm long, circular opening on short neck, opening even, inside of neck with ring of perisarc projections. Embryos brooded in acrocysts.

Remarks – *Abietinaria abietina* (Linnaeus, 1758) and *Abietinaria filicula* (Ellis & Solander, 1786) are distinguishable only by the size of their hydrothecae. Although size is mostly not considered a good character in hydroid taxonomy, in this case the difference is so obvious (see Figs 73 and 74) and there is no overlap in the size range of both species. During this study, both were found together rather frequently.

Distribution – widely recorded on both sides of the North Atlantic Ocean from the arctic region to Madeira, all Arctic Oceans, in the North Pacific Ocean south to California and Japan. Also known from Madagascar (Cornelius 1995b). Known also from eastern and western Greenland. At Iceland it occurs all around the island, depth range of 10-630 m.

Abietinaria filicula (Ellis & Solander, 1786)
(Fig. 74)
Sertularia filicula Ellis & Solander, 1786: 57, pl. 6 figs C, c.
Abietinaria filicula – Broch 1918: 119, fig. 63; Kramp 1938: 48, fig. 4; Ólafsson 1975: 10, fig. 20; Cornelius 1979: 253, fig. 5; Cornelius 1995a: 27, fig. 3.
Diphasia filicula – Kramp 1914: 1056.
Type locality – Scarborough, Yorkshire, England (Cornelius 1979).
Material Greenland – "Littoral" station 21.

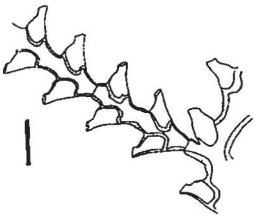

Figure 74. Abietinaria filicula *(Ellis & Solander, 1786); part of stem and hydrocladium, note size difference to* A. abietina *in figure 73, scale bar 0.5 mm.*

Material Iceland – BIOICE stations 2000 – 2001 – 2002, fertile – 2003, fertile – 2060 – 2062 – 2064 – 2067 – 2069 – 2070 – 2097 – 2161 – 2198 – 2201 – 2203 – 2204 – 2234 – 2240 – 2249 – 2313 – 2481 – 2526 – 2527 – 2528, fertile – 2533 – 2537 – 2539 – 2540 – 2556 – 2558 – 2559 – 2564 – 2601 – MHNG INVE29024, Garður, coll. 8.05.2000 by author, examined alive, fertile, numerous colonies.

Diagnosis – like *A. abietina*, but all dimension much smaller, depth of hydrotheca 0.3-0.4 mm, diameter of opening 90-120 µm.

Remarks – see also under *Abietinaria abietina*.

Distribution – in Europe recorded from Iceland (all coasts), western Greenland, Barents and White Seas, British Isles, occasional records from Germany, and Denmark, absent from Belgium. Widely recorded also from east and west North America in higher latitudes (Cornelius 1995b). The observed depth range of the BIOICE samples was 20-656 m.

Abietinaria fusca (Johnston, 1847)
(Fig. 75A-D)
Sertularia fusca Johnston, 1847: 70, woodcut 6 figs 10c, 11; Hincks 1968: 272, pl. 50.
Thuiaria salicornia Allman, 1874: 473, pl. 65 fig. 3.
Thuiaria fusca – Jäderholm 1909: 95, pl. 10 fig. 17.
Abietinaria fusca – Broch 1918: 120; Kramp 1938: 51; Vervoort 1942: 295; Naumov 1969: 431, figs 292.
Selaginopsis fusca – Cornelius 1995b: 64, fig. 14.
[not *Selaginopsis fusca* Allman, 1876 = *Thuiaria allmani* (Norman, 1878)]

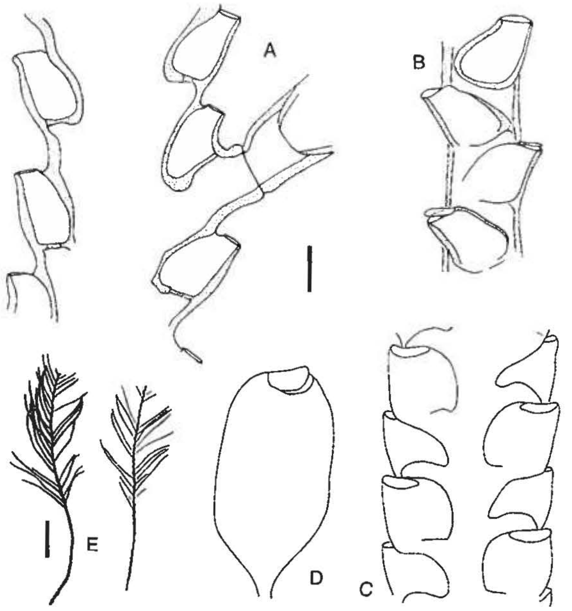

Figure 75. Abietinaria fusca *(Johnston, 1847); A-D, BIOICE 2377, scale bar 0.2 mm. A, part of stem with origin of hydrocladium, transparent view. B, hydrocladium seen from narrow side. C, hydrocladium broad side view. D, gonotheca. E, silhouettes of two colonies, BIOICE material, scale bar 1 cm.*

Salacia articulata – in part Cornelius 1979: 276.
Type locality – Dunstanburgh, Northumberland, Great Britain (Cornelius 1979).
Material Iceland – BIOICE stations 2374 – 2377, fertile – 2490 – 2493 – 2495 – 2506 – 2511 – 2512 – 2522 – 2524 – 2530 – 2531 – 2597 – 2564.

Description – colonies forming erect, monosiphonic, pinnate stems reaching 8 cm in height. Main stem and hydrocladia yellow to dark brown with thick perisarc, stem thicker than hydrocladia and not branched. Hydrocladia on opposite sides of stem, alternate, regularly spaced, rather straight, forming an angle of about 60° with stem. Stem and hydrocladia flattened. Hydrocladia originate from well formed apophysis. No nodes except at origin of hydrocladium. Hydrothecae on both stem and hydrocladia, nearly completely adnate, short and wide, narrowly spaced, height around 0.3 to 0.35 mm. Hydrothecae of stem in two opposite rows along sides, about three hydrothecae between two hydrocladia of one row. Flat side of hydrocladia horizontal, hydrothecae on narrow sides, each hydrotheca contiguous with next one, openings directed alternately away of each other, giving a 4-rowed appearance, but bases are nearly in one line. Hydrothecal opening a transverse oval, nearly perpendicular to hydrocladium or stem, margin of abcauline side may be even or raised to a shallow tooth. Opening covered by a single flapped operculum attached at adcauline side. Gonothecae, borne on hydrocladia, elongate pear-shaped to rounded-tubular, about 1 mm, smooth, tapering below, terminal apperture rather broad.

Remarks – Cornelius (1995b) placed *A. fusca* incorrectly in the genus *Selaginopsis*, although this genus has an operculum attached on the abcauline side. Furthermore, the genus *Selaginopsis* has recently been suppressed by Peña-Cantero, Svoboda & Vervoort (1997).

Thuiaria alternitheca resembles closely *A. fusca* in its microscopic structure. But both are reliably distinguishable by the attachment site of the operculum: adcauline in *A. fusca*, abcauline in *T. alternitheca*.

Distribution – Barents Sea, Kola Peninsula, Norway, British Isles (rare), Faroes, all around Iceland. Not known from Greenland.

***Abietinaria pulchra* (Nutting, 1904)**

(Fig. 76A-F)
Diphasia pulchra Nutting, 1904: 111, pl. 31 figs 1-3; Jäderholm 1908: 17, pl. 3 figs 1-6; Kramp 1914: 1053; Fraser 1944: 246, pl. 52 fig. 231; Calder 1970: 1527, pl. 5 fig. 8; Schuchert 2000: 425, figs 8-9.
Abietinaria pulchra – Kramp 1932b: 14, fig. 1; Naumov 1969: 427, fig. 289.
Type locality – 48.97°N 123.17°W, 123 m, Vancouver Island, Canada.
Material Greenland – Bank. unders. stations 31, fertile – 37 – "Grønland" 1975 station 25.
Material Iceland – BIOICE stations 2008 –

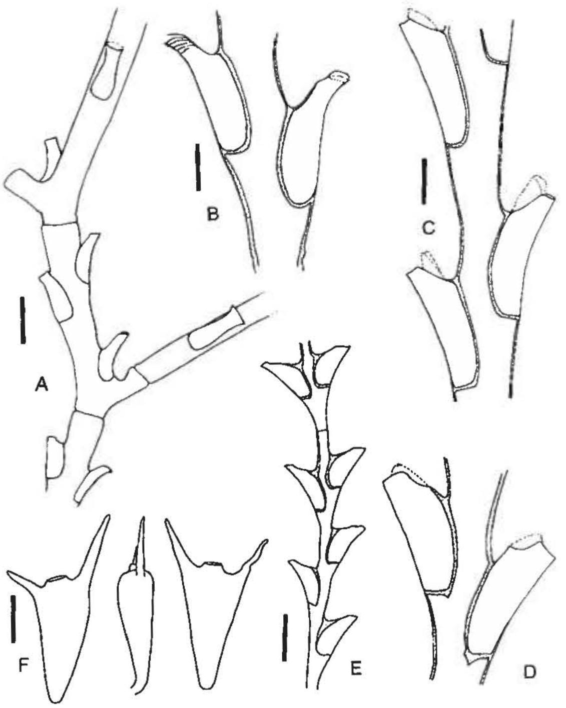

Figure 76. Abietinaria pulchra *(Nutting, 1904).*
A, BIOICE 2330, part of stem with one hydrocladium, scale bar 0.5 mm. B, BIOCE 2330, hydrothecae, note renovations of margin, scale bar 0.2 mm. C, BIOICE 2320, part of hydrocladium, scale bar 0.2 mm. D, BIOICE 2136, part of hydrocladium, note variation of hydrothecal shape compared to B and C, same scale as C. E, BIOICE 2583, hydrocladium, note change of hydrothecal arrangement from alternate to sub-opposite, same scale as A. F, gonothecae, middle one seen from side, scale bar 0.5 mm.

2124 - 2128, fertile - 2135 - 2136 - 2273 - 2318 - 2320 - 2325 - 2327 - 2330 - 2360 - 2363 - 2372 - 2376 - 2377 - 2379 - 2570 - 2573 - 2583 - 2588 - 2591 - 2603 - 2612 - ZMUC, *Sertularia fabricii*, "Ingolf" stations 2, 3 and 4, all described by Broch (1918) as *S. fabricii*.

DESCRIPTION – colonies 8 cm and more, stems monosiphonic, zigzag, rather thin and soft, hydrocladia arranged spirally. Stem divided by regular transverse nodes, segments short, each segment with an apophysis for the attachment of a hydrocladium at proximal end and three hydrothecae, one in axil and two distally placed (Fig. 76A). On lower part of stem hydrocladia broken off. Hydrocladia ramified several times, nodes present only occasionally, hydrothecae arranged alternately or sub-opposite, variable even within same branch (Fig. 76E). Hydrothecae elongated, vasiform in frontal view, nearly tubular in side view, distal end narrowing, slightly curved or straight, adcauline side adnate for 2/3 of length, depth 0.4-0.5 mm. Hydrothecal margin sometimes renovated and much elongated, often ill defined or soft (Fig. 76B), adcauline side with broad sinus of variable depth, but margin mostly not clearly demarcated from operculum. Operculum composed of one adcauline valve, size variable, base not well demarcated from hydrotheca, often renovated and multiplied. At least some hydranths with abcauline caecum, some hydranths may lack it. Gonothecae on branches, flattened, elongated triangular in broad view, club-shaped in side view, on middle of distal end a small neck with circular aperture. Apperture flanked by two large spines, often of unequal size.

REMARKS – see Schuchert (2000).

DISTRIBUTION – Vancouver Island, Bering Sea, Sea of Okhotsk, Chukchi Sea, East Siberian Sea, Laptev Sea, Kara Sea, White Sea, Barents Sea, Spitsbergen, western Greenland, northern Canada (Nutting 1904, Calder 1970). At Iceland recorded from many localities along the north and east coast, few from the west, in depths of 146-772 m. It is conspicuously absent from the south coast.

Abietinaria thuiarioides (Clark, 1877)

(Fig. 77A-C)

Sertularia thuiarioides Clark, 1877: 223, pl. 7 figs 38-39.

Thuiaria thuiarioides – Nutting 1904: 64, pl. 8 figs 1-6; Fraser 1937: 173, fig. 210; Fraser 1944: 309, fig. 297.

Diphasia thuiarioides – Broch 1909b: 182, fig. 37.

Abietinaria thujarioides – Naumov 1969: 425, figs 287-288; Schuchert 2000:428, fig 10.

Abietinaria koltuni Naumov, 1960: 394, fig.

286; Naumov 1969: 424, fig. 286; Antsulevich 1987: 88, synonymy.
Abietinaria thuiaroides – Schuchert 2000:428, fig. 10.
TYPE LOCALITY – 5 miles off West Cape of Nunivak Island, Bering Sea, and Chignik Bay, Alaska Peninsula (Clark 1877).
MATERIAL ICELAND – BIOICE stations 2570, three damaged shoots, max. 5 cm – 2591.

DESCRIPTION – colonies 5 cm and more, forming erect, monosiphonic, pinnate stems with alternate branches, these hydrocladia branched again, all in one plane. Basal region without hydrocladia. Stem segmented by more or less distinct nodes. Each segment with three alternating hydrothecae in two lateral rows and one apophysis for hydrocladium originating below most distal hydrotheca. Hydrocladia only with occasional nodes, hydrothecae alternate, in two rows along side and in same plane as hydrocladia. Hydrotheca about 0.4 mm long, abcauline wall s-shaped to nearly straight, adcauline wall adnate for 4/5 of its length, adnate part convex, free part concave. Aperture and operculum half-moon shaped, operculum fixed on its adcauline side which is nearly straight to slightly curved. Hydropore near abcauline wall. Hydranth with abcauline caecum. Gonothecae not seen, after Naumov (1969) flabellate, with two lateral spines and a opening on a short neck (like in *A. pulchra*, Fig. 76F).

REMARKS – the semi-circular opening and operculum of the hydrothecae are quite characteristic (Fig. 77C) and match well the description of Clark (1877). The figures and descriptions of Nutting (1904) and Fraser (1944) are somewhat superficial. As this species grows to a size of 20 cm and then has hydrocladia all around the stem, the present smaller plumes (originally > 5 cm) are probably juvenile (see Naumov 1969).

DISTRIBUTION – arctic species: known from Alaska, Bering Sea, Sea of Okhotsk, Japan Sea, Barents Sea, Kara Sea, Laptev Sea, Chukchi Sea (Naumov 1969). In the Atlantic Ocean known from northern Canada (Fraser 1944) and Iceland (Schuchert 2000).

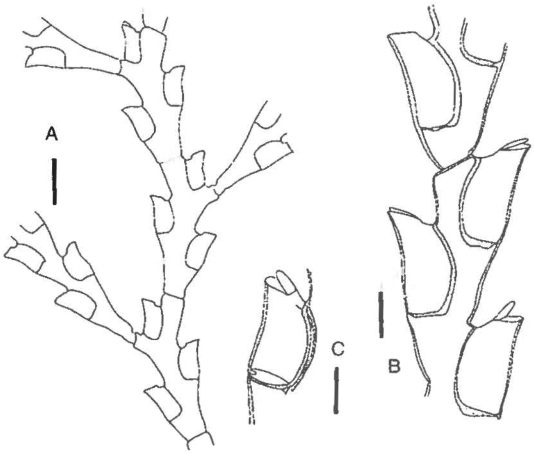

Figure 77. Abietinaria thuiarioides *(Clark, 1877); BIOICE 2570. A, part of stem with hydrocladia, scale bar 0.5 mm. B, part of hydrocladium, scale bar 0.2 mm. C, hydrotheca, note shape of operculum, scale bar 0.1 mm.*

***Diphasia attenuata* (Hincks, 1866)**
Sertularia attenuata Hincks, 1866: 298.
Diphasia attenuata – in part Broch 1918: 113; Kramp 1938: 47; Vervoort 1959: 258, fig. 26; Cornelius 1979: 256, fig. 7; Medel *et al.* 1991: 505, fig. 1; Ramil & Vervoort 1992a: 197, fig. 51c; Cornelius 1995b: 38, fig. 6.
Diphasia attenuata var. *robusta* – Ramil & Vervoort 1992a: 198, fig. 51a-b.
TYPE LOCALITY – British Isles (Cornelius 1979).

DESCRIPTION – see Cornelius (1995b).

REMARKS – this species was not among the examined samples. For the distinction of the very similar *D. rosacea* see the remarks under this species. One sample identified by Broch (1918: 113, "Ingolf" Station 98) as *D. attenuata* was re-examined and it proved to belong to *D. margareta* (see Fig. 79B). It's hydrotheca had the characteristic internal process and the male gonotheca had four instead of six ridges. As Broch's (1918) description matches *D. attenuata* rather well, his other material was presumably correctly identified.

Ramil & Vervoort (1992a) mention an adcauline epidermal lamina as characteristic for *D. attenuta*. Such a tissue covering, however, might be found in many Sertulariidae. In dredged material it is often damaged or otherwise invisible.

Distribution – British Isles, Sweden, Faroes, Iceland, Jan Mayen, western Greenland, Marocco, Azores. Absent from Denmark and Norway. Outside the north Atlantic there are two records from New Caledonia and one dubious record from South Africa (Cornelius 1995b, Vervoort 1993a).

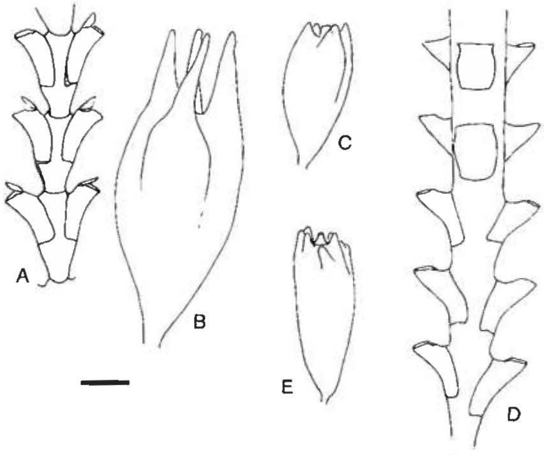

Figure 78. Diphasia fallax *(Johnston, 1847); all to same scale, scale bar 0.5 mm. A, part of hydrocladium, BIOICE 2823. B, mature female gonotheca, BOICE 2493. C, younger female gonothecae adjacent to the one shown in B. D-E,* Diphasia fallax *var.* wandeli. *D, hydrocladium showing transition of normal biseriate to triseriate arrangement of hydrothecae (top), BIOICE 2360. E, male gonotheca with increased number of spines.*

Diphasia fallax (Johnston, 1847)

(Fig. 78A-D)

Sertularia fallax Johnston, 1847: 73 pl. 11 figs 2, 5-6.

Diphasia coronifera Allman, 1872: 172.

Diphasia wandeli Levinsen, 1893; 55, pl. 8 figs 1-5; Kramp 1914: 1053; Broch 1918: 111; Kramp 1932a: 49, Kramp 1938: 45.

Diphasia fallax – Broch 1909b: 179, fig. 34; Kramp 1914: 1052; Broch 1918: 108, fig. 59; Kramp 1938: 45; Kramp 1943: 35; Fraser 1944: 244, pl. 51 fig. 230; Naumov 1969: 360, figs 223-224; Cornelius 1979: 260, fig. 9, synonymy; Cornelius 1995b: 44, fig. 8.

Nigellastrum fallax – Vervoort 1942: 289.

Type locality – NE coast of Britain, between Scarborough and Aberdeen (Cornelius 1979).

Material Greenland – "Kangamiut" station 4 – "Kap Farvel" stations 115, fertile – 142, fertile – "Grønland" 1975 station 38, fertile.

Material Iceland – BIOICE stations 2056, fertile – 2097 – 2099, fertile – 2132, fertile – 2154, fertile – 2168, fertile – 2170 – 2185, fertile – 2273, fertile – 2314, fertile – 2349 – 2350 – 2360, fertile – 2369, fertile – 2469, fertile – 2491 – 2493, fertile – 2495, fertile – 2506 – 2509 – 2512 – 2514 – 2515 – 2520, fertile – 2522, fertile – 2524 – 2533, fertile – 2537 – 2548, fertile – 2562, fertile – 2595, fertile – 2597 – 2599, fertile – 2662 – 2710, fertile – 2818 – 2823 – 2824 – Gar›ur, coll. 8.05.2000 by author, examined alive, infertile.

Description – colony erect, 4-10 cm, loosely pinnate, monosiphonic, stem and branches straight to gently curved, some branches with secondary branching, living and preserved colonies nearly white. Branches on two sides of stem, regularly or irregularly pinnate. Structure of stem and branches similar. Hydrothecae biseriate, occasionally triseriate in some parts of the colony, in opposite pairs, tubular, 0.5-0.6 mm in depth, diameter of opening 0.3 mm, adnate for 3/4 or more of abcauline length, curving outward, aperture circular, adcauline wall with broad notch, operculum formed by one flap attached to adcauline side. Gonothecae borne on branches. Female gonotheca up to 3 mm, diameter max. 1.2 mm, widest in middle, spindle-shaped, distal end with crown formed by 4 long horns encircling terminal aperture on short neck. Male gonotheca only half the size of female one, broadest at end, with four short horns. In forms with triseriate hydrothecae the gonothecae have up to 8 horns.

Remarks – this is a well known species. The female gonotheca (Fig. 78B) is very characteristic. Levinsen (1993) described the closely resembling species *Diphasia wandeli* from Greenland. It differs from the more typical forms in having very thick stems, three rows of hydrothecae in some parts, hydrothecae with a short free part, and male gonothecae with two to four additional spines (Fig. 78D-E). Kramp (1932a, 1938) re-examined Levinsen's type material as well as other material assigned to that species and he found that these variants are connected by intermediates to the normal form (Fig. 78D). He was unable to draw a clear separation line and therefore synonymised *Diphasia wandeli* with *D. fallax*. Figure 78D shows that the more common bi-seriate arrangement of the hydrotheca can change to the rarer triseriate form even within the same branch.

FURTHER DATA – embryos brooded in acrocyst, some colonies monoecious (Cornelius 1995b).

DISTRIBUTION – northern temperate North Atlantic Ocean to arctic Oceans, extending south to northern parts of British Isles (Naumov 1969, Cornelius 1995b). In North American waters known from western and eastern Greenland and from Canada southward to deep waters off Charleston (Fraser 1944). Icelandic records cover the whole coastline, the form *wandeli* is found along the north-east and north coast.

Diphasia margareta Hassall, 1841

(Fig. 79A-C)

Sertularia margareta Hassall, 1841: 284, pl. 6 figs 3-4.

Diphasia pinaster – Hincks, 1868: 252, pl. 50 fig. 1; Cornelius 1995b: 50, fig. 10.

Diphasia elegans G. O. Sars, 1874: 145, pl. 3 figs 23-26.

Diphasia margareta – Cornelius 1979: 263, fig. 11; Ramil & Vervoort 1992a: 201, figs 52a-c. 53a-g, 54a-e, 55a-c, 56c-e, 57a, 58a-d.

TYPE LOCALITY – off Howth, near Dublin and near Giant's Causaway, Ireland.

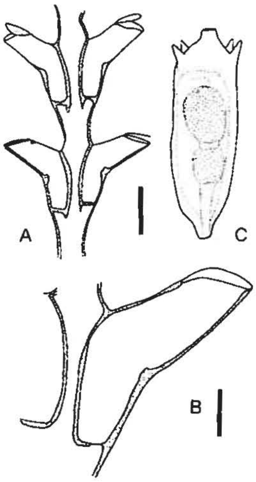

Figure 79. Diphasia margareta *Hassall, 1841; A, BIOICE 2823, B-C "Ingolf" Station 98. A, part of hydrocladium, scale bar 0.5 mm. B, hydrotheca, note presence of internal thickening in middle of outer wall, scale bar 0.2 mm. C, male gonotheca, same scale as A.*

MATERIAL ICELAND – ZMUC, as *Diphasia attenuata*, "Ingolf" Station 98, sample mentioned in Broch (1918) as *D. attenuata* – BIOICE stations 2418 – 2493 – 2495 – 2514 – 2719 – 2823.

DESCRIPTION – colonies erect, up to 15 cm, irregularly pinnate, main stem thicker than branches in old colonies, hydrocladia sometimes with secondary branching. Hydrothecae on stem and hydrocladia biseriate, opposite, each sharply out-turned in middle, 0.8-1.0 mm deep, diameter 0.25-0.3 mm, 1/2 to 3/4 adnate, with characteristic inward projection at angle of bend, aperture slightly oblique, circular, with broad notch of variable depth at adcauline side. Operculum attached to adcauline side of margin. Male gonothecae about 2 mm long, diameter about 0.7 mm, rectangular to cylindrical, tapering rapidly below, aperture at distal end on distinct neck, surrounded by four short horns. Female gonotheca not seen, according to Cornelius (1995b) up to 4 mm, oblong, with four longitudinal crests each bearing 1-3 spines in upper half, aperture distal, on short neck.

Remarks – there has been a profound confusion concerning the name of this species (see Cornelius 1979). Despite being formally incorrect, Cornelius (1995b) followed long usage and named this species *Diphasia pinaster* sensu Hincks. In the interest of future nomenclatural stability, it seems, however, better to use the correct name *D. margareta*. Accordingly, *Diphasia pinaster* (Cuvier, 1830) must be used instead of *D. alata* Hincks, 1855. *Diphasia pinaster* (Cuvier, 1830) is not known to occur in the region under investigation.

Diphasia margareta shows quite some variability of the hydrothecal shape. This variability is well documented in Ramil & Vervoort (1992a). Characteristic for the species is the thickening on the abcauline wall of the hydrotheca (Fig. 79A-B), allowing also identification of non-reproductive material. However, this thickening can rarely be absent (Ramil & Vervoort 1992a). In such cases only the characteristic female gonotheca allows a reliable identification.

One sample identified by Broch (1918: 113, "Ingolf" Station 98) as *D. attenuata* was re-examined and it proved to belong to *D. margareta* (see Fig. 79B). It's hydrotheca had the characteristic internal process and the male gonotheca had four instead of six ridges.

Distribution – widely distributed in the North-eastern Atlantic, extending from Norway to Guinea Bissau. Also present in the Mediterranean. Present at Iceland on the east and south coast only. Not known from Greenland.

Diphasia rosacea (Linnaeus, 1758)

(Fig. 80A-C)
Sertularia rosacea Linnaeus, 1758: 807.
Sertularia nigellastrum Pallas, 1766: 129.
Diphasia rosacea – Broch 1918: 112, fig. 60; Kramp 1938: 46; Vervoort 1959: 257, fig. 25; Naumov 1969: 358, figs 221-222; Cornelius 1979: 269, fig. 8; Ramil & Vervoort 1992a: 213, fig. 56b; Cornelius 1995b: 54, fig. 11.
not *Diphasia rosacea* – Vervoort 1959: 257, fig. 25.

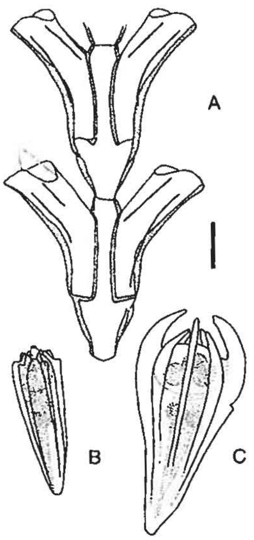

Figure 80. Diphasia rosacea *(Linnaeus, 1758); BIOICE 2484. A, two segments of hydrocladium, note longitudinal streaks, scale bar 0.2 mm. B, male gonotheca with 3 sperm masses, scale bar 0.5 mm. C, female gonotheca with eggs, same scale as B.*

Type locality – Brighton, Sussex, England (Cornelius 1979).

Material Iceland – BIOICE 2484, fertile.

Description – colonies erect, up to 5 cm, loosely pinnate, stem slightly thicker than hydrocladia but otherwise same structure. Hydrocladia alternate, arising below cauline hydrothecae. Stem and hydrocladia segmented by transverse nodes, each segment with two opposite hydrothecae. Hydrothecae tubular, about 0.6 mm deep and 0.17 mm in diameter, 1/3-1/2 adnate, gradually outturned, aperture circular, rim even, with deep emargination on inner side, operculum made of one valve attached at site of emargination. On outside of hydrotheca 3 longitudinal ridges. Male gonotheca 1.6 mm long, 0.5 mm diameter, carrot-shaped, straight sided, with 8 longitudinal, thin, smooth ribs ending distally in small spines, aperture on small neck. Female gonotheca about 2.4 mm long, 1.2 mm diameter near end, thick carrot-shaped, with eight longitudinal, mostly smooth ribs running along nearly the whole gonothecae and continued as incurved horns at distal end, two opposite horns about two times as large and thick, overarching a brooding space, ribs of this longer pair often with notches.

REMARKS – Cornelius (1979, 1995b) considers that *Diphasia rosacea* (Linnaeus, 1758) and *Diphasia attenuata* (Hincks, 1866) might be conspecific. Both species mainly differ in the morphology of the female gonotheca and in the presence of ridges on the hydrotheca of *D. rosacea* (see Fig. 80A-C).

DISTRIBUTION – widespread in the Northeast Atlantic Ocean, being known from the Gibraltar region north to Iceland (SW) and the White Sea (Cornelius 1995b). Along North America it has been recorded from Canada to Nantucket (Fraser 1944). Absent from Greenland.

***Dynamena pumila* (Linnaeus, 1758)**
(Fig. 81A-C)
Sertularia pumila Linnaeus, 1758: 807; Hincks 1868: 260, pl. 53 fig. 1; Kramp 1914: 1045.
Dynamena pumila – Broch 1918: 115, fig. 61; Kramp 1938: 47; Naumov 1969: 356, figs 38 & 219; Ólafsson 1975: 9, fig. 18; Cornelius 1979: 271, fig. 14, synonymy; Cornelius 1995b: 57, fig. 12.
TYPE LOCALITY – Sussex, England, neotype (Cornelius 1979).
MATERIAL ICELAND – MHNG INVE29033, Sandger›i and Gar›ur, coll. 8.05.2000 by author, examined alive, fertile, numerous colonies.

DESCRIPTION – colonies erect, small, up to 3 cm, stiff, shoots often straight and unbranched, but sometimes loosely branched. Stem and branches identical in structure. Hydrothecae in opposite pairs, with transverse node between each 1-3 pairs. Hydrothecae 0.25-0.45 mm deep, 2/3 adnate, margin with two lateral cusps, operculum composed of 2 flaps. Hydranth without abcauline caecum. Gonotheca ovoid, about 1.2 mm long, wall smooth to slightly rugose, aperture terminal, wide, on short neck.

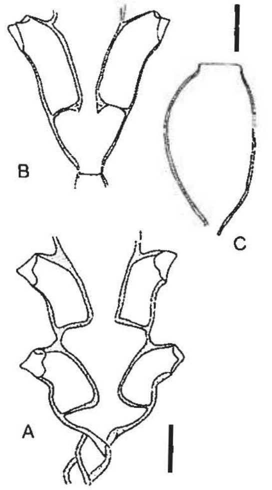

Figure 81. Dynamena pumila *(Linnaeus, 1758); Iceland, Sandger›i. A, basal part of stem, scale bar 0.2 mm. B, distal part of same stem, note shape variation of hydrotheca, same scale as A. B, gonotheca, scale bar 0.4 mm.*

DISTRIBUTION – cool to temperate North Atlantic, frequent at the low water mark. Along European coasts, reliably recorded from White and Barents Seas, Iceland (north, south, west coast), and Faroes southwards to France and NW Spain. Penetrates also the Baltic Sea. Along the American coasts recorded from northern Canada and western Greenland south to New England (Cornelius 1995b).

***Hydrallmania falcata* (Linnaeus, 1758)**
(Fig. 82A-D)
Sertularia falcata Linnaeus, 1758: 810.
Sertularia stipulata Linnaeus, 1758: 813.
Hydrallmania falcata – Kramp 1914: 1051; Broch 1918: 135, figs 73-74; Kramp 1938: 54; Kramp 1943: 37; Naumov 1969: 433, fig. 294; Ólafsson 1975: 10, fig. 22; Cornelius 1979: 273, figs 15-16, synonymy; Ramil & Vervoort 1992a: 216, fig. 60c-d; Cornelius 1995b: 60, fig. 13.

TYPE LOCALITY – Kent, England.

MATERIAL GREENLAND – "Kangamiut" stations 6 – 10 – "Grønland" 1975 stations 25 – 55, fertile – ZMUC , 66.00°N 56.12°W, 200-204 m, 1.08.1975 – ZMUC, 66.25°N 56.38°W, 187-190 m, 1.8.1975.

MATERIAL ICELAND – BIOICE samples 2000 – 2002 – 2003 – 2004 – 2005, fertile – 2056 – 2074 – 2097 – 2099 – 2126 – 2128 – 2140 – 2142 – 2143 – 2150 – 2152 – 2161 – 2168 – 2170 – 2172 – 2178, fertile – 2180 – 2197 – 2198, fertile – 2201 – 2213 – 2221 – 2234 – 2282 – 2313 – 2314 – 2330 – 2332 – 2337 – 2346 – 2348 – 2349 – 2350 – 2351 – 2352 – 2356 – 2358 – 2374 – 2377, fertile – 2381 – 2382 – 2442 – 2454 – 2480 – 2481 – 2484, fertile – 2485, fertile – 2490 – 2491 – 2493 – 2495 – 2499 – 2501 – 2505 – 2506 – 2508 – 2509, fertile – 2511, fertile – 2512 – 2514 – 2514 – 2520 – 2522 – 2524 – 2526, fertile – 2527 – 2528, fertile – 2530 – 2531 – 2533 – 2537 – 2540 – 2548 – 2556 – 2558 – 2562 – 2564 – 2597 – 2678 – 2713 – 2820 – 2821 – 2824 – 2880 – MHNG INVE29025, Gar›ur, coll. 8.05.2000 by author, examined alive, fertile, numerous colonies.

DESCRIPTION – colonies erect, usually large, 5-20 cm, elongate, monosiphonic, main stem in open spiral, with lateral pinnate branches. Hydrothecae usually on one side of hydrocladium, alternate ones inclined left and right. Hydrothecae in groups of 3-10, groups separated by nodes. In some colonies the arrangement of the hydrothecae can be biserial in parts of the colony (Fig. 82C). Hydrotheca 0.35-0.5 mm deep, roughly tubular but widest basally, adnate for 1/2 to 4/5 of its length, aperture circular to ovate, rim smooth or with two lateral cusps, operculum formed by two valves, abcauline one small, adcauline one large. Gonotheca on hydrocladia, 1.2-1.7 mm, ovate to pear-shaped, with broad distal aperture on short neck.

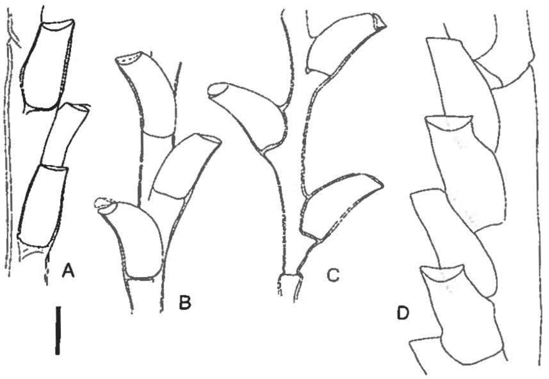

Figure 82. Hydrallmania falcata *(Linnaeus, 1758); A-C BIOICE 2821, D "Grønland" 1975 station 55, all same scale, scale bar 0.2 mm. A, hydrocladium in side view, note displacement of hydrothecae towards frontal side (right). B, same section seen from frontal side. C, more proximal part of same hydrocladium, note biseriate arrangement of hydrothecae. D, hydrocladium in side view, note larger hydrothecae and denser arrangement compared to A.*

REMARKS – in addition to the characteristic colony form with pinnate side branches, *Hydrallmania falcata* has a very characteristic uniseriate arrangement of its hydrothecae (see Fig. 82A-B). The hydrothecae are typically displaced towards one side of the hydrocladium and arranged in a single row. In the Icelandic population, however, there are often colonies that have a high proportion of their hydrothecae arranged biserially, like in other members of the Sertulariidae (see Fig. 82C). This normally poses no problem when dealing with large, intact colonies as some parts with uniseriate arrangement are always present. But in juvenile colonies, or fragmented and damaged material, identification is often nearly impossible, as they closely resemble other *Sertularia* species or notably *Abietinaria pulchra*. The hydrothecal margins *H. falcata* are often rather irregular and the opercula difficult to observe, other factors that make fragmented *H. falcata* liable to misidentifications. This has also been noted by Broch (1918). The spacing of hydrothecae along the hydrocladium is also very variable (Fig. 82A-C)

DISTRIBUTION – common throughout western Europe excepting the Baltic Sea, most abundant in depths of 20-100 m. Known from the Arctic Seas (White, Kara and

Barents Sea), south to France. Along North America known from southern Greenland to Massachusetts (Cornelius 1995b). Surprisingly, Vervoort (1993) found it also in deep waters near New Caledonia. Closely related species, perhaps conspecific with *H. falcata*, are also known from the Pacific coast of Canada and California (Fraser 1937). *Hydrallmania falcata* is also present at eastern and western Greenland. However, it has been found only once at eastern Greenland (Kramp 1943), while the other localities lie in the south and south-west. Kramp (1938, map fig. 5) recorded it from numerous localities along nearly the complete coast of Iceland, excepting the north-east corner. The present findings confirm this pattern. The depth range was 20-1102 m, with the majority of findings below 100 m.

Sertularella gayi (Lamouroux, 1821)
(Fig. 83A-B)
Sertularia gayi Lamouroux, 1821, pl. 66 figs 8-9.
Sertularia pinnata Templeton, 1836: 468.
Sertularia Gayi var. *robusta* Allman, 1873: 186; Allman 1877: 22, pl. 15 figs 3-5.
Sertularella gayi – Jäderholm 1909: 100, pl. 11 fig. 13; Kramp 1914: 1038; Broch 1918: 102, fig. 55; Kramp 1938: 44; Vervoort 1959: 273, figs 33b-c, 34b; Cornelius 1979: 284, fig. 21; Medel *et al.* 1991: 524, fig. 9; Ramil, Parapar & Vervoort 1992: 496, fig. 1a, 2-3; Cornelius 1995b: 71, fig. 16; Hirohito 1995: 192, fig. 63a-b.
Sertularella gayi gayi – Ralph 1961a: 833, fig. 24d-f; Ramil & Vervoort 1992a: 219, fig. 61a-e; Medel & Vervoort 1998: 40, figs 10-11.
Sertularella gayi robusta – Ramil & Vervoort 1992a: 223, figs 60b, 62a-c; Calder & Vervoort 1998: 39, fig. 19a-b; Medel & Vervoort 1998: 45, fig. 12.
TYPE LOCALITY – English Channel.
MATERIAL ICELAND – BIOICE stations 2714 – 2245 – 2247, with residues of gonothecae – 2824 – 2880.

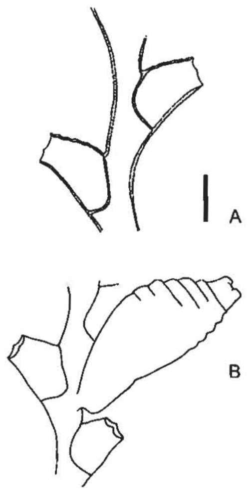

Figure 83. Sertularella gayi *(Lamouroux, 1821). A, part of hydrocladium, BIOICE 2824, scale bar 0.5 mm. B, hydrocladium with gonotheca, material from Roscoff (Brittany), note the two lip-like processes at the distal end, same scale as A.*

OTHER MATERIAL EXAMINED – MHNG, INVE 28841, France, Roscoff, coll. Bedot 31.7.1906, polysiphonic, fertile female.

DESCRIPTION – colonies erect, 5-10 cm (max. 25 cm acc. Cornelius 1995b). Main stem and branches polysiphonic, arrangement of smaller branches loosely pinnate, with some 2nd- and 3rd-order branching. Hydrocladia flexuose to straight, perisarc smooth to slightly undulated, nodes infrequent, oblique. Hydrothecae alternate, widely spaced, 0.5-0.8 mm deep, adnate for 1/2 of their length, narrowing towards aperture, aperture at 90° to axis of hydrotheca, rim 4 cusped, free adcauline wall either smooth or undulated. Gonotheca about 2 mm long, ovoid to club-shaped, distal 1/3-2/3 ridged to rugose, terminal aperture flanked by two lip-like processes.

REMARKS – *Sertularella* is a difficult genus with an enormous number of nominal species, of which many are not objectively separable. *Sertularella* species offer few anatomical details and the situation is worsened by their morphological variability. The validity of all *Sertularella* species recognised here has been the subject of discussions by several authors and some nominal species might prove to be conspecific. Table 4 summarises the traits used to separate the species.

Sertularella gayi and *Sertularella polyzonias* are very similar and Cornelius (1979) suspected that they are conspecific, *S. polyzonias* being only younger colonies of *S. gayi*. Ramil, Parapar & Vervoort (1992a) worked out the differences between a number of European *Sertularella* species and concluded that *Sertularella gayi* and *Sertularella polyzonias* are distinct species. *Sertularella gayi* is as a rule polysiphonic with regular pinnate ramifications, the free part of the adcauline hydrothecal wall is often undulated (see Fig. 83A), and most importantly its gonothecal aperture is provided with two characteristic lip-like processes (Fig. 83B). *Sertularella polyzonias* colonies are monosiphonic, irregularly ramified, the hydrothecal walls are smooth and the gonothecal aperture has four or more cusps of varied development (Fig. 84C-E). While it is highly likely that indeed two species are involved, intergradation seems to occur (see Cornelius 1995b). Some typical colonies of *S. gayi* from Brittany (Fig 83B) had either smooth or undulated hydrothecae. In some colonies of otherwise typical colonies of *S. polyzonias* from Greenland, the adcauline hydrothecal walls were likewise variably smooth or undulated. Some hydrothecae had also undulated abcauline walls. As the colonies were monosiphonic and the gonotheca had four horns, they were reliably identifiable as *S. polyzonias* (see Fig. 84). Therefore, undulated hydrothecal walls seem thus to be a character of limited value for distinguishing *S. polyzonias* and *S. gayi*.

Several authors have proposed subspecies status for differing forms, notably *S. gayi gayi* and *S. gayi robusta* (see Medel & Vervoort 1998 : 54 for table with differences). If not different species, these morphotypes must be seen as variants only because they occur sympatrically, thus cannot be subspecies. As the morphology of both forms intergrade, they are more probably variants only. Medel & Vervoort (1998) also raised *Sertularella gayi unituba* Calder, 1991 to species rank, although they do not discuss their motives. It is not obvious why *S. gayi unituba* should deserve species status while *S. gayi robusta* is regarded as a subspecies.

DISTRIBUTION – known in the eastern and western Atlantic Ocean from Spitsbergen and Bay of Fundy to the tropics and also from some remote south Atlantic islands (Fraser 1944, Medel & Vervoort 19982) and from New Zealand (Ralph 1961a). At Iceland this species is known from the west and south coast, in depths of 98-550 m. At Greenland it is only known from the west coast.

Table 4, characters used to distinguish Sertularella *species*

character	*S. gayi*	*S. polyzonias*	*S. tenella*	*S. rugosa*
polysiphonic	yes	no	no	no
hydrotheca undulated	no, or slightly only	yes or no	no	no
hydrotheca with ridges	no	occasionally	yes	yes
ridges encircle hydrotheca	no	no	yes	yes
notch below abcauline side of hydrotheca	no	no	no	yes
aperture inclined to axis	no	no	no	yes
neck of gonotheca	two lips	4 or more cusps	4 or more cusps	4 cusps

Sertularella polyzonias (Linnaeus, 1758)
(Fig. 84A-F)
Sertularia polyzonias Linnaeus, 1758: 814.
Sertularella polyzonias var. *gigantea* Hincks, 1874: 151, pl. 7 figs 11-12.
Sertularella gigantea Mereschkowsky, 1878: 330, pl. 14, figs 6-7; Kramp 1914: 1034; Naumov 1969: 365, fig. 227, pl. 6 fig. 1.
Sertularella polyzonias – Broch 1909b: 170, fig. 26; Jäderholm 1909: 100, pl. 11 fig. 12; Kramp 1914: 1033; Broch 1918: 101, fig. 54; Kramp 1932b: 12; Kramp 1938: 42; Kramp 1943: 34; Calder 1970: 1528, pl 6 figs 3-5; Millard 1975: 299, fig. 98 (includes several invalid subspecies); Cornelius 1979: 287, fig. 22, synonymy; Medel *et al.* 1991: 519, fig. 7; Ramil, Parapar & Vervoort 1992: 500, figs 1b, 4-5; Ramil & Vervoort, 1992a: 225, fig. 63a-b; Cornelius 1995b: 74, fig. 17.

TYPE LOCALITY – north coast of Kent, England (Cornelius 1979).

MATERIAL GREENLAND – ZMUC, Greenland, Holsteinsborg, 120-200 m, 19.07.1953, fertile – Bank. unders. station 22 – "Grønland" 1975 station 15 – "Kap Farvel" stations 42 – 91, fertile – 100, fertile – 101 – 135, fertile – 103, typical, small form, fertile.

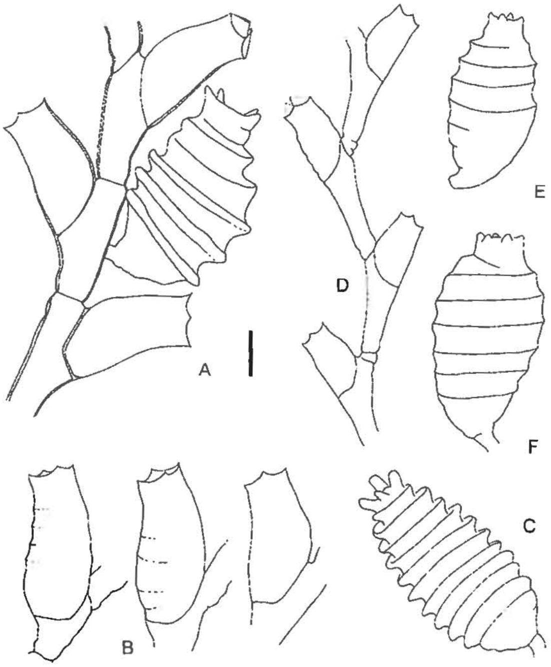

Figure 84. Sertularella polyzonias *(Linnaeus, 1758); Greenland, all same scale, scale bar 0.5 mm. A, "Kap Farvel" station 91, part of stem with gonotheca. B, "Kap Farvel" station 135, three hydrotheca of the same colony, note variation of transversal ridges. C, gonotheca of sample mentioned under B. D, "Kap Farvel" station 103, stem with 3 hydrothecae, note size difference to A and B. E, four cusped gonotheca of colony mentioned under D. F, six cusped gonotheca*

DESCRIPTION – colonies erect, up to 6 cm, monosiphonic throughout, openly and irregularly branched, often with 2nd- and 3rd-order branching, sometimes branches ending in tendrils which may attach to other objects. Perisarc mostly smooth, stem flexuose or not, regularly segmented, nodes transverse to oblique. Hydrothecae alternate, one at distal end of each segment, size variable from 0.6 to 1.4 mm, flask-shaped to cylindrical, narrowing or not just below opening, opening usually roughly at right-angles to hydrothecal axis, rim 4-cusped, operculum 4-flapped, adcauline side of hydrotheca 1/5-1/3 adnate, walls mostly smooth, sometimes undulated or slightly ridged either on abcauline or adcauline side, but ridges do not encircle hydrotheca. Gonotheca barrel-shaped, up to 2 mm high, 5-10 transverse ridges, ridges variably expressed, aperture on neck with 4-7 cusps.

REMARKS – the validity of this species has been questioned by Cornelius (1979), but I consider *S. polyzonias* a valid species. For a discussion and distinction from *S. gayi* see the remarks concerning this species and Table 3.

Most samples of this species, also the ones from Cape Farewell, had hydrothecae measuring more than 1 mm in depth (equals length of abcauline side), thus conformed to the form *gigantea* introduced by Hincks (1874) (Fig. 84A-B). Only one sample from Cape Farewell had hydrothecae that measured only 0.7 mm in depth and conformed more to the typical form (Fig. 84D). Some authors (e. g. Mereschkowsky 1878, Nutting 1904, Fraser 1944, Naumov 1969) regarded the large form as distinct species, while other did not (e. g. Broch 1918, Calder 1970). Broch (1918) found intermediate forms along the west coast of Greenland and concluded that *S. gigantea* is only a form of *S. polyzonias*. With some misgivings, I accepted Broch's view, although the difference between the two forms is striking (comp. Fig. 84A and D). I suspect that two species are involved. However, as I had only a few samples, and more samples might produce also intermediate forms, I prefer to postpone any decision until more samples have been examined. Additionally, the only sample with typically sized hydrothecae was also the one from the deepest locality.

The gonothecae of both forms observed here had a quite variable number of distal cusps, varying even within the same colony (Fig. 84E-F). The number varied from 4 to 7. In Europe, there are usually not more than 4 cusps. Also the transverse ridges of the gonotheca were very variably formed, but most of them had rather strongly exsert ridges, this in contrast again to European populations which have only weakly developed ridges (Cornelius 1995b). This renders them more similar to *S. tenella*. The sample from station "Kap Farvel" 135 (Fig. 84B-C) was particularly intermediate between *S. polyzonias* and *S. tenella*, although it had the large sized hydrotheca of the *gigantea* form of *S. polyzonias*. For a discussion of the status of *S. tenella* see under remarks for this species.

No material from Iceland could be positively identified as *S. polyzonias*. The BIOICE was often severely fragmented and pieces of *Sertularella* were not identified due to the possible confusion with *S. gayi*. So, the absence of *S. polyzonias* in the BIOICE material does not imply that this species is not present at Iceland. Other authors (e. g. Broch 1918) have recorded it from all around Iceland.

Distribution – Arctic Oceans, Atlantic Ocean from Spitsbergen, all around Iceland, western and eastern Greenland to South Africa, and from Canada south to Georgia. Also known from Alaska, Bering Sea, Japan, and Kerguelen Islands (Cornelius 1995b).

Sertularella rugosa (Linnaeus, 1758)
(Fig. 85 A-B)
Sertularia rugosa Linnaeus, 1758: 809
Sertularella rugosa – Jäderholm 1909: 101, pl. 11 fig. 14; Kramp 1914: 1036; Broch 1918: 106, figs 57-58; Kramp 1938: 45; Naumov 1969: 367, fig. 230; Ólafsson 1975: 9, fig. 16; Cornelius 1979: 290, fig. 23; Cornelius 1995b: 77, fig. 18.

Type locality – coast of Northumberland, England (Cornelius 1979).

Material Greenland – "Littoral"station 21, small fragment.

Material Iceland – ZMUC, Grindavík, coll Saemundsson, 4.9.1895, infertile, material mentioned in Broch (1918) – MHNG INVE 29032, Sandger›i & Gar›ur, coll. May 2000 by author, fertile, on red algae.

Description – colonies stolonal and erect, stolonal part bearing hydrothecae directly on stolons, erect shoots unbranched or sparingly branched, small (0.5-1.5 cm), zigzag, bearing closely spaced alternating hydrothecae in two rows. Hydrotheca barrel-shaped, 1/4 - 2/3 adnate, about 0.5 mm deep and 0.3 mm in diameter, walls thick, with 3-5 sharp, encircling transverse ridges, opening inclined downwards abcauline side resulting in a furrow below outer margin, operculum four-valved. Gonotheca egg-shaped, 1.2-1.4 mm long, with several prominent encircling ridges, some smooth basally; aperture terminal on neck, with 4 uniform cusps.

Remarks – The differences of this species to *S. tenella* were tabulated by Cornelius (199b: 82, table 1). Cornelius (1979, 1995b) thought that *Sertularella rugosa* is perhaps conspecific with *S. tenella*, an opinion also shared by myself.

Distribution – reported from arctic waters north of Russia, European coasts south to

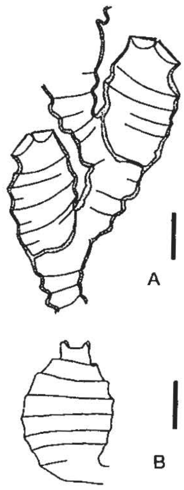

Figure 85. Sertularella rugosa *(Linnaeus, 1758); Iceland. A, sample from Grindavík, part of stem, scale bar 0.2 mm. B, sample from Sandgerði, gonotheca, scale bar 0.5 mm.*

France, absent from Baltic Sea (Cornelius 1995b). Reported from eastern North America from arctic regions to Cape Cod (Fraser 1944), along the Pacific side from California and from Vancouver Island to Alaska (Fraser 1937). At Iceland only known from four localities along the west coast (Broch 1918). Known also from western Greenland.

Sertularella tenella (Alder, 1856)

(Fig. 86)

Sertularia tenella Alder, 1856a: 357, pl. 13 figs 3-6.

Sertularella geniculata Hincks, 1874: 152, pl. 7 figs 13-14; Hincks 1877b: 66; Stechow 1923: 186, fig. A^{1}c.

Sertularella tenella – Hartlaub 1901: 63, figs 34-35, pl. 5 figs 21-24, pl. 6 figs 2, 4, 7, 9-10; Nutting 1904: 83, pl. 18 figs 1-2; Jäderholm 1909: 102, pl. 11 fig. 15; Kramp 1914: 1027; Broch 1918: 104, fig. 56; Stechow 1923: 185, fig. A^{1}b; Fraser 1937: 158, pl. 36 fig. 190; Kramp 1943: 35; Fraser 1944: 273, pl. 60 fig. 263; Naumov 1969: 368, fig. 231; Calder 1970: 1529, pl. 6 fig. 6; Ólafsson 1975: 9, fig. 17; Cornelius 1979: 292, fig. 24, synonymy; Cornelius 1995b: 80, fig. 19; Hirohito 1995: 203, fig. 67e; Calder & Vervoort 1998: 41, fig. 20a-b.

Sertularella atlantica Stechow, 1920: 21, fig. 2a; Stechow 1923: 183, fig. A^{1}a.

TYPE LOCALITIES – *Sertularia tenella*: coast of Northumberland, England (Cornelius 1979); *S. geniculata*: Frederikshaab, Greenland.

MATERIAL ICELAND – BIOICE stations 2099 – 2150 – 2152 – 2185 – 2249 – 2303 – 2314 – 2321 – 2332 – 2337 – 2454 – 2493, fertile – 2501 – 2506 – 2511 – 2520 – 2522 – 2524 – 2526 – 2531 – 2583 – 2597 – 2608 – 2610, fertile – 2710 – 2820 – 2821 – 2823 – 2824 – 2877.

DESCRIPTION – colonies erect, small, up to 2 cm, monosiphonic, sparingly branched. Hydrothecae about 0.6 mm deep, alternate, widely spaced, 1/3 adnate, walls with 3-6 transverse ridges that encircle hydrotheca, ridges sharp (like crease lines), aperture transverse to axis, 4 sharp cusps, 4 flapped operculum. Gonotheca 2 mm, ovate, with encircling ridges in distal half, terminal aperture with normally 4 small cusps, occasionally 6.

REMARKS – surprisingly, neither Broch (1918) nor Kramp (1938) recorded this species in Icelandic waters. Broch's record closest to Iceland was halfway between Iceland and Greenland. Also *Sertularella geniculata* Hincks, 1874 – a species appropriately regarded as conspecific with *S. tenella* – was originally collected from Greenland and not Iceland (Hincks 1877b). Ólafsson (1975) recorded this species for the first time for Icelandic waters. There were a number of samples among the BIOICE material that were allocated to *S. tenella* as they had sharp ridges that encircled the hydrotheca (Fig. 86). However, it was not so easy to separate some Greenland material of *S. polyzonias* from *S. tenella*. *Sertularella polyzonias* can also have undulated hydrothecal wall, occasionally even quite sharp ridges (see Fig. 84B). Contrary to *S. tenella*, however, they did not encircle the hydrotheca completely. Although I am convinced that both are distinct species,

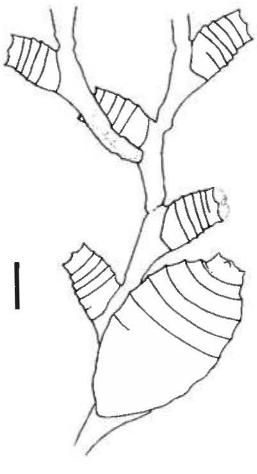

Figure. 86. Sertularella tenella *(Alder, 1856), BIOICE 2493, part of shoot, scale bar 0.5 mm.*

their morphologies seem to approach each other occasionally.

DISTRIBUTION – nearly cosmopolitan, although predominantly in northern hemisphere. Recorded from the Atlantic Ocean along European coasts from northern Norway to France, Spitsbergen, western and eastern Greenland, Mid-Atlantic Ridge, Davis Street to Gulf of Mexico, Angola. Also recorded from the Barents Sea. In the Pacific Ocean recorded from the Bering Sea, Kurile Islands, Japan, along the north American continent from the Gulf of Alaska to California (Fraser 1937, Naumov 1969, Cornelius 1995b, Calder & Vervoort 1998). At Iceland present nearly all around the Island, but absent in the north-east. The depth range of the BIOICE samples was 112-1102 m. Most localities were quite far off the coast.

Sertularia argentea Linnaeus, 1758

(Fig. 87A-E)

Sertularia argentea Linnaeus, 1758: 809; Hincks 1868: 268, pl. 56; Cornelius 1995b: 84, fig. 20.

Sertularia cupressina – ? Naumov 1969: 389, fig. 252

MATERIAL GREENLAND – "Kap Farvel" stations 54 – 128, fertile – 136 – 148, fertile –"Grønland" 1975 stations 25 –38, fertile – 55, fertile.

MATERIAL ICELAND – ZMUC, 65.03°N 13.94°W, 140 m, material identified by Broch (1918) as *S. cupressina* – ZMUC, Faskrud Fjord, 7.07.1899, 38-94 m, material identified by Broch (1918) as *S. cupressina*.

OTHER MATERIAL EXAMINED – ZMUC, Faroes, near Thorshavn, coll. 1902, fertile, material identified by Broch (1918) as *S. cupressina* – MHNG INVE26182, France, Roscoff, Brittany, coll 2.4.1998 by author, fertile.

DESCRIPTION – colony erect, long and bushy, up to 15 cm. Stem flexible, monosiphonic, sometimes forking, hydrocladia of uniform length, arranged all around the stem. Stem with transverse nodes, indistinct in proximal region, distinct more distal, each segment with the origin of one hydrocladium near the proximal end and three hydrothecae, one hydrotheca in upper axil of hydrocladium, one pair more distal. Hydrocladia in mature specimens branched, immature colonies (up to 4 cm) pinnate. Hydrocladia with occasional, irregularly distributed transverse nodes, hydrothecae subopposite to opposite. Hydrotheca adnate for about 3/5 to 2/3 of adcauline side, depth 0.25 to 0.3 mm, opening directed away of hydrocladium at an angle of about 60°, margin with two distinct, rounded teeth. Operculum formed of an abcauline and an adcauline flap. Gonothecae on hydrocladia, 1-1.2 mm in length, drop-shaped, somewhat flattened, terminal opening on short neck, opening with internal ring of perisarc pegs, sometimes with two small horns flanking terminal neck (Fig. 87C).

REMARKS – *Sertularia argentea* Linnaeus, 1758 and *Sertularia cupressina* Linnaeus, 1758 resemble each other closely and many authors – starting with Pallas (1766) – regarded them as conspecific (for more details see Cornelius 1979, 1995b). Cornelius (1995b) is one of the few recent authors who regarded them as distinct and he provided a table to distinguish them (Cornelius 1995b: 87, table 2). Despite this, both forms seem to intergrade to a certain degree and some colonies –

in particular juvenile ones – cannot be identified trustworthy.

For the material available for this study, only one character of Cornelius' table proved to be useful. The others were either not applicable (colour), incorrect (size of the two hydrothecal cusps and the direction of the openings) or too variable to be of any use. Although Broch (1918) cautioned that unequal size of the lateral hydrothecal cusps is mostly due to size distortion by oblique observation, I found that they can differ in size in *S. argentea* as well as in *S. cupressina*. A good character, however, proved to be the number of hydrocladia per stem segment (comp. Figs 87A and 88A). While single colonies of *S. argentea* had regularly one hydrocladium per segment, *S. cupressina* had mostly two, occasionally more, only very rarely just one. Despite that this character shows some occasional variation – even within one colony –, by observing several cauline segments the predominant number can easily be observed. Observations are best made in the middle of the stem.

Other morphologically similar species – in particular if juvenile – are *Sertularia tenera*, *S. similis*, *S. fabricii*. Identifications of young colonies (no gonothecae and hydrocladia in one plane) are therefore normally not possible. For further discussions on see also under these species and Table 5.

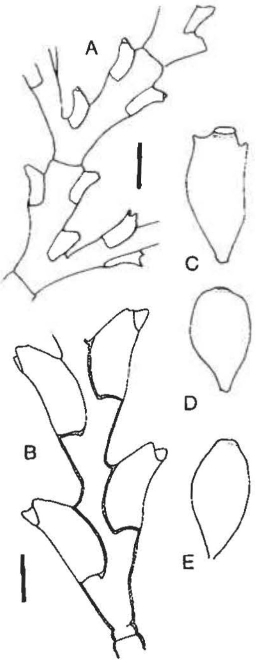

Figure 87. Sertularia argentea *Linnaeus, 1758; from Faroe Islands. A, two segments of stem, each with one hydrocladium only, scale bar 0.5 mm. B, part of hydrocladium. C-E, gonothecae, note variation, same scale as A.*

Table 5. Distinguishing characters of Sertularia *species*

character	*S. argentea*	*S. cupressina*	*S. fabricii*	*S. schmidti*	*S. similis*	*S. tenera*	*S. mirabilis*
rows of hydrothecae	2	2	2	2	2	2	6
hydrothecae subopposite	occasionally	occasionally	occasionally	yes	yes	never	n. a.
hydrocladia per cauline segment	1	2	1	1	1	1	nodes reduced
hydrocladial arrangement plane	all around stem	usually on two sides	all around stem	in one plane	in one plane	planar or all around stem	in one plane
gonothecae with long horns	no	no	yes	no	no	no	no
gonotheca polygonal cross-section	no	no	no	no	no	some	no
maximal colony size in cm	10-15	10-60	10	2.5	4-8	8-15	5-25

As emphasised by Cornelius (1995b), new studies – in particular a genetic analysis – are clearly needed to evaluate all these hydroids.

Distribution – northern boreal to arctic, owing to the frequent lumping or confusion of this species with *S. cuppressina*, no precise distribution data can be given. For more details see Cornelius (1995b).

***Sertularia cupressina* Linnaeus, 1758**

(Fig. 88A-C)

Sertularia cupressina Linnaeus, 1758: 808; in part Broch 1918: 124, figs 65-66; Kramp 1938: 51; Cornelius 1979: 294, fig. 25; Cornelius 1995b: 88, fig. 21.

Type locality – coast of England.

Material Greenland – Bank. unders. station 5304.

Material Iceland – ZMUC, 63.50°N 20.23°W, 80 m, 12.07.1904, with gonothecae, material identified by Broch (1918) as *S. cupressina* – ZMUC, Lonsvík, 15-19 m, det. Broch – ZMUC, Isa Fjord, 38-56 m, 26.08.1902 – Gar›ur, living material collected by author, 8.05.2000, fragmented, fertile.

Other material examined – MHNG INVE 25804, France, 47.18°N 5.45°W, 63 m, coll. 1886, with gonothecae – MHNG INVE25805, France, Roscoff, 24 m, coll. 21.7.1906 – MHNG INVE25807, France, Roscoff, coll. 6.5.1910, 3 cm plume with bicorned gonothecae – MHNG INVE25808, Roscoff, les cochons noirs, coll. Bedot 15.5.1910 – MHNG INVE25806, France, Golfe de Gascogne France, 63 m – MHNG INVE25439, Germany, North Sea, Jadebusen, coll. 30.4.75, fertile

Diagnosis – like *S. argentea*, but stem segments with 2 or more hydrocladia and 4-6 hydrothecae, hydrocladia usually directed sideways, colony 10-60 cm.

Remarks – see *S. argentea*.

Distribution – northern boreal to arctic, owing to the frequent lumping or confusion of this species with *S. argentea*, no precise distribution data can be given. For more details see Cornelius (1995b).

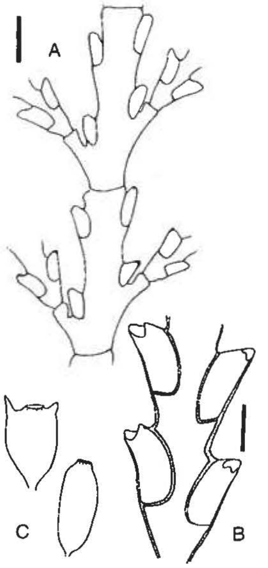

Figure 88. Sertularia cupressina *Linnaeus, 1758. A, two segments of stem, each with two hydrocladia, Iceland 63.50°N 20.23°W, scale bar 0.5 mm. B, part of hydrocladium, same specimen as in A, scale bar 0.2 mm. C, gonothecae, North Sea, two gonothecae from the same hydrocladium, note variability of shape, same scale as A.*

***Sertularia fabricii* Levinsen, 1893**

(Fig. 89A-D)

Sertularia fabricii Levinsen, 1893: 48, pl. 6 figs 14-17; Calkins 1899: 361, pl. 5 fig. 24; Kramp 1914: 1044; in part Broch 1918: 130, fig. 69-70; Kramp 1932b: 13; Kramp 1938: 52; Calder 1970: 1532, pl. 7 fig. 2.

Thuiaria fabricii – Nutting 1901: 185, pl. 24 figs 4-5; Nutting 1904: 71, pl. 12 figs 1-2.

Type localities – Store Hellefiskebanke, Godthaab, Julianehaab (all Greenland).

Type material examined – ZMUC, Julianehaab, 10 cm shoot with most hydrocladia broken off except for a region towards the end bearing very dense hydrocladia, with numerous gonothecae, may be shoot depicted by Levinsen (1893).

Material Greenland – ZMUC, Godthaabsfjord, Greenland, "Tialfe" station 52, 293 m, coll. 15.6.1908, described by Kramp (1914) as *Sertularia fabricii*, gonothecae without horns – Bank. unders. stations 5303 – 5306 – "Kangamiut" stations 1 – 6 – "Kap Farvel" station 58 – ZMUC, 66.62°N 56.50°W, 335-360, 3.08.1975 – ZMUC, Godthaab, Hovedstation, 100 m, 25.07.1955, gonothecae with long horns, looks exactly like type material.

Material Iceland – ZMUC, mouth of Berufjord, 77-102 m, material of Broch (1918) – BIOICE stations 2327, identification uncertain – 2360, identification uncertain – 2377, with gonothecae lacking horns, id. uncertain.

Description – colonies with shoots up to 10 cm high, stems monosiphonic, zigzag, rather rigid, hydrocladia arranged spirally, basal hydrocladia broken off leaving only basal stumps. Stem divided by regular transverse nodes, segments short, each segment at proximal end with an apophyis for the attachment of a hydrocladium and three hydrothecae, one axially and two distally placed ones. Hydrocladia ramified several times, nodes present only occasionally. Hydrothecae held horizontally, hydrotheca of one branch all in same plane, not or only slightly displaced towards one side. Hydrotheca elongated, 0.4-0.5 mm in abcauline length, vasiform in frontal view, vasiform to tubular in side view, adcauline side adnate for 3/4-1/1 of its length, walls either straight or somewhat curved, hydrothecal margin with two distinct lateral teeth. Operculum composed of two adcauline valves of similar size, often multiplied. Gonothecae on branches, about 1.2 mm long, oblong, more or less flattened, distal end bearing a small neck ending in circular opening, inside of opening shallow denticles, one to two long horns flanking aperture, can be as long as 1/2 length of gonotheca body, but can also be absent.

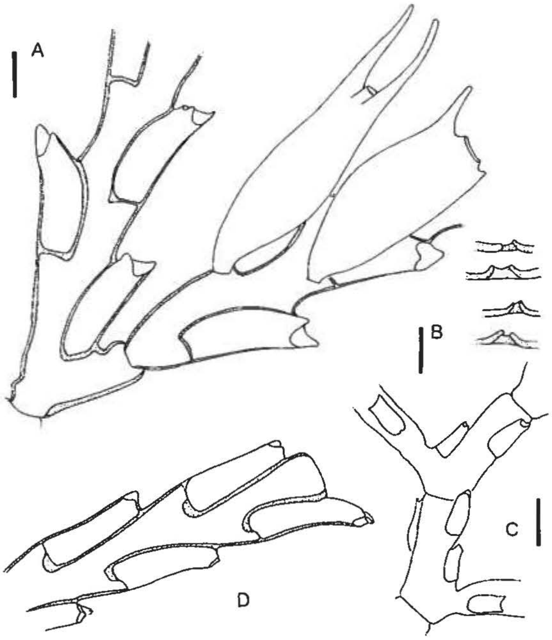

Figure 89. Sertularia fabricii *Levinsen, 1893; A-B type specimen, C-D Kangaamiut, Greenland. A, part of hydrocladium with branching point and two gonothecae, note long horns, scale bar 0.2 mm. B, series of hydropores in frontal view, note variability, scale bar 50 µm. C, two segments of stem, scale bar 0.5 mm. D, part of hydrocladium, note almost adnate hydrothecae, same scale as A.*

Remarks – the present material was allocated to *Sertularia fabricii* largely based on comparisons with the type material and some material identified Broch and Kramp (see material examined). However, some of the specimens described by Broch (1918) as *S. fabricii* proved to be *A. pulchra* (see there).

Sertularia fabricii is difficult to separate from *S. argentea* and they are perhaps conspecific. Although the type material is quite distinct from typical *S. argentea*, intermediate forms exist. Based on the material examined, the differences of *S. fabricii* to *S. argentea* are: the thick stem, the general more robust appearance, the larger, less curved and more adnate hydrothecae (size 0.4-0.5 mm versus 0.25-0.30 mm), and in particular the longer horns of the gonothecae (comp. Figs 87 and 89). However, these horns may be absent like in other *Sertularia* species. Some samples had their hydrothecae almost completely adnate (Fig. 89D). These samples were rather distinct from *S. argentea* and readily separable. The type material showed considerable variation of this character, but some hydrothecae are almost completely adnate (see also Broch 1918: fig. 69). Also Calder (1970) observed nearly completely adnate hydrothecae for this species. If present, the horns of the gonothecae offer the best character for distinguishing the two species.

Broch (1918) distinguished *S. fabricii* from *S. argentea* through the direction of the spirals of the hydrocladia. Broch's material, however, included also *A. pulchra* and I found that the coiling direction is unreliable. In some colonies the direction is not unambiguously identifiable and even seems to change within the colony (notably also the type of *S. fabricii*).

Naumov (1969) and Vervoort (1972) considered *S. fabricii* conspecific with *Sertularia robusta* (Clark, 1877). *Sertularia robusta* is characterised by a hydropore drawn into a long cone (Clark describes it as a double pointed pyramid). An elevated hydropore was also frequently found in the type specimen of *S. fabricii* (Fig. 89B), but it was rather variable and it's taxonomic value remains unclear. If such an elevated pore is present, it can help to distinguish the material from *S. argentea*, which never has such elevated hydropores. Calder (1970) kept *S. fabricii* and *S. robusta* distinct, although it is not entirely clear why he did so. I think it is preferable to keep them separate until a thorough study of intact and fully mature colonies allows a comparison of them.

Distribution – northern Canada, western Greenland, eastern Iceland, Jan Mayen, Kara Sea, Alaska, Puget sound.

Sertularia mirabilis (Verrill, 1873)
(Fig. 90A-E)
Diphasia mirabilis Verrill, 1873: 9.
Sertularia mirabilis – Levinsen 1893: 49; Broch 1909b: 173, fig. 29, pl. 3 fig. 10; Kramp 1914: 1045; Broch 1918: 133, fig. 72; Kramp 1932b: 13; Kramp 1938: 53; Naumov 1969: 394, fig. 257, pl. 8 fig. 1; Calder 1970: 1532, pl. 7 fig. 3.
Selaginopsis mirabilis – Nutting 1904: 128, pl. 38 figs 11-12.
Polyserias hincksii Mereschkowsky, 1877: 226, pl. 6 figs 15-16.

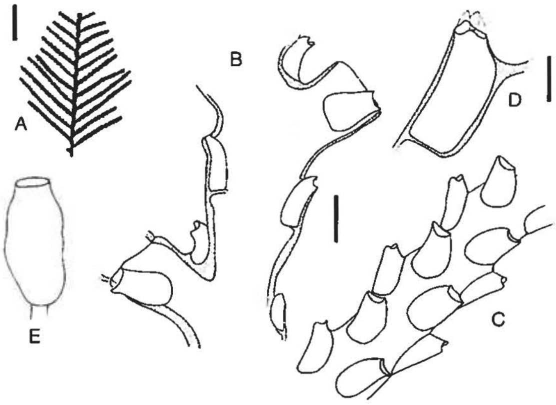

Figure 90. Sertularia mirabilis *(Verrill, 1873); BIOICE 2001. A, silhouette of part of a plume, bar equals 1 cm. B, part of stem with two apophyses, scale bar 0.5 mm. C, part of hydrocladium, same scale as B. D, hydrotheca, scale bar 0.2 mm. E, gonotheca, same scale as B.*

Type locality – Le Havre Bank, Nova Scotia, Canada.

Material Greenland – Bank. unders. stations 53 – 5292 – 5293 – 5294, fertile – 5294 – 5294 – 5297 – 5297 – 5297 – 5297 – 5299 – 5312 – 5312– "Kap Farvel" stations 1, fertile – 62 – 112, fertile – 148, fertile – "Littoral" stations 12 – 42 – Just & Vibe 1968 stations 20 – 26 – ZMUC, 67.08°N 54.75°W, 70 m, 12.08.1975 – ZMUC, 66.72°N 54.22°W, 150-300 m, 12.07.1966 – ZMUC, 67.08°N 54.75°W, 70 m, 12.08.1975.

Material Iceland – ZMUC, Hellefiskebanke, det. Levinsen, with gonotheca – BIOICE stations 2001, fertile – 2528 – 2530.

Description – colonies forming stiff, 5-15 cm high plumes (max. 25 cm acc. Naumov 1969). Stem geniculate, coarse, flattened, with hydrocladia on lateral sides in same plane. Hydrothecae of stem along lateral sides, 3 between two successive hydrocladia of one side, segmentation mostly absent, with massive apophysis for hydrocladia. Apophysis with two hydrothecae, one on front, one on back side. Hydrocladia straight, all at same angle to stem (about 60°), unbranched, thick, thickness even along length, ends blunt, cross-section rounded, with 6 longitudinal rows of hydrothecae. Hydrothecae about 0.5 mm deep, 2/3 adnate, adcauline side curved, margin with two lateral teeth, teeth of moderate height, hydrothecal opening with an operculum of two valves (often absent, damaged or distorted). Gonothecae on hydrocladia, oval, approx. 1.2 mm in length, end truncate, cross-section circular, on thick peduncle.

REMARKS – this very robust species with its toothed hydrothecae in six or four rows is very distinctive. The present material had an operculum of two valves just like described by Nutting (1904) and Calder (1970). It was therefore placed in the genus *Sertularia* and not *Thuiaria* as done by Peña-Cantero, Svoboda & Vervoort (1997). The opercula, however, are often damaged or irregular.

DISTRIBUTION – northern Canada, western Greenland, eastern and western Iceland, Spitsbergen, Barents Sea, White Sea, Kara Sea, Sea of Japan, Bering Sea, Alaska. Saemundsson (1902) reported this species for a single locality in the north-west of Iceland. The new records are again from this region, but additionally also from the east coast.

***Sertularia schmidti* Kudelin, 1914**
(Fig. 91A-C)
Sertularia schmidti Kudelin, 1914: 191, figs 39-40; Naumov 1969: 382, fig 245; Calder 1970: 1533, pl. 7 figs 7-9.
TYPE LOCALITY – Solovetskie Islands, White Sea.
GREENLAND MATERIAL – Bank. unders. stations 5298, fertile – 5299 – "Kap Farvel" stations 11, fertile – 14 – 21, fertile female with acrocysts – 54 – 55, fertile – 112, fertile – 148, labelled as *S. similis*, fertile.

DESCRIPTION – colony forming 1-2.5 cm high pinnate stems, monosiphonic, soft, flexible, profuse colonies form a tangled mass. Hydrocaulus monosiphonic, about 0.15 mm in diameter, stem only slightly thicker than branches, distinctly geniculate, regularly segmented by distinct nodes. Cauline segments having a proximal, long, thin apophysis with an axillary hydrotheca and 2 distally placed subopposite hydrothecae. Hydrocladia given off alternately from opposite sides of hydrocaulus at an angle of 60° with the main axis, can be relatively long (1.5 cm). Hydrocladia in one plane, broad side of branches vertical, thus all hydrothecae in plane of ramification. Hydrocladia with occasional nodes, 0-4 shorter secondary branches. Hydrothecae subopposite, curved outward, slender, diameter distinctly narrowing towards distal, abcauline wall concave, length 0.25-0.30 mm, adcauline side adnate for not more than half of its length, free part straight to slightly concave. Margin with two distinct lateral teeth. Gonothecae obovate, 0.5-0.6 mm long, with recurved pedicel, arising near the base of the hydrothecae, walls smooth, aperture terminal, circular, on a small neck, well developed marginal teeth along inside of aperture. Planulae brooded in acrocyst exterior to gonotheca.

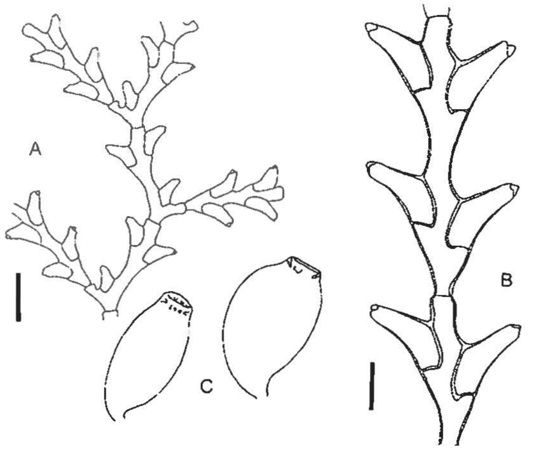

Figure 91. Sertularia schmidti *Kudelin, 1914; "Kap Farvel" station 112. A, part of hydrocaulus with parts of hydrocladia, scale bar 0.5 mm. B, Hydrocladium, scale bar 0.2 mm. C, two gonothecae, same scale as B.

Remarks – the identification of these hydroids as *S. schmidti* were largely influenced by Calder (1970) and our material is certainly identical. However, whether it really belongs to *S. schmidti* is somewhat uncertain as the first description was based on very little, infertile material. Material from the north-eastern Atlantic mostly lacks the slight upward bent of the distal part of the hydrotheca as depicted in Kudelin (1914) and Naumov (1969).

Sertularia schmidti can most easily be confused with *S. similis*. However, although otherwise the differences are mostly confined to a size difference of all aspects, the colonies of them have a strikingly different appearance. *Sertularia schmidti* forms small, delicate plumes that are flexible and tend to form tangled masses in profuse colonies. *Sertularia similis* plumes are stiff and are about two times larger. At the microscopic level, all proportions of *S. schmidti* are distinctly smaller and more gracile (comp. Figs 91 and 92, magnifications correspond). The hydrocaulus of *S. schmidti* is only about half as thick, the hydrothecae distinctly smaller and more elongate, and the gonothecae are also only about half the size. The hydrothecae of *S. schmidti* are also less adnate, reaching the condition seen in *S. tenera*. The latter species, however, has strictly alternate hydrothecae.

Distribution – White Sea, north-eastern Canada, south-western and southern Greenland (new record).

Sertularia similis* Clark, 1877

(Fig. 92A-D)

Sertularia similis Clark, 1877: 219, pl. 15 fig. 56; Naumov 1969: 384, fig. 247; Calder 1970: 1535, pl. 7 fig. 10; Schuchert 2000:428, fig. 11.

Thuiaria similis – Nutting 1904: 69, pl. 10 figs 7-9; ? Fraser 1944: 307 fig. 294.

Sertularia tubuliformis – Broch 1918: 132, fig. 71.

Sertularia cupressina – in part Broch 1918: 124, figs 65-66.

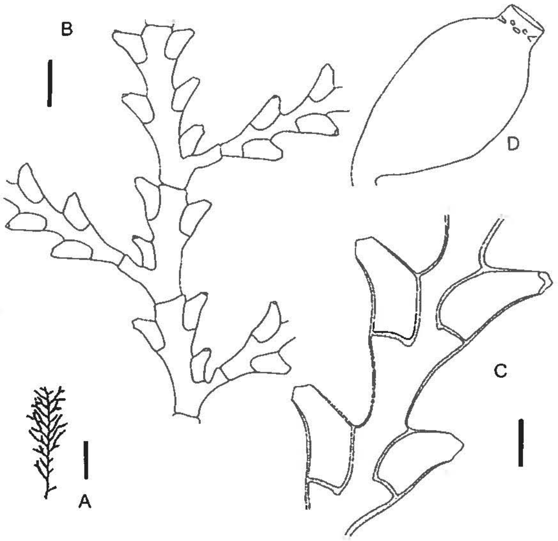

Figure 92. *Sertularia similis* (Clark, 1877). A, silhouette of shoot, BIOICE 2558, scale bar 1 cm. B, part of stem with parts of hydrocladia, BIOICE 2526, scale bar 0.5 mm. C, part of hydrocladium, BIOICE 2526, scale bar 0.2 mm. D, gonotheca, same colony and scale as in C.

[not *Sertularia cupressina* Linnaeus, 1758]

? *Sertularia tenera* – Ólafsson 1975: fig. 21.

Type locality – Hagmeister Island, Alaska.

Material Iceland – ZMUC, 65.85°N 23.97°W, 17.06.1904, 62 m, material identified by Broch (1918) as *S. cupressina* – BIOICE stations 2097 – 2480 – 2526, fertile – 2528 – 2533 – 2539 – 2540 – 2548 – 2558 – 2562.

Description – colony forming up to 4-7 cm high pinnate shoots, stiff. Hydrocaulus monosiphonic, about 0.3 mm in diameter, only slightly thicker than branches, geniculate to straight, regularly segmented by distinct nodes. Cauline segments having a proximal apophysis with an axillary hydrotheca and 2-5 distally placed subopposite hydrothecae. Hydrocladia given off alternately from opposite sides of hydrocaulus at an angle of 60° with the main axis. Hydrocladia in one plane, broad side of branches vertical, thus all hydrothecae in plane of ramification. Hydrocladia with occasional nodes, unbranched or branched. Hydrothecae subopposite, curved outward, diameter narrowing towards distal, abcauline wall straight or concave, length 0.3-0.4 mm, adcauline side adnate for half or more of its length. Margin with two distinct lateral teeth. Gonothecae obovate, about 0.9 mm long, oval in cross-section, with recurved pedicel, arising near the base of the hydrothecae, walls smooth, aperture terminal, circular, on an distinct neck, well developed marginal teeth along inside of aperture.

Remarks – see discussion under *S. schmidti*. A colony previously identified by Broch (1918) as *S. cupressina* was here identified as *S. similis*. The fertile, pinnate colony was only 4.5 cm high and matched well the other samples of *S. similis*.

Distribution – northern Canada, northern and western Iceland, Sea of Okhotsk, Sea of Japan, Chucki Sea, Bering Sea, Alaska. Not known from Greenland, but may occur there.

Sertularia tenera G. O. Sars, 1874

(Fig. 93A-D)

Sertularia tenera G. O. Sars, 1874: 108, pl. 4 figs 1-4; Broch 1909b: 171, figs 27-28, pl. 2 fig. 5; Kramp 1914: 1042; Broch 1918: 126, figs 67-68; Kramp 1932b: 12; Kramp 1938: 53; Kramp 1943: 36; Naumov 1969: 382, fig. 244; Cornelius 1979: 301, fig. 27, synonymy; Cornelius 1995b: 91, fig. 22.

Sertularia arctica Allman, 1874: 179.

Dynamena unilateralis Bonnevie, 1899: 78, pl. 7 fig. 5.

Sertularia thompsoni Shidlovskii, 1902.

Thuiaria tenera – Jäderholm 1909: 93, pl. 10, figs 1-4.

Thuiaria arctica – Jäderholm 1908: 21, pl. 3 figs 14-20; Jäderholm 1909: 93, pl. 10 figs 5-13.

[not *Thuiaria arctica* (Bonnevie, 1899)]

Sertularia nasonovi Kudelin, 1914; Antsulevich, 1987: 74.

Type locality – Skudesnas, Norway.

Material Greenland – ZMUC, Ndr. Strømfjord, 200-240 m, material of Kramp (1914).

Material Iceland – BIOICE stations 2005 – 2006 – 2374 – 2360 – 2558 – 2873.

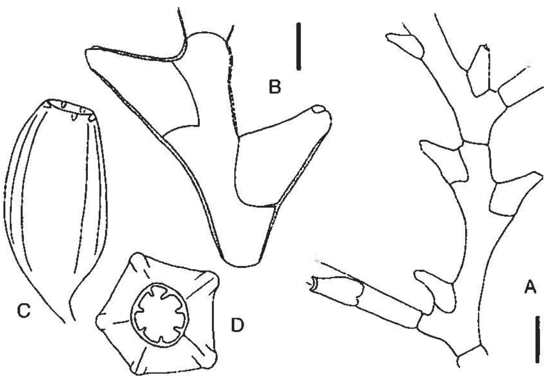

Figure 93. Sertularia tenera *G. O. Sars, 1874; Greenland, N. Strømfjord. A, part of stem, scale bar 0.5 mm. B, part of hydrocladium, scale bar 0.2 mm. C, gonotheca, same scale as B. D, gonotheca seen from distal end, same scale as B.*

Description – colonies erect, fully grown 10-15 cm, stem straight to flexuose, soft, unbranched, monosiphonic. Colony loosely alternate pinnate basally, sometimes loosely spiral distally, hydrocladia may be branching. Stem segmented by oblique nodes, each segment with an apophysis for the attachment of the hydrocladium just at its proximal end and three hydrothecae above apophysis. Hydrocladia with irregularly spaced nodes, segments with 2-6 hydrothecae. Hydrothecae about 0.5 mm deep, strictly alternate, widest in centre, narrowing much distally, adcauline wall adnate for less than half of its length, abcauline wall nearly straight or sometimes concave, margin with two lateral, rounded teeth, operculum formed of two flaps. Gonotheca ovoid, 0.8-0.9 mm long, aperture at truncate distal, aperture with 5-7 internal perisarc projections. Gonotheca may be polygonal in cross-section and have 4-6 longitudinal ridges. Gonotheca may also have a round cross-section and lack ridges.

Remarks – in the characters of its trophosome *Sertularia tenera* resembles *S. similis* and *S. schmidti*. Infertile *Sertularia tenera* can be distinguished by its hydrothecae that are strictly alternate and not subopposite as in *S. similis* or *S. schmidti* (comp. Figs 91-93). The gonothecae of *S. tenera* can be very distinctive with longitudinal ribs, resulting in a polygonal cross-section (Fig. 93C-D). Unfortunately, this is not a constant feature and smooth gonothecae are frequent. This character is variable even within one colony. For more details see Cornelius (1979, 1995b).

DISTRIBUTION – arctic and sub-arctic circumpolar, in depths of the continental shelf: Canada, western Greenland, all around Iceland, Faroes, Norway, Sweden, Skagerrak and Kattegat, arctic seas north of Russia, Sea of Japan, Bering Strait, Alaska (Naumov 1969, Cornelius 1995b). *Sertularia tenera* seems to be restricted to depths of less than 400 m.

Symplectoscyphus bathyalis **Vervoort, 1972** (Fig. 94A-E)

Sertularella amphorifera – Broch 1918: 100, fig. 53 [not *Sertularella amphorifera* Allman, 1877: 22, pl. 15 figs 8-10]

? *Symplectoscyphus amphoriferus* – Millard 1967: 182, fig. 4E-F.

Symplectoscyphus bathyalis Vervoort, 1972: 174, figs 58-59, 60a; Vervoort 1993: 242, figs 54f-h, 55a-b, 55 d, tab 45; Calder & Vervoort 1998: 43, fig. 21a-b; Medel & Vervoort 1998: 72, fig. 24a-b.

TYPE LOCALITY – Bay of Biscay, 48.07°N 9.38°W, 1828 m.

MATERIAL ICELAND – BIOICE 2341, fertile – ZMUC, as *Sertularella amphorifera*, "Ingolf" station 7, 63.22°N 14.68°W, 1130 m, coll. 17.5.1895; material described by Broch (1918: 100) – ZMUC, *Sertularella amphorifera*, "Ingolf" station 54, 63.13°N 15.67°W, 1301 m, with one gonotheca, material described by Broch (1918).

DESCRIPTION – colonies forming erect stems reaching 5 cm in height, sparingly branched, monosiphonic. Stem and branches distinctly geniculate except in most proximal part of stem, with very slender internodes and nodes of variable distinctness. Hydrothecae in one plane on opposite sides, alternate and far apart, large, deep, depth 0.65-0.85 mm, diameter 0.36-0.40 mm, cylindrical, standing well away from stem at an angle of about 60°, adcauline wall adnate for about 1/4 of its length, hydropore large and adjacent to abcauline wall, margin with three teeth (one adcauline, two laterals), often regenerated. Below hydrotheca often a circular mark (fenestra) closed by perisarcal membrane. Gonothecae arising below hydrothecae from fenestrae, 0.6-0.8 mm long, ovoid, tapering evenly to base, with a terminal aperture at the end of a tubular neck, body with five marked transverse folds, may be more pronounced on one side than on the other (Fig. 94D).

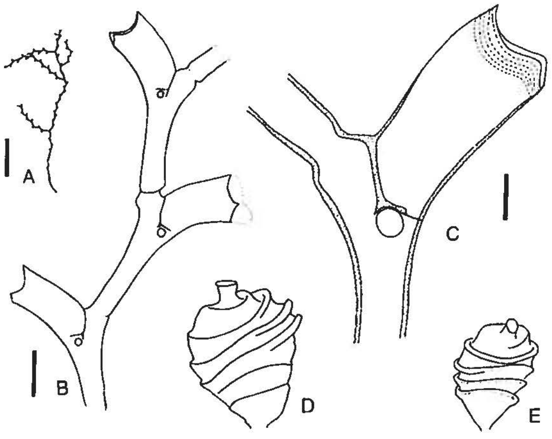

Figure 94. Symplectoscyphus bathyalis *Vervoort, 1972; A-D "Ingolf" station 54, E BIOICE 2341. A, colony, scale bar 10 mm. B, part of stem, scale bar 0.5 mm. C, hydrotheca with renovations, scale bar 0.2 mm. D-E, gonothecae, same scale as B.*

REMARKS – the larger size of its hydrotheca and the fenestrae makes *S. bathyalis* immediately distinguishable from the only congener of the region, *S. tricuspidatus*.

Material identified by Broch (1918) as *S. amphorifera* Allman, 1877 was re-examined for this study and it obviously belongs to *S. bathyalis* Vervoort, 1972 (see Fig. 94A-D). *Symplectoscyphus amphorifera* is not well known and the size of its hydrothecae were unknown. Re-examination of the type material of *S. amphorifera* (MCZ Harvard, leg. Allman) showed that it is quite different from *S. bathyalis* (Fig. 95): the hydrothecae

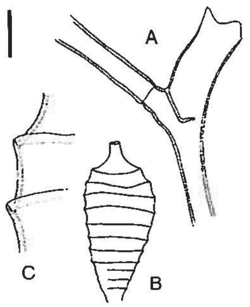

Figure 95. Symplectoscyphus amphoriferus *Allman, 1877; type material. A, hydrotheca, scale bar equals 0.2 mm, note size difference to Fig. 94C. B, gonotheca, scale bar equals 0.5 mm. C, higher magnification of gonothecal wall, scale bar 0.1 mm.*

are only about half the size and the gonothecae are more elongated. The name is indeed very appropriate as it refers to the gonotheca shaped like a Roman amphora (Fig. 95B). It also appears that there are no distinct fenestrae in *S. amphorifera*.

Distribution – deep Atlantic and Pacific waters, Bay of Biscay (1828 m, Vervoort 1972), off Mauritania (500-840 m, Medel & Vervoort 1998), Mid-Atlantic Ridge (1574-1622 m, Calder & Vervoort 1998), Chile (2657-2470 m, Vervoort 1972), New Caledonia (650-680 m, Vervoort 1993). At Iceland recorded off the south coast in a depth of 1015-1301 m. Not known from Greenland.

Symplectoscyphus tricuspidatus (Alder, 1856)

(Fig. 96A-B)

Sertularia tricuspidata Alder, 1856a: 356, pl. 13 figs 1-2.

Sertularia ericoides in part Pallas, 1766: 127.

? *Sertularella pallida* Marktanner-Turneretscher, 1895: 424, pl. 11 fig. 18, pl. 12 figs 2-4.

Sertularella tricuspidata – Hincks 1868: 239, fig. 30, pl. 47 fig. 1; Broch 1909b: 168, fig. 25; Kramp 1914: 1038; Broch 1918: 98, fig. 52; Kramp 1932b: 11; Kramp 1938: 42; Vervoort 1942: 292; Kramp 1943: 33; Naumov 1969: 376, fig. 240; Calder 1970: 1531, pl. 6 figs 7-8; Ólafsson 1975: 9, fig. 15.

Symplectoscyphus tricuspidatus – Cornelius 1979: 301, fig. 28, synonymy; Cornelius 1995b: 94, fig. 23; Hirohito 1995: 225, fig. 76a-g.

Type locality – Northumberland coast, England.

Material Greenland – Hoels 1025, fertile – Bank. unders. stations 22 – 5291 – 5293 – Bank. unders. 5294 - 5299 – "Grønland" 1975 stations 15 – 25 – 38, fertile – 58 – "Kangamiut" stations 4 – 6 – 8 – 9 – "Kap Farvel" stations 11 – 21 – 22 – 25 – 42 – 45 – 55, fertile – 58, fertile – 62 – 74 – 75, fertile – 82 – 87 – 91, fertile – 95 – 100 – 112, fertile – 117 – 128, fertile – 135, fertile – 138 – 148 – "Littoral" station 40 – Just & Vibe 1968 stations 29 – 35 – ZMUC, 66.00°N 56.12°W, 200-204 m, 1.08.1975 – ZMUC, 66.32°N 54.73°W, 98-124 m, 2.08.1975 – ZMUC, 60.16°N 44.16°W, 40-60, 12.08.1970, fertile – ZMUC, Holsteinsborg, 120-200 m, 19.07.1953, fertile – ZMUC, Godthaab, Hovedstation, 100 m, 25.07.1955, fertile.

Material Iceland – BIOICE stations 2000 – 2001 – 2002 – 2003, fertile – 2004 – 2006 – 2010 – 2011 – 2060 – 2062 – 2064 – 2067 – 2097 – 2099 – 2126 – 2142 – 2150 – 2152 – 2161 – 2185 – 2198 – 2207, fertile – 2313 – 2323 – 2327 – 2349 – 2360 – 2362 – 2364 – 2377 – 2379 – 2481 – 2484, fertile – 2490 – 2491, fertile – 2493 – 2495 – 2505 – 2506 – 2508 – 2509 – 2511 – 2512 – 2514 – 2520 – 2522 – 2524 – 2526 – 2527 – 2528 – 2530, fertile – 2533, fertile – 2539 – 2540 – 2556 – 2558 – 2559 – 2562 – 2564, fertile – 2573 – 2594 – 2595 – 2597 – 2682 – 2710, fertile – 2792 – 2821 – 2823 – 2824, fertile.

Description – colonies erect, 2-10 cm, large colonies tangled, stem and branches always monosiphonic, flexuose, hydrothecae borne at the bends, branching irregularly, secondary branching often present, branches and stem identical in structure, more or less regularly segmented by transverse to oblique nodes. Hydrothecae in two rows, alternating in direction. Hydrotheca 0.3-0.5 mm in depth, cylindrical, straight to slightly curved, adaxial side adnate for 1/3-2/3, aperture held oblique to segment axis (ca 60°), rim with 3 well

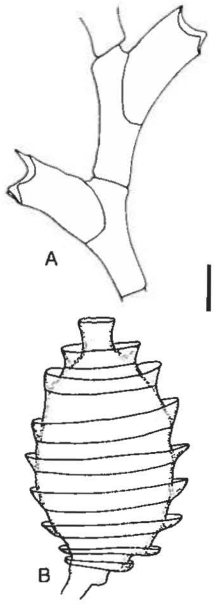

Figure 96. Symplectoscyphus tricuspidatus *(Alder, 1856). A, BIOICE 2710, two segments with hydrothecae, left hydro-theca renovated, scale bar 0.2 mm. B, gonotheca, same scale as A.*

formed cusps, round bays, operculum formed by three valves of similar size, renovations frequent. Gonotheca elongate oval, about 1 mm long, with 7-9 strongly exsert transverse folds, folds often inclined towards distal and thus forming distinct collars, aperture at distal end of gonotheca on tube, sometimes flaring.

DISTRIBUTION – circumpolar and widespread in arctic to boreal waters in both Atlantic and Pacific Oceans, northern limit at least 79.5°N, southern limit may have shifted towards north and it may not occur along the coast of the British Isles (Cornelius 1995b). Frequent all around Iceland, depth range 13-622 m, abundant also along eastern and western Greenland.

Tamarisca tamarisca (Linnaeus, 1758)

(Fig. 97)

Sertularia tamarisca Linnaeus, 1758: 808.

Sertularella tamarisca – Kramp 1914: 1041; Broch 1918: 96, fig. 51.

Sertomma tamarisca – Kramp 1938: 41.

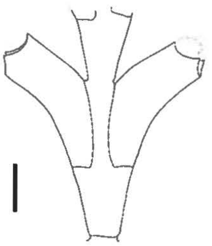

Figure 97. Tamarisca tamarisca *(Linnaeus, 1758); BIOICE 2824, pair of hydrothecae, scale bar 0.5 mm.*

Tamarisca tamarisca – Naumov 1969: 354, fig. 218; Cornelius 1979: 304, fig. 29; Cornelius 1995b: 98, fig. 24.

Diphasia tamarisca – Fraser 1944: 248, fig. 234.

TYPE LOCALITY – near Island of Dalkey, Dublin, Ireland (Cornelius 1979).

MATERIAL GREENLAND – Bank. unders. station 5306 – "Grønland" 1975 station. 25 – "Kangamiut" stations 10 – 6 – 6 – 9 – "Kap Farvel" station 115 – ZMUC, 66.00°N 56.12°W, 200-204 m, 1.8.1975 – ZMUC, 66.25°N 56.38°W, 187-190 m, 1.8.1975 – ZMUC, 66.53°N 56.32°W, 191-195 m, 3.8.1975.

MATERIAL ICELAND – BIOICE stations 2056, with male gonothecae – 2067 – 2099 – 2154 – 2168, with male gonothecae – 2180 – 2185 – 2207 – 2313 – 2314 – 2330 – 2346 – 2349, with male gonothecae – 2379 – 2493 – 2495 – 2501 – 2502 – 2505 – 2509 – 2514 – 2526 – 2528 – 2533 – 2562 – 2597 – 2710 – 2823 – 2824, with male gonothecae.

DESCRIPTION – colony erect, 4-15 cm, robust, monosiphonic throughout, branching in one plane, loosely pinnate to irregular, secondary branches present, branches alternate or opposite. Structure of stem and branches identical. Hydrothecae large, 1.1-1.3 mm deep, in opposite pairs, biseriate, tubular, outward curving, adaxial side about 1/2 adnate, rim 3-cusped, sometimes renovated, operculum 3-valved. Male gonotheca around 2.5 mm in length, drop-shaped, flattened, small aperture on distinct tubular neck. Female gonothecae not observed, according to Naumov (1969) up to 5 mm in length, at distal end three large sheet-like processes with lobed margin. The two larger processes inclined like a gabled roof and covering the third, smaller process.

DISTRIBUTION – north Atlantic Ocean, from Barents and White Seas along European coasts south to Brittany (France). Absent from Belgian and Dutch coasts and the Mediterranean. Along the western Atlantic from Davis Street south to New England (Cornelius 1995b). Occurs all around Iceland, from Greenland only reported from the west coast, but it is likely to occur along the east coast too.

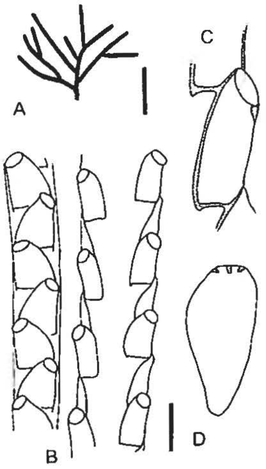

Figure 98. Thuiaria alternitheca *Levinsen, 1893; "Kangamiut" station 5. A, silhouette of a hydrocladium, scale bar 12.5 mm. B, parts of hydrocladia seen from narrow side (left) and broad side (right), scale bar 0.5 mm. C, hydrotheca, scale bar 0.2 mm. D, gonotheca, same scale as B.*

***Thuiaria alternitheca* Levinsen, 1893**
(Fig. 98A-D)
Thuiaria alternitheca Levinsen, 1893: 52, pl. 7 figs 15-20; Jäderholm 1909: 96, pl. 10 fig. 18; Kramp 1914: 1050; Broch 1918: 143, fig. 78; Kramp 1932b: 13; Kramp 1938: 57; Naumov 1969: 455, figs 49B & 309, pl. 12 fig. 6; Calder 1970: 1536, pl. 8 fig. 2; Ólafsson 1975: 10, fig. 23.
TYPE LOCALITY – Davis Strait, Greenland.
TYPE MATERIAL EXAMINED – ZMUC, leg. Levinsen.
MATERIAL GREENLAND – "Kangamiut" station 5, fertile.
MATERIAL ICELAND – BIOICE 2562, small fragment.

DESCRIPTION – colony erect, up to 12 cm, with helically arranged, horizontal, branching hydrocladia (bottle-brush like). Stem thick, unsegmented, with two rows of completely sunken hydrothecae, the two rows twisted helically. Hydrocladia spaced about 0.5 cm, length 3 cm, dichotomously branched up to 3rd order, without nodes, oval in cross-section, flat side held horizontally, relatively thick, hydrothecae arranged in two rows along narrow sides of hydrocladium, each one overlapping with following one, consecutive openings directed alternately to right and left (Fig. 98A). Hydrotheca 0.5 mm deep, almost completely sunken, opening circular, with perisarc thickening below abcauline side (Fig. 98C), operculum circular and attached to abcauline side of hydrothecal opening, opercula present in most distal hydrothecae only. Hydranth with abcauline caecum, epidermal lining of hydrotheca present. Gonothecae develop in rows on broad upper side of hydrocladia, 1.6 mm long, thickly club-shaped, with truncated end and occasionally very short neck, opening with four internal perisarc projections. One large embryo (1 mm) brooded outside gonotheca in acrocyst.

REMARKS – Cornelius (1979: 309) synonymised *Thuiaria alternitheca* Levinsen, 1893 with *T. articulata*. I cannot agree with this as *T. alternitheca* has branched hydrocladia like *T. thuja*, as well as consecutive hydrothecal openings pointing alternately to the left and right (Fig. 98B).

Peña Cantero, Svoboda & Vervoort (1997) have re-defined this genus. Their emendation is also adopted here (for a precise diagnosis see the cited study, otherwise use Cornelius 1995b). The genus *Selaginopsis* is accordingly no longer used. The changes, however, concern species outside the area under investigation.

Some *Thuiaria* species are difficult to distinguish. Table 6 summarises the important differences of the better known species.

Distribution – Davis Strait, Canada, western Greenland, western Iceland, Sea of Okhotsk.

***Thuiaria arctica* (Bonnevie, 1899)**
(Fig. 99A-D)
Selaginopsis arctica Bonnevie, 1899: 87, pl. 6 fig. 4; Broch 1910: 222, pl. 3 fig. 9.
[not *Sertularia arctica* Allman, 1874]
Thujaria variabilis Broch 1918: 145, new name; Kramp 1938: 58.
Thuiaria arctica – Saemundsson 1911: 94; Naumov 1969: 462, fig. 318.

Type locality – 74.57°N 19.52°E, off Spitsbergen, 38 m.

Material Iceland – ZMUC, as *Thuiaria variabilis*, Vattarnes, Rødefjord (Rey›arfjör›ur), 150 m, 10.08.1898, material of Saemundsson (1911) and Broch (1918).

Description – erect, pinnate colonies, up to 6 cm, stem branched, hydrocladia unbranched. Stem geniculate, divided into segments of irregular length, with hydrothecae in two lateral rows, in distal regions two double rows, about 2-4 hydrothecae between successive hydrocladia. Openings of stem hydrothecae sometimes directed alternately to front and rear. Origins of stem branchings tapering and with a few deep annulations (Fig. 99A). Hydrocladia alternate, thick, rounded cross section, normally with four longitudinal rows of hydrothecae, rows may

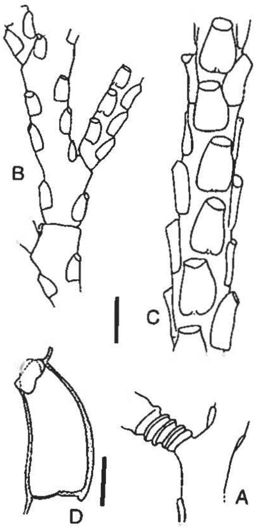

Figure 99. Thuiaria arctica *(Bonnevie, 1899); Iceland, Rey›arfjör›ur. A, branching point of stem, note strong annulation at base of side stem, scale bar equals 1 mm. B, more distal part of stem with bases of three hydrocladia, hydrocladium at right has only three rows of hydrothecae (one row invisible), scale bar 1 mm. C, hydrocladium with four rows of hydrothecae, note alternating directions of openings in successive hydrothecae of one row, scale bar 0.5 mm. D, hydrotheca in lateral view, note shallow lateral teeth and operculum, scale bar equals 0.2 mm.*

Table 6. Distinguishing characters of the better known Thuiaria *species.*

character	*T. alternitheca*	*T. arctica*	*T. articulata*	*T. carica*	*T. laxa*	*T. sachalini*	*T. thuja*
hydrocladia branched	yes	no	no	in mature animals	yes	no	yes
hydrothecal opening alternate direction	yes	slightly	no	no	no	yes	no
rows of hydrothecae	2	4	2	2	2	2	2
max. branch length [mm]	30	>10	>15	>10	30	15	<15
hydrothecae completely immersed	almost	almost	occasionally	no, relatively exsert	yes	yes	yes

be helical, often only three rows at proximal end of hydrocladium. Hydrocladial hydrothecae of one row have their openings slightly directed alternately left and right. Hydrothecae broadest at base, about 0.5 mm deep, almost completely sunken, not in contact with each other, free part less than 1/10 of length, margin smooth or with two shallow lateral teeth, one round opercular valve attached to outer side of hydrothecal margin, hydropore may be drawn into cone-shape. Gonothecae absent, according to Broch (1918) on upper side of hydrocladia, inversely conical, truncate end, no neck.

REMARKS – Broch (1918) proposed the new name *Thuiaria variablis* for this species to avoid possible confusion with *Sertularia arctica* Allman, 1874, a subjective synonym of *Sertularia tenera* G. O. Sars, 1874. Since generic concepts have changed meanwhile and no modern authors include *S. arctica* Allman, 1874 in the genus *Thuiaria*, the name of this species is here reverted to the one given by Bonnevie (1899).

Bonnevie (1899) gives the following description of the stem: "Both stem and branches bear hydrothecae, standing in 4 longitudinal rows (a few branches only 2)". This statement must be interpreted that also the stem has four rows. In his key to the arctic *Thuiaria* species Naumov (1969) separates *T. arctica* (as *T. variabilis*) from *T. hartlaubi* solely on account of the cauline hydrothecae in four rows in *T. arctica* and two rows in *T. hartlaubi*. Broch (1918), however, described *T. arctica* (as *T. variabilis*) with two rows along the stem. Re-examination of Broch's material proved that he was correct, only that successive hydrothecae of one row are very slightly displaced to alternate sides, exactly as found for the rows along the hydrocladia. I suspect that Bonnevie's description of four rows of hydrothecae along the stems was inaccurate as she was referring to the hydrocladia only. Unfortunately, it was not possible to examine type material of this species and clarify the situation. Re-examination of type material of both, *T. arctica* and *T. hartlaubi* is needed, as I suspect that they are conspecific (see also under *T. hartlaubi*). Pending such an examination, both are here kept separate. There are several other species that closely resemble this species and might prove to be conspecific: e. g. *Thuiaria cylindrica* Clark, 1877 and *Thuiaria plumiformis* (Nutting, 1904).

Due to the inadequate knowledge of all these species, above all on the degree of variation, the present material was left in the species it was placed in by Saemundsson (1911) and Broch (1918). Future revisions based on more material will have to investigate the problem in more depth.

DISTRIBUTION – Spitsbergen, eastern Iceland, Bear Island, Kola Peninsula. The Icelandic records were from Rey›arfjör›ur (east coast), depth 150 m (Saemundsson 1911). Not known from Greenland.

Thuiaria articulata (Pallas, 1766)

(Fig. 100A-C)

Sertularia articularia Pallas, 1766: 137.

Sertularia lichenastrum Linnaeus, 1758: 813, parts.

Sertularia lonchitis Ellis & Solander, 1786: 42, nom. nov. for *S. lichenastrum*.

Thuiaria articulata – in part Hincks 1868: 277, pl. 60; Naumov 1969: 440, figs 13D, 49A, 296, pl. 7 fig. 3; Cornelius 1995b: 102, fig. 25.

Thuiaria lonchitis – Broch 1909b: 1743, fig. 30; Kramp 1914: 1049; Broch 1918: 146; Kramp 1938: 58; Calder 1970: 1538, pl. 8 fig. 5.

Thuiaria barentsi Naumov, 1960: 409, fig. 297, pl. 9 fig. 2; Naumov 1969: 452, fig. 307, pl. 14 fig. 5; Cornelius 1979: 280, synonym.

Salacia articulata – Millard 1975: 273, fig. 89C-F; in part Cornelius 1979: 276, fig. 17, synonymy.

[not *Sertularia fusca* Johnston, 1847 = *Abietinaria fusca*]

TYPE LOCALITY – Lancashire, England (neotype, Cornelius 1979).

MATERIAL GREENLAND – ZMUC, Cape Farewell, >10 cm plume, hydrothecae flush.

MATERIAL ICELAND – BIOICE stations 2327, f = 0.25-0.39 – 2330, f = 0.64-1.0 – 2346, f = 0.23-0.58 – 2349, 2 colonies, f = 0.56-0.62 and 0.33-0.56 – 2350, f = 0.25-0.60 – 2526.

OTHER MATERIAL – MHNG INVE26089, Golfe de Gascogne, 180 m, coll. Bedot, campagne scientifique Hirondelle, 6 cm plume fragment, f = 0.24-0.39, rather typical.

DESCRIPTION – colonies erect, 10 cm and more, rigid, regularly pinnate. Stem thick, flattened, branches parallel, evenly spaced, opposite or alternate, inserted on short apophyses. Hydrothecae on stem and branches biseriate, consecutive ones separated from each other. Hydrotheca tubular, about 0.3-0.4 mm deep, outcurving, aperture nearly parallel to hydrocladial axis, adcauline wall almost completely adnate, free part never measuring more than one diameter of hydrotheca, abcauline wall variably thickened near opening, operculum circular, attached to abcauline side. Gonothecae not seen, according to Cornelius (1995b) 1.1-1.5 mm, obovate, truncated end.

REMARKS – *Thuiaria articulata* (Pallas, 1766) has a complicated taxonomic history, as many authors kept *T. articulata* and *T. lonchitis* distinct on account of opposite versus alternate arrangement of the hydrocladia. Cornelius (1979) reviewed the taxonomic history of these species and resolved their long dispute concerning a possible synonymy. Both are apparently objective synonyms. The arrangement of the hydrocladia is variable even within the same colony (own observations, see also plate 60 in Hincks 1868).

Cornelius (1979) erroneously synonymised *Abietinaria fusca* (Johnston, 1847) with *T. articulata*, but later separated them again (Cornelius 1995b).

The present Icelandic material was only tentatively assigned to this species, as the material was juvenile and differences to *T. carica* are not always so clear as asserted by Broch (1918). Broch kept both species separate on account of the branched hydrocladia in older colonies of *T. carica*, and on the length of the free part of the adcauline side of the hydrotheca. This trait (here termed f) is best given as the ratio of the length of the free part and the diameter of the hydrotheca. According to Broch (1918) and Naumov (1969) *T. articulata* has values below 1, while *T. carica* has values of 1 and above. However, the range of values observed in the present material of *T. articulata* and *T. carica* show no significant gap (see range of f values under material examined). Despite this, I am convinced that both species are valid and fully grown material is readily distinguishable. *Thuiaria articulata* has rather stiff hydrocladia and f values mostly below 0.8 (the neotype material has apparently a value of 0.8 according to the figure 25C given in Cornelius 1995b). *Thuiaria carica* has rather limp hydrocladia, these are branched in older colonies, and f values are consistently above 1. It is important to measure several hydrothecae to obtain a prevalent value. If at least some hydrothecae have values above 1, this is very indicative for *T. carica*. Colonies with branched hydrocladia are immediately identifiable as *T. carica*.

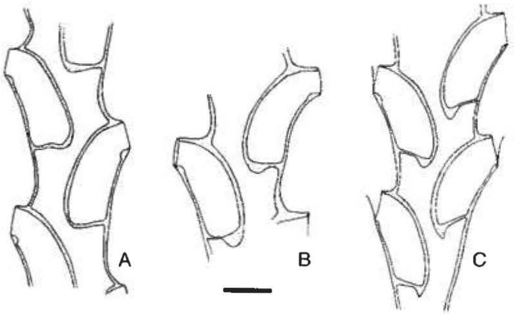

Figure 100. Thuiaria articulata *(Pallas, 1766); scale bar 0.2 mm. A, part of branch of material from Gulf of Gascogne. B, part of branch, BIOICE 2330. C, part of branch, BIOICE 2349.*

Broch (1918) mentions that both *T. articulata* and *T. carica* can have distal hydrocladia arranged in spirals. However, Naumov

(1969), Millard (1975) and Cornelius (1979) did not find such colonies and spiral arrangement must indeed be very rare.

Thuiaria articulata has also often been confused with juvenile *Thuiaria laxa* (Broch 1918, Kramp 1938). For the distinction of the two see remarks under the latter species.

DISTRIBUTION – widespread in northern and cooler waters of the Atlantic and Pacific Oceans. In Europe from arctic seas south to Brittany (Cornelius 1995b). Also known from cooler waters of the southern hemisphere (see Millard 1975). Kramp (1938) reported this species for Iceland for a few localities along the east, south and west coast. The present BIOICE material came from a restricted area between Iceland and the Faroes. It is here recorded for the first time for the southern tip of Greenland.

***Thuiaria carica* Levinsen, 1893**

(Fig. 101A-D)
Thujaria carica Levinsen, 1893: appendix, pl. 7 figs 26-29; Broch 1909b: 176, figs 32-33; Broch 1918: 148.
Thuiaria carica – Jäderholm 1908: 20, pl. 2 figs 21-22; Jäderholm 1909: 89, pl. 9 fig. 5; Kramp 1938: 59; Naumov 1969: 439, fig. 295; Calder 1970: 1537, pl. 8 fig. 3.
Thuiaria kirchenpaueri Marktanner-Turneretscher, 1895: 421, pl. 11 fig. 1, pl. 12 fig. 6; Broch 1909b: 176, synonym.
Thuiaria sp. aff. *distans* – Broch 1918: 148, fig. 79.
TYPE LOCALITY – Kara Sea, Russia.
TYPE MATERIAL EXAMINED – ZMUC, loc. Karahavet (Kara Sea), coll. August 1884, 2 plumes max. 14 cm, without gonothecae, f = 1.7-1.9.
MATERIAL ICELAND – BIOICE stations 2134, damaged plume 4 cm, f = 2.0-2.3 – 2273, detached branched hydrocladia, f = 1.7-2.1 – 2328, fragment – 2330, fragments, f = 0.9-1.7 – 2337, small plume 1 cm, f = 1.5-2.1 – 2360, fragments, f = 1.5-2.0 – 2556 – 2818, small fragments, f = 1.2-1.7 – 2823, fragments, id. uncertain – 2824, f = 0.8-1.6, fragments, juvenile, f = 1.0-1.4 – 2877 – 2880.

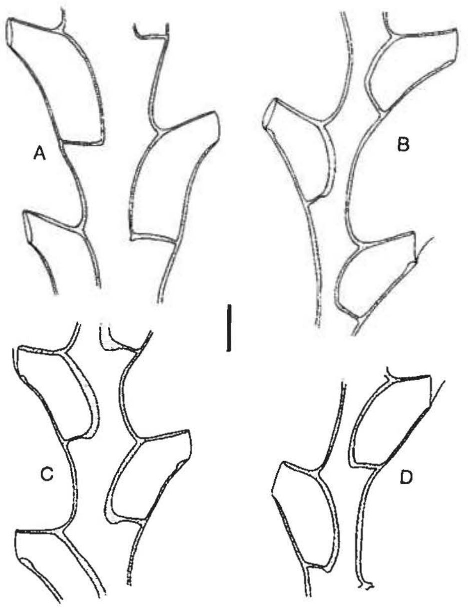

Figure 101. Thuiaria carica *Levinsen, 1893; scale bar 0.2 mm, valid for all sections. A, part of branch of type material. B, BIOICE 2337, variant with distantly spaced hydrothecae. C, BIOICE 2824. D, BIOICE 2824, other branch with relatively short free adcauline parts of hydrotheca.*

DESCRIPTION – pinnate colonies up to 14 cm (reportedly up to 20 cm). Stem with occasional nodes, hydrocladia alternate except for first one or two pairs. Hydrocladia in older colonies ramified and sometimes distal ones arranged spirally, few nodes present. Hydrothecae on stem and hydrocladia in two rows, alternately arranged, on upper and lower side of branches. Hydrothecae 0.4-0.6 mm deep, curved for 90°, opening parallel to axis of hydrocladium or nearly so, about 1/2 to 2/3 of adcauline side of fused to hydrocladium, adcauline side with more or less distinct bent where becoming free, length of free adcauline side exceeds diameter of opening, opening circular and even, with operculum fixed at abcauline side, abcauline side of hydrotheca concave, with thickening near opening. Hydranth with abcauline caecum. Gonothecae not observed, after Naumov (1969) oblong-oval, about 1.2 mm, attached below hydrothecae, lower end tapering into stalk, distal aperture on short neck, circular, with denticles on inside.

REMARKS – although the microscopic morphology of the BIOICE material matched very well the descriptions given by other authors, all samples were either small colonies or fragments only. This makes the identifications somewhat uncertain. The identifications relied mainly on the characteristically exsert hydrotheca, the free part of which is longer than the diameter of the opening of the hydrotheca (f value). But some few hydrothecae had f values near 1 and approached thus the condition seen in *T. articulata.* For the distinction of the two species see discussion under *T. articulata.*

Broch (1918) named some Icelandic material as *Thuiaria* sp. aff. *distans.* It closely resembled *T. articulata,* but had its hydrothecae more widely spaced. Such material was also found during the present investigation (see Fig. B, BIOICE 2337). However, the spacing of the hydrothecae is quite variable even within the same colony and encompasses the typical spacing as seen in Fig. 101A and the one depicted in Fig. 101B. I therefore think that Broch's material of *Thuiaria* sp. aff. *distans* belongs to *T. carica.*

DISTRIBUTION – all arctic seas north of Russia, Spitsbergen, Faroe Islands, all around Iceland, Hudson Bay (eastern Canada), and British Columbia (western Canada). The BIOICE samples came from all around Iceland, although few from the west and east. Four localities were from halfway between Iceland and the Faroes. The depth range was astonishingly broad encompassing 20-1102 m. It is unknown from Greenland, but might well occur there.

Thuiaria hartlaubi (Nutting, 1904)

Selaginopsis hartlaubi Nutting, 1904: 133, pl. 40, fig. 8; Jäderholm 1909: pl. 11 fig. 16; Ritchie 1912: 220, figs 1-2; Fraser 1937: 144, fig. 168.

Thuiaria hartlaubi – Naumov 1969: 460, figs 49D, 314, pl. 19 fig. 2.

TYPE LOCALITY – 56.67°N 169.33°W, 79 m, Aleutian Islands (Nutting 1904).

DESCRIPTION – see Ritchie (1912) or Nutting (1904).

REMARKS – no material of this species could be obtained for examination. *Thuiaria hartlaubi* is characterised by pinnately arranged, unbranched hydrocladia with four rows of hydrothecae. The hydrothecae of each row are inclined alternately to the right and left. It may be conspecific with *T. arctica* (Bonnevie, 1899) and *T. cylindrica* Clark, 1877. For further discussions see under *T. arctica.* The material depicted by Ritchie (1912) differed only minimally from the material identified by Saemundsson (1911) , Broch (1918), and myself as *T. arctica* (Bonnevie, 1899). The only difference is the alternate displacement of the hydrothecae within a single row. In the material of Ritchie they appear more displaced, while they are only slightly displaced in Saemundsson's material (see Fig. 99C). I am quite convinced that Saemundsson's and Ritchie's specimens belong to the same species.

DISTRIBUTION – Kurile Island, San Juan Archipelago, Kurile Islands, Bering Sea, Tartar Strait, Kola Peninsula, Iceland (Ritchie 1912, Fraser 1937, Naumov 1969). The Icelandic locality is not precisely known. Ritchie (1912) recorded it from "neighbourhood of Iceland", which is probably east of Iceland. This is apparently the only Atlantic record for this species, the nearest other locality being the Kola Peninsula (Jäderholm 1909).

Thuiaria laxa Allman, 1874

(Fig. 102A-C)

Thuiaria laxa Allman, 1874: 472, pl. 65 figs 1 & 1a; Broch 1909b: 175, fig. 31; Broch 1918: 142, fig. 77; Kramp 1938: 56; Vervoort 1942: 299; Kramp 1943: 37; Naumov 1969: 449, figs 16F, 46M, 304, pl. 11 fig. 3.

Thuiaria lonchitis – Marktanner-Turneretscher 1890: 236; Marktanner-Turneretscher 1895: 422.
Thujaria hjorti Broch, 1903: 7, pl. 3 figs 11-14; Jäderholm 1909: 89, pl. 9 figs 1-2;
Thuiaria immersa Nutting, 1904: 66, pl. 9 figs 3-4.
Dymella laxa – Vervoort 1972: 189, figs 63-64.
TYPE LOCALITIES – 60.35°N 03.73°W, 1171 m and 60.42°N 08.17°W, 210 m.
MATERIAL GREENLAND – "Grønland" 1975 stations 38 – 55 – "Kangamiut" stations 2 – 3 – "Kap Farvel" stations 117 – 128 – 132 – 136 – ZMUC, 66.00°N 56.12°W, 200-204 m, 1.08.1975.
MATERIAL ICELAND – BIOICE stations 2094 – 2344 – 2356 – 2360 – 2524 – ZMUC, "Ingolf" station 87, 65.03°N 23.93°W, 207 m, coll. 23.6.1896, 4 cormoids, branched hydrocladia present, described by Broch (1918) – ZMUC, "Ingolf" station 15, 66.30°N 25.98°W, 621 m, coll. 4.6.1895, described by Broch (1918), could as well be *T. articulata*.

DESCRIPTION – colonies 5-12 cm (reportedly up to 22 cm), pinnate in lower parts, spirally arranged hydrocladia in distal part, in older colonies pinnate part often absent. In the pinnate portion, the broad plane of the branches is vertical, in the spiral part horizontal. Stem with two opposite rows of hydrothecae, about 4-5 hydrothecae between two successive branches on the same side. Branches are only occasionally segmented. The distal hydrocladia are fan-shaped, dichotomously branched, flexible and comparatively long (2-3 cm). The hydrothecae are set alternately in two rows on the narrow sides of the hydrocladia, entirely embedded or a very small part of the adcauline wall free, never more than half the opening diameter, interval between two successive hydrothecae of the same row about equal or more than the opening diameter. Hydrothecal opening round, without teeth, the abcauline operculum often lost. The hydranth has an abcauline caecum. Male gonothecae are club-shaped with a truncated end, female ones more rounded, without neck. Planulae are brooded in an acrocyst.

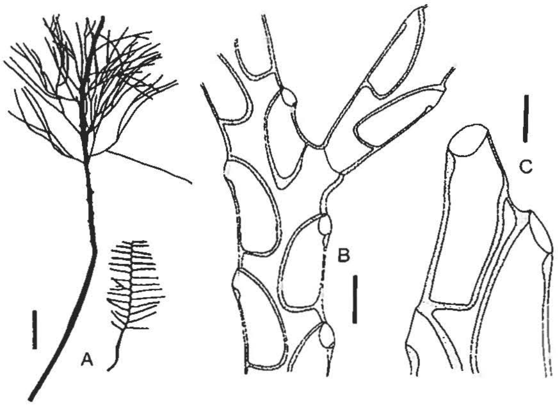

Figure 102. Thuiaria laxa *Allman, 1874. A, BIOICE 2524, parts of colonies, left old one, right juvenile with beginning branching of hydrocladia, scale bar 1 cm. B, branching point of a hydrocladium, "Ingolf" station 87, scale bar 0.2 mm. C, terminal hydrotheca of hydrocladium, "Ingolf" station 87, scale bar 0.1 mm.*

REMARKS – young colonies of *T. laxa* (up to 5 cm, see Fig. 102A) are pinnate and resemble *T. articulata*. *Thuiaria laxa* differs from *T. articulata* by having its hydrothecae completely immersed and the hydrocladia become branched in older specimens.

The fully grown colony of *Thuiaria laxa* has distal hydrocladia arranged and branched like *T. thuja*. The pinnately arranged hydrocladia may be lost at this stage. The microscopic structure of both, *T. laxa* and *T. thuja* is also identical. *Thuiaria laxa* differs from *T. thuja* by having longer and flexible hydrocladia (1 cm versus > 2 cm, comp Figs 102A and 104A), by having occasionally also a pinnate proximal part even in mature colonies (see Jäderholm 1909: pl. 9 fig. 1), and by terminal hydrothecae without lateral teeth (comp. Figs 102C and 104C). The last character, however, is not a reliable character to identify *T. thuja* (see there).

Young *Thuiaria laxa* or *T. thuja* have frequently been misidentified as *T. articulata* (Broch 1918). The free part of the hydrothecae (f value see above) of *T. articulata* is prone to variation and Cornelius (1979) depicts branches with completely flush hydrothecae.

Therefore, young pinnate colonies with flush hydrothecae and without an indication of branching cannot be identified reliably. A number of *Thuiaria* samples of the present collection were therefore not identified with a particular species. Also some specimens identified by Broch (1918) must be treated cautiously. Vervoort (1972) distinguished *T. laxa* from *T. articulata* by the presence of a perisarc swelling near the end of the abcauline side of the hydrotheca. He was probably influenced by Marktanner-Turneretscher (1890) who also made similar remarks. However, such a perisarc swelling is variable and it is frequently found in typical *T. articulata* too (see Fig. 100). Vervoort (1972) placed *T. laxa* in a separate genus *Dymella* because he could not find an abcauline caecum. This caecum is visible in contracted hydranths only and it is associated with a tissue strand that connects it to the abcauline wall of the hydrotheca. The caecum can be a rather difficult to observe because after or during collection the rapid disintegration of the tissue will obliterate its presence, as well as fixation will turn the tissue rather opaque. A good indicator of the caecum, however, is the presence of a thick tissue strand attaching it to the abcauline wall of the hydrotheca. Contrary to Vervoort's observation, the present samples of *T. laxa* had such an abcauline caecum, although visible for only some of the hydranths.

Distribution – Labrador, western and eastern Greenland, all around Iceland, Faroes, Shetland, Spitsbergen, arctic seas along northern Russia, Sea of Japan, Sea of Okhotsk.

***Thuiaria sachalini* Kudelin, 1914**

(Fig. 103A-C)

Thuiaria alternitheca f. *sachalini* Kudelin, 1914: 315.

Thuiaria sachalini – Naumov 1969: 453, fig. 308, pl. 14 fig. 4.

Type locality – Sakhalin Island.

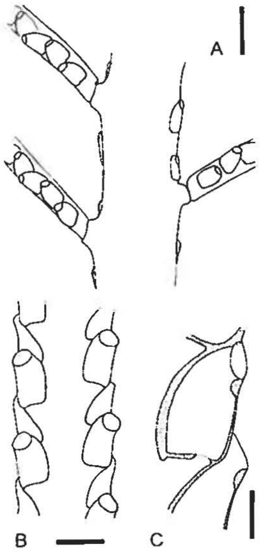

Figure 103. Thuiaria sachalini *Kudelin, 1914; western Greenland. A, part of stem with hydrocladia, scale bar 1 mm. B, part of hydrocladium seen from broad side, scale bar 0.5 mm. C, hydrotheca, scale bar 0.2 mm*

Material Greenland – "Grønland" 1975 station 24, one plume.

Description – colony pinnate, around 10 cm in height, with unbranched hydrocladia on two sides of stem, variably alternate or opposite. Stem straight, round, thick (1.6 mm diameter), with few transverse nodes, with two rows of completely immersed hydrothecae. Hydrocladia arise from short apophysis, between each pair of apophyses of one side 2, occasionally 3, hydrothecae. Hydrocladia short (15 mm), widely spaced (about 3 mm), straight, unbranched, oval in cross-section, flat side held horizontally, relatively thick, without nodes, hydrothecae arranged in two rows along narrow sides of hydrocladium, each one overlapping with following one, consecutive openings directed alternately to right and left (Fig. 103A). Hydrotheca 0.5 mm deep, completely adnate, opening circular, inclined relative to branch axis, with perisarc thickening below abcauline side (Fig. 103C). Hydranth with abcauline caecum, epidermal lining of hydrotheca present. Gonothecae not observed, according to Naumov (1969) 1 mm high, diameter 0.4 mm, oval, with truncated distal end.

Remarks – this is the first record of this species outside the Pacific and a new record for Greenland. It was previously known only from the north Pacific, where it is rather common according to Naumov (1969).

The microscopic structure of this species is identical to the one of *T. alternitheca* and I suspect that *T. sachalini* is only a pinnate form of *T. alternitheca*. Such a variation in colony structure is also known in other *Thuiaria species*, e. g. *T. laxa*. Kudelin (1914) described it initially as a form of *T. alternitheca*, while Naumov (1969) treats it as a full species. Naumov (1969) also mentions that occasionally the hydrocladia of *T. sachalini* can be branched once. I see this as further evidence that the *T. sachalini* might only be a form of *T. alternitheca*. New investigations based on more samples are needed.

Distribution – Sea of Okhotsk, Sea of Japan, Kurile Islands, western Greenland. Not known from Iceland.

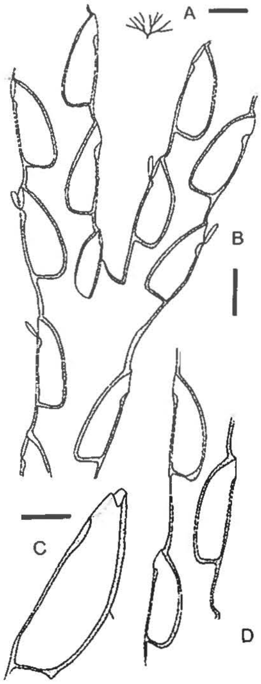

Figure 104. Thuiaria thuja *(Linnaeus, 1758). A, typical hydrocladium, BIOICE 2824, scale bar 1 cm. B, part of hydrocladium with branching point, BIOICE 2824, scale bar 0.2 mm. C, side-view of most distal hydrotheca of hydrocladium, BIOICE 2710, note margin with two lateral cusps, scale bar 0.1 mm. D, hydrocladium of sample identified by Kramp as* T. hippuris, *same scale as B.*

***Thuiaria thuja* (Linnaeus, 1758)**
(Fig. 104A-D)
Sertularia thuja Linnaeus, 1758: 809.
Thuiaria thuja – Hincks 1868: 275, pl. 59; Jäderholm 1909: 87, pl. 8 fig. 16; Kramp 1914: 1047; Broch 1918: 139, fig. 75; Kramp 1932b: 13; Kramp 1938: 54; Naumov 1969: 450, figs 13F, 305, pl. 13 figs 1-2; Calder 1970: 1538, pl. 8 fig. 6; Cornelius 1995b: 105, fig. 26.
Salacia thuja – Cornelius 1979: 280, fig. 19.
? *Thujaria hippuris* – Kramp 1914: 1048; Broch 1918: 141: fig. 76; Kramp 1932a: 47; Naumov 1969: 448, fig. 303, pl. 13 fig. 4.

Type locality – Scotland (Cornelius 1979).

Material Greenland – Bank. unders. station 2 – "Grønland" 1975 stations 25 – 38 – 54 – 55 – "Kangamiut" stations 10 – 3 – 4 – 5 – 8 – "Kap Farvel" stations 14 – 83 – 88 – 95 – 102 – 117 – 142 – ZMUC, 66.00°N 56.12°W, 200-204 m, 1.08.1975 – ZMUC, Strømfjord, June 1911 – ZMUC, 66.53°N 56.32°W,195-198 m, 3.08.1975 – ZMUC, 66.25°N 56.38°W, 187-190 m, 1.08.1975, fertile – ZMUC, 67.12°N 56.40°W, 200 m, 11.08.1975 – ZMUC, 66.53°N 56.32°N, 191-195 m, 3.08.1975, fertile – ZMUC, as *Thuiaria hippuris*, Greenland, "Godthaab" station 14, material of Kramp (1932a).

Material Iceland – BIOICE stations 2056 – 2002 – 2003 – 2004 – 2005 – 2006 – 2008 – 2097 – 2099 – 2126 – 2128 – 2136, fertile – 2142 – 2161 – 2168 – 2177 – 2185 – 2313 – 2327 – 2328 – 2331 – 2345, fertile – 2346 – 2348, fertile – 2349, fertile – 2351, fertile – 2359, fertile – 2360 – 2374 – 2377, fertile – 2379 – 2490 – 2491 – 2491 – 2493 – 2493 – 2495 – 2501 – 2506 – 2509 – 2512 – 2514 – 2514, fertile – 2520 – 2522 – 2524 – 2526 – 2527 – 2528 – 2530 – 2531 – 2533 – 2537 – 2540 – 2558 – 2562 – 2564 – 2568 – 2570 – 2579 – 2591 – 2592 – 2594 – 2597 – 2599 – 2610 – 2710 – 2823 – 2824.

DESCRIPTION – erect colonies, 5-12 cm, main stem unbranched, often zigzag, brown, often lacking branches (hydrocladia) in basal 1/3-3/4. Young colony pinnate (up 2 cm). In mature colonies branches all around the stem, in form of bottle brush, hydrocladial ramification horizontal, stem without nodes. Hydrocladia up to 1.5 cm long, branching dichotomously 3-4 times in one plane. Hydrothecae confined to hydrocladia, in two rows, alternate, entirely or nearly so sunken within branch, distance of consecutive hydrothecae in one row variable, either almost in contact or with space measuring up to 3/4 of hydrothecal length. Hydrotheca 0.3-0.4 mm deep, diameter 0.1-0.15 mm, cylindrical below, narrowing at top, adcauline wall curved in upper part, abcauline wall straight, opening parallel to branch axis, circular, with circular operculum attached to abcauline side, with perisarc thickening at upper and of abcauline wall. Gonotheca 0.8-1.2 mm long, ovate to club-shaped, aperture terminal, circular, acrocyst in female.

REMARKS – the "bottle-brush" hydroid is very distinctive, but many similar species have been described from Russian arctic waters (see Naumov 1969). A thorough revision is needed.

Broch (1905) found that some terminal hydrothecae of *T. thuja* have lateral teeth as in *Sertularia*. If present, these teeth are diagnostic for *T. thuja* (Fig. 104C). However, as not all terminal hydrothecae have it and they may be entirely absent in otherwise typical colonies, their absence is not diagnostic. For the distinction of the potentially similar *T. laxa* see the remarks under this species.

Another similar species is *Thuiaria hippuris* Allman, 1874, described from deeper waters off the Shetland Islands. It has reportedly more widely spaced hydrothecae which are slightly exserted. Otherwise it offers few traits that justify a separation from *T. thuja*. It has been found only rarely (see Naumov 1969). Kramp (1914) records it also from Greenland. Material allocated by Kramp (1932a) to this species was re-examined for this study (Fig. 104D). It has its hydrothecae somewhat wider spaced than usual (comp. Fig. 104B) and it has openings that are only slightly exsert or completely flush with the hydrocladium. These traits are well within the variation observed even within colonies of *T. thuja* and I regard this material without doubt as belonging to *T. thuja*. I also think that *T. hippuris* is conspecific with *T. thuja*, but as I have not examined the type material I refrain here from synonymising it.

DISTRIBUTION – circumpolar arctic to northern temperate. In Europe recorded from Portugal to the north of Scandinavia. Also present at Iceland (all coasts), western Greenland, northern Canada to New England, arctic seas north of Russia, Bering Sea, Alaska to Vancouver Island.

Family Halopterididae

Halopteris catharina (Johnston, 1833)

(Fig. 105A-B)

Plumularia catharina Johnston, 1833: 497, figs 61-62; Nutting, 1900: 60, pl. 3 figs 1-2; Jäderholm, 1909: 107, pl. 12 fig. 7; Broch, 1918: 56, figs 25-26.
Schizotricha catharina – Kramp 1938: 36.
Antennella catharina – Vervoort 1942: 300.
Halopteris catharina – Totton, 1930: 217; Vervoort, 1972: 236; Gili, Vervoort & Pages 1989: 83, fig. 12; Cornelius & Ryland, 1990: 152, fig. 4.23; Ramil & Vervoort, 1992a: 145, fig. 37e-g; Cornelius, 1995b: 126, fig. 29; Schuchert 1997: 107, fig. 38, synonymy.

TYPE LOCALITY – Great Britain.

MATERIAL ICELAND – BIOICE samples 2207 – 2818, fertile – 2823 – 2824.

DESCRIPTION – (in part after Schuchert 1997) colony forming plumes up to 4 cm high. Hydrocaulus monosiphonic, unbranched, with a basal part (1/4) devoid of hydrothecae and hydrocladia and a longer distal part bearing hydrothecae and hydrocladia. Basal part divided into segments by means of transverse nodes, last node oblique, each segment with a variable number of up to 11 frontal nematothecae in two longitudinal rows. Stem above basal part heteromerously segmented by well formed alternating oblique and transverse nodes. Each main segment of stem with an opposite pair of hydrocladia, only occasionally in more distal region one branch only and alternate. Main segments with a frontal hydrotheca and five nematothecae: one medial proximal, and two pairs of laterals. Intersegments with one to four nematothecae. Hydrocladia arise below stem hydrothecae on long apophysis, apophysis without nematothecae. First hydrocladial segment long, with two nematothecae on upper surface. Remaining part of hydrocladium segmented as described for hydrocaulus. Main segments similar to the ones of stem, intersegments with one to two nematothecae. Hydrotheca cup-shaped, about 0.1 mm deep, placed in the middle of segment, margin reaches distal end of segment, abcauline and adcauline walls straight in side view, converging towards proximal. Hydrotheca adnate for about half its length or slightly more. Rim of hydrotheca smooth, forming an angle of about 35 to 45° with hydrocladium. Nematothecae of stem and hydrocladia all two-chambered and movable. Lateral nematothecae in pairs, larger one on pedicel that is as long as nematotheca itself, shorter nematotheca at the base of pedicel, both nematothecae conical with lowered adcauline wall of upper chamber, wall straight. Nematothecae of intersegments and median inferior one similar to lateral ones. Gonothecae of both sexes on the same plume, developing on main segments below hydrotheca of stem and hydrocladia. Female gonotheca up to 1 mm long, slightly flattened cylinder, tapering near basal end, only slightly curved in basal region where there are also two nematothecae, terminal region truncated with a annular thickening and a lid, gonotheca sitting on a pedicel of two quadrangular segments. Male gonotheca smaller and slender, largest diameter in middle, tapering towards both ends, basally with two nematothecae, sitting on pedicel of one segment, occasionally a second indistinct one is present.

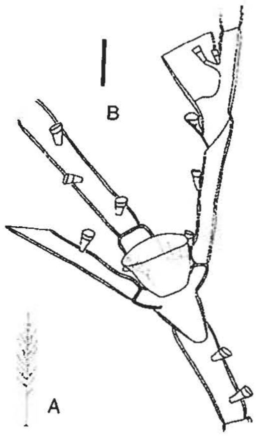

Figure 105. Halopteris catharina *(Johnston, 1833). Colony (modified after Schuchert 1997), scale bar 1 cm. B, BIOICE 2824, part of stem with bases of two opposite hydrocladia, note presence of two nematothecae at each side of the hydrotheca, scale bar 0.2 mm.*

REMARKS – although small and delicate, with its opposite hydrocladia it is a distinctive species that needs no further comments.

DISTRIBUTION – *Halopteris catharina* is widely distributed in the temperate and southern-boreal regions of the Atlantic including the Mediterranean, occurring on both the western and eastern sides of the Atlantic, reaching as far south as the Straits of Magellan, depth range down to 412 m (Gili *et al.* 1989; Ramil & Vervoort 1992a). Until now, there was only a single Icelandic record of this species (Saemundsson 1911). It came from close to the Vestmannaeyjar. The majority of the present samples also came from close to the south coast, but one additional sample was from Faxaflói (west coast). The depth range was 82-206 m. The species is not known to occur at Greenland.

Schizotricha frutescens **(Ellis & Solander, 1786)**
(Fig. 106A-D)
Sertularia frutescens Ellis & Solander, 1786: 55, pl. 6 figs a, A, pl. 9 fig. 1.
Plumularia frutescens – Kirchenpauer, 1876: 26, pl. 1 fig. 9, pl. 3 fig. 9;.
Schizotricha frutescens – Jäderholm, 1909: pl. 12 fig. 9; Kramp 1938: 36; Millard, 1975: 368; Cornelius & Ryland, 1990: 154, fig. 4.23; Ramil & Vervoort, 1992a: 150, fig. 38b-d; Schuchert 1997: 134; Peña Cantero & Vervoort 1999: 362.
Polyplumaria frutescens – Broch, 1918: 59, fig. 27; Cornelius, 1995b: 166, fig. 39.
? in part *Polyplumularia profunda* – Broch 1918: 59.

TYPE LOCALITY – Scarborough, U. K.

MATERIAL ICELAND – BIOICE sample 2463, 4 cm plume with unbranched stem, with gonothecae.

DESCRIPTION – colony forming erect plumes (3-15 cm acc. to Cornelius 1995b), stem polysiphonic for most of its length, composed of a superficial primary tube and accessory tubes. Accessory tubes unsegmented, with nematothecae, tubes gradually reduced in numbers towards distal. Primary tube with a longitudinal row of hydrothecae, each hydrotheca with lateral nematothecae, median inferior nematothecae displaced to base of hydrocladium. Hydrocladia alternate, arising below hydrothecae of primary tube, not separated from primary tube by node. Hydrocladia unbranched or branched once or twice, first side branch originates proximal to first hydrotheca. Hydrocladia segmented by occasional transverse nodes, each segment with 1-5 hydrothecae. Hydrothecae cup-shaped, 0.23-0.28 mm deep, adcauline wall completely adnate, rim smooth, opening perpendicular to hydrocladial axis. Three nematothecae associated with each hydrotheca: one median inferior at some distance below hydrothecal base and two laterals at or slightly below hydrothecal rim. Gonothecae develop on hydrocladia and stem between base of hydrotheca and inferior nematotheca, length about 1 mm, shape ovoid, tapering basally and there with a pair of nematothecae. Distal end truncate, with circular aperture closed by lid.

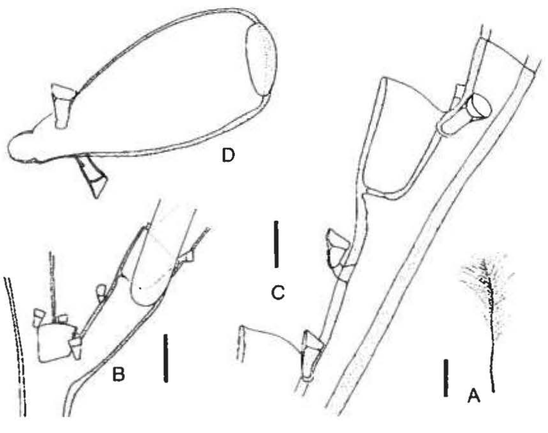

Figure 106. Schizotricha frutescens *(Ellis & Solander, 1786); BIOICE 2463. A, silhouette of colony, scale bar 1 cm. B, monosiphonic part of stem with hydrocladium which itself branches again, note absence of a node between stem and hydrocladium, scale bar 0.2 mm. C, part of hydrocladium, note absence of intersegments, scale bar 0.1 mm. D, gonotheca, same scale as B.*

REMARKS – *Schizotricha frutescens* is well characterised and readily distinguished from other species of the genus by the absence of a node between the stem and the hydrocladium (Fig. 106B). All species of the genus *Schizotricha* have recently been reviewed by Peña Cantero & Vervoort (1999). Contrary to the opinion of Peña Cantero & Vervoort (1999), even mature colonies of *Schizotricha frutescens* do not always have branched stems. Cornelius (1995b) even states that the stems are branched in some colonies only.

DISTRIBUTION – north-eastern part of Atlantic Ocean, from off Swedish coasts, eastern and southern Iceland, south to Morocco and the Mediterranean (Peña Cantero & Vervoort 1999). Not known from Greenland.

Schizotricha variabilis **(Bonnevie, 1899)**
Plumularia variabilis Bonnevie, 1899: 91, pl. 7 fig. 3

? in part *Polyplumaria profunda* – Broch, 1918: 60, fig. 24; Kramp 1938: 37.
Schizotricha variabilis – Naumov 1969: 507, fig. 357; Schuchert 1997: 136; Peña Cantero & Vervoort 1999: 373, fig. 4, table 3.
TYPE LOCALITY – 72.45°N 20.85°E, 349 m, north of Norway (Peña Cantero & Vervoort 1999).

DESCRIPTION – see Peña Cantero & Vervoort (1999).

REMARKS – *Schizotricha variablis* differs from the previous *S. frutescens* by having hydrocladia with regular nodes delimiting segments with one hydrotheca. Peña Cantero & Vervoort (1999) re-described *Schizotricha variabilis* (Bonnevie, 1899) and they also referred Icelandic material identified by Broch (1918) as *S. profunda* to it. *Schizotricha profunda* (see re-description by Peña Cantero & Vervoort 1999) has unbranched hydrocladia and because Broch (1918) mentions second order hydrocladia in his material, Peña Cantero & Vervoort (1999) referred Broch's material to *S. variablis*. Two of Broch's three samples (kept by ZMUC) could be examined, as well as a part of the type material of *S. profunda*. This latter material is kept by the ZMUC and was most probably given to Broch by Nutting. One sample identified by Broch as *P. profunda* ("Ingolf" Station 98) is almost indistinguishable from *S. frutescens*. The cauline main tube is only indistinctly segmented, if visible the segments bear two hydrothecae. The hydrocladia of this sample are joined to the caulus without any node, a trait typical for *S. frutescens*. This fertile material differed from *S. frutescens* by the main tube being central and not peripheral to the polysiphonic stem and by having only few hydrocladia branched. Unbranched hydrocladia and a central main tube is characteristic for *S. profunda*. With some hesitation I would refer this material nevertheless to *S. frutescens*. The second sample examined ("Ingolf" Stat 24) consists in a 1 cm sterile, mostly monosiphonic fragment (depicted in Broch 1918: fig. 29). The caulus has regular nodes delimiting segments with one hydrotheca. The hydrocladia are not branched. Using only the morphological criteria of Peña Cantero & Vervoort (1999), this material is difficult to assign. The relatively long cauline segments with their regular nodes – which, however, could be due that this piece is the terminal part of a plume – are better compatible with *S. variabilis*. The biogeographic arguments given in Peña Cantero & Vervoort (1999) also better support such a conclusion. Concluding, the material of Broch (1918) is thus not unambiguously identifiable and records of *S. variablis* for Iceland are uncertain.

DISTRIBUTION – north of Norway, ? Iceland

Family Kirchenpaueriidae

Kirchenpaueria bonnevieae (Billard, 1906)
(Fig. 107A-D)
Plumularia rubra Bonnevie, 1899: 90, pl. 7 fig. 2.
Plumularia Bonnevieae Billard, 1906: 331.
Plumularia triangulata Totton, 1930: 225, fig. 61; Ralph, 1961b: fig. 5f-g; Vervoort 1966: 136, figs 38-39; Hirohito 1995: 255, fig. 85c-h.
Kirchenpaueria triangulata – Millard, 1962: 292, fig. 6E-J; Vervoort, 1966: 136, figs. 38-39; Millard, 1975: 375, fig119E-H; Rees & Vervoort 1987: 129, fig. 27; Hirohito 1995: 255, fig. 85c-h.
Kirchenpaueria bonnevieae – Ramil & Vervoort 1992a: 151, figs 39d-g, 40b, e; Ramil, Vervoort & Ansin 1998: 32; Schuchert 2000:431.
Kirchenpaueria bonnevieae simplex Billard, 1930: 80; Ramil & Vervoort 1992a: 156, figs 39a-c; 40a, c-d.
TYPE LOCALITIES – Trondheim Fjord in Norway; and localities between Faroe and Shetland Islands
MATERIAL ICELAND – BIOICE stations 2097 – 2272, one plume infertile – 2273, 1 plume about 4 cm, with female gonothecae.

DESCRIPTION – pinnate colonies reaching 4 cm in height, stem monosiphonic, unbranched, divided into segments by straight nodes which may be indistinct in lower

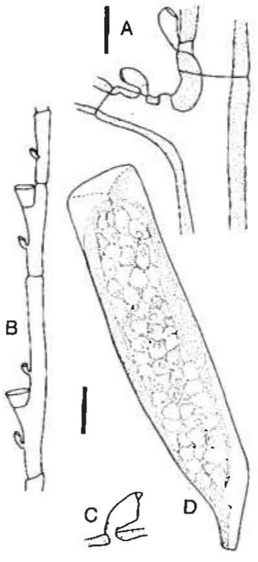

Figure 107. Kirchenpaueria bonnevieae *(Billard, 1906); BIOICE 2273. A, part of stem with apophysis and begin of hydrocladium, the scar right to the nematotheca on the apophysis is due to a lost gonotheca, scale bar 0.1 mm. B, part of hydrocladium, note rare node delimiting an intersegment at the top, scale bar 0.2 mm C, nematotheca distal of hydrotheca (one-chambered), scale bar 50 mm. D, mature female gonotheca, note triangular cross-section, same scale as B.*

parts, hydrocladia alternate. Each stem segment bears one hydrocladial apophysis and one or two nematothecae, one near base on side of previous apophysis and one on hydrocladial apophysis distal to the mamelon. No internal ribs present in cauline segments. Hydrocladia bear hydrothecae on upper surface, homomerously segmented by straight or slightly oblique nodes. Each segment with a hydrotheca and two nematothecae, one median inferior and one median superior. No internal ribs present in hydrocladial segments. Hydrotheca situated in proximal half of segment. Hydrotheca cup-shaped, adcauline side completely adnate or with very short free part, widening slightly to margin, depth 70-80 mm. Nematothecae one chambered, movable, abcauline side curved, adcauline one nearly straight. Gonothecae borne on hydrocladial apophysis, up to 1.5 mm, without nematothecae, elongated, roughly triangular in cross-section, distal end truncated. Female gonothecae filled with numerous orange-red eggs.

VARIATION – (after Millard 1975 and Ramil & Vervoort 1992a) the stem may be lacking and the hydrocladia can arise directly from the stolons. The nodes can be rather indistinct, however, the distal part of a hydrocladial segment can occasionally be sub-divided of by a node, thus giving a local heteromerous segmentation (see Fig. 107B). The cauline segment may bear up to four nematothecae.

REMARKS – contrary to all other plumularids, members of the family Kirchenpaueriidae lack nematothecae lateral to the hydrotheca (see Fig. 107B), which is a good synapomorphy for this family. *Kirchenpaueria bonnevieae* is a rather well known species with a wide distribution. Some deviant morphotypes have been given a subspecies status, which is incorrect as they are sympatric with the normal forms. These forms are either separate species or mere variants. After Millard (1975) and Ramil & Vervoort (1992a) *Kirchenpaueria bonnevieae* grows exclusively on other hydroids. For the distinction of the similar *Kirchenpaueria pinnata* see below.

DISTRIBUTION – Norway, Faroes, Shetland, northern and western Iceland, Bay of Biscay, Morocco, Mediterranean, South Africa, Oman, Zanzibar, New Zealand, Japan. Not known from Greenland.

Kirchenpaueria pinnata (Linnaeus, 1758)

Sertularia pinnata Linnaeus, 1758: 813.
? *Plumularia echinulata* Lamarck, 1816: 126.
Plumularia Macleodii Westendorp, 1843: 23; Cornelius 1995b: 134, synonym.
? *Plumularia echinulata* – Hincks 1868: 302, pl. 65 figs 2 & 2a
Plumularia pinnata – Hincks 1868: 295, pl. 65 figs 1 & 1a; Saemundsson 1911: 103.
Plumularia elegantula G. O. Sars, 1874: 103, pl. 3 figs 9-14.

Plumularia helleri Hincks, 1872; Marktanner-Turneretscher 1890: 251, pl. 6 fig. 3.
Plumularia hians Marktanner-Turneretscher, 1890: 253, pl. 6 fig. 6
Plumularia unilateralis Ritchie, 1907: 541, pl. 2 figs 1A-C.
Kirchenpaueria pinnata – Broch 1918: 53, fig. 23; Kramp 1938: 35; Millard, 1975: 372, fig. 119A-D; Ramil & Vervoort 1992a: 158, fig. 41a-c; Medel & Vervoort 1995: 41, figs 17-18; Cornelius 1995b: 130, fig. 30; Hirohito 1995: 253, fig. 85a-b; Ramil, Vervoort & Ansin 1998: 33, figs 20-21.

DESCRIPTION – see Cornelius (1995b).

REMARKS – no material from Greenland or Iceland could be examined for this study. The south coast of Iceland is perhaps the northern limit of this species.

Kirchenpaueria pinnata differs mainly from *K. bonnevieae* by its different gonothecae, but also infertile material can be identified reliably. Contrary to *K. bonnevieae* – which has two distinct one-chambered nematothecae (Fig. 107C) – *K. pinnata* has either only naked nematophores or scale-shaped reduced nematothecae. *Kirchenpaueria pinnata* is rather variable and several nominal species are now regarded as conspecific with it, but discussions are still ongoing. For further details see Ramil & Vervoort (1992a) and Cornelius (1995b).

DISTRIBUTION – *Kirchenpaueria pinnata* is widely distributed in the Atlantic Ocean, ranging from Iceland and Norway south to South Africa. Hirohito (1995) recorded it also from Japan. At Iceland known from one locality in the south (Saemundsson 1911). There are no records from Greenland.

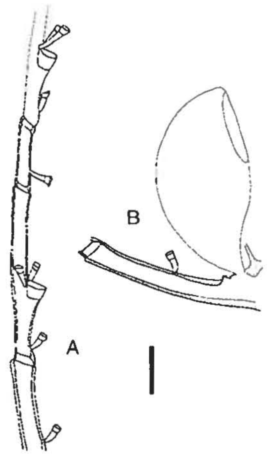

Figure 108. Nemertesia antennina *(Linnaeus, 1758); BIOICE 2240, scale bar 0.2 mm. A, apophysis and proximal part of hydrocladium, note presence of the characteristic intersegment without hydrotheca. B, apophysis with gonotheca.*

Family Plumulariidae

Nemertesia antennina (Linnaeus, 1758)

(Fig. 108A-B)
Sertularia antennina Linnaeus, 1758: 811.
Nemertesia antennina – Broch 1918: 64, figs 30-31; Kramp 1914: 1057; Kramp 1932b: 19; Kramp 1938: 37; Millard 1975: 381, fig. 121D-E; Ramil & Vervoort 1992a: 163, figs 42a-r, 43a-h, synonymy; Medel & Vervoort 1995: 50, figs 21, 23b; Cornelius 1995b: 148, fig. 34; Hirohito 1995: 264, fig. 89a-g; Calder & Vervoort 1998: 45, fig. 22a-d; Ramil, Vervoort & Ansin 1998: 35.
TYPE LOCALITY – European Seas.
MATERIAL GREENLAND – "Grønland" 1975 station 38 – ZMUC, 66.00°N 56.12°W, 200-204, 1.08.1975.
MATERIAL ICELAND – BIOICE stations 2168 – 2215, fertile – 2216 – 2218, fertile – 2240, fertile – 2241 – 2272, fertile – 2273 – 2329 – 2360 – 2415 – 2418, fertile – 2493 – 2501 – 2520 – 2522 – 2524 – 2531 – 2599 – 2710 – 2717 – 2719, fertile – 2777, fertile.

DESCRIPTION – colonies with aggregated stems, stems straight, unbranched, up to 25 cm, growing from tangled fibrous mass of dead and living stolons, young colonies with solitary shoots, young plumes pinnate. Main stem monosiphonic but thick, often losing hydrocladia from basal regions, nodes occasional. Soft tissue of main stem canaliculate (in several tubes). Hydrocladia short in comparison to stem, in mature colonies arising from all sides of the stem in 6-10 longitudinal rows from apophyses. Stem with numerous scattered nematothecae, no hydrothecae. Apophyses very long, with a mamelon in upper axil and one nematotheca. Hydrocladium straight to slightly curving, heteromerously segmented by regular oblique nodes into main segments bearing hydrotheca and intersegments without hydrotheca. All segments elongated. Main segment with hydrotheca below middle and three nematothecae. Intersegment with one nematotheca only. Hydrotheca cup-shaped, shallow, about 50-70 μm deep, diameter at rim 80-100 μm, adcauline wall and base completely attached to segment, walls converging. Nematothecae conical, relatively long (0.1 mm), movable, two-chambered. Gonothecae arise from apophyses close to mamelon, sac-shaped, about 0.8 mm, with large, round opening on lateral side, pedicel indistinct, small. Planulae develop in gonothecae.

Remarks – the hydrocladia of *Nemertesia antennina* have characteristic intermediate segments without a hydrotheca (Fig. 108A). This hetermerous segmentation helps to identify *N. antennina* reliably from the two other *Nemertesia* species known from Greenland or Iceland.

Distribution – in the Atlantic Ocean, occurring from Barents sea, western and eastern Greenland, Faroes, all around Iceland, south through Mauritania to South Africa, including the Mediterranean Sea. On the American side of the North Atlantic, recorded from arctic Canada south to Florida. Known also from Japan (Hirohito 1995).

***Nemertesia norvegica* (G. O. Sars, 1874)**
(Fig. 109A-C)
Heteropyxis norvegica G. O. Sars, 1874: 104, pl. 3 figs 15-22.
Antennopsis norvegica Browne 1907: 33.
Antennularia norvegica – Bonnevie 1899: 96; Broch 1903: 11; Jäderholm 1909: 106.

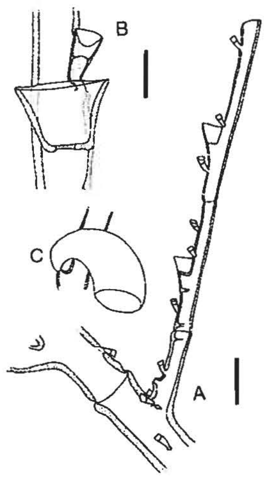

Figure 109. Nemertesia norvegica *(G. O. Sars, 1874); BIOICE 2454. A, part of stem, apophysis and basal part of hydrocladium, scale bar 0.2 mm B, frontal view of hydrotheca and the typical single lateral nematotheca, scale bar 50 mm. C, stem apophysis with gonotheca, note characteristic curvature, same scale as A.*

Nemertesia norvegica – Cornelius 1995b: 152, fig. 35; Schuchert 2000:431.
Type locality – Norway, Oslofjord and Hardangerfjord (Sars 1874).
Material Iceland – BIOICE stations 2215 – 2270 – 2273, fertile – 2401 – 2442 – 2454, fertile – 2462 – 2713 – 2719, fertile – 2720 – 2810 – 2817 – 2818, fertile – 2823.

Description – colonies forming 3-10 cm high plumes, delicate, monosiphonic. Stem with transverse nodes, several hydrocladia per stem segment, stem without canaliculate coenosarc, without hydrothecae, with nematothecae, with long apophyses bearing hydrocladia. Apophyses with mamelon on upper side and 2 nematothecae: one near upper axil and one more distal. Hydrocladia in lower part on two sides, in more distal parts all around the stem. Hydrocladia segmented homomerously by transverse nodes. Each segment with a hydrotheca in its middle and 3 nematothecae: one median inferior far below hydrotheca, one median superior far above hydrotheca and a single lateral nematotheca at the level of the opening of the hydrotheca (Fig 109B). Hydrotheca cup-shaped, about 50-80 µm deep, walls straight, converging towards below, adcauline side nearly completely fused to hydrocladium, aperture perpendicular to hydrocladium. Nematothecae conical, two-chambered, movable, adcauline wall of upper chamber emarginated. Gonotheca arise at base of apophyses of stem, 0.4 mm, inverted conical, strongly curved, end truncate and with large opening, without nematothecae.

REMARKS – *Nemertesia norvegica* is much unlike the adults of two other *Nemertesia* species of the studied area. In having a segmented stem without a canaliculate coenosarc it resembles more a *Plumularia* species (Fig. 109A). Its proximal hydrocladia are in one plane, while the distal ones are arranged spirally (the figure 35B in Cornelius 1995b is somewhat misleading, as it suggests that all hydrocladia are in two planes only). *Nemertesia norvegica* thus resembles juvenile *A. ramosa*, with which it may have been confounded quite often. Their microscopical structure is also very similar. A peculiarity of *N. norvegica* is, however, that the nematothecae lateral to the hydrothecal opening are actually rarely paired as normally seen in other Plumulariidae. Nearly always there is just a single nematotheca (see Fig. 109B). This feature has already been described by Sars (1874) and later been confirmed by Bonnevie (1899). Although nematothecae are frequently lost during the collection procedure, the presence of a single lateral nematotheca seems to be a natural feature of this species. Even if the nematothecae are lost, careful examination at high magnifications often reveals the presence of a pore or a slight pedicel. Such examinations confirmed the predominant presence of a single nematotheca only, although rare paired ones could also be observed in the present material. With the necessary caution, this trait helps to immediately distinguish *N. norvegica* from all other *Nemertesia* species.

Billard (1906) allocated a damaged fragment from the Mediterranean to *N. norvegica*. His specimen had two lateral nematothecae associated with each hydrotheca. Castric-Fey (1970) and Ramil & Vervoort (1992a) doubted this identification and referred Billard's material to *Nemertesia ventriculiformis* (Marktanner-Turneretscher, 1890). *Nemertesia ventruciliformis* closely resembles *N. norvegica* except for the lateral nematothecae. I suspect that the two are only regional variants.

Figure 110. Nemertesia ramosa *(Lamarck, 1816). A, BIOICE 2313, part of hydrocladium, note absence of intersegments. B,* Nemertesia ramosa *from Mediterranean (MHNG INVE25335) stem apophysis with gonotheca and basal part of hydrocladium, note absence nematothecae distal of hydrotheca.*

DISTRIBUTION – mid Norway to Oslo Fjord, Faroes, Scotland, North Sea, Bay of Biscay, southern Iceland. There are no records from Greenland.

***Nemertesia ramosa* (Lamarck, 1816)**
(Fig. 110 A-B)
Antennularia ramosa Lamarck, 1816: 123.
Nemertesia ramosa – Broch 1918: 66, figs 32-33; Kramp 1938: 38; Millard 1962: 299, fig. 7A-D; Vervoort 1966: 139, fig. 41; Rees & Vervoort 1987: 133: 28a-b; Ramil & Vervoort 1992a: 173, fig. 44a-f; Medel & Vervoort 1995: 48, figs 20, 23a, synonymy; Cornelius 1995b: 155, fig. 36.
MATERIAL ICELAND – BIOICE 2313, part of stem with hydrocladia.
OTHER MATERIAL – MHNG INVE25335, Mediterranean, Naples, several plumes with gonothecae.

Diagnosis – like *N. antennina*, but shoots usually not aggregated, stem branched, hydrocladia homomerously segmented (no intersegments), variably with or without a superior median nematotheca, gonotheca less curved.

Remarks – see under *Nemertesia antennina* and *N. norvegica*.

Distribution – in the north-east Atlantic Ocean from southern Iceland to at least north-west Africa, including the Mediterranean Sea, Azores, Canaries and Madeira, and South Africa. At Iceland known from the south coast only, 66-595 m (Broch 1918, Kramp 1938). There are no records from Greenland.

Plumularia setacea (Linnaeus, 1758)

(Fig. 111 A-B)

Sertularia setacea Linnaeus, 1758: 813.

Plumularia setacea – Hincks 1868: 296, fig. 34, pl. 66 fig. 1; Broch 1918: 55, fig. 24; Billard 1913: 32, fig. 24; Kramp 1938: 35; Ralph 1961b: 33, figs 3e, 4a, c-d; Vervoort 1966: 142, fig. 43; Naumov 1969: 503, fig. 354; Millard 1975: 399, fig. 124E-K; Ramil & Vervoort 1992a: 191, fig. 47f-i; Cornelius 1995b: 159, fig. 37; Hirohito 1995: 278, fig. 95c-d; Medel & Vervoort 1995: 56, fig. 24, synonymy.

Type locality – England.

Material Iceland – BIOICE 2818, 1-2 cm plumes on *N. norvegica*, with male and female gonothecae on same plumes.

Description – pinnate colony, 1-2 cm, delicate, stem simple, monosiphonic, curving, carrying alternate hydrocladia on two sides, regularly segmented by transverse nodes, each segment with a distal apophysis and two nematothecae: one basal and one in upper axil of apophysis. Hydrocladia segmented heteromerously, nodes delimiting main- and intersegments, most proximal segment short and without nematotheca. Main segments elongate, with hydrotheca in distal third, with three nematothecae: one median inferior and two laterals. Intersegments variable in length, with 1-2 median nematothecae. Hydrotheca cup-shaped, about 80 µm deep, adcauline wall completely adnate, rim smooth, perpendicular to segment axis. Nematothecae conical, up to 50 µm, walls straight, two chambered, movable. Gonothecae on apophysis of stem, male ones more proximal, female ones more distal. Female gonotheca 0.7 mm, spindle shaped, slender, distal opening on long, slender neck giving often a bottle-like appearance to the whole gonotheca, planulae brooded in gonotheca. Male gonothecae shorter, 0.4 mm, spindle-shaped, terminal opening without distinct neck.

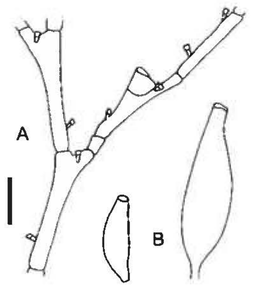

Figure 111. Plumularia setacea *(Linnaeus, 1758), BIOICE 2818, scale bar 0.2 mm. A, part of stem and basal part of a hydrocladium. B, gonothecae: left male, right female.*

Additional information – shoot can grow up to 6 cm high, stems can rarely be branched, hydrotheca can reach depths of 0.12 mm, dioecious colonies exist (Cornelius 1995b and unpubl. own observations on material from Brittany and New Zealand).

Distribution – nearly cosmopolitan in tropical and temperate coastal waters of Atlantic, Indian and Pacific Oceans. The northern limit in Europe seems to be Bergen in Norway, absent from Faroes (Kramp 1938). Rare in Icelandic waters, only known from one locality near the Vestmannaeyjar (Saemundsson 1911). The sample of the BIOICE collection came from a locality somewhat west of the Vestmannaeyjar from 206 m depth. It thus appears that the south coast of Iceland is the northern limit of this species. It is unknown from Greenland.

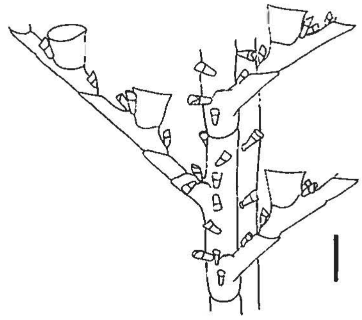

Figure 112. Polyplumaria flabellata *G. O. Sars, 1874, BOICE 2824, part of polysiphonic stem and three basal parts of hydrocladia, note that there are two hydrocladia per stem segment, scale bar 0.2 mm.*

***Polyplumaria flabellata* G. O. Sars, 1874**

(Fig. 112)

Polyplumaria flabellata G. O. Sars, 1874: 101, pl. 2 figs 16-22; Broch 1918: 59, fig. 28; Kramp 1938: 37; Vervoort 1966: 134, fig. 37; Ramil & Vervoort, 1992a: 193, fig. 50a-g; Medel & Vervoort, 1995: 61, fig. 26, synonymy; Cornelius 1995b: 163, fig. 38; Calder & Vervoort 1998: 50, fig. 24a-c.

TYPE LOCALITY – Kvitsøy Island (formerly Hvítingsø), near Stavanger, Norway (Sars 1874).

MATERIAL ICELAND – BIOICE stations 2818 – 2823 – 2824 (all three samples part of plumes only).

DESCRIPTION – (in part after Cornelius 1995b) colony pinnate, up to 35 cm, very regular and rigid in appearance, stiffly erect, stem with secondary and tertiary branching, branching in one plane, primary branches opposite. Stem polysiphonic, thinning out to monosiphonic distally, composed of accessory tubes and a superficial primary tube bearing the hydrocladia. Accessory tubes with nematothecae, without regular nodes. Primary tube with nodes delimiting segments with one or more hydrocladia, with numerous nematothecae, with apophyses for hydrocladia, mamelon in upper axil of apophysis, apophysis bearing also two nematothecae. Hydrocladia monosiphonic, stiff, neatly parallel. Hydrocladia normally homomerously segmented by oblique nodes, occasionally a short segment without nematothecae at base. Hydrocladial segments with one hydrotheca and 4 nematothecae: one median inferior far below hydrotheca, two laterals, and one median superior. Hydrotheca 0.15 mm deep, cylindrical cup-shaped, inserted at 45° to hydrocladium, adcauline side adnate for basal third. Nematothecae conical, straight, movable, two-chambered, adcauline wall of upper chamber deeply emarginated. Gonothecae not seen, according to Calder & Vervoort (1998) 0.65 mm long, arising from apophyses of primary tube, ovoid to pear-shaped, with small pedicel, distal end truncate with large circular lid, at base of gonotheca 3-4 nematothecae.

VARIATION – there may be 1-3 median superior nematothecae, the hydrotheca can reach depths of 0.23 mm (Calder &Vervoort 1998).

REMARKS – the regular, flat colony structure and the partially free hydrothecae render this species immediately recognisable.

DISTRIBUTION – temperate to tropical eastern Atlantic, from Iceland and Norway south to Congo River, including Azores, Mid-Atlantic Ridge, and entrance of Mediterranean, depth range 115-1378 m (Ramil & Vervoort, 1992a, Calder & Vervoort 1998). It has its northern limit along the south coast of Iceland, where it was previously recorded from the Vestmannaeyjar at 510 m (Broch 1918). The present findings are also all from the south coast in the Bay of Me›allands in 120-206 m. There are no records from Greenland.

***Polyplumaria gracillima* (G. O. Sars, 1873)**

(Fig. 113A-E)

Plumularia gracillima G. O. Sars, 1873: 86; G. O. Sars 1874: 15, pl 3 figs 1-8.

Plumularia verrillii Clark, 1875: 64, pl. 10.

Plumularia groenlandica Levinsen, 1893: 205, pl. 8 figs 10-12; Kramp 1914: 1057.

Schizotricha gracillima – Jäderholm 1909: 108, pl. 12 fig. 8.

Polynemertesia gracillima – Broch 1918: 70, figs 34-35; Naumov 1969: 511, fig. 365.

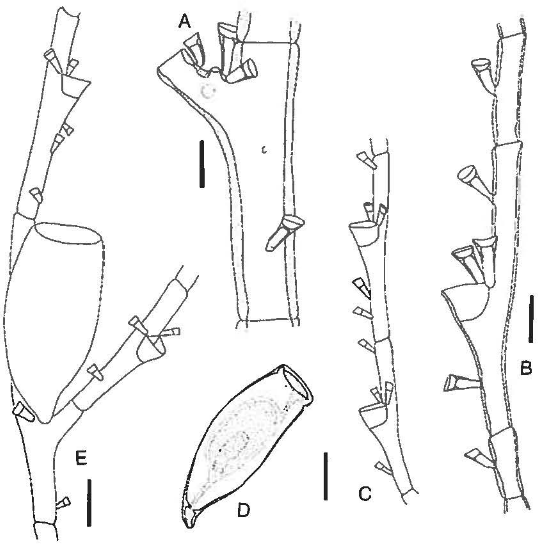

Figure 113. Polyplumaria gracillima *(G. O. Sars, 1873); A-D BIOCE 2506, E BIOICE 2107. A, segment of stem, note apophysis with mamelon and below scar of gonotheca that has fallen off (dotted circle), scale bar 0.1 mm. B, distal most part of a hydrocladium (apophysis at bottom), scale bar 0.1 mm. C, most proximal part of another hydrocladium, note differences in segmentation and nematothecae numbers, scale bar 0.2 mm. D, gonotheca with male gonophore, same scale as C. E, part of branching hydrocladium with gonotheca, scale bar 0.2 mm.*

Polyplumaria gracillima – Kramp 1938: 36; Cornelius 1995b: 169, fig. 40.

TYPE MATERIAL EXAMINED – type material of *Plumularia groenlandica* Levinsen, 1893, ZMUC, Davis Street, 20.10.1884.

MATERIAL ICELAND – BIOICE stations 2107, fertile – 2168 – 2358 – 2424, fertile – 2506, fertile – 2514, fertile

DESCRIPTION – colonies erect, up to 5 cm, pinnate, main stem sometimes forked. Main stem polysiphonic basally, tapering rapidly so that distal 2/3 or more are monosiphonic. Stem in monosiphonic part segmented by transverse nodes, each segment at its distal end with a long apophysis for the attachment of the hydrocladium, apophysis with cone-shaped mamelon on upper side and 3-4 nematothecae, 1-2 additional nematothecae on median line of cauline segments. Hydrocladia alternate, plane of both rows forming an angle of less than 180°. Hydrocladia rather thin, branched up to second order, branching not in same plane, segmentation very irregular. First segment of hydrocladium either a normal hydrothecate segment or short and without hydrotheca but with one nematotheca. Segments with hydrotheca long, sometimes intercalated by short intersegment with one nematotheca only. Hydrothecate segments (main segments) with hydrotheca in distal third, 1-3 inferior median nematothecae, one lateral nematotheca on each side of hydrotheca, 0-1 median superior nematotheca. Hydrotheca, shallow (75-90 µm deep), adcauline wall completely adnate, opening at right angle to segment axis. Nematothecae all conical, long, movable, one side of upper chamber usually somewhat lowered. Gonothecae develop on apophysis of stem or on hydrocladia in axils of branched segments. Gonotheca oblong, tapering proximally, distal end truncate and concave. Gonotheca bears no nematothecae.

DISTRIBUTION – Barents Sea, Norway, all around Iceland, western Greenland, Skagerrak, Cattegat and Oslo Fjord, Canada to New England (Fraser 1944, Cornelius 1995b).

Family Aglaopheniidae

REMARKS – for this study the scope of the genus Cladocarpus Allman, 1874 as defined by Bouillon (1985) was used. The salient feature of Bouillon's version is the presence of appendages – so called phylactocarps – on the ordinary hydrocladia. The phylactocarps protect the gonothecae and the latter also mostly develop on them. The phylactocarps of the various species are rather different, some being either unbranched, branched, with or without hydrothecae. This has led to various proposal for a subdivision of the genus. Species with phylactocarps having hydrothecae were placed by some authors in the separate genus *Aglaophenopsis*. Broch (1918) defined the genus *Nematocarpus* to accommodate *N. ramuliferus*. The latter species bears phylactocarps on nearly all hydrocladial segments. They are either branched or unbranched, but do not bear gonothecae (see Fig. 124E). Recently Ramil & Vervoort (1992b) distinguished two types of phylactocarps. The first type has a segmented axis, each segment with an apophysis for a side branch bearing nematothecae. The authors homologised this organisation to a caulus with hydrocladia of a normal colony, although this assertion appears rather speculative to me. The second type is rarely branched and has opposite nematothecae. Although such thoughts are highly welcome to overcome the possible polyphyletic nature of the taxon *Cladocarpus* sensu Bouillon, some problems persist. The phylactocarp of *Cladocarpus bonneviae*, e. g., has a proximal part conforming with Ramil & Vervoort's second type of phylactocarp, while the distal ends are of the first type (see Fig. 115E). The phylactocarp of *C. integer* (Fig. 120) is also not unambiguously referable to one type. The nematothecae are arranged rather variably, some segments have three, some two only, some are opposite, some not. I therefore think it is advisable to continue to use the genus diagnosis of Bouillon (1985), until a comprehensive phylogenetic analysis of all species allows to recognise monophyletic taxa with sufficient reliability, and the types of phylactocarps can be defined more precisely.

It is interesting to note that only members of the genus *Cladocarpus* and *Lytocarpia* occur in this region. The genus *Aglaophenia*, a predominantly warm water genus, is absent from Greenland and Iceland.

***Cladocarpus bicuspis* (G. O. Sars, 1874)**
(Fig. 114A-D)
Aglaophenia bicuspis G. O. Sars, 1874: 98, pl. 2 figs 7-10.
Cladocarpus bicuspis – Broch 1918: 89, fig. 48; Kramp 1938: 40; Cornelius 1995b: 202, fig. 47.

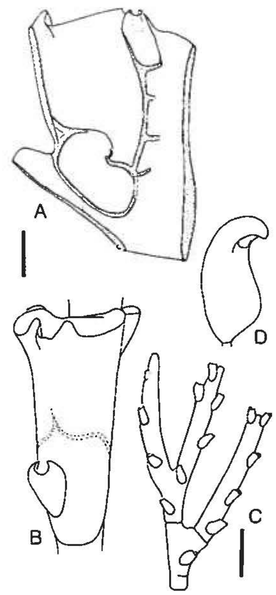

Figure 114. Cladocarpus bicuspis *(G. O. Sars, 1874); "Ingolf" Station 98. A, hydrocladial segment in transparent side view, scale bar 0.2 mm. B, hydrotheca in frontal view, note septum, same scale as A. C, phylactocarp, gonothecae removed, scale bar 0.5 mm. D, gonotheca in side view, same scale as C.*

TYPE LOCALITY – Norway, Kvitsøy island (formerly Hvítingsø), near Stavanger, 59.07°N 5.42°E (Sars 1874).
MATERIAL ICELAND – ZMUC, "Ingolf" Station 98, material of Broch (1918), 65.63°N 26.45°W, 260 m, coll. 28.06.1896.

DESCRIPTION – colony pinnate, up to 8 cm, stem not branching, polysiphonic basally, thinning to monosiphonic above. Stem composed of a primary tube bearing hydrocladia and several accessory tubes. Primary tube divided into short segments above basal part, each segment with an apophysis on alternating sides and three nematothecae, one median below apophysis, one pair above apophysis. Hydrocladia unbranched, with up to 15 segments, segments about 1 mm long, each with a large hydrotheca and three nematothecae: one median inferior and two laterals. Hydrotheca deep (0.8-0.9 mm deep, diameter 0.4 mm), adcauline side completely adnate, laterally compressed, cup-shaped, opening sloping slightly downwards, rim even at sides but rising on outer edge to two prominent teeth with a square-sided to V-shaped gap between, hydrothecal margin of the teeth folded inward. Hydrotheca with a prominent, curved, transverse septum which forces hydranth into a S-shape, opening of septum in middle, hydropore at base of adcauline side of hydrotheca. Median inferior nematotheca egg-shaped, open at adcauline side, attached at level of lower chamber of hydrotheca. Lateral nematotheca reach to level of hydrothecal margin, with emarginated adcauline side. Hydrocladial segments with 4 short internal ribs at site of attachment of hydrotheca. Gonothecae on stem and on phylactocarps, on the latter attached in axils of branching points. Phylactocarps branched and with 3-4 ends, nodes often indistinct, with nematothecae in rows or irregularly distributed. Gonotheca oval to pear-shaped, somewhat flattened, with subterminal, broadly oval opening directed to the side, curved terminal end of gonotheca forming hood.

Remarks – contrary to Cornelius (1995b) the gonothecae are also found on the phylactocarps and not only on the stem. With its two prominent marginal teeth this is a very distinctive species.

Distribution – Stavanger to Trondheim Fjord (Norway), Iceland (south and west coast). There are no records from Greenland.

Cladocarpus bonnevieae Jäderholm, 1909

(Fig. 115A-E)

Aglaophenia compressa Bonnevie, 1899: 94, pl. 7 fig. 4.

Aglaophenopsis compressa – Kramp 1932a: 57, figs 23-27; Vervoort 1942: 303, figs 2 a-d; Naumov 1969: 521, figs 374-375.

Cladocarpus bonnevieae Jäderholm, 1909: 110; Ritchie1912: 223, fig. 3

Type locality – 74.55° N 15.49°E, 373m (Norway).

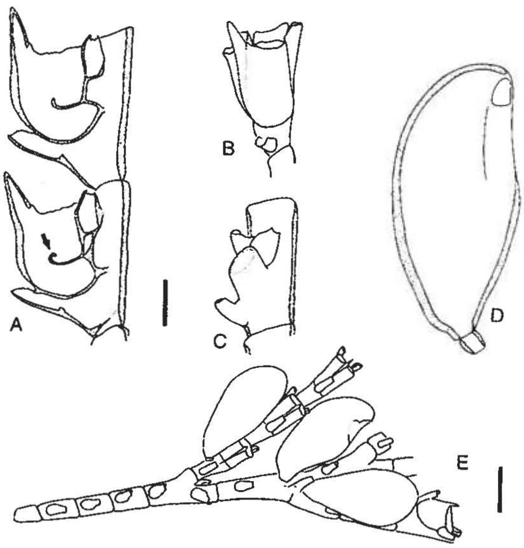

Figure 115. Cladocarpus bonnevieae *Jäderholm, 1909; scale bar for all sections except E equals 0.2 mm, for E scale bar equals 0.5 mm. A, two segments of hydrocladium, BIOICE 2126, arrow indicates characteristic intrathecal shelf. B, hydrotheca in oblique view, note keel, BIOICE 2126. C, segment of caulus in monosiphonic part, hydrocladium removed, BIOICE 2126. D, gonotheca in side view, BIOICE 2161. E, proximal half of phylactocarp, BIOICE 2126, the most proximal (left) segments are seen from the side, thus one row of nematothecae is invisible, note also the presence of hydrothecae on the distal branches.*

Material Iceland – BIOICE stations 2126 – 2161, fertile – 2168, fertile – 2360 – 2516, fertile – 2524, fertile.

Description – colonies pinnate, up to 15 cm high, stem polysiphonic thinning out to monosiphonic distally. Stem with a peripheral, segmented primary tube bearing the hydrocladia. Segments of primary tube rather short in region where there are hydrocladia, each with one apophysis for the attachment of the hydrocladium and three nematothecae, one median at proximal end and one pair in the upper axil of the apophysis. Accessory tubes unsegmented, with nematothecae. Hydrocladia not branched, distinctly segmented by transverse nodes. Each segment with one hydrotheca and three nematothecae. Hydrothecae rather short, 0.3-0.4 mm deep, laterally compressed, completely adnate on adcauline side, with large hollow horn on abcauline side of margin, horn continued as keel all along abcauline side of hydrotheca. Margin of hydrotheca besides horn only slightly crenulated. Interior of hydrotheca with conspicuous adcauline shelf which is upwardly inrolled. Nematothecae all with serrate margins, median inferior one fused to hydrotheca and reaching to level of intrathecal shelf, lateral pair reaching over margin of hydrotheca, adcauline walls deeply emarginated. Gonothecae ovoid, opening subterminal and at right angle to axis. Gonothecae borne on phylactocarps. Phylactocarps are like branched hydrocladia originating from proximal segments of ordinary hydrocladia. Most basal part of phylactocarp composed of 3-4 short segments with two opposite nematothecae, followed by more elongated segments bearing three nematothecae, apophysis for side branches, and gonothecae, all these segments without hydrothecae. Distal segments of phylactocarps with hydrothecae and structure identical to the one of normal hydrocladia.

REMARKS – this species was first described by Bonnevie (1899) as *Aglaophenopsis compressa*. Because the genus *Aglaophenopsis* is here regarded as a synonym of *Cladocarpus*, and because the name *Cladocarpus compressa* Fewkes, 1881 (see Nutting 1900: 111, pl. 26 figs 3-5) was preoccupied, Jäderholm (1909) proposed a new name for this species, *Cladocarpus bonnevieae*. Kramp (1932a) remarked that the description of Bonnevie (1899) was presumably incorrect as far as the number of nematothecae per cauline segment was concerned. In agreement with Kramp (1932a), the present material has also three nematothecae per segment of the primary tube (see Fig. 115C).

Cladocarpus bonnevieae resembles *C. cornutus* Verrill, 1879, but the latter has no intrathecal shelf and the hydrothecae are shaped differently (see Figs 115A and 117C).

DISTRIBUTION – Kola Peninsula, off Bear Island, western Greenland, Iceland (north, east, and south coast).

***Cladocarpus campanulatus* Ritchie, 1912**
(Fig. 116A-D)

Cladocarpus campanulatus Ritchie, 1912: 226, figs 4-5; Kramp 1932a: 61, fig. s 28-30; Kramp 1938: 40; Vervoort 1942: 303.
Halicornaria campanulata – Broch 1918: 72, fig. 36.

TYPE LOCALITY – "neighbourhood of Iceland", Ritchie (1912).

MATERIAL GREENLAND – "Kap Farvel"station 142, colony > 10 cm, with gonothecae, no phylactocarps – ZMUC, "Godthaab" station 188 (material of Kramp 1932a), 60.37°N 47.45°W, 120 m, 10.10.1928.

DESCRIPTION – mature colonies 2-10 cm high, stem branching once or twice in one plane, polysiphonic, only most distal parts monosiphonic. Stems composed of a peripheral primary tube with hydrocladia and a variable number of accessory tubes. Accessory tubes parallel, with nematothecae. Primary tube of side branches arise from primary tube of stem. Primary tubes with nodes, weak in proximal regions, segments short, with a distal apophysis for the attachment of the hydrocladium and 3 nematothecae: 1 median below apophysis, one pair in upper axil of apophysis. Hydrocladia 1-1.5 cm, alternate, all very regular and parallel, all in one plane, not branching, with distinct transverse nodes, segments short. Each segment with one hydrotheca and 3 nematothecae: one median inferior and a pair of laterals. Hydrotheca campanulate, 0.5 mm deep, diameter 0.4 mm, bottom evenly rounded, margin undulated, inside hydrotheca at lower third a annular ridge, may be reduced to a semi-circle at abcauline side or even completely absent. Lateral nematothecae broad, tubular, with serrated margin. Median inferior nematotheca short, reaching to base of hydrotheca and not much further, with opening on adcauline side giving into space below hydrotheca (Fig. 116B). Gonothecae arise from primary tube, 0.4 mm long, ovoid with oblique truncated end, short pedicel,

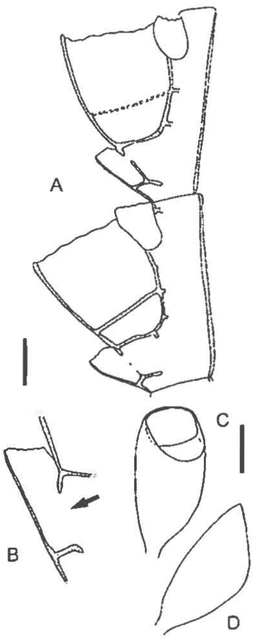

Figure 116. Cladocarpus campanulatus *Ritchie, 1912; A "Godthaab" Station 188, B-D "Kap Farvel" station 142. A, two hydrocladial segments, scale bar 0.2 mm. B, median inferior nematotheca, arrow indicates opening into lumen of segment, scale bar 0.1 mm. C, gonotheca in oblique view, scale bar 0.5 mm. D, gonotheca in side view, same scale as C*

without hood formation, opening subterminal, broadly oval. Phylactocarps absent.

REMARKS – *Cladocarpus campanulatus* requires a detailed, microscopic examination to discriminate it reliably from *C. formosus*, *C. integer*, and *C. paraformosus*. *Cladocarpus campanulatus* forms mostly no phylactocarps, or rarely rudimentary phylactocarps composed of two segments only (Kramp 1932a). However, as they can also be absent in *C. formosus*, their absence is not a diagnostic character. *Cladocarpus campanulatus* is best distinguished from *C. formosus* by examining the distal hydrocladial segments. The hydrothecae of *C. campanulatus* are broader and their margins have less distinct teeth, mostly only a gentle undulation. The internal shelf of the hydrotheca in *C. campanulatus* is mostly a mere ridge along the wall only, while it is a well formed septum in *C. formosus*. The gonotheca of *C. campanulatus* does not form a distinct hood overarching the opening as in *C. formosus* (compare Figs 116D and 119D). An important difference is found in the median inferior nematotheca. In *C. campanulatus* it is rather short and does not reach much beyond the base of the hydrotheca, while in *C. formosus* it reaches to the middle of the hydrotheca (comp. Fig. 116B). Additionally, the median inferior nematotheca of *C. campanulatus* has a nearly vertical opening at its adcauline side leading into the space below the hydrotheca (arrow in Fig. 116B). Unfortunately, the situation in the most proximal segment of the hydrocladium of *C. formosus* is apparently unlike the more distal ones. The most proximal segment is almost identical to ones of *C. campanulatus*.

Cladocarpus paraformosus forms branched phylactocarps, has deeper hydrothecae with sharp teeth, and there are more nematothecae per cauline segment (see Fig. 121).

Cladocarpus campanulatus is immediately distinguishable from *C. integra* as it's hydrotheca lacks the distinct adcauline shelf of the latter species. There is only a internal ridge, which, if incomplete, is on the abcauline side. Additionally, the margin of the hydrothecae in *C. integra* is smooth. Contrary to *C. campanulata*, which has no or short phylactocarps, there are simple phylactocarps in *C. integra* composed of about five segments.

DISTRIBUTION – south-western Greenland, northern Iceland (Kramp 1938).

***Cladocarpus cornutus* Verrill, 1879**

(Fig. 117A-E)

Cladocarpus cornutus Verrill, 1879: 310.

Aglaophenopsis cornuta – Nutting 1900: 120, pl. 30 figs 6-9; Kramp 1914: 1059; Broch 1918: 77, figs 39-41; Kramp 1932b: 20; Calder 1970: 1540, pl. 8 fig. 7.

TYPE LOCALITY – off Sable Island, Nova Scotia, 366 m.

MATERIAL GREENLAND – ZMUC, 60.77°N 46.85°W, 700 m, 25.08.1912, fertile – ZMUC,

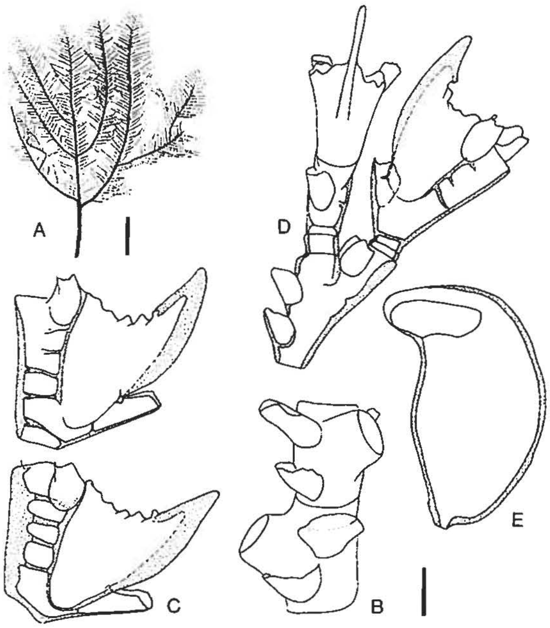

Figure 117. Cladocarpus cornutus *Verrill, 1879; "Ingolf" Station 98. A, silhouette of colony, scale bar 1 cm, B, two segments of stem in monosiphonic part, scale bar 0.2 mm. B, two non-adjacent segments of the same hydrocladium, note difference of perisarc thickness, same scale as B. D, phylactocarp, same scale as B. E, gonothecae in side view, same scale as B*

66.00°N 56.12°W, 200-204 m, 1.08.1975 – ZMUC, 60.67°N 46.75°W, 1.10.1973, fertile.

Material Iceland – ZMUC, "Ingolf" station 98, 65.63°N 26.45°W, 260 m, material of Broch (1918).

Description – colonies up to 7 cm, stem branching several times in one plane, main- and side-stems polysiphonic, only most distal ends monosiphonic. Hydrocladia arise from superficial primary tube accompanied by accessory tubes without nematothecae. Primary tube divided into short, almost rectangular segments. Each cauline segment with an apophysis for the hydrocladium and three nematothecae, one pair above apophysis, one at base of apophysis, the latter nematotheca broader than the other ones. Hydrocladia alternate and in one plane, composed of up to 12 short segments separated by transverse nodes. Segment walls thick, but thickness variable, with 3-5 thick internal ribs (Fig. 117C). Each segment with one hydrotheca and three nematothecae. Hydrotheca almost as large as the segment itself (depth approx. 0.5 mm, diameter 0.3-0.4 mm), cone-shaped, with a very large abcauline horn (0.3 mm), horn laterally compressed, hollow, continued on hydrotheca as keel. Lateral margins of hydrotheca with 5 rounded teeth and em-bayments, the latter strongly everted, teeth becoming gradually shallower towards rear. Hydrotheca without intrathecal shelves or ridges. One pair of lateral nematothecae attached to hydrocladium, gutter shaped, crenulated margin, reaching to level of hydrothecal margin. Median inferior nematotheca gutter-shaped, crenulated margin, originating at level of hydrothecal base and reaching to middle of hydrotheca. Gonothecae on stem or phylactocarps, oval to pear-shaped, somewhat flattened, with subterminal broadly oval opening directed to the side, curved terminal end of gonotheca forming hood. Phylactocarps are short, branched, modified hydrocladia, composed of a Y-shaped segment and two (rarely 3) segments identical to the ones of the ordinary hydrocladia (Fig. 117D). The branched segment with two median nematothecae at base and a pair of nematothecae in the axil.

Remarks – see under *C. bonneviae*.

Distribution – northern Canada, Massachusetts, western Greenland, western Iceland.

Cladocarpus diana Broch, 1918

(Fig. 118A-D)

Cladocarpus diana Broch, 1918: 87, fig. 47.

Type localities – 61.53°N 11.60°W, 1358 m and 60.62°N 27.87°W, 1504 m (Broch 1918).

Type material examined – syntype, ZMUC, "Ingolf" Station 46, 61.53°N 11.60°W, 11.05.1897.

Description – colonies form up to 5 cm pinnate shoots, stem polysiphonic in lower half, unbranched, hydrocladia arise from a main tube. Main tube weakly segmented,

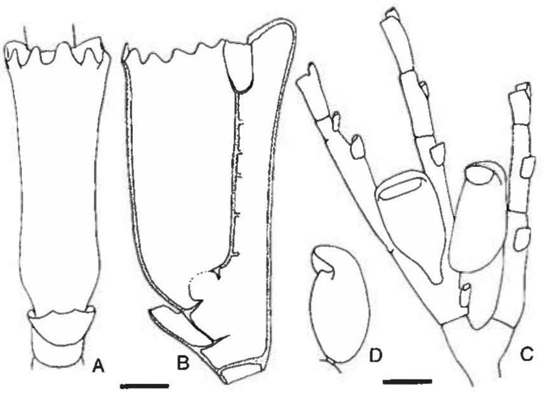

Figure 118. Cladocarpus diana *Broch, 1918; type material. A, hydrocladial segment in frontal view (shown opaque), note the very broad median inferior nematotheca, scale bar 0.2 mm. B, hydrocladial segment in side view (shown transparent), same scale as A. C, phylactocarp with two gonothecae, scale bar 0.5 mm. D, gonotheca in side view, same scale as C.*

segments long, each segment with an apophysis in its upper third and 3-4 nematothecae, one pair above apophysis and 1-2 median ones below apophysis. Hydrocladia alternate, in one plane, unbranched, regularly segmented. Each segment with a large hydrotheca that is about 4/5 as long as the segment and three nematothecae, one pair lateral to hydrotheca and one median inferior. Hydrotheca deep (ca 1 mm deep, 0.35 mm diameter), adcauline side adnate, cylindrical, parallel to segment axis, opening at right angle to hydrocladium, somewhat compressed laterally, with 9 large, rounded teeth, embayments rounded and everted, median tooth largest, 4 lateral tooth somewhat smaller. Lateral nematothecae reach level of hydrothecal margin, oblong, crenulated margin. Median inferior nematotheca reaches somewhat beyond base of hydrotheca, as broad as hydrotheca, margin with two teeth, adcauline side open. Hydrocladial segments with five short internal ribs along adcauline side of hydrotheca and one large rib at proximal end of segment. Gonothecae are borne on dichotomously branched phylactocarps originating below the hydrotheca of the first hydrocladial segment. Phylactocarps have three branches, each with one row of nematothecae. Phylactocarps composed of two forking elements followed by several tubular segments (Fig. 118C). Gonothecae egg- to pear-shaped, attached via a short pedicel, body somewhat flattened, aperture broadly oval and turned sidewards, the curved end of the gonotheca forming a hood-like structure (Fig. 118C-D).

REMARKS – no new material of this rare species could be obtained. *Cladocarpus diana* is only known from its original description. It's characteristic traits are the very broad median inferior nematotheca and the rather large marginal cusps (Fig. 118A).

DISTRIBUTION – only known from deep waters south of Iceland.

Cladocarpus formosus Allman, 1874a

(Fig. 119A-D)

Cladocarpus formosus Allman, 1874a: 478, pl. 68 figs 1, 1a-b; Kramp 1914: 1060; Broch 1918: 85, figs 45-46; Kramp 1932b: 20; Kramp 1938: 39; Naumov 1969: 524, fig. 378, synonymy; Cornelius 1995b: 205, fig. 48.

Cladocarpus speciosus Verrill, 1879: 311; Nutting 1900: 116, pl. 28 figs 8-11; Fraser 1944: 41, pl. 90 fig. 399.

Cladocarpus crenulatus Levinsen, 1893: 210, pl. 8 figs 13-14.

TYPE LOCALITY – 61.05°N 05.97°W, 305 m (Allman 1874a).

MATERIAL GREENLAND – "Kap Farvel" station 136 – "Kangamiut" station 10, fertile, without phylactocarps – ZMUC, 66.25°N 56.38°W, 187-190, 1.08.1975, fertile – ZMUC, 67.12°N 56.40°W, 200 m, 11.08.1975, fertile.

MATERIAL ICELAND – BIOICE stations 2012 – 2110, fertile – 2126 – 2360 – 2369 – 2514, fertile – 2522 – 2575 – 2591 – 2594 – 2599.

DIAGNOSIS – like *C. campanulatus*, but normally with phylactocarps, phylactocarps branched, with 4-5 ends bearing numerous nematothecae, nematothecae paired in distal region, gonothecae developing at branching point; gonotheca forming a hood; hydrothe-

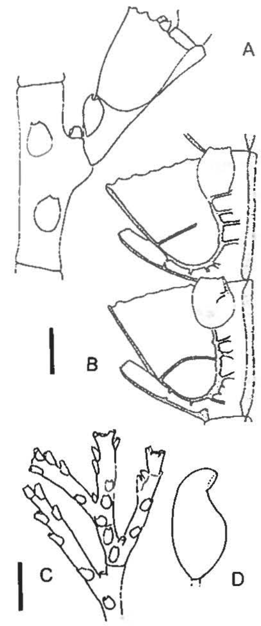

Figure 119. Cladocarpus formosus *Allman, 1874; A-B BIOICE 2126, C-D Greenland material. A, stem segment with base of hydrocladium, scale bar 0.2 mm. B, two hydrocladial segments in transparent view, same scale as A. C, phylactocarp, gonothecae removed, scale bar 0.5 mm. D, gonotheca in side view, same scale as C.*

ca narrower, margin with distinct teeth, particularly the abcauline ones, with distinct abcauline internal septum; median inferior nematotheca long, reaching to middle of hydrotheca (except most proximal one of the hydrocladium).

VARIATION – gonothecae can also grow on hydrocaulus without any phylactocarp ("Kangamiut" station 10).

DESCRIPTION – see Cornelius (1995b).

REMARKS – the similarities to other *Cladocarpus* species of the region are discussed under *C. campanulatus.*

Broch (1918) re-examined the type material of *Cladocarpus crenulatus* Levinsen, 1893 and referred it to *C. formosus*. The figures of Levinsen (1893) leave no doubt that this must be correct.

DISTRIBUTION – Faroes, Shetland Islands, Iceland (north, west, east coast), Greenland (east and west coast), Barents Sea, Davis Street to Gulf of St. Lawrence. Also reported from Sea of Okhotsk and Kurile Islands (Cornelius 1995b).

Cladocarpus integer (G. O. Sars, 1874)

(Fig. 120A-D)

Aglaophenia integra G. O. Sars, 1874: 100, pl. 2 figs 11-15.

Cladocarpus pourtalesi Verrill, 1879: 309.

Cladocarpus holmi Levinsen, 1893: 67; Kramp 1914: 1059; Naumov 1969: 523, pl. 19 fig. 3, text-fig. 376.

Halicornaria integra – Ritchie 1912: 228, fig. 6.

Cladocarpus integer – Broch 1918: 82, figs 82-44, synonymy; Kramp 1938: 39; Calder 1970: 1540, pl. 8 fig. 8; Cornelius 1995b: 208, fig. 49.

TYPE LOCALITY – Stavanger to Bodø, Norway (Sars 1874).

MATERIAL GREENLAND – ZMUC, 66.53°N 56.32°W, 191-195 m, 3.08.1975, fertile – "Kangamiut" stations 8 – 10, fertile.

MATERIAL ICELAND – BIOICE stations 2099, fertile – 2168, fertile – 2350 – 2356 – 2359 – 2360 – 2493 – 2514 – 2518 – 2528 – 2678, fertile.

DESCRIPTION – colony erect, 10-20 cm, pinnate, main stem polysiphonic but thinning gradually to monosiphonic distally, sometimes forked. Polysiphonic stem composed of a primary tube on the surface of a bundle of accessory tubes. Accessory tubes unsegmented, with nematothecae. Primary tube segmented by transverse nodes, segments short, each with a lateral apophysis in its middle and two median nematothecae. Hydrocladia alternate, homomerously segmented by oblique nodes, segments short. Segments with internal ribs along hydrotheca, ribs variable in number. Hydrotheca about 0.5 mm deep, cup-shaped, walls almost parallel, adcauline side completely adnate, with distinct adcauline intrathecal septum at lower third, breadth of septum variable, lower adnate part of hydrotheca often bulging into lumen of hydrocladium, margin of hydrotheca smooth and slightly flaring, opening slightly tilting downwards.

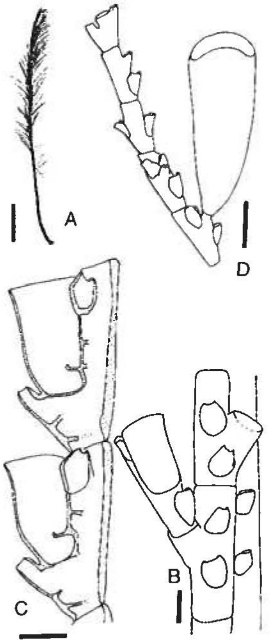

Figure 120. Cladocarpus integer *(G. O. Sars, 1874). A, typical colony, BIOICE 2678, scale bar 2 cm. B, part of polysiphonic stem with base of hydrocladium, BIOICE 2350, scale bar 0.2 mm. C, two hydrocladial segments, BIOICE 2350, scale bar 0.2 mm. D, phylactocarp with gonotheca, another gonotheca on the second segment was removed, BIOICE 2099, scale bar 0.4 mm.*

Median inferior nematotheca reaching 1/3 or less up the hydrotheca. Lateral nematothecae ovoid. Margin of nematothecae finely toothed. Gonothecae borne on phylactocarps. Gonotheca conical, curved aperture on lateral side of distal end, size 1-1.5 mm. Phylactocarps arise below first hydrotheca of hydrocladium, segment number variable, often reduced. Proximal segments with a distal pair of adjacent lateral nematothecae and below them a median nematotheca, gonothecae attached between the nematothecae, distal segments of phylactocarp with two nematothecae at variable positions.

Remarks – type material of *Cladocarpus holmi* Levinsen, 1893 was re-examined by Broch (1918) and subsequently referred to C. *integer*. The similarity of C. *holmi* to C. *integer* is already evident from Levinsen's figures. See also discussion under C. *campanulatus*.

Distribution – Norway, western Sweden, Barents Sea, all around Iceland, western and eastern Greenland, northern Canada.

***Cladocarpus paraformosus* Schuchert, 2000** (Fig. 121A-E)

Cladocarpus paraformosus Schuchert, 2000: 432, fig 13.

Type locality – 67.836°N 19.555W, 905m, BIOICE sample 2107.

Type material examined – holotype, IMNH 1999.08.17.1, about 2 cm plume fragment with gonothecae and phylactocarps, part of this material (schizoholotype) as slide preparation MHNG INVE 26300, slide H3/18.

Description – pinnate colonies, taller than 2 cm, distal parts monosiphonic, proximal parts unknown. Hydrocladia alternate and in one plane. Caulus segmented by distinct nodes, each segment at distal third with a short apophysis for the attachment of hydrocladium and five nematothecae: two median below apophysis, two near upper axil of apophysis and one on side of apophysis. This latter nematotheca somewhat different from the other four, with circular aperture. The other cauline hydrothecae short, gutter-shaped, rounded base. Hydrocladia segmented by distinct transverse nodes, longest hydrocladia reach 2 cm and have 16 segments. Each segment with internal ribs, 4-8 ribs along hydrotheca and two below median inferior nematotheca. Hydrotheca deeply beaker-shaped, 0.6-0.7 mm deep, about half as broad as deep, adcauline wall nearly straight and completely adnate, abcauline wall gently curved, hydrothecal margin with 13-15 distinct cusps, median abcauline cusp sharp, about 40 mm, lateral cusps becoming gradually shallower towards rear but remain distinct. At lower part of hydrotheca sometimes a transverse semi-circular or nearly circular ridge along inside of hydrotheca (see Fig. 121B, upper hydrotheca). Lateral nematothecae oval, margin reaching slightly over

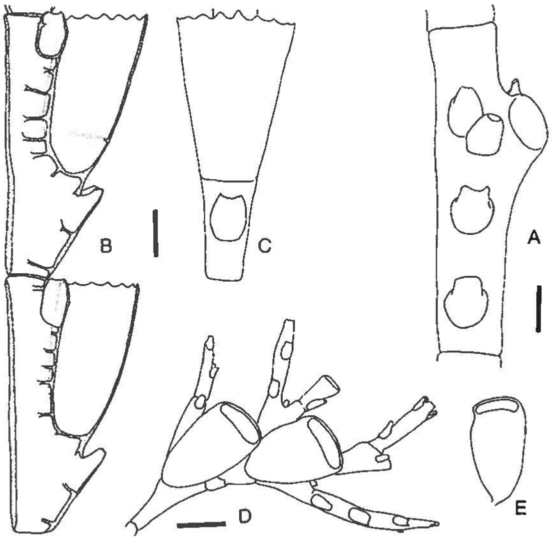

Figure 121. Cladocarpus paraformosus *Schuchert, 2000; after type material. A, segment of stem, scale bar 0.2 mm. B, two segments of hydrocladium, same scale as A. C, hydrocladial segment in frontal view, same scale as A. D, phylactocarp with two gonothecae, scale bar 0.5 mm. E, single gonotheca in oblique side-view, same scale as D.*

hydrothecal margin, margin finely dentated, adcauline side deeply emarginated. Median inferior nematotheca clearly below level of hydrotheca, straight, gutter-shaped, ovoid in frontal view, margin finely dentated. Gonothecae borne on phylactocarps and on stem, one to three per phylactocarp, shape oval to roughly triangular, flattened, on short peduncle, apperture subterminally and narrowly oval, directed towards front. Phylactocarps relatively short, arising from first segment of hydrocladium just below hydrotheca, consisting in dichotomously ramified branches, with more or less distinct nodes. Two types of segments present: central elements with apophysis and about three nematothecae, and terminal elements which are elongated, tapering, bearing 2-4 pairs of opposite nematothecae and ending in nematotheca-like opening. Nematothecae of phylactocarps resembling median inferior nematothecae of hydrocladium.

Remarks – see Schuchert (2000) and under *C. campanulatus* for further discussions.

Distribution – Known only from one locality far off the north coast of Iceland.

***Cladocarpus paraventricosus* Ramil & Vervoort 1992**
(Fig. 122A-B)
Cladocarpus paraventricosus Ramil & Vervoort 1992a: 111, fig. 27bd; Schuchert 2000: 431, fig. 12.
Type locality – 36.79°N 09.47°W, 1163 m.
Material Iceland – BIOICE stations 2299 – 2414 – 2701 (all infertile).

Description – pinnate, monosiphonic colonies, up to 3.5 cm. Basal part of stem without hydrocladia, otherwise with hydrocladia on alternate sides. Segmentation of stem only visible in distal part, each segment with an apophysis and two nematothecae, one on lower half, one in upper axil of apophysis, the latter nematotheca atypical as recurved. Hydrocladia divided into regular segments by oblique nodes, each segment with one hydrotheca and three nematothecae: one median inferior and two laterals near margin of hydrotheca. Adcauline wall of hydrotheca completely adnate, with short adcauline triangular septum at lower third and with marked concavity above and below septum. Abcauline hydrothecal wall with marked convexity in lower part, straight and directed obliquely outwards above curvature. At begin of this straight part on inside of hydrotheca a semi-circular perisarc thickening. Hydrothecal margin with one median abcauline tooth and on both sides five lower cusps, the one closest to the lateral nematothecae highest and rather pointed. The median inferior nematotheca gutter-shaped, its end just overlapping with base of hydrotheca. Lateral hydrothecae small, not surpassing hydrothecal margin. Segments with 10-11 internal ribs. Phylactocarps not seen, according to Ramil & Vervoort (1992a) inserting on first hydrocladial segment at level with hydrothecal base, composed of single, dichotomously forked branch, bearing nu-

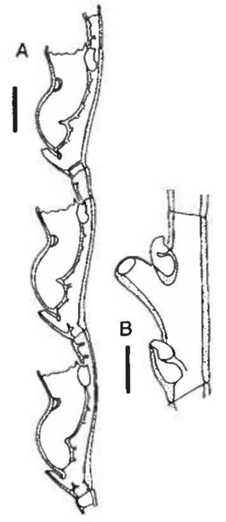

Figure 122. Cladocarpus paraventricosus *Ramil & Vervoort 1992; BIOICE 2299. A, three segments of hydrocladium in side view, scale bar 0.2 mm. B, segment of caulus, scale bar 0.1 mm.*

merous, short nematothecae with gutter-shaped apertures, either placed singly or in opposite or subopposite pairs. Gonothecae borne on branches of phylactocarps just after each ramification. Gonotheca ovoid, with circular aperture laterally at end of it.

Distribution – previously known only from south of Portugal. The Icelandic material came from off the south-west coast from a depth of 790 m.

***Cladocarpus pectiniferus* Allman, 1883**
(Fig. 123)

Cladocarpus pectiniferus Allman, 1883: 50, pl. 17 figs 1-5; Ramil & Vervoort 1992a: 114, figs 28a-h, 29a-j, 30a-g; Schuchert 2000:432.
Aglaophenopsis (?) *pharetra* Broch, 1918: 80, fig. 42.
not *Cladocarpus pectiniferus* – Pictet & Bedot 1900: 49.
Streptocaulus pectiniferus – Ramil, Vervoort & Ansin 1998: 29, fig. 19.
Type locality – 38.18°N 27.15°W, 1646 m.
Material Iceland – BIOICE stations 2097 – 2257 – 2299 – 2337 – 2404 – 2410 – 2412 – 2414 – 2415 – 2415 – 2474 – 2475 – 2512 – 2698 – 2701 – 2704.

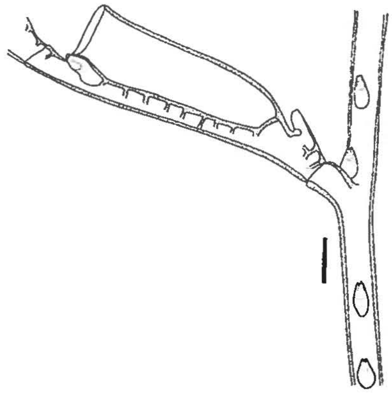

Figure 123. Cladocarpus pectiniferus *Allman, 1883; BIOICE 2257, monosiphonic part of stem with basal part of a hydrocladium, scale bar 0.2 mm.*

Description – pinnate colonies, up to 10 cm, stem basally polysiphonic, distally monosiphonic, unforked. Polysiphonic stem composed of one peripheral primary tube and several accessory tubes. Hydrocladia arise alternately from axial tube only. Primary tube with few nodes, with apophyses for hydrocladia and median nematothecae, number of nematothecae between two apophyses variable from 2 to more than 10. All cauline nematothecae with pear-shaped notch on adcauline side. Hydrocladia composed of segments separated by slightly oblique to transverse nodes, each segment with one hydrotheca and three nematothecae: one median below hydrotheca and two laterals reaching over margin of hydrotheca. Hydrotheca elongated, tubular, 0.8-0.9 mm deep, diameter 0.22 mm. Adcauline wall completely adnate, straight, without internal septum. Abcauline wall mostly straight, slightly flaring towards opening. Hydrothecal rim smooth, somewhat elevated at site of lateral nematothecae. Median inferior nematotheca gutter shaped, lateral ones also tubular, adcauline side with deep pear-shaped notch. Phylactocarps and gonothecae not seen, after Ramil & Vervoort (1992a) phylactocarps arise in pairs from first hydrocladial segment at base of hydrotheca, composed of axis (rachis) bearing gonothecae and paired, opposite nematothecae. There are four segments per rachis, first two with two pairs of nematothecae each, third and fourth with one pair. Nematothecae very long, tubular, directed obliquely towards apex of rachis, with finely serrated apical opening and large, oval basal opening, one or two additional openings may occur between the ones already mentioned. Each segment of rachis also provided with one basal and one distal internal rib.

REMARKS – Ramil & Vervoort (1992a) examined numerouis colonies of *C. pectiniferus*, including type material, and they documented the extent of variation. They found that the length of the hydrotheca is variable, while the segment length remains rather uniform. Ramil & Vervoort (1992a) also included *Aglaophenopsis* (?) *pharetra* Broch, 1918 in the synonymy of this species. Although no phylactocarps are so far known from Iceland, the perfect congruence of the BIOICE material with the material described by Ramil & Vervoort (1992a) leaves little doubt that also *Aglaophenopsis* (?) *pharetra* Broch, 1918 actually belongs to *C. pectiniferus*. *Aglaophenopsis* (?) *pharetra* was described by Broch (1918) – without discussing the similarity to *S. pectiniferus* Allman, 1883 – based on a single small plume originating from south-west off Iceland. There is nothing in Broch's description that distinguishes his species from *C. pectiniferus*.

DISTRIBUTION – Iceland (north, south, and west coast), Azores, Canary Islands, Portugal, Strait of Gibraltar, Alborean Sea (Mediterranean), depths: 92 to 1646 m (Ramil & Vervoort 1992a). The present samples came from the south, west and north of Icelandic, depths 110-1102 m. Not known from Greenland.

Cladocarpus ramuliferus (Allman, 1874)

(Fig. 124A-F)

Halicornaria ramulifera Allman, 1874: 477, pl. 67 fig. 3.

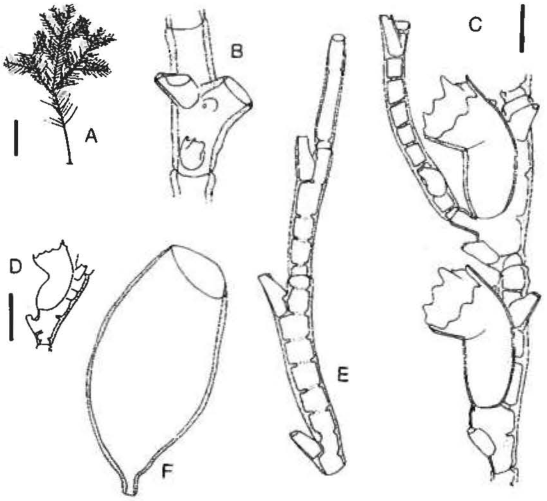

Figure 124. Cladocarpus ramuliferus *(Allman, 1874); A BIOICE 2524, others BIOICE 2126. A, typical colony, scale bar 0.5 cm. B, frontal view of stem segment from monosiphonic part, proximal part of hydrocladium cut away at junction with apophysis, same scale as C. C, oblique view of two segments of hydrocladium, one with phylactocarp, scale bar 0.2 mm. D, hydrotheca in side view, scale bar 0.2 mm. E, phylactocarp, same scale as C. F, gonotheca, same scale as C.*

Halicornaria pluma Broch, 1903: 8, pl. 15-21.
Nematocarpus ramulifera – Broch 1918: 74, figs 37-38; Kramp 1938: 38.

TYPE LOCALITY – 61.35°N 03.73°W, 1171 m, off Shetland Islands.

MATERIAL ICELAND – BIOICE stations 2126, fertile – 2260 – 2522 – 2359 – 2360 – 2493, fertile – 2524, fertile – 2591, fertile – 2701 – 2706 – 2568, fertile – 2570, fertile.

DESCRIPTION – pinnate colonies reaching 2.5 cm in height, stem branching several times in one plane, polysiphonic, consisting of a primary tube and accessory tubes. Axial tube of branches and hydrocladia originate from axial tubes only. Accessory tubes without nematothecae. Axial tube on surface of stem, segmented, segments without internal ribs, bearing one hydrocladial apophysis on alternating sides and two nematothecae, one below and one above apophysis. Nematothecae of stem large, with two openings. Hydrocladium bearing hydrothecae on frontal surface, segmented by transverse nodes, no first ahydrothecate segment. Segments with five internal ribs, one hydrotheca, a median inferior nematotheca far below hydrotheca and a pair of nematothecae above hydrotheca. If present, phylactocarps originate just below hydrotheca from a prominent apophysis. Hydrotheca bent for almost 90° in middle, adcauline side adnate for about 2/3, then free, margin with 9 to 11 teeth. Normally one smaller median abcauline tooth, four lateral teeth with last one quite prominent, and a double tooth at adcauline side. Median inferior nematotheca far below hydrotheca, open at adcauline side, lateral nematothecae conical, gutter-shaped, margin with fine teeth. Phylactocarps numerous, normally composed of three segments, these with many thick internal ribs. First segment with two nematothecae, one at begin and one towards end, others with one nematotheca near distal end, last segment may lack nematotheca but distal end with opening and nematotheca-like. Some phylactocarps branched. Nematothecae of phylactocarps resemble lateral ones of main segments, nematothecae occasionally with serrated margin. Gonothecae ovoid, not flattened, with oblique terminal apperture, stalk rather small. Gonothecae develop on primary tube and hydrocladia.

Distribution – off Norway, Shetland Islands, all around Iceland. Not known from Greenland.

***Lytocarpia myriophyllum* (Linnaeus, 1758)**
(Fig. 125A-B)
Sertularia myriophyllum Linnaeus, 1758: 810
Thecocarpus myriophyllum – Broch 1918: 92, fig. 50; Kramp 1938: 40.
Lytocarpia myriophyllum – Ramil & Vervoort 1992a: 137, figs 35b-d, 36a-j; Medel & Vervoort 1995: 30, fig. 12; Cornelius 1995b: 216, fig. 51, synonymy.

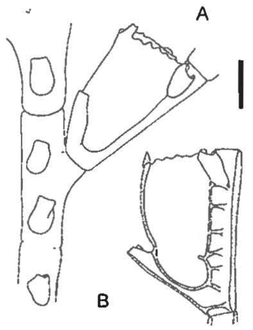

Figure 125. Lytocarpia myriophyllum *(Linnaeus, 1758); BIOICE 2393, scale bar 0.2 mm. A, part of stem and base of a hydrocladium, note characteristic median cusp of hydrothecal margin. C, hydrocladial segment in transparent side view.*

Material Iceland – BIOICE stations 2310, fertile – 2311, fertile – 2414 – 2407 – 2512 – 2417 – 2728 – 2698 – 2475 – 2797, fertile – 2403 – 2701 – 2719 – 2097 – 2218, fertile – 2273 – 2293 – 2305, fertile – 2313, fertile – 2314, fertile – 2388, fertile – 2390, fertile – 2392, fertile – 2394, fertile – 2397, fertile – 2398, fertile – 2400 – 2401 – 2410 – 2415 – 2418, fertile – 2420, fertile – 2427 – 2429 – 2442 – 2463, fertile – 2474 – 2475 – 2823 – 2824, fertile – 2826.

Description – colony pinnate, large, 10-40 cm. Polysiphonic stem composed of one peripheral primary tube and several accessory tubes. Side branches and hydrocladia arise from primary tube only. Accessory tubes with nematothecae. Stem often forked several times, with distinct nodes in distal parts, each segment with an apophysis in its distal third and about 2 median nematothecae. Hydrocladia alternate, unbranched, straight, closely spaced, regularly segmented by transverse nodes, segments short. Hydrocladial segments with one hydrotheca and three nematothecae: one median inferior and two laterals. Hydrotheca 0.5 mm deep, diameter about half of depth, cylindrical, rounded base, adcauline side completely adnate, with transverse adcauline septum in lower third of hydrotheca, may be reduced to short process. Margin of hydrotheca sinuous to sharply cusped, nearly always with characteristic, large, rectangular median cusp and smaller lateral ones. Median inferior nematotheca tubular, reaching halfway up hydrotheca or less, free part of adcauline side open. Lateral nematothecae oblong, reaching slightly over hydrothecal margin. Gonothecae sac-shaped, born in corbula. Corbula a modified, branched hydrocladium bearing paired costae. The costae curving and loosely surrounding gonothecae to form a protective, but open basket. Costae not fused, each with a hydrotheca at the outer side of its base and distally about 10 nematothecae.

Remarks – the characteristic, rectangular median cusp of the hydrotheca, often notched in the middle, allows also a reliable identification of infertile material.

Distribution – in the eastern Atlantic from northern Norway and all aorund Iceland south to Guinea Bissau and Liberia, on the American side from Davis street and western Greenland south to New England. In the south Atlantic known from the Falkland Islands and Magellan Strait. Also known from Pacific Ocean, e. g. Chile, Borneo and Japan (Cornelius 1995b).

Family Bonneviellidae

***Bonneviella grandis* (Allman, 1876)**

(Fig. 126A-C)

Campanularia grandis Allman, 1876: 25, pl. 12 figs 1-3.

Lafoea gigantea Bonnevie, 1899: 68, pl. 6 fig. 2.

Bonneviella grandis – Kramp 1914: 1073; Broch 1918: 173, fig. 89; Kramp 1938: 28; Naumov 1969: 316, figs 15B, 9C, 185, 186.

Type locality – Japan.

Material Greenland – "Kap Farvel" stations 83 – 102 – 117, fertile.

Material Iceland – ZMUC, 64.29°N 14.73°W, 15 m, 23.08.1902, det. Levinsen, fertile – BIOICE stations 2516 – 2528, fertile.

Description – colony erect, irregularly ramified, up to 25 cm high, stem and branches polysiphonic thinning out to monosiphonic, stem with pedicellate hydrothecae. Hydrothecae very large (up to 7 mm depth, diameter 2.5 mm), deep, cylindrical to bell-shaped, margin of opening smooth and slightly everted, often with renovations, no diaphragm, base rounded and continued as stalk of variable length. Stalks with 2-5 nodes, perisarc smooth or undulated, without rounded segment below hydrotheca. Hydranth with conical hypostome and pregastric chamber (Fig. 126C). Gonothecae on stems and branches, oblong ellipsoid, 6-8 mm long, diameter 2.5 mm, with short terminal neck, terminal opening with everted margin, pedicel short, outer side of gonothecal body with 6-8 undulated longitudinal ribs.

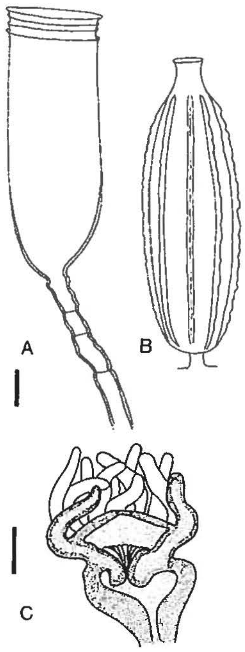

Figure 126. Bonneviella grandis *(Allman, 1876). A, BIOICE 2516, hydrotheca with renovated margin, note large size, scale bar 1 mm. B, gonotheca, Iceland 64.29°N 14.73°W, same scale as A. B, BIOICE 2516, vertical section through hydranth, note pregastric chamber, scale bar 0.5 mm.*

Remarks – several species of *Bonneviella* are known from the North Pacific that can only reliably be distinguished by their gonothecal morphology. In the region under investigation only *B. grandis* seems to occur.

Although the genus *Bonneviella* has been removed from the family Campanulariidae, the morphology of the hydranth with its pregastric chamber suggests that it might have been derived from a campanularid ancestor (see Fig. 126C).

DISTRIBUTION – western Greenland, Iceland (north, south, and west coast), Faroes, Norway, Barents Sea, Bering Sea, Sea of Okhotsk, Japan, in depths of 25 to 800 m (Naumov 1969).

Family Campanulariidae

Campanularia crenata Allman, 1876

(Fig. 127)

Campanularia crenata Allman, 1876: 258, pl. 11 figs 1-2; Cornelius 1982: 52, fig 2.

[not *Campanularia crenata* (Hartlaub, 1901)]

Campanularia speciosa Clark, 1877: 214, pl. 9 fig. 11; Levinsen 1893: 167, pl. 5 fig 7-9; Kramp 1914: 1067; Broch 1918: 158; Kramp 1932b: 21; Naumov 1969: 275, fig. 141; Calder 1970: 1519, pl. 4 fig. 3.

Campanularia magnifica Fraser, 1913: 164, pl. 11 figs 1-3; Naumov 1969: 277, synonym.

Campanularia bigena Naumov, 1960: 254, fig. 140; Naumov 1969: 274, fig. 140; Antsulevich, 1987.

TYPE LOCALITIES – Yukon Harbour, Big Konishui, Shumagin Islands (Alaska).

MATERIAL GREENLAND – Bank. unders. station 5294 – "Kap Farvel" stations 95, fertile – 128 – 147 – 148 – ZMUC, 66.72°N 54.22°W, 150-300,12.07.1966 – ZMUC, 66.52°N 53.92°W, Holsteinsborg, 120-200, 19.07.1953, fertile – ZMUC, Hellefiskebanke, det. Levinsen, material mentioned in Broch (1918) – ZMUC, N. Strømfjord, 25.06.1911, 14-38 m, material of Kramp (1932a).

DESCRIPTION – colonies stolonal, hydrothecae on long pedicels (1-3 mm), pedicels smooth or spirally sculptured over stretches, nearly invariably so at distal end, without clear subhydrothecal spherule. Hydrotheca large (1.5-2 mm), about three times as deep as broad, cylindrical with rounded base, distal end distinctly widened, narrowest at about 1/3 from end, margin with 10-14 gently rounded cusps and bays, embayments everted, at base of hydrotheca an annular thickening of the perisarc delimiting a small basal chamber. Gonotheca bottle shaped, up to 3 mm high, with oval body and long tubular neck (1/3 of body), circular aperture on distal end of neck, pedicel at base short.

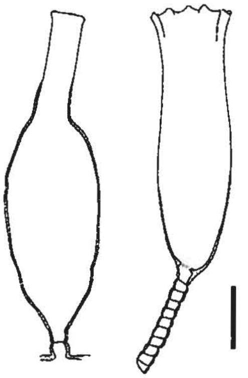

Figure 127. Campanularia crenata *Allman, 1876; "Kap Farvel" 95, left gonotheca, right hydrotheca, scale bar 0.5 mm.*

REMARKS – the unusually tall hydrothecae with their trumpet-shaped end and the undulated margin render this campanularid immediately recognisable. Levinsen (1893) realised that *Campanularia speciosa* Clark, 1877 is a subjective synonym of *C. crenata* Allman, 1876. However, while *C. speciosa* was widely and regularly used, Allman's name has not been used often, mainly because it was believed that Clark's publication had appeared in 1876. Cornelius (1982) noted that the publication date of Clark's paper was actually 1877, hence *C. speciosa* is a junior, subjective synonym of *C. crenata* Allman, 1876. The situation became more complicated with the description of *Eucopella crenata* Hartlaub, 1901. For this well known cosmopolitan species the name *Campanularia crenata* has widely been used. *Campanularia crenata* (Hartlaub, 1901) is thus a secondary homonym to *C. crenata* Allman, 1876. Because *C. crenata* Allman, 1876 is clearly a valid name, a new name for *Eucopella crenata* Hartlaub, 1901 must be provided if it is used in the combination with the genus *Campanularia*.

DISTRIBUTION – Arctic waters in the Atlantic and Pacific Oceans. Known from western and southern Greenland, but absent from Iceland and eastern Greenland.

Campanularia groenlandica Levinsen, 1893

(Fig. 128A-C)

Campanularia groenlandica Levinsen, 1893: 168, pl. 5 figs 10-12; Broch 1909b: 187, fig. 41, variation; Kramp 1914: 1065; Broch 1918: 157, fig. 72; Fraser 1937: 63, pl. 123 fig. 55; Kramp 1938: 16; Kramp 1943: 18; Fraser 1944: 120, pl. 21 fig. 91; Naumov 1969: 273, figs 16-17; Calder 1970: 1518, pl. 4 fig. 1; Cornelius 1982: 57; ? not Hirohito 1995: 54, fig. 16a-b; Schuchert 2000:419, fig. 5.

Campanularia levinseni Shidlovskii, 1902: 130, figs 23-24.

TYPE LOCALITY – Davis Street, Greenland, 146 m.

TYPE MATERIAL EXAMINED – ZMUC, holotype of *Campanularia groenlandica*, in three pieces, on *Lafoea dumosa*, damaged, probably dried out at some stage, gonothecae present, calyx length 0.9 mm.

MATERIAL GREENLAND – "Grønland" 1975 station 15, fertile – "Kangamiut" stations 1 – 10 – 2 – 4 – "Kap Farvel" station 95, fertile.

MATERIAL ICELAND – BIOICE stations 2006, fertile – 2056, fertile – 2067 – 2074 – 2097 – 2349 – 2356 – 2358 – 2377, fertile – 2493, fertile – 2508, fertile – 2509, fertile – 2511, fertile – 2514 – 2528, fertile – 2533, fertile – 2595 – 2710.

DESCRIPTION – colony stolonal, hydrothecae on long (up to 4 mm) pedicels. Pedicels smooth proximally, distal end with distinct oblique rings, subhydrothecal spherule present. Hydrotheca bell-shaped, sides somewhat converging towards bottom, 0.8-1 mm deep, about 1.5 times as long as broad, at bottom a stalk-like appendage forming a basal chamber, chamber delimited from lumen by a diaphragm formed by an annular thickening of the perisarc. Hydrothecal rim with about 10-14 cusps, cusps without notch, normally rounded but rectangular ones also possible, embayments between cusps deep, rounded and slightly everted. From the bottom of these embayments, sharp crease lines run longitudinally along the outside of the hydrotheca, length of lines 3/4 or more of hydrothecal length. The crease lines render the hydrotheca polygonal in cross-section. Gonothecae bottle-shaped, on stolons, about 1.5 mm high, connected to stolons by short stalk, body mostly smooth with some crinkles, distal end normally with neck of variable length. Nematocysts: almond-shaped microbasic mastigophores, (6-7)x(1.5-2) mm, r = 3.3-4.0, s ~ 1; oval microbasic mastigophores, (13-15)x(3-4) mm, r = 3.5-4.8, s = 0.8-1.2.

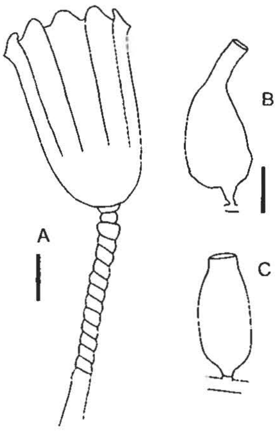

Figure 128. Campanularia groenlandica *Levinsen, 1893. A, Hydrotheca with upper part of caulus, BIOICE 2356, scale bar 0.2 mm. B, female gonotheca with four eggs, BIOICE 2493, scale bar 0.5 mm. C, female gonotheca, BIOICE 2006, variant form among normal form as depicted in B, same scale as B.*

REMARKS – see Schuchert (2000) and under *C. hincksii* for a discussion. Additional material was examined since Schuchert (2000) and a few gonothecae showed variation in the length of their neck (Fig. 128C). Some mature gonothecae apparently lacked the long neck, while others of the same colony had it. Perhaps they were immature or had aborted their growth prematurely.

DISTRIBUTION – northern Canada, western and eastern Greenland, Iceland (north, west, and east coast), Faroes, northern Norway, Spitsbergen, Barents Sea, White Sea, Kara Sea, Laptev Sea, Sea of Okhotsk, Sea of Japan, Bering Sea, Alaska (Calder 1970). This distribution pattern probably reflects a preference for colder waters. The species normally occurs on other hydroids.

Campanularia hincksii Alder, 1856

Campanularia hincksii Alder, 1856a: 360, pl. 13 fig. 9; Broch 1918: 162; Kramp 1938: 16; Fraser 1937: 63, pl. 13 fig. 56; Fraser 1944: 121, pl. 21 fig. 92; Vervoort 1959: 311, fig. 55a; Millard 1975: 208, fig. 67b-e; Boero 1981: 191, fig. 9; Cornelius 1982: 53, fig. 3, synonymy; Calder 1991: 49, fig. 29; Ramil & Vervoort 1992a: 233, fig. 66; Cornelius 1995b: 229, fig. 52.

TYPE LOCALITY – Coast of Northumberland, England.

MATERIAL ICELAND – BIOICE 2450, calyx depth 1.6 mm.

OTHER MATERIAL – MHNG, INVE28841, Roscoff, Brittany, on *Sertularella gayi*, no gonothecae, calyx depth 0.5 mm

DESCRIPTION – colony stolonal, hydrothecae on pedicels of variable length. Pedicels smooth at proximal end, distal end with few transverse rings, subhydrothecal spherule present. Hydrotheca bell-shaped, sides nearly parallel, about 1.8 times as long as broad. Hydrothecal rim with about 10-14 rectangular cusps, cusps may be notched, embayments between them rounded and very slightly everted. From the middle of these embayments, lines run longitudinally along the outside of the hydrotheca, length of lines 1/4 or less of hydrothecal length. Cross-section of hydrotheca polygonal due to these longitudinal crease lines, Gonothecae according to Cornelius (1995b) spindle-shaped, on stolons, about 1.5 mm high, usually broadest basally, rounded off below, tapering gradually above, sides smooth to irregularly sinuous in loose succession of rings, distal end truncate, sometimes flared, aperture wide, terminal.

REMARKS – *Campanularia hincksii* resembles closely *C. groenlandica* and both might be conspecific, *C. groenlandica* being either a cold water form, or a true subspecies. Differences of *C. hincksii* and *C. groenlandica* are: the few and transverse annulations of the stem versus several oblique ones, and the gonotheca without a neck versus a bottle-shaped one, the cusps with a notch versus cusps without notch.

Boero (1981) described the nematocysts and the morphological variation of this species. The nematocysts of *C. groenlandica* do not differ from *C. hincksii*. Only one infertile, poorly preserved colony of *C. hincksii* could be obtained from Iceland. It had a pedicel with a few transverse annuli and notched, rectangular marginal cusps. However, the size of the calyx attained 1.6 mm, which is rather unusually large.

DISTRIBUTION – temperate to warm waters of the Atlantic and eastern Pacific: Great Britain, North Sea, France, Spain, Mediterranean, Marocco, Azores, Mauritania, South Africa, New Brunswick to Florida, California, Mexico, usually recorded 20 m to 200 m. Absent from the Baltic sea and Black Sea. At Iceland recorded from the south and east coast. There are no records from Greenland.

Campanularia integra MacGillivray, 1842

(Fig. 129A-C)

Campanularia integra MacGillivray, 1842: 465; Broch 1909b: 185, fig. 40; Kramp 1914: 1060; Broch 1918: 159, fig. 83; Kramp 1932b: 20; Kramp 1938: 17; Kramp 1943: 19; Naumov 1969: 279, fig. 17A, 54, 145; Calder 1970: 1518, pl. 4 fig. 2; Millard 1975: 208, fig. 69,.

Laomedea repens Allman 1862: 49, fig. 20.

Orthopyxis integra – Cornelius 1982: 60, fig. 6, synonymy; Cornelius 1995b: 235, fig. 54.

TYPE LOCALITY – Mouth of River Don, Aberdeen, Scotland, on *Tubularia indivisa*.

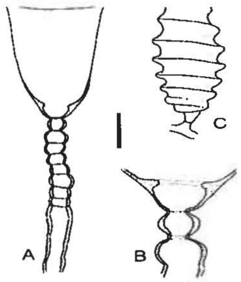

Figure 129. Campanularia integra *MacGillivray, 1842; BIOICE 2679. A, hydrotheca, scale bar 0.2 mm. B, base of hydrotheca, scale bar 0.1 mm. C, gonotheca, scale bar 0.5 mm.*

MATERIAL GREENLAND – "Kangamiut" stations 1 – 3 – 5 – 9 – "Kap Farvel" stations 55, fertile – 60, fertile – 74, fertile – 95, fertile – 117 – 138 – 139, fertile – ZMUC, N. Strømfjord, 31.07.1911, 21-24 m, material of Kramp (1914) on seaweed, fertile.

MATERIAL ICELAND – BIOICE stations 2350 – 2679, fertile.

DESCRIPTION – colony stolonal, pedicels long, smooth or with stretches of transverse annulation especially at top. Between pedicel and hydrotheca a sub-hydrothecal spherule. Hydrotheca bell-shaped, up to 0.7 mm deep, broadest at margin, walls sometimes thickened, margin smooth, slightly flaring, at base a small separate chamber delimited by an ring of thickened perisarc. Gonotheca 0.6 mm high, cylindrical, truncate at end, tapering abruptly at base, body encircled by a sharp spiral keel (6-8 windings). Gonophores released as medusoids devoid of tentacles (see Cornelius 1995b for more details).

REMARKS – this species was placed into the genus *Campanularia* and not *Orthopyxis*, as the distinction of these two genera is based on merely gradual characters.

DISTRIBUTION – nearly cosmopolitan, occurring in all oceans from the intertidal to a little below continental shelf depths; and from the tropics to latitudes as high as 76.67°N (Greenland). The species is one of the most widely distributed of all hydroids. Despite its wide distribution, it is rare or absent in some places, like the Baltic Sea and Dutch Waters (Cornelius 1982). Present all around Iceland as well as at western and eastern Greenland.

***Campanularia volubilis* (Linnaeus, 1758)**
(Fig. 130A-B)

Sertularia volubilis Linnaeus, 1758: 811.

Campanularia volubilis – Broch 1909b: 184, fig. 39, variation; Kramp 1914: 1063; Broch 1918: 153, fig. 80; Kramp 1932b: 21; Fraser 1937: 69, pl. 14 fig. 63; Kramp 1938: 14; Kramp 1943: 17; Fraser 1944: 131, pl. 23 fig. 104; Naumov 1969: 273, figs 16G, 17C, 139; Calder 1970: 1520, pl. 4 fig. 5; Ólafsson 1975: 7, fig. 4; Cornelius 1982: 55, fig. 4, synonymy; Cornelius 1995b: 232, fig. 53.

TYPE LOCALITY – Brighton, England (see Cornelius 1982).

MATERIAL GREENLAND – Bank. unders. station 5291 – "Kap Farvel" stations 58 – 136 – ZMUC, 66.52°N 53.92°W, Holsteinsborg, 120-200 m, 19.07.1953.

MATERIAL ICELAND – BIOICE stations 2000 – 2003, fertile – 2067 – 2203 fertile – 2204 – 2484, fertile – 2485, fertile – 2508 – 2509 – 2524 – 2528 – 2537, fertile – 2548 – 2679.

DESCRIPTION – colonies stolonal, small, frequently on other hydroids, hydrothecae on pedicels. Pedicels up to 2 mm, straight, smooth or spirally sculptured over stretches, nearly invariably so at distal end, with distinct subhydrothecal spherule. Hydrotheca cylindrical, rounded base, depth 0.5-0.6 mm, diameter 1/2 of length or less, rim with rounded cusps and embayments, embayments slightly everted, no crease lines running along hydrotheca, cross-section circular, at base of hydrotheca an annular thickening of the perisarc delimiting a small basal chamber. Gonotheca bottle shaped, up to 1.1 mm high, with oval body and long tubular neck (1/3 of body), circular aperture on distal end of neck, pedicel at base short.

REMARKS – Cornelius (1982) regarded *C. groenlandica* Levinsen, 1893 as conspecific

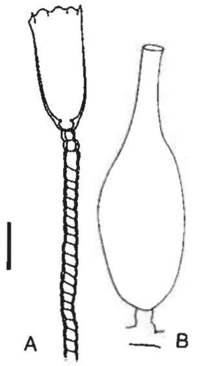

Figure 130. Campanularia volubilis *(Linnaeus, 1758); BIOICE 2003, scale bar 0.2 mm. A, hydrotheca and part of caulus. B, gonotheca.*

with *C. volubilis*. Formally they are indeed similar, however the twofold size difference and the distinct crease lines along the hydrotheca of *C. groenlandica* make both species easily separable (comp. Figs 130 and 127). In the material examined here, both species were found occasionally growing on the same hydroid and the differences were very obvious.

DISTRIBUTION – Atlantic coast of Europe (except Baltic Sea), Mediterranean, all around Iceland, western and eastern Greenland, Canada (Atlantic & Pacific side), New England, Arctic seas north of Russia, Sea of Okhotsk, Sea of Japan, Bering Sea, Alaska, Washington, California (Naumov 1969, Fraser 1937, Fraser 1944, Calder 1970).

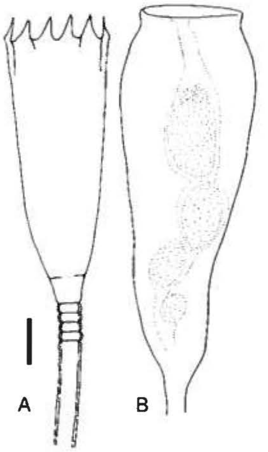

Figure 131. Clytia gracilis *(M. Sars, 1850); BIOICE 2097, scale bar 0.2 mm. A, hydrotheca. B, gonotheca with medusae buds.*

Clytia gracilis (M. Sars, 1850)
(Fig. 131A-B)
Laomedea gracilis M. Sars, 1850: 138.
Gonothyraea gracilis – Hincks 1868: 183, pl. 36 fig. 1; Jäderholm 1909: 64, pl. 6 fig. 3; Fraser 1937: 81, pl. 16 fig. 80; Fraser 1944: 148, pl. 27 fig. 121.
Laomedea gracilis – ? Broch 1918: 170, fig. 88; ? Kramp 1938: 22; Ólafsson 1975: 8, fig. 10.
Obelia gracilis – Naumov 1969: 287, figs 16H & 153.
Clytia gracilis – Cornelius & Östman 1986: 163; Calder 1991: 54, fig. 31, synonymy; Ramil & Vervoort 1992a: 235, fig. 67a; Cornelius 1995b: 246, fig. 56; Hirohito 1995: 63, fig. 18c-g; Migotto 1996: 81, fig. 15c.

TYPE LOCALITIES – Lofoten, Norway.

MATERIAL ICELAND – BIOICE stations 2440 – 2442, fertile – 2245, fertile – 2459, with gonothecae – BIOICE 2821, fertile – 2820, fertile – 2097, fertile – 2161 – 2438, fertile.

DESCRIPTION – colonies erect, up to 2 cm, shoots branching 2-3 times, pedicels long, smooth and annulated. Hydrotheca elongate, depth 1-1.2 mm, diameter at opening 0.4 mm, thin walled, with 10-12 large, pointed triangular cusps, cusped inclined to one side, embayments rounded. Diaphragm very thin, iris-like. Pedicel at origin and end with a few annuli. Gonotheca carrot-shaped, 1.5 mm long, diameter 0.55 mm, walls smooth, with short and broad neck, large terminal opening. Gonotheca contains several medusae buds that are released as free medusae. For description of adult medusa see Cornelius (1995b).

REMARKS – the elongated hydrotheca with sharp, tilted teeth (Fig. 131A) and the branched colony make this campanularid distinctive and identifiable even in the absence of a gonotheca.

DISTRIBUTION – nearly cosmopolitan, but not all identifications are reliable. Recorded from continental Europe, British Isles, Faroes, Iceland (north, south, west coast), Mediterranean, Marocco, Barents Sea, South Africa, Tierra del Fuego, Brazil, Florida to Canada, Vancouver Island to Alaska. It occurs normally at 15-40 m depth, but depths down to 1443 m are possible (Fraser 1937, Fraser 1944, Cornelius 1995b, Migotto 1996). The previous Icelandic records of this species are perhaps referring in part to *Gonothyraea loveni* (see remarks under this species). Unambiguously identified *Clytia gracilis* of the BIOICE collection came from the south and north coast, from depths of 53-436 m. The species is not known from Greenland.

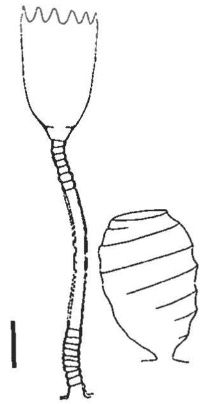

Figure 132. Clytia hemisphaerica *(Linnaeus, 1767); from Mediterranean, scale bar 0.2 mm, left hydrotheca, right gonotheca.*

Clytia hemisphaerica (Linnaeus, 1767)
(Fig. 132)
Medusa hemisphaerica Linnaeus, 1767:1098.
Campanularia johnstoni – Broch 1918: 163, map 84; Kramp 1938: 16; Naumov 1969: 270, figs 136-137.
Clytia johnstoni – Fraser 1944: 138, pl. 24 fig. 111.
Clytia hemisphaerica – Millard 1975: 217, fig. 72a-d; Cornelius 1982: 73; fig. 9; Calder 1991: 57, fig. 32, synonymy; Cornelius 1995b: 252, fig. 57; Migotto 1996: 82, fig. 15d-f.
TYPE LOCALITY – Belgium.
MATERIAL ICELAND – BIOICE stations 2249 – 2438 (both infertile).
OTHER MATERIAL EXAMINED – MHNG INVE 28964, Mediterranean, Mallorca, Cala Murada, June 1997, 2-4 m, coll. by author, release of medusa observed.

DESCRIPTION – colonies nearly always stolonal, hydrothecae on pedicels, pedicels smooth and annulated, annulated stretches at begin and end of pedicel. Hydrotheca bell shaped, broadest at rim, up to 1 mm deep in Icelandic material, smaller in more southern populations, diameter about half the length, margin with about 10 tall, rounded or pointed, symmetric cusps, embayments rounded, not everted, near base of hydrotheca a thin, iris-like diaphragm. Gonotheca ovoid, on short pedicel, distal end broadly truncate, wall with more or less distinct spiral ridge. Gonophores released as free medusa. For description of adult medusa see Cornelius (1995b).

REMARKS – *Clytia hemisphaerica* can be difficult to identify in the absence of gonothecae.

DISTRIBUTION – polyp nearly cosmopolitan in temperate waters of all oceans, in Europe reaching up to Bergen in Norway and at least 70°N along the North American continent, but not all records are reliable, especially the arctic ones. (Fraser 1944, Cornelius 1995b). At Iceland recorded from the east and south coast in waters less than 80 m deep. Unknown from Greenland.

Gonothyraea loveni (Allman, 1859)
(Fig. 133A-B)
Laomedea loveni Allman, 1859: 138; Kramp 1914: 1072; Kramp 1938: 22.
Gonothyraea hyalina Hincks, 1866: 297; Hincks 1868: 184, pl. 35 fig. 2.
Laomedea gracilis – ? Broch 1918: 170, fig. 88; ? Kramp 1938: 22.
Obelia loveni – Naumov 1969: 285, figs 16I, 152.
Gonothyraea loveni – Ralph 1957: 824, fig. 3g-k; Calder 1970: 1520, pl. 4 fig. 6; Millard 1975: 224, fig. 74A-F; Cornelius 1982: 92, fig. 15, synonymy; Cornelius 1995b: 262, fig. 60.

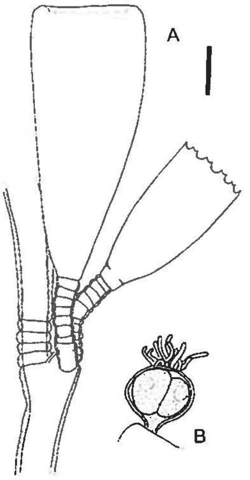

Figure 133. Gonothyraea loveni *(Allman, 1859). A, "Kap Farvel" station 103, part of stem with gonotheca and hydrotheca, scale bar 0.2 mm. B, Sandger›i, sporosac dangling out of gonotheca, after life, same scale as A.*

Laomedea hyalina – Kramp 1914: 1071; Broch 1918: 169, fig. 87; Kramp 1932b: 21; Kramp 1938: 22.

Type locality – Firth of Forth, Scotland.

Material Greenland – Bank. unders. station 5291 – "Grønland" 1975 stations 15, fertile – 25 – "Kap Farvel" stations 59, fertile – 103, fertile – ZMUC, 66.52°N 53.92°W, Holsteinsborg, 120-200 m, 19.07.1953, fertile.

Material Iceland – BIOICE stations 2002, fertile – 2003, fertile – 2005, fertile – 2006, fertile – 2451 – 2137, fertile – MHNG INVE29034, Sandger›i, numerous living colonies collected 3.05.2000 by author, low water mark, fertile.

Description – colonies erect, height 1.5 cm and more, monosiphonic, branching several times, annulated above origin of branches. Hydrothecae on pedicels, pedicels usually annulated throughout and tapering towards distal. Hydrotheca bell-shaped, elongate, depth 0.55-0.7 mm, diameter about half the length or less, margin castellate, cusp with shallow rounded notch, embayments between cusps rounded, at base of hydrotheca iris-like diaphragm. Gonotheca on pedicel similar to the ones of the hydrothecae, gonotheca up to 1.2 mm in length, diameter widest at end, about 0.4-0.5 mm, tapering evenly towards below, distal end truncate, opening almost as large as end of gonotheca, with small intucked collar. Gonophores sessile medusoids, spherical, several per gonotheca, mature medusoids dangle in groups of 1-3 outside aperture of gonotheca, medusoids with a tuft of 8-20 thin tentacles, females with 3-4 eggs.

Remarks – the nominal species *Gonothyraea hyalina* Hincks, 1866 is here also regarded indistinguishable from *G. loveni*, following authors like Naumov (1969), Calder (1970), and Cornelius (1982). Broch (1918) and Kramp (1938) kept both species apart on account of the lines along the exterior of the hydrotheca. Such lines, however, are not evident in the figures of Hincks (1868). Also Broch's *Laomedea gracilis* perhaps belong to here, as he describes them as having sessile sporosacs protruding from the gonotheca, a trait very characteristic for *G. loveni*. Much confusion arose around the name *Laomedea gracilis* Sars, 1850, as apparently two species were included in the type material (see Cornelius 1982: 94). One part of the type material belonged to the actual species, while the other is now known as *Clytia gracilis* (see above).

Distribution – recorded from both sides of the North Atlantic Ocean and from the Arctic Ocean; also from South Africa, Australia and New Zealand. In Europe, reported north to the Faroes and Svalbard, Baltic Sea and Mediterranean. Kramp (1938, as *L. hyalina* and *L. loveni*) reports this species from all around the Iceland, in depths from 0 to 95 m. The species is present at western and eastern Greenland

Laomedea flexuosa Alder, 1857

(Fig. 134A-C)

Laomedea flexuosa Alder, 1857: 122; Broch 1918: 165; Kramp 1938: 17; Ólafsson 1975: 7, fig. 5; Cornelius 1982: 105, fig. 19, synonymy; Cornelius 1995b: 281, fig. 65.

Type locality – British Isles.

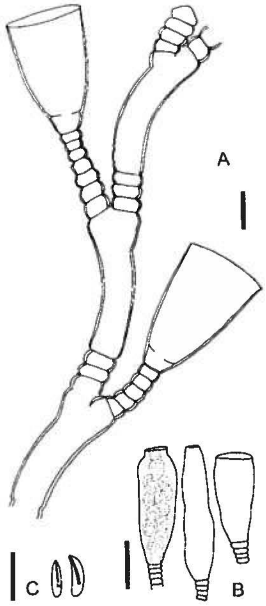

Figure 134. Laomedea flexuosa *Alder, 1857; Iceland, Sandger›i, after living material. A, part of stem, note curved segments, scale bar 0.2 mm. B, gonothecae from same colony, first one with sporosacs shown, note variability of shape, scale bar 0.5 mm. C; nematocysts, scale bar 10 µm.*

Material Iceland – MHNG INVE29031, Sandger›i, numerous living colonies with male sporosacs collected by author, May 2000, intertidal.

Description – colonies erect, up to 2 cm, branching or not, stem and branches characteristically flexuose through curved internodes, internodes intercalated by 1-8 annuli, annulated stretches usually above origin of pedicels or side branches. Hydrotheca on completely annulated pedicels, tapering towards distal. Hydrotheca bell-shaped, about 0.55-0.70 mm deep, diameter about 0.4 mm, margin smooth, diaphragm thin, transverse. Gonotheca 1.0-1.7 mm, diameter 1/3 to 1/4 of length, carrot- to spindle shaped, variable, end truncated (Fig 134B). Nematocysts: almond-shaped microbasic mastigophores in tentacles; slightly larger and curved microbasic mastigophores in hydranth body and especially in budding regions (Fig 134C).

Remarks – this species occurs in shallow waters and can be very abundant just at the low water mark. In the Icelandic material, the shape of the gonotheca varied considerably, even within the same colony (Fig 134B).

Distribution – recorded widely in the North Atlantic Ocean from north Norway, Barents Sea, White Sea, Faroes, Iceland, western Greenland, Mediterranean, Mauritania, Ghana, and Gulf of St. Lawrence. At Iceland recorded from nearly all coasts, but some records may be wrong (Kramp 1938). Reliable records are from the south-western part of the island.

Laomedea neglecta Alder, 1856

Laomedea neglecta Alder, 1856b: 440, pl. 16 figs 1-2; Kramp 1938: 18; Cornelius 1982: 107, fig. 20, synonymy; Cornelius 1995b 284, fig. 66.
Campanularia fragilis Hincks, 1863: 46; Hincks 1868: 175, pl. 32.

Type locality – Newcastle upon Tyne, England.

Material Iceland –ZMUC, Hvalfjor›ur, Iceland, coll. 25.5.1935, material of Kramp (1938).

Description – see Cornelius (1995b).

Remarks – *Laomedea neglecta* is a very rare species and its validity is not entirely established. At least some of its records may actually refer to other Campanulariidae (Cornelius 1995b). Kramp (1938) recorded this species also for Iceland. Kramp's material was re-examined for this study. It is composed of a few small stems growing on *Hydrallmania falcata*, each stem with 2 to 3 mostly damaged hydrothecae. While all other characters are compatible with the description of *L. neglecta* given by Cornelius (1995b), the hydrothecae are larger (around 0.75 mm compared to 0.3-0.4 mm). There are no gonothecae present. Thus, there are no diagnostic characters available for a positive identification and the material could as well belong to several other Campanulariidae, notably also *G. loveni*. Fertile material must be found until the presence of this species can be considered certain for Iceland.

DISTRIBUTION – British Isles, ? Iceland, European coast from Denmark to France, Mediterranean. Not known from Greenland.

Obelia dichotoma (Linnaeus, 1758)

Sertularia dichotoma Linnaeus, 1758: 812.
Laomedea longissima – in part Broch 1918: 167.
Laomedea dichotoma – Kramp 1938: 20.
Obelia dichotoma – in part. Cornelius 1975a: 265, figs 3-4; Millard 1975: 227, fig. 75F-J; Cornelius 1982: 117; Cornelius 1990: 550, figs 2-3, synonymy; Calder 1991: 72, fig. 38, synonymy; Ramil & Vervoort 1992a: 243, fig. 68c; Cornelius 1995b 296, fig. 69; Hirohito 1995: 74, fig. 21d-k; Migotto 1996: 88, fig. 16d.
TYPE LOCALITY – coast of SW England.
MATERIAL ICELAND – BIOICE stations 2462 – 2570 – 2820 – 2821 (all without gonothecae).

DIAGNOSIS – *Obelia* species with normally large polysiphonic colonies, but mature monosiphonic ones occasionally also possible, 5-35 cm, rim of hydrotheca even to crenate. With characteristic, banana-shaped isorhiza nematocyst.

DESCRIPTION – see Cornelius (1995b).

REMARKS – despite being infertile, all specimens could reliably identified by examining their nematocysts. The long, thin, banana-shaped capsules present besides the more usual ones render this species quite easily identifiable (Östman 1982, 1987). Nematocyst examination is necessary to distinguish monosiphonic specimens of *O. dichotoma*, which is normally polysiphonic, from the very similar *O. longissima* and other branching campanularids (see Cornelius 1995b for further details).

DISTRIBUTION – recorded as nearly cosmopolitan in coastal waters. Although this may reflect the true distribution, confusion with other species of *Obelia* may account for some of the records (Cornelius 1995b). Kramp (1938) recorded this species for the first time for Iceland. He also referred Saemundsson's and Broch's (1918) *Laomedea flexuosa* to the present species. Kramp found it at localities from all sides of the island. The present material came from 128-374 m from the south and north coast. It is not known from Greenland.

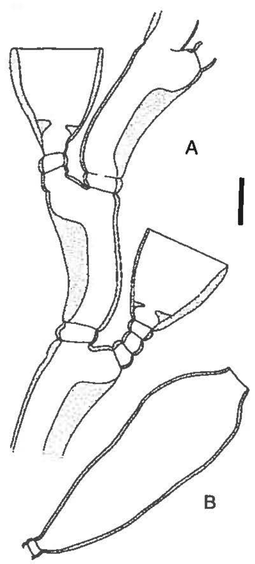

Figure 135. Obelia geniculata *(Linnaeus, 1758); Iceland, Sandger›i, scale bar 0.2 mm. A, part of stem, note asymmetric thickenings of perisarc. B, gonotheca*

Obelia geniculata (Linnaeus, 1758)

(Fig. 135A-B)
Sertularia geniculata Linnaeus, 1758: 812.
Obelia geniculata – Ralph 1957: 831, fig. 4i; Cornelius 1975a: 272 figs 1 & 5, synonymy; Millard 1975: 229, fig. 75A-B; Ólafsson 1975: 7, fig. 6; Cornelius 1982: 119, table 4, synonymy; Cornelius 1995b 301, fig. 70; Hirohito 1995: 76, fig. 22a-b; Migotto 1996: 90, fig. 16e.
Laomedea geniculata – Broch 1918: 166, fig. 85; Kramp 1938: 18.
TYPE LOCALITY – Dover, Kent, England, intertidal on fucoid alga.
MATERIAL ICELAND – MHNG INVE29029, abundant living material collected May 2000 by author at Sandger›i and Gar›ur, growing on laminarians, release of medusae observed.

DIAGNOSIS – *Obelia* species with monosiphonic colonies, sparingly branched or not, usually less than 2 cm high, rim of hydrothecae smooth, lateral walls of internodes with characteristic asymmetric thickening of the perisarc (Fig. 135A).

DESCRIPTION – see Cornelius (1995b).

REMARKS – in the examined material, only one type of nematocysts was found: the ordinary almond-shaped microbasic mastigophore.

DISTRIBUTION – nearly cosmopolitan in temperate to cold waters, from north Atlantic to South Georgia, northern Pacific to New Zealand, only rare or absent in tropical waters. At Iceland it is known from numerous localities around the island, except for the south coast from Vestmannaeyjar to Sey›isfiör›ur (Kramp 1938). The absence from the latter region is explained by Kramp by lack of investigations and lack of suitable substrata. The species is also unknown from Greenland.

***Obelia longissima* (Pallas, 1766)**
(Fig. 136A-C)
Sertularia longissima Pallas, 176: 119, in part.
Obelia longissima – Kramp 1914: 1069; Kramp 1932b: 22; Ralph 1957: 831, figs 4j-k & 5 a-h; Naumov 1969: 284, figs 149-151; Cornelius 1990: 557, figs 5-6; Cornelius 1995b 304, fig. 71.
Laomedea longissima – in part Broch 1918: 167, map 86; Kramp 1938: 21; Kramp 1943: 19.
MATERIAL GREENLAND – Just & Andersen 1966 stations 7 – 8 – 23 – 24 – Bank. unders. station 5294 - ZMUC, Godthaab, Hovedstation, 100 m, 25.07.1955, fertile.
MATERIAL ICELAND – BIOICE stations 2000, fertile – 2002, fertile – 2189, fertile – 2189.

DESCRIPTION – colonies long (up to 17 cm in examined material), very elongate shape. Main stem only occasionally branched, brown, soft, mostly monosiphonic except some that are secondarily polysiphonic at base due to overgrowth by young, pale tubes (max. 3 tubes). Segments usually nearly straight, sometimes slightly curved, tubular, wall usually of uniform thickness, regular stretches with distinct annulation (up to 10 annuli), annulated region at base of side branches and below hydrotheca. Side branches paler than stem. Pedicels of hydrothecae with about 6-10 annuli, diameter decreasing towards distal. Hydrotheca conical to bell-shaped, depth 0.4-0.5 mm, diameter about 0.3 mm, circular in cross-section, perisarc thin, rim undulated but often also eroded, diaphragm at lower sixth of hydrotheca, thin, iris-like, transverse to oblique. Gonotheca carrot-shaped, about 0.8 mm long, diameter about 0.28 mm near end, opening on short neck at distal end. Gonophores are released as free medusae typical for the genus. Nematocysts: two sizes of mastigophores (see Fig. 136), larger one 8.5x2.5 µm, smaller and more abundant one 6.5x2 µm. For more details and the medusa see Cornelius (1995b).

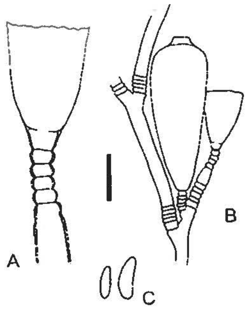

Figure 136. Obelia longissima *(Pallas, 1766); from northern Greenland, Jørgen Brønlund Fjord. A, hydrotheca and pedicel, scale bar 0.2 mm. B, part of stem with gonotheca and hydrotheca, scale bar 0.5 mm. C, shape of nematocysts, scale bar 10 µm.*

REMARKS – *Obelia longissima* closely resembles *Obelia dichotoma* and both species have often been synonymised. Nematocyst comparisons by Östman (1982), however, showed that they are distinct. This was later elaborated by Cornelius (1990). The present samples were all examined for their nematocysts and they had capsules that matched the frequent microbasic mastigophore described by Östman (1982) (Fig. 136C).

DISTRIBUTION – probably nearly cosmopolitan in temperate to cold waters, recorded from Arctic seas to South Orkneys. Numerous Indo-Pacific records under a variety of names probably refer to this species (Cornelius 1990). The species was also reported from all around Iceland, in depths of 0 to 75 metres (Broch 1918, Kramp 1938). Previously also known from the western and eastern coast of Greenland. New material of this species came also from the north tip of Greenland (Pearyland), which extends this already widely distributed hydroid to 82°N.

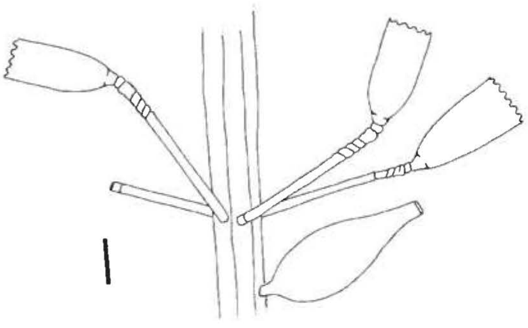

Figure 137. Rhizocaulus verticillatus *(Linnaeus, 1758); BIOICE 2005, part of stem with a whorl of hydrothecae and a gonotheca, scale bar 0.5 mm.*

Rhizocaulus verticillatus (Linnaeus, 1758)

(Fig. 137)

Sertularia verticillata Linnaeus, 1758: 811.

Rhizocaulus verticillatus – Cornelius 1982a: 67, fig. 7, synonymy; Cornelius 1995b: 240, fig. 55.

Verticillina verticillata – Naumov 1969: 291, fig. 159.

Campanularia verticillata – Broch 1909b: 188, fig. 43; Kramp 1914: 1068; Broch 1918: 155, fig. 71; Kramp 1932b: 21; Kramp 1938: 15; Kramp 1943: 17; Calder 1970: 1519, pl. 4 fig. 4.

Type locality – coast of Cumberland, NW England (Cornelius 1982).

Material Greenland – Bank. unders. station 5291, fertile – "Grønland" 1975 station 38, fertile – "Kangamiut" stations 1 – 2 – 3 – 4 – 6 – 9 – 10 – "Kap Farvel" stations 11, fertile – 14, fertile – 40 – 45 – 48, fertile – 54, fertile – 59, fertile – 62 – 75, fertile – 95, fertile – 128 – Just & Vibe 1968 station 12 – ZMUC, 69.23°N 51.50°W, 350-380m, 25.07.1966, fertile – ZMUC, Christianshaab, 380-410 m, 22.07.1949, fertile.

Material Iceland – BIOICE stations 2002 – 2003 – 2005, fertile – 2006 – 2097 – 2114, fertile – 2154 – 2156 – 2162 – 2180 – 2332 – 2490 – 2491 – 2524 – 2528 – 2530 – 2533, fertile – 2537 – 2564 – 2597 – 2601.

Description – colonies erect, up to 15 cm, occasionally and irregularly forked, polysiphonic, tubes smooth, parallel. Hydrothecae on unbranched pedicels arising in regular whorls all around the stem, 4-6 hydrothecae per whorl. Pedicels smooth for most of their part, distally with spiral sculpturing, ending in subhydrothecal spherule, hydrotheca bell-shaped, depth 0.9-1.2 mm, diameter about _ of depth, rim with well formed rounded cusps and embayments. Gonothecae bottle-shaped, about 2 mm, arising between successive whorls of hydrothecae, on short pedicel, aperture small on long tubular neck.

Remarks – this campanularid with its distinctive colony structure is rather easy to identify, even if only fragments are available.

Distribution – in the north-east Atlantic, recorded from the Arctic Ocean south to Brittany. Known from the Black Sea, but absent from the Mediterranean. In the West Atlantic known from the Arctic Ocean to Cape Hatteras, in the Pacific Ocean known from the Arctic Ocean south to the Sea of Japan and California. At Iceland, Kramp (1938) summarises the known records which are mainly from the south, west and north-western coast in depths of 34-150 m. A single record came from the north coast. Interestingly, the BIOICE material came mostly from the north and east coast. It is also well known from western and eastern Greenland.

Order Limnomedusae

Monobrachium parasitum Mereschkowsky, 1877

(Fig. 138 A-C)

Monobrachium parasitum Mereschkowsky, 1877: 225, pl. 5 figs 1-6, pl. 6 figs 7-14; Kramp

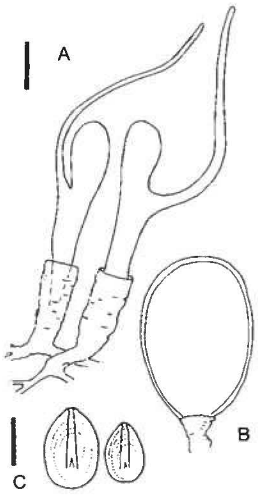

Figure 138. Monobrachium parasitum *Mereschkowsky, 1877; "Kap Farvel" station 38. A, two hydranths, scale bar 0.4 mm. B, gonophore, some scale as A. C, nematocysts, scale bar 10 µm.*

1914: 995; Broch 1916: 43; Kramp 1932a: 5; Naumov 1969: 548, figs 394-396.

Type locality – Bay of Onega, White Sea, 9 m.

Material Greenland – "Kap Farvel" station 38, fertile – Just & Vibe 1968 stations 18, fertile – 30 – 34 – ZMUC, Godthaab Harbour, 4 m, coll. 6.04.1960, on *Macoma calcaria* (Chemnitz) (Bivalvia).

Description – hydroids colonial, stolonal, growing on bivalves. Stolons ramified, of very variable diameter, increasing towards polyp and dilating into loose tube surrounding the base of the hydranths. Perisarc with crinkles. Hydranths 2-3 mm, club-shaped, hypostome very large, rounded, often swollen. Hydranth with a single, long, filiform tentacle. Gonophores arise from stolons, about 2 mm, oblong spherical, with perisarc covered pedicel. Gonophores develop into medusoid with 4 radial canals, no tentacles, gonads in broad double strands along whole radial canal, manubrium rudimentary, velum present (for histological details see Naumov 1969).

Remarks – Petersen (1978, 1984) examined the relationship of *Monobrachium parasitum* and its bivalve host and found that *M. parasitum* causes a growth retardation of the host bivalve. The hydroid is thus a true parasite.

Distribution – arctic seas north of Russia, seas of Okhotsk and Japan, Spitsbergen, western Greenland, eastern and western Canada, California (doubtful). Not known from Iceland.

Acknowledgements

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Appendix 1

Material of Icelandic Museum of Natural History BIOICE material, of Icelandic origin, see Tendal (1998) and Schuchert (2000) for an introduction. BIOICE station data are given as follows: station number, co-ordinates in decimal degrees, depth interval, collection date

2000, 65.35N 13.79W, 26-26 m, 19.07.1991
2001, 65.35N 13.79W, 26-27 m, 19.07.1991
2002, 65.35N 13.61W, 65-68 m, 19.07.1991
2003, 65.35N 13.61W, 64-68 m, 19.07.1991
2004, 65.35N 13.33W, 177-173 m, 19.07.1991
2005, 65.35N 13.31W, 171-171 m, 19.07.1991
2006, 65.35N 12.96W, 222-228 m, 20.07.1991
2008, 65.42N 11.73W, 320-321 m, 20.07.1991
2009, 65.50N 11.39W, 611-626 m, 20.07.1991
2010, 65.50N 11.39W, 619-639 m, 20.07.1991
2011, 65.58N 11.28W, 768-755 m, 20.07.1991
2012, 65.58N 11.28W, 769-779 m, 20.07.1991
2018, 66.57N 11.22W, 1390-1415 m, 21.07.1991
2019, 66.55N 12.19W, 1253-1268 m, 21.07.1991
2021, 66.64N 12.59W, 1018-962 m, 22.07.1991
2022, 66.61N 12.72W, 325-315 m, 22.07.1991
2056, 66.28N 18.81W, 120-108 m, 10.07.1992
2060, 66.01N 17.53W, 48-46 m, 02.07.1992
2061, 66.01N 17.54W, 49-50 m, 02.07.1992
2062, 66.04N 17.54W, 104-103 m, 02.07.1992
2064, 66.04N 17.54W, 102-102 m, 02.07.1992
2067, 66.14N 17.61W, 196-202 m, 02.07.1992
2069, 66.57N 17.72W, 485-486 m, 03.07.1992
2070, 66.57N 17.73W, 489-485 m, 03.07.1992
2071, 66.66N 17.94W, 104-99 m, 03.07.1992
2074, 66.67N 17.92W, 201-171 m, 03.07.1992
2075, 67.19N 17.53W, 563-572 m, 03.07.1992
2080, 67.38N 17.35W, 897-900 m, 04.07.1992
2085, 67.26N 17.44W, 754-761 m, 04.07.1992
2088, 67.24N 17.86W, 617-636 m, 04.07.1992
2090, 67.22N 17.82W, 539-532 m, 05.07.1992
2091, 67.19N 17.77W, 405-408 m, 05.07.1992
2093, 67.20N 17.76W, 407-409 m, 05.07.1992
2094, 67.03N 17.57W, 303-304 m, 05.07.1992
2096, 67.02N 17.58W, 300-297 m, 05.07.1992
2097, 66.62N 18.24W, 110-116 m, 05.07.1992
2099, 66.62N 18.24W, 112-107 m, 05.07.1992
2100, 68.00N 19.42W, 1141-1132 m, 06.07.1992
2102, 68.00N 19.44W, 1146-1146 m, 06.07.1992
2103, 67.83N 19.55W, 905-903 m, 06.07.1992
2107, 67.84N 19.55W, 905-903 m, 06.07.1992
2110, 67.76N 19.49W, 762-765 m, 06.07.1992
2114, 67.70N 19.46W, 489-493 m, 07.07.1992
2116, 67.70N 19.44W, 495-493 m, 07.07.1992
2117, 67.47N 19.53W, 405-383 m, 07.07.1992
2119, 67.12N 19.87W, 284-286 m, 07.07.1992
2122, 67.18N 19.56W, 346-343 m, 07.07.1992
2124, 67.18N 19.56W, 347-351 m, 07.07.1992
2126, 66.99N 18.83W, 208-204 m, 08.07.1992
2128, 66.98N 18.83W, 203-202 m, 08.07.1992
2129, 66.76N 18.70W, 678-661 m, 08.07.1992
2131, 66.76N 18.70W, 660-674 m, 08.07.1992
2132, 66.74N 18.92W, 492-499 m, 08.07.1992
2134, 66.74N 18.92W, 504-497 m, 08.07.1992
2136, 66.73N 18.95W, 417-399 m, 08.07.1992
2137, 66.72N 19.32W, 297-293 m, 08.07.1992
2139, 66.71N 19.31W, 300-289 m, 08.07.1992
2140, 66.72N 19.58W, 204-207 m, 08.07.1992
2142, 66.71N 19.58W, 207-202 m, 08.07.1992
2143, 66.86N 20.16W, 399-397 m, 08.07.1992
2145, 66.85N 20.16W, 398-399 m, 08.07.1992
2147, 66.75N 20.10W, 300-297 m, 09.07.1992
2150, 66.70N 20.04W, 149-149 m, 09.07.1992
2152, 66.70N 20.05W, 148-148 m, 09.07.1992
2154, 66.57N 20.03W, 100-98 m, 09.07.1992
2156, 66.57N 20.01W, 97-99 m, 09.07.1992
2161, 66.29N 20.11W, 130-129 m, 09.07.1992
2162, 66.45N 19.59W, 294-296 m, 09.07.1992
2164, 66.45N 19.60W, 294-296 m, 09.07.1992
2166, 66.33N 19.60W, 169-194 m, 09.07.1992
2167, 66.33N 19.59W, 183-168 m, 09.07.1992
2168, 66.31N 19.21W, 86-88 m, 09.07.1992
2170, 66.31N 19.20W, 88-88 m, 09.07.1992
2174, 66.44N 18.81W, 425-436 m, 09.07.1992
2175, 66.50N 18.54W, 203-206 m, 10.07.1992
2177, 66.51N 18.53W, 201-199 m, 10.07.1992
2178, 66.37N 18.30W, 100-99 m, 10.07.1992
2180, 66.36N 18.29W, 99-97 m, 10.07.1992

2185, 66.28N 18.00W, 68-68 m, 10.07.1992
2187, 66.16N 18.05W, 23-29 m, 10.07.1992
2189, 66.16N 18.05W, 19-24 m, 10.07.1992
2193, 66.09N 18.62W, 18-22 m, 10.07.1992
2197, 64.30N 22.41W, 38-50 m, 02.09.1992
2198, 64.31N 22.39W, 63-64 m, 02.09.1992
2201, 64.37N 22.82W, 69-75 m, 02.09.1992
2203, 64.29N 22.65W, 23-23 m, 02.09.1992
2207, 64.06N 22.99W, 81-83 m, 02.09.1992
2213, 64.16N 23.97W, 260-264 m, 03.09.1992
2215, 64.26N 24.43W, 213-219 m, 03.09.1992
2216, 64.26N 24.44W, 214-219 m, 03.09.1992
2217, 64.19N 25.29W, 259 m, 03.09.1992
2218, 64.21N 25.28W, 265-270 m, 03.09.1992
2219, 64.21N 25.28W, 265 m, 03.09.1992
2221, 63.92N 25.27W, 240-250 m, 03.09.1992
2229, 63.81N 24.36W, 296-300 m, 04.09.1992
2233, 63.71N 24.41W, 209-209 m, 04.09.1992
2234, 63.65N 24.43W, 189 m, 04.09.1992
2237, 63.45N 24.68W, 296-296 m, 04.09.1992
2239, 63.35N 25.36W, 307-310 m, 04.09.1992
2240, 63.35N 25.36W, 307-308 m, 04.09.1992
2241, 63.35N 25.36W, 305-305 m, 04.09.1992
2245, 63.30N 25.56W, 426-467 m, 04.09.1992
2247, 63.30N 25.60W, 550-552 m, 04.09.1992
2249, 63.28N 25.65W, 650-663 m, 04.09.1992
2257, 63.24N 26.49W, 1209-1212 m, 05.09.1992
2260, 62.96N 27.53W, 1392-1404 m, 07.09.1992
2262, 63.12N 25.29W, 648-650 m, 07.09.1992
2265, 63.15N 25.26W, 546-569 m, 08.09.1992
2270, 63.14N 24.99W, 317-318 m, 08.09.1992
2271, 63.14N 24.99W, 312-317 m, 08.09.1992
2272, 63.14N 24.99W, 316-319 m, 08.09.1992
2273, 63.14N 24.98W, 313-316 m, 08.09.1992
2282, 63.14N 23.93W, 390-403 m, 08.09.1992
2288, 62.39N 22.68W, 1390-1410 m, 09.09.1992
2291, 62.46N 22.67W, 1206-1207 m, 09.09.1992
2293, 62.46N 22.67W, 1203-1204 m, 09.09.1992
2299, 63.00N 22.66W, 775-804 m, 10.09.1992
2303, 63.06N 22.69W, 600-612 m, 10.09.1992
2305, 63.11N 22.69W, 406-410 m, 10.09.1992
2308, 63.25N 22.79W, 263-266 m, 10.09.1992
2310, 63.57N 22.71W, 172-207 m, 11.09.1992
2311, 63.58N 22.70W, 206-208 m, 11.09.1992
2313, 63.71N 23.06W, 96-134 m, 11.09.1992
2314, 63.70N 23.06W, 139-156 m, 11.09.1992
2315, 64.10N 9.05W, 991-980 m, 02.05.1993
2316, 64.10N 8.98W, 988-978 m, 02.05.1993
2317, 64.12N 9.05W, 996-1020 m, 02.05.1993
2318, 64.03N 9.62W, 772-775 m, 02.05.1993
2319, 64.02N 9.62W, 776-760 m, 02.05.1993
2320, 64.03N 9.73W, 758-757 m, 02.05.1993
2321, 63.93N 10.00W, 639-628 m, 03.05.1993
2322, 63.92N 10.07W, 627-629 m, 03.05.1993
2323, 63.92N 10.08W, 623-622 m, 03.05.1993
2326, 63.73N 10.15W, 563-562 m, 03.05.1993
2327, 63.35N 10.85W, 430-429 m, 03.05.1993
2328, 63.33N 10.95W, 430-429 m, 03.05.1993
2329, 63.08N 11.35W, 453-453 m, 03.05.1993
2330, 63.08N 11.33W, 453-452 m, 03.05.1993
2331, 62.92N 12.22W, 563-560 m, 04.05.1993
2332, 62.92N 12.23W, 550-564 m, 04.05.1993
2337, 62.45N 12.92W, 1099-1105 m, 05.05.1993
2341, 62.85N 13.53W, 1015-1018 m, 05.05.1993
2342, 62.85N 13.27W, 846-841 m, 06.05.1993
2343, 63.07N 13.12W, 698-705 m, 06.05.1993
2344, 63.20N 12.97W, 610-616 m, 06.05.1993
2345, 63.38N 12.62W, 497-495 m, 06.05.1993
2346, 63.38N 12.63W, 501-497 m, 06.05.1993
2348, 63.60N 12.25W, 407-403 m, 06.05.1993
2349, 63.62N 12.28W, ~ 400 m 06.05.1993
2350, 63.62N 12.32W, 411-409 m, 06.05.1993
2351, 63.78N 11.85W, 355-356 m, 06.05.1993
2352, 63.78N 11.82W, 350-356 m, 07.05.1993
2353, 63.77N 11.80W, 335-346 m, 07.05.1993
2356, 63.92N 11.62W, 327-324 m, 07.05.1993
2358, 64.17N 11.53W, 318-330 m, 07.05.1993
2360, 64.28N 10.82W, 391-395 m, 07.05.1993
2361, 64.45N 10.45W, 498-494 m, 07.05.1993
2362, 64.48N 10.43W, 495-496 m, 07.05.1993
2363, 64.48N 10.43W, 493-500 m, 07.05.1993
2364, 64.58N 10.05W, 605-606 m, 08.05.1993
2366, 64.65N 9.78W, 675-680 m, 08.05.1993
2367, 64.63N 9.72W, 719-780 m, 08.05.1993
2369, 64.67N 9.57W, 920-1020 m, 08.05.1993
2370, 64.68N 9.55W, 1320-1350 m, 08.05.1993
2371, 64.75N 10.52W, 449-443 m, 08.05.1993
2372, 64.87N 11.43W, 476-461 m, 09.05.1993
2374, 64.93N 11.80W, 215-215 m, 10.05.1993
2376, 64.85N 11.62W, 356-355 m, 10.05.1993
2377, 64.40N 12.88W, 146-147 m, 10.05.1993
2379, 64.32N 12.48W, 310-303 m, 10.05.1993

2380, 64.33N 12.45W, 403-406 m, 10.05.1993
2381, 63.72N 11.50W, 389-389 m, 10.05.1993
2382, 63.58N 11.23W, 302-298 m, 10.05.1993
2388, 63.50N 22.06W, 171-172 m, 30.06.1993
2390, 63.46N 22.07W, 182 m, 30.06.1993
2392, 63.25N 22.20W, 288-291 m, 30.06.1993
2394, 63.13N 22.25W, 230-240 m, 30.06.1993
2397, 63.17N 21.90W, 330-348 m, 30.06.1993
2398, 63.17N 21.89W, 346-348 m, 30.06.1993
2400, 63.13N 21.94W, 511-580 m, 01.07.1993
2401, 63.12N 22.90W, 520-612 m, 01.07.1993
2403, 63.05N 21.83W, 838-840 m, 01.07.1993
2404, 63.04N 21.85W, 802-827 m, 01.07.1993
2407, 62.98N 21.82W, 917-922 m, 01.07.1993
2412, 62.75N 21.55W, 1170-1174 m, 02.07.1993
2414, 63.01N 21.01W, 784-808 m, 02.07.1993
2415, 63.00N 21.01W, 819 m, 02.07.1993
2417, 63.17N 21.20W, 259 m, 02.07.1993
2418, 63.17N 21.20W, 256-280 m, 02.07.1993
2420, 63.13N 20.67W, 300-319 m, 02.07.1993
2424, 63.17N 20.16W, 495-575 m, 03.07.1993
2435, 63.23N 19.53W, 965-987 m, 03.07.1993
2440, 63.34N 19.83W, 228 m, 04.07.1993
2441, 63.34N 19.83W, 228 m, 04.07.1993
2442, 63.27N 20.39W, 138-116 m, 04.07.1993
2450, 63.35N 21.00W, 124 m, 04.07.1993
2451, 63.35N 21.00W, 125 m, 04.07.1993
2454, 63.34N 21.17W, 152-153 m, 04.07.1993
2459, 63.50N 21.66W, 125-125 m, 04.07.1993
2463, 63.42N 21.66W, 133 m, 05.07.1993
2465, 63.25N 21.23W, 180 m, 05.07.1993
2472, 63.11N 21.63W, 666 m, 05.07.1993
2474, 63.07N 21.59W, 791-834 m, 05.07.1993
2475, 63.07N 21.58W, 842-780 m, 05.07.1993
2480, 65.81N 23.92W, 62 m, 11.07.1993
2481, 65.80N 23.89W, 64-65 m, 11.07.1993
2484, 65.84N 24.21W, 37-38 m, 11.07.1993
2488, 65.93N 24.77W, 75 m, 11.07.1993
2490, 66.07N 24.99W, 124 m, 11.07.1993
2491, 66.08N 24.97W, 127-126 m, 11.07.1993
2493, 66.17N 25.94W, 275-275 m, 11.07.1993
2495, 66.18N 25.99W, 333-321 m, 12.07.1993
2499, 66.31N 26.51W, 629-627 m, 12.07.1993
2501, 66.42N 25.84W, 630 m, 12.07.1993
2502, 66.32N 25.82W, 444-446 m, 12.07.1993
2505, 66.25N 25.82W, 321-318 m, 12.07.1993
2506, 66.25N 25.79W, 291-285 m, 12.07.1993
2508, 66.28N 25.44W, 150-150 m, 12.07.1993
2509, 66.29N 25.43W, 154-160 m, 12.07.1993
2511, 66.47N 25.36W, 333-330 m, 12.07.1993
2512, 66.49N 25.30W, 333-335 m, 12.07.1993
2514, 66.57N 25.23W, 465-476 m, 13.07.1993
2515, 66.61N 25.34W, 653 m, 13.07.1993
2516, 66.61N 25.38W, 680-686 m, 13.07.1993
2518, 66.62N 25.56W, 749-746 m, 13.07.1993
2520, 66.75N 24.54W, 155-154 m, 13.07.1993
2522, 66.91N 24.19W, 252-254 m, 13.07.1993
2524, 66.95N 24.00W, 213-216 m, 13.07.1993
2526, 66.61N 23.98W, 226-225 m, 13.07.1993
2527, 66.62N 23.96W, 225-226 m, 13.07.1993
2528, 66.63N 23.93W, 222-218 m, 13.07.1993
2530, 66.42N 23.83W, 138-152 m, 13.07.1993
2531, 66.43N 23.81W, 150-154 m, 13.07.1993
2533, 66.28N 23.97W, 77-76 m, 14.07.1993
2537, 66.25N 23.64W, 44-42 m, 14.07.1903
2539, 66.25N 23.29W, 115-115 m, 14.07.1993
2540, 66.25N 23.29W, 115-115 m, 14.07.1993
2545, 66.07N 22.95W, 67-72 m, 14.07.1993
2548, 66.12N 23.02W, 64-19 m, 14.07.1993
2554, 66.27N 22.65W, 78-74 m, 14.07.1993
2556, 66.36N 23.10W, 20-20 m, 14.07.1993
2557, 66.37N 23.08W, 20-20 m, 14.07.1993
2558, 66.38N 23.13W, 30-30 m, 14.07.1993
2559, 66.38N 23.12W, 30-30 m, 14.07.1993
2562, 66.50N 23.45W, 91-91 m, 14.07.1993
2564, 66.75N 23.21W, 122-123 m, 14.07.1993
2565, 66.83N 23.15W, 180 m, 15.07.1993
2568, 66.92N 23.52W, 196-201 m, 15.07.1993
2570, 67.05N 23.99W, 370-377 m, 15.07.1993
2572, 67.09N 24.09W, 495-496 m, 15.07.1993
2573, 67.10N 24.08W, 489-489 m, 15.07.1993
2574, 67.14N 24.35W, 797 m, 15.07.1993
2575, 67.16N 24.32W, 800-794 m, 15.07.1993
2579, 67.10N 24.72W, 996-994 m, 15.07.1993
2582, 67.73N 22.48W, 721-722 m, 16.07.1993
2583, 67.60N 22.39W, 605-607 m, 16.07.1993
2588, 67.33N 22.53W, 356-357 m, 16.07.1993
2591, 67.21N 22.42W, 333-331 m, 16.07.1993
2592, 67.21N 22.42W, 333-331 m, 16.07.1993
2594, 67.00N 22.61W, 215-213 m, 16.07.1993
2595, 67.00N 22.57W, 203-205 m, 16.07.1993
2597, 66.87N 22.41W, 132-133 m, 17.07.1993

2599, 66.78N 21.56W, 83-84 m, 17.07.1993
2603, 66.93N 17.93W, 433 m, 10.07.1994
2606, 66.93N 17.94W, 435-431 m, 10.07.1994
2608, 67.11N 17.41W, 246-236 m, 10.07.1994
2610, 67.00N 17.42W, 248-238 m, 10.07.1994
2612, 67.13N 17.08W, 350-372 m, 11.07.1994
2613, 67.14N 17.03W, 362-381 m, 11.07.1994
2615, 67.19N 16.85W, 528-538 m, 11.07.1994
2616, 67.19N 16.84W, 535-535 m, 11.07.1994
2618, 67.27N 16.66W, 597-602 m, 11.07.1994
2624, 67.57N 16.57W, 904-910 m, 11.07.1994
2629, 67.33N 16.12W, 602-604 m, 12.07.1994
2631, 67.39N 15.97W, 699-695 m, 12.07.1994
2632, 67.38N 15.95W, 696-695 m, 12.07.1994
2635, 67.50N 15.80W, 795-792 m, 12.07.1994
2648, 68.08N 15.31W, 1306-1310 m, 14.07.1994
2652, 67.60N 15.12W, 910-916 m, 14.07.1994
2655, 67.30N 14.95W, 549-545 m, 14.07.1994
2660, 67.24N 15.47W, 277-265 m, 15.07.1994
2662, 67.22N 16.15W, 350-354 m, 15.07.1994
2668, 66.99N 15.75W, 187-194 m, 15.07.1994
2672, 66.84N 16.26W, 229-225 m, 15.07.1994
2673, 66.84N 16.26W, 227-222 m, 15.07.1994
2675, 66.73N 16.84W, 150-146 m, 15.07.1994
2679, 66.43N 17.17W, 39-90 m, 16.07.1994
2682, 66.26N 17.33W, 181-174 m, 16.07.1994
2683, 66.26N 17.32W, 178-181 m, 16.07.1994
2691, 64.44N 28.24W, 1162-1212 m, 31.08.1994
2697, 64.17N 27.72W, 1042-1042 m, 02.09.1994
2698, 64.18N 27.71W, 1038-1034 m, 02.09.1994
2700, 64.09N 27.83W, 1105-1105 m, 02.09.1994
2701, 64.09N 27.83W, 1121-1123 m, 02.09.1994
2704, 63.84N 27.71W, 1295-1295 m, 02.09.1994
2706, 63.93N 28.27W, 1406-1408 m, 03.09.1994
2707, 63.92N 28.28W, 1407-1408 m, 03.09.1994
2710, 64.84N 24.22W, 220-230 m, 06.09.1994
2713, 64.57N 24.54W, 273-273 m, 06.09.1994
2714, 64.57N 24.54W, 268-267 m, 06.09.1994
2717, 64.51N 25.73W, 256-254 m, 07.09.1994
2719, 64.43N 26.40W, 300-305 m, 07.09.1994
2720, 64.43N 26.40W, 304-304 m, 07.09.1994
2728, 64.23N 27.51W, 927-929 m, 07.09.1994
2740, 67.64N 20.26W, 503-512 m, 30.07.1995
2743, 67.75N 20.47W, 729-732 m, 30.07.1995
2744, 67.75N 20.47W, 729-732 m, 30.07.1995
2745, 67.75N 20.45W, 733-732 m, 30.07.1995
2749, 68.02N 20.65W, 970-941 m, 31.07.1995
2751, 67.99N 20.68W, 962-956 m, 31.07.1995
2756, 67.92N 18.31W, 610-562 m, 01.08.1995
2757, 67.92N 18.83W, 622 m, 01.08.1995
2768, 68.34N 18.03W, 521-464 m, 02.08.1995
2774, 69.25N 14.26W, 1630-1629 m, 03.08.1995
2777, 68.61N 14.68W, 1556-1554 m, 03.08.1995
2786, 67.41N 18.24W, 693-674 m, 05.08.1995
2787, 67.36N 18.33W, 561-552 m, 05.08.1995
2789, 67.31N 18.39W, 540-530 m, 05.08.1995
2790, 67.33N 18.38W, 538-527 m, 05.08.1995
2792, 67.25N 18.87W, 480-485 m, 05.08.1995
2810, 62.66N 19.75W, 1695-1695 m, 23.08.1995
2813, 63.25N 17.99W, 173-180 m, 24.08.1995
2815, 63.25N 17.99W, 167-180 m, 24.08.1995
2817, 63.25N 17.84W, 204-207 m, 24.08.1995
2820, 63.47N 17.89W, 126-130 m, 25.08.1995
2821, 63.47N 17.89W, 126-130 m, 25.08.1995
2823, 63.50N 17.70W, 120-125 m, 25.08.1995
2824, 63.50N 17.70W, 120-123 m, 25.08.1995
2826, 63.69N 17.66W, 44-46 m, 25.08.1995
2829, 63.42N 16.84W, 277-283 m, 25.08.1995
2830, 63.42N 16.84W, 272-277 m, 25.08.1995
2849, 62.83N 18.01W, 976-1000 m, 27.08.1995
2853, 62.67N 16.97W, 1833-1846 m, 28.08.1995
2855, 62.34N 17.00W, 2074-2076 m, 28.08.1995
2856, 62.34N 16.99W, 2074-2084 m, 29.08.1995
2873, 64.62N 27.24W, 554 m
2877, 64.58N 27.61W, 776 m
2880, 65.54N 27.41W, 367 m
2888, 65.33N 27.18W, 332 m

Appendix 2

Material of Zoological Museum Copenhagen (ZMUC). Data of specimens not derived from the following expeditions are given for each species under material examined. Station data below given as follows: station number, co-ordinates in decimal degrees, depth interval, collection date.

Bankeundersøgelser, abbreviated as:
Bank. unders. stations
2, 63.02N 51.92W, 94-94 m, 28.07.1975
22, 66.68N 54.35W, 82-82 m, 01.08.1975
31, 66.68N 54.10W, 500-500 m, 05.08.1975
37, 66.17N 55.57W, 224-224 m, 02.08.1975
53, 67.08N 54.75W, 70-70 m, 12.08.1975
81, 66.63N 54.67W, 360-360 m, 02.08.1975
5291, 66.68N 55.15W, 100-100 m, 21.08.1976
5292, 66.73N 55.00W, 74-74 m, 21.08.1976
5293, 66.80N 54.87W, 57-57 m, 21.08.1976
5294, 66.83N 54.75W, 59-59 m, 21.08.1976
5297, 67.00N 54.67W, 64-70 m, 22.08.1976
5298, 67.05N 54.67W, 70-70 m, 23.08.1976
5299, 67.08N 54.12W, 80-95 m, 23.08.1976
5303, 67.50N 54.50W, 35-38 m, 23.08.1976
5304, 67.57N 54.28W, 24-24 m, 24.08.1976
5306, 66.02N 54.28W, 176-176 m, 25.06.1976
5312, 68.00N 54.37W, 57-60 m, 28.08.1976

"Grønland" 1975 expedition
15, 65.92N 54.10W, 77-80m, 01.08.1975
24, 66.32N 54.73W, 98-124m, 02.08.1975
25, 66.35N 54.93W, 02.08.1975
38, 66.25N 56.38W, 187-190m, 01.08.1975
52, 67.12N 54.12W, 100-100m, 12.08.1975
54, 67.12N 56.00W, 140-142m, 11.08.1975
55, 67.12N 56.40W, 200-200m, 11.08.1975
58, 67.25N 55.37W, 75-78m, 12.08.1975

"Kangamiut" stations
1, 66.17N 56.18W, 160-200m, 04.06.1976
2, 66.17N 56.17W, 160-200m, 04.06.1976
3, 66.15N 56.15W, 160-200m, 04.06.1976
4, 66.15N 56.13W, 160-200m, 04.06.1976
5, 66.15N 56.12W, 160-200m, 04.06.1976
6, 66.13N 56.23W, 160-200m, 04.06.1976
8, 66.17N 56.22W, 160-200m, 04.06.1976
9, 66.17N 56.23W, 160-200m, 04.06.1976
10, 66.17N 56.25W, 160-200m, 04.06.1976

"Kap Farvel" expedition 1970
1, 59.91N 44.43W, 50-90 m, 11.07.1970
11, 60.16N 44.25W, 60-70 m, 13.07.1970
14, 60.13N 44.31W, 70-90 m, 15.07.1970
16, 60.13N 44.33W, 60-60 m, 15.07.1970
21, 60.16N 44.25W, 70-80 m, 17.07.1970
22, 60.16N 44.25W, 100-120 m, 17.07.1970
23, 60.16N 44.25W, 100-120 m, 17.07.1970
25, 60.16N 44.26W, 150-150 m, 19.07.1970
34, 60.08N 44.26W, 0 m, 20.07.1970
38, 60.33N 44.26W, 20-20 m, 22.07.1970
40, 60.33N 44.26W, 100 m, 22.07.1970
42, 60.15N 44.29W, 60 m, 23.07.1970
45, 60.16N 44.28W, 25-35 m, 24.07.1970
48, 60.25N 44.19W, 250-250 m, 24.07.1970
54, 60.14N 44.31W, 30-40 m, 30.07.1970
55, 60.14N 44.31W, 50-60 m, 30.07.1970
56, 60.21N 44.21W, 400-420 m, 31.07.1970
58, 60.14N 44.31W, 35-50 m, 31.07.1970
59, 60.14N 44.34W, 40 m, 03.08.1970
60, 60.14N 44.29W, 40 m, 03.08.1970
62, 60.14N 44.29W, 50-60 m, 03.08.1970
74, 60.09N 44.26W, 25-30 m, 05.08.1970
75, 60.09N 44.24W, 40-50 m, 05.08.1970
82, 60.12N 44.29W, 50 m, 08.08.1970
83, 60.13N 44.26W, 230-250 m, 08.08.1970
87, 59.89N 44.37W, 70 m, 09.08.1970
88, 59.89N 44.37W, 140 m, 09.08.1970
90, 60.15N 44.17W, 40-50 m, 12.08.1970
91, 60.16N 44.16W, 40-60 m, 12.08.1970
93, 60.15N 44.17W, 140 m, 12.08.1970
95, 59.91N 44.43W, 80-100 m, 13.08.1970
100, 60.17N 44.22W, 40-60 m, 17.08.1970
101, 60.17N 44.22W, 40 m, 17.08.1970
102, 60.15N 44.17W, 250-400 m, 17.08.1970

103, 60.14N 44.18W, 250-400 m, 17.08.1970
108, 59.99N 43.68W, 120-120 m, 18.08.1970
112, 59.99N 43.93W, 30-40 m, 19.08.1970
114, 59.99N 43.93W, 30-40 m, 19.08.1970
115, 59.99N 43.93W, 200-200 m, 19.08.1970
117, 59.88N 43.53W, 225-225 m, 20.08.1970
128, 60.03N 43.99W, 530-530 m, 21.08.1970
130, 60.13N 44.28W, 170-200 m, 22.08.1970
132, 59.93N 44.38W, 400-450 m, 23.08.1970
135, 60.08N 43.05W, 120-120 m, 25.08.1970
136, 60.08N 43.05W, 240-240 m, 25.08.1970
138, 60.08N 43.08W, 30-35 m, 25.08.1970
139, 60.08N 43.08W, 20-25 m, 25.08.1970
141, 60.03N 43.10W, 100 m, 26.08.1970
142, 60.06N 43.16W, 120 m, 26.08.1970
145, 60.07N 43.20W, 100 m, 27.08.1970
148, 60.07N 43.20W, 50 m, 28.08.1970

Just and Andersen 1966 stations

4, 82.15N 29.88W, 5.5 m, 28.06.1966
7, 82.17N 30.46W, 11.5 m, 25.05.1966
8, 82.18N 30.75W, 5 m, 25.05.1966
23, 82.15N 29.88W, 5.5 m, 28.06.1966
44, 82.18N 30.75W, 17 m, 25.07.1966
69, 82.14N 30.08W, 40 m, 03.08.1966

Just & Vibe 1968 stations

12, 76.55N 69.00W, 40-60 m, 12.08.1968
16, 76.52N 69.48W, 94-94 m, 14.08.1968
18, 76.54N 69.38W, 70-70 m, 14.08.1968
18, 76.54N 69.38W, 70-70 m, 14.08.1968
20, 76.58N 69.41W, 35-35 m, 14.08.1968
20, 76.58N 69.41W, 35-35 m, 14.08.1968
20, 76.58N 69.41W, 35-35 m, 14.08.1968
20, 76.58N 69.41W, 35-35 m, 14.08.1968
26, 76.51N 69.89W, 34-34 m, 09.08.1968
26, 76.51N 69.89W, 34-34 m, 09.08.1968
26, 76.51N 69.89W, 34-34 m, 09.08.1968
27, 76.47N 69.32W, 50-50 m, 11.08.1968
29, 76.48N 69.36W, 97-97 m, 11.08.1968
29, 76.48N 69.36W, 97-97 m, 11.08.1968
30, 76.50N 69.41W, 254-254 m, 11.08.1968
30, 76.50N 69.41W, 254-254 m, 11.08.1968
34, 76.50N 69.18W, 125-125 m, 15.08.1968
35, 76.45N 69.71W, 260-260 m, 15.08.1968
35, 76.45N 69.71W, 260-260 m, 15.08.1968
35, 76.45N 69.71W, 260-260 m, 15.08.1968
35, 76.45N 69.71W, 260-260 m, 15.08.1968
40, 76.45N 69.35W, 11-11 m, 17.08.1968
66, 77.42N 71.25W, 240-240 m, 24.08.1968
68, 77.43N 69.48W, 300-300 m, 24.08.1968

Just & Schiøtte 1983 stations

6, Jørgen Brønlund Fjord, outside Drivtømmernæs, 11.08.1983
7, like station 6
8, Jørgen Brønlund Fjord, outside Drivtømmernæs, 12.08.1983
10, 82.12N 30.83W, 80 m,13.08.1983
20, 82.16N 30.17W, 12 m,15.08.1983
23, 82.14N 30.05W, 38m, 17.08.1983

"Littoral" stations

12, 67.22N 53.90W, 1 m, 22.07.1976
21, 67.22N 53.90W, 0 m, 22.07.1976
40, 67.27N 53.90W, 0 m, 23.07.1976
42, 67.27N 53.90W, 0 m, 23.07.1976
48, 67.17N 53.73W, 0 m, 23.07.1976

Appendix 3

Material Zoological museum Oslo (ZMO). Hydroids from the Hoel's expedition to eastern Greenland. Stations are also described in Soot-Ryen (1958). Station data are given as follows: station number, co-ordinates in decimal degrees, depth interval, collection date.

Hoels stations:
1016, 74.21N 19.72W, 43-53 m, 19.07.1930
1016, 74.21N 19.72W, 43-53 m, 19.07.1930
1018, 74.21N 19.72W, 35-83 m, 19.07.1930
1024, 74.05N 21.70W, 12-12 m, 24.07.1930
1025, 73.96N 21.90W, 15-15 m, 25.07.1930
1025, 73.96N 21.90W, 15-15 m, 25.07.1930
1025, 73.96N 21.90W, 15-15 m, 25.07.1930
1051, 73.60N 20.16W, 100-100 m, 29.07.1930
1067, 73.09N 23.08W, 20-30 m, 03.08.1930
1081, 72.38N 25.27W, 70-70 m, 08.08.1930
1087, 72.03N 23.12W, 100-100 m, 10.08.1930
1119, 74.35N 21.82W, 25-25 m, 22.07.1930
1107, 72.69N 26.73W, 42-42 m, 14.08.1930

Index

A
Abietinaria abietina 88
Abietinaria filicula 89
Abietinaria fusca 89
Abietinaria koltuni 91
Abietinaria pulchra 90
Abietinaria thuiarioides 91
Acaulidae *35*
Acaulis primarius 35
Acharadria larynx 43
Acryptolaria conferta 61
Acryptolaria triserialis 65
Aequorea 57
Aglaophenia bicuspis 134
Aglaophenia compressa 135
Aglaophenia integra 140
Aglaopheniidae *133*
Aglaophenopsis compressa 135
Aglaophenopsis cornuta 137
Aglaophenopsis pharetra 143
Amalthea islandica 38
Amphinema biscayana 21
Antennella catharina 123
Antennopsis norvegica 129
Antennularia norvegica 129
Antennularia ramosa 130
Anthoathecata *8*
Auliscus pulcher 44

B
Bimeria biscayana 21
Bonneviella grandis 146
Bonneviellidae *146*
Boreohydra simplex 36
Bougainvillia muscus 23
Bougainvillia ramosa 23
Bouillonia cornucopiae 42
Branchiocerianthus reniformis 42
Buccinium groenlandicum 15

C
Calycella fastigiata 51
Calycella obliqua 67
Calycella producta 54
Calycella syringa 57
Campanularia bigena 147
Campanularia crenata 146, 147
Campanularia fastigiata 51
Campanularia fragilis 154
Campanularia fruticosa 67
Campanularia gracillima 67
Campanularia grandis 146
Campanularia groenlandica 148, 149
Campanularia hincksii 149
Campanularia integra 149
Campanularia johnstoni 152
Campanularia lacerata 55
Campanularia levinseni 148
Campanularia magnifica 147
Campanularia serpens 63
Campanularia verticillata 157
Campanularia volubilis 150
Campanularia groenlandica 150
Campanulariidae *147*
Campanulina birulai 56
Campanulina denticulata 56
Campanulina lacerata 55, 56
Campanulina panicula 56
Campanulina pedicellaris 51
Campanulina pumila 56
Campanulina syringae 57
Campanulina turrita 55, 57
Campanulinidae *56*
canaliculate *128*
Candelabridae 37
Candelabrum phrygium 37
Capitata *35*
Cladocarpus bicuspis 134
Cladocarpus bonnevieae 135
Cladocarpus campanulatus 136
Cladocarpus cornutus 137
Cladocarpus diana 138
Cladocarpus formosus 139
Cladocarpus holmi 140
Cladocarpus integer 140
Cladocarpus paraformosus 137, 141
Cladocarpus paraventricosus 142
Cladocarpus pectiniferus 143
Cladocarpus pourtalesi 140

Cladocarpus ramuliferus 144
Clava multicornis 9
Clava squamata 9
Clytia gracilis 151
Clytia hemisphaerica 152
Clytia johnstoni 152
Colus spec. 12
Coppinia arcta 63
Coppinia mirabilis 63
Cordylophoridae 19
Corymorpha glacialis 38
Corymorpha groenlandica 38
Corymorpha nutans 40
Corymorpha Spitsbergensis 39
Corymorphidae 38
Coryne cerberus 49
Coryne fritillaria 44
Coryne hincksii 46
Coryne lovenii 47
Coryne mirabilis 50
Coryne producta 49
Coryne pusilla 48
Coryne tubulosa 50
Coryne vermicularis 48
Corynidae 46
Cryptolaria borealis 65
Cryptolaria triserialis 65
Cuspidella grandis 59
Cuspidella humilis 58
Cuspidella procumbens 58
Cuspidella quadridentatum 60

D
Dentalium dentale 23
Dianaea rotunda 51
Dicoryne conferta 24
Diphasia abietina 88
Diphasia attenuata 92
Diphasia coronifera 93
Diphasia elegans 94
Diphasia fallax 93
Diphasia filicula 89
Diphasia margareta 94
Diphasia mirabilis 107
Diphasia pinaster 94
Diphasia pulchra 90
Diphasia rosacea 95
Diphasia tamarisca 113
Diphasia thuiarioides 91
Diphasia wandeli 93
Dymella laxa 120
Dynamena pumila 96
Dynamena unilateralis 110

E
Ectopleura larynx 43
Ectopleura wrighti 43
Eirene indicans 53
Eirenidae 53
Eudendriidae 26
Eudendrium annulatum 26
Eudendrium arbusculum 33
Eudendrium capillare 27
Eudendrium caricum 33
Eudendrium islandicum 29
Eudendrium planum 30
Eudendrium rameum 31
Eudendrium ramosum 32
Eudendrium rigidum 33
Eudendrium tenellum 33
Eudendrium wrighti 33
Euphysa aurata 42
Eutonina indicans 53
Eutonina socialis 53

F
Filellum serpens 63
Filellum serratum 63
Filifera 8

G
Garveia groenlandica 25
Gonothyraea gracilis 151
Gonothyraea hyalina 152
Gonothyraea loveni 152
Grammaria abietina 64
Grammaria borealis 65
Grammaria conferta 65
Grammaria gracilis 66
Grammaria immersa 66
Grammaria insignis 64
Grammaria intermedia 64

Grammaria magellanica 64
Grammaria ramosa 64
Grammaria robusta 64
Grammaria serpens 63
Grammaria stentor 64
Gymnogonos crassicornis 41
Gymnogonos obvolutus 42

H
Haleciidae *73*
Halecium articulosum 83
Halecium beanii 73
Halecium beringi 73
Halecium birulai 74
Halecium boreale 73
Halecium corrugatum 81
Halecium crenulatum 79
Halecium curvicaule 76
Halecium delicatulum 79
Halecium filiforma 82
Halecium groenlandicum 77
Halecium halecinum 78
Halecium kuekenthali 76
Halecium labrosum 79
Halecium laeve 80
Halecium minutum 81
Halecium mirabile 76
Halecium muricatum 82
Halecium plumulosum 83
Halecium polytheca 77
Halecium repens 76
Halecium scutum 73
Halecium sessile 83
Halecium tenellum 84, 85
Halecium textum 85
Halecium undulatum 74, 87
Halicornaria campanulata 136
Halicornaria integra 140
Halicornaria pluma 144
Halicornaria ramulifera 144
Halisiphonia arctica 61
Halitholus cirratus 22
Halitholus yoldiaarcticae 22
Halopterididae *123*
Halopteris catharina 123
Hebellidae *61*
Heteropyxis norvegica 129
Hybocodon prolifer 44
Hydractinia allmanii 12
Hydractinia arctica 14
Hydractinia borealis 9
Hydractinia carica 15
Hydractinia carnea 12
Hydractinia echinata 15
Hydractinia ingolfi 16
Hydractinia minuta 15
Hydractinia monocarpa 17, 18
Hydractinia ornata 12
Hydractinia sarsii 18
Hydractinia serrata 18
Hydractiniidae *8*
Hydrallmania falcata 96

K
Keratosum complexum 59
Keratosum maximum 59
Kirchenpaueria bonnevieae 126
Kirchenpaueria pinnata 127
Kirchenpaueria triangulata 126
Kirchenpaueriidae *126*

L
Lafoea dumosa 67
Lafoea frcticosa 67
Lafoea gigantea 146
Lafoea gracillima 67
Lafoea grandis 67
Lafoea halecioides 70
Lafoea pinnata 70
Lafoea plicatilis 51
Lafoea pocillum 67
Lafoea pygmaea 57
Lafoea serrata 63
Lafoeina maxima 59
Lafoeina tenuis 60
Lampra arctica 39
Lampra atlantica 38
Lampra purpurea 39
Lampra socia 39
Laomedea dichotoma 155
Laomedea flexuosa 153
Laomedea geniculata 155

Laomedea gracilis 151, 152, 153
Laomedea hyalina 153
Laomedea longissima 155
Laomedea loveni 152
Laomedea neglecta 154
Laomedea repens 149
Leptothecata 51
Leuckartiara abyssi 23
Leuckartiara octona 23
Lictorella halecoides 70
Limnomedusae 157
Lovenella producta 54
Lovenellidae 54
Lucernaria phrygia 37
Lytocarpia myriophyllum 145

M
Macoma calcaria 158
Mitrocomella polydiademata 59
Modeeria formosa 51
Modeeria rotunda 51
Monobrachium parasitum 157
Monocaulus groenlandica 38
Myriothela arctica 37
Myriothela phrygia 37

N
Nematocarpus ramulifera 144
Nemertesia antennina 128, 131
Nemertesia norvegica 129
Nemertesia ramosa 130
Nigellastrum fallax 93

O
Obelia dichotoma 155, 156
Obelia geniculata 155
Obelia gracilis 151
Obelia longissima 155, 156
Obelia loveni 152
Opercularella denticulata 56
Opercularella lacerata 55, 57
Opercularella nana 56
Opercularella pumila 56
Orthopyxis 150
Orthopyxis integra 149

P
Pandeidae 21
Perigonimus repens 23
Perigonimus roseus 25
Perigonimus sarsii 25
Perigonimus yoldia-arcticae 22
Perigonymus muscus 23
Phialella quadrata 55
Phialellidae 55
Plumularia Bonnevieae 126
Plumularia echinulata 127
Plumularia elegantula 127
Plumularia frutescens 125
Plumularia gracillima 132
Plumularia groenlandica 132
Plumularia helleri 128
Plumularia hians 128
Plumularia Macleodii 127
Plumularia pinnata 127
Plumularia rubra 126
Plumularia setacea 131
Plumularia triangulata 126
Plumularia unilateralis 128
Plumularia variabilis 125
Plumularia verrillii 132
Plumulariidae 128
Podocoryna carnea 18
Podocoryne borealis 9
Podocoryne carnea 12
Podocoryne sarsii 18
Polynemertesia gracillima 132
Polyplumaria flabellata 132
Polyplumaria frutescens 125
Polyplumaria gracillima 132
Polyplumaria profunda 126

R
Reticularia serrata 63
Rhizocaulus verticillatus 157
Rhizogeton nudum 20
Rhizorhagium roseum 25
Rotundula brochii 51

S
Salacia articulata 90, 116
Salacia thuja 122

Sarsia eximia 49
Sarsia producta 49
Sarsia tubulosa 50
Schizotricha catharina 123
Schizotricha frutescens 125
Schizotricha gracillima 132
Schizotricha variabilis 125
Selaginopsis 114
Selaginopsis arctica 115
Selaginopsis fusca 89
Selaginopsis hartlaubi 119
Sertomma tamarisca 113
Sertularella amphorifera 62, 111
Sertularella atlantica 102
Sertularella gayi 98
Sertularella geniculata 102
Sertularella gigantea 100
Sertularella pallida 112
Sertularella polyzonias 99, 100
Sertularella rugosa 101
Sertularella tenella 102
Sertularella tricuspidata 112
Sertularia arctica 110
Sertularia argentea 103
Sertularia articularia 116
Sertularia cupressina 103, 105, 109
Sertularia ericoides 112
Sertularia fabricii 105
Sertularia falcata 96
Sertularia lichenastrum 116
Sertularia lonchitis 116
Sertularia mirabilis 107
Sertularia nasonovi 110
Sertularia nigellastrum 95
Sertularia pinnata 98
Sertularia schmidti 108
Sertularia similis 109
Sertularia stipulata 96
Sertularia syringa 57
Sertularia tamarisca 113
Sertularia tenera 110
Sertularia thompsoni 110
Sertularia thuiarioides 91
Sertularia tricuspidata 112
Sertularia tubuliformis 109
Sertularia volubilis 57
Sertulariidae *88*
Stauridia producta 49
Stauridium productum 49
Stegolaria 52
Stegopoma 52
Stegopoma caricum 51
Stegopoma fastigiatum 51
Stegopoma plicatile 51
Styactaria ingolfi 16
Stylactis arctica 14
Stylactis sarsii 18
Symplectoscyphus amphorifera 111
Symplectoscyphus amphoriferus 111
Symplectoscyphus bathyalis 111
Symplectoscyphus tricuspidatus 112
Syncoryna Sarsii 50
Syncoryne Sarsii 50

T

Tamarisca tamarisca 113
Thecocarpus myriophyllum 145
Thuiaria alternitheca 90, 114
Thuiaria arctica 115, 119
Thuiaria articulata 116
Thuiaria barentsi 116
Thuiaria carica 118
Thuiaria cylindrica 116
Thuiaria fabricii 105
Thuiaria fusca 89
Thuiaria hartlaubi 119
Thuiaria immersa 120
Thuiaria kirchenpaueri 118
Thuiaria laxa 119
Thuiaria lonchitis 116, 120
Thuiaria plumiformis 116
Thuiaria sachalini 121
Thuiaria salicornia 89
Thuiaria similis 109
Thuiaria sp. aff. *distans* 118
Thuiaria thuiarioides 91
Thuiaria thuja 120, 122
Thujaria hippuris 122
Thujaria hjorti 120
Thujaria variabilis 115
Tiaranna rotunda 51
Tiarannidae *51*

Tiarops indicans 53
Toichopoma obliquum 67, 70
Trophon clathrus 17
Tubularia borealis 45
Tubularia christinae 44
Tubularia cornucopia 42
Tubularia indivisa 44, 45, 149
Tubularia larynx 43
Tubularia obliqua 44
Tubularia prolifer 44
Tubularia pulcher 44
Tubularia regalis 45
Tubularia simplex 44
Tubularia variabilis 45
Tubulariidae 42

V
Verticillina verticillata 157

W
Wrightia coccinea 25

Y
Yoldiella 22

Z
Zygophylax armata 72
Zygophylax biarmata 71
Zygophylax Brownei 70
Zygophylax brownei 70
Zygophylax elegantula 71
Zygophylax levinseni 71
Zygophylax pinnata 72

MONOGRAPHS ON GREENLAND

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This is a comprehensive study of the marine benthic hydroids of Greenland and Iceland. It provides the reader with a faunal inventory, a revision of the species involved, and an identification aid. All the known species of the region are discussed and wherever possible, they are also described and illustrated with drawings based on original material.

Dr. Peter Schuchert is a taxonomist working at the Museum of Natural History in Geneva, Switzerland. He is a well-known specialist in marine hydroids and hydromedusa.