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Revision of the genus *Asconema* (Porifera: Hexactinellida: Rossellidae)

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The genus *Asconema*, widely distributed in the North Atlantic and Arctic, was for some time considered to be monospecific. Its revision shows that it contains five species including the previously known *A. setubalense*, reinstated *A. foliata* and three new species (two of which are subdivided into three and four subspecies). The generic diagnosis is changed to encompass the specific characters of the new species.

INTRODUCTION

The genus *Asconema* (Hexactinellida: Lyssacinosida: Rossellidae: Rossellinae), well known in the North Atlantic and Arctic from numerous collections, was considered to be monospecific but after investigation of numerous specimens stored in many museums the variability of this 'species' was found to be much greater than that of other genera of Rossellidae. For instance, some specimens of *Asconema* have spiny and smooth hypodermal pentactins; they have various microsclere combinations etc. The reinvestigation of the probable holotype of *Asconema setubalense* and specimens collected near the type location showed their uniformity in spicule composition, but they differ strongly from the specimens collected in other locations in the Atlantic and Arctic (Schulze, 1887; Topsent, 1892, 1904, 1913, 1928; Burton, 1928; Koltun, 1967) which were previously referred to the same species. It is obvious that the species must be divided into several species, characterized by combinations of microscleres, hypodermal pentactins and some differences in the dermal and atrial spicules.

All these specimens have a common unique feature among Rossellinae—the presence of dermal pentactins in which the unpaired ray is directed outside the body (distally). Only *Caulophacus*, recently transferred to this subfamily (Tabachnick, 2000), has some dermal pentactins (among more abundant hexactins) with the unpaired ray distally directed.

The complete synonymy of the species of *Asconema* requires reinvestigation of all specimens described by the following authors under the name *A. setubalense*: Hentschel (1929); Brønsted (1933); and Koltun (1964, 1967). We have not succeeded in finding and re-examining all of them and their descriptions are too poor to settle the question of their synonymy. *Trichasterina sagittaria* described by Burton (1930) may also be a representative of the genus *Asconema*.

ABBREVIATIONS

MZUB—Museum of Zoology, University of Bergen
NHM—Natural History Museum (London)
IORAS—Institute of Oceanology of the Russian Academy of Sciences (Moscow)
MNHN—Muséum National d'Histoire Naturelle (Paris)
MO—Muséum Océanographique (Monaco)
SMNH—Swedish Museum of Natural History (Stockholm)
USNM—Smithsonian Institution (Washington)
ZINRAS—Zoological Institute of the Russian Academy of Sciences (St Petersburg)
ZMUC—Zoologisk Museum, Universitet Copenhagen

MATERIALS AND METHODS

The specimens examined (including the type materials) were collected by a range of equipment (trawls, dredges and underwater submersibles). They were stored by various institutions (see the list of abbrevations above) either in 80% alcohol or as dried specimens. The sponges were examined and subsamples taken for spicule preparations from defined body areas: dermal, atrial and choanosomal. The slides with spicule preparations were examined by transmission light microscopy (with the objective magnification up to 100× with oil immertion); drawings and measurements of spicules were made by camera lucida. The terms (spicule names, their fragments and their location in the body) are used after the dictionary of Tabachnick & Reiswig (2002).

Asconema Kent, 1870

Figure 1

Synonymy

Asconema Kent, 1870: 241. Part of *Trichasterina—T. bispiculigastra* Rezvoi, 1923: 35; 1925: 193. Part of *Hyalonema—H. foliata* Fristedt, 1887: 413. Part of *Hyalascus—H. foliatus* Hentschel, 1929: 913; Koltun, 1964: 145. Not *Asconema kentii* Schmidt, 1880: 65 (which belongs to the genus *Hyalonema*). Not *A. setubalense* Burton, 1928: 8 (specimen ZMUC—Ingolf Expedition, Station 76, 60°50'N 26°50'W, 1518 m which turned out to be *Trichasterina borealis*). Not *A. setubalense* Arnsen, 1932: 9 (specimen MZUB 25646 turned out to be *Trichasterina borealis* Michael Sars, Station 102, 60°57'N

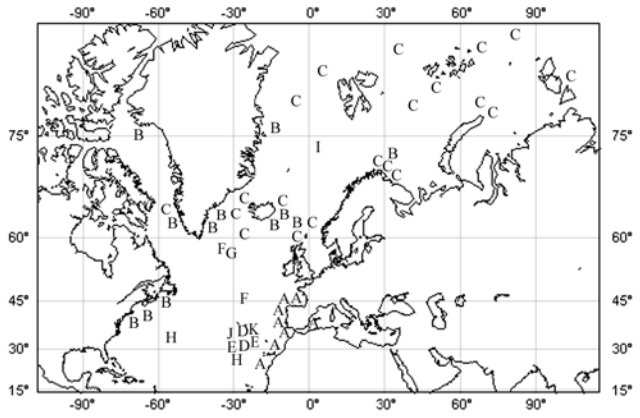

Figure 1. Distribution of *Asconema*: (A) *A. setubalense*; (B) *A. foliata*; (C) *A.* aff. *foliata*; (D) *A. topsenti*; (E) *A. fristedti fristedti*; (F) *A. fristedti nordazoriensis*; (G) *A. fristedti icelandiensis*; (H) *A. megaatrialia megaatrialia*; (I) *A. megaatrialia nordiense*; (J) *A. megaatrialia seamounti*; (K) *A. megaatrialia biacorica*.

4°48'W, 1098 m). Not *Asconema* aff. *setubalense* and *A. foliata* van Soest & Lavaleye, 2005 (they are *Rossella nodastrella*).

Type species

Asconema setubalense Kent, 1870 (by monotypy).

Definition

Saccular, tubular or funnel-like Rossellinae with dermalia represented by pentactins (and rare hexactins) of which the unpaired ray is distally directed.

Diagnosis

Body is funnel-like, saccular or tubular, basiphytous with thin walls and very large osculum. Choanosomal skeleton is composed of diactins and rare hexactins. Hypodermal and usually hypoatrial spicules are pentactins. Dermalia are mainly pentactins with distally directed unpaired ray. Atrialia are hexactins together with pentactins or hexactins only. Microscleres are various in different species—combinations of spicules with discoidal outer ends (macrodiscohexasters, macrodiscasters, microdiscohexasters) and oxyoidal outer ends (asterous and actinous spicules).

Remarks

One new species described below has hypoatrial hexactins with spiny ray directed outside the body in addition to hypoatrial pentactins.

Key to species and subspecies of the genus Asconema

1. Hypodermal pentactins have smooth (rarely rough) tangential rays (never spined) 2
— Hypodermal pentactins have both spiny and smooth tangential rays 3

2. All microscleres have discoidal outer ends (macrodiscohexasters and macrodiscasters have clavate outer ends with a circular row of spines forming hardly distinguishable disc and smooth shafts) ..... *A. setubalense* Kent
— Microscleres with oxyoidal outer ends always present (the outer ends of macrodiscohexasters and macrodiscasters have well distinguishable discs and spiny shafts) ..... *A. foliata* (Fristedt)

3. Hypoatrial hexactins with spiny proximal ray corresponds in size to hypodermal and hypoatrial pentactins present ..... *A. topsenti* sp. nov.
— No hypoatrial hexactins (pentactins only) 4

4. Atrialia are hexactins which are much larger then dermal spicules (mainly pentactins); hypoatrial pentactins absent ..... *A. megaatrialia* sp. nov. 5
— Atrialia are pentactins with some hexactins, which do not differ strongly from dermal spicules in size ..... *A. fristedti* sp. nov. 8

5. Oxyhexasters and oxyhemihexasters prevail over other oxyoidal microscleres .... *A. megaatrialia nordiense* ssp. nov.
— Oxyhexactins prevail over oxyhemihexasters 6

6. Macrodiscohexasters are small (about 0.05–0.1 mm in diameter) ..... *A. megaatrialia biacorica* ssp. nov.
— Macrodiscohexasters and macrodiscasters are large (about 0.1–0.3 mm in diameter) 7

7. Microscleres with reduced number of primary rays present among oxyoidal spicules ..... *A. megaatrialia seamounti* ssp. nov.
— Oxyoidal microscleres are oxyhexactins and oxyhemiexasters (forms with reduced number of primary rays seem to be absent or rare) ..... *A. megaatrialia megaatrialia* sp. nov.

8. Macrodiscohexasters present 9
— Macrodiscohexasters absent ..... *A. fristedti nordazoriensis* ssp. nov.

9. Discohexasters or discasters have anchorate discs ..... *A. fristedti fristedti* sp. nov.
— Discohexasters are spherical with pileate discs ..... *A. fristedti icelandiensis* ssp. nov.

Asconema setubalense Kent, 1870
Figure 2; Table 1

Synonymy

Asconema setubalense Kent, 1870: 246; many other authors described material off the central-east Atlantic shore. Not *Asconema setubalense* and *A. setubalense* v. *pauperata* Schulze, 1899: 25. Not *Asconema setubalense* Bronsted, 1917: 478; 1933?: 5; Burton, 1928: 8; Topsent, 1892: 27; Topsent, 1904: 40; Topsent, 1913: 9; Topsent, 1928: 76; Arnsen, 1932: 9; Hentschel, 1929; 913; Koltun, 1967: 81. Not: *Trichasterina bispiculigastra* Rezvoi; *T. sagittaria* Topsent and *Hyalonema foliata* Fristedt or *Hyalascus foliatus* (Fristedt) as was suggested by Koltun, 1967: 81. Not *Asconema* aff. *setubalense* van Soest & Lavaleye, 2005.

Definition

Asconema setubalense is characterized by presence of macrodiscohexasters or macrodiscasters with clavate outer ends with a circular row of spines forming hardly distinguishable disc, and smooth shafts; smooth (never spined) hypodermal pentactins and absence of oxyoidal microscleres.

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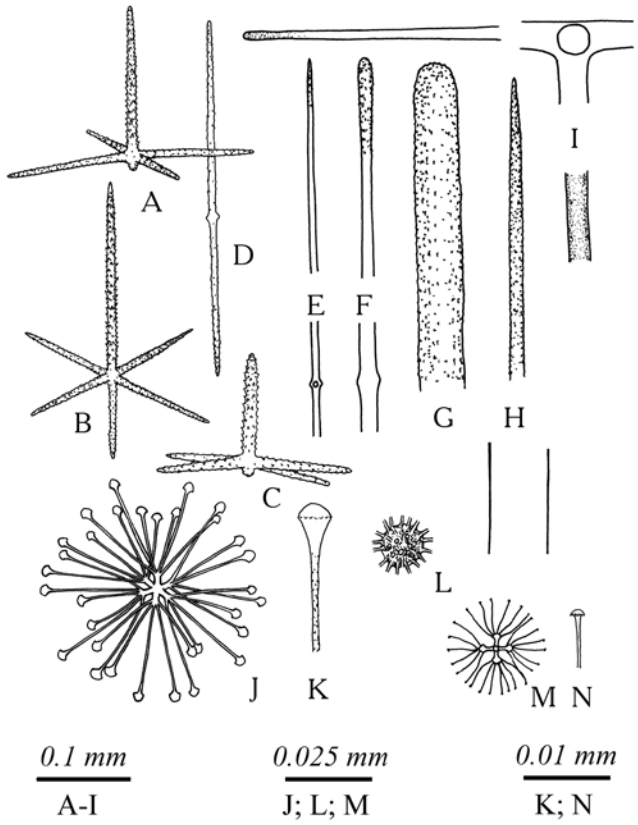

Figure 2. Spicules of *Asconema setubalense*. (A) Dermal pentactin; (B) atrial hexactin; (C) atrial pentactin; (D) small choanosomal diactin or dermal diactin; (E,F) mediate choanosomal diactins; (G,H) large choanosomal diactins; (I) hypodermal pentactin; (J) macrodiscohexaster; (K) secondary ray tip of macrodiscohexaster; (L) primary rosette of macrodiscaster; (M) microdiscohexaster; (N) secondary ray tip of microdiscohexaster. A–B & D–K, NHM 1870.12.10.001; C, MNHN HCL 625; L, NHM 1889.01.08.001.

Material examined

A fragment of the probable holotype NHM 1870.12.10.001—off Portugal.

Other material assigned here to *A. setubalense*. NHM 1965.01.01.001—Eastern Telegraph Company. NHM 1889.01.08.001—off Portugal, 673 m. NHM 1902.10.31.001—North Atlantic. NHM 1898.07.30.001 (two specimens)—Conception Bank, 30°08'N 12°41.60'W, 450 m. IORAS 5/2/44—RV 'Academik Petrovsky-12', Station 3, 36°44'N 14°20'W, 300 m. IORAS 5/2/103.23—RV 'Academik Petrovsky-12', Station 4, 36°44'N 14°21'W, 340–380 m. IORAS 5/2/12; 5/2/13.2; 5/2/23.2; 5/2/57.3—RV 'Academik Petrovsky-12', Station 12, 36°44'N 14°15'W, 280–270 m. IORAS 5/2/98—RV 'Academik Petrovsky-12', Station 12 6b, Banc Josephine, 36°45'N 14°15.1'W, 320 m. IORAS 5/2/1327—RV 'Academik Mstislav Keldysh-16', Station 1978, 36°34.75'N 11°25.75'W, 396–420 m. IORAS 5/2/2353—RV 'Moscow University', Station 2 17(3), 505–150 m. IORAS 5/2/2313; 5/2/2314; 5/2/2315; 5/2/2316; 5/2/2317—RV 'Academik Oparin', Station 4, 32°02.05'N 12°56.06'W, 470 m. IORAS 5/2/900.1; 5/2/900.2; 5/2/900.3; 5/2/1275—RV 'Vitiaz 2' (4)-2, Station 75, 36°43.01'N 14°13.6'W, 280–300 m. MNHN HCL 606, HCL 607—SEAMOUNT 1, RV 'Le Noroit', Station CP 12, Banc Goringe, 36°24.20'N 11°43.20'W, 1005–1040 m. MNHN HCL 608-610—SEAMOUNT 1, RV 'Le Noroit', Station CP 20, Banc Goringe, 36°33.70'N 11°30.10'W, 305–320 m. MNHN HCL 611-616—SEAMOUNT 1, RV 'Le Noroit', Station CP 99, Banc Ampere, 35°04'N 12°55'W, 225–280 m. MNHN HCL 617—SEAMOUNT 1, RV 'Le Noroit', Station DW 111, Banc Galice, 42°39.90'N 11°35.80'W, 675–685 m. MNHN HCL 618—SEAMOUNT 1, RV 'Le Noroit', Station DW 15, 36°33.40'N 11°28.80'W, 300–330 m. MNHN HCL 619—SEAMOUNT 1, RV 'Le Noroit', Station DW 45, Banc Josephine, 36°45.80'N 14°17.50'W, 315–335 m. MNHN HCL 620—SEAMOUNT 1, RV 'Le Noroit', Station DW 58, Banc Josephine, 36°45.90'N 14°20.40'W, 340–380 m. MNHN HCL 621—RV 'Calypso', Station SME 1277, Banc Goringe, 36°30'N 11°30'W, 510 m. MNHN HCL 622—RV 'Calypso', Station SME 1281, Banc Spartel, 35°54'N 6°W, 110 m. MNHN HCL 623—Polymede II, Station DR 12. MNHN HCL 624—RV 'President Theodore Tissier', Station M 109, east of Gibraltar, 690 m. MNHN HCL 625—RV 'Thalassa', Station U 854, 44°10'N 8°22.30'W, 410–640 m. MNHN HCL 626—RV 'Thravailleur', Station. DR 1, south Gascogne Bay, 43°01'N 0°25'E, 420 m. MNHN HCL 627—RV 'Thravailleur'. MNHN HCL 628—RV 'Talisman', Station DR 136, Gascogne Bay. MNHN (p3912)—RV 'Talisman', Station DR 69, off Sahara, 25°41'N 13°35.46'W, 410 m. MNHN HCL 629; (p3995)—RV 'Talisman'. MNHN HCL 630–637—location unknown. MNHN (p6204)—RV 'Thalassa', Station W 364, Gascogne Bay, 43°34.40–33.80'N 3°33.80'W, depth 520–580 m. MNHN (p6203; p6205; p6206)—RV 'Thalassa', Station W 365, Gascogne Bay, 43°35.60'N 3°33.80'W, depth 350–300 m. MNHN (p6207)—RV 'Thalassa', Station W 391, Gascogne Bay, 44°5'N 4°33.50'W, depth 805–730 m. MNHN (p6194)—RV 'Thalassa', Station W 392, Gascogne Bay, 44°6.90'N 4°49.30'W, depth 1130–600 m.

Other material assigned here to *Trichasterina borealis* (erroneously identified as *A. setubalense* by Arnsen (1932)): MZUB 25646—RV 'Michael Sars', Station 102, N of W Thomson Ridge, 60°57'N 4°48'W, depth 1098 m.

Description

Body: body is funnel-like, basiphytous with thin walls and very large osculum. The marginal parts are often everted and turned downwards. The sponge is often large. The holotype is about 600 mm in length, the largest specimen is a tubular fragment of the upper part of the sponge 900 mm in length. The maximal diameter of these sponges is usually similar to the length while the diameter of the lower part is much smaller. Some short rhizophytous-like processes may be present in the lower part of the body.

Spicules: the choanosomal skeleton is composed of diactins which can be divided into three types. The largest ones are 16–22/0.038–0.076 mm, they have conically pointed or rounded rough outer ends and even shafts. The mediate choanosomal diactins are the most numerous choanosomal spicules. They are over 1.5 mm in length and 0.004–0.009 mm in diameter. Their outer ends are similar to the largest diactins while the shafts have a widening or four rudimental tubercles in the middle. The small diactins are about 0.4

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Table 1. *Spicule dimensions of* Asconema setubalense *(mm).*

	NHM 1870.12.10.001					NHM 1889.01.08.001					NHM 1898.07.30.001					MNHN HCL 624				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.142	0.099	0.190	0.027	6	0.146	0.106	0.205	0.040						17	0.133	0.099	0.182	0.023
L dermal pentactin tangential ray	25	0.136	0.084	0.160	0.020	6	0.118	0.076	0.167	0.030						17	0.124	0.091	0.160	0.020
L atrial hexactin ray directed outside body	1	0.182	0.182	0.182		4	0.194	0.167	0.266	0.048						17	0.177	0.114	0.243	0.037
L atrial hexactin tangential ray	2	0.125	0.114	0.137	0.016	2	0.129	0.084	0.175	0.064						17	0.113	0.084	0.152	0.016
L atrial hexactin ray directed inside body	2	0.095	0.091	0.099	0.005	1	0.106	0.106	0.106							17	0.117	0.076	0.160	0.019
D macrodiscohexaster	25	0.062	0.047	0.083	0.010	15	0.066	0.043	0.090	0.012	15	0.063	0.043	0.090	0.017	18	0.061	0.043	0.076	0.010
d macrodiscohexaster	25	0.007	0.004	0.014	0.002	15	0.007	0.004	0.011	0.001	15	0.009	0.006	0.011	0.002	18	0.007	0.006	0.009	0.001
D microdiscohexaster						3	0.025	0.022	0.029	0.004	9	0.028	0.022	0.036	0.005	5	0.022	0.019	0.025	0.002
d microdiscohexaster						3	0.006	0.005	0.007	0.001	9	0.008	0.007	0.011	0.001	5	0.006	0.005	0.007	0.001

	MNHN HCL 625					MNHN HCL 628					MNHN HCL 618					MNHN (p3912)				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	15	0.153	0.114	0.198	0.023	15	0.191	0.152	0.243	0.026	16	0.162	0.122	0.205	0.026	15	0.136	0.091	0.190	0.031
L dermal pentactin tangential ray	15	0.126	0.076	0.167	0.031	15	0.128	0.084	0.175	0.025	16	0.142	0.099	0.182	0.028	15	0.121	0.065	0.205	0.039
L atrial hexactin ray directed outside body						15	0.238	0.144	0.380	0.076	15	0.199	0.084	0.289	0.052	4	0.112	0.076	0.167	0.039
L atrial hexactin tangential ray						15	0.132	0.084	0.228	0.037	15	0.131	0.091	0.220	0.037	5	0.163	0.114	0.236	0.051
L atrial hexactin ray directed inside body						15	0.108	0.061	0.198	0.034	15	0.112	0.084	0.144	0.017	5	0.131	0.114	0.152	0.015
D macrodiscohexaster	16	0.064	0.043	0.079	0.011	16	0.070	0.040	0.090	0.015	15	0.073	0.050	0.079	0.007	19	0.055	0.040	0.083	0.012
d macrodiscohexaster	16	0.008	0.005	0.011	0.001	16	0.008	0.004	0.011	0.002	15	0.010	0.007	0.014	0.002	19	0.007	0.005	0.011	0.001
D microdiscohexaster	1	0.018	0.018	0.018		6	0.026	0.023	0.029	0.002						7	0.026	0.025	0.027	0.001
d microdiscohexaster	1	0.007	0.007	0.007		6	0.006	0.004	0.009	0.002	1	0.009	0.009	0.009		7	0.007	0.005	0.008	0.001

	MNHN HCL 617					MNHN HCL 627					IORAS 5/2/900.1					IORAS 5/2/2313				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body						15	0.146	0.099	0.182	0.022	25	0.137	0.054	0.223	0.037	3	0.131	0.100	0.177	0.041
L dermal pentactin tangential ray						15	0.108	0.076	0.144	0.021	25	0.120	0.069	0.169	0.024	9	0.116	0.092	0.138	0.014
L atrial hexactin ray directed outside body						12	0.199	0.137	0.281	0.054	25	0.149	0.069	0.215	0.043	1	0.115	0.115	0.115	
L atrial hexactin tangential ray						12	0.127	0.091	0.182	0.028	18	0.109	0.085	0.146	0.021	1	0.100	0.100	0.100	
L atrial hexactin ray directed inside body						12	0.108	0.068	0.144	0.026	18	0.106	0.062	0.146	0.024	1	0.115	0.115	0.115	
D macrodiscohexaster	15	0.082	0.058	0.097	0.012	17	0.068	0.050	0.079	0.008	25	0.075	0.050	0.096	0.014	17	0.084	0.050	0.106	0.017
d macrodiscohexaster	15	0.010	0.008	0.013	0.001	17	0.009	0.005	0.011	0.002	25	0.008	0.006	0.010	0.001	17	0.010	0.008	0.014	0.002
D microdiscohexaster	2	0.028	0.024	0.032	0.006	12	0.026	0.020	0.032	0.003	7	0.022	0.018	0.025	0.002					
d microdiscohexaster	2	0.007	0.007	0.007	0.000	12	0.007	0.004	0.007	0.001	7	0.006	0.004	0.006	0.001					

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

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mm in length and 0.004–0.009 mm in diameter, they have a widening in the middle and are entirely rough. In their dimensions the small diactins are similar to the dermal and atrial spicules but no other transitional forms between these spicule types were seen, hence they are referred to as choanosomal spicules. Hypodermal pentactins have orthotropal tangential rays 0.4–1.8/0.009–0.023 mm, the rays directed inside the body are several times longer then the tangential ones. The tangential rays are smooth with rounded, rough outer ends. The ray directed inside the body is smooth or rough. Hypoatrial pentactins are rare, they are equal to the dermal ones. Dermalia are chiefly pentactins with the unpaired ray directed outside the body or sometimes hexactins; one specimen MNHN HCL 617 has a considerable number of stauractins among dermal and atrial spicules. A short rudiment is situated in the pentactins instead of the ray directed inside the body. The ray directed outside the body of dermal pentactins is 0.054–0.243 mm in length, the tangential rays are 0.065–0.205 mm in length. The rays of dermal pentactins are 0.009–0.015 mm in diameter and have rounded outer ends. The ray directed outside the body is spinous (nearly pinular), the tangential ones are spiny or rough. Atrialia are mostly hexactins with ray directed outside the body usually the longest 0.069–0.380 mm in length, tangential rays are 0.084–0.236 mm in length, ray directed inside the body is 0.061–0.198 mm in length. These rays are 0.009–0.017 mm in diameter. The shape of the ray directed outside the body of atrial hexactins is similar to that of dermal pentactins while all their other rays are similar to each other. Atrial pentactins are similar to dermal ones, they were found in some specimens sometimes in notable amounts. Their ray directed outside the body is 0.053–0.266 mm in length, the tangential rays are 0.053–0.175 mm.

Microscleres: microscleres are spherical macro-discohexasters, macrodiscasters and microdiscohexasters. The macrodiscohexasters and macrodiscasters are 0.040–0.106 mm in diameter, their primary rosettes are 0.004–0.014 mm in diameter. The secondary rays (about 6–8 at each primary ray) are not entirely discoidal, they have clavate outer ends with a circular row of spines forming a hardly distinguishable disc, their shafts are rough. The macrodiscohexasters are common spicules in most investigated specimens while macrodiscasters with nearly spherical primary rosettes were found (together with the former type) only in some specimens: NHM 1889.01.08.001; MNHN HCL 628; IORAS 5/2/900.1; they prevail the 'normal' macrodiscohexasters in the specimen MNHN HCL 618. The microdiscohexasters are 0.018–0.036 mm in diameter with primary rosette 0.004–0.011 mm in diameter. The microdiscohexasters and macrodiscohexasters are hardly distinguished from each other in the specimen MNHN HCL 627 because of presence of transitional forms. Microdiscohexasters are located in the vicinity of atrial surface. In poor fragments which have no well-represented atrial area these spicules were not found (for instance in the schizoholotype). One sponge MNHN HCL 617 contains a considerable number of oxyhexasters 0.061–0.101 mm (mean 0.077 mm; SD 0.012 mm) in diameter with primary rosette 0.007–0.011 mm (mean 0.010 mm; SD 0.001 mm) in diameter. These oxyhexasters are supposed to have allochthonic origin as well as dermal or atrial stauractins (see above).

Distribution

Off the coasts of Spain, Portugal and Morocco, Bay of Gascogne, depth 110–2075 m.

Remarks

The observed materials differ from the original description. The shape of the disc of macrodiscaster figured in the original description differs from that of all the observed materials (including the possible holotype) collected in the adjacent area. It can be easily assigned to the macrodiscaster type (the term was not used at that time and the spicule name is 'multiradiate spicula of the sarcode') due to its size (about 0.11 mm in diameter). Unlike the observed and described above the secondary ray in the description has a pileate disc (Kent, 1870, pl. LXIV, figure 9a). This contradiction is suspected to be a result of inaccurate representation of the figure or even a mistake during figure preparation (the same shape is figured for the secondary ray of discoidal spicule of *Aulodictyon woodwardi* in Kent's figure 25). Another principal difference is absence of the microdiscohexaster in the primary description; it may be suspected that they were not found.

The problems of the genus *Askonema* have initially grown from the publication of Schulze in 1887 when he redescribed and figured *A. setubalense* based on the specimen NHM 1887.10.24.010, which is now considered to be *A. foliata* (see below). He postulated that it was identitical to the specimen described by Kent (1870) (a poor description). However, many differences were found. The later authors dealing with these materials: Topsent, Burton, Arndt, Bronsted and Koltun (see the synonymy) tried to solve this problem by increasing the variability within the single species of *Asconema*.

Asconema foliata (Fristedt, 1887)
Figures 3 & 4; Table 2

Synonymy

Hyalonema foliata Fristedt, 1887: 413. *Hyalascus foliatus* Henschel, 1929: 914; Koltun, 1964: 145. *Asconema setubalense* Schulze, 1887: 116. *Asconema setubalense* and *A. setubalense* v. *pauperata* Schulze, 1899: 25. *Asconema setubalense* Bronsted, 1917: 478; 1933?: 5; Burton, 1928: 8. *Trichasterina bispiculigastra* Rezvoi, 1923: 35; Rezvoi, 1925: 194. All or part of *Asconema setubalense* Koltun, 1967: 81. Not *Asconema foliata* van Soest & Lavaleye, 2005.

Definition

Asconema foliata is characterized by presence of smooth (never spined) hypodermal pentactins; microscleres various; oxyoidal always present as oxyhexactins, oxyhemihexasters often together with oxyhexasters; discoidal forms are known in some specimens as macrodiscasters (with spiny shafts and toothed discs) and microdiscohexasters.

Material examined

Types: SMNH 1677 (3 fragments)—Swedish Arctic Expedition 1883, Station 542, 75°26'N 67°27'W, 473 m.

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Table 2. *Spicule dimensions of* Asconema foliata *(mm).*

	SMNH 1677					ZMUC RN43					ZMUC 104b					IORAS 5/2/2360				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.065	0.037	0.126	0.019	25	0.070	0.022	0.104	0.019	25	0.080	0.056	0.152	0.021	25	0.100	0.061	0.152	0.024
L dermal pentactin tangential ray	25	0.069	0.052	0.089	0.012	25	0.072	0.056	0.094	0.012	25	0.066	0.044	0.111	0.015	25	0.079	0.061	0.122	0.015
L atrial hexactin ray directed outside body	24	0.242	0.148	0.333	0.044	15	0.159	0.056	0.233	0.067	20	0.209	0.085	0.363	0.074	14	0.177	0.084	0.334	0.070
L atrial hexactin tangential ray	23	0.175	0.107	0.233	0.038	15	0.133	0.052	0.192	0.055	21	0.156	0.070	0.229	0.043	16	0.132	0.068	0.190	0.038
L atrial hexactin ray directed inside body	22	0.156	0.085	0.204	0.032	16	0.147	0.056	0.303	0.070	21	0.164	0.067	0.229	0.047	12	0.121	0.061	0.171	0.030
D macrodiscohexaster	14	0.120	0.104	0.133	0.009	25	0.123	0.081	0.215	0.026	6	0.112	0.096	0.118	0.009	10	0.107	0.097	0.122	0.009
d macrodiscohexaster	14	0.022	0.015	0.033	0.004	25	0.023	0.019	0.033	0.003	6	0.020	0.016	0.026	0.004	10	0.018	0.013	0.022	0.003
D microdiscohexaster						13	0.032	0.018	0.040	0.006	14	0.028	0.023	0.036	0.005					
d microdiscohexaster						13	0.011	0.008	0.014	0.002	14	0.010	0.004	0.013	0.002					
D oxyhemihexaster	25	0.156	0.096	0.192	0.026	25	0.119	0.096	0.148	0.014	25	0.115	0.059	0.178	0.027	25	0.169	0.114	0.220	0.028
d oxyhemihexaster	20	0.014	0.007	0.022	0.004	25	0.011	0.007	0.015	0.002	25	0.010	0.007	0.015	0.002	25	0.010	0.008	0.012	0.001
D oxyhexactin	3	0.140	0.122	0.158	0.018	20	0.139	0.111	0.170	0.018	10	0.137	0.126	0.163	0.014	6	0.162	0.140	0.192	0.020
D regular oxyhexaster	9	0.089	0.059	0.185	0.044	17	0.114	0.059	0.185	0.037	25	0.073	0.044	0.104	0.018	5	0.091	0.083	0.115	0.014
d regular oxyhexaster	9	0.014	0.011	0.019	0.003	17	0.021	0.009	0.030	0.005	25	0.010	0.007	0.015	0.003	5	0.008	0.007	0.011	0.002

	NHM 1887.10.24.010					USNM (w627)					USNM (kt1480)					USNM (kt1481)				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.084	0.068	0.106	0.012	25	0.118	0.042	0.177	0.037	25	0.118	0.046	0.277	0.046	25	0.091	0.062	0.123	0.017
L dermal pentactin tangential ray	25	0.078	0.053	0.106	0.012	25	0.077	0.042	0.131	0.019	25	0.078	0.038	0.146	0.022	25	0.071	0.054	0.085	0.008
L atrial hexactin ray directed outside body	5	0.157	0.091	0.198	0.041	25	0.219	0.131	0.346	0.045	25	0.222	0.146	0.362	0.058	25	0.175	0.108	0.246	0.046
L atrial hexactin tangential ray	4	0.122	0.084	0.167	0.041	25	0.137	0.077	0.177	0.026	25	0.137	0.069	0.177	0.032	25	0.124	0.069	0.192	0.031
L atrial hexactin ray directed inside body	5	0.116	0.091	0.137	0.020	25	0.134	0.065	0.177	0.029	25	0.127	0.077	0.192	0.030	25	0.131	0.069	0.192	0.036
D macrodiscohexaster	13	0.116	0.101	0.137	0.013	5	0.126	0.120	0.134	0.006										
d macrodiscohexaster	13	0.018	0.011	0.022	0.003	5	0.016	0.014	0.020	0.003										
D microdiscohexaster	2	0.029	0.025	0.032	0.005											2	0.034	0.026	0.042	0.011
d microdiscohexaster	2	0.013	0.012	0.014	0.002											2	0.010	0.008	0.012	0.003
D oxyhemihexaster	15	0.109	0.076	0.140	0.019	25	0.148	0.124	0.184	0.014	25	0.110	0.084	0.146	0.015	25	0.124	0.072	0.152	0.020
d oxyhemihexaster	15	0.010	0.007	0.013	0.002	25	0.009	0.006	0.012	0.001	25	0.010	0.008	0.014	0.002	25	0.011	0.008	0.016	0.002
D oxyhexactin	8	0.132	0.122	0.148	0.010	25	0.151	0.118	0.180	0.015	7	0.129	0.116	0.150	0.012	10	0.131	0.110	0.156	0.015
D regular oxyhexaster	17	0.063	0.040	0.108	0.020	2	0.029	0.026	0.031	0.004	2	0.058	0.032	0.084	0.037	5	0.070	0.028	0.092	0.028
d regular oxyhexaster	17	0.011	0.007	0.014	0.002	2	0.011	0.010	0.011	0.001	2	0.011	0.010	0.012	0.001	5	0.010	0.008	0.012	0.001

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Table 2. *(Continued.)*

	USNM 7520					USNM 7521					ZMUC RN35					USNM 7524				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.091	0.061	0.114	0.014						25	0.082	0.054	0.100	0.013					
L dermal pentactin tangential ray	25	0.068	0.008	0.099	0.017						25	0.076	0.062	0.092	0.009					
L atrial hexactin ray directed outside body	25	0.144	0.062	0.208	0.040	10	0.228	0.131	0.362	0.076	25	0.194	0.077	0.308	0.060	25	0.173	0.062	0.308	0.056
L atrial hexactin tangential ray	25	0.124	0.077	0.177	0.029	9	0.110	0.062	0.192	0.039	25	0.140	0.069	0.192	0.037	25	0.132	0.062	0.192	0.040
L atrial hexactin ray directed inside body	25	0.130	0.077	0.246	0.051	10	0.125	0.062	0.192	0.043	25	0.130	0.062	0.185	0.037	25	0.124	0.038	0.231	0.041
D macrodiscohexaster						11	0.112	0.100	0.126	0.009						1	0.108	0.108	0.108	
d macrodiscohexaster						11	0.016	0.012	0.020	0.003						1	0.014	0.014	0.014	
D microdiscohexaster	8	0.027	0.020	0.034	0.005	3	0.029	0.028	0.030	0.001										
d microdiscohexaster	8	0.011	0.008	0.014	0.002	3	0.012	0.011	0.012	0.001										
D oxyhemihexaster	7	0.102	0.048	0.140	0.031	25	0.126	0.100	0.164	0.018	25	0.172	0.100	0.210	0.027	25	0.111	0.080	0.134	0.014
d oxyhemihexaster	7	0.012	0.010	0.014	0.001	25	0.010	0.008	0.014	0.001	25	0.010	0.006	0.014	0.002	25	0.010	0.008	0.012	0.001
D oxyhexactin	3	0.129	0.120	0.140	0.010	14	0.130	0.116	0.156	0.013	4	0.203	0.176	0.214	0.018	5	0.124	0.114	0.130	0.007
D regular oxyhexaster	5	0.054	0.030	0.090	0.022	6	0.048	0.024	0.106	0.030	7	0.049	0.029	0.083	0.020	4	0.073	0.066	0.076	0.005
d regular oxyhexaster	5	0.010	0.010	0.012	0.001	6	0.010	0.008	0.012	0.001	7	0.008	0.005	0.010	0.002	4	0.011	0.008	0.012	0.002

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

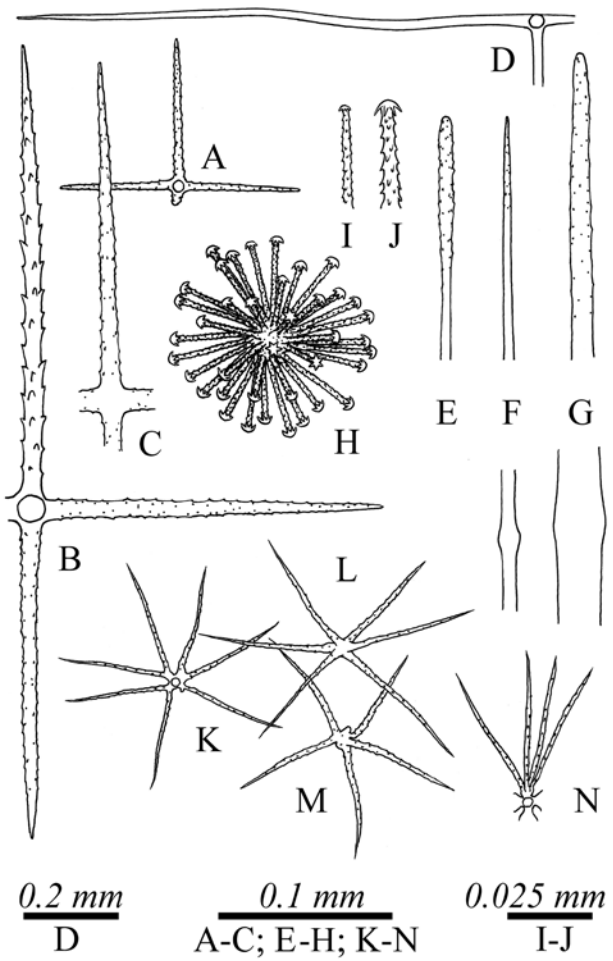

Figure 3. Spicules of *Asconema foliata*, SMNH 1677, type. (A) Dermal pentactin; (B) atrial hexactin; (C) atrial? stauractin; (D) hypodermal pentactin; (E–G) fragments of choanosomal diactins; (H–J) macrodiscaster and its outer ends; (K) oxyhemihexaster; (L) oxyhexactin; (M) oxypentactin; (N) oxyhexaster.

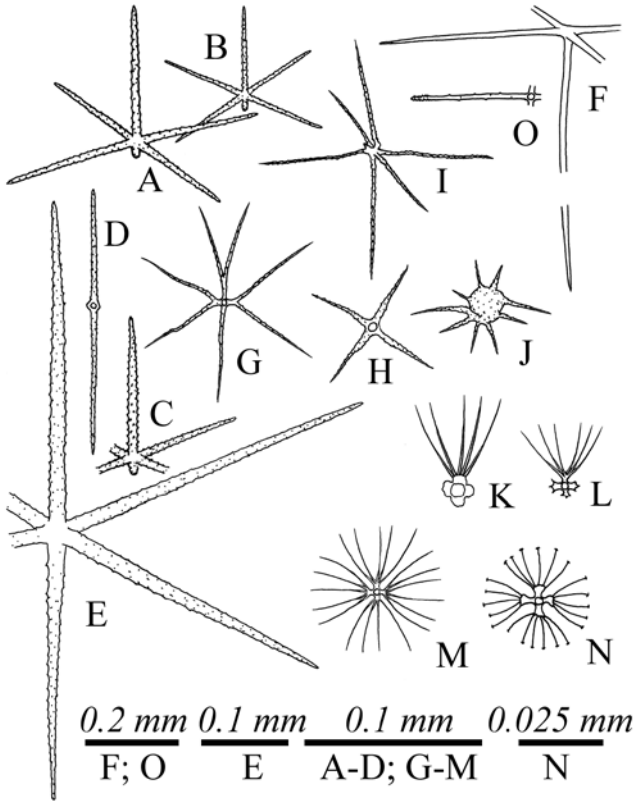

Figure 4. Spicules of *Asconema foliata*. (A–C) Dermal pentactins; (D) dermal or choanosomal diactin; (E) atrial hexactin; (F) hypodermal pentactin; (G) oxyhemihexaster; (H–I) oxyhexactin; (J) abnormal oxyoidal microsclere; (K–M) oxyhexasters; (N) microdiscohexaster; (O) rough hypodermal pentactin. A–H, K–N, ZMUC RN 43; J, ZMUC RN35; O, holotype of *Trichasterina bispiculigastra* ZINRAS.

The other type specimen, SMNH 1203 from the same location, was not available for the investigation.

Other material here assigned to *A. foliata*: ZMUC RN 43—INGOLF EXPEDITION, Station 143, 62°58'N 7°09'W, 1105 m. ZMUC RN 37—INGOLF EXPEDITION, Station 53, 63°15'N 15°07'W, 1497 m. ZMUC RN 35—INGOLF EXPEDITION, Station 94, 65°56'N 36°19'W, 384 m. ZMUC (2371)—INGOLF EXPEDITION, Station 25, 63°30'N 54°25'W, 1096 m. IORAS 5/2/2360—RV 'RT97' , Station 1655, 62°13'N 40°30'W, 430 m. IORAS 5/2/2361—RV 'RT97', Station 1081, 63°37'N 11°37'W, 385 m. NHM 1887.10.24.010—RV 'Triton', Station 4, probably off Scotland, 559–774 m. NHM 1936.09.22.161—material accepted from the ZINRAN, labelled as *Trichasterina borealis*. USNM 7525—US FISH COMMISSION, RV 'Fish Hawk', Station 687, 44°35'N 57°20'W. USNM 7526—US FISH COMMISSION, RV 'Fish Hawk', off Martha's Vineyard. USNM (w 626; w 627; kt5513)—RV 'Eltanin-2', Station 10, 44°31–32'N 56°48–57'W, 403 m. USNM 7520; (kt 1481)—US FISH COMMISSION, RV 'Bache', Station 21B, Maine, Casco Bay, 43°38'N 70°04'W, 93–162 m. USNM 7521 US FISH COMMISSION, Station 1122, 40°02'N 68°50'W, 642 m. USNM 7522—US FISH COMMISSION, RV 'Bache', Station 21, off Cape Hatteras, 35°N 75°W. USNM 7523; (kt 1480) US FISH COMMISSION, RV 'Fish Hawk', Station 1124, 40°01'N 68°54'W, 1170 m. USNM 7524—RV 'Albatross', Station 2069, off Martha's Vineyard, 41°54.50'N 65°48.35'W, 190 m. USNM 23432-2—Mexico (location?).

Other material here also assigned to *A. foliata*: holotype. *Trichasterina bispiculigastra*—ZINRAS 7169, cruise organized by the Murmansk Biological Station, 72°N 33°30'E, 266 m (there are some contradictions between the station number, coordinates and depth in the description and label, the information above is taken from the description).

Other material here assigned to *Asconema* aff. *foliata*: ZMUC (104b)—DENMARK EXPEDITION, 76°06'N 13°26'W, 200–250 m.

Description

Body: the body is tubular. The largest specimens do not attain the sizes of *A. setubalense*, they are about 150 mm in length, 80 mm in diameter with walls 2–3 mm thick. The largest fragment described by Fristedt is 50×30 mm and 3 mm in thickness and coexists with the re-investigated largest fragment of the type SMNH 1677 (containing also two smaller fragments belonging to the same species). Schulze (1899) figured a specimen dichotomously branching to several oscula.

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Spicules: the choanosomal skeleton is composed of diactins which may be divided into three types. The largest ones are about 16/0.046–0.076 mm, they have conically pointed smooth outer ends and shafts even or with a hardly resolvable widening in the middle. The mediate choanosomal diactins are most numerous. They are over 1.5 mm in length and 0.006–0.011 mm in diameter, their outer ends are conically pointed and rough, the shafts have a widening in the middle. The small diactins are 0.03–1.0/0.006–0.008 mm, they have a widening or four rudimental tubercles in the middle and are entirely rough, the position of these spicules is not clear. In their dimensions the small diactins are similar to the dermal and atrial spicules, but no other transitional forms between these spicule types were found; hence, they are referred to as choanosomal spicules. Hypodermal pentactins have orthotropal tangential rays 0.5–1.1/0.011–0.023 mm, the rays directed inside the body are longer than the tangential ones (being approximately 1.4–2.2 mm in length). The tangential rays are smooth with conically pointed or rarely clavate, rough or smooth outer ends. The entire surface of the tangential rays is usually smooth, rarely rough or tuberculated in the *T. bispiculigastra* (in the original description these spicules were called spiny). However, one, probably allochthonic, pentactin with spiny tangential rays was found in the specimen ZMUC (104b). Hypoatrial pentactins usually present, they are equal to the dermal ones. Dermalia are chiefly pentactins with the unpaired ray directed outside the body (even in *T. bispiculigastra*, despite that in the description Rezvoi (1923, 1925) pointed out the opposite direction) or sometimes hexactins. A short rudiment 0.007–0.019 mm long is present in the pentactins instead of the ray directed outside the body. The ray directed outside the body of dermal pentactins is 0.022–0.277 mm in length, the tangential rays are 0.038–0.146 mm in length. The rays of dermal pentactins are 0.007–0.015 mm in diameter and rough, they have rounded or conically pointed outer ends. The unpaired ray is equal in shape to the tangential ones. Sometimes it is possible to find stauractins and tauactins with rays equal to tangential rays of the pentactins or longer up to 0.26/0.020 mm. Atrialia are hexactins and pentactins. The ray directed outside the body of hexactins (usually the longest) is 0.056–0.363 mm in length, tangential rays are 0.052–0.233 mm in length, ray directed inside the body is 0.038–0.303 mm in length. These rays are 0.016–0.022 mm in diameter. The shape of all the rays of atrial hexactins is similar; they are rough with conically pointed outer ends. Atrial pentactins are present in many specimens in notable amounts, they are similar to dermal ones being a little smaller then the atrial hexactins; their ray directed outside the body is 0.030–0.213 mm in length, the tangential rays are 0.030–0.144 mm.

Microscleres: the microscleres always include forms with oxyoidal tips, and in some specimens forms with discoidal outer ends: the former are oxyhexactins, oxyhemihexasters and rare regular oxyhexasters; the latter are spherical macrodiscasters (usual in some specimens, rare in others and entirely absent in some specimens) and rare microdiscohexasters (which were not found in many specimens including types). The oxyhexactins are relatively not abundant, they are 0.104–0.214 mm in diameter with slightly curved, rough or nearly spiny rays and finely pointed outer ends. The oxyhemihexasters with 1–2 secondary ray(s) at each principal ray prevail over all other microsclere types; they are 0.048–0.220 mm in diameter, their primary rosettes are 0.006–0.022 mm in diameter. Their rays are similar in shape to that of oxyhexactins. The regular oxyhexasters with up to four (rarely 4–6) secondary rays at each principal ray are usually rare spicules, they are 0.024–0.185 mm in diameter with primary rosette 0.005–0.030 mm in diameter, their secondary rays are numerous, thin and smooth. The specimen ZMUC RN 35 contains rare abnormal oxyoidal microscleres with strongly curved rays and modified central parts. The macrodiscasters (with about ten secondary rays at each primary ray) are 0.081–0.215 mm in diameter with primary rosette spherical 0.011–0.033 mm in diameter, their secondary rays are spiny with notable toothed or pileate disc. Only once did we find a discaster with secondary rays equal to that of *A. setubalense* (USNM7523) probably owing to contamination during slide preparation. The microdiscohexasters are 0.018–0.042 mm in diameter with primary rosette 0.004–0.014 mm. They are rare in most specimens and entirely absent or not found in others. The microsclere composition varies in the investigated materials: the macrodiscohexasters are found always together with the microdiscohexasters (except the holotype where they are not described and not found in the small fragments loaned for examination); microdiscohexasters were only found in the specimen USNM 7520; no spicules with discoidal outer ends were found in the following specimens: USNM 7526; USNM 7522; USNM (kt480); NHM 1936.09.22.161; IORAS 5/2/2361; ZMUC (104b); ZMUC RN35; ZMUC (2371) and in the holotype of *T. bispiculigastra*.

Remarks

It seems that Ijima (1904, 1927) overlooked this species and hence never analysed its systematic position. *Hyalonema foliata* of Fristedt (1887) was transferred to the genus *Hyalascus* by Hentschel (1929) (species name was changed to '*foliatus*'), a move upheld by Koltun (1964). Later Koltun (1967) placed this species to a lower synonym of *A. setubalense*.

Macrodiscohexasters of '*foliata*' were initially called 'the rosettes with obtuse branches' by Fristedt; in shape (comparing pictures) and size they are similar to macrodiscohexasters (when present) of the examined materials.

The microsclere composition of this species (presence or absence of discoidal microscleres) varies more than among species within the other genera of Rossellidae. Nevertheless all investigated specimens of *Asconema* were considered to be a single species including *A. foliata* (Fristedt) which is reconstructed now after Fristedt's (1887) insufficent description. The high variation of microsclere composition is likely to be interspecific since it is observed in all the areas of the species distribution.

It may be supposed that the direction of the unpaired ray of dermal pentactins is distal in Fristedt's species, because this is true in all of the other specimens which we include in *A. foliata*. Some other microscleres common in the investigated species were not described at all: hexactins, hemihexasters and hexasters. Fristedt's description has many shortcomings. Fristedt mentioned only 'rosettes with

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Table 3. *Spicule dimensions of* Asconema fristedti fristedti *(mm).*

	IORAS 5/2/2339					IORAS 5/2/2341					IORAS 5/2/1297					IORAS 5/2/1299					IORAS 5/2/1293				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.071	0.042	0.091	0.015	25	0.068	0.046	0.103	0.017	25	0.065	0.046	0.084	0.011	25	0.078	0.053	0.106	0.014	25	0.074	0.046	0.106	0.015
L dermal pentactin tangential ray	25	0.059	0.042	0.072	0.008	25	0.059	0.038	0.084	0.011	25	0.056	0.046	0.068	0.007	25	0.060	0.038	0.072	0.009	25	0.061	0.046	0.095	0.009
L atrial hexactin ray directed outside body	25	0.101	0.053	0.152	0.023	25	0.075	0.030	0.152	0.028	3	0.071	0.053	0.084	0.016	25	0.078	0.053	0.106	0.014	10	0.066	0.053	0.099	0.013
L atrial hexactin tangential ray	25	0.066	0.034	0.084	0.011	25	0.064	0.030	0.129	0.019	3	0.053	0.053	0.053	0.000	25	0.060	0.038	0.072	0.009	10	0.057	0.046	0.084	0.011
L atrial hexactin ray directed inside body	25	0.066	0.046	0.084	0.010	25	0.058	0.023	0.114	0.022	3	0.051	0.046	0.053	0.004	25	0.056	0.023	0.084	0.013	10	0.054	0.042	0.068	0.008
L atrial pentactin ray directed outside body	25	0.112	0.068	0.144	0.018	25	0.088	0.061	0.114	0.014	25	0.079	0.053	0.114	0.018	25	0.085	0.046	0.122	0.019	25	0.064	0.046	0.099	0.014
L atrial pentactin tangential ray	25	0.066	0.046	0.084	0.011	25	0.065	0.046	0.103	0.014	25	0.059	0.038	0.099	0.017	25	0.057	0.038	0.076	0.008	25	0.055	0.046	0.076	0.010
D macrodiscohexaster	25	0.103	0.076	0.132	0.014	10	0.083	0.072	0.096	0.009						7	0.120	0.094	0.130	0.012	10	0.075	0.060	0.100	0.014
d macrodiscohexaster	25	0.009	0.008	0.010	0.001	10	0.009	0.007	0.010	0.001						7	0.007	0.006	0.008	0.001	10	0.008	0.006	0.012	0.002
D microdiscohexaster	2	0.018	0.018	0.018	0.000	17	0.019	0.016	0.022	0.002											2	0.020	0.020	0.020	0.000
d microdiscohexaster	2	0.008	0.007	0.008	0.001	17	0.006	0.004	0.009	0.001											2	0.009	0.008	0.009	0.001
D oxyhemihexaster	25	0.139	0.100	0.184	0.019	25	0.131	0.100	0.170	0.015	25	0.102	0.080	0.140	0.013	25	0.152	0.114	0.186	0.018	25	0.135	0.116	0.174	0.012
d oxyhemihexaster	25	0.012	0.008	0.018	0.002	25	0.012	0.010	0.016	0.002	25	0.012	0.007	0.014	0.002	25	0.014	0.010	0.018	0.002	25	0.014	0.008	0.018	0.002
D oxyhexactin	25	0.148	0.124	0.180	0.015	10	0.135	0.120	0.154	0.011	5	0.104	0.080	0.114	0.014	7	0.143	0.118	0.180	0.024	7	0.151	0.142	0.170	0.009

	IORAS 5/2/1276					MNHN HCL647					MNHN HCL646					MNHN HCL643					MNHN (p1629)				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.052	0.034	0.076	0.010	14	0.056	0.033	0.070	0.010	14	0.044	0.026	0.056	0.009	5	0.070	0.044	0.089	0.018	15	0.047	0.033	0.063	0.007
L dermal pentactin tangential ray	25	0.044	0.038	0.053	0.005	14	0.050	0.033	0.063	0.008	14	0.045	0.037	0.056	0.005	5	0.060	0.052	0.070	0.008	15	0.044	0.033	0.052	0.005
L atrial hexactin ray directed outside body	2	0.046	0.046	0.046	0.000											12	0.060	0.041	0.078	0.009					
L atrial hexactin tangential ray	2	0.042	0.038	0.046	0.005											12	0.056	0.041	0.070	0.009					
L atrial hexactin ray directed inside body	2	0.046	0.046	0.046	0.000																				
L atrial pentactin ray directed outside body	23	0.057	0.038	0.076	0.009	15	0.062	0.044	0.089	0.011	15	0.045	0.037	0.056	0.006						15	0.046	0.037	0.059	0.006
L atrial pentactin tangential ray	23	0.045	0.038	0.061	0.006	15	0.054	0.041	0.063	0.006	15	0.043	0.033	0.052	0.006						15	0.041	0.030	0.056	0.006
D macrodiscohexaster	4	0.051	0.048	0.052	0.002	11	0.067	0.040	0.108	0.019	1	0.060	0.060	0.060		1	0.058	0.058	0.058		1	0.047	0.047	0.047	
d macrodiscohexaster	4	0.008	0.007	0.010	0.001	11	0.005	0.004	0.007	0.001	1	0.006	0.006	0.006		1	0.005	0.005	0.005		1	0.007	0.007	0.007	
D microdiscohexaster	15	0.016	0.014	0.018	0.001	4	0.015	0.012	0.016	0.002	15	0.016	0.014	0.019	0.002	1	0.016	0.016	0.016		4	0.012	0.011	0.014	0.002
d microdiscohexaster	15	0.007	0.005	0.008	0.001	4	0.005	0.003	0.008	0.002	15	0.006	0.004	0.008	0.001	1	0.004	0.004	0.004		4	0.005	0.004	0.006	0.001
D oxyhemihexaster	25	0.109	0.092	0.128	0.010	15	0.111	0.089	0.126	0.009	15	0.110	0.074	0.133	0.016	15	0.122	0.104	0.178	0.019	15	0.105	0.089	0.126	0.010
d oxyhemihexaster	25	0.009	0.006	0.012	0.001	15	0.008	0.006	0.011	0.002	15	0.010	0.007	0.013	0.002	15	0.014	0.009	0.019	0.003	15	0.010	0.007	0.019	0.003
D oxyhexactin	10	0.113	0.096	0.126	0.008	8	0.122	0.104	0.141	0.015	15	0.132	0.111	0.163	0.014	15	0.127	0.111	0.155	0.013	15	0.119	0.104	0.133	0.010

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

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Figure 5. *Asconema fristedti fristedti*: (A) holotype; (B) paratype IORAS 5/2/3313. Scale bar: 20 mm.

sharply pointed branches', hence it seems that he did not distinguish the classes of oxyoidal microscleres. He did not describe microdiscohexasters but they are often rare and very small, so their absence in all investigated specimens is still problematic even after their re-examination. The measurements of spicules in Fristedt's data correspond to our averages. The drawings made by Fristedt are similar to the material we observed. So we have reasonable grounds to reconstruct the species name '*foliata*' for this series of specimens.

Another question is the identity of materials investigated by Koltun (1967) and their description. His pictures, measurements and description entirely correspond to *A. foliata* with no similarity to *A. setubalense*. The description of *Trichasterina bispiculigastra* of Rezvoi (1923, 1925) contains the mention of two types of hypodermal pentactins: with smooth and with spiny tangential rays (we interpret these as rare tubercles rather than spines). This together with the fact that the unpaired ray of dermal pentactins has the outside direction (despite that Rezvoi considered them to be directed inside the body); absence of 'trichasters' (they are hexasters with no similarity to trichasters of *T. borealis* Schulze (1900)) allow inclusion of *T. bispiculigastra* into *A. foliata*. All Koltun's conclusions on this subject require reinvestigation. Burton also made some mistakes in identification. One sponge identified by him as *A. setubalense* turned out to be *Trichasterina borealis*; some other reinvestigated specimens are referred to *A. foliata*. Other material described by him was not at our disposal and still requires re-examination.

Distribution

Off the shore of North America, probably from the Gulf of Mexico to Baffin Bay, North Atlantic and, very probably, Arctic Ocean and coast of northern Europe, depth 93–1497 m.

Asconema fristedti sp. nov.

Etymology

Named in the honour of K. Fristedt, the author of *Hyalonema foliata*.

Synonymy

Part of *Asconema setubalense* Topsent, 1892: 27.

Definition

Asconema fristedti is characterized by presence of two types of hypodermal and hypoatrial pentactins: with smooth and spined tangential rays (no hypoatrial hexactins with spiny ray directed outside the body); dermal and atrial spicules of uniform size and similar shape with gradually tapering rays; atrial pentactins equal to the dermal ones are numerously present, as well as dermal and atrial hexactins which are also common in some specimens; oxyoidal and usually various discoidal microscleres are present.

Distribution

Central Atlantic (from the Azores to Iceland), depth 190–4270 m.

Asconema fristedti fristedti sp. nov.

Figures 5 & 6; Table 3

Synonymy

Part of *Asconema setubalense* Topsent, 1892: 27.

Definition

Asconema fristedti fristedti is characterized by the presence of macrodiscohexasters with anchorate discs with smooth secondary rays.

Material examined

Holotype: IORAS 5/2/2339—RV 'Akademik Mstislav Keldysh-28', Station 2794, 59°50.50–49.70'N 29°45'W, 917–696 m.

Paratypes: MNHN HCL 638—BIACORES, Station ChP+F, 37°21.50'N 25°45.50'W, 760-645 m. IORAS 5/2/3313—RV 'Akademik Mstislav Keldysh-4', Station 271, location unknown. IORAS 5/2/1293—RV 'Akademik Mstislav Keldysh-4', Station 363, 58°31.30'N 31°32.06'W, 1310 m. IORAS 5/2/1297—RV 'Akademik Mstislav Keldysh-4', Station 477, 58°25.06–26.03'N 31°49.09–

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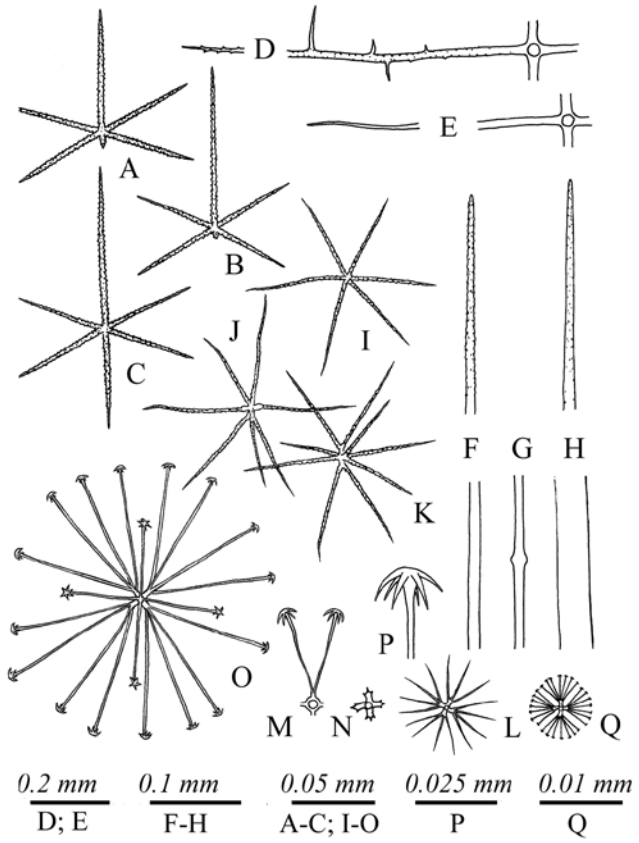

Figure 6. Spicules of *Asconema fristedti fristedti*, holotype: (A) dermal pentactin; (B) atrial pentactin; (C) atrial hexactin; (D) spiny hypodermal pentactin; (E) smooth hypodermal pentactin; (F–H) choanosomal diactins; (I) oxyhexactin; (J,K) oxyhemihexasters; (L) oxyhexaster; (M–O) macrodiscohexasters; (P) secondary ray tip of macrodiscohexaster; (Q) microdiscohexaster. A–Q, IORAS 5/2/2339.

Figure 7. *Asconema fristedti nordazoriensis*: (A) Holotype; (B) paratype IORAS 5/2/3314. Scale bar: 20 mm.

49.04'W, 1805–1660 m. IORAS 5/2/3196; 3198—RV 'Akademik Mstislav Keldysh-4', Station 478, 58°27.3–26.9'N 31°45.0–41.1'W, 1800–1780 m. IORAS 5/2/1299; 3186; 3189—RV 'Akademik Mstislav Keldysh-4', Station 496, 58°25.01–25.01'N 31°32.07–33.06'W, 1635–1465 m. IORAS 5/2/2341—RV 'Akademik Mstislav Keldysh-28', Station 2775, 59°52.08–52.05'N 29°44–38'W, 890–1142 m. MNHN HCL 646-647—SEAMOUNT 2, Station DW 209, Irving et Cruiser, 31°59.17–58.93'N 27°55.95–56.19'W, 460–435 m. MNHN HCL 649—SEAMOUNT 2, Station DW 184, Hyeres, 31°24.45–24.07'N 28°52.27–52.46'W, 705–675 m. IORAS 5/2/1276.1; 5/2/1276.2; 5/2/1276.3; 5/2/1276.6; 5/2/1281; 5/2/1283—RV 'Vitiaz 2 (4)-2', Station 167, 29°58'N 28°16.02'W, 625–580 m.

Description

Body: the body is tubular or funnel-like. The holotype is a tubular fragment of the upper part 130 mm in length and 70 mm in diameter, the walls are about 1 mm thick. The other specimens are often broken fragments of various parts of their bodies, some of them are more or less complete specimens 70–320 mm in length and 40–200 mm in diameter with thin walls about 1 mm thick.

Spicules: the choanosomal skeleton is composed of diactins which may be divided into two types. The thickest and the largest ones are several mm in length and 0.038–0.053 mm in diameter; they have conically pointed outer ends and stout shafts. The other diactins are several mm in length and 0.006–0.008 mm in diameter with conically pointed rough outer ends and shafts with or without a widening in the middle. Hypodermal pentactins have orthotropal tangential rays about 1.5/0.010–0.027 mm, the ray directed inside the body is about 2 mm in length. The tangential rays are smooth or they often have numerous long spines and sometimes the latter are rough. Hypoatrial pentactins correspond to dermal ones in shape and size. Dermalia are chiefly pentactins with the unpaired ray directed outside the body, sometimes with hexactins among them. A short rudiment is situated in the pentactins instead of the ray directed inside the body. The ray of dermal pentactins directed outside the

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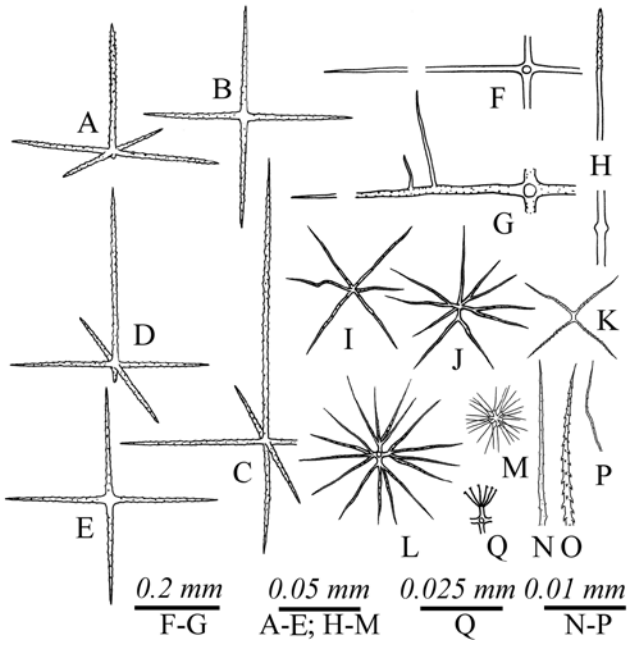

Figure 8. Spicules of *Asconema fristedti nordazoriensis*: (A) Dermal pentactin; (B) dermal stauractin; (C) atrial hexactin; (D) atrial pentactin; (E) atrial stauractin; (F) smooth hypodermal pentactin; (G) spiny hypodermal pentactin; (H) choanosomal diactin; (I) oxyhexactin; (J) oxyhemihexaster; (K) oxystauractin; (L,M) oxyhexasters; (N–P) outer ends of oxyoidal microscleres; (Q) microdiscohexaster. A–J, L, Q, IORAS 5/2/3110 (holotype); K, M–P, MZUB N15402.

body is 0.026–0.106 mm in length, the tangential rays are 0.033–0.095 mm in length. The rays of dermal pentactins are 0.002–0.004 mm in diameter, they gradually taper to the finely pointed outer end and are covered with minute spines being nearly rough. All the rays are similar in shape. Dermal hexactins corresponding in shape to the pentactins were found in few specimens (IORAS 5/2/1299; 5/2/1293). The ray directed outside the body of dermal hexactins is usually the longest and 0.038–0.076 mm in length, tangential rays are 0.046–0.122 mm in length, the ray directed inside the body is 0.023–0.084 mm in length. Atrialia are mainly pentactins with hexactins among them, which are more common here than in the dermalia. Dermal and atrial spicules are similar to each other in size and shape. The ray of atrial pentactin directed outside the body is 0.037–0.144 mm in length, the tangential rays are 0.030–0.103 mm. The ray of atrial hexactins directed outside the body is usually the longest, 0.030–0.152 mm in length, tangential rays are 0.030–0.129 mm in length, the ray directed inside the body is 0.023–0.114 mm in length. These rays are 0.002–0.004 mm in diameter.

Microscleres: the microscleres are presented by forms with oxyoidal and discoidal outer ends: the former are oxyhexactins, oxyhemihexasters (1–2 secondary rays at each primary ray) and rarely oxyhexasters, the latter are macrodiscohexasters and microdiscohexasters. The oxyhexactins are relatively not abundant, they are 0.074–0.186 mm in diameter with slightly curved, rough or nearly spiny rays with finely pointed outer ends. The oxyhemihexasters are 0.074–0.186 mm in diameter, their primary rosettes are 0.006–0.019 mm in diameter. Their rays are similar in shape to that of oxyhexactins. The regular oxyhexasters are very rare, they are about one-half the size of the other oxyoidal microscleres. The macrodiscohexasters are spherical, with 2–6 secondary rays at each primary ray, 0.040–0.132 mm in diameter with primary rosette 0.004–0.012 mm in diameter, their secondary rays are smooth with an anchorate disc. Some specimens have fragments of secondary rays with a clavate, serrated disc like those of *A. setubalense*: MNHN HCL 643; HCL 644; HCL 648; HCL 650; HCL 652 besides the toothed ones. A complete macrodiscohexaster with such discs was found in MNHN HCL 643, it is 0.061 mm in diameter with primary rosette 0.007 mm in diameter. A small part of the specimens which we have referred to *A. fristedti fristedti* with some hesitation have no anchorate macrodiscohexasters or fragments of their secondary rays and only fragments of secondary rays of clavate and serrated discs were found: MNHN HCL 640; HCL 641; HCL 642; HCL 645 and MO 04 0567. The microdiscohexasters are spherical, they are 0.011–0.022 mm in diameter with primary rosette 0.003–0.009 mm in diameter.

Remarks

It is uncertain that some of the examined specimens listed above, which have fragments of macrodiscohexaster secondary rays with clavate and serrated discs, have autochthonic origin. Their rarity in slides and the occurrence of intermediate forms having both types of discs give some reason to consider them to be autochthonic.

Distribution

Central Atlantic (from the Azores to Iceland), depth 215–4270 m.

Asconema fristedti nordazoriensis ssp. nov.
Figures 7 & 8; Table 4

Etymology

The name reflects the species distribution.

Definition

Asconema fristedti nordazoriensis is characterized by absence of macrodiscohexasters and relatively large numbers of dermal stauractins in some specimens.

Material examined

Holotype: IORAS 5/2/3110—RV 'Akademik Mstislav Keldysh-43', Station 3988, submarine 'Mir', 44°57.4'N 28°00.9'W, 2800 m.

Paratypes: IORAS 5/2/3314—RV 'Akademik Mstislav Keldysh-4', Station 280, 58°29.7'N 31°33.3'W, 1245 m. IORAS 5/2/3220; 3221; 3222—RV 'Akademik Mstislav Keldysh-4', Station 318-2, 58°36.7–36.0'N 30°7.0–6.0'W, 1413–1560 m. IORAS 5/2/3312—RV 'Akademik Mstislav Keldysh-4', Station 364, 58°31.2–31.3'N 31°33.7–33.4'W, 1300–1330 m. IORAS 5/2/3183; 3184; 3185—RV 'Akademik Mstislav Keldysh-4', Station 418, 58°23.0–23.1'N 31°33.8–34.1'W, 1915–1815 m. IORAS 5/2/1292—RV 'Akademik Mstislav Keldysh-4', Station 445,

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Table 4. *Spicule dimensions of* Asconema fristedti nordazoriensis *(mm).*

	IORAS 5/2/3110					IORAS 5/2/1292					IORAS 5/2/1294				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.069	0.044	0.104	0.013	25	0.063	0.030	0.093	0.016	25	0.080	0.038	0.114	0.021
L dermal pentactin tangential ray	25	0.059	0.044	0.074	0.008	25	0.058	0.041	0.074	0.007	25	0.055	0.046	0.068	0.007
L dermal stauractin ray	25	0.066	0.052	0.081	0.007	4	0.065	0.056	0.070	0.007	25	0.066	0.052	0.078	0.007
L atrial hexactin ray directed outside body	8	0.127	0.070	0.204	0.048	3	0.128	0.093	0.148	0.031	7	0.069	0.053	0.099	0.016
L atrial hexactin tangential ray	8	0.080	0.056	0.115	0.025	3	0.075	0.070	0.078	0.004	7	0.056	0.046	0.068	0.007
L atrial hexactin ray directed inside body	8	0.072	0.052	0.100	0.020	3	0.070	0.067	0.074	0.004	7	0.052	0.030	0.061	0.013
L atrial pentactin ray directed outside body	25	0.106	0.052	0.174	0.027	25	0.101	0.056	0.148	0.021	25	0.058	0.038	0.084	0.012
L atrial pentactin tangential ray	25	0.056	0.041	0.078	0.008	25	0.064	0.048	0.078	0.009	25	0.053	0.030	0.072	0.011
D microdiscohexaster	1	0.020	0.020	0.020							4	0.020	0.018	0.024	0.003
d microdiscohexaster	1	0.010	0.010	0.010							4	0.007	0.004	0.008	0.002
D oxyhexaster and oxyhemihexaster	25	0.101	0.059	0.118	0.012	25	0.096	0.074	0.118	0.011	25	0.107	0.088	0.124	0.010
d oxyhexaster and oxyhemihexaster	25	0.012	0.007	0.015	0.003	25	0.010	0.007	0.015	0.002	25	0.012	0.009	0.016	0.002
D oxyhexactin	11	0.096	0.081	0.118	0.014	25	0.110	0.096	0.126	0.008	8	0.116	0.106	0.132	0.010

	IORAS 5/2/3173					MZUB 15402					MZUB 15528				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.049	0.033	0.067	0.010	25	0.062	0.036	0.103	0.017	5	0.093	0.070	0.117	0.019
L dermal pentactin tangential ray	25	0.054	0.037	0.067	0.008	25	0.068	0.049	0.139	0.017	11	0.097	0.079	0.122	0.016
L dermal stauractin ray	25	0.060	0.052	0.070	0.005	25	0.086	0.063	0.148	0.019	3	0.070	0.061	0.081	0.010
L atrial hexactin ray directed outside body						21	0.133	0.090	0.166	0.021					
L atrial hexactin tangential ray						23	0.109	0.070	0.157	0.019					
L atrial hexactin ray directed inside body						23	0.105	0.072	0.144	0.020					
L atrial pentactin ray directed outside body						4	0.111	0.078	0.159	0.036					
L atrial pentactin tangential ray						5	0.148	0.111	0.178	0.030					
D microdiscohexaster	21	0.018	0.014	0.022	0.002	10	0.024	0.020	0.032	0.004	9	0.015	0.011	0.018	0.002
d microdiscohexaster	21	0.008	0.004	0.010	0.002	10	0.007	0.005	0.011	0.002	9	0.007	0.005	0.009	0.001
D oxyhexaster and oxyhemihexaster	25	0.082	0.058	0.097	0.010	25	0.113	0.073	0.151	0.022	25	0.086	0.054	0.130	0.013
d oxyhexaster and oxyhemihexaster	13	0.010	0.005	0.013	0.002	25	0.010	0.006	0.012	0.002	25	0.009	0.005	0.014	0.002
D oxyhexactin	13	0.089	0.072	0.108	0.010	25	0.131	0.104	0.170	0.019	25	0.095	0.072	0.119	0.012

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

Table 5. *Spicule dimensions of* Asconema fristedti icelandiensis *(mm).*

	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.082	0.057	0.099	0.013
L dermal pentactin tangential ray	25	0.063	0.046	0.080	0.007
L atrial hexactin ray directed outside body	12	0.101	0.072	0.137	0.022
L atrial hexactin tangential ray	12	0.067	0.053	0.091	0.011
L atrial hexactin ray directed inside body	12	0.062	0.030	0.084	0.017
L atrial pentactin ray directed outside body	25	0.106	0.068	0.144	0.019
L atrial pentactin tangential ray	25	0.063	0.053	0.076	0.007
D macrodiscohexaster	18	0.078	0.065	0.092	0.009
d macrodiscohexaster	18	0.014	0.010	0.018	0.003
D microdiscohexaster	14	0.021	0.014	0.028	0.005
d microdiscohexaster	14	0.009	0.006	0.012	0.002
D oxyhemihexaster	25	0.097	0.074	0.114	0.012
d oxyhemihexaster	25	0.012	0.006	0.018	0.003

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

58°21.1–21.7'N 31°35.1–33.0'W, 1650–1860 m. IORAS 5/2/1274—RV 'Akademik Mstislav Keldysh-4', Station 446, 58°23.9–24.1'N 31°49.2'–47.3' W, 1750–1650 m. IORAS 5/2/1294—RV 'Akademik Mstislav Keldysh-4', Station 489, 58°21.7–22.0'N 31°39.8–41.0'W, 1560–1550 m. IORAS 5/2/3179; 3182—RV 'Akademik Mstislav Keldysh-4', Station 499, 58°3.3–4.0'N 30°26.1–17.2'W, 2440–2429 m. IORAS 5/2/3173—RV 'Akademik Mstislav Keldysh-49', Station 4535, 52°58'N 35°1'W, 2156 m. MZUB N15528—MAR-ECO, RV 'G.O. Sars', superatation 70, local Station 385, 52.97567–52.96583°N 34.86917–34.86517°W, depth 1860–2165 m. MZUB N15402—MAR-ECO, RV 'G.O. Sars', superatation 60, local Station 379, 51.55833–51.57083°N 30.311–30.30667°W, depth 1255–1179 m.

Other materials assigned here to *A. f. nordazoriensis*. IORAS 5/2/3178; 3180—RV 'Akademik Mstislav Keldysh-4', Station 499, 58°3.3–4.0'N 30°26.1–17.2'W, 2440–2429 m.

Description

Body: the body is tubular. The holotype is a tubular fragment of the upper part 80 mm in length and 18 mm in diameter, the walls are about 1 mm thick, the biggest paratype is 310 mm in length and 100 mm in diameter with walls 1–1.5 mm thick.

Spicules: the choanosomal skeleton is composed of two types of diactins. The thickest and the largest ones are about 20 mm in length and 0.015–0.034 mm in diameter; they have conically pointed outer ends and stout shafts. The other diactins are about 1 mm in length and 0.005–0.008 mm in diameter with conically pointed rough outer ends and shafts with or without a widening in the middle. Hypodermal pentactins have orthotropal tangential rays about 0.8–1.5/0.02–0.03 mm, the ray directed inside the body is 1.1–1.4 mm in length. The tangential rays are smooth or slightly rough, often they have numerous long spines up to 0.3 mm. Hypoatrial pentactins correspond to dermal ones in shape and size. Dermalia are chiefly pentactins with the unpaired ray directed outside the body, sometimes with stauractins, which are rather numerous in the holotype and specimens 5/2/1294 and 5/2/1274. A short rudiment is situated in the pentactins instead of the ray directed inside the body. The ray of dermal pentactins directed outside the body is 0.030–0.117 mm in length, the tangential rays are 0.037–0.139 mm in length. The rays of dermal pentactins are 0.003–0.004 mm in diameter, they are gradually tapering toward the finely pointed outer end and covered with minute spines being nearly rough. All the rays are similar in shape. Atrialia are pentactins together with some hexactins, the rays of dermal and atrial spicules are similar in size and shape to each other. The ray of atrial pentactin directed outside the body is 0.038–0.174 mm in length, the tangential rays are 0.030–0.078 mm. The ray of atrial hexactins directed outside the body is usually the longest, 0.053–0.204 mm in length, tangential rays are 0.046–0.115 mm in length, the ray directed inside the body is 0.030–0.100 mm in length. These rays are 0.003–0.004 mm in diameter.

Microscleres: microscleres have oxyoidal and rarely discoidal outer ends: the former are oxyhexactins, oxyhemihexasters (1–2 secondary ray(s) at each principal ray) and rarely oxyhexasters (3–4 secondary rays at each principal ray), the latter are microdiscohexasters. The oxyhexactins are relatively rare, they are 0.072–0.170 mm in diameter with slightly curved, rough or nearly spiny rays with finely pointed outer ends. The oxyhemihexasters and oxyhexasters are 0.054–0.151 mm in diameter, their primary rosettes are 0.005–0.016 mm in diameter. Their rays are similar in shape to those of oxyhexactins. The microdiscohexasters are very rare, spherical, 0.011–0.032 mm in diameter with primary rosette 0.004–0.011 mm in diameter.

Distribution

Central Atlantic (from the Azores to Iceland), depth 1560–2800 m.

Asconema fristedti icelandiensis ssp. nov.
Figures 9 & 10; Table 5

Etymology

The name reflects the location of collected specimen.

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Figure 9. *Asconema fristedti icelandiensis*, holotype. Scale bar: 20 mm.

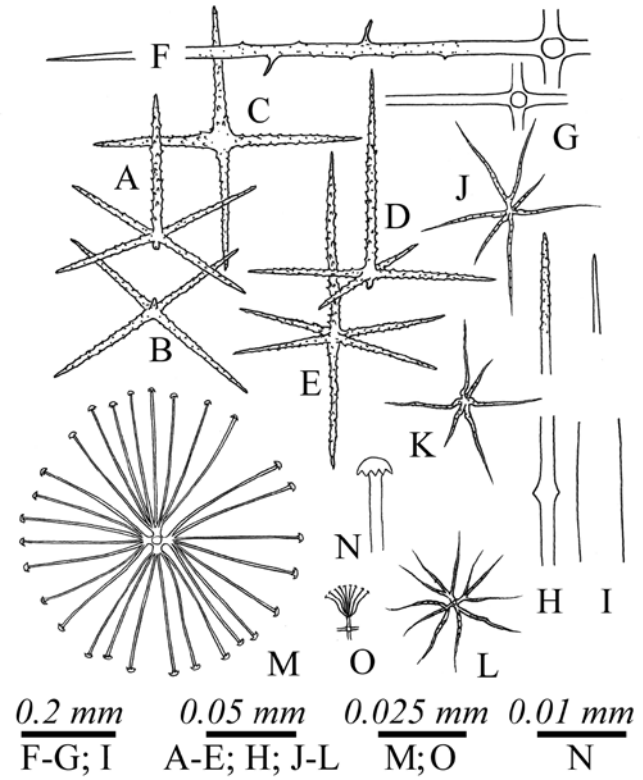

Figure 10. Spicules of *Asconema fristedti icelandiensis*: holotype. (A) dermal pentactin; (B–C) dermal stauractin; (D) atrial pentactin; (E) atrial hexactin; (F) spiny hypodermal pentactin; (G) smooth hypodermal pentactin; (H–I) choanosomal diactins; (J) oxyhemihexaster; (K) oxyhexactin; (L) oxyhexaster; (M) macrodiscohexaster; (N) secondary ray of macrodiscohexaster; (O) microdiscohexaster.

Definition

Asconema fristedti icelandiensis is characterized by presence of spherical macrodiscohexasters with pileate discs.

Material examined

Holotype: IORAS 5/2/1298—RV 'Akademik Mstislav Keldysh-4', Station 492, 58°21.8–21.7'N 31°44.7–45.2'W, 1875–1895 m.

Description

Body: the body is a tubular fragment 130 mm in length, 45 mm in diameter, the walls are about 2 mm in thickness.

Spicules: the choanosomal skeleton is composed of two types of diactins. The thickest and the largest ones are up to 30 mm in length and 0.038–0.068 mm in diameter; they have conically pointed smooth or rough outer ends and stout shafts. The other diactins are from 0.3 to several mm in length and 0.002–0.006 mm in diameter with conically pointed rough outer ends and shafts with or without a widening in the middle. Hypodermal and hypoatrial pentactins have orthotropal tangential rays 1.1–2.3/0.01–0.03 mm. The tangential rays are smooth or slightly rough, often they have numerous spines. Dermalia are chiefly pentactins, rarely stauractins or stauractins with two rudimental rays instead of the ones directed inside and outside. The pentactins have the unpaired ray directed outside the body, a short rudiment replaces the ray directed inside the body. The ray of dermal pentactins directed outside is 0.057–0.099 mm in length, the tangential rays are 0.046–0.080 mm in length. The rays of dermal pentactins are 0.004–0.005 mm in diameter, they are gradually tapering toward the conically pointed outer end and covered with minute spines being nearly rough. All the rays are similar in shape. Atrialia are pentactins together with some hexactins; rays of dermal and atrial spicules are similar in size and shape. The ray of atrial pentactin directed outside the body is 0.068–0.144 mm in length, the tangential rays are 0.053–0.076 mm. The ray of hexactins directed outside the body is usually the longest, 0.072–0.137 mm in length; tangential rays are 0.053–0.091 mm in length; the ray directed inside the body is 0.030–0.084 mm in length. These rays are 0.004–0.005 mm in diameter.

Microscleres: microscleres consist of oxyoidal forms (with 1–3 secondary rays at each primary ray): oxyhemihexasters, some oxyhexasters and rare oxyhexactins and discoidal forms (with 8–10 secondary rays at each primary ray): macro- and microdiscohexasters. The oxyhemihexasters and oxyhexasters are 0.074–0.114 mm in diameter, their primary rosettes are 0.006–0.018 mm in diameter. The macrodiscohexasters are spherical, with pileate discs and smooth secondary rays, they are 0.065–0.092 mm in

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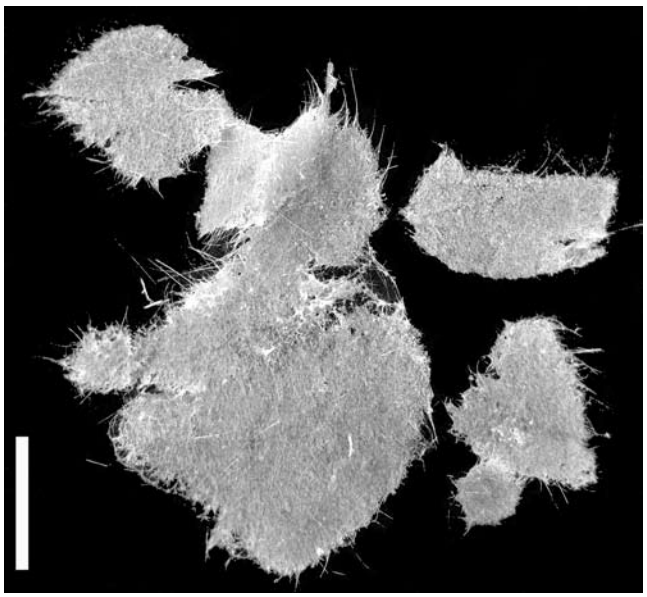

Figure 11. *Asconema topsenti*, holotype. Scale bar: 20 mm.

diameter with primary rosette 0.010–0.018 mm in diameter. The microdiscohexasters are 0.014–0.028 mm in diameter with primary rosette 0.006–0.012 mm in diameter.

Distribution

Off Iceland, depth 1875–1895 m.

Asconema fristedti ssp.

The following specimens consist of poor fragments. They clearly belong to *A. fristedti* but their subspecies assignment is presently undeterminable:

MO 04 007; MO 04 0073—RV 'Princesse Alice', Station 105, 38°23.45'N 30°51.30'W, 927 m. MO 04 0567—RV 'Princess Alice', Station 719, 39°11'N 30°24,15'W, 1600 m.

MNHN HCL 644; 639—BIACORES, Station DG 34, 38°09.50'N 29°15'W, 670–650 m. MNHN HCL 645—BIACORES, Station DP 49, 37°56'N 29°12'W, 225–215 m. MNHN HCL 640—BIACORES, Station ChG 161, 37°39.50'N 25°50.50'W, 590 m. MNHN HCL 641—BIACORES, Station ChG 176, 38°00.50'N 26°21.50'W, 2720–2440 m. MNHN HCL 658—BIACORES, Station DR 197, 37°49.50'N 25°01.50'W, 815 m. MNHN HCL 642-643—BIACORES, Station ChG 245, 40°57'N 22°16'W, 4270 m. MNHN (p6247-6257 (11 specimens))—SEAMOUNT 2, Station DW 166, Meteor, 29°36.04–36.17'N 28°22.81–22.81'W, depth 575–550 m. MNHN HCL 648; 661-662—SEAMOUNT 2, Station DW 184, Hyeres, 31°24.45–24.07'N 28°52.27–52.46'W, 705–675 m. MNHN HCL 650-652; 663-665—SEAMOUNT 2, Station DW 202, Hyeres, 31°16.50–16.70'N 28°43.15–43.08'W, 640–655 m. MNHN HCL 653—SEAMOUNT 2, Station DW 203, Hyeres, 31°09.52–09.67'N 28°43.52–43.38'W, 845 m. MNHN HCL 654-656—SEAMOUNT 2, Station DW 227, Irving et Cruiser, 32°07.17–07.46'N 28°08.74–08.62'W, 695–730 m. MNHN HCL 657; 666—SEAMOUNT 2, Station DW 236, Irving et Cruiser, 32°03.72–05.52'N 27°40.59–39.69'W, 1925–1960 m. MNHN HCL 667—SEAMOUNT 2, Station DW 247, Plato, 33°13.69–13.69'N 29°35.26–35.54'W, 580–625 m. MNHN HCL 668—SEAMOUNT 2, Station DW 273, Atlantis, 34°19.91–20.13'N 30°27.98–27.72'W, 1490–1440 m. IORAS 5/2/3177—RV 'Akademik Mstislav Keldysh-4', Station 445, 58°21.1–21.7'N 31°35.1–33.0'W, 1650–1860 m. IORAS 5/2/3181; 3182—RV 'Akademik Mstislav Keldysh-4', Station 499, 58°3.3–4.0'N 30°26.1–17.2'W, 2440–2429 m.

Asconema topsenti sp. nov.
Figures 11 & 12; Table 6

Etymology

The species is named in honour of E. Topsent.

Synonymy

Part of *Asconema setubalense* Topsent, 1904: 40.

Definition

Asconema topsenti is characterized by the presence of hypoatrial hexactins with spiny proximal ray besides pentactins of two types with smooth and spiny tangential rays; two types of atrial spicules: large hexactins and small pentactins (the latter are similar to dermal ones); macrodiscohexasters with toothed–anchorate discs and with smooth secondary rays; stellate microdiscohexasters; oxyhexactins usually prevail over oxyhemihexasters.

Material examined

Holotype: IORAS 5/2/1279—RV 'Vityaz 2 (4)-2', Station 167, 29°58'N 28°16.02'W, 625–580 m.

Paratypes: IORAS 5/2/1276.4; 5/2/1276.5; 5/2/1287; 5/2/1280—RV 'Vitiaz 2 (4)-2', Station 167, 29°58'N 28°16.02'W, 625–580 m. MO 04 0618—RV 'Princesse Alice', Station 866, 38°52.50'N 27°23.05'W, 599 m. MNHN HCL 670—BIACORES, Station DP 48, 37°44'N 29°31'W, 465–430 m. MNHN HCL 671-674—SEAMOUNT 2, DW 221, Irving et Cruiser, 32°17.84–18.03'N 28°15.32–15.47'W, 1180–1160 m. MNHN HCL 675—SEAMOUNT 2, Station DW 241, Plato, 33°11.01–11.89'N 28°59.32–58.96'W, 695–695 m. MNHN HCL 676—SEAMOUNT 2, Station DW 261, Atlantis, 34°22.37–22.52'N 30°27.79–27.99'W, 1340–1190 m. MNHN HCL 677—SEAMOUNT 2, Station DW 248, Plato, 33°13.58–13.56'N 29°32.49–32.78'W, 735–670 m.

Description

Body: this species is represented by fragments of the walls about 1 mm thick, the only tubular specimen MNHN HCL 673 is a wall segment 20 mm in length and 15 mm in diameter.

Spicules: the choanosomal skeleton is composed of diactins, which can be divided into two types. The thickest and the largest ones are up to 15 mm in length and 0.017–0.027 mm in diameter; they have conically pointed slightly rough outer ends and stout shafts. The other diactins are several mm in length and 0.006–0.008 mm in diameter with conically pointed slightly rough outer ends and stout shafts with or without a widening in the middle. Hypodermal pentactins have orthotropal tangential rays 0.4–1.5/0.008–0.030 mm,

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Table 6. *Spicule dimensions of* Asconema topsenti *(mm).*

	IORAS 5/2/1279					IORAS 5/2/1282					IORAS 5/2/1280					MNHN HCL670				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	21	0.041	0.015	0.061	0.011	9	0.047	0.038	0.061	0.009	21	0.049	0.034	0.072	0.010	15	0.050	0.041	0.059	0.007
L dermal pentactin tangential ray	21	0.042	0.030	0.057	0.008	9	0.041	0.038	0.046	0.004	21	0.042	0.027	0.068	0.010	15	0.044	0.030	0.056	0.007
L atrial hexactin ray directed outside body	3	0.104	0.076	0.129	0.027	14	0.137	0.053	0.334	0.071	1	0.084	0.084	0.084						
L atrial hexactin tangential ray	3	0.071	0.038	0.091	0.029	14	0.104	0.061	0.182	0.032	1	0.076	0.076	0.076						
L atrial hexactin ray directed inside body	3	0.071	0.038	0.099	0.031	14	0.103	0.046	0.190	0.045	1	0.076	0.076	0.076						
L atrial pentactin ray directed outside body	22	0.053	0.041	0.067	0.007	17	0.052	0.034	0.076	0.010	11	0.039	0.030	0.053	0.007	14	0.048	0.041	0.056	0.005
L atrial pentactin tangential ray	22	0.048	0.033	0.063	0.008	17	0.047	0.032	0.068	0.008	11	0.039	0.027	0.053	0.009	14	0.045	0.037	0.056	0.006
D macrodiscohexaster	3	0.100	0.096	0.106	0.005						1	0.086	0.086	0.086						
d macrodiscohexaster	3	0.013	0.010	0.016	0.003	3	0.015	0.014	0.016	0.001	1	0.010	0.010	0.010						
D microdiscohexaster	15	0.026	0.024	0.030	0.002	15	0.026	0.018	0.032	0.004	13	0.027	0.024	0.032	0.003	15	0.031	0.026	0.036	0.003
d microdiscohexaster	15	0.011	0.010	0.014	0.001	15	0.010	0.008	0.012	0.002	13	0.010	0.008	0.012	0.002	15	0.011	0.008	0.014	0.002
D oxyhemihexaster	16	0.106	0.086	0.124	0.013	25	0.104	0.070	0.124	0.012	9	0.088	0.070	0.116	0.014	15	0.049	0.041	0.056	0.004
d oxyhemihexaster	16	0.012	0.008	0.016	0.003	25	0.013	0.008	0.016	0.002	9	0.011	0.008	0.016	0.003	15	0.006	0.004	0.007	0.001
D oxyhexactin	25	0.108	0.080	0.128	0.012	7	0.107	0.100	0.120	0.007	14	0.101	0.084	0.114	0.010	15	0.052	0.037	0.067	0.007
D oxyhexaster	1	0.050	0.050	0.050							1	0.020	0.020	0.020						
d oxyhexaster	1	0.010	0.010	0.010							1	0.011	0.011	0.011						

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

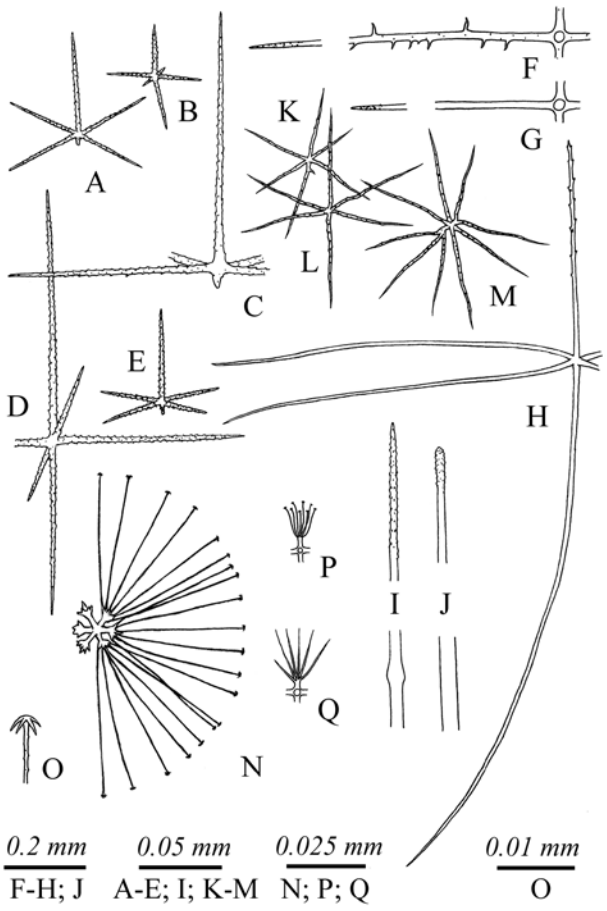

Figure 12. Spicules of *Asconema topsenti*, holotype: (A) dermal pentactin; (B) dermal hexactin; (C) large dermal pentactin; (D) atrial hexactin; (E) atrial pentactin; (F) spiny hypodermal pentactin; (G) smooth hypodermal pentactin; (H) hypoatrial hexactin; (I) small choanosomal diactin; (J) large choanosomal diactin; (K,L) oxyhexactins; (M) oxyhemihexaster; (N) macrodiscohexaster; (O) secondary ray tip of macrodiscohexaster; (P) microdiscohexaster; (Q) oxyhexaster. A–Q, IORAS 5/2/1279.

the ray directed inside the body is 0.9–1.9 mm in length. The tangential rays are smooth or often they have numerous long spines and rough surface. The outer ends of hypodermal pentyactins are conically pointed and rough. Hypoatrial pentactins correspond to dermal ones in shape and size but they occur together with specific hypoatrial hexactins. These hexactins have ray directed outside the body 0.25–0.90 mm in length with rare short spines; the tangential rays are 0.6–2.1 mm in length, the ray directed inside the body is 1.0–2.4 mm in length. These rays are conically pointed, slightly rough outer ends are 0.009–0.017 mm in diameter. Dermalia are chiefly pentactins with the unpaired ray directed outside the body or rarely stauractins. A short rudiment up to 0.011 mm in length replaces the ray directed inside the body in the pentactins. The ray directed outside the body of dermal pentactins is 0.015–0.076 mm in length, the tangential rays are 0.027–0.068 mm in length. The rays of dermal pentactins are 0.002–0.003 mm in diameter, they gradually taper toward the finely pointed outer end and are covered with minute spines being nearly rough. All the rays are similar in shape. In most specimens atrialia are mainly pentactins with rare relatively large hexactins (these hexactins are rather numerous in the specimen IORAS 5/2/1282). The atrial pentactins are similar to the corresponding dermal spicules. The ray of atrial pentactin directed outside the body is 0.030–0.076 mm in length, the tangential rays are 0.027–0.068 mm. The rays of atrial hexactins are similar to these spicules in shape, the ray of hexactins directed outside the body is 0.053–0.334 mm in length, tangential rays are 0.038–0.182 mm in length, the ray directed inside the body is 0.038–0.190 mm in length. These rays are 0.002–0.004 mm in diameter. Rarely it is possible to find a large pentactin similar to the atrial hexactins.

Microscleres: the microscleres consist of forms with oxyoidal and discoidal outer ends: the former are oxyhexactins, oxyhemihexasters (1–2 rarely 3 secondary rays at each principal ray) and rarely oxyhexasters (approximately 6–10 secondary rays at each principal ray), the latter are spherical macrodiscohexasters and stellate microdiscohexasters. The oxyhexactins are quite abundant, sometimes prevailing over the oxyhemihexasters. They are 0.037–0.128 mm in diameter with rough rays and finely pointed outer ends, sometimes they have occasional spines usually close to the base. The oxyhemihexasters are 0.041–0.124 mm in diameter, their primary rosettes are 0.004–0.016 mm in diameter. Their rays are similar in shape to that of oxyhexactins. The regular oxyhexasters are unique, they are about one-half the size of the other oxyoidal microscleres (0.020–0.050 mm in diameter with primary rosette 0.010–0.011 mm in diameter). The macrodiscohexasters are 0.086–0.106 mm in diameter with primary rosette 0.010–0.016 mm in diameter, their secondary rays are smooth with anchorate disc, the primary ray has a spine surrounded by bases of the secondary rays. The microdiscohexasters are relatively large and stellate, 0.018–0.036 mm in diameter with primary rosette 0.008–0.014 mm in diameter.

Remarks

The presence of peculiar hypodermal hexactins differentiates this species from the others of the genus *Asconema*. In most other respects this new species is similar to *A. fristedti* with few differences: presence of two types of atrial spicules in *A. topsenti*: large hexactins and pentactins similar to dermal ones (observed in some specimens); form and size of microdiscohexasters (in *A. topsenti* they are stellate and larger then these spicules in *A. fristedti* which are spherical). The new species is distinguished on the basis of these differences. Moreover, some specimens of *A. topsenti* and *A. fristedti* were captured together. Most of the investigated materials are represented by poor fragments with incomplete spicule sets and their assignment to the genus is made on the presence of the peculiar feature of the species-specific hypoatrial hexactins.

Distribution

Off the Azores, depth 430–1190 m.

Asconema aff. *topsenti* sp. nov.

MO 04 0612—RV 'Princesse Alice', Station 866, 38°52.50'N 27°23.05'W, 599 m.

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Table 7. *Spicule dimensions of* Asconema megaatrilia *(mm).*

	A. megaatrilia megaatrialia																			
	IORAS 5/2/1278					IORAS 5/2/1277					IORAS 5/2/1271					MNHN (p3801)				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	25	0.122	0.074	0.192	0.030	25	0.185	0.076	0.304	0.051	25	0.134	0.076	0.182	0.026	25	0.082	0.057	0.129	0.018
L dermal pentactin tangential ray	25	0.082	0.070	0.104	0.010	25	0.125	0.084	0.190	0.027	25	0.105	0.076	0.137	0.018	25	0.070	0.011	0.099	0.019
L atrial hexactin ray directed outside body	24	1.006	0.532	1.672	0.298	17	0.790	0.395	1.520	0.306	21	0.304	0.114	0.760	0.140	10	0.695	0.357	1.596	0.395
L atrial hexactin tangential ray	24	0.348	0.228	0.570	0.083	19	0.358	0.144	0.798	0.154	21	0.173	0.091	0.372	0.066	10	0.282	0.152	0.456	0.088
L atrial hexactin ray directed inside body	24	0.397	0.266	0.608	0.093	17	0.328	0.190	0.699	0.136	21	0.153	0.068	0.357	0.065	7	0.255	0.144	0.380	0.078
D macrodiscohexaster	25	0.154	0.090	0.230	0.038	25	0.230	0.144	0.288	0.046	25	0.203	0.133	0.270	0.040	17	0.222	0.108	0.281	0.046
d macrodiscohexaster	25	0.013	0.011	0.018	0.003	25	0.016	0.011	0.022	0.003	25	0.015	0.011	0.022	0.003	17	0.013	0.007	0.018	0.003
D microdiscohexaster	2	0.024	0.023	0.025	0.002	2	0.021	0.020	0.022	0.002	2	.020	0.019	0.022	0.002					
d microdiscohexaster	2	0.010	0.008	0.013	0.003	2	0.006	0.005	0.006	0.001	2	0.007	0.007	0.007						
D oxyhexactin	25	0.092	0.072	0.115	0.011	25	0.108	0.076	0.137	0.016	25	0.111	0.086	0.133	0.014	25	0.093	0.065	0.108	0.010
	A. megaatrilia biacorica					*A. megaatrilia seamounti*					*A. megaatrilia nordiense*									
	MNHN HCL679					MNHN HCL678					IORAS 5/2/3086					IORAS 5/2/3088				
	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD	N	Mean	Min	Max	SD
L dermal pentactin ray directed outside body	9	0.217	0.167	0.281	0.037	7	0.066	0.037	0.093	0.020	25	0.098	0.059	0.137	0.018	25	0.091	0.068	0.122	0.015
L dermal pentactin tangential ray	13	0.116	0.076	0.137	0.016	19	0.074	0.039	0.135	0.024	25	0.095	0.070	0.133	0.015	25	0.094	0.061	0.137	0.020
L atrial hexactin ray directed outside body	9	1.021	0.304	2.888	0.847	8	0.361	0.198	0.740	0.174	24	0.410	0.278	0.585	0.092	24	0.320	0.122	0.471	0.091
L atrial hexactin tangential ray	4	0.163	0.137	0.175	0.018	11	0.174	0.115	0.296	0.053	16	0.267	0.030	0.377	0.085	22	0.233	0.106	0.327	0.059
L atrial hexactin ray directed inside body	7	0.331	0.122	0.623	0.213	6	0.165	0.104	0.233	0.053	7	0.252	0.222	0.270	0.018	22	0.211	0.091	0.289	0.058
D macrodiscohexaster						24	0.222	0.126	0.252	0.034	25	0.182	0.137	0.216	0.023	11	0.172	0.072	0.230	0.048
d macrodiscohexaster						24	0.042	0.022	0.050	0.008	25	0.011	0.007	0.018	0.002	11	0.011	0.007	0.014	0.002
D microdiscohexaster	11	0.077	0.050	0.108	0.018						5	0.023	0.020	0.031	0.004					
d microdiscohexaster	11	0.011	0.005	0.014	0.003	4	0.014	0.011	0.018	0.003	5	0.006	0.004	0.007	0.001					
D oxyhemihexaster											25	0.091	0.067	0.126	0.015	25	0.082	0.061	0.101	0.010
d oxyhemihexaster											25	0.008	0.007	0.013	0.002	25	0.008	0.007	0.011	0.001
D oxyhexactin	25	0.079	0.054	0.090	0.009	24	0.077	0.061	0.112	0.011	9	0.111	0.089	0.126	0.011	11	0.094	0.065	0.112	0.013

Min, minimum; Max, maximum, SD, standard deviation; L, length; D, diameter; d, diameter of primary rosette.

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Figure 13. *Asconema megaatrialia megaatrialia*, holotype. Scale bar: 60 mm.

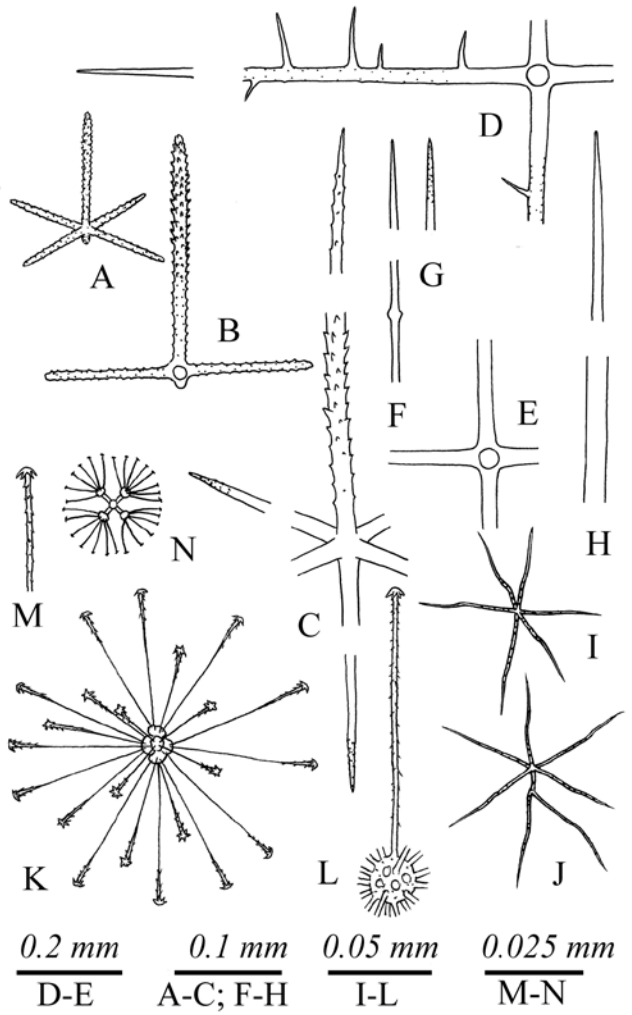

Figure 14. Spicules of *Asconema megaatrialia megaatrialia*, holotype: (A,B) dermal pentactins; (C) atrial hexactin; (D) spiny hypodermal pentactin; (E) smooth hypodermal pentactin; (F–H) choanosomal diactins; (I) oxyhexactin; (J) oxyhemihexaster; (K,L) macrodiscohexaster; (M) secondary ray tip of macrodiscohexaster; (N) microdiscohexaster.

Asconema megaatrialia sp. nov.

Etymology

The name reflects the specific very large atrial hexactins.

Definition

Asconema megaatrialia is characterized by the presence of two types of hypodermal pentactins: with smooth and spined tangential rays (hypoatrial pentactins are probably entirely absent); dermal and atrial spicules differ strongly in size, dermalia are usually pentactins with all the rays smooth or spiny, atrialia are giant hexactins with pinular proximal ray and other rays smooth; oxyoid and various discoid microscleres are present.

Distribution

Central and North Atlantic, depth 1107–2942 m.

Asconema megaatrialia megaatrialia sp. nov.
Figures 13 & 14; Table 7

Definition

Asconema megaatrialia megaatrialia is characterized by a specific combination of microscleres: oxyhexactins prevail over rare oxyhemihexasters (oxyoidal microscleres with reduced amount of primary rays seem to be absent), macrodiscasters and macrodiscohexasters and macrodiscasters are 0.1–0.3 mm in diameter, they have spiny secondary rays with toothed discs.

Material examined

Holotype: IORAS 5/2/1278—RV 'Vitiaz 2 (4)-2', Station 80.3, 35°38.8'N 52°03.2'W, 1940–2040 m.

Paratypes: IORAS 5/2/1286—ibid. IORAS 5/2/1271, 5/2/1277—RV 'Vityaz 2 (4)-2', Station 159, 29°56.1'N 28°13.0'W, 2480–2550 m. MNHN (p3801)—RV 'Travailleur' (the label contains many contradictions, hence the location is unknown).

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Figure 15. *Asconema megaatrialia nordiense*, holotype. Scale bar: 60 mm.

Description

Body: tubular sponges. The holotype is the most complete sponge: 220 mm in length, 50 mm in diameter with wide osculum and walls 1–2 mm in thickness. The sponge 5/2/1277 is a tubular fragment 290 mm in length, 80 mm in diameter with walls 1–2 mm in thickness. The sponge (p3801) is 180 mm in length, 150 mm in diameter with walls about 4 mm in thickness. The sponges 5/2/1286 and 5/2/1271 are poor small fragments.

Spicules: the choanosomal skeleton is composed of diactins, which can be divided into two types. The thickest and the largest are 6–20 mm in length and 0.03–0.04 mm in diameter; they have conically pointed outer ends and shafts stout or with hardly resolvable widening. The other diactins are about 1.5 mm in length and 0.005–0.013 mm in diameter with conically pointed outer ends and shafts with a widening in the middle. Hypodermal pentactins have orthotropal tangential rays 1.9–2.7/0.027–0.030 mm, the ray directed inside the body is about 1.5 times longer than the tangentials. Some of the tangential rays are smooth, the others have numerous long spines and are rough; the outer ends are conically pointed. Hypoatrial pentactins were not found. Dermalia are chiefly pentactins with the unpaired ray directed outside the body or rarely hexactins. A short rudiment is situated in the pentactins in place of the proximal ray. The ray of dermal pentactins directed outside the body is 0.057–0.304 mm in length, the tangential rays are 0.011–0.190 mm in length. The rays of dermal pentactins are 0.006–0.008 mm in diameter, they have rounded outer ends and rough surface, the unpaired ray is often covered with short spines. Atrialia are large hexactins with ray directed outside the body the longest covered with short spines, the other rays are smooth with conically pointed rough outer ends. The ray directed outside the body of atrial hexactins is 0.144–1.672 mm in length, tangential rays are 0.091–0.798 mm in length, the ray directed inside the body is 0.068–0.699 mm in length. These rays are 0.008–0.020 mm in diameter.

Microscleres: the microscleres consist of forms with oxyoidal and discoidal outer ends: the formers are oxyhexactins and rare oxyhemihexasters, the latter are spherical macrodiscasters, macrodiscohexasters and microdiscohexasters. The oxyhexactins are 0.065–0.137 mm in diameter with rough rays and finely pointed outer ends. The oxyhemihexasters with 1–2 secondary rays are similar to them in size and shape. The macrodiscohexasters and macrodiscasters (these spicules are hardly distinguishable from each other since the primary rays in the former type are very short) are 0.090–0.288 mm in diameter with primary rosette 0.007–0.022 mm in diameter. Their secondary rays are smooth at base and spiny at distal parts, the discs are toothed, rarely pileate. Two forms of primary rosettes are known: common hexactinoid and nearly spherical, whose primary rays are short and rounded, the amount of secondary rays is numerous about ten at each primary ray. The microdiscohexasters are 0.019–0.025 mm in diameter with primary rosette 0.005–0.013 mm in diameter.

Distribution

Central–North Atlantic, depth 1940–2550 m.

Asconema megaatrialia nordiense ssp. nov.
Figures 15 & 16

Etymology

The name reflects the subspecies' far-northern location.

Definition

Asconema megaatrialia nordiense is characterized by microhexasters prevailing over the other oxyoid microscleres; macrodiscohexasters and rare macrodiscohexactines have spiny secondary rays with anchorate discs; microdiscohexasters are present.

Material examined

Holotype: IORAS 5/2/3086—RV 'Akademik Mstislav Keldysh-36', Station 3572, 73°12.80–22.10'N 7°16.30–16.90'W, 2920–2942 m.

Paratype: IORAS 5/2/3088—ibid.

Description

Body: the sponges are tubular with wide oscula. The holotype is a complete sponge 320 mm in length, 120 mm in diameter, the walls are 4–8 mm in thickness. The paratype is 320 mm in length, 150 mm in diameter, the walls are 4–8 mm in thickness.

Spicules: the choanosomal skeleton is composed of diactins that can be divided into two types. The thickest and the largest are up to 25 mm in length and 0.05–0.08 mm in diameter; they have conically pointed outer ends and stout shafts. The other diactins are more than 0.2 mm in length

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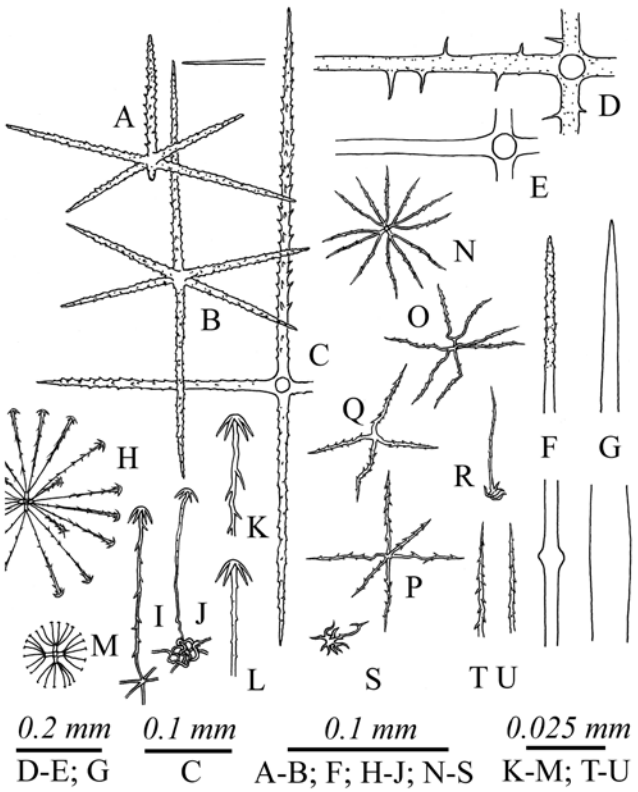

Figure 16. Spicules of *Asconema megaatrialia nordiense*, holotype: (A) dermal pentactin; (B) dermal hexactin; (C) atrial hexactin; (D) spiny hypodermal pentactin; (E) smooth hypodermal pentactin; (F,G) choanosomal disctins; (H) macrodiscohexaster; (I) macrodiscohexactin; (J) abnormal macrodiscohexactin; (K,L) secondary ray tips of macrodiscohexaster or macrodiscohexactin; (M) microdiscohexaster; (N) oxyhexaster; (O) abnormal oxyhemihexaster; (P) oxyhexactin; (Q) oxystauractin; (R,S) abnormal oxyoidal microscleres; (T,U) secondary rays of oxyoidal spicules.

and 0.006–0.009 mm in diameter with conically pointed or rounded rough outer ends and shafts with a widening in the middle. Rarely it is possible to find choanosomal tauactins corresponding to the smaller type of diactins. Hypodermal pentactins have orthotropal tangential rays about 2.7/0.03–0.05 mm, the ray directed outside the body is about 1.5 times longer then the tangentials. Some of the tangential rays are smooth, the others have numerous long spines and rough surface; the outer ends are conically pointed. The hypoatrial pentactins are likely absent. Dermalia are chiefly pentactins with the unpaired ray directed outside the body and with a short rudiment situated in place of the ray directed inside the body or rarely hexactins. The ray of dermal pentactins directed outside the body is 0.059–0.137 mm in length, the tangential rays are 0.061–0.137 mm in length. The rays of dermal pentactins are 0.005–0.008 mm in diameter, they have rounded or conically pointed outer ends and rough surface, the unpaired ray is often covered with short spines. Atrialia are large hexactins with ray directed outside the body the longest covered with short spines, the other rays are smooth with conically pointed rough outer ends. The ray directed outside the body of atrial hexactins is 0.278–0.585 mm in length, tangential rays are 0.030–0.377 mm in length, the ray directed inside the body is 0.091–0.289 mm in length. These rays are 0.009–0.015 mm in diameter.

Microscleres: the microscleres, consisting of forms with oxyoidal (1–3 secondary rays at each primary ray) and discoidal outer ends, are more variable than in other subspecies: the former are oxyhexasters, oxyhemihexasters, rare oxyhexactins, oxystauractins and abnormal oxyoidal forms; the latter are spherical macrodiscohexasters (3–4 secondary rays at each primary ray), discohexactins, their abnormal forms and microdiscohexasters (about 8 and more secondary rays at each primary ray). The oxyhexasters and oxyhemihexasters are 0.061–0.126 mm in diameter with primary rosette 0.007–0.013 mm in diameter. The oxyhexactins correspond in size—0.065–0.126 mm in diameter. They have finely pointed outer ends, their rays are rough or often harpoon-like (the spines are directed towards the base), straight or curved. Abnormal spicules with oxyoid rays are relatively common: oxystauractins or small oxyoidal spicules with strongly curved rays. Sometimes it is possible to find discohexactins or analogous abnormal spicules, which correspond in size to the macrodiscohexasters. Their secondary rays are smooth or rough at the base and spiny in distal parts, the discs are anchorate. The microdiscohexasters are present as rare spicules only in the holotype; they are 0.020–0.031 mm in diameter with primary rosette 0.004–0.007 mm in diameter.

Distribution

Greenland Sea, depth 2920–2942 m.

Asconema megaatrialia seamounti ssp. nov.

Figure 17

Etymology

The name is derived from the name of the French expedition SEAMOUNT which captured it.

Definition

Asconema megaatrialia seamounti is characterized by: microhexactins most prevalent among oxyoid microscleres and derivatives with primary ray reduction up to oxydiactins; macrodiscasters and macrodiscohexasters (0.120–0.250 mm in diameter) with spiny secondary rays and toothed–anchorate discs; atrial hexactins of two sizes, large and giant.

Material examined

Holotype: MNHN HCL 678—SEAMOUNT 2, RV 'Tyro', Station DW 275, 34°3.49–3.31'N 28°18.07–18.18'W, 1665–1590 m.

Description

Body: the sponge is tubular 250 mm in length, 65 mm in diameter, the walls are 1–2 mm in thickness.

Spicules: the choanosomal skeleton is composed of diactins, which may be divided into two types. The thickest and the largest are up to 30 mm in length and 0.03–0.20 mm in diameter; they have conically pointed outer ends and stout shafts. The other diactins are smaller, 0.005–0.020 mm in diameter with conically pointed or rounded rough outer ends and shafts with a widening in the middle. Rarely it is

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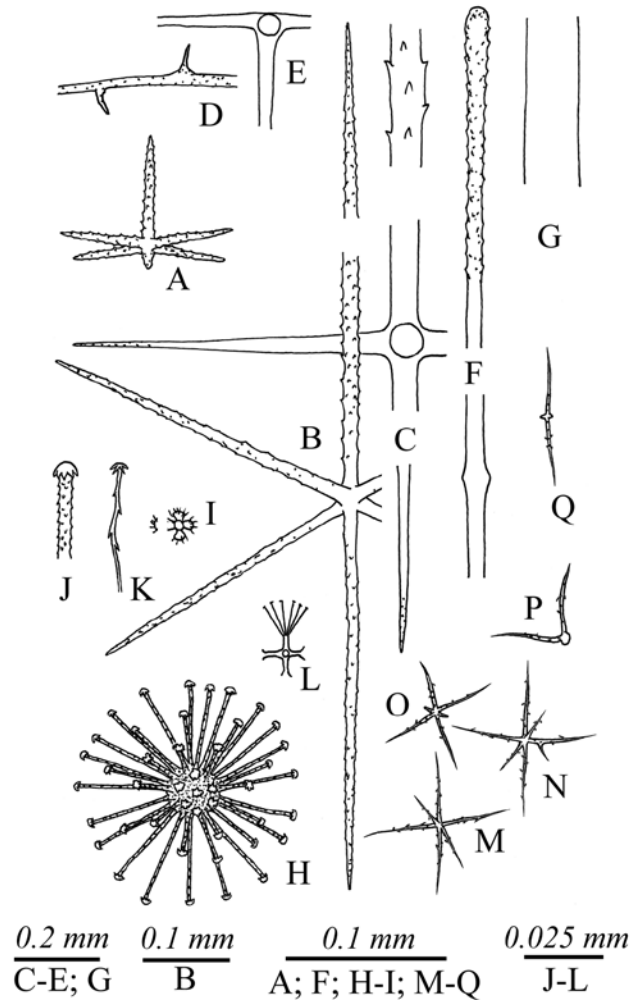

Figure 17. Spicules of *Asconema megaatrialia seamounti*, holotype: (A) dermal pentactin; (B) large atrial hexactin; (C) giant atrial hexactin; (D) tangential ray of spiny hypodermal pentactin; (E) smooth hypodermal pentactin; (F,G) choanosomal diactins; (H) macrodiscaster; (I) centrum of macrodiscohexaster; (J,K) secondary rays' tips of macrodiscasters; (L) microdiscohexaster; (M) oxyhexactin; (N) spiny oxyhexactin or oxyhemihexaster; (O) oxystauractin; (P) oxyparatetractin; (Q) oxydiactin.

possible to find choanosomal tauactins corresponding to the smaller type of diactins. Hypodermal pentactins are very rare due to the great damage to dermal and atrial layers, they have orthotropal tangential rays 1.7–2.2 mm, the ray directed inside the body is about 3.4 mm in length, they are 0.034–0.046 mm in diameter. Some of the tangential rays are smooth, the others have numerous long spines and rough surface; the outer ends are conically pointed. Hypoatrial pentactins are likely absent. Dermalia are pentactins (rarely hexactins and stauractins) with the unpaired ray directed outside the body, a short rudiment is situated in the pentactins instead of the ray directed inside the body. The ray directed outside the body of these spicules is 0.037–0.093 mm, tangential rays are 0.039–0.135 mm in length. The rays of dermal pentactins are 0.005–0.020 mm in diameter, they have rough surface and conically pointed or rounded outer ends. Two size-classes of atrialia are distinguished: large and giant. The ray directed outside the body of large hexactins is covered with numerous short spines, the other rays are smooth or slightly rough with conically pointed rough outer ends. The ray directed outside the body of atrial hexactins is 0.198–0.740 mm in length, tangential rays are about 0.115–0.296 mm in length, the ray directed inside the body is 0.104–0.233 mm in length. These rays are 0.030–0.067 mm in diameter. The giant hexactins have the ray directed outside the body about 3/0.05–0.10 mm covered with short numerous spines, the tangential rays 1.1–1.5 mm in length and the ray directed inside the body 1.7–2.3 mm in length (the tangentials and the rays directed inside the body are smooth with conically pointed rough outer ends).

Microscleres: the microscleres consist of forms with oxyoidal and discoidal (toothed–anchorate) outer ends: the former are oxyhexactins, oxyhemihexasters (with 1–2 secondary rays at each primary ray) and some stauractins and diactins; the latter are macrodiscasters (with numerous secondary rays fixed to a common spherical part composed of fused primary rays) and macrodiscohexasters (with about ten secondary rays at each primary ray). The oxyhexactins and rare oxyhemihexasters are 0.061–0.112 mm in diameter. A unique spicule, an oxyaster with fused central part similar to that of macrodiscaster, is 0.180 mm in diameter, with primary rosette 0.043 mm in diameter. The numerous macrodiscasters have rough secondary rays and toothed discs, their primary rosette is spherical. The macrodiscasters are 0.126–0.252 mm in diameter with primary rosette 0.022–0.050 mm in diameter. The relatively rare macrodiscohexasters are presented by their primary rosettes 0.011–0.018 mm in diameter.

Asconema megaatrialia biacorica ssp. nov.
Figure 18

Etymology

The name refers to the French expedition BIACORES which captured it.

Definition

Asconema megaatrialia biacorica is characterized by oxyhexactins prevailing over other oxyoidal microscleres and small (about 0.05–0.1 mm in diameter) macrodiscohexasters.

Material examined

Holotype: MNHN HCL 679—BIACORES, Station ChG 179, 38°5.50'N 25°46'W, 1665–1590 m.

Description

Body: the sponge is represented by a broken fragment of the lower basal part 50 mm in length, 40 mm in diameter, the walls are 1–2 mm in thickness.

Spicules: the choanosomal skeleton is composed of diactins, which may be divided into two types. The thickest and the largest are up to 20 mm in length and 0.03–0.08 mm in diameter; they have conically pointed outer ends and stout shafts. The other diactins are smaller about 1.1/0.004–0.023 mm in length/diameter with conically pointed or rounded rough outer ends and shafts with a widening in the middle.

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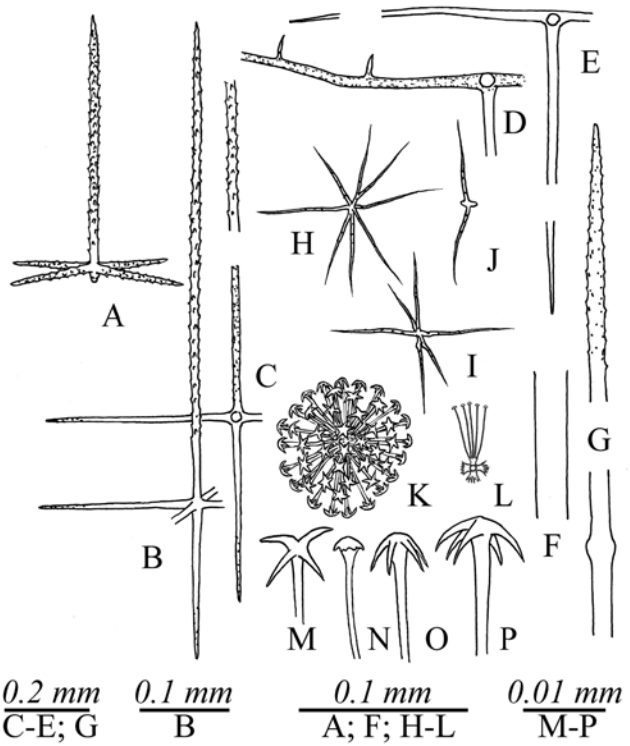

Figure 18. Spicules of *Asconema megaatrialia biacorica*, holotype: (A) dermal pentactin; (B) large atrial hexactin; (C) giant atrial hexactin; (D) spiny hypodermal pentactin; (E) smooth hypodermal pentactin; (F-G) choanosomal diactins; (H) oxyhemihexaster; (I) oxyhexactin; (J) oxydiactin; (K) spherical macrodiscohexaster; (L) stellate macrodiscohexaster; (M-P) secondary rays' tips of discoidal spicules.

Hypodermal pentactins have orthotropal tangential rays about 1.6/0.015–0.030 mm, the ray directed inside the body is about 1.4 mm in length. Some of the tangential rays are smooth, the others have numerous long spines and rough surface; the outer ends are conically pointed. Hypoatrial pentactins were not found. Dermalia are pentactins with the unpaired ray directed outside the body, a short rudiment replaces in the pentactins the ray directed inside the body. The ray of these spicules directed outside the body is 0.167–0.281 mm; tangential rays are 0.076–0.137 mm in length. The rays of dermal pentactins are 0.007–0.013 mm in diameter; the unpaired ray is covered with short spines; tangentials are rough, the outer ends are conically pointed or rounded. Atrialia are hexactins; the ray directed outside the body of these hexactins is covered with short spines, the other rays are smooth or slightly rough with conically pointed rough outer ends. The ray of atrial hexactins directed outside the body is 0.304–2.888 mm in length, tangential rays are about 0.137–0.175 mm in length, the ray directed inside the body is 0.122–0.623 mm in length. The rays are 0.009–0.022 mm in diameter.

Microscleres: the microscleres consist of oxyhexactins, rare oxyhemihexasters and diactins and macrodiscohexasters spherical (nearly discasters) and stellate (with 4– usually more than 10 secondary rays at each primary ray). The oxyhexactins and oxyhemihexasters (with 1–2 secondary rays at each primary ray) are 0.054–0.090 mm in diameter. The macrodiscohexasters are 0.050–0.108 mm in diameter with primary rosette 0.005–0.014 mm in diameter. They have anchorate, rarely toothed and pileate discs.

Remarks

Similar to the subspecies of *A. fristedti*, *A. megaatrialia* is here divided into subspecies that are distinguished by their microscleres peculiarities and their combinations. Anchorate discs in 'macro-discoidal' spicules were observerd in '*biacorica*', '*nordiense*' and sometimes in '*seamounti*'. The size of 'macro-discoidal' spicules smaller then 0.1 mm in diameter are known in '*biacorica*' only. Oxyoidal microscleres are oxyhexactins and oxyhemihexasters with few primary rays branching into secondary ones. Oxyhexactins' derivatives with a reduced number of primary rays up to diactin were found in three subspecies: '*seamounti*', '*nordiense*' and '*biacorica*'. The rays of oxyoidal spicules with notable spines are known in '*seamounti*' and '*nordiense*'. *Asconema megaatrialia nordiense* is the most outstanding subspecies with all its types of microscleres and with specific discohexactins (absent in other subspecies). Nevertheless the macroscleres correspond to those of other subspecies, hence they are united into a common species. The entire absence of the hypoatrial pentactins in *A. megaatrialia* is not certain; they were rarely observed in some specimens where they should have a 'hypodermal origin'. The size of atrial hexactins (at least that of the large size) gives possibilities to compare them with 'hypoatrial' hexactins of other Rosselidae. *Asconema megaatrialia biacorica* and *A. megaatrialia seamounti* are represented by 'poor' sponges and their description should be clarified when specimens in better condition will be available.

Asconema sp.

Several examined specimens consist of poor fragments and their species identification is impossible:

MO 04 0307—RV 'Princesse Alice', Station 553, 37°42.40'N 25°05.15'W, 1385 m. MNHN (p1690)—BIACORES, Station ChG 191, 37°56'N 24°49.50'W, 1750–1650 m. MNHN (p1708; p1709)—BIACORES, Station Bl 179, 38°05.50'N 25°46'W, 1665–1590 m. MNHN HCL 659—BIACORES, Station ChG 176, 38°00.50'N 26°21.50'W, 2720–2440 m. MNHN HCL 660—BIACORES, Station DR 84, 38°58.50'N 28°03.50'W, 220–190 m. MNHN HCL 669—SEAMOUNT 2, Station DW 186, Hyeres, 31°26.14–26.34'N 28°51.77–51.93'W, 1520 m. IORAS 5/2/1273—RV 'Akademik Mstislav Keldysh-4', Station 446, 58°23.9–24.1'N 31°49.2–47.3'W, 1750–1650 m. IORAS 5/2/901—RV 'Akademik Mstislav Keldysh-4', Station 465, 58°21.3–20.8'N 31°38.5–37.0'W, 1620–1650 m. IORAS 5/2/ 1296—RV 'Akademik Mstislav Keldysh-4', Station 499, 58°03.3–04.0'N 30°26.1–17.2'W, 2440–2429 m.

Remarks on the genus Asconema

The value of features in the genus *Asconema* differs from that in the other genera of Rossellidae. The form of hypodermal, hypoatrial, dermal and atrial spicules were used for specific recognition; the microscleres, which

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sometimes vary greatly, provide the subspecific level recognition; they demonstrate mosaic variation among two species of the genus subdivided into subspecies. The large discoidal microscleres vary from hexasterous to asterous forms, which are often hardly differentiated from each other. These spicules have discs, which also vary between clavate, pilaete-toothed and anchorate forms.

The distinguished subspecies are speculative. It is not yet possible to say anything on their genetic or spatial isolation. The criteria used here for the subspecies differentiation are sufficient to distinguish species for some Rossellidae off Japan according to criteria used by Ijima (1904). In the present case of *Asconema* it is obvious that the species which are subdivided into subspecies have reasons to be distinguished as well. The geographical distribution of the subspecies seems to be contiguous or even sometimes overlapping; however, they were never collected at the same station. The problem may be solved by investigation of other new materials and by molecular methods.

An interpretation of atrial–hypoatrial large hexactins in *A. topsenti* and *A. megaatrialia* is made on the similarity of shape and dimension of the tangential rays with that of hypodermal pentactins in the first species and with atrial hexactins and analogous large spicules in the second species. It is not quite correct that large atrialia and hypoatrial hexactins are not characteristic for Rossellidae. The large sizes of atrial spicules (especially as observed in *A. megaatrialia seamounti*) were known in the Euplectellidae while in the Rossellidae only *A. topsenti* and *A. megaatrialia* being surely representatives of this family and genus *Asconema* have such unusual features.

The close affinity of *Asconema* with *Trichasterina* suggested by Koltun (1967) becomes more likely after finding oxyoidal microscleres with harpoon-like rays in *A. megaatrialia nordiense*. These spicules were considered characteristic for the single known species of *Trichasterina—T. borealis* (Schulze, 1900) in spite of their rarity in some specimens. The trichasters, which provided the generic name for *Trichasterina*, are similar to some regular oxyhexasters of *A. foliata*. The discovery of dermal stauractins together with pentactins in some subspecies of *A. fristedti* makes the difference between these two genera nearly invisible except for the diagnostic feature—direction of the unpaired ray in dermal pentactins (which should be always examined now in these genera). In *Asconema* the unpaired ray of dermal pentactins is distally directed; in *Trichasterina* this ray is directed inside the body (Schulze, 1900; Koltun, 1967). The latter fact seems to be rather a common situation than a permanent rule. Thus the genus *Asconema* can be considered as an ancestral for *Trichasterina* which diverged from the former by reduction of some rays (particularly the distal one) in dermal spicules.

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