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Species of genus *Schizotheca* Hincks (Bryozoa, Cheilostomata) described in the Atlantic-Mediterranean region, with notes on some species of *Parasmittina* Osburn

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Species of genus *Schizotheca* Hincks (Bryozoa, Cheilostomata) described in the Atlantic-Mediterranean region, with notes on some species of *Parasmittina* Osburn

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Abstract

Material held in collections, originally ascribed to the genus *Schizotheca* and originating from the NE Atlantic and Mediterranean, is revised. Two new species are described: *Schizotheca carmenae* sp. nov. from Azores and Portugal, originally cited as *Strophliella tubigera* [sic], and *Schizotheca buski* sp. nov. from Cape Verde and Brazil, originally cited as *Schizotheca fissa*. *Schizotheca talismani*, also from Cape Verde, is redescribed from original material and transferred to the genus *Parasmittina*. The Atlantic species *Schizotheca tuberigera* is redescribed and a new synonymy is established. *Schizotheca aviculifera*, from Morocco, is also redescribed and a lectotype designated. A lectotype is also chosen for *Schizotheca fissa*, type species of the genus. *Schizotheca lepida*, from north France, is considered to be an unrecognizable species.

Keywords: Biogeography, Bryozoa, Cheilostomata, Mediterranean, NE Atlantic, new species, Parasmittina, Schizotheca

Introduction

In comparison with other genera of Bryozoa, the genus *Schizotheca* Hincks, 1877 has scarcely been cited in the Atlantic-Mediterranean region. Furthermore, only a few species of this genus have been described throughout the world (approximately seven valid species at present). The scarcity of published information and knowledge regarding some of the species has given rise, on occasion, to a certain degree of confusion; for example, *Schizotheca tuberigera* (Jullien, in Jullien and Calvet 1903) has been described three times by different authors, each of whom placed the species in different genera.

The genus *Schizotheca* is characterized by zooids with a few marginal perforations, an orifice with fine distal and lateral denticulations, the presence of vicarious avicularia and by an imperforate ovicell with a frontal fissure. The form of growth of the colony (all are

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encrusting except *Schizotheca serratimargo* (Hincks, 1886)), the shape of the orifice, development of the peristome, the number of marginal perforations, as well as the shape, size, location, and number of avicularia as well as the difference in size between the vicarious and the adventitious avicularia are particularly important for differentiating the species in this genus.

Schizotheca fissa (Busk, 1856), type species of the genus, is the only species that has been relatively frequently cited, although its distribution must be revised. *Schizotheca serratimargo* is also well known in the study region, although it appears to have a fundamentally Mediterranean distribution. *Schizotheca divisa* (Norman, 1864) is a rare species, which appears to be distributed only in the south and west of the British Isles. The Atlantic species *S. tuberigera* is relatively frequent, although it has often been cited under other names. *Schizotheca aviculifera* Canu and Bassler, 1925, described from the Atlantic coast of Morocco, does not appear to have been cited since its original description. In the present study, we describe a new species of *Schizotheca* originating from the Azores and the south of Portugal, previously cited as *Strophoella tubigera* ? [sic], as well as a new species originating from Cape Verde and Brazil, previously cited as *S. fissa*.

Another two species originally ascribed to the genus *Schizotheca* have been described in the NE Atlantic. We believe that *Schizotheca talismani*, described by Calvet (1906) from Cape Verde, should be placed in the genus *Parasmittina*. Furthermore, *Schizotheca lepida* was described by Jullien (1881) from Étretat (N France), a location where the author indicated the presence of *S. fissa* and *S. divisa*. The description of *S. lepida* is very vague and does not include figures; moreover, the only specimen collected has since been lost. Although the brief description allows us to assume that the species does not belong to the genus *Schizotheca*, the lack of further information and of the original material prevents correct characterization of the species, and we consider that *Schizotheca lepida* Jullien, 1881 should be considered as unrecognizable.

Material and methods

To carry out the present study, we re-examined more than 100 samples deposited in various institutions: Muséum National d'Histoire Naturelle (Paris) (Milieux et peuplements Aquatiques (MNHN) and Laboratoire de Paléontologie (MNHN-LP); Natural History Museum, London (NHM); The Manchester Museum (MM); National Museum of Ireland (NMI); Musée Océanographique de Monaco (MOM); and personal collections of the authors and of Dr J.-G. Harmelin. All of the samples originated from the northeast of the Atlantic, between Ireland and the Gulf of Guinea, and the Mediterranean. Other reference material, originating from the NE Pacific and the Caribbean has been studied from photographs of material deposited in the Santa Barbara Museum of Natural History (California) and in the Smithsonian Institution (Washington, DC).

The samples were examined and measured with a Wild M8 binocular microscope.

Measurements are expressed in mm and identified by the following abbreviations: AAL, adventitious avicularium length; AAW, adventitious avicularium width; AZL, autozooid length; AZW, autozooid width; OL, orifice length; OW, orifice width; OVL, ovicell length; OVW, ovicell width; VAL, vicarious avicularium length; VAW, vicarious avicularium width.

The photographs were taken with a LEO 435 VP scanning electron microscope, on most occasions from uncoated material.

Systematics

Parasmittina Osburn, 1952

Parasmittina talismani (Calvet, 1906) comb. nov.

(Figure 1)

Schizotheca talismani Calvet 1906, p 429, Plate 28, Figure 5.

Material examined

Holotype (by original designation): MNHN-299 and MNHN-1038: *Talisman* 1883. st. 105. 110–180 m. Ilot Branco, Cape Verde. Calvet Coll. Both samples correspond to the single colony originally described by Calvet (1906).

Other material. MNHN-1037: *Talisman* 1883. 20–25 m. Ilot Branco, Cape Verde. Calvet Coll. MOM-42 0822: st. 1203, 1901. 91 m. Calvet Coll.

Description

Colony encrusting, unilaminar. Autozooids quadrangular, arranged in linear series and separated by marked sutures; frontal surface flat or slightly convex, smooth or slightly granular, centrally imperforate, with numerous marginal areolar pores, very conspicuous.

Primary orifice orbicular, deeply immersed by secondary calcification and difficult to observe, situated very distally; lyrula very wide (0.08–0.09 mm) with a straight edge and sharp-pointed lateral extremes facing two small condyles. Peristome well developed, with two thick proximal projections that define a deep rounded median groove that extends along the internal wall of the peristome, and to which two smaller lateral projections are added. Four to five thick, hollow, very long spines (usually broken in the material examined), their bases surrounded by the secondary calcification of the distal zooid but without being totally masked; two spines on ovicellate zooids, but the bases of the other two remain within the ovicell.

Autozooids with two small distal avicularia (sometimes one or both may be absent), long, with a semicircular distal edge; foramen occupies half of the rostrum. Avicularia located on both sides of the orifice, supported by the peristome, the distal extreme directed towards the orifice and facing slightly upwards. One or two marginal adventitious avicularia may be present, originating from the areolar pores, placed more proximally and directed towards the centre of the autozooid.

Ovicell formed rapidly at the edges of the colony, immersed in the distal zooid and surrounded by secondary calcification, so that it scarcely projects from the surface of the colony; subcircular frontal area regularly perforated by protuberant circular pores. Proximal edge of the ovicell straight, projecting internally in the zoecial orifice.

Ancestrula not observed.

Measurements

MNHN-299 (holotype). AZL: 0.34 ± 0.04 (24); AZW: 0.29 ± 0.045 (24); OL: 0.09 ± 0.005 (10); OW: 0.11 ± 0.003 (10); OVL: 0.14 ± 0.02 (11); OVW: 0.15 ± 0.015 (11); AAL: 0.06 ± 0.01 (14); AAW: 0.03 (14).

Figure 1. *Parasmittina talismani*. (A) View of the colony (MNHN-299, holotype); (B) view in perspective, showing the development of the peristome and adventitious avicularia (MNHN-299, holotype); (C) an ovicellate zooid (MNHN-1037); (D) primary orifice and adventitious avicularia (MNHN-1037); (E) primary orifice and adventitious avicularium (MNHN-299, holotype); (F) two broken zooids showing the lyrula, the adventitious avicularia and the remaining basis of spines under the ovicells (MNHN-1037); (G) growing edge of the colony (MNHN-299, holotype).

Remarks

In a study of the specimens of Bryozoa collected by the *Travailleur* and *Talisman* surveys, Calvet (1906) described the species *Schizotheca talismani* from Cape Verde; however, the author himself (Calvet 1906, p 430) expressed his doubts about the inclusion of the species in the genus *Schizotheca* because of the structure of the ovicell, and also indicated that he was unable to study the form of the orifice in detail as he only had one specimen available.

We have been able to study four samples labelled as *Schizotheca talismani* deposited in the Muséum National d'Histoire Naturelle and in the Musée Océanographique de Monaco; of these, samples MNHN-299 and MNHN-1038 correspond to the specimen originally cited by Calvet (1906), therefore both should be considered as the holotype of the species. The other two samples, also belonging to the Calvet Collection and originating from Cape Verde, also correspond perfectly to the original description of the species, although they do not appear to have been cited in any publication. Examination of this material has allowed us to confirm the presence of a large lyrula that occupies almost all of the proximal edge of the orifice, and which has a straight distal edge, terminating in two laterally orientated, pointed corners, opposite two small condyles, a characteristic not noted by Calvet (1906). This detail, along with the structure of the ovicell, well-described and represented in the original study (Calvet 1906), the presence of conspicuous marginal areolae, development of peristome and spines, existence of adventitious avicularia, as well as basal pore-chambers, allows us to place this species in the genus *Parasmittina*.

More than 70 species ascribed to the genus *Parasmittina* have been described from throughout the world (see e.g. Osburn 1952; Soule and Soule 1973, 2002; Hayward 1988; Ryland and Hayward 1992; Hayward and Parker 1994). The regions with the greatest diversity of species of the genus are the SW Pacific (more than 20 species), E Pacific (15 species), Hawaii (14 species), and SE Africa (14 species). However, it is not clear if all these species can be considered valid or if they represent simple morphological variations of the same basic pattern. Moreover, there have been frequent misunderstandings, mistaken citations and unjustified synonyms, which makes necessary detailed studies to enable redefinition of the species; such studies have recently been initiated by some authors, although they will probably still be insufficient.

The original material of *P. talismani* shows similarities to *Parasmittina fraseri* Osburn, 1952, a species ranging in the Pacific between California and the Galapagos Islands (Osburn 1952), and which has also been reported as a fossil from the Pleistocene in Panama and Costa Rica, and from the Pliocene on the Caribbean coast of Panama (Cheetham et al. 1999). Both species have a similar orifice, deeply immersed and difficult to observe, with a wide straight lyrula with pointed ends, a large number of spines, reduced to two in ovicellate zooids, peristome with two points in the proximal border, enclosing a rounded secondary sinus; small adventitious avicularia frequently situated at the sides of the zoecial orifice.

However, the original description of Osburn (1952) is somewhat broad, and the figure is not very representative. *Parasmittina fraseri* has also been cited by Soule and Soule (2002), who have used one of the paratypes of the species (#4) for their description (Dr H. W. Chaney, personal communication, March 2006). However, examination of new photographs of the specimen (Figure 2B) sent to us by Dr Chaney (SBMNH) revealed ogival avicularia, always located on both sides of the orifice, that are larger than originally reported by Osburn (1952). The paratype is very similar to the material collected from the Dominican Republic and Panama, reported as *Parasmittina* n. sp. 3 on the website <http://eusmilia-geology.uiowa.edu/database/bryozoa/systemat/parasm.htm>. On the same website,

Figure 2. (A) *Parasmittina fraseri*, holotype; (B) *Parasmittina* sp. (paratype #4 of *P. fraseri*); (C) *P. fraseri*; (D) *Parasmittina regularis* (labelled as *P. fraseri*). Photographs: (A, B, D) H. Chaney; (C) J. A. Sanner. Scale bars: 0.20 mm (A); 1.00 mm (B); 0.10 mm (C); 0.50 mm (D).

there is also a reference to *P. fraseri*, a species of which 11 specimens have been collected in the Gulf of Panama. Miss J. A. Sanner (personal communication, March 2006) sent us more photographs (Figure 2C) and unpublished data on this material (unpublished material belonging to Dr A. Cheetham and Dr J. Jackson), that appears to fit well to the original description of the species.

Finally, there is another specimen in the SBMNH collection, labelled as *P. fraseri* by J. Soule, with the same location and date as paratype #4 of the species, which, however, corresponds to *Parasmittina regularis* Soule and Soule, 2002 (Figure 2D). Since *P. regularis* is currently recorded only from its type locality (north of San Francisco) there is a major discrepancy in the label data (from the Isle Raza).

In summary, it appears that the identity of *P. fraseri* is not sufficiently established and that other undescribed species may be involved. All of the material reported under this name, as well as other similar material, should be examined to establish definitively the characteristics of the species, possible margins of morphological variation, and its

distribution, before being able to establish its relation to *P. talismani*; however, this type of study is outside the aims of the present study.

Nevertheless, the original material of *P. talismani* appears to show certain important differences from the species of Osburn (1952): in the Cape Verde material, the peristome is proximally very well-developed, with two long proximal projections that outline a deep rounded median groove that extends along the inner wall of the peristome, and to which two smaller lateral projections are frequently added; distally, the peristome does not appear to be developed on the ovicell, as in *P. fraseri*, but terminates at the level of the two oral spines. Finally, the avicularia are small, long and distally semicircular, whereas, according to the original description and the holotype of the species (Figure 2A), the avicularia in *P. fraseri* are rounded or elliptical.

***Schizotheca* Hincks, 1877**
***Schizotheca fissa* (Busk, 1856)**
 (Figure 3)

Lepralia fissa Busk 1856, p 308.

Schizotheca fissa (Busk): Zabala 1986, p 534, Figure 189; Zabala and Maluquer 1988, p 150, Figure 392; Reverter-Gil and Fernández-Pulpeiro 1998, p 48, Plate 2, Figure C; Hayward and Ryland 1999, p 382, Figures 180D, 181.

Not *Schizotheca fissa* (Busk): Calvet 1906, p 429 (part: D. 10 *Talisman*, 1883).

Not *Schizotheca fissa* (Busk): Canu and Bassler 1925, p 47 (part: st. no. 29).

Not *Schizotheca fissa* (Busk): d'Hondt 1978, p 449 (part or whole).

Not *Schizotheca fissa* (Busk): Cook 1968, p 204.

Material examined

Lectotype (designated here): NHM-1899.7.1.2470: Busk Coll. Guernsey.

Other material. MNHN-2340: *Travailleur* 1881, D. 24 (2^{ème} sér.). 55–77 m. Bonifacio. MNHN-2693: Hastings. MNHN-2697: Etretat. MNHN-6324: (with more species). *Vanneau*, st. 44, 145 m. Atlantic Morocco. MNHN-7927: *Meteor*, 29. Manche. MNHN-7935: (with more species). *Meteor*, 29. Manche. MNHN-8518: *Jean-Charcot*, st. 27. 210 m. MNHN-17134: *Président Théodore Teissier*, no locality. MNHN-17135: *Président Théodore Teissier*, no locality. MNHN-17136: *Président Théodore Teissier*, no locality. NHM-1881.4.29.16: Naples. 35 m. NHM-1897.5.1.800: Hastings. NHM-1899.5.1.1164: (with more species). Guernsey. NHM-1899.5.1.1165: Adriatic. NHM-1899.5.1.1167: Guernsey. NHM-1899.5.1.1168: no locality. NHM-1911.10.1.824: Isle of Skye. NHM-1911.10.1.825: off Antrim Coast. NHM-1911.10.1.826: (with more species). Guernsey. NHM-1911.10.1.827: (with more species). Bertraghboy Bay, Ireland. NHM-1934.10.20.122: Hastings. NHM-1936.12.30.383: Liverpool Bay. NHM-1963.2.12.133: Salterton. NHM-1963.3.30.174: (with more species), no locality. NHM-1963.3.30.175: Plymouth, 25 fathoms. NHM-1975.1.12.22: Chios, st. 25. NHM-1975.1.12.70: Chios, st. 4. NHM-1975.7.18.30: St. Raphael-Boulouris. NHM-unreg: Weymouth, Britain. NHM-unreg: (with more species). Weymouth. MM-5364: (with more species). Naples. MM-5365: Naples. MM-5366: Capri. MM-5367: Guernsey. MM-5368: The Sound, Plymouth. MM-5369: The Sound, Plymouth. MM-5370: The Sound, Plymouth. MM-10867: Naples. NMI-1913.307.16: Portrush. NMI-2003.70.9: (with more species). Roundstone. NMI-1911.404.66: off Bonett Clew Bay, Coast of Mayo.

Figure 3. *Schizotheca fissa*. Ría de Ferrol, NW Iberian Peninsula. (A) General view of the colony; (B, C) two primary orifices; (D) ancestrula and early astogenesis; (E) detail of the ancestrula.

Remarks

Schizotheca fissa is characterized by: convex zooids arranged in clear alternating rows, with a few marginal perforations; suborbicular orifice with a concave proximal edge and two small condyles that delimit an apparent U-shaped sinus; a well-developed tubular peristome, with a median proximal U-shaped notch; presence of six large oral spines, reduced to four

in ovicellate zooids; and by large vicarious avicularia, whereas the adventitious avicularia are sporadic and associated distally with the ovicells, which have a narrow proximal fissure. The ancestrula of this species (Figure 3D, E) has been formally described by Reverter-Gil and Fernández-Pulpeiro (1998), although there was a previous, unpublished description (López de la Cuadra 1991).

Although this is the type species of the genus, to date no material corresponding to *S. fissa* has been formally designated as type material; we therefore designate here the sample NHM-1899.7.1.2470, the only extant colony belonging to the Busk Collection, and cited by the author in the original description, as the lectotype of *S. fissa*.

As it is the type species of the genus, and theoretically the most common, there has been a certain tendency in previous publications to cite other species of the genus under the name *S. fissa*; thus for example, among the material reviewed in the present study, we observed that the citations made by Calvet (1906: material from st. 10), Canu and Bassler (1925: material from st. 29), d'Hondt (1978: part or whole) and Cook (1968) do not correspond to *S. fissa* but to other species of the genus, as discussed further below. Previous reports of *S. fissa* must be considered carefully. Revision of museum collection material and of the existing literature allows us to state that this species ranges in the Atlantic from the British Isles to Morocco. We consider here that the citation of the species by Cook (1968) from Cape Verde, the southernmost record considered to date, correspond to an undescribed species of the genus *Schizotheca* (see further below); there are also two colonies from this area in the Jullien Collection deposited in the MNHN, Paris (MNHN-2694: Talisman 1883, D. 104), which do not appear to have been cited in any publications, perhaps because they are labelled as *Schizotheca fissa* ?; this material indeed corresponds to the same undescribed species. Waters (1918) also cited *S. fissa* from Cape Verde, but we have not had a chance to examine the original material, and the brief description (Waters 1918) may correspond to several species of *Schizotheca*. Finally, *S. fissa* is also well known in the Mediterranean, extending at least as far east as Chios.

Schizotheca carmenae sp. nov.

(Figure 4A–E)

Strophliella tubigera Jullien, 1903?: d'Hondt 1975, p 576.

Material examined

Holotype: MNHN-7426: 38°44'N, 28°32.5'W. *Jean-Charcot*, *Biaçores*, st. 61. 77 m. 14 October 1971.

Other material. MNHN-7519 (with more species): 37°41'N, 25°33.5'W. *Jean-Charcot*, *Biaçores*, st. 145. 135–148 m. 30 October 1971. MNHN-7543 (with more species): 37°51'N, 25°41'W. *Jean-Charcot*, *Biaçores*, st. 188. 45 m. 4 November 1971.

Dr Harmelin's personal collection: “*Biaçores* 1971, st. 167, 130 m, 1 November 1971, 37°46'N, 25°48.5'W”, and “S Portugal, Sagres, Grotte Donzelle. PAL 13, Oct. 86”.

Etymology

We dedicate this species to our dear colleague and friend Dña. M^a Carmen Barcia Leal, who died on 14 May 2004. We will forever remember her comradeship, her unfailing good humour, her capacity to work, and her brave fight against illness.

Figure 4. (A–E) *Schizotheca carmenae* sp. nov.: (A) growing edge of the colony, showing adventitious avicularia (MNHN-7519); (B) growing edge of the colony, showing adventitious and vicarious avicularia (MNHN-7426, holotype); (C) primary orifice (MNHN-7426, holotype); (D) an ovicellate zooid with adventitious avicularia (MNHN-7426, holotype); (E) group of zooids at the growing edge, showing adventitious and vicarious avicularia (Sagres, Portugal, photograph: J.-G. Harmelin). (F, G) *Schizotheca buski* sp. nov.: (F) general view of the colony, showing two rows made of vicarious avicularia and kenozooids (NHM-1899.7.1.5199, holotype); (G) growing edge of the colony, showing vicarious avicularia (below) and oval adventitious avicularia (left above) (NHM-1963.4.18.23).

Description

Colony unilaminar to multilaminar, forming a broad spreading sheet. Autozooids oval to rhomboidal, in alternating series separated by distinct grooves; frontal surface slightly convex, smooth or slightly granular, imperforate except for up to four large, marginal pores (often two).

Primary orifice longer than wide; anter semielliptical, with denticulations small and scarce, that appear to originate from towards the middle of the orifice; poster concave, without sinus, with two small round condyles that delimit an apparent wide, shallow sinus. Peristome well developed, somewhat laminar, with an inconspicuous pseudosinus at the proximal border. Up to six oral spines on the edge of the colony, generally reduced to two to four in calcified zooids, and to two in ovicellate ones.

An adventitious avicularium proximo-laterally to the orifice (occasionally absent; on rare occasions two); mandible wide, triangular, with distal end curved in the form of a beak and orientated laterally; foramen extensive, occupying half to two-thirds of the rostrum; cross bar fine and without columella.

Vicarious avicularia of similar size to the autozooids, situated particularly on the edges of the colony and orientated towards the periphery; structure similar to that of the adventitious avicularia. The vicarious avicularium is less than twice the size of the adventitious avicularium.

Kenozooids irregularly shaped, of similar size or smaller than the autozooids; may bear an adventitious avicularium similar to that in the autozooids.

Ovicell partially immersed by secondary calcification, smooth and imperforate, with a large more or less triangular proximal fissure.

Ancestrula not observed.

Measurements

MNHN-7426 (holotype). AZL: 0.47 ± 0.03 (20); AZW: 0.35 ± 0.04 (20); OL: 0.10 ± 0.005 (20); OW: 0.09 ± 0.008 (20); OVL: 0.19 ± 0.01 (3); OVW: 0.24 ± 0.02 (3); VAL: 0.26 ± 0.03 (12); VAW: 0.13 ± 0.02 (12); AAL: 0.15 ± 0.02 (16); AAW: 0.08 ± 0.01 (16); VAL/AAL=1.73.

Remarks

Schizotheca carmenae sp. nov. is clearly differentiated from other species of the genus by: the form of the orifice, which has a slightly semielliptical anter with few denticulations, poster concave, without sinus and cardella, with two small round condyles that delimit an apparent wide, shallow sinus. The structure of the adventitious and vicarious avicularia is similar, with a wide triangular rostrum with a very extensive, lanceolate foramen and cross bar lacking denticle; the vicarious avicularium is less than twice the size of the adventitious avicularium.

The material ascribed here to *S. carmenae* sp. nov., originating from the Azores and deposited in the Muséum National d'Histoire Naturelle, had previously been cited as *Strophliella tubigera* Jullien, 1903? [sic] by d'Hondt (1975). Apart from the three original samples we have examined two colonies, given to us by Dr J.-G. Harmelin, originating from the Azores Isles and from SW Portugal (Sagres).

Schizotheca tuberigera (see further below) and *S. carmenae* are clearly distinguished by several characteristics: amongst others, in *S. tuberigera* the orifice is orbicular and has two

proximal teeth; the avicularia are narrow, with a thick denticle and foramen closed over by calcification; the ovicells are prominent and have a large fissure that narrows at the apex; whereas in *S. carmenae* the orifice is semielliptical, the avicularia are wider, without denticle and with a very extensive foramen, whereas the ovicell is immersed by calcification and has a wider, shorter fissure.

Schizotheca carmenae likewise shows certain similarities to *S. fissa*, although they are easily differentiated. The primary orifice in *S. fissa* is suborbicular, wider than long; the peristome is tubular, well developed, with a median, U-shaped notch; the zooids have six oral spines, reduced to four in ovicellate zooids; the adventitious avicularia are sporadic and associated distally with the ovicells. In *S. carmenae*, the orifice has a semielliptical anter and is longer than wide; the peristome is less well developed and has a less marked pseudosinus at the proximal edge, the zooids have four to six oral spines, reduced to two in ovicellate zooids. The zooids usually have an adventitious avicularium situated proximo-laterally to the orifice. Finally, the values of all parameters measured are greater in *S. carmenae*.

***Schizotheca buski* sp. nov.**

(Figures 4F, G, 5A–C)

Schizotheca fissa (Busk): Cook 1968, p 204.

Material examined

Holotype: NHM-1899.7.1.5199: Cape Verde Islands. HMS *Herald*. Busk Coll. Paratype: NHM-1899.7.1.5063: John Adams Bank. HMS *Herald*. Busk Coll.

Other material. NHM-1899.7.1.4467: Cape Verde. HMS *Herald*. Busk Coll. NHM-1899.7.1.4468: John Adams Bank. Busk. Coll. NHM-1899.7.1.5226: Cape Verde. HMS *Herald*. Busk Coll. NHM-1963.4.18.22: Cape Verde. HMS *Herald*. Busk Coll. NHM-1963.4.18.23: Cape Verde. HMS *Herald*. Busk Coll. MNHN-2694: Talisman 1883, D. 104. Cape Verde.

Etymology

We dedicate this species to the British bryozoologist G. Busk, who first studied the specimens described here as a new species.

Description

Colony encrusting, unilaminar. Autozooids oval, arranged in linear series and separated by fine sutures, indistinct in calcified zooids; frontal surface flat, covered in thick granulation and imperforate, except for two to five conspicuous circular marginal pores.

Primary orifice almost circular; anter with denticulations concealed in frontal view by a rim of calcification; poster with a scarcely perceptible wide sinus and two long inconspicuous condyles. Peristome circular, thick, more evident proximally and covered by the granulation of the frontal wall of the zooid; the appearance is of two thick proximal tongues separated by a median U-shaped notch. Four to five oral spines, reduced to two in ovicellate or calcified zooids.

Autozooids occasionally with a small lateral avicularium, oval or lanceolate, located at the level of the peristome or slightly below, orientated laterally; foramen very extensive, occupying two-thirds to three-quarters of the rostrum; cross bar fine and without denticle.

Figure 5. (A–C) *Schizotheca buski* sp. nov.: (A) group of ovicellate zooids with lanceolate adventitious avicularia (NHM-1899.7.1.5063, paratype); (B) a vicarious avicularium and a kenozooid with a porous plate (left) (NHM-1899.7.1.5199, holotype); (C) primary orifice (NHM-1899.7.1.5199, holotype). (D–F) *Schizotheca tuberigera*: (D) group of autozooids, some ovicellate, with adventitious avicularia and a vicarious avicularium (MNHN-14121); (E) group of kenozooids with adventitious avicularia (MNHN-13831); (F) primary orifice (MNHN-14061).

Vicarious avicularia similar in size to the autozooids; orientation variable, but generally facing towards the edge of the colony; mandible triangular, distally hooked; foramen approximately half of the rostrum; cross bar lacks denticle. Rostrum of vicarious avicularium is three times the size of the adventitious avicularium.

Vicarious avicularia usually situated in rows consisting exclusively of avicularia and by irregular kenozooids of similar size or smaller than autozooids, with frontal wall of similar appearance to the autozooids; kenozooids may occasionally bear an adventitious avicularium similar to those existing in autozooids. In one specimen (1899.7.1.5199; Figure 5B) the kenozooid was formed by recalcification of a vicarious avicularium, with the rostrum substituted by a porous plate.

Ovicell hyperstomial, prominent, imperforate, covered by the calcification of the distal zooids, which imparts to it an uneven appearance. Fissure wide, vaguely triangular, situated vertically.

Ancestrula not observed.

Measurements

NHM-1899.7.1.5199 (holotype). AZL: 0.41 ± 0.06 (25); AZW: 0.28 ± 0.04 (25); OL: 0.09 ± 0.006 (10); OW: 0.10 ± 0.01 (10); OVL: 0.14 ± 0.01 (20); OVW: 0.20 ± 0.01 (20); VAL: 0.33 ± 0.04 (11); VAW: 0.16 ± 0.02 (11); AAL: 0.11 ± 0.02 (19); AAW: 0.06 ± 0.01 (19); VAL/AAL=3.08.

Remarks

Schizotheca buski sp. nov. is characterized by: encrusting colonies consisting of zooids with a circular orifice with a scarcely perceptible wide sinus and two small, long, inconspicuous condyles; the peristome has the appearance of two thick tongues separated by a median U-shaped notch; adventitious oral avicularium with oval rostrum (the only one of the species dealt with here that is not triangular) and on occasions lanceolate, and by vicarious avicularia with a triangular mandible distally hooked, situated in rows and mixed with kenozooids, separating sections of the colony. The vicarious avicularium is three times the size of the adventitious avicularium.

The material ascribed here to *Schizotheca buski* sp. nov. was originally studied by Busk, and labelled by this author with a MS name. This same material was later studied and expressly cited by Cook (1968), the author who re-labelled it as *S. fissa*. There are also two colonies from Cape Verde in the Jullien collection deposited in the MNHN, Paris (MNHN-2694: Talisman 1883, D. 104), which do not appear to have been cited in any publications; they also correspond to *S. buski* sp. nov.

Schizotheca buski sp. nov. shows some similarities to *S. fissa*, but the species are distinguished by the growth of the colonies (small, subcircular, with zooids arranged in clear alternating rows in *S. fissa*; more extensive, consisting of zooids that are not organized in clear rows, in *S. buski*); the marginal perforations of zooids, as *S. buski* has a larger number of very conspicuous perforations; the primary orifice, suborbicular, with slightly rectangular condyles in *S. fissa*, and almost circular, larger, with two small, long condyles in *S. buski*; the development of peristome; the number of oral spines, six to four in *S. fissa*, and four to two in *S. buski*; the shape and position of vicarious avicularia, randomly distributed in *S. fissa*, and situated preferentially in rows in *S. buski*. Furthermore, in *S. buski* the adventitious avicularia have an oval or lanceolate rostrum, and the ovicells have a wider proximal fissure.

Schizotheca buski sp. nov. also shows some similarities to *S. carmenae* sp. nov. However, the two species are distinguished, amongst other characteristics, by the shape of the orifice (semielliptical and longer than wide in *S. carmenae*, almost circular in *S. buski*); by the condyles, round in *S. carmenae* and long in *S. buski*; by the shape of the peristome notch, much narrower and conspicuous in *S. buski*, and by the shape and size of the adventitious avicularia.

There is a certain degree of variation in the shape of the adventitious avicularium in *S. buski*. In some colonies, from Cape Verde, it is constantly oval (NHM-1899.7.1.4467, NHM-1899.7.1.5199, NHM-1899.7.1.5226, NHM-1963.4.18.23), whereas in those originating from John Adams Bank (off Brazil) the adventitious avicularia are lanceolate (NHM-1899.7.1.4468, NHM-1899.7.1.5063) (Figure 5A).

However, this difference must not be due to geographical variability and is perhaps of no taxonomic relevance, as one of the Cape Verde colonies (NHM-1963.4.18.22) has both types of avicularia.

***Schizotheca serratimargo* (Hincks, 1886)**

Schizoporella serratimargo Hincks 1886, p 268, Plate 10, Figure 6.

Schizotheca serratimargo (Hincks): Zabala 1986, p 535, Figure 190, Plate 17, Figures C–F; Zabala and Maluquer 1988, p 150, Figures 393, 394, Plate 22, Figures E, F; McKinney 1989, p 35–48, Plate 1–3; Hayward and McKinney 2002, p 98, Figures 45A–H, 46.

Not *Schizotheca serratimargo* (Hincks): Canu and Bassler 1925, p 48.

Material examined

MNHN-12866: Corfu. MNHN-(Paléontologie): Adriatic. NHM-1899.5.1.280: Adriatic. Co-type. NHM-1899.5.1.1088: Adriatic. Part of type. NHM-1996.2.14.1: English Channel? MM-5371: Golfo di Taranto. MM-5372: Golfo di Taranto. MM-5373: Golfo di Taranto. MM-5374: Golfo di Taranto. MM-8192: Reggio, Calabria. Pliocene. MM-8193: Messina. MM-8194: Rametto, Sicily. Pliocene. MM-8195: Messina, Sicily.

Remarks

Schizotheca serratimargo is characterized by erect bilaminar colonies with flat branches; the autozooids have a prominent periorbital region (which does not form an actual peristome) that masks a primary orifice, which has a semielliptical finely denticulated anter and concave poster with median sinus. Each zooid bears a triangular, inconstant avicularium, whereas the vicarious avicularia, similar to the adventitious avicularia in structure but larger, are generally situated at the lateral extreme ends of the branches and on the axils of the dichotomies; the vicarious avicularium is three times the size of the adventitious avicularium. The ovicell has a wide proximal fissure.

Schizotheca serratimargo appears to be a fundamentally Mediterranean species, from where it has been cited by different authors. It is abundant in the western Mediterranean and in the Adriatic Sea, extending at least to Corfu. Only two prior reports place this species in the Atlantic.

Canu and Bassler (1925) cited the species from the Atlantic coast of Morocco. However, these authors (Canu and Bassler 1925, p 48) indicated that the appearance of the zoaria of *S. serratimargo* may vary, and they may be “encroûtantes, rampantes, unilamellaires, plurilamellaires et libres, à deux lamelles adossées”. However, other authors such as Hincks

(1886), Gautier (1962), and Hayward and McKinney (2002) indicated that the zoarium of this species is erect and branched, with flat, bilaminar branches; McKinney (1989) indicated the presence of an eschariform portion in a colony collected from the Adriatic. The opinion of Canu and Bassler (1925) on the variability of this species appears to be due to erroneous identifications; we have examined material identified by Canu as *S. serratimargo* and have found that, with the exception of one sample, from the Adriatic, the material actually corresponds to *S. tuberigera* and *S. aviculifera*. Although we were not able to locate all of the original material, we believe that the report of *S. serratimargo* in the Moroccan Atlantic by Canu and Bassler (1925) should not be considered as valid. In fact, Gautier (1962, p 225) noted this Moroccan citation with a “?”.

Schizotheca serratimargo has also been reported from the English Channel by Hayward and Ryland (1999). However, Dr P. J. Hayward has informed us (personal communication, December 2005) that the colony, currently deposited in the Natural History Museum, London, with registration number 1996.2.14.1, had been part of the old exhibition collection at the NHM, and was only labelled “English Channel”. As Dr Hayward could not be certain that it was actually from the Channel, the species was excluded from the Synopsis (Hayward and Ryland 1999).

***Schizotheca tuberigera* (Jullien, in Jullien and Calvet, 1903)**

(Figure 5D–F)

Strophliella tuberigera Jullien, in Jullien and Calvet 1903, p 66, Plate 9, Figure 1.

Schizotheca fissa (Busk): Calvet 1906, p 429 (part: D.10 *Talisman*, 1883).

Schizotheca fissa (Busk): Canu and Bassler 1925, p 47 (part: st. no. 29).

Schizotheca serratimargo (Hincks): Canu and Bassler 1925, p 48 (part).

Schizoporella fallax Canu and Bassler 1928, p 32, Plate 3, Figures 12, 13.

Strophliella tubigera [sic] Jullien: d’Hondt 1978, p 455; Fernández Pulpeiro, Reverter Gil, and Ramil 1990, p 62.

Schizotheca fissa (Busk): d’Hondt 1978, p 449 (part or whole).

Schizotheca levis Cook 1985, p 178, Figure 46; Arístegui Ruiz 1984, p 359, Figure 78a, b, Plate 28, Figures 7, 8.

Schizotheca tuberigera (Jullien): Harmelin and d’Hondt 1992, p 49, Plate 7C, D.

not *Strophliella tubigera* [sic] Jullien 1903 ? : d’Hondt 1975, p 576.

Material examined

Holotype (by original designation): MNHN-3758: as *Strophliella tuberigera*. *Hirondelle*, st. 53. 135 m.

Other material. MNHN-300: as *Schizotheca fissa*. *Talisman*, Gulf of Cadiz. 717 m. MNHN-1035: as *Schizotheca fissa*. *Talisman*, Gulf of Cadiz. 717 m. MNHN-1036: as *Schizotheca fissa*. *Talisman*, Gulf of Cadiz. 717 m. MNHN-2180: as *Schizotheca fissa*. *Talisman*, Gulf of Cadiz. 717 m. MNHN-2341: as *Schizotheca fissa*. *Talisman*, Gulf of Cadiz. 717 m. MNHN-2696: (with more species), as *Schizotheca*...? MNHN-4026: as *Schizotheca fissa*. *Talisman*, Gulf of Cadiz. 717 m. MNHN-4348: as *Schizotheca fissa*. *Vanneau*, st. XXIX. MNHN-4352: as *Schizotheca serratimargo*. *Vanneau*, st. XXIX. MNHN-4362: as *Schizotheca serratimargo*. *Vanneau*, st. XXIX. 160 m. MNHN-6292: (with more species), as *Strophliella tubigera*. *Vanneau*, st. XXXI. MNHN-9980: as *Schizotheca fissa*. *Vanneau*, st. CX. MNHN-13718: as *Schizoporella fallax*. *Vanneau*, st. XLIII. MNHN-13763: as *Schizoporella* cf. *fallax*. *Vanneau* st.

XXI. MNHN-13770: as *Schizoporella fallax*. Vanneau, st. LV. MNHN-13790: as *Schizoporella fallax*. Vanneau, st. XXXVII. MNHN-13831: as *Schizoporella fallax*. Vanneau, st. XXXI. MNHN-13896: as *Schizoporella fallax*. Vanneau, st. XLIV. 145 m. MNHN-14018: as *Schizoporella fallax*. Vanneau, st. CXXVI. MNHN-14035: as *Schizoporella fallax*. Vanneau, st. XXI. 150 m. MNHN-14047: (with more species), as *Schizoporella fallax*. Vanneau, st. CXXVI. MNHN-14061: as *Schizoporella fallax*. Vanneau, st. XXXVII. MNHN-14097: as *Schizoporella fallax*. Vanneau, st. LX. 132 m. MNHN-14121: as *Schizoporella fallax*. Vanneau, st. XCI. MNHN-14165: as *Schizoporella fallax*. Vanneau, st. XLIV. MNHN-14199: as *Schizoporella fallax*. Vanneau, st. XLIII. 133 m. MNHN-14325: (with more species), Vanneau st. XLIII. MNHN-14419: (with more species), as *Schizoporella fallax*. Vanneau, st. CXXIX. MNHN-14457: as *Schizoporella fallax*. Vanneau, st. XLVI. MNHN-14469: (with more species), as *Schizoporella fallax*. Vanneau, st. XXXVII. MNHN-14542: as *Schizoporella fallax*. Vanneau, st. XXXV. MNHN-16833: as *Schizotheca fissa*. PTT. MNHN-(Paléontologie): as *Schizotheca serratimargo*. Vanneau, st. LV. MNHN-(Paléontologie): as *Schizotheca serratimargo*. Vanneau, st. XXIX. MNHN-(Paléontologie): as *Schizotheca serratimargo*. Vanneau, st. LXIX. MNHN-(Paléontologie): as *Schizotheca serratimargo*. Vanneau, st. XXVIII. MNHN-(Paléontologie): (with more species). Oran. NHM-1973.3.22.7: as *Schizotheca levis*. st. 60. 78 m. Paratype. Figured. NHM-1973.3.22.8: as *Schizotheca levis*. Ghana. Holotype and paratypes.

Dr Harmelin's personal collection: *Balgim* DW43, 35°54.1'N, 06°14.5'W, 150 m, May–June 1984. One colony.

The authors' personal collection: 42°48'30"N, 09°23'42"W, 115 m. Several colonies on a cetacean bone.

Description

Colony encrusting, extensive, unilaminar. Autozooids oval to rhomboid, arranged in alternating series and separated by fine sutures; frontal surface slightly convex, finely granular, bearing small denticulations; imperforate, except for up to five (often two) marginal circular pores.

Primary orifice orbicular; anter denticulate, poster with a small median notch, marked by two thick teeth and two long condyles; denticles characteristically blunt, formed as a continuation of the condyles. Peristome fine, more developed laterally and distally, describing a secondary elliptical orifice, longer than wide. Four to six cylindrical hollow oral spines, reduced to two in ovicellate or calcified zooids.

Autozooids bear a lateral adventitious avicularium, sometimes two, situated towards the middle of the frontal surface; mandible triangular, laterally directed, with slightly curved distal end that often touches the peristome of the neighbouring zooid. Foramen usually divided into two small lacunae, formed by separation of a more or less triangular foramen; the distalmost lacuna may sometimes be lacking. Cross bar fine, with a thick denticle. The avicularium has one or two conspicuous lateral pores. Avicularium sometimes associated with the ovicell of the proximal autozooid, then directed proximally.

Large vicarious avicularium with a narrow triangular mandible distally hooked; orientation variable, generally towards the peripheral of the colony; foramen similar to the adventitious avicularium, although less commonly the small most distal lacuna is absent. Large columella. Proximal opesia generally closed over by calcification.

Kenozooids irregularly shaped and variable in size, sometimes very abundant; may sometimes bear one or more adventitious avicularia similar to those existing in the autozooids.

Prominent, smooth, imperforate hyperstomial ovicell with a wide, more or less triangular fissure that narrows at the apex.

Ancestrula not observed.

Measurements

MNHN-3758 (holotype). AZL: 0.58 ± 0.05 (17); AZW: 0.36 ± 0.05 (17); OVL: 0.23 ± 0.01 (13); OVW: 0.25 ± 0.02 (13); VAL: 0.34 (1); VAW: 0.19 (1); AAL: 0.16 ± 0.01 (17); AAW: 0.066 ± 0.009 (17); VAL/AAL=2.1. We were unable to measure the orifice of this specimen because of the poor state of conservation of the sample.

MNHN-14061. AZL: 0.60 ± 0.08 (20); AZW: 0.40 ± 0.05 (20); OL: 0.12 ± 0.009 (20); OW: 0.12 ± 0.008 (20); OVL: 0.24 ± 0.016 (13); OVW: 0.27 ± 0.03 (13); VAL: 0.41 ± 0.04 (13); VAW: 0.20 ± 0.02 (13); AAL: 0.165 ± 0.02 (20); AAW: 0.067 ± 0.008 (20); VAL/AAL=2.5.

Remarks

Schizotheca tuberigera is characterized by a primary orbicular orifice with two small teeth on the proximal edge and blunt teeth along the inner edge; a secondary elliptical orifice; and by the form of the foramen of the avicularia, frequently divided into two small lacunae, and cross bar with a large denticle; the vicarious avicularia are more than twice the size of the adventitious avicularia.

This species was described by Jullien (in Jullien and Calvet 1903) from material collected in the NW of the Iberian Peninsula, and placed in the genus *Strophoella* Jullien in Jullien and Calvet, 1903. In the description of the species (Jullien and Calvet 1903, p 66) it was indicated that the orifice is of variable form, and three different types were therefore established. We were able to examine numerous colonies of *S. tuberigera* (amongst these the type material of the species, MNHN-3758), demonstrating that the difference in the form of the orifice is simply due to the intrinsic variability in the autozooids, presence or absence of ovicells, degree of calcification and state of conservation of the material. Harmelin and d'Hondt (1992) studied material of this species originating from the *Balgim* expedition and proposed its inclusion in the genus *Schizotheca* Hincks, 1877.

Schizotheca tuberigera has been described as *Schizotheca levis* by Cook (1985), whose type material we have examined. As indicated by Harmelin and d'Hondt (1992), this species should be considered a junior synonym of *S. tuberigera*.

This species has also been described as *Schizoporella fallax* Canu and Bassler, 1928. We were not able to locate the type material of the species and we assume that it was not originally designated. However, the description and figures of these authors (Canu and Bassler 1928, p 32, Plate 3, Figures 12, 13) are sufficiently representative. We also re-examined numerous colonies of *S. fallax* from the Balavoine Collection, deposited in the MNHN in Paris, from the *Vanneau* expedition, and which correspond perfectly to the original description of the species of Canu and Bassler (1928). We therefore consider that *Schizoporella fallax* is definitely a junior synonym of *S. tuberigera*.

Schizotheca tuberigera has often been confused with other species of the genus, particularly *S. fissa* and *S. serratimargo*.

We have studied several colonies from the Canu Collection (MNHN) originating from the *Vanneau* expedition, identified as *S. serratimargo*, part of which has been cited by Canu and Bassler (1925, p 48); six of the colonies were found to belong to *S. tuberigera*. We have

also examined a sample identified as *S. fissa*, originating from station no. 29 of the *Vanneau* expedition (MNHN-4348), cited by Canu and Bassler (1925, p 47), which actually corresponds to *S. tuberigera*.

We examined six samples labelled as *S. fissa*, originating from dredge no. 10 of the *Talisman* expedition in 1883, cited by Calvet (1906, p 429), and which actually correspond to *S. tuberigera*; however, we do not possess any information on the material cited from dredge no. 24 in the same survey.

d'Hondt (1978, p 449) cited *S. fissa* from st. 110 in the *Vanneau* expedition. We examined a sample from this locality (MNHN-9980), which corresponded to *S. tuberigera*; however, we do not know how many colonies were collected at this site and therefore we do not know if the citation of *S. fissa* made by this author can be maintained.

The same author (d'Hondt 1975, p 576) cited various colonies from the Azores Islands as *Strophliella tubigera* Jullien, 1903?. However, the reference material deposited in the MNHN belongs to *S. carmenae* sp. nov. (see above).

Schizotheca tuberigera is much more common than considered to date, as most of the previous citations have been made under other names. The area of distribution is also greater than previously thought, as it has been reported from Galicia (NW Spain) (Jullien and Calvet 1903, as *Strophliella tuberigera*; Fernández Pulpeiro, Reverter Gil, and Ramil 1990, as *Strophliella tubigera* [sic]; Reverter-Gil and Fernández-Pulpeiro 2001), Gulf of Cadiz (Calvet 1906, as *Schizotheca fissa*, part), Morocco (Canu and Bassler 1925, as *Schizotheca serratimargo*, part, and as *Schizotheca fissa*, part; Canu and Bassler 1928, as *Schizoporella fallax*; d'Hondt 1978 as *Strophliella tubigera* [sic] and as *Schizotheca fissa*, part), Strait of Gibraltar (Harmelin and d'Hondt 1992), Canaries (Aristegui Ruiz 1984, as *Schizotheca levis*), and Gulf of Guinea (Cook 1985, as *Schizotheca levis*).

***Schizotheca aviculifera* Canu and Bassler, 1925**

(Figures 6, 7)

Schizotheca aviculifera Canu and Bassler 1925, p 49, Plate 3, Figures 6–9; Canu and Bassler 1928, p 51.

Schizotheca serratimargo (Hincks): Canu and Bassler 1925, p 48 (part: material from Fedhala).

Material examined

Lectotype (designated here): MNHN-(Paléontologie) -A-26411: Casablanca (Morocco). Canu Coll.

Other material. MNHN-14748: Temara (Morocco), 18 August 1951. MNHN-14754: as *Schizotheca serratimargo*, Temara, 4 April 1958, Morocco. MNHN-(Paléontologie): as *Schizotheca serratimargo*, Fedhala, Morocco.

Description

Colony encrusting, unilaminar. Autozooids oval to hexagonal, separated by clear sutures, indistinct in calcified zooids; frontal surface convex, smooth or slightly granular, perforated by up to 10 large conspicuous marginal pores.

Primary orifice immersed in calcified zooids; anter semielliptical, finely denticulated; poster straight, with two well-developed teeth defining an apparent wide, shallow sinus.

Figure 6. *Schizotheca aviculifera*. (A) Group of zooids (MNHN-14754); (B) view in perspective, showing the position of adventitious avicularia (MNHN-14748); (C) two ovicellate zooids, one of them with three spines (right) (MNHN-14748); (D) two orifices, showing poorly developed proximal teeth, and condyles with wavy distal edge (MNHN-14754); (E) orifice with well-developed proximal teeth (MNHN-14748); (F) a vicarious avicularium, showing Y-shaped foramen (MNHN-14754).

Figure 7. *Schizotheca aviculifera*. (A–C) Casablanca, lectotype: (A) general view, showing orifices filled with sand; (B) orifice with well-developed proximal teeth; (C) orifice showing poorly developed proximal teeth. (D–F) Fedhala (as *Schizotheca serratimargo*): (D) general view, showing calcified zooids, and vicarious and adventitious avicularia; (E) orifice with well-developed proximal teeth; (F) orifice showing poorly developed proximal teeth.

Two oblique condyles, occasionally with slightly wavy distal edge, which does not reach the ends of the sinus. Peristome developed forming a fine, wide ring around the primary orifice, with a slight medio-proximal notch. Four spines at the edge of the colony, reduced to two in calcified or ovicellate zooids.

Each autozoid bears two small adventitious avicularia, situated on each side of the orifice; sometimes one or both avicularia may be lacking; mandible lanceolate, orientated distally and slightly upwards. Foramen basically triangular, but usually more or less narrow in the median zone; cross bar fine, generally without columella. Occasionally an avicularium may be associated distally with an ovicell, varying in its orientation.

Vicarious avicularia large, with a wide triangular mandible facing distally and upwards; orientation may be lost in very calcified colonies; foramen extensive, closed gradually from the distal end due to calcification, and Y-shaped. Cross bar with a large denticle. The vicarious avicularium is three times the size of the dependent avicularium.

Ovicell prominent, smooth and imperforate, deeply immersed in the distal zoid; proximal fissure wide, more or less elliptical.

Ancestrula not observed.

Measurements

MNHN. (Paléontologie) -A-26411 lectotype. AZL: 0.52 ± 0.03 (10); AZW: 0.36 ± 0.03 (10); OL: 0.12 ± 0.005 (5); OW: 0.11 ± 0.008 (5); VAL: 0.29 (1); VAW: 0.15 (1); AAL: 0.10 ± 0.02 (10); AAW: 0.06 ± 0.04 (10); VAL/AAL=3.

MNHN-14748. AZL: 0.51 ± 0.03 (20); AZW: 0.34 ± 0.03 (20); OL: 0.12 ± 0.01 (20); OW: 0.11 ± 0.008 (20); OVL: 0.21 ± 0.01 (10); OVW: 0.25 ± 0.01 (10); VAL: 0.39 ± 0.08 (10); VAW: 0.19 ± 0.03 (10); AAL: 0.12 ± 0.02 (30); AAW: 0.06 ± 0.01 (30); VAL/AAL=3.16.

Remarks

Schizotheca aviculifera is characterized by encrusting colonies consisting of zooids with a large number of very conspicuous marginal pores and often presenting a pair of disto-lateral avicularia, orientated distally. The vicarious avicularium is three times the size of the adventitious avicularium, of similar structure, but the former has a thick denticle in the cross bar.

This species was described by Canu and Bassler (1925) from a dead specimen collected in Casablanca (Morocco) and from about 10 dead fragments from Mazagan (now El Jadida), to the south of Casablanca; the latter material is that originally figured (Canu and Bassler 1925, Plate 3, Figures 6–9). In a subsequent study (Canu and Bassler 1928, p 51) these authors cited *S. aviculifera* from a dredge close to Casablanca (Vanneau, st. XIII, 9 July 1923, 100 m). From all of this original material, we have only been able to locate the dead colony from Casablanca, which is held in the Canu Collection deposited in the Laboratoire de Paléontologie of the MNHN, which has no registration number and was not labelled as the type specimen. The colony is very deteriorated and has many zoecial orifices filled with sand, making their examination difficult. The ovicells have been lost, with only the deep perforation in the distal zoid remaining. Only one large vicarious avicularium has been preserved. As this is the only original extant material, expressly cited by Canu and Bassler (1925, p 49), and as we have verified that it fits the description of the species, despite its poor state of conservation, we here designate the specimen as the lectotype of *S. aviculifera*.

We have been able to locate two colonies deposited in the MNHN (14754 and 14784) labelled as *S. aviculifera* and as *S. serratimargo*, but they do not correspond to the original material of Canu as indicated by the dates of collection (18 August 1951 and 4 April 1958);

however, the material fits perfectly the description and the original figures of *S. aviculifera*, and furthermore originates from Temara, a beach situated 15 km to the south of Rabat and therefore relatively close to the original locations.

We have also located another colony from the Canu Collection deposited in the Laboratoire de Paléontologie, labelled as *Schizotheca serratimargo*, and originating from Fedhala (now Mohammedia), which is close to Casablanca. This material was cited by Canu and Bassler (1925, p 48). This encrusting colony consists of very calcified nodular zooids; the orifice of the zooids, difficult to observe as it is deeply immersed, totally coinciding with that typical of the species. The adventitious avicularia are very numerous, located on the margins of the zooids and orientated at random, with a narrowed foramen in the median zone, due to calcification, and adopting the shape of a figure '8'.

The colonies cited here constitute the only existing material that corresponds to *S. aviculifera*, as the species does not appear to have been cited since its original description.

***Schizotheca divisa* (Norman, 1864)**

Lepralia divisa Norman 1864, p 86, Plate 10, Figure 6.

Schizotheca divisa (Norman): Hayward and Ryland 1999, p 384, Figures 182, 183A, B.

Material examined

NHM-1985.1.10.27: Stokes Point, Plymouth. Figured by Hayward and Ryland (1999).

Remarks

Schizotheca divisa is easily distinguished from other species in the genus by a well-developed peristome with an asymmetrical deep U-shaped notch on the inner side of the proximal border, the scarcity or absence of vicarious avicularia, with a small elliptical rostrum, the absence of adventitious avicularia, and by the aspect of the ovicell, which has a long, narrow median fissure, closed proximally.

According to Hayward and Ryland (1999) this species does not appear to have been found beyond the British Isles, where it ranges from Antrim to the English Channel. *Schizotheca divisa* has also been reported on the north coast of France: Roscoff (Echalier and Prenant 1951; Reverter et al. 1995) and Étretat (Jullien 1881); however, we were not able to locate the original reference material and were therefore unable to confirm these reports.

Conclusions

Seven species of genus *Schizotheca* are present in the area of study, six of them in the NE Atlantic and two in the Mediterranean. Two of these species are new to science.

Schizotheca fissa, type species of the genus, seems to have the widest range of distribution, ranging from the British Isles to the Atlantic coast of Morocco; this species is also present in the Mediterranean, where it extends east as far as Chios. The extent of its range outside these limits must be reviewed.

Schizotheca tuberigera also has a wide distribution, from NW Iberian Peninsula to the Gulf of Guinea, but it seems to be absent from the Mediterranean.

Schizotheca serratimargo is a typical Mediterranean species, being abundant in the western Mediterranean and Adriatic, and reaching Corfu. Records outside the Mediterranean must be considered doubtful.

The distribution of the other four species in the genus is more limited. *Schizotheca carmenae* is known from the Azores Islands and the south of Portugal. *Schizotheca buski* is known from the Cape Verde Islands and in Brazil. *Schizotheca aviculifera* is found on the Atlantic coast of Morocco. Finally, *S. divisa* occurs in the English Channel and north to Antrim.

Parasmittina talismani (Calvet, 1906), known only from Cape Verde, appears to be related to *P. fraseri*, but a complete redescription of this last species is required to confirm this.

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