

A new species of *Sphinctrella* (Demospongiae : Astrophorida) and remarks on the status of the genus in the Mediterranean

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Abstract

We describe in this study a new Mediterranean species of the genus *Sphinctrella* SCHMIDT. *Sphinctrella aberrans* sp. nov. is characterized by the presence of malformed ortho-plagiotriaenes and pseudocalthrops, a category of spirasters with a very thick central axis, microxeas with attenuate ringed ornamentation, and a very fine, pore-like fenestration of the ectosome of the exhalant sieves.

Apart from *S. aberrans*, three other species of *Sphinctrella* are known from the Mediterranean according to the literature : *Sphinctrella gracilis* SOLLAS, *Sphinctrella horrida* SCHMIDT and *Sphinctrella verrucolosa* PULITZER-FINALI. However, the re-examination of the single Mediterranean individual claimed to be *S. horrida* made evident that this specimen was misidentified and the species actually does not exist in the Mediterranean.

Keywords : Astrophorida, calthrops, Pachastrellidae, tetraxonid spicules, triaenes.

Resumen

En este estudio se describe una nueva especie mediterránea del género *Sphinctrella*. Esta especie, *Sphinctrella aberrans* sp. nov., se caracteriza por la presencia de orto-plagiotrienas y pseudocaltropas con malformaciones, por poseer una categoría de espirásteres con el eje central muy grueso, por una ornamentación anillada muy débil en las microxas y una fenestración puntiforme del ectosoma de las cribas exhalantes.

Según la bibliografía, otras tres especies del género *Sphinctrella*, además de *S. aberrans*, están presentes en el Mediterráneo : *Sphinctrella gracilis* SOLLAS, *Sphinctrella horrida* SCHMIDT y *Sphinctrella verrucolosa* PULITZER-FINALI. Sin embargo, la revisión del único material hasta ahora atribuido a la especie *S. horrida* en el Mediterráneo ha revelado que el ejemplar fue mal identificado y que dicha especie no existe realmente en el Mediterráneo.

Palabras clave : Astrophorida, caltropas, espiculas tetraxonas, Pachastrellidae, trienas.

Introduction

The genus *Sphinctrella* SCHMIDT has a worldwide distribution with species which are mostly bathyal. So far, three species are reported from the Mediterranean : *Sphinctrella verrucolosa* PULITZER-

FINALI, 1983, *Sphinctrella gracilis* SOLLAS, 1888 and *Sphinctrella horrida* SCHMIDT, 1870. *Sphinctrella verrucolosa* is known from just three records (PULITZER-FINALI, 1983; TEMPLADO *et al.*, 1986; JUAN, 1987) and its geographical distribution seems to be limited to the Mediterranean. *Sphinctrella gracilis* is a common species in the Atlanto-Mediterranean region (e.g., SOLLAS, 1888; TOPSENT, 1928; SARÀ, 1958; VACELET, 1969; MALDONADO, 1993a; BOURY-ESNAULT *et al.*, 1994) and is also reported from the Arabian Sea (BURTON, 1959). *Sphinctrella horrida* is common in both the western and eastern Central Atlantic (e.g. SCHMIDT, 1870; TOPSENT, 1892, 1904, 1928), but it is known from a single record in the Mediterranean (PULITZER-FINALI, 1983).

In the present study, we describe a new Mediterranean species of *Sphinctrella*. Its characterization and relationships are discussed in the light of a re-examination of holotypes and additional specimens belonging to the closest Atlanto-Mediterranean species.

Material and methods

The studied material was collected from the slope of the Alboran Island (lat 35° 54' - 35° 52'N, long 03° 09' - 03° 05'W) during the Spanish cruise "Coral Rojo" in 1982. For further information on the sampling methodology, geographical location and faunal characterization of the sampling site, see ORTIZ *et al.* (1986), TEMPLADO *et al.* (1986) and MALDONADO (1992, 1993a). Specimens were fixed in 10% formalin-seawater and preserved in 70% ethanol for systematic study. The type material has been deposited in the Porifera collection of the Centro de Estudios Avanzados de Blanes (CSIC), Spain, under the reference numbers CEAB-POR.BIO 173A, B, C. Apart from the collected material, we examined several holotypes and diverse material stored in the collections of the Natural History Museum of London (BMNH), the Museo Civico di Storia

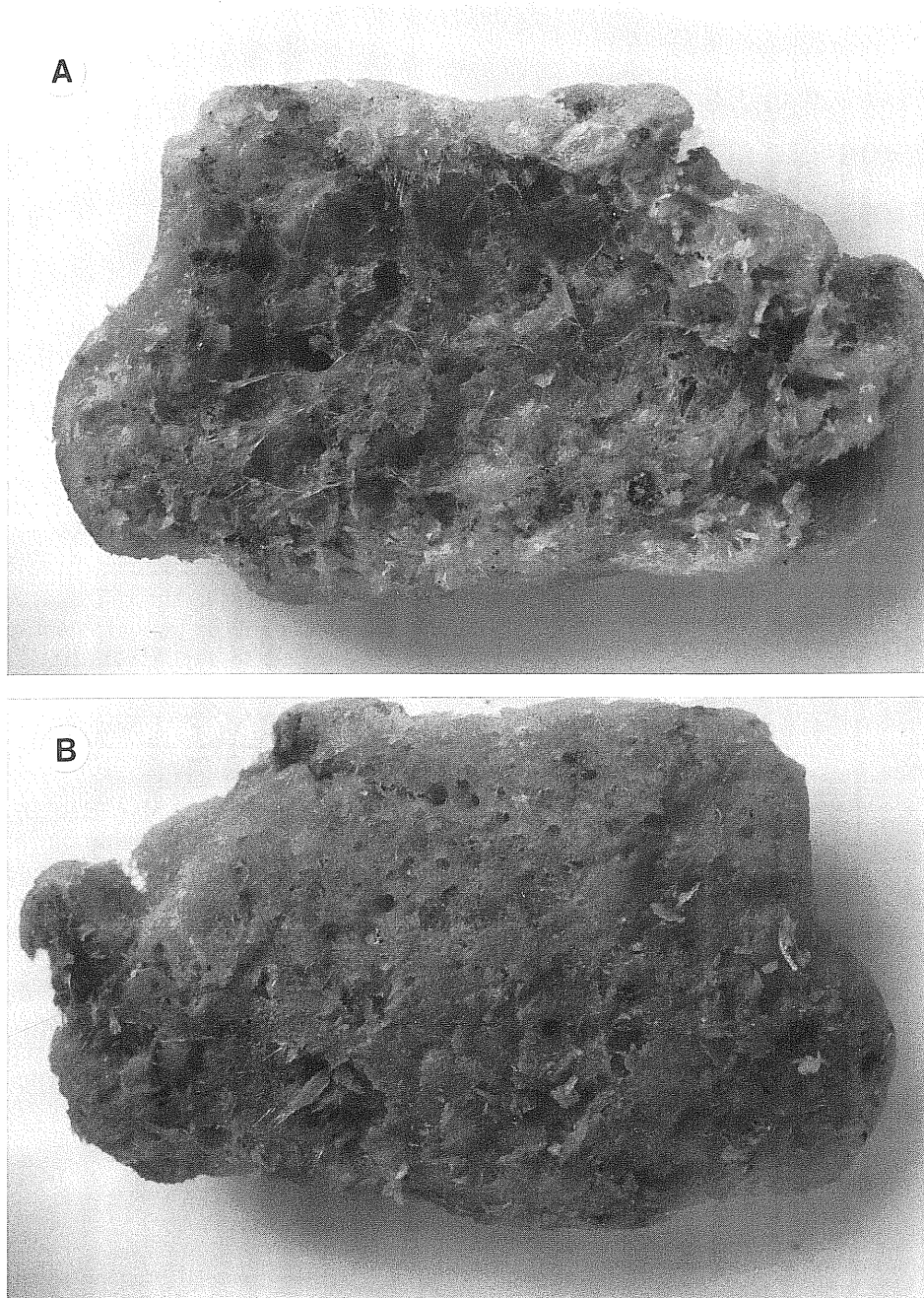


Fig. 1. - Holotype of *Sphinctrella aberrans*. - A. Exhalant side showing cloacas and cloacal palisades. - B. Inhalant side.

Naturale "G. Doria" of Genoa (MSNG) and the Centro de Estudios Avanzados of Blanes (CEAB), as follows : *Sphinctrella gracilis* SOLLAS, 1888 (schizotypes, BMNH:94:11:16:144 to 146; MSNG:NIS.70.2, MSNG:P.F.455; CEAB:ALB-est 7-11cx), *Sphinctrella horrida* SCHMIDT, 1870 (schizotype, BMNH:70:5:3:47; BMNH:1877:5:21:

1251 to 1252; MSNG:11.XI.70-P.F.268), *Sphinctrella cribrifera* SOLLAS, 1888 (holotype, BMNH:89:1:1:39).

Skeletal slides for light microscopy were prepared according to standard methodology (e.g. RÜTZLER, 1978). Micrographs were taken through a HITACHI S-2300 SEM.

Results

Class Demospongiae

Subclass **Tetractinomorpha** LÉVI, 1956

Order **Astrophorida** LÉVI, 1973

Family **Pachastrellidae** CARTER, 1875

Genus ***Sphinctrella*** SCHMIDT 1870

SYNONYMY

Vulcanella SOLLAS 1886

DIAGNOSIS

(Amended from SOLLAS, 1888; MALDONADO, 1993 : 136; BOURY-ESNAULT *et al.*, 1994 : 50).

Pachastrellidae in which oscula are grouped in specialized exhalant areas (fenestrate cloacas, *sensu* SOLLAS, 1888) fringed by palisades of ectosomal (cloacal) oxeas. Megascleres consist of oxeas in two categories (slender cloacal oxeas and stout choanosomal oxeas) and tetraxons in one or two categories (calthrops-pseudocalthrops and/or ortho-plagiotriaenes). Microscleres consist of one or several types of streptasters (metasters, spirasters and rarely amphistasters-pleiastasters) along with one or two categories of microxeas.

REMARKS

In most species of this genus, some types of microscleres show a ringed ornamentation which is originated by coalescence of microspines to make either verticils or spires. This ringed ornamentation is commonly present in the largest microxeas, but it can also occur in other categories of microscleres and microcalthrops, depending on the species. Although this feature might be considered as diagnostic at the generic level, the ringed ornamentation is not reported in all the species of this genus described in the literature.

Sphinctrella aberrans sp. nov.

MATERIAL EXAMINED

CEAB-POR.BIO 173A (holotype).

CEAB-POR.BIO 173B, CEAB-POR.BIO 173C (paratypes).

DESCRIPTION

Individuals are plate-like, with rounded edges and no apparent trace of basal attachment (Fig. 1). Their dimensions range from 5 to 10 cm in maximal diameter and from 1.5 to 2 cm in thickness. The colour in alcohol is pale ochre, almost white. The consistency is slightly crumbly. Oscula are grouped in specialized sieve-like structures (cloacas, *sensu* SOLLAS 1888) that only occur on one of the sides of the sponge (exhalant side). Ostia are located on the opposite side (inhalant side). The exhalant side is always slightly concave and harbors between 3 and 12 cloacas, depending on the individuals (Fig. 1A). Cloacas are about 1 cm in

diameter, lined by a thin, porous ectosome and fringed by a palisade of long oxeas that protrude about 3.5 mm from the sponge surface. The fenestration of the cloacal ectosome consists of pore-like orifices (proctia), each one about 100 µm in diameter, which are densely and homogeneously distributed. The inhalant side of the individuals is slightly convex, provided with a short and irregular hispidation and scattered ostia (Fig. 1B). Ostia are about 300-500 µm in diameter.

Spicules

Choanosomal oxeas

Stout, strongly fusiform, slightly curved, with blunt ends, occasionally strongyle-like (Figs. 2A, 3A). Their dimensions are 1500-3115 x 23-70 µm.

Cloacal oxeas

Long and slender, isodiametric, straight or slightly flexuous, also flexible, with sharp points (Figs 2B, 3A). Their dimensions are 3500-6000 x 9-20 µm.

Pseudocalthrops and ortho-plagiotriaenes

Typically with a straight, stout rhabdome and malformed cladomes (Figs. 2C, 3A-B). The ratio of malformed triaenes ranges between 40% and 90%, depending on the individuals. The spicule shape resulting from these malformations is highly diverse. In some cases, one or two clads can be either partially underdeveloped or missing; occasionally, the whole cladome is reduced to an irregular swelling. Dimensions of rhabdomes and fully developed clads are 565-11025 x 9-15 µm and 150-350 x 7-15 µm, respectively.

Microxeas-I

Fusiform, faintly curved and finely microspiny, sometimes centrotylote (Figs. 3C-F). The arrangement of the microspines is somewhat variable. In some microxeas, microspines are uniformly distributed on the whole spicule. In other cases, spines are arranged in a barely ringed pattern at the middle of the microxea, shifting gradually to a homogeneous distribution towards both ends of the spicule. Spicule dimensions are 150-315 x 3-7 µm.

Microxeas-II

Faintly or sharply curved, with a fine and homogeneous microspination (Figs. 3C-D). Their dimensions are 65-140 x 2-2.5 µm.

Metasters

With a thin, straight axis and few long, thin actines (Fig. 4A); they can very rarely show amphistaster-like morphology. The spicule length ranges from 18 to 25 µm.

Spirasters

In two form categories (Fig. 4B). One of them is characterized by having an uncommonly thick axis and stout, short actines (Figs. 4B-C). The other category is characterized by a relatively thin axis and thin, long actines (Figs. 4B, D). The spicule length is similar in both forms and ranges from 16 to 21 µm.

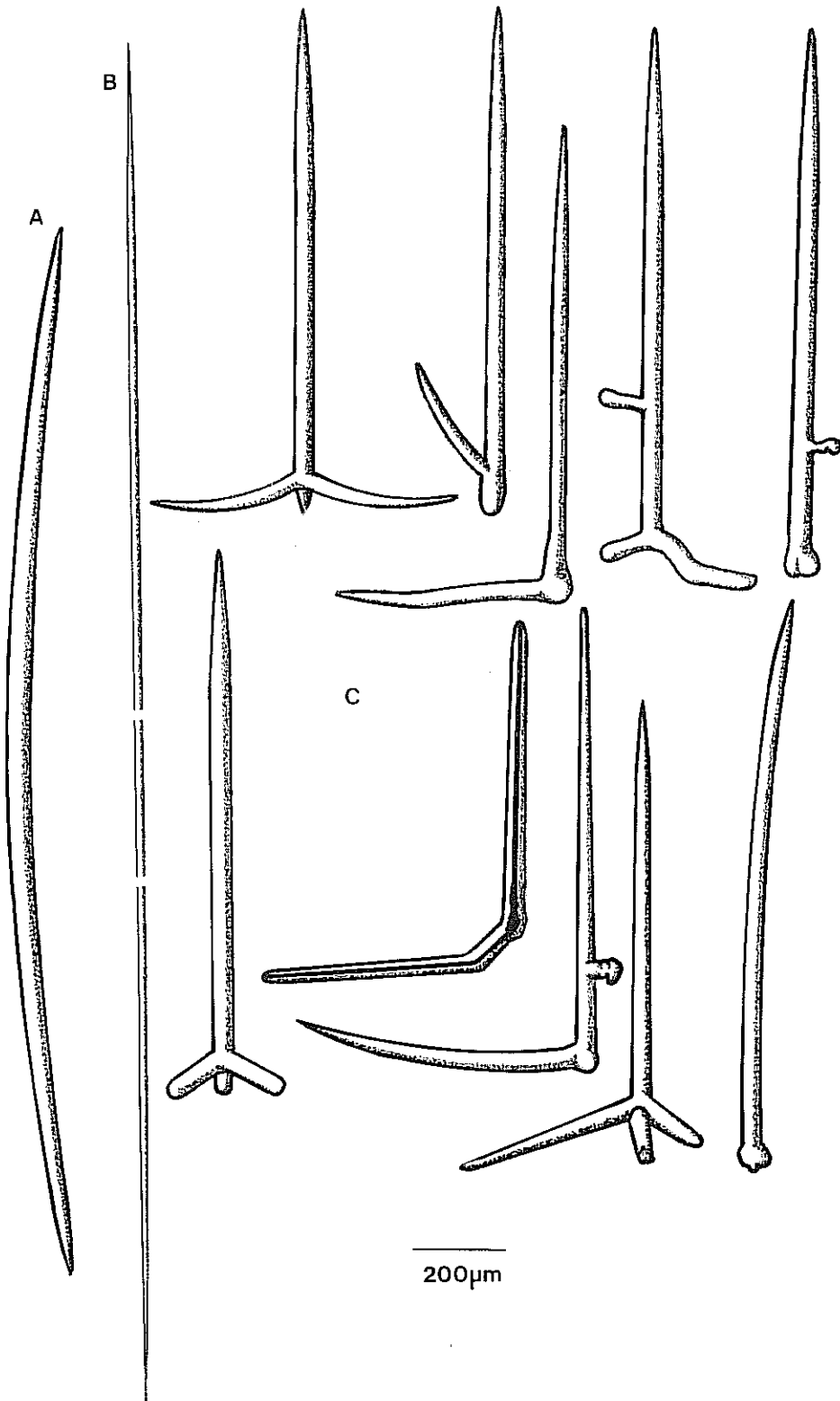
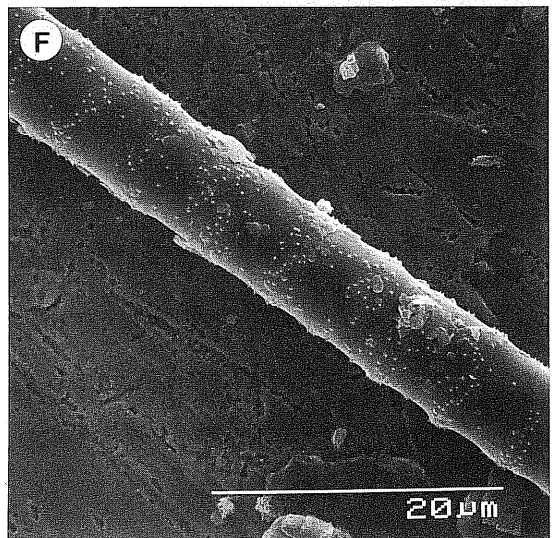
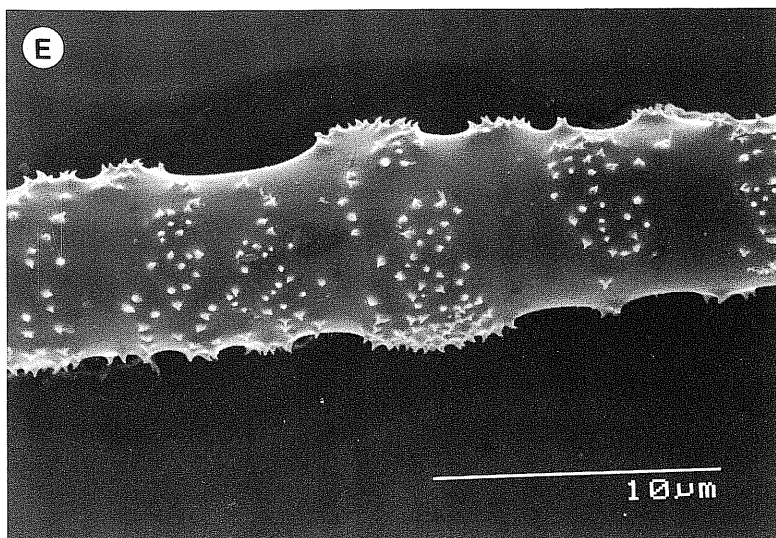
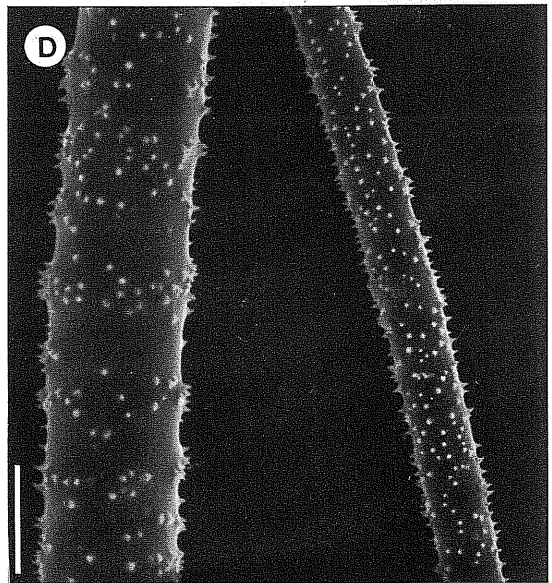
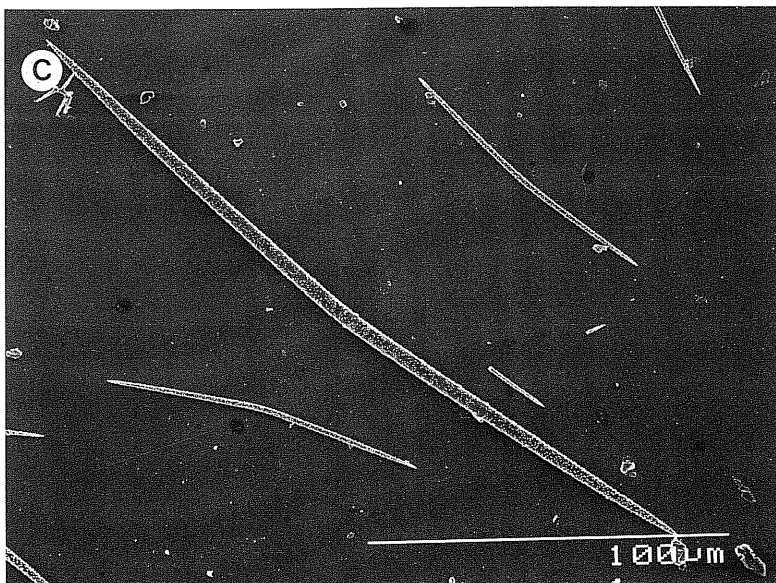
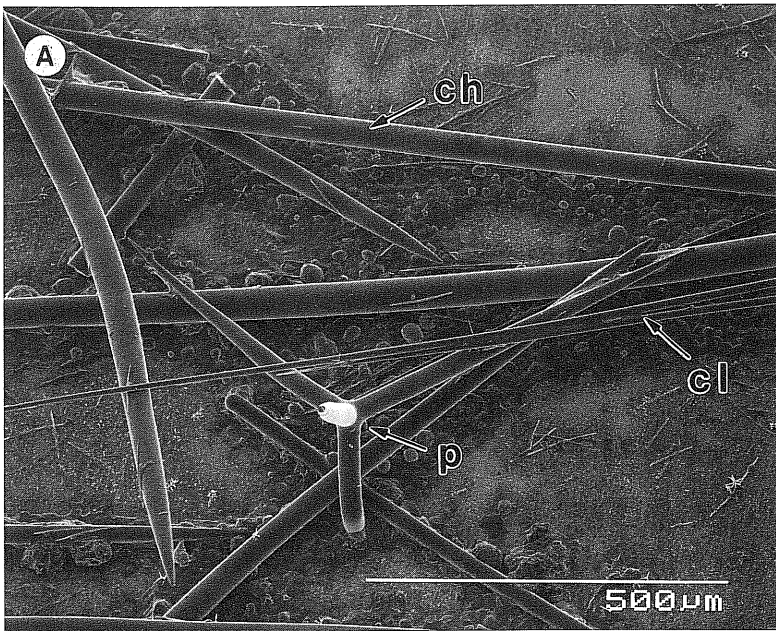


Fig. 2. - Set of megascleres of *Sphinctrella aberrans*. - A. Choanosomal oxea. - B. Cloacal oxea. - C. Pseudocalthrops, plagiotriaenes and orthotriaenes showing characteristic malformations

Fig. 3. - SEM detail of some spicules of *S. aberrans*. - A. Megascleres (ch = choanosomal oxeas, cl = cloacal oxea, p = pseudocalthrops). - B. Malformed plagiotriaene, whose rhabdome is indicated by arrow heads. - C. Microxea-I and microxeas-II. Note that the ringed ornamentation is just barely perceptible at the mid part of the microxea-I. - D. Ornamentation pattern in a microxea-I (on the left) and a microxea-II (on the right). Scale bar as that in Fig. 3E. - E-F. Two different aspects of the ornamentation at the mid part of the microxeas-II. ▷



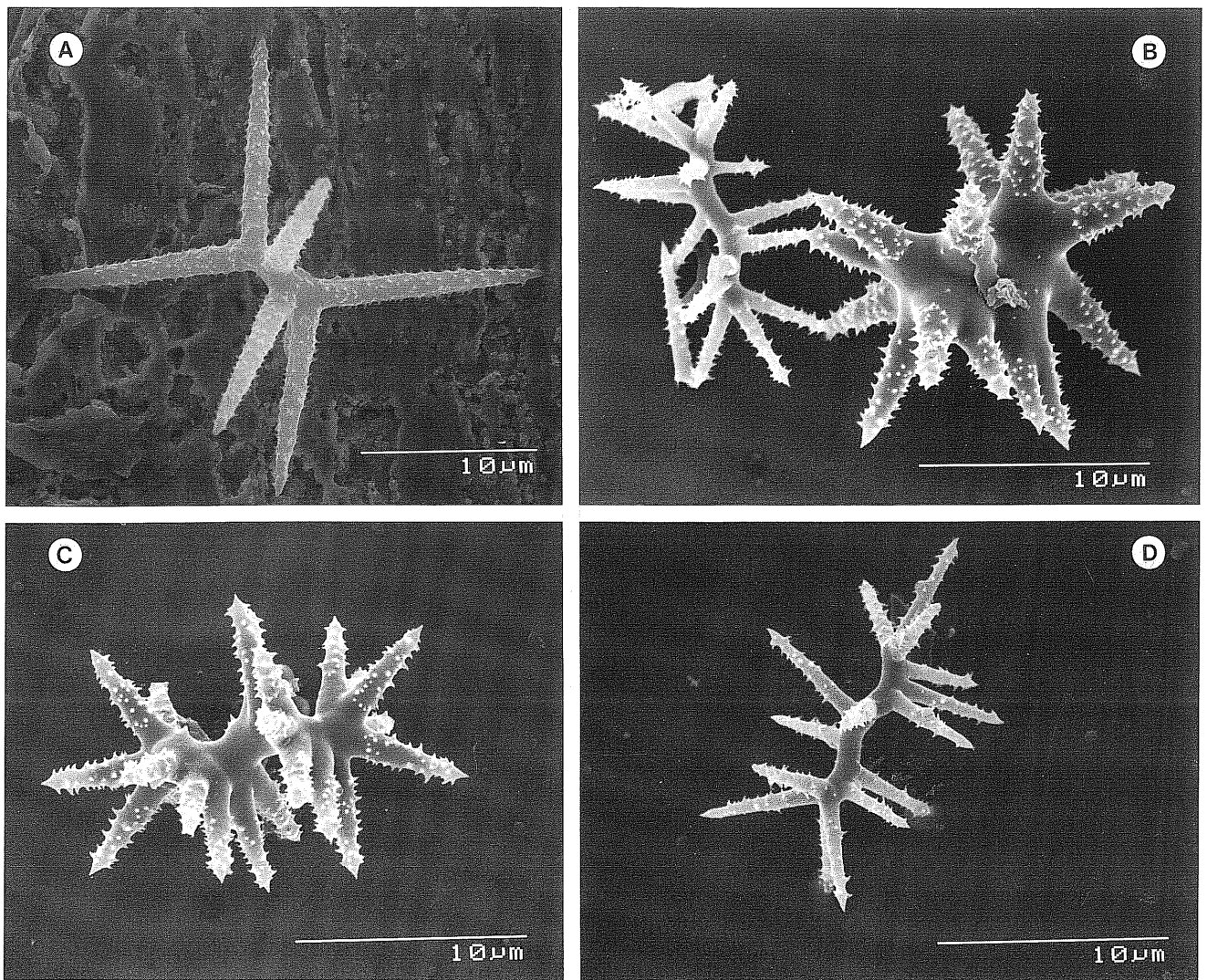


Fig. 4. - Streptasters of *S. aberrans*. - A. Metaster. - B. Comparison between a thin-axis spiraster (on the left) and thick-axis spiraster (on the right). - C. Thick-axis spiraster. - D. Thin-axis spirasters.

Skeletal arrangement

The ectosome harbors abundant streptasters and microxeas, especially microxeas-II. Nevertheless, the largest microxeas, metasters and thin spirasters are also abundant in the deeper part of the choanosome. The ectosome lining the cloacas contains mainly streptasters, especially thick-axis spirasters. The presence of cloacal oxeas is limited to the palisades that fringe the cloacas. Choanosomal oxeas are abundant throughout the choanosome, showing a chaotic arrangement. Triaenes, which are relatively scarce, seem to be limited to the subectosomal regions of the choanosome.

DISTRIBUTION

Western Mediterranean (Alboran Sea) : circalittoral bottoms with facies of *Corallium rubrum*, at depths of 70-120 m.

ETYMOLOGY

The species name "aberrans" refers to the frequent malformation affecting the tetraxonid spicules of this species.

Discussion

This new species is characterized by the following traits : (1) a plate-like body, (2) a very fine, almost microscopic, fenestration of the cloacal ectosome, (3) the presence of malformed ortho-plagiotriaenes and pseudocalthrops, (4) microxeas with an attenuate ringed ornamentation, only patent at the mid part of some of the largest spicules, and (5) the presence of a category of spirasters circumscribed to the cloacal ectosome and characterized by a peculiarly thick axis.

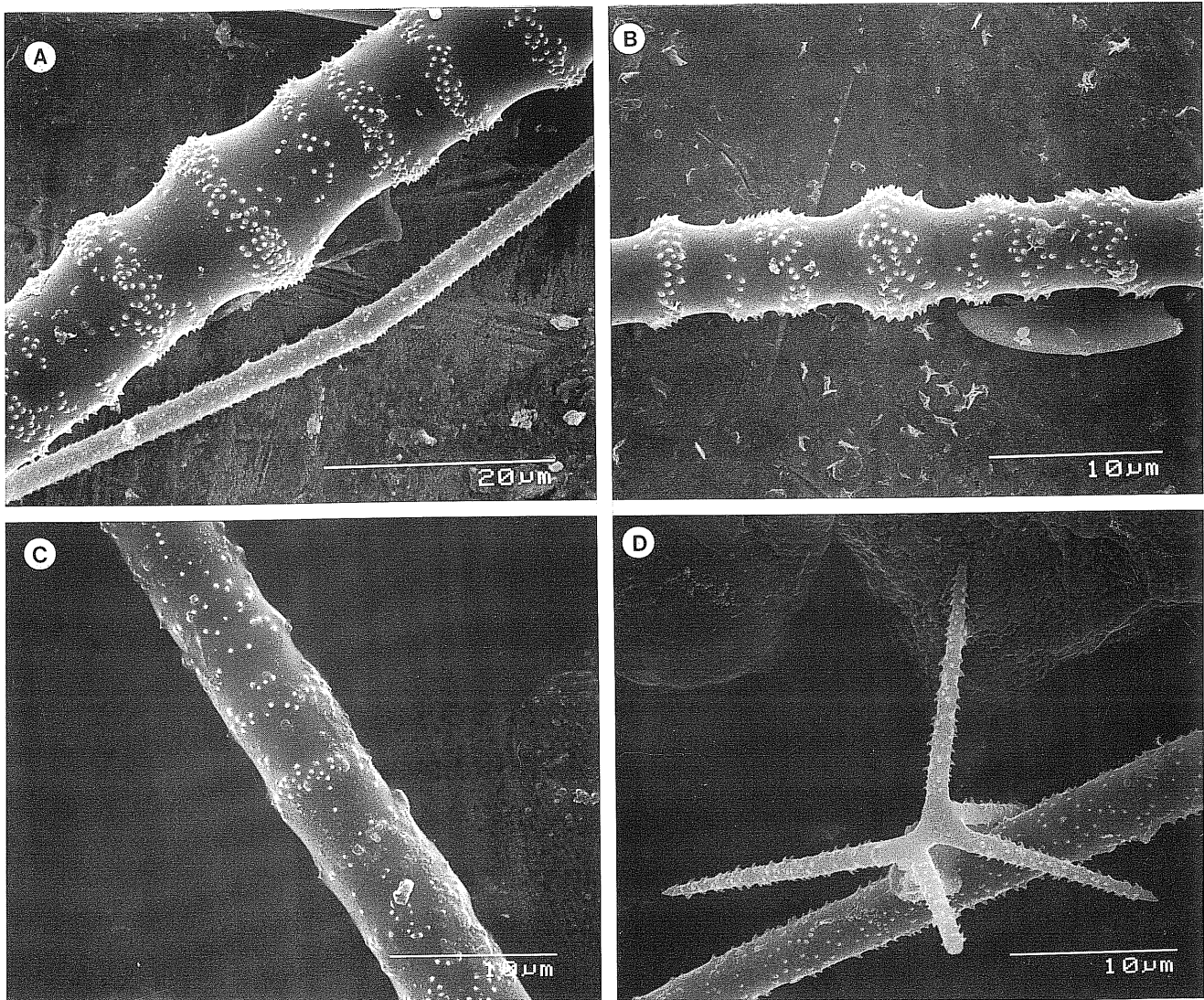


Fig. 5. - A. Microxea-I and microxea-II of a specimen of *Sphinctrella gracilis* collected by PULITZER-FINALI (1983) from the Gulf of Genoa. - B. Ornamentation of microxeas-I of another specimen of *S. gracilis* also collected by PULITZER-FINALI (1983) from the Gulf of Genoa. - C. Microxea of a specimen of *Sphinctrella* sp. from the Gulf of Genoa (loc. cit.) which was misidentified as the first Mediterranean record of *Sphinctrella horrida*. - D. Metaster on microxea, both belonging to the above-mentioned specimen of *Sphinctrella* sp.

This new Mediterranean species is related to a small group of species that are also characterized by having ortho-plagiotriaenes either along with calthrops or instead of calthrops : *Sphinctrella cribiporosa* LEBWOHL, *Sphinctrella porosa* LEBWOHL (both of them from the Japan Sea), *Sphinctrella bifacialis* WILSON (from the Meridional Sea of China), *Sphinctrella orthotriaena* LÉVI & LÉVI (from New Caledonia) and *Sphinctrella cribrifera* SOLLAS (from the Cape Verde Archipelago and the Brazilian coast). This latter species shows the strongest skeletal similarities with *S. aberrans*. From a geographical point of view, *S. cribrifera* is also the species recorded in the closest proximity to the Mediterranean. However, there are some differences between both species (Table 1). From the only two

previous descriptions of *S. cribrifera* (i.e., SOLLAS, 1888 : from the Cape Verde archipelago; MOTHES DE MORAES, 1978 : from the Brazilian coast), it seems to have a thick-encrusting growth habit. Its cloacas have a somewhat coarse fenestration. Its tetraaxon spicules (isoactinal calthrops and orthotriaenes) rarely have malformations. There is only one category of microxeas, whose microspination is very weak and usually does not show any trace of ringed pattern. Even under SEM magnification, only few microxeas showed some trace of a ringed ornamentation at the mid part of the spicule. Its streptasters are metasters and spirasters, but the category of thick-axis spirasters is not present. Besides the above mentioned features, there is yet a major distinctive trait : the presence of strongyles in

Table 1 :
Summary of characteristics of the genus *Sphinctrella* in the Atlanto-Mediterranean biogeographical province.

	<i>S. horrida</i> SCHMIDT	<i>S. gracilis</i> SOLLAS	<i>S. aberrans</i> n. sp.	<i>S. cribrifera</i> SOLLAS	<i>S. annulata</i> (CARTER)*	<i>S. verrucolosa</i> PULITZER-FINALI
Growth habit	massive or plate-like	encrusting or massive	plate-like	encrusting	massive or encrusting	massive
Cloacal strongyles	absent	absent	absent	present	present	absent
Tetrazons	regular calthrops & pseudocalthrops	regular calthrops	irregular triaenes & pseudocalthrops	regular calthrops & triaenes	microtrioids & microcalthrops	microtrioids, microcalthrops & polyactinal forms
Microxeas	two types	two types	two types	one type	one or two types	one type
Streptasters	metasters, thin-axis spirasters, amphistasters-pleiastasters	metasters and/or thin-axis spirasters	metasters, thin-axis spirasters & thick-axis spirasters	thin-axis spirasters	metasters and/or thin-axis spirasters	metasters, amphistasters & thin-axis spirasters
Cloacal fenestration	coarse	coarse	pore-like	somewhat coarse	no cloacal membrane	no cloacal membrane
Geographical distribution	Atlantic	Atlantic, Mediterranean, Arabian Sea & Indian Ocean	western Mediterranean	Atlantic	Atlantic & Indo-Pacific	western Mediterranean

(*) The species *S. annulata* is regarded as a species group consisting of *S. annulata* (CARTER), *Stelletinopsis ornata* SCHMIDT & *Sphinctrella ornata* SOLLAS.

the margin of the cloacas. Although these strongyles were described in the holotype of *S. cribrifera*, the author expressed some doubts about whether these spicules were actually proper to the sponge or not (SOLLAS, 1888 : 89). A second record of this species from the Brazilian coast (MOTHES DE MORAES, 1978) made evident that these strongyles are proper to the sponge. Therefore, its presence unequivocally characterizes *S. cribrifera*.

Apart from *S. aberrans* and *S. cribrifera*, four other species of this genus have been reported in the Atlanto-Mediterranean region : *Sphinctrella annulata* (CARTER) = *S. ornatus* SOLLAS, *Sphinctrella verrucolosa* PULITZER-FINALI, *Sphinctrella gracilis* SOLLAS and *Sphinctrella horrida* SCHMIDT (Table 1). The new species, *S. aberrans*, is well distinguished from *S. annulata* and *S. verrucolosa* by the presence of a ringed ornamentation in the actines of streptasters and microcalthrops of these two latter species. *S. aberrans* is also clearly distinguishable from *S. gracilis*, whose tetraxons are exclusively isoactinal calthrops (triaenes are absent). *S. gracilis* also has a coarse fenestration of the cloacal ectosome and a very patent ringed ornamentation in the microxeas (Figs 5A-B). In addition, this species lacks the category of thick-axis spirasters described from the cloacal ectosome of *S. aberrans*.

Before tackling the differences between *S. aberrans* and *S. horrida*, we must take into account that the single record of *S. horrida* in the Mediterranean (Gulf of Genoa : PULITZER-FINALI, 1983) is the result of a taxonomic misidentification. A comparative re-examination of the holotype (schizotype) of *S. horrida* from Florida and the Mediterranean material described by PULITZER-FINALI (*loc. cit.*) revealed that they are not conspecific. The spiculation of the holotype consists of cloacal and choanosomal oxeas, abundant isoactinal calthrops (sometimes triactinal), two categories of microxeas (the larger with an extremely marked ringed ornamentation) and diverse types of streptasters including spirasters, metasters and amphiaster-pleasiasters. The specimen from the Gulf of Genoa is not an entire individual, but a macerated fragment in which no cloaca is apparent and the ectosome seems to be lost as well. The megasclere set consists of cloacal and choanosomal oxeas, calthrops and pseudocalthrops with regular actines (sometimes triactinal) measuring 500-825 x 15-25 μm , plagiotriaenes whose rhabdome and clads measure up to 800 x 30 μm and 250 x 25 μm , respectively. There is only a category of microxeas, ranging from small (150 x 2 μm), sharp-curved, uniformly spiny microxeas to large (450 x 9 μm), faintly curved and weakly ringed microxeas (Fig. 5C). Its streptasters are metasters (Fig. 5D) and rarely amphiasters, but spirasters are not present.

After this re-examination, it can be concluded that the species *S. horrida*, originally described from Florida (SCHMIDT, 1870) and commonly present at

bathyal depths in the Central Atlantic (e.g., TOPSENT, 1892, 1904, 1928), is incorrectly recorded in the Mediterranean. The available skeletal features of the Mediterranean specimen suggest that it may belong to *S. cribrifera*. Nevertheless, due to its fragmentary nature, its actual identity remains unresolved.

According to the composition of the tetraxonid spicule complement, we can recognize three major species groups in *Sphinctrella*. A first group characterized by having exclusively calthrops (e.g., *S. gracilis* SOLLAS, *S. theneides* BURTON), a second group characterized by the co-occurrence of calthrops and triaenes (e.g., *S. cribrifera* SOLLAS, *S. aberrans* n. sp.) and a third group characterized by having exclusively triaenes (e.g. *S. orthotriaene* LÉVI, *S. bifacialis* WILSON). From a suprageneric point of view, the existence of species characterized by having plagiotriaenes or orthotriaenes creates controversy about whether the genus *Sphinctrella* should be classified in the family Theneidae or Pachastrellidae. Although *Sphinctrella* has mostly been considered to be a pachastrellid, it was occasionally assigned to the family Theneidae because of the presence of orthotriaenes in some species (e.g. SOLLAS, 1888; LÉVI & LÉVI, 1983). It is noteworthy that, apart from calthrops and pseudo-calthrops, a wide variety of tetraxon spicules can be found in Pachastrellidae (reviewed by MALDONADO, 1993a, b, 1995), as follows : orthotriaenes and plagiotriaenes in *Sphinctrella*, anatriaenes in *Characella* SOLLAS and *Poecillastra* SOLLAS, short-shafted dichotriaenes in *Dercitus* DENDY and *Stoeba* SOLLAS, mesodichotriaenes in *Triptolemus* SOLLAS and *Yodomia* LEBWOHL, and mesotriders in *Brachiaster* WILSON. It seems, therefore, that the presence of calthrops in Pachastrellidae is not the rule, but the exception. Consequently, those "calthrops-pseudocalthrops" were proposed to be evolved in Pachastrellidae (but not in Calthropellidae) from long-shafted triaenes by an evolutionary shortening of the rhabdome (MALDONADO, 1996). This also involved a re-definition of the family Pachastrellidae to harbor those genera in which calthrops and long-shafted triaenes can co-occur (*loc. cit.*) According to this definition there is no doubt about the assignation of the genus *Sphinctrella* to the family Pachastrellidae.

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