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Sponges of Western Mediterranean seamounts: new genera, new species and new records

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Background. The seamounts Ses Olives (SO), Ausias March (AM) and Emile Baudot (EB) at the Mallorca Channel (Balearic Islands, western Mediterranean), are poorly explored areas with rich and singular sponge communities. Methods. Sponges were collected during several surveys carried out by the Balearic Center of the Spanish Institute of Oceanography at the Mallorca Channel Seamounts. Samples were obtained by Beat-trawl, rock dredge and Remote Operated Vehicle. Additional samples were obtained from fishing grounds of the Balearic Islands continental shelf, through the sampling device GOC-73. Sponges were identified throught the analysis of morphological and molecular characters. Results. A total of 19 species have been analysed, including the new genus *Pseudoaplysina* **new gen.**, represented by *Pseudoaplysina balearica* **sp nov.** and *Pseudoaplysina minuta* **sp. nov.**, as well as the new species *Paratimea massutii* **sp. nov.** and *Heteroxya mediterranea* **sp. nov.**, the last being the first record of the genus *Heteroxya* in the Mediterranean Sea. Moreover, the species *Petrosia* (*~~p~~etrosia*) *raphida*, *C.* cf. *tufa* and *Lanuginella pupa* are reported for the first time ~~at~~ the Mediterranean while *Petrosia* (*strongylophora*) *vansoesti* is reported for first time in the western Mediterranean and *Haliclona* (*~~s~~oestella*) *fimbriata* is reported for first time in the north-western Mediterranean, *Axinella spatula* and *Hemiasterella elongata* are reported for second time in the Mediterranean and for the first time out of the Alboran Sea. The species *Melonanchora emphysema* and *Rhabdobaris implicata* are reported for third time in the Mediterranean and together with *Polymastia polytylota*, *Dragmatella aberrans*, *Phakellia ventilabra* and *Pseudotrachya hystrix* are reported for first time off Balearic Islands. Additionally, this is the second report ~~ever~~ of *A. spatula* and *H. fimbriata* since ~~its~~ description, a fact that allows us to study the variability of ~~its~~ characters at different localities. We also provide a taxonomic discussion on the genus *Phakellia*, describing newly collected material of *P. robusta* and *P. hirondellei* from the three seamounts and from fishing grounds on the continental shelf around Mallorca and Menorca (Balearic Islands). Following the Sponge Barcoding project goals, we have sequenced the Cytochrome Oxidase subunit I (COI) and the 28S ribosomal fragment (C1-D2 domains) for *Pseudoaplysina balearica* **sp. nov.**, *Pseudoaplysina minuta* **sp. nov**., *Heteroxya mediterranea* **sp. nov.** and *Calyx* cf. *tufa,* and the COI for *Paratimea massuti* **sp. nov**. We also provide a phylogenetic analysis to discern the systematic location of *Pseudoaplysina* **gen. nov.**, which, in accordance to morphological traits, is placed in the family Hymerhabdiidae. A brief biogeographical discussion is provided for all these species, with emphasis on the sponge singularity of SO, AM and the EB seamounts and the implications for ~~its~~ future protection.

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Abstract

Background. The seamounts Ses Olives (SO), Ausias March (AM) and Emile Baudot (EB) at the Mallorca Channel (Balearic Islands, western Mediterranean), are poorly explored areas with rich and singular sponge communities.

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Results. A total of 19 species have been analysed, including the new genus *Pseudoaplysina* **new gen.**, represented by *Pseudoaplysina balearica* **sp nov.** and *Pseudoaplysina minuta* **sp. nov**., as well as the new species *Paratimea massutii* **sp nov.** and *Heteroxya mediterranea* **sp. nov**., the last being the first record of the genus *Heteroxya* in the Mediterranean Sea. Moreover, the species *Petrosia* (*petrosia*) *raphida*, *C.* cf. *tufa* and *Lanuginella pupa* are reported for the first time at the Mediterranean while *Petrosia* (*strongylophora*) *vansoesti* is reported for first time in the western Mediterranean and *Haliclona* (*soestella*) *fimbriata* is reported for first time in the north-western Mediterranean, *Axinella spatula* and *Hemiasterella elongata* are reported for second time in the Mediterranean and for the first time out of the Alboran Sea. The species *Melonanchora emphysema* and *Rhabdobaris implicata* are reported for third time in the Mediterranean and together with *Polymastia polytylota*, *Dragmatella aberrans*, *Phakellia ventilabrum* and *Pseudotrachya hystrix* are reported for first time off Balearic Islands. Additionally, this is the second report ever of *A. spatula* and *H. fimbriata* since its description, a fact that allows us to study the variability of its characters at different localities. We also provide a taxonomic discussion on the genus *Phakellia*, describing newly collected material of *P. robusta* and *P. hirondellei* from the three seamounts and from fishing grounds on the continental shelf around Mallorca and Menorca (Balearic Islands). Following the Sponge Barcoding project goals, we have sequenced the Cytochrome Oxidase subunit I (COI) and the 28S ribosomal fragment (C1-D2 domains) for *Pseudoaplysina balearica* **sp. nov.**, *Pseudoaplysina minuta* **sp. nov**., *Heteroxya mediterranea* **sp. nov.** and *Calyx* cf. *tufa,* and the COI for *Paratimea massuti* **sp. nov**. We also provide a phylogenetic analysis to discern the systematic location of *Pseudoaplysina* **gen. nov.**, which, in accordance to morphological traits, is placed in the family Hymerhabdiidae. A brief biogeographical discussion is provided for all these species, with emphasis on the sponge singularity of SO, AM and the EB seamounts and the implications for its future protection.

Keywords: Biodiversity, Sponges, New genus, New species, New records, DNA barcoding, Seamounts, Mediterranean Sea.

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Introduction

Seamounts are habitats of high ecological and biological interest (*Rogers, 2018*), that harbor rich communities of filter-feeding animals like corals, crinoids or sponges (*Samadi et al., 2007*). Those animals tend to be favored by enhanced currents, scarcity of fine sediment, accidented topographies and predominance of hard substrata, features that tend to characterize Seamounts (*White & Mohn, 2004*). Sponges are ubiquitous in seamounts, where tend to form dense and diverse aggregations that provide habitat and refuge to other groups of species like crustaceans, mollusks and fishes (*Samadi et al., 2007*). Also, they are involved in bentho-pelagic coupling and recycling of nutrients, both processes of utmost importance in oligotrophic areas like the Mediterranean Sea, where they may contribute to the maintenance of higher trophic levels (*de Goeij et al., 2013*).

Despite its importance, very little is known about the sponge faunistic of the Mediterranean seamounts, a fact that is very significative when thinking on the vast number of studies on sponge taxonomy available in other domains like the continental shelf or the submarine canyons (e.g. *Vacelet, 1961, 1969; Pulitzer-Finali, 1978, 1983; Boury-Esnault, Pansini & Uriz, 1994*). Information of sponges is only available from the Erathostenes seamount in the Levantine Sea (*Galil & Zibrowius, 1998*), the Vercelli seamount in the northern Tyrrhenian Sea (*Bo et al., 2011*), the Ulisse and Penelope seamounts in the Ligurian Sea (*Bo et al., 2020*), the Avempace, Alboran Ridge, Seco de los Olivos and Cabliers seamounts in the Alboran Sea (*Boury-Esnault et al., 1994; Pardo et al., 2011; Sitjà & Maldonado, 2014; De la Torriente et al., 2018; Corbera et al., 2019*), and the Stone Sponge, Ses Olives, Ausias March and Emile Baudot seamounts in the Balearic Sea (*OCEANA, 2011; Aguilar et al., 2011; Maldonado et al., 2015*). However, most of ~~this~~ works study the sponges at a community level, focus~~ed~~ on a general habitat characterization. Nonetheless, those that deal with taxonomy have revealed that Mediterranean seamounts are habitats of rare, poorly known or new species. For example, *Aguilar et al., (2011)* reported the carnivorous sponge *Abestopluma lycopogea* the Ausia March seamount, representing the first ~~sight~~ of this species outside littoral caves. Latter, a singular reef formed by the Lithistid *Leiodermatium pfeifferae* (*Carter, 1873*) was ~~spotted~~ at the Stone Sponge seamount, being the first report of this species in the Mediterranean. Facts like the ecological role, extension or associated diversity of this reef remains poorly understood. In the Alboran Island, a large faunistic list of 87 sponge species was found, including three new species, four new reports for the Mediterranean and several new records for the area (*Sitjà & Maldonado, 2014*).

Knowing which species are present on a given seamount, and hence its biodiversity, is a first step towards the development of management plans to protect these habitats. It is also crucial to understand these ecosystems, their structure and dynamics and how they can be affected by human disturbances, as well as to monitor potential biological invasions and long-term community changes (*Clark et al., 2012; Danovaro et al., 2020*). In this regard, sponges are a problematic group as they are difficult to identify, a fact that may lead to incorrect or underestimated biodiversity values. Moreoever, the use of molecular markers, a powerful tool to help in sponge identification, has shown that this goup is much more specious than previously thought, being cryptic species very common *(Cárdenas et al., 2012)*. In this sense, generating a complete genetic database, supported by detailed morphological descriptions, is crucial for future works.

The objective of this work is to improve the taxonomic knowledge of the sponges at three seamounts of the Mallorca Channel in the Balearic Islands: Ses Olives, Ausias March and Emile Baudot. Currently, these seamounts are being assessed to be included within the Natura 2000 network, under the scope of LIFE IP INTEMARES project. One of the goals of this project is to improve the scientific knowledge of areas of ecological interest, harboring rich, vulnerable and protected habitats an~~s~~ species, necessary for the development of management plans. During several surveys carried out in 2018, 2019 and 2020 at these seamounts, it has been observed an elevated abundance and diversity of invertebrates, of which sponges highlights with sponges outstanding as the dominant group. In the present paper we provide detailed descriptions ~~for~~ 19 demosponges, including a new genus and four new species, together with new descriptions and records of poorly known taxa. For the new species, the sequences of two most used barcoding genes, the mitochondrial Cytochrome Oxidase subunit I (COI) and the nuclear 28S ribosomal fragment (C1-D2 domains), are also provided.

Material and Methods

Study area

The Mallorca Channel is located in the Balearic Promontory (western Mediterranean), between the islands of Mallorca and Ibiza (Fig. 1). The area harbors three seamounts: Ses Olives (SO) and Ausias March (AM) located east~~ern~~ Ibiza and Formentera islands~~, respectively~~, and Emile Baudot (EB) located ~~southern~~ Mallorca and east~~ern~~ Ibiza-Formentera. The seamounts SO, AM and EB are 375, 264 and 600 m high, respectively and 10 to 17 km long, with tabular summits elongated in NE-SW trends and located at 225-290, 86-115 and 94-150 m depth, respectively. SO and AM are of orogenic origin, emerging from depths around 900 and 600 m~~, respectively~~ in their eastern sides and being separated from Ibiza and Formentera islands by depths around 600 and 400 m~~, respectively~~. By contrast, EM is a guyot of volcanic origin, which in its western side emerges from a plain ~~of~~ around 900 m de~~pth~~, with numerous fields of pockmark~~s~~ type depressions, that connect~~s~~ to SO and AM. The eastern side of EM is connected to the abyssal plain of the Algerian sub-basin (between the Balearic Isands and the Algerian coast) and depths up to 2600 m through the so-called Emile Baudot scarpment (*Acosta et al., 2004*).

The hydrodynamics of the Algerian sub-basin is mainly affected by density gradients and receives warm and less saline Atlantic waters (*Pinot et al., 2002*). These surface waters have high seasonal temperature variation, ranging from 13 °C during winter to 26 °C during summer, when a strong vertical temperature gradient is established between 50 and 100 m depth. The water column below this depth shows less variation than in other parts of the western Mediterranean, being mainly influenced by the Levantine Intermediate Water (LIW). This water mass, originated in the eastern Mediterranean, has temperature and salinity around 13.3°C and 38.5, respectively, and ~~it~~ is situated approximately between 200 and 700 m depth, just above the Western Mediterranean Deep Water, which is located in the lowest part of the water column [illegible]e western Mediterranean Intermediate Water, characterized by ~~minimum~~ temperature (~12.5º C) because it is formed during winter in the Gulf of Lions by deep convection when sea-air heat flux losses are high enough, is found at 100-300 m depth, but does not reach the Mallorca Channel every year (*Monserrat et al., 2008*).

Within the general oligotrophy of the Mediterranean, the waters southern Balearic Islands, in the Algerian sub-basin, show more pronounced oligotrophy than waters northwards the Archipelago, in the Balearic sub-basin, above all than the adjacent waters off the Iberian Peninsula and the Gulf of Lions (*Estrada, 1996; Bosc et al., 2004*). The lack of supply of nutrients from land runoff and the lower influence of shelf/slope fronts flowing along the Iberian Peninsula and northern insular shelf edge could explain these differences (*Massutí et al., 2014;* and references cited therein).

Sampling

Sponge samples were collected at SO, AM and EB seamounts with a Jennings type beam trawl (BT) of 2 and 0.5 m horizontal and vertical openings, respectively, and a 5 mm mesh size cod-end, a rock dredge (RD) and the Remote Operated Vehicle (ROV) Liropus 2000 equiped with an extensible arm, during INTEMARES research surveys carried out in 2018, 2019 and 2020 on board of the R/Vs *Angeles Alvariño* and *Sarmiento de Gamboa* (Fig. 1). Additional samples from trawl fishing grounds of the continental shelf off Mallorca and Menorca were collected during the MEDITS research surveys carried out in 2017, 2019 and 2020 using the bottom trawl net GOC-73 of 2.5-3 and 18-22 m vertical and horizontal openings, respectively and a 10 mm mesh size cod-end, on board the R/V *Miquel Oliver* (Fig. 1). The sampling strategy of MEDITS surveys is detailed in *Bertrand et al. (2002)* and *Spedicato et al. (2019).* BT and GOC-73 have been shown eff~~icient~~ for sampling macro-benthic species of the epi-benthic and necto-benthic communities of sedimentary bottoms~~,~~ respectively (*Reiss et al., 2006; Fiorentini et al., 1999; Ordines & Massutí, 2009*). The SCANMAR and MARPORT systems were used to control the arrival and departure of both gears to the bottom. By contrast, RD and ROV ~~are~~ used for sampling rocky bottoms and steep slopes. A summary of sampling stations used in the present work can be found in Table 1.

On board, specimens were photographed and stored in absolute EtOH. External morphology, colour and texture were annotated, prior to ~~samples~~ conservation. Spicule~~s~~ preparations and histological sections were made according to the standard methods described by *Hooper (2003)*. The ~~individuals~~ were deposited in the Marine Fauna Collection (http://www.ma.ieo.es/cfm/) based at the Centro Oceanográfico de Málaga (Instituto Español de Oceanografía), with the ~~identification~~ numbers CFM7356–CFM7415.

The electronic version of this article in Portable Document Format (PDF) will represent a published work according to the International Commission on Zoological Nomenclature (ICZN), and hence the new names contained in the electronic version are effectively published under that Code from the electronic edition alone. This published work and the nomenclatural acts it contains have been registered in ZooBank, the online registration system for the ICZN. The ZooBank LSIDs (Life Science Identifiers) can be resolved and the associated information viewed through any standard web browser by appending the LSID to the prefix http://zoobank.org/. The LSID for this publication is: [urn:lsid:zoobank.org:pub:47EC2384-A88C-4654-8425-A7A46BC47AC5]. The online version of this work is archived and available from the following digital repositories: PeerJ, PubMed Central and CLOCKSS.

Morphological descriptions

Spicules were observed with a Nikon S-Ke optical microscope and photographed with a CMOS digital camera. Images were processed with the Fiji software (*Schindelin et al., 2012*). When possible, at least 30 spicules per ~~spicule class~~ or category were counted. Tangential-surface and transversal-surface [illegible]ck sections were made with a scalpel and, when necessary, dehydrated with alcohol, included in DPX and observed ~~with~~ microscope. Aliquots of suspended spicules were transferred onto aluminium foil, air dried, sputter coated with gold and observed under a HITACHI S-3400N scanning electron microscope (SEM).

Molecular analysis

DNA was extracted from a piece of choanosomal tissue (~2 cm^3) using the DNeasy Blood and Tissue Extraction kit (QIAGEN). Polymerase chain reaction (PCR) was used to amplify the Cytochrome C Oxidase subunit I (COI; DNA barcoding) and the C1-D2 domains of the 28S ribosomal gen, with the universal primers LCO1490/HCO2198 (*Folmer et al., 1994*) and C1' ASTR/D2 (*Vân Le et al., 1993; Chombard et al., 1998*), respectively. PCR was performed in 50 µl volume reaction (34.4 µl ddH20, 5 µl Mangobuffer, 2 µl DNTPs, 3.5 MgCl$_2$, 1 µl of each primer, 1 µl BSA, 0.1 µl TAQ and 2 µl DNA). The PCR thermal profile for the applied for COI amplification was [94°C / 5 min; 37 cycles (94°C / 15 s, 46°C / 15 s, 72°C / 15 s); 72°C / 7 min], while for 28S amplification was carried out as detailed in *Chombard et al., (1998).* PCR products were visualized with 1% agarose gel, purified using the QIAquickR PCR Purification Kit (QIAGEN) and sequenced at Macrogen Inc. (South Korea).

Sequences were imported into BioEdit 7.0.5.2. (*Hall, 1999*) and checked for quality and accuracy with nucleotide base assignment. Sequences were aligned with Mafft (*Katoh et al., 2002*). The resulting sequences were deposited in the GenBank database (http://www.ncbi.nlm.nih.gov/genbank/) under the following accession numbers: MW858346-MW858351 for COI sequences and MW881149-MW881153 for 28S sequences; Table S1).

To assess the phylogeny of *Pseudoaplysina balearica* **sp nov.** and *Pseudoaplysina minuta* **sp. nov.,** two different approaches were used: Bayesian Inference (BI) and Maximum likelihood (ML). To do that, we selected closely related sequences belonging to the orders Agelasida, Axinellida, Scopalinida and Biemnida, obtained after the BLAST search (*Altschul et al., 1990*). Adit~~t~~ionally, two sequences belonging to the order Suberitida were used as outgroup. A complete list of the used sequences is available at Table S1. BI and ML analyses were performed with the CIPRES science gateway platform (http://www.phylo.org; *Miller et al., 2010*) using Mr Bayes version 3.6.2 (*Ronquist et al., 2012*) and RAXML (*Stamatakis, 2014*). For Mr Bayes, we conducted four independent Markov chain Monte Carlo runs of four chains each, with 5 million generations, sampling every 1000th tree and discarding the first 25% as burn-in, while RAXML was performed under the GTRCAT model with 1000 bootstrap iterations. Convergence was assessed by effective sample size (ESS) calculation and was visualised using TRACER version 1.5. Genetic distance (p-distance) and number of base differences between pair of DNA sequences were estimated with MEGA version 10.0.5 software *(Kumar et al., 2018)*.

Results

A total of 60 specimens belonging to 2 classes, 9 orders, 13 families, 15 gen~~us~~ and 19 species have been analysed. All these species were found at the Mallorca Channel seamounts, while three of them (*Phakellia robusta*, *Petrosia (~~p~~etrosia) raphida* and *Hemiasterella elongata*) were also found at the continental shelf around Mallorca and Menorca. In situ images of some of these sponges, obtained with ROV from the seamounts of the Mallorca Channel, are shown in Figure 2.

Systematics

Phylum PORIFERA *Grant, 1836*

Class DEMOSPONGIAE *Sollas, 1885*

Suborder HETEROSCLEROMORPHA *Cárdenas, Pérez & Boury-Esnault, 2012*

Order AGELASIDA *Hartman, 1980*

Family HYMERHABDIIDAE *Morrow, Picton, Erpenbeck, Boury-Esnault, Maggs & Allcock, 2012*

Genus *Pseudoaplysina* gen. nov.

(Figs. 2B, 2F, 2H; Fig. 3; Fig. 4, Fig. 5, Fig. 6; Table 2)

Type species

Pseudoaplysina balearica **sp. nov.**

Diagnosis

Hymerhabdiidae massive, massive-tubular or bushy, with styles, subtylostyles, tylostyles and rhabdostyles. May have curved or angulated oxeas. Ectosome with an aspicular dermal membrane supported by a ~~tangential~~ plumoreticulated skeleton. Inhalant pores grouped in areas. Choanosome confusedly plumoreticulated. ~~Two species.~~

Etymology

From the Latin *Pseudo* (false) and *Aplysina* (sponge genus). The name refers to the external similarity between the type species and sponges of the genus *Aplysina*.

Pseudoaplysina balearica sp. nov.

(Figs. 2B, 2F, 2H; Fig. 3; Fig. 4; Fig. 6; Table 2)

Diagnosis

Massive-tubular to bushy *Pseudoaplysina*, with styles, rhabdostyles and oxeas.

Etymology

The name refers to the Balearic Islands, the area where the species has been collected.

Material examined

Holotype: CFM-IEOMA-7356/i802, St 37, AM, ROV.

Paratypes: CFM-IEOMA-7357/i144, St 4, EB, BT; CFM-IEOMA-7358/i293_1, St 9, AM, BT; CFM-IEOMA-7359/i239 (not described), St 8, AM, BT; CFM-IEOMA-7360/i745 (not described), St 26, EB, BT; CFM-IEOMA-7361/i824_4, St 39, EB, ROV.

Specimens reporte t not sampled: St 12, EB, BT; St 14, EB, BT.

Comparative material

Pseudoaplysina minuta **sp. nov.**: CFM-IEOMA-7362/i439, St 27, RD, SO; CFM-IEOMA-7363/i474, St 29, SO, RD.

Rhabderemia sp.: CFM-IEOMA-7415/i729_1 (only a slide deposited at the CFM-IEOMA), St 35, EB, RD.

Description

Massive-tubular or bushy sponges (Figs. 2B, 2F, 2H and Fig. 3A). Largest specimens up to 6 cm in diameter. When present, chimneys e 2-3 cm in height and 1 cm in diameter. Sometimes several chimneys are fused ugh one of its sides. Consistency slightly spongy, ttle, easily broken when manipulated. Surface smooth, rough to the touch. Color in life golden yellow, tan after preservation in EtOH. Translucid membrane sent, more evident near the oscula (Fig. 3A1). Subdermal grooves forming a visible pattern (Fig. 3A2). Circular oscula 0.3-0.6 cm. Most of the times oscula are placed at the end of chimneys, however, the holotype also has a large osculum in the main body (Fig. 3A1).

Spicules

Styles (Fig. 3B-3D): Fusiform, most gently curved, but sometimes abruptly curved once or twice. When the curvature is ~~at~~ the last portion of the spic, they may resemble rhabdostyles. ~~Heads r~~oundish and sharp tips, sometimes telescoped, strongylot~~a modifications~~ present. Swellings are common at the head or below, sometimes barely visible, sometimes more patent, rarely tuberculated lyaxonal modifications present but uncommon. Size range constant between ~~individuals~~, not influenced by depth nor area (Table 2). Overall measuring 177-634/3-14 µm.

Rhabdostyles (Fig. 3E): Uncommon. Abruptly curved below the head. Stylot~~a~~, subtylot~~a~~ and tylot~~a~~ modifications present. Head curved and tips acerated. erall measuring 90-179/3-7 µm. However, in the holotype and some other individuals they may sporadically be up to 220/8 µm.

Oxeas (Fig. 3F): ~~They abundance varies between individuals~~. Curved or ~~angulated~~, with one, two or several curvatures, sometimes slightly sinuous. Tips acerated or telescoped. Overall measuring 249-763/3-13 µm.

Skeleton

Cavernous choanosome, confusedly plumoreticulated, with ascending spicule ~~tracks~~ of 2-5 st~~yles,~~ sometimes protruding the surface~~, sometimes becoming tangential beneath the dermal.~~ The ~~tracks are supported by~~ abundant spongin. In between the trac~~ks, three-dimensional reticulation of single styles membrane~~ (Figs. 4A-4C).

Ectosome characterized by a dermal membrane without spicules (Figs. 4D and 4E). In some areas of the dermal membrane there are small pores gathered~~, with subdermal holes below~~. These por~~al~~ areas correspond to the grooves that are perceptible to the eye. ~~Beneath the dermal membrane, there is a reticulate tangential skeleton, less confused than at the choanosome.~~

Genetics

Two *COI* Folmer fragment sequences were obtained for the Holotype (CFM-IEOMA-7356/i802) and for one paratype (CFM-IEOMA-7358/i293_1) (Genbank id's MW858346 and MW858347, respectively). Besides, we obtained a *28S* sequence (C1-D2 domains) for the Holotype (Genbank id MW881153).

Ecological notes

The species is very abundant on ~~mesophotic depths of~~ the EB and AM, between 100 and 169 m (Table 2). It can be mainly found on rhodolith beds and sedimentary bottoms with gravel, together with other sponges like *Poecillastra compressa*, *Axinella* spp., *Halichondria* spp. or some Haplosclerids, as well as with a very broad number of crustaceans and echinoderms. It has also been collected down to 470 m (St 14), although its presence at this depth is merely anecdotic.

***Pseudoaplysina minuta* sp. nov.**

(Fig. 5; Table 2)

Diagnosis

Small, massive-encrusting ~~and greyish~~ *Pseudoaplysina*, with styles and rhabdostyles as only spicules.

Etymology

The name refers to the small size of the two collected specimens.

Material examined

Holotype: CFM-IEOMA-7362/i439, St 27, SO, RD.

Paratype: CFM-IEOMA-7363/i474, St 29, SO, RD.

Comparative material

Pseudoaplysina balearica **sp. nov.**: CFM-IEOMA-7357/i144, St 4, EB, BT; CFM-IEOMA-7358/i293_1, St 9, AM, BT; CFM-IEOMA-7356/i802, St 37, AM, ROV; CFM-IEOMA-7361/i824_4, St 39, EB, ROV.

Rhabderemia sp.: CFM-IEOMA-7415/ i729_1, St 35, EB, RD.

Description

Small massive encrusting sponge (Figs. 5A and 5B), about 1.5 cm in diameter and 0.5 cm in ~~high~~. Consistency ~~spongy,~~ compressible and slightly crumby. Surface velvety. The holotype was brownish due to mud, the paratype was greyish, both in life and after preservation in EtOH. A translucid membrane that can be peeled off is present, with subdermal grooves forming a distinguishable pattern (Fig. 5B). A single, circular osculum is present on the holotype, measuring about 0.3 cm in diameter.

Spicules

Styles (Figs. 5C and 5D): Fusiform, gently curved or straight. Heads roundish ~~and~~ sharp tips. ~~Most are tylota.~~ Size range variable between the holotype and the paratype (Table 2). Overall measuring 244-658/9-21 µm.

Rhabdostyles (Fig. 5E-5F): Uncommon. Abruptly curved below the head~~, most with roundish, tylota modifications at the head and~~ acerated tips. Some countoured. Overall measuring 147-262/7-9 µm.

Skeleton

The ectosome consist of a dermal membrane supported ~~by~~ a tangential ~~plumo~~reticulation of styles (Figs. 5G and 5H)~~, with~~ some loose rhabdostyle.

The choanosome is a plumoreticulated net of styles.

Genetics

Sequences of the *COI* Folmer fragment and *28S* C1-D2 domains were obtained for the holotype and deposited at the Genbank under the accession numbers MW858348 and MW881151, respectively.

Ecological notes

Both specimens were found at SO, between 288 and 318 m depth, associated to hard bottoms with fossil ostreid~~s~~ reefs.

Remarks on *P. balearica* sp. nov. and *P. minuta* sp. nov.

The external morphology of *P. balearica* **sp. nov.** may remind some *Axinella* spp., although it is distinguished from the species of that genus by the fragility of its body, the presence of a subdermal tangential network of spicules and a dermal membrane. Regarding the ~~interspecific~~

variability of *P. balearica* **sp. nov.**, the spicules of the studied specimens are ~~very similar~~ in the size range erestingly, the styles of the specimen from AM (CFM-IEOMA-7358/i293_1) are shorter and thinner than those of the specimens from EB. Also, this specimen much more abundant oxeas than the others.

Regarding *P. minuta* **sp. nov.**, the species supports the differential diagnostic characters of the genus *Pseudoaplysina* (plumoreticulated choanosomal ~~and ectosomal~~ leton~~s~~, dermal aspicular membrane with poral areas, ~~mixed~~ presence of large styles and small rhabdostyles), but differs ~~with~~ *P. balearica* **sp. nov.** in its external morphology, being much smaller and massive encrusting against massive-tubular or bushy and of a greyish colour instead o~~r~~ golden yellow. Also, the spicular ~~set~~ is different~~, yet~~ *P. minuta* **sp. nov.** lacks oxeas and ha~~ve~~ longer and thicker styles and rhabdostyles. The differences in the size of the styles between the holotype and the paratype are notable, considering that both were collected at similar depths and habitats. It could suggest intraspecific variability for the spicule size in the species, but more ~~individuals~~ are needed to corroborate this.

The morphological differences between ~~both~~ species are strongly supported by the genetic results. The phylogenetic reconstructions for the COI and 28S fragments show well-supported separation between the two *P. balearica* **sp. nov.** sequences and the *P. minuta* **sp. nov.** sequence. On the other hand, the pb differences and the p-distance (in percentage) between ~~both~~ species for the *COI* Folmer and the *28S* fragments were 1bp/0.2% and 1bp/0.1%, respectively.

Remarks on genus *Pseudoaplysina*

The family Hymerhabdiidae was recently erected nclude the gen~~us~~ *Hymerhabdia*, *Prosuberites* and some species of the polyphyletic genus *Axinella* and *Stylissa*. Here, we propose *Pseudoaplysina* as a new Hymerhabdid genus. Main differences between *Pseudoaplysina* **gen nov.** and both *Hymerhabdia* and *Prosuberites* are the growing habit, being *Pseudoaplysina* **gen. nov.** massive, massive-tubular or bushy against encrusting. Also, it differs ~~with~~ *Pros rites* in the presence of rhabdostyles and oxeas, a fact, however, shared with *Hymerhabdia*. ~~Notwithstanding this,~~ the genetic differentiation between *Pseudoaplysina* and *H. typica* (type species of *Hymerhabdia*) is clear (Fig. 6). In addition, the ectosome with a dermal membrane and grouped pora~~l~~ areas of *Pseudoaplysina* is not present in any *Hymerhabdia*~~. Only~~ *Hymerhabdia oxeata* (*Dendy, 1924*) ~~was described as having~~ a dermal membrane, although nor Dendy nor the re-examination done by *Hooper & Van Soest (1993)* described pora~~l~~ areas. Therefore, *H. oxeata* could represent an intermedium stage between genuine *Hymerhabdia* and *Pseudoaplysina* species.

As stated before, there are also species of *Axinella* and *Stylissa* that group inside Hymerhabdiidae. Altought currently all these species are kept in Axinellida and Suberitida, respectively (*Van Soest et al., 2021*), they are phylogenetically related to *Pseudoaplysina* (see Fig. 6). To elucidate this relativeness, we have included in the phylogenetic analysis sequences of *A. damicornis*, *A. verrucosa*, *A. corrugata*, *S. carteri* and *S. massa* used by *Morrow et al. (2012)* to define Hymerhabdiidae. The resulting trees show that those species are clearly different ~~with~~ *Pseudoaplysina,* a fact that is also corroborated by morphology (*Pansini, 1984; Hooper & Van Soest, 2002*).

Phylogenetic analyses included representatives of Biemnida since species of its monogeneric family Rhabderemiidae resembles *Pseudoaplysina* in having rahbdostyles and possessing a plumoreticulated choanosomal skeleton. However, most ~~of the Rhabderemids~~ also have peculiar rugose microscleres (thraustoxeas, spirosigmata, thraustosigmata, microstyles). We have included in the *COI* tree one sequence of an encrusting *Rhabderemia* sp. (CFM-IEOMA-7415/ i729_1; Genbank ID MW881152) collected at the EB, with spined rhabdostyles, toxas and spirosigmata (Fig. 6B). The sequence clustered together with *R. sorokinae Hooper, 1990* a Great Barrier Reef sponge which also has spined rhabdostyles, toxas and spirosigmata, in addition to microspined microstyles, a fact that confirm that archetypical Rhabderemids are not related to *Pseudoaplysina*. However, microscleres are lacking in *Rhabderemia mona* (*de Laubenfels, 1934*) and *Rhabderemia destituta Van Soest & Hooper, 1993*. The first is a Caribbean sponge described from bathyal depths of Puerto Rico, used to erect the genus *Stylospira* for "sponges having no spicules other than peculiar spirally twisted styles" (*de Laubenfels, 1934*). Its single specimen was later studied by *Van Soest & Hooper (1993)* on a revision of the genus, concluding that *Stylospira* should be considered a subgenus of *Rhabderemia*. ~~They~~ also described *R. destituta* from the Galapagos Islands, a second species matching de Laubenfel's diagnosis. Interestingly, apart from the lack of any kind of microscleres (even though de Laubenfels reported raphides for *R. mona*, not found by *Van Soest & Hooper, 1993*), both species had smooth rhabdostyles, just as *Pseudoaplysina*, but contrarily to most of the other *Rhabderemia* spp. ~~For~~ the 30 known species, only *R. stellata* (Bergquist, 1961), *R. spirophora* (*Burton, 1931*), *R. gallica* (*Van Soest & Hooper, 1993*), *R. profunda* (*Boury-Esnault, Pansini & Uriz, 1994*), *R. africana Van Soest & Hooper, 1993*, *R. prolifera Annandale, 1915* and *R. meirimensis Cedro, Hajdu & Correira, 2013* have smooth rhabdostyles. Unfortunately, there are no sequences available for *R. mona* nor *R. destituta*, so ~~its~~ potential relativeness with *Pseudoaplysina* cannot be addressed. However, it should be noted that both species have only rhabstosytles as megascleres, against the heterogenous set of megascleres ~~for~~ *Pseudoaplysina* (styles, tylostyles, subtylostyles, rhabdostyles and oxeas). This seems a strong argument against the congeneric relativeness with *Pseudoaplysina*. However, it should be properly addressed in the future when sequences of *R. mona* and *R. destituta* are available.

Order AXINELLIDA *Lévi, 1953*

Family AXINELLIDAE *Carter, 1875*

Genus *Axinella Schmidt, 1862*

Axinella spatula Sitja Maldonado, 2014

(Fig. 7; Table 3)

Material examined

CFM-IEOMA-7364/i338_1A, CFM-IEOMA-7365/i338_1B and CFM-IEOMA-7366/i338_1C, St 11, EB, BT.

Description

Small, erect, cylindrical and slightly flattened sponges, up to 3 cm ~~height~~ and 2-3 mm ~~width~~ (Figs. 7A and 7B). Very hispid all along the body. Orange in life (Fig. 7A) and orange beige after preservation in EtOH (Fig. 7B).

Spicules

Megascleres

Styles (Figs. 7C-7E): With a wide size range, ~~and~~ rounded end and sharp tips. Straight or slightly curved. Largest ones may be slightly sinuous, sometimes with subterminal swellings (Fig. 7C1). Rhabdostyle modifications are present in small and intermedium stages (Fig. 7E). Overall measuring 248-1304/4-17 µm.

Oxeas: ~~Most c~~urved (Figs. 7F-~~7~~J), with the curvature point at the center or displaced towards one of the ~~sites. Curvature may be abrupt or circular~~. Tips acerated. ~~Some centrotylote swellings present.~~ Overall measuring 187-507/5-16 µm.

Microscleres

Raphides in trichodragmata (Fig. 7K), ~~being~~ abundant and of same morphology in all specimens. Overall measuring 32-56/5-11 µm.

Skeleton

As in *Sitjà & Maldonado (2014)*.

Ecology notes

Found only once north-eastern EB, at 152 m depth, on gravel bottoms with dead rhodolits and with large abundance of sponges such as *Petrosia ficiformis*, *P. raphida*, *P. vansoesti* and several Tetractinelida.

Remarks

The specimens match well with ~~the~~ original descri~~ption~~ from the Alboran Sea. Balearic specimens are smaller and the size range of its ~~styles~~ and oxeas is not as wide as in Alboran specimens. Also, our trichodragmata were always longer (Table 3).

Sitjà & Maldonado (2014) described two phenotypes, according to the color acquired after preservation in EtOH (black or beige). Also, they found skeletal variations linked to each group, corresponding to a higher or lower presence of short styles, the morphology of the trichodragmata or the skeletal arrangement. Regarding this, the specimens collected here correspond only to the beige phenotype.

With the present record, the species distribution widens towards the northwestern Mediterranean, since previously it was known only for the type locality, at the Alboran Island (*Sitjà & Maldonado, 2014*).

Phakellia robusta Bowerbank, 1866

(Fig. 8 and 9; Table 4)

Synonymised names.

Phacellia robusta (*Bowerbank, 1866*) (misspelling of genus name)

Material examined

CFM-IEOMA-7367/i347_2, St 12, EB, BT; CFM-IEOMA-7368/i405 and CFM-IEOMA-7369/i409, St 15, EB, BT; CFM-IEOMA-7370/i414_2, St 16, EB, BT; CFM-IEOMA-7371/i417, St 17, EB, BT; CFM-IEOMA-7372/i712, St 25, EB, BT; CFM-IEOMA-7373/i731, St 35, EB, RD; CFM-IEOMA-7374/POR760, St 20, south-western Cabrera Archipelago, GOC-73; CFM-IEOMA-7375/POR762, St 21, south-western Cabrera Archipelago, GOC-73.

Description

Fan-shaped sponges supported by a peduncle (Fig. 8A). Corporal lamina only exceptionally fused. Large variability in size, being some specimens 1.5-2 cm in diameter, while others exceed 30 cm. ~~Width~~ of the lamina between 0.1 and 0.5 cm, being the larger the individual, the thicker the lamina. Hard consistency, slightly velvety to the touch. Hispidation present at the end of the lamina~~.~~ In some ~~individuals, hispidation~~ is also present all over the lamina. Small circular pores scattered along the body. Color greyish in life, becoming more whitish after preservation in EtOH.

Spicules

Monactinal spicules (Figs. 8B-8E), straight to slightly curved. In some individuals, large monactinal spicules may be abruptly ben~~d~~ near ~~its~~ tip~~, even sinuous~~. Head termination stylota in larger (Figs 8B and 8C) and oxeota in smaller ones (Figs. 8D and 8E). Usually, spics shorter than 300 µm are anisoxeas and those larger than 500 µm are styles, ~~being~~ the intermedium ~~ranges~~ (300-500 µm) ~~of a transition forms (~~styloxeas~~). When the termination~~ is ~~oxeota~~ tips are steppe~~d~~. Size variable between individuals, ranging between 88-1311 and 2-23 µm (Table 3).

Robust vermiform spicules (Figs. 8F and 8G), presenting strongy lota and oxeota variations, although of same size, with stepped tips representing intermedium stages between both types. Size variable between individuals, overall measuring 310-1486 and 4-27 µm (Table 3).

Skeleton

Plumoreticulated.

Ecology notes

The species was frequent at the studied area, being found in a broad depth range (150-750 m; Table 4) on both rocky and sedimentary bottoms. In the trawl fishing grounds of the continental shelf around Mallorca and Menorca it has been mostly found below 300 m depth, where most of the collected specimens were larger. In the seamounts of the Mallorca Channel, the species was common on gravel bottoms between 150-170 m depth, where individuals tended to be very small

(1.5-3 cm in height) and in rocky outcrops and vertical walls, where sizes were intermedium (4-12 cm in height) and large (20-35 cm in height).

Remarks

Although widely reported, some taxonomic facts of the species remain little known. It is notorious the large intraspecific variability in characters like spicule size, gross morphology and habitat. Regarding the spicule size, we have observed a tendency towards increasing the width (but not the length) of both monactinal and vermiform spicules ~~in individuals growing~~ at greater depths. We have divided the spicules in two categories, diactinal ~~(vermiform)~~ and monactinal forms, being the former vermiform and the second straight or curved. According to our results, in this species the classic division of monoactinal spicules in oxeas and styles is artificial, since both correspond to different grow~~ing~~ stages of the same type of spicule. This is clear when many spicules are studied~~, yet~~ size distribution shows a continuous size range between small oxeas and large styles, with intermediary stages (styloxeas) in between (Fig. 9). This pattern is present in all the studied specimens, regardless the habitat, depth or external morphology, and it probably has a ~~systematic~~ significance (see remarks on *Phakellia ventilabrum* and *Phakellia hirondellei*)

Macroscopic morphology also seems related to the depth, because small individuals have not been collected below 200 m. However, it could be more related to the habitat, yet small individuals are common on gravel bottoms, mostly found between 150-170 m depth. These bottoms are likely a dynamic substrate, affected by currents or animal grazing, thus being inappropriate to support larger specimens, as suggested by *Santin et al. (2019)* in a study relating the growth pattern of sessile invertebrates with the substrate.

The species is reported for the first time in the Mallorca Channel, being its second record at the Balearic Islands, where it had been previously recorded by *Santin et al. (2018)* from the Menorca Channel. In the Mediterranean, it is also known from the Gulf of Lions (*Vacelet, 1969*), the Tyrrhenian Sea (*Topsent, 1925*), the Alboran Sea (*Maldonado, 1992*), the Strait of Sicily (*Calcinai et al., 2013*) and the Adriatic Sea (*D'Onghia et al., 2015*). Besides, the species has been reported from several localities of the North Atlantic, like Gulf of Cadiz (*Sitja et al., 2019*), Azores (*Topsent, 1904*), Cantabrian Sea (*Ferrer-Hernández, 1914*) and the North Sea (*Bowerbank, 1866*).

Phakellia ventilabrum (Linnaeus, 1767)

(Figs. 9 and 10; Table 4)

Synonymised names

Halichondria ventilabrum (*Linnaeus, 1767*)

Phacellia ventilabrum (misspelling of genus name)

Phakellia ventilabra (ruling of ICZN)

Spongia strigose Pallas, 1766 (genus transfer & junior synonym)

Spongia venosa Lamarck, 1814 (genus transfer & junior synonym)

Spongia ventilabra *Linnaeus, 1767* (genus transfer & incorrect spelling)

Spongia ventilabrum *Linnaeus, 1767* (genus transfer)

Material examined

CFM-IEOMA-7376/i822_1, St 39, EB, ROV.

Description

Vasiform sponge, 11 x 7 (maximum diameter) x 0.1 cm (Fig. 10A). Flexible consistency, harder on the basis ~~and slightly velvety to the touch~~. Surface microhispid. No veins visible to the naked eye. Small circular pores aligned all over the body. Brownish in life, dirty grey after preservation in EtOH.

Spicules

Monactinal (Figs. 10B-10E): Curved one or more times, some sinuous. Head termination stylot~~a~~ and styloxeot~~a~~ in large (>500 µm; Figs. 10B and 10B1, 10C and 10C1), and oxeota in small spics (>300 µm; Figs. 10D and 10D1, 10E and 10E1). Intermedium stages (300-500 µm) are mostly styloxeot~~a~~. When the termination is oxeot~~a~~, tips are stepped. Measuring 183-435-820/4-7-10 µm.

Vermiform (Figs. 10F and 10G): With oxeot~~a~~ endings, sharp~~ed~~ or occasionally strongylot~~a~~, 447-633-935/4-8-13 µm.

Skeleton

Plumoreticulate.

Ecology notes

The single specimen was collected on a rodolith bed in the summit of the EB at 132 m depth (Fig. 2C)~~,~~ where according to preliminary analysis of ROV videos, it seems to be a rare species.

Remarks

Most of the vermiform spicules of the specimen described above ~~are~~ clearly oxeot~~a~~, with sharp and well-developed tips. This contrasts with the previous reports ~~of~~ specimens~~,~~ having only strongyles as vermiform spicules. This has been used as a diagnostic character to differentiate between non-vasiform individuals of *P. ventilabrum* and individuals of *P. robusta*, act that can no longer be sustained. However, it seems that the heads of monactinal spicules may be a useful character to differentiate between these two sister species. As pointed above, in *Phakellia* spp. there are growth modifications of the head in form of oxeot~~a~~ or stylot~~a~~ modifications. For the studied ~~individual~~ of *P. ventilabrum*, long monactinal spicules are both oxeot~~a~~ and stylot~~a~~ (Figs. 10B and 10B1, 10C and 10C1) while small are always oxeot~~a~~ (Figs. 10D and 10D1, Figs. 10E and 10E1), on a similar fashion that *P. robusta*. However, intermedium styloxeot~~a~~ stages are the predominant modification, a fact that contrasts with *P. robusta*, in which intermedium styloxeot~~a~~ forms are rare.

The morphology of the monactinal spicules in *P. ventilabrum* suggests a continuous growth at the head. Probably, a sharp (oxeot~~a~~) head is first developed, subsequently covered ~~with~~ silica and becoming roundish (stylota). Subsequently, more silica is precipitated creating a new tip. That may explain the high percentage of intermedium styloxeot~~a~~ forms (Fig. 9). In contrast, for *P. robusta*, growth of large spicules may be limited to the terminal part of the spicule, which is sharp, but not of the head, that is rounded.

This is the first report of the species at the Balearic Islands. The species has been widely reported from the North Atlantic (e.g. *Alvarez & Hooper, 2002*), being doubtful off Greenland (*Lundbeck, 1909; Hentschel, 1929*) and Canada (*Lambe, 1900*). In the Mediterranean, it is known off northern Iberian Peninsula (*Uriz, 1984*), in the Alboran Sea (*Maldonado, 1992*) and Corsica (*Vacelet, 1961*).

***Phakellia hirondellei* Topsent, 1890**

(Figs. 9 and 11; Table 4)

Synonymised names

Axinella hirondellei Topsent, 1890 (reverted genus transfer)

Phakellia robusta var. Hirondellei (*Topsent, 1890*) (status change)

Tragosia hirondellei (*Topsent, 1890*) (reverted genus transfer)

Material examined

CFM-IEOMA-7377/i353, St 13, EB, BT; CFM-IEOMA-7378/i623, St 33, AM, RD.

Description

Fan-shaped sponges (Fig. 11A)~~, being t~~he two collected samples broken fragments of larger ~~individuals~~. Largest fragment (i623) measures up to 10 cm in diameter and 1-2 mm in width of the lamina. Hard but friable consistency. Two differentiated faces, one is soft while the other is velvety or rugose. Subdermal veins 0.5 mm wid~~th~~, only visible when the rugose face is watched backlight or at abrased areas. Hispidation present at the end of the lamina and at the broken parts. Small circular pores scattered along the body, 0.5 mm in diameter. Color whitish beige in life, whitish after preservation in EtOH.

Spicules

Monactinal (Figs. 11B-D): Straight or gently curved at ~~its~~ upper side. Larger ones may also be centrocurved [illegible]ead termination stylot~~a~~, styloxeot~~a~~ and oxeot~~a~~ in larger (>700 µm), intermedium (500-700 µm) and small (<500 µm) spicules. However, intermedium and large spicules are more commonly oxeota, ~~while~~ very rarely stylot~~a~~ (Fig. 9). Overall measuring 328-1454/6-26 µm.

Vermiform (Figs. 11E and 11E1): Robust, in most of the cases curvatures are gently, not pronounced, with oxeot~~a~~ or strongylot~~a~~ tips. Different sizes between ~~individuals~~, measuring 1110-2341/14-28 µm (Table 4).

Skeleton

The skeleton is composed by two kind of spicule tracks: primary tracks running parallel to the surface, about 300-500 µm in width, and, perpendicular to those, secondary tracks drawing more or less regular meshes, 100-250 µm in width. The meshes draw circular spaces between the tracks, that constitute the orifices visible with the naked eye (Fig. 11F). These orifices are cemented by spongin, that leads to openings towards the exterior.

Ecology notes

The species was found at two stations of similar depth (135-147 m) in AM and EB. Both stations are located at the border of the summit, an area that may be affected by enhanced water current and so an increase of nutrient and food supply (*Samadi et al., 2007; Rogers, 2018*). This could explain the common presence of large erect sponges such as *Poecillastra compressa* (*Bowerbank,* 1866) on stations located at these areas (personal observations).

Remarks

Our observations are in accordance with previous descriptions for the species: large sponges, with equal ~~corporal~~ sides, lacking large veins and with robust and ~~little~~ flexuous vermiform spicules. It may be easily confused with larger specimens of *P. robusta,* although the la~~st~~ has always well distinguishable veins, well-differentiated body sides and smaller, more flexuous vermiform spicules. The head of the monactinal spicules also seems to be a valuable character~~,~~ ~~yet~~ most (but not all) of the large spicules are oxeot~~a~~ and small spicu~~l~~les stylot~~a~~, a fact that is the opposite than in *P. robusta*, whose large spicules tend to be stylot~~a~~ and small oxeot~~a~~ (Fig. 9). In the same way, it differs ~~with~~ the pattern of *P. ventilabrum,* which also has ~~the fact of having~~ intermedium styloxeot~~a~~ stages as the most common spicule modification (Fig. 9).

However, considering the skeletal architecture of the sponge, it is not clear if this is a true *Phakellia*, nor even an Axinellid. Conversely, the fact of having a reticulated skeleton instead of plumoreticulated, the friable consistency, the lack of large veins and the possession of equal body faces, non-polarizated into inhalant and exhalant sides are unusual characters in this group. It is likely that this would fix better as a fan shaped *Topsentia,* a sponge genus commonly found at deep sea and easy to confuse with *Phakellia*. In fact, Topsent first described the species as *Phakellia hirondellei* (*Topsent, 1890*), but la~~t~~ter change his mind to place the species in the genus *Tragosia* (*Topsent, 1892*). In his own words "(…) *P. ventilabrum, le type du genre, possède des fibres spiculeuses fort nettes, qui autorisent pleinement le rapprochement des Phakellia et des Axinella; P. Hirondellei, au contraire, présentant une structure rénieroïde, serait totalement dépourvu de ces axes fibreux.*", "(…) *P. ventilabrum, the type of the genus, has very sharp spiculous fibers, that authorize the bringing together of Phakellia and Axinella; P. Hirondellei, on the contrary, have a renieroid structure, would be totally devoid of these fibrous axes.*" He moved towards Ridley's classification, which ~~emphazised~~ on the skeletal arrangement, giving less importance to the spicules morphology: "*Il semble préférable de s'en tenir au système de Ridley, qui accorde au genre Phakellia un sens beaucoup plus large et groupe ensemble les Eponges lamelliformes à longues fibres squelettiques sans rechercher si les mégasclères sont flexueux ou bien droits, ou légèrement courbés, ce qui peut, après tout, n'être* *qu'un caractère de mince valeur générique.*”, “*It seems preferable to stick to the Ridley system, which gives the genus Phakellia a much broader meaning and groups together the lamelliform sponges with long skeletal fibers without investigating whether the megasclera are flexuous or straight, or slightly curved, which may, after all, be only a character of thin generic value.*”. According to that, Topsent stated: “*D'après cette manière de voir, l'Eponge que j'appelais d'abord Phakellia Hirondellei n'est pas un Phakellia, malgré la flexuosité de ses mégasclères.*” “*According to this view, the Sponge that I first called Phakellia Hirondellei is not a Phakellia, despite the flexuosity of its megasclera*”. Because of that, he included the species ~~on~~ the genus *Tragosia,* which was a provisional decision as he admitted that this genus was too heterogeneous and needed ~~for~~ a revision. To date, despite ~~of~~ the mentioned Topsent’s and the present works, the only published description of *P. hirondellei* also emphazised in the mentioned “non-Axinellid”, characters (see *Boury-Esnault, Pansini & Uriz, 1994*), a fact that supports the hypothesis of its current polyphyly.

The species is reported for the first time in the Mallorca Channel, being its second record at the Balearic Islands, where it had been previously recorded by *Santin et al. (2018)* from the Menorca Channel. In the Mediterranean, it is also known off northern Iberian Peninsula (*Uriz,* 1984) and in the Gulf of Lions, Ligurian Sea ~~and~~ Corsica (*Fourt et al., 2017*) and Alboran Sea (*Boury-Esnault, Pansini & Uriz, 1994*).

Family HETEROXYIDAE *Dendy, 1905*

Genus *Heteroxya Topsent, 1898*

***Heteroxya mediterranea* sp. nov.**

(Figs. 12 and 13; Table 5)

Diagnosis

Heteroxya in which the Oxea I measure 319-623/6-15 µm, small oxeas are smooth, barely reaching 104-293/3-10 µm. Styles present but uncommon.

Etymology

The name refers to the Mediterranean Sea, where the species has been described.

Material examined

Holotype: CFM-IEOMA-7380/i726, St 35, EB, RD.

Paratypes: CFM-IEOMA-7379/i727, St 35, EB, RD; CFM-IEOMA-7381/i444, St 27, SO, RD; CFM-IEOMA-7382/i461, St 28, SO, RD.

Description

Small encrusting patches, up to 2 cm in diameter, ~~growing on a well-defined circular or irregular pattern~~ (Figs. 12A and 12B). Body ~~rises~~ less than 1 mm ~~from the sediment~~. Consistency hard and slightly flexible. Hispidation visible to the naked eye. Greyish in life and after preservation in EtOH. No orifices observed.

Spicules

Oxeas I (Fig. 12C): May be gently curved or bent in the middle, with sharp tips. Overall measuring 319-623/7-15 µm.

Oxeas II (Figs. 12D-12F): Gently curved, ~~centro~~curved or bent in the middle. Some stylot~~a~~ modifications present. Many with teratogenic parts like bifid tips, swellings or poliaxonal modifications (Figs. 12G and 12H). Overall measuring 104-293/3-10 µm.

Hispidating styles (Fig. 12I): Very long and thin, curved, with round~~ed~~ ends and sharp tips. Most broken, only three complete from ~~the~~ specimen ~~i~~444, measuring 1151-3502/8-14 µm (n= 3).

Skeleton

A basal spongin layer adheres ~~the sponge~~ to the substrate ~~that~~ allows the whole body to be peeled-off with a scalpel. Just upon this layer there are Oxea II running parallel to the substrate. The choanosome has low spicule content~~,~~ choanosomal chambers are relatively well developed in thicker parts of the sponge (Figs. 13A and 13B). Thick areas also have ascending trac~~ks~~ of Oxea II, with loose Oxea II ~~are~~ found in between. The choanosomal tracks are not present in thinner areas (Fig. 13C). The basal layer and the choanosome have abundant circular bodies 3-9 µm in diameter, dark or transparent (Fig. 13B). The ectosome is constructed by a dense palisade of Oxea II, perpendicular to the surface, with Oxea I placed in the same perpendicular position, emerging towards the exterior. Long styles are found here and there outcrossing the ectosome and causing the hispidation.

Ecological notes

The species has been collected on smooth basaltic rocks between 270 and 325 m depth at SO and EB, where it seems to be rather common. Mostly associated to other minute incrusting sponges like *Hamacantha* spp. or *Bubaris* spp.

Genetics

Sequences of the *COI* Folmer fragment and the *28S* C1-D2 domains were obtained from the Holotype (CFM-IEOMA-7380/i726). Both sequences were deposited ~~to~~ the [illegible]nbank, under the accession numbers MW858350 and MW881150, respectively.

Remarks

Heteroxya mediterranea **sp. nov.** represents the first record of a species belonging to the genus *Heteroxya* in the Mediterranean and the third known species of this genus. Elsewhere, the genus has been recorded from several locations in the Atlantic Ocean (Table 5). The COI sequence of *H. mediterranea* **sp. nov.** was identical to those of *H. corticata* and *H. beauforti*. Despite that, morphological differences are conclusive: both Oxea I and Oxea II are markedly shorter and the ~~S~~tyles, not present in *H. corticata*, are smaller than those of *H. beauforti* (Table 5). The lack of spines in the ~~O~~xeas is shared with *H. beauforti*. In addition, we have found circular bodies embedded in the choanosome and the basal layer, which can be equivalent to the spherulous cells found in *H. beauforti* (*Morrow et al., 2019*). Regarding the lack of differences in the COI sequence, ~~and~~ as already suggested by *Morrow et al. (2019)*, the COI is highly conserved in sponges and it may lack resolution to delimitate certain species (see also *Wörheide, 2006*). Unfortunately, no 28S sequences are available for this family, so we cannot compare the variability of this marker.

Family STELLIGERIDAE *Lendenfeld, 1898*

Genus *Paratimea* *Hallmann, 1917*

***Paratimea massutii* sp. nov.**

(Fig. 14; Table 6)

Diagnosis

Massive ovoid sponge with ~~O~~xeas ~~of both~~ megascleres and auxiliary spicules~~,~~ ~~c~~entrotylotism occasionally present in both. Oxyasters smooth

Etimology

Dedicated to Professor Enric Massuti, for its contribution ~~in~~ the knowledge of the benth~~onic~~ communities of the Balearic Islands.

Material examined

Holotyope: CFM-IEOMA-7383/i403, St 15, EB, BT.

Paratype: CFM-IEOMA-7384/i420, St 17, EB, BT.

Description

Both specimens are massive, subspherical, the largest (holotype, CFM-IEOMA-7383/i403; Fig. 14A) measuring about 5 cm in diameter, having a lobose surface with grooves and humps. Skin of a leathery touch, hispid only in the grooves. Colour in life differing between the upper and the lower faces, having the first a brownish tinge while the second ~~is~~ whitish to beige (Fig. 14A and 14B). After preservation in EtOH it turns homogeneous vanilla cream (Fig. 14C). Both specimens have 4-6 circular oscula, 1-2 mm in diameter, scattered throughout the body~~;~~ ~~h~~owever, the holotype also has a main large and circular osculum, about 1 cm in diameter, on the upper side. Both specimens expelled lot of mucus when collected.

Spicules

Megascleres

Oxea I (Fig. 14D): Robust and fusiform, some double bent, ~~few with a minute~~ centrotylote ~~swelling~~. Overall measuring 910-1711/11-33 µm.

Auxil~~l~~iary spicules

Oxea II (Fig. 14E): Uncommon. Bent or slightly sinuous, ~~few with a minute~~ centrotylote ~~swelling~~. Overall measuring 469-1088/3-10 µm.

Microscleres

Oxyasters (Figs. 14F-14I): With long and sharp rays. About 7-25 rays, occasionally less. Smaller ones tend to have more rays than larger ones, measuring 25-57 µm. Occasionally, some two-rayed oxyaster present.

Skeleton

Ectosome not separable from the choanosome, formed by a dense crust of oxyasters and tangential principal and ~~accessory~~ oxea. Choanosome ~~is~~ composed of irregularly arranged oxeas and oxyasters, although radial bundles of large oxeas are present in the periphery, supporting the ectosome.

Ecological notes

Found at two stations on calcareous gravel~~s~~ bottoms ~~in~~ the summit of EB (155 and 167 m depth), dominated by sponges such as *Hexadella* sp., *Phakellia robusta* and different species of the order Tetractinellida. A large number of the brachiopod *Gryphus vitreus* (*Born,* 1778) and echinoderms were also recorded.

Genetics

Sequences of the *COI* Folmer fragment was obtained from the Holotype (CFM-IEOMA-7383/i403) and deposited to the Genbank under the accession numbers MW858351.

Remarks (see Table 6 for a detailed comparison with other *Paratimea* spp.)

Morphologically, the species resembles *Paratimea oxeata*, a Mediterranean species reported on rocky and muddy bottoms, 35-60 and 110 m depth, respectively (*Pulitzer-Finali, 1978; Bertolino et al., 2013*), and from submarine caves at 15-20 m depth (*Morrow et al., 2019*). However, *P. massutii* **sp. nov.** is massive, a fact only shared with the cave individual ~~(~~specimen S153) reported by *Morrow et al. (2019)*. Nothstanding that, in *P. massutii* **sp. nov.** oxeas I are thicker, oxeas II longer and oxyasters slightly larger and with more actines (2-25 versus 4-12). A comparison of the *COI* sequences between the Holotype of *P. massutii* **sp. nov.** and this specimen confirms those morphological differences, with 15 bp differences and a *p*-distance of 2%. On the other side, both Holotype and *Bertolino et al. (2013)* specimens differ ~~with~~ *P. massutii* **sp. nov.** in being cushion shaped and having smaller oxea I and oxea II. Unfortunately, no sequences of this specimens are available to compare. ~~It~~ is also similar to *P. hoffmannae Morrow & Cárdenas, (2019)*, a North Atlantic species found in Norway and Ireland that is also massive and subspherical and has oxeas as both megascleres and auxiliary spicules. However, the large oxeas are much larger and thicker than in *P. massutii* **sp. nov.**, ~~contrarly than~~ the auxiliary spicules~~, which~~ are shorther and thinner. Also, oxyasters of *P. hoffmannae* are larger and with less actines. As for *P. oxeata*, COI sequences between *P. hoffmannae* and *P. massutii* **sp. nov.** are notably distant, with 13 bp differences and a *p*-distance of 2%. A similar case happens with *P. lalori Morrow & Cárdenas~~s~~ (2019)* from Ireland. This species is also massive~~,~~ subspherical with oxeas as main megascleres and auxiliary spicules. Just as in *P. hoffmannae*, megascleres of *P. lalori* are longer and thicker than those of *P. massutii* **sp. nov.**, auxiliary spicules are shorter~~t~~ and thinner and oxyasters slightly larger and with less actines.

Besides, *P. massutii* **sp. nov.** also differs ~~with~~ the other Mediterranean *Paratimea* spp. as follows: *P. loricata* (*Sarà, 1958a*) is encrusting, ha~~ve~~ much smaller oxeas I and oxeas II and two categories of oyasters, and bears tylostyles; *P. pierantonii* (*Sarà, 1958b*)~~,~~ is cushion-shaped, has styles and subtylotyles as megascleres, longer, thicker, and never centrotylo~~ta~~ oxeas II and smaller oxyasters.

Also, *P. massutii* **sp. nov.** differs ~~with~~ North-eastern Atlantic *Paratimea* spp. as follows: *P. constellata* is cushion shaped, has tylostyles and smaller oxyasters*;* *P. arbuscula* (*Topsent, 1928*)~~,~~; is arbustive, lacks auxiliary spicules and has smaller, acanthose oxyasters~~,~~ *Paratimea duplex* (*Topsent, 1927*) is cushion shaped, has much larger oxeas I, bears styles, subtylostyles, and two categories of oxyasters; *P. loennbergi* (*Alander, 1942*) is thinly encrusting, has tylostyles and smaller oxyasters.

This is the first report of the genus *Paratimea* in the Balearic Islands, and its deepest ~~sigth~~ in the Mediterranean Sea.

Order BUBARIDA *Morrow & Cárdenas, 2015*

Family BUBARIDAE *Topsent, 1894*

Genus *Rhabdobaris Pulitzer-Finali, 1983*

Rhabdobaris implicata Pulitzer-Finali, 1983

(Fig. 15; Table 7)

Synonymised names

Cerbaris implicatus (*Pulitzer-Finali, 1983*)

Material examined

CFM-IEOMA-7385/i338_2_1, St 11, EB, BT; CFM-IEOMA-7386/i698, St 34, EB, RD.

Description

Small, stalked sponge, up to 1.5 cm in height, 1 cm wide at its wider part, rising from an encrusting basal lamina, very hispid and thickly adhere~~d at~~ the substrate (Fig. 15A). The specimen CFM-IEOMA-7386/i698 shows a secondary stalk, ~~notoriously~~ more cylindric and hispid than the main one. The lamina is smooth, with very localized hispid areas. Whitish colour both in life and after preservation in EtOH.

Spicules

Megascleres

Acanthorhabdostyles (Figs. 15B and 15C): With a marked curvature near the head, more or less spined. They can be modified ~~as~~ true styles or present some swelling near the head. Overall measuring 181-272/8-12 µm~~,~~ being very scarce in CFM-IEOMA-7386/i698.

Smooth ~~R~~habdostyles (Fig. 15D): Common. Same morphology as acanthorhabdostyles, with some juvenile stage present. Overall measuring 135-431/4-14 µm.

Hispidati~~on~~ styles (Fig. 15E): Uncommon. Slightly curved, with round~~ed~~ end and sharp point. Overall measuring 645-1614/4-12 µm.

Smooth ~~S~~trongyles (Fig. 15F): Scarce. Curved, with round~~ed~~ ends and measuring 274-314/10-13 µm (n= 5) in specimen i338_2_1, but not found in specimen i698.

Acanthostrongyles (Fig. 15G): Scarce. Curved or slightly sinuous, most ~~are~~ strongly spined ~~in the~~ shaft ~~but~~ smooth ~~in the~~ ends. Overall measuring 113-228/4-12 µm.

Acanthoxeas (Fig. 15H): Scarce. Softly or abruptly curved, some sinuous, less spined than the acanthostrongyles~~,~~ and measuring 182-220-279/7-9-11 µm (n= 13) in specimen i338_2_1, but not found in specimen i698.

Smooth ~~O~~xeas (Figs. 15I and 15J): Softly or abruptly curved, some sinuous, with blunt tips, occasionally with central swellings. Overall measuring 176-431/3-12 µm.

Microscleres

Raphides (Fig. 15K): Packed in trichodragmata, overall measuring 25-59/4-9 µm.

Skeleton

Skeletal architecture as described in *Sitjà & Maldonado (2014)*, plumoreticulated tracks cored by abundant spongin, with long echinating styles projecting on the surface.

Ecological notes

Uncommon sponge found in two stations on the ~~summit of~~ EB summit at 117 and 152 m depth, growing on living rodoliths. Both stations were rich in massive demosponges, including large Tetractinellids, *Petrosia ficiformis* and *P. vansoesti*.

Remarks

The present material matches with the description of the holotype and paratype (*Pulitzer-Finali, 1983*; *Sitjà & Maldonado, 2014*; Table 7). It is notorious the variability in the abundance of acanthose~~s~~ forms of the rhabdostyles, oxeas and strongyles, being common in CFM-IEOMA-7385/i338_2_1 but extremely scarce in CFM-IEOMA-7386/i698. This variability in the presence/absence of acanthose~~s~~ spicules is also known for the sister genus *Cerbaris*. However, *Cerbaris* is restricted to encrusting sponges, with hispid surface and with characteristic ceroxeas (*Alvarez & Van Soest, 2002*). This is the third time that the species has been recorded, previously only known from the holotype collected in Corsica (*Pulitzer-Finali, 1983*) and the ~~paratype~~ collected at the Alboran Island (*Sitjà & Maldonado 2014*).

Order DESMACELLIDA *Morrow & Cárdenas, 2015*

Family DESMACELLIDAE *Ridley & Dendy, 1886*

Genus *Dragmatella* *Hallman, 1917*

Dragmatella aberrans **(*Topsent, 1890*)**

(Fig. 16; Table 8)

Material examined

CFM-IEOMA-7387/i52_b1, St 2, SO, BT; CFM-IEOMA-7388/i175, St 5, EB, BT.

Description (modified from *Hooper & Van Soest, 2002*)

Small hollow sponge encrusting on stones or corals. Up to 2 cm in diameter. Whitish grey in life and after preservation in EtOH. Surface smooth, but provided with long thin, pointed fistul~~a~~s (Fig. 16A).

Spicules

Megascleres

Mycalos~~t~~iles (Figs. 16B and 16B1) fusiform, ~~narrowing~~ towards the head, slightly or abruptly ben~~d~~. Overall measuring 349-676/6-15 µm.

Microscleres

Raphides (Figs. 16C and 16C1) abundant, straight, with an irregular shaft and one end hook-shaped, occasionally with central swellings. Overall measuring 162-222/1-3 µm.

Skeleton

Choanosome is cavernous (Fig. 16D), with ~~brushes~~ ~~M~~ycalostyles, about 200 µm, verging from a basal layer towards the ectosome (Fig. 16E). Ectosome composed of parallel tight ~~brushes~~ of ~~M~~ycalostyles, disposed in 4-5 layers of 30-50 µm in thickness (Fig. 16F). The raphides are scattered ~~and without pattern at~~ the ectosom~~e~~ and ~~the~~ choanosomal ~~brushes. Sometimes grouped in trichodragmata~~.

Ecological notes

Abundant ~~sponge from~~ sedimentary bottoms, with rests of calcareous shells and corals, found in SO, AM and EB and, to a lesser extent, on traw fishing grounds of the continental shelf off Mallorca (between 138 and 362 m depth). ~~The species usually appears with~~ other small encrusting sponges such as *Hamacantha* spp. or *Bubaris* spp., the pedunculated *Rhizaxinella pyrifera* (*Delle Chiaje, 1828*) and *Thenea muricata* (*Bowerbank, 1858*), the brachiopod *Gryphus vitreu*[illegible]d small crustaceans.

Remarks

The species is easily distinguishable by its hollow body and the possession of both mycalostyles and raphides. The last have singular hook-shaped ends, a fact not recorded before, that reminds the raphides found in some species of the genus *Dragmaxia* (Order Axinellida) (*Hooper & Van Soest, 2002*). No molecular data ~~is~~ available for *Dragmatella*, but a phylogenetic relationship with *Dragmaxia* is little probable, given the possession of ~~M~~ycalostyles and considering the skeletal arrangement of both genera. Therefore, hook-shaped raphids are probably homoplasic.

This is the first report of the species in the Balearic Islands. In the Mediterranean it has been recorded from the Gulf of Lions (*Vacelet, 1969*), Corsica (*Pulitzer-Fina~~l~~li, 1983*) and the Alboran Sea (*Boury-Esnault, Pansini & Uriz, 1994; Sitjà & Maldonado, 2014*). In the North Atlantic th~~s~~ species is known from several points, including the coast of Portugal (*Topsent, 1895*), the Josephine bank (*Topsent, 1928*) and the Cantabric Sea (*Topsent, 1890*).

Order HAPLOSCLERIDA *Topsent, 1928*

Family CHALINIDAE *Gray, 1867*

Genus *Haliclona Grant, 1841*

Subgenus *Soestella De Weerdt, 2000*

***Haliclona (Soestella) fimbiata* Bertolino & Pansini, 2015**

(Fig. 17)

Material examined

CFM-IEOMA-7389/i825_1, St 40, EB, ROV.

Description

The single collected specimen was broken during the ROV sampling (the whole individual is shown in situ in Fig. 2E), so it has been only partially examined (Figs. 17A and 17B). Erect sponge, 7 cm high and 1-1.5 cm diameter. Fragile and microhispid, of whitish color both fresh and after preservation in EtOH.

Spicules

Oxeas (Figs. 17C-17E) straight, gently curved, rarely contoured, with acerated tips (Fig. 17E1). No stylot~~a~~ modifications observed. Measuring 110-181-229/3-7-9 µm.

Skeleton

As in the description by *Bertolino et al. (2015)*.

Ecological notes

The species was spotted regularly at the rhodolith beds of the EB summit, between 134 and 150 m depth. However, it was ~~little~~ abundant and not forming patches, as occurs in some areas of the Gulf of St. Eufemia in the Tyrrhenian Sea, where *Bertolino et al. (2015)* reported densities of 7.4±0.7 specimens/m^2.

Remarks

The ~~individual~~ collected at the EB matches well with the original description, in both external morphology and skeletal features. A minor difference is that our individual has slightly thicker oxeas than the type specimen~~s~~.

~~It represents~~ the second re~~p~~ort of the species, previously known only ~~at~~ the Gulf of St. Eufemia (southern Tyrrhenian Sea; *Bertolino et al., 2015*), and expands its distribution range towards the westernmost part of the Mediterranean Sea.

Family PETROSIIDAE *Van Soest, 1980*

Genus *Petrosia Vosmaer, 1885*

Subgenus *Strongylophora Dendy, 1905*

Petrosia (Strongylophora) vansoesti Boury-Esnault, Pansini & Uriz, 1994

(Fig. 18, Table 9)

Material examined

CFM-IEOMA-7390/i192_A and CFM-IEOMA-7391/i192_B, St 6, EB, BT; CFM-IEOMA-7392/i313_P and CFM-IEOMA-7393/i313_G, St 11, EB, BT; CFM-IEOMA-7394/i351, St 13, EB, BT; CFM-IEOMA-7395/i694, St 35, EB, RD.

Description

Massive, ovoid or mushroom-like sponges (Figs. 18A-18C), up to 9 cm in height and 5 cm in diameter. Dirty white to yellowish color in life (Figs. 18A and 18B) and ochre after preservation in EtOH (Fig. 18C). One specimen showed greenish tinges, probably indicating the presence of photosynthetic symbionts (Fig. 18B). Consistency stony hard, surface soft to the touch, with no hispidation visible to the naked eye. Single and roundish oscula, 0.5 cm in diameter, located at the apex of the body. Ostia inconspicuous.

Spicules

Large oxeas (Fig. 18D): Slightly curved, sometimes with stylote modifications, most of them with tapered ends, sometimes telescoped or rounded~~, becoming strongyles~~. Overall measuring 205-322/9-19 µm.

Small oxeas (Fig. 18E): More curved than large ones, thinner and tapered. Found in large size variability, measuring 49-266/2-10 µm.

Strongyles (Fig. 18F): Sausage-like, straight or curved, cannot be clearly divided in size categories. However, strongyles larger than 90 µm are rare and overall measuring 27-95/6-14 µm.

Skeleton

~~Disorganized~~ choanosome, irregular net of spicule tracks forming roundish meshes with loose spicules in between (Fig. 18G). These tracks condense near the surface, where run in parallel to support the ectosome. Large subectosomal chambers present.

The ectosome is composed by a dense crust of thin oxeas disposed in perpendicular to the surface (Fig. 18H) ~~and~~ forming circular meshes and causing microhispidation. Behind this crust, the terminal parts of the choanosomal ascending spicule tracks are disposed in parallel to the surface.

Ecological notes

Large amounts of *P*. (~~*s*~~) *vansoesti* were collected from various stations in the summit of the EB, suggesting that it is an important species inhabiting Mediterranean seamounts and probably a habitat builder that confers three-dimensionality to the seafloor. The species was found from 116 to 152 m depth, on stations with liv~~e~~ and dea~~th~~ rhodoliths and gravels, associated with large sponges like *P. ficiformis* and some Tetractinellids and Halichondrids. Many groups of invertebrates, like small crustaceans and echinoderms, were also observed at these stations.

Remarks

The ~~individuals~~ match well with previous records of the species, ~~in basis of~~ the massive-oval shape, a circular osculum about 5 mm in diameter located at the upper side of the body and the possession of characteristic kidney-shaped strong~~i~~les.

Our specimens differ with previous records in having a palisade of perpendicular oxeas at the ectosome (Fig. 18H), increasing the already elevated plasticity of the species.

This is the first record of the species in the western Mediterranean. The type is ~~located at~~ the Gulf of Cadiz, in the north-eastern Atlantic. In the Mediterranean it has been recorded on a marine cave at both the Ionian Sea (*Costa et al., 2019*) and the Aegean Sea (*Gerovasileiou & Voultsiadou, 2019*). It has been also recorded at the Levantine Sea, living on rocks at ~~waters~~ shallower than 3 m ~~depth~~ (*Evcen & Çinar, 2018*). On the Balearic Islands, the species has only been collected in EB.

Subgenus *Petrosia Vosmaer, 1885*

***Petrosia raphida* Boury-Esnault, Pansini & Uriz, 1994**

(Fig. 19; Table 10)

Material examined

CFM-IEOMA-7396/POR406, St 1, south-east of Menorca, GOC-73; CFM-IEOMA-7397/i178_3, St 5, EB, BT; CFM-IEOMA-XXX/i242 and CFM-IEOMA-7398/i254_2, St 8, AM, BT; CFM-IEOMA-7399/i305, St 10, AM, BT; CFM-IEOMA-7400/i312, St 11, EB, BT.

Description

Massive sponges, ~~measuring~~ the largest collected specimen about 4.5 cm in diameter and 2.5 cm in height (Fig. 19A). Whitish in life, beige after preservation in EtOH. Consistency hard, slightly crumby. Surface rough due to minute conules, although some in some individuals this is less obvious. There are 1 to 6 circular oscules of 2-5 mm diameter.

Spicules

Oxeas (Figs. 19B and 19C): Curved, with mucronated ends. Some polyaxonal modification in shaft and ends may be present. Measuring 242-450/9-19 µm, although underdeveloped stages (196-368/3-8 µm) are present. Styles and strongyles of the same length and width as the oxeas present but scarce.

Raphides (Figs. 19D and 19E): Slightly curved, most minutely spined, although smooth ones are also present (Fig. 19E). Overall measuring 62-95/1-2 µm.

Skeleton

Choanosome (Figs. 19F and 19G) with an isotropic net of pauci-spicular spicule tracks covered by spongin, ~~alltogether drawing~~ roundish meshes. These meshes are abundantly embedded by raphides. The tracks tend to condense towards the surface, supporting the ectosome.

Ectosome forming a detachable crust not evident to the naked eye, tightly ~~packed~~ to the choanosome and made of an ~~isotropic layer of spicules forming~~ irregular~~ly arranged~~ polygonal to triangular meshes. Meshes are constituted by one or two spicules. Spongin is present and fully embedded with raphides.

Ecological notes

This is ~~a~~ very common ~~sponge~~ in both AM and EB at the 101-152 m bathymetric range, ~~which~~ has been also found at the same depths off the southeast coast of Menorca (Table 10). It can be found as a free-living sponge or growing attached to small fragments of calcareous sediments. However, it is also commonly found as an epibiont of other sponges and rodoliths. The species seems to prefer massive individuals of *Hexadella* sp. and *Halichondria* sp. as substrate.

Remarks

The species is easy to recognize due to the presence of characteristic spined raphides, added to other Petrosid characters like the skeletal architecture and the morphology of the oxeas. It is ~~notorious~~ that the present specimens differ ~~with~~ the two previous reports having much smaller oxeas. This could be explained by the scarcity of nutrients in water around the Balearic Islands ~~waters~~, the bathymetric range in which the specimens were collected and/or differences in water temperature, seasonal variability and population phenotypes (*Simpson, 1978; Valisano et al., 2012*). Those variables could also be the cause of the difference in the morphology of the megascleres already noted by *Sitjà et al., (2019)* when comparing ~~its~~ material with the holotype. In the specimens from the Gulf of Cadiz (north-eastern Atlantic), strongyles were rare. Instead, megascleres consisted mostly in oxeas with stepped tips and some occasional stylote or strongylote modification. The last feature is shared with the Balearic Islands specimens but not with the holotype, ~~which~~ have mostly strongylote ~~tips~~.

This is the first record of the species in the Mediterranean. This report is considerably shallower (101-152 m) than in north-eastern Atlantic, where the species was reported at 580 m depth in the Strait of Gibraltar (*Boury-Esnault, Pansini & Uriz, 1994*) and at 530-575 m depth in the Gulf of Cadiz (*Sitjà et al., 2019*) (Table 10). This may be related to differences in nutrient~~s~~ regime between the Balearic Islands and these areas (*Santinelli, 2015*).

Family PHLOEODICTYIDAE *Carter, 1882*

Genus *Calyx Vosmaer, 1885*

Calyx* cf. *tufa

(Fig. 20; Table 11)

Material examined

CFM-IEOMA-7403/i525, St 24, AM, BT; CFM-IEOMA-7401/i75, St 3, AM, BT; CFM-IEOMA-7402/i515, St 23, AM, BT.

Description

Large, massive and semicircular sponges, up to 15 cm diameter and 5 cm height (Fig. 20A). Surface smooth to the touch~~,~~ stony hard and uncompressible. Choanosome spongy, compressible, slightly friable and cavernous. Color in life beige, with pink tints in the upper side of the body and whitish beige in the lower. It became homogeneous brownish beige after preservation in EtOH. From 2-3 large and circular oscula placed in the upper side of the body, measuring 1.3 cm in diameter. Ostia grouped in poral areas of the ectosome, which measure 100-250 µm in diameter (Fig. 20B).

Spicules

Oxeas (Figs. 20C and 20D) slightly curved, with hastate points (Fig. 20D1) and rarely contoured in the middle. Overall measuring 132-206/ 4-9 µm.

Skeleton

The ectosome (Fig. 20E) is formed by a crust of tangential spicules~~, confusedly orientated in~~ triangular paucispicular meshes that become less dense ~~and confused~~ at the poral areas. Spongin present but not abundant, of a granular apparency due to the presence of spherulous cells~~,~~ filled with granules (Fig 20E, arrow).

The chonosome (Figs. 20F and 20G) is mostly composed by a rather isotropic, unispicular net of spicules. However, near the choanosomal chambers it becomes more confused and tends to draw uncontinuous paucispicular meshes.

Genetics

Sequences of the *COI* Folmer and *28S* C1-D2 domains were obtained from the specimen CFM-IEOMA-7403/i525 and deposited in the Genbank under the accession numbers MW858349 and MW881149, respectively.

Ecological notes

The species has been found only at the summit of AM between 105 and 114 m depth, associated to rhodolith beds. It has been also found with diverse set of sponges, including large Tetractinellids such as *Hexadella* sp., *Axinella* spp. or *Petrosia raphida*, as well as many other invertebrates typically inhabiting the rhodolith beds, like small crustaceans and echinoderms. The pink coloration of its upper skin is probably caused by symbiotic cyanobacteria, as commonly happens in other Haplosclerids (*Rützler, 1990*).

Remarks

There are only two species of *Calyx* reported from the north-eastern Atlantic and the Mediterranean: *Calyx nicaeensis* (*Risso, 1827*) and *C. tufa* (*Ridley & Dendy, 1886*). The first is the type ~~taxon~~ of the genus, a well-known species characterized by its growing habit (vasiform), blackish color and large size. This species is widely reported from both western and eastern Mediterranean in infralittoral and circalittoral bottoms at 3-50 m depth (*Trainito et al., 2020*). *Calyx* cf. *tufa* clearly differs ~~with~~ *C. nicaeensis* in morphology (massive *vs.* vasiform, respectively), genetics (COI: 11 bp difference; 28S: 43 bp difference) and bathymetry (105-114 vs. 3-50 m, respectively). ~~Apart from *C. nicaeensis*, the nearest species is~~ *C. tufa*~~,~~ only known ~~in the Atlantic Ocean, from~~ its type at Cape Verde (*Dendy, 1886*) and from the Cantabrian sea (*Topsent, 1892*). Th~~is~~ species shares many characteristics with *C.* cf. *tufa*, like the external morphology, consistency and skeletal architecture. Unfortunately, the only description available is the one provided by *Dendy (1886)*, which is too general and matches with the characters of many other *Calyx* spp. (e.g. *Calyx podatypa de Laubenfels 1934*; *Calyx magnoculata Van Soest, Meesters & Becking, 2014*; *Calyx nyaliensis Pulitzer-Finali, 1993*). The large distances between the reports of *C. tufa* and *C.* cf. *tufa*, the strong genetic barriers that are in between (the Strait of Gibraltar and the Almeria-Oran front), the generalized low dispersive potential of some sponge species (*Riesgo et al., 2019; Griffiths et al., 2021*) and the difference of habitats, suggest that ~~*C.* cf. *tufa*~~ is different from *C. tufa*. Another argument to consider both species as different is that no intermedium geographical reports have been reported, which would be expected in case of conspecificity (*Topsent, 1928*; *Maldonado, 1992*; *Boury-Esnault, Pansini & Uriz, 1994*; *Sitjà & Maldonado, 2014*; *Sitjà et al., 2019*). It should be not~~t~~ed that *C.* cf. *tufa* is a very large, massive and easily recognizable sponge, which cannot be easily unnoticed. However, taking into account ~~of~~ neither comparative material nor genetic sequences of *C. tufa* are available, the conspecificity of *C.* cf. *tufa* with *C. tufa* cannot be completely ruled off.

Order POECILOSCLERIDA *Topsent, 1928*

Family MYXILLIDAE *Dendy, 1922*

Genus *Melonanchora Carter, 1874*

***Melonanchora emphysema* (Schmidt, 1875)**

(Fig. 21)

Synonymised names

Desmacidon emphysema *Schmidt, 1875* (genus transfer)

Material examined

CFM-IEOMA-7404/i573, St 31, AM, RD.

Description

Hollow sponge with a detachable, smooth and paper-like ectosome provided with fistul~~a~~s (Fig. 21A). About 2 cm in diameter. The choanosome is loose and includes sediment. Greyish white in life and after preservation in EtOH.

Spicules

Megascleres

Tornotes (Figs. 21B and 21C) slightly curved or ben~~d~~ with roundish ends. Longer ones tend to be thinner and shorter thicker. Overall measuring 359-446-556/5-8-11 µm.

Microscleres

Spheranchoras (Fig. 21D and 21E) of usual morphology, but uncommon. Overall measuring 36-40-46/14-19-23 µm (n= 11).

Arcuate isochela I (Fig. 21F) with well-developed fimbriae and spatulated and bifid alae. Overall measuring 29-42-47 µm.

Arcuate isochela II (Fig. 21G) similar to isochela I, but with rounded alae. Overall measuring 14-18-21 µm.

Skeleton

As in previous records of the species (*Schmidt, 1785; Vacelet, 1969; Pulitzer-Fina~~l~~li, 1983*).

Ecological notes

The single specimen was found in AM, on a rodolith bed between 104 and 138 m depth. It was growing upon a large rodolith, which was extensively epiphyted by encrusting, massive-encrusting or pedunculated sponges like *Hamacantha* sp., *Jaspis* sp. and *Axinella* spp.

Remarks

The specimen matches well with previous records of the species, ~~in~~ both external morphology, spicules and skeletal arrangement. This is the third record of this species in the Mediterranean, ~~previously only known~~ in the canyon de Cassdaigne in the Gulf of Lions (*Vacelet, 1969*) and Corsica (*Pulitzer-Fina~~l~~li, 1983*). In the north-Atlantic, is known form several ~~reports, including~~ its type locality at Norway (*Schmidt, 1875*), the east Greenland shelf (*Lundbeck, 1905*), the Faroe Plateau (*Hentschel, 1929*) ~~or~~ the north coast of the Iberian Peninsula (*Solorzano,1990*). It is notorious the vast distances between the Mediterranean and the North Atlantic reports, being the closest off northern Iberian Peninsula. This, added to the fact that there are no intermedium findings in well-studied areas as the Alboran Sea, may be indicative that Mediterranean and North Atlantic *M. emphysema* are different species, as already discussed by *Vacelet (1969)*.

Order POLYMASTIIDA (*Morrow & Cárdenas, 2015*)

Family POLYMASTIIDAE (*Gray, 1867*)

Genus *Polymastia* (*Lam~~m~~arck, 1815*)

***Polymastia polytylota* Vacelet, 1969**

(Fig. 22; Table 12)

Material examined

CFM-IEOMA-7405/i810, St 39, AM, ROV.

Description

Rounded sponge ~~of~~ 2 cm h~~e~~igh~~t~~ and wid~~th~~, with two conical papilas (0.5 cm h~~e~~igh and 3 mm wid~~th~~) placed in the upper side of the body (Figs. 22A and 22B). Consistency hard and slightly compressible. Surface smooth to the touch, but microhispid under the stereomicroscope. Cream color before and after preservation in EtOH, with a darker choanosome. In life the sponge was 4.5 height and 4 width, with its surface full of visible ostia (Fig. 2A)

Spicules

Principal tylostyles (Figs. 22C and 22C1): Straight and fusiform, with several tyles in the proximal half part of the shaft. Overall measuring 438-909-1154/8-11-15 µm.

Intermediary tylostyles (Figs. 22D and 22D1): Fusiform, with a rounded ~~tyle~~, often showing a vesicle. Overall measuring 308-443-586/6-7-9 µm.

Ectosomal tylostyles (Fig. 22E and 22E1): Slightly curved and subtylote. Overall measuring 121-166-200/2-3-5 µm.

Skeleton

Like in the previous reports of the species (*Vacelet,1969; Pulitzer-Finali, 1983; Boury-Esnault, 1987; Boury-Esnault, Pansini & Uriz, 1994*)

Ecology notes

Only one specimen collected northern AM, between 352 and 465m depth, on a rocky bottom characterized by enhaced water movement, with several large *Phakellia* spp, *Pachastrella* spp and *Poecillastra compressa*, as well as other *Polymastia* cf. *polytylota*. Although the present specimen was the only collected, its easy identification and the other sigths made during ROV transects may suggest that this sponge is quite common in some areas of the Mallorca Channel.

Remarks

The present specimen match with the previous descriptions of the species in external morphology, skeletal architecture and spicule morphometrics. The only difference is that our specimen has two papillae instead of one. The Fig. 2A shows the first in-situ image of this species. It is notorious how the sponge body was much loose and how contracted once collected.

This is the first record of this species at the Balearic Islands~~, which~~ in the Mediterranean is known from the type locality at the Gulf of Lions (*Vacelet, 1969*), the Ligurian Sea (*Vacelet, 1969; Pulitzer-Finali, 1983*) and the Alboran Sea, while it has been also reported from the Gulf of Cadiz in the north-eastern Atlantic (*Boury-Esnault, Pansini & Uriz, 1994*).

Genus *Pseudotrachya Hallmann, 1914*

***Pseudotrachya hystrix* (*Topsent, 1890*)**

(Fig. 23; Table 13)

Material examined

CFM-IEOMA-7406/i303_A, St 19, AM, RD; CFM-IEOMA-7407/i613, St 32, AM, RD.

Description

Roundish and pad-like encrusting sponge, up to 2 cm diameter and 3 mm in height (Fig. 23A). Coloration beige in life and whitish after preservation in EtOH. Very hispid surface. Consistency hard and only slightly compressible. No papillae, oscula and ostia inconspicuous.

Spicules

Anisoxeas (Figs. 23B and 23B1): Straight and robust, with stepped ends. Intermediary stages between oxeas and styles present. Size differs between individuals, measuring 834-1689-3358/10-25-42 µm in specimen i303 and 768-2088-3402/18-32-45 µm in specimen i613. Small and immature ones also present, but very scarce, about 500/10 µm.

Microxeas (Fig. 23C): Fusiform and measuring 156-185-217/4-5-6 µm in specimen i303 and 152-203-270/3-5-6 in specimen i613.

Skeleton (modified from *Plotkin et al., 2013*)

Single layered cortex (palisade of microxeas)~~, radial~~ main choanosomal skeleton of principal anisoxeas echinating the surface and auxiliary choanosomal skeleton of microxeas (Figs. 23D and 23D1).

Ecology notes

~~Despite~~ the described specimens, several other *P. hystrix* were collected from rocky slopes of AM and EB, between 195 and 302 m depth, suggesting that this species could be quite common in the Mallorca Channel seamounts. The species occur at rocky slopes, together with other small encrusting sponges such as *Hamacantha* spp., *Bubaris* spp. and the Hexactinellid *Tretodyctium* sp.

Remarks

This is a well-characterized species, according to the combination of characteristic, enormous megascleres with unequal, oxeote to stylote tips and small microxeas. Variation in the size of megascleres has been previously documented and may respond to ecological facts like depth, nutrient availability or temperature (*Maldonado et al., 1999*). However, due to ~~its~~ size, largest megascleres are mostly broken, which could be a reason ~~for~~ the lack of reports on ranges from 5000-7000 µm (Table 13).

This is the first record of the species in the Balearic Islands, expanding its geographic distribution in the Mediterranean, where was previously reported ~~in~~ the Tyrrhenian Sea (*Sarà, 1959*), Ligurian Sea (*Pulitzer-Fina~~l~~li, 1983*), Gulf of Lions (*Vacelet, 1969*) and Alboran Sea (*Boury-Esnault, Pansini & Uriz, 1994*).

Order TETHYIDA *Morrow & Cardenas, 2015*

Family HEMIASTERELLIDAE *Lendenfeld, 1889*

Genus *Hemiasterella* *Carter, 1879*

***Hemiasterella elongata* Topsent, 1928**

(Fig. 24; Table 14)

Material examined

CFM-IEOMA-7408/i149_4, St 7, EB, RD; CFM-IEOMA-7409/i337, St 11, EB, BT; CFM-IEOMA-7410/i531, St 24, AM, BT; CFM-IEOMA-7411/POR1066, St 36, south-western Cabrera Archipelago, GOC-73.

Description

Small erect sponges (Fig. 24A) up to 3 cm high and a diameter of 0.5x1.5 cm. Surface lobulated, with lobules growing perpendicular to the surface. Slightly hispid to the naked eye. Hard consistency and velvet touch.

Spicules

Megascleres

Styles (Figs. 24B and 24B1) straight, curved or slightly sinuous, with rounded heads and fusiform tips. Subterminal swellings ~~are~~ present but rare. Overall measuring 1151-2657/7-34 µm. Oxeot~~a~~ modifications present, although probably represent immature stages of the styles, ~~yet they~~ usually ~~do~~ not exceed 10 µm in thickness.

Microscleres

Spherostrongylasters (Figs. 24C-24F) with actines spined toward the tips and smooth near the centrum. Some have a second centrum (Fig. 24F) and are rarely modified to triactinal forms. The last are always larger than the regular ones, reaching 29-30 µm. Regular ones measure 11-26 µm in diameter.

Skeleton

As in *Sitja & Maldonado (2014)*.

Ecological notes

This species was found at meshophotic bottoms, between 109 and 152 m depth, generally associated to rhodolith beds or areas with dead rhodoliths o~~f~~ the summits of EB and AM, but also sporadically at same depths on trawl fishing grounds of the continental shelf off Mallorca.

Remarks

The Balearic specimens are very similar to those described in the Alboran Sea in both external morphology and skeletal features (*Sitjà & Maldonado, 2014*). In agreement with these authors, we have found the same differences with the type material from Cabo Verde described by *Topsent (1928)*: thinner styles and larger ~~ox~~strongylasters. The first difference may be ~~explained by the difference in both environments: bathyal depths of the North Atlantic against circalittoral bottoms of the western Mediterranean, being Atlantic waters richer in nutrients than~~ Mediterranean ones (*Santinelli, 2015*). This fact is known to affect the size of the sponge spicules~~, thus Atlantic representatives use~~ to be longer and thicker (*Maldonado et al., 1999*). The fact that strongyloxyasters are smaller in the type, could suggest the presence of two different species. However, further molecular studies are needed to compare the North Atlantic and the Mediterranean specimens to clarify it.

This is the ~~second~~ record of the species ~~in~~ the Mediterranean, where it was only known from the Alboran Sea (*Sitjà & Maldonado, 2014*). ~~It is also the third report worldwide, considering the type locality at Cabo Verde in the eastern Atlantic (*Topsent, 1928*)~~.

Class HEXACTINELLIDA *Schmidt, 1870*

Subclass HEXASTEROPHORA *Schulze, 1886*

Order LYSSACINOSIDA *Zittel, 1877*

Family ROSSELLIDAE *Schulze, 1885*

Subfamily LANUGINELLIDAE *Gray, 1872*

Genus *Lanuginella* *Schmidt, 1870*

***Lanuginella pupa* Schmidt, 1870**

(Fig. 25)

Material examined

CFM-IEOMA-7412/i286_1, CFM-IEOMA-7413/i286_2 and CFM-IEOMA-7414/i286_3, St 18, AM, RD.

Description

Tubular (CFM-IEOMA-7412/i286_1) to calyx-like (CFM-IEOMA-7413/i286_2 and CFM-IEOMA-7414/i286_3) sponges (Fig. 25A), up to 4 cm high and 2 cm ~~o~~n diameter. Surface smooth, but slightly hispid at localized areas. Fragile consistency and soft touch. Dirty white color in life and white after preservation in EtOH. All three specimens present a single, circular oscul~~a~~ at the upper part of the body. One of the calyx-like specimens (CFM-IEOMA-XXX/i286_2) has a minute and short peduncle ~~on~~ its basis.

Spicules

Choanosomal diactins (Fig. 25B). Long and slim, slightly sinuous, with four vestigial tubercles in the center (Fig. 25B1), which may have sweelings all over the shaft and spines ~~in its~~ tips. Overall measuring 245-1611/3-15 µm.

Choanosomal hexactins (Fig. 25C): With different length actines, sometimes sinuous. Overall measuring 349-983/10-25 µm (n= 12).

Hypodermal pentactins (Fig. 25D): With a ray reduced to a stump or absent. Proximal ray much larger than the others and ~~placed in~~ perpendicular ~~with those~~. Rays are smooth or slightly rugose. Proximal ray measuring 242-950/7-19 µm (n= 8) and perpendicular rays measuring 137-850/4-20 µm (n= 28).

Stauractins (Fig. 25E): With four actines ~~placed in~~ perpendicular ~~and on~~ the same plane~~,~~ straight or slightly curved~~. S~~trongly spined, with roundish tips. Overall measuring 61-111/3-5 µm (n= 23).

Dermal hexactins (not shown): Uncommon. Rugose, with proximal ray slightly longer than distal ~~ray~~. Overall measures: proximal rays 151/7 µm (n= 1), distal rays 105/6 µm (n= 1) and perpendicular rays 68-110/2-6 µm (n= 3).

Paratetractin: Overall measuring 77/4 (n= 1).

Atrialia hexactins (Fig. 25F and 25g): Common. Slightly rough to s~~o~~mooth. Overall measures: proximal rays 107-159/4-6 µm (n= 8), distal rays 70-102/4-7 µm (n= 8) and perpendicular rays 70-150/3-7 µm (n= 22).

Discohexasters (Fig. 25H): Rather uncommon. Some with underdeveloped, twisted rays. Overall measuring 43-76 µm (n= 29).

Strobiloplumicomes (Fig. 25I): Very rare and not found in specimen CFM-IEOMA-7413/i286_2. Overall measuring: 20-38 µm (n= 6).

Skeleton

As usual for the species (see *Ijima, 1904*; *Tabachnick, 2002* and *Sitjà et al., 2019* for detailed descriptions)

Ecological notes

Species found only at one station located in a rocky slope at SO, between 220 and 275 m depth. It was associated to fossil ostreid reefs and carbonated rocks, together with other encrusting sponges like *Hamacantha* sp., *Bubaris* sp., and *Jaspis* sp.

Remarks

This poorly known species is the single representative of the genus *Lanuginella*, reported from several distant localities around the world: ~~the~~ Kagoshima Gulf at the Sea of China (*Okada, 1932*), ~~the little~~ Ki Island at the Sea of Banda (*Schulze, 1887*)~~, and~~ Cabo Verde (*Schmidt, 1870*), Gulf of Cadiz (*Sitjà et al., 2019*) and ~~the~~ Strait of Gibraltar (*Topsent, 1895*) ~~in the northern Atlantic~~. This is the first record of the species in the Mediterranean Sea, increasing its already wide distribution. However, a revision of the species is needed, and it is likely that such a cosmopolitan distribution ~~suggest~~ that *L. pupa* represents a species complex. However, deep sea species tend to be more widely distributed tha~~t~~ shallow ones, probably because the homogeneity in the environmental conditions (*McClain & Hardy, 2010*). A detailed examination of worldwide specimens, combined with molecular methods, may clarify it.

Discussion

Biogeography and seamount singularity

The present study gives a further step towards a better knowledge of the sponge diversity of the Mediterranean seamounts. We ~~include the description of~~ a new genus, 4 new species, and 15 new geographical reports, including two new reports for the Mediterranean Sea. Highlight also that *Pseudoaplysina balearica* **sp. nov.** is probably the most common sponge at AM and EB, being large and easily distinguishable. A similar situation was observed with the less abundant *Calyx* cf. *tufa*, which is a massive and very notable sponge. This suggests that both species are not present in other already explored Mediterranean seamounts of a similar depth range, such as the Seco de los Olivos or the Alboran Ridge, ~~which~~ sponge fauna ha~~ve~~ been previously studied (*Sitjà & Maldonado, 2014; Würtz & Rovere, 2015; De la Torriente et al., 2018*). The ~~lack of presence~~ of this[illegible]d other species on the faunistic lists provided by *OCEANA (2011)* on the studies carried out in the same area may be explained by its sampling methodology, which emphasizes[illegible]e use of ROV images. This is a major handicap for a ~~grup such~~ as sponges, which cannot be correctly identified without sampling. Therefore, the Mallorca Channel seamounts may be considered as very singular faunal refugees, appealing to what is called the "Seamount endemism hypothesis" (*de Forges et al., 2000*), which suggests that geographical separation of seamounts is reflected in genetic isolation of their fauna and promotes speciation by vicariance. The theory has been questioned, as some works have shown that benthic fauna (including sponges) is well connected between isolated seamounts (*Samadi et al., 2006; Ekins et al., 2016*). However, others show~~n~~ structure[illegible]pulation between seamounts (*Castelin et al., 2010*), or between seamounts and the continental shore ~~populations~~ (*Crochelet, 2020*). Other authors suggest that there is a mixture of panmictic and structured populations, largely dependent on[illegible]h species nature (*Rogers, 2018*). If we consider that dispersal in sponges tends to be very limited (*Maldonado, 2006; Riesgo et al., 2019; Griffiths et al., 2021*), it is plausible that certain seamount sponge populations are very structured. This may be enhaced in isolated seamounts or those with ~~very singular~~ or unique ecological characteristics. In this sense, both AM and EB have very shallow summits and are placed in an area of special oligotrophy (e.g. *Bosc et al., 2004; Uitz et al., 2012*). The nearest habitat with similar features is the continental shelf of the Balearic promontory, although these areas tend to be under the impact of bottom-trawling (*Farriols et al. 2017; Ordines et al., 2017*), thus probably being very different in terms of biological communities. In fact, most of the species of SO, AM and the EB were never found at the continental shelf of the Balearic Islands (*Bibiloni, 1990; 1993; Grinyo et al., 2018; Santin et al., 2018*), with the exceptions of *Phakellia robusta, P. hirondellei, Petrosia raphida* and *Hemiasterella elongata* (*Santin et al., 2018*). A similar case was that of the brittle star *Ophiomyces grandis* Lyman, 1879, recently found in large amounts from SO, AM and the EB, but never on the continental shelf around the Balearic Islands (*Ordines et al.,* 2019).

The particular conditions of the Balearic Islands, extreme oligotrophy, geographical isolation, low fishing pressure and heterogeneity of habitats (*Quetglas et al., 2012*; *Massutí et al., 2014*) could suggest this area as a hotspot of sponge diversity, with much of its fauna still unknown, specially at depth below 90 m (*Bibiloni, 1990; Santin et al., 2018; Díaz et al., 2020*). In recent years, ~~it~~ has been ~~observed in its~~ rich benthic assemblages (*Ordines & Massutí, 2009*; *Barberá et al., 2012*; *Ordines et al., 2017*), as well as ~~the~~ elevated number of new species and new geographical reports (e.g. *Kovačić et al., 2017, 2019; Ordines et al., 2019; Díaz et al., 2020*). Because of this, there is a need to find out which sponge species inhabit those waters and how much do they contribute to the benth~~on~~ic biomass. We must consider that sponges are key components of the benth~~on~~ic ecosystems, playing important biogeochemical roles (*de Goeij et al., 2013*) and serving as food or refugee to many other animals (*Maldonado et al., 2017*). Future works should characterize benthic habitats of the continental shelf and slope around the Balearic Islands potentially similar to those of the Mallorca Channel seamounts (e.g. non-impacted sedimentary and rocky bottoms with rhodoliths and gravels located between 90 and 150 m depth and rocky slopes down to 400-500 m depth) and compare both biocenosis to confirm if the habitats of the Mallorca Channel seamounts are ~~as~~ unique.

Integrative taxonomy

The generalized lack of distinctive characters has led ~~the~~ sponges ~~as~~ one of the most difficult groups to classify. This difficulty has also trigged the sponge~~s~~ phylogenetic relationship, with polyphyletic taxa present in all the levels of Linnean classification (e.g. *Cardenas, 2012; Diaz et al., 2020*). For that reason, using both morphology and molecular markers is a central step towards an improvement of our knowledge of this group. Following this approach, here we have proposed the new genus *Pseudoaplysina* to be erected in the family Hymerhabdiidae, supported by the two new species *Pseudoaplysina balearica* **sp. nov.** and *Pseudoaplysina minuta* **sp. nov.**, confirmed by morphological traits and both COI and 28S markers. On the other side, the species *Heteroxya mediterranea* **sp nov.** has shown no variability in its COI sequence when compared to its North Atlantic congenerics, which highlights the need to combine both approaches. It is known that the COI is known to be a poor-resolution marker to delimitate species in ~~the~~ sponges, so we also sequenced the more variable 28S marker. However, no 28S sequences are currently available in any database to compare with the other *Heteroxya* spp., so this will need to be checked in the future.

A key topic in the spoge taxonomy is the robustness of the skeletal characters as species diagnostic tool, and how reliable they are for drawing the line between species and populations. This is tangled by the fact that skeletal elements may change depending on environmental traits like temperature, depth or nutrient concentration, or due to intraspecific plasticity, overall modifying ~~its~~ length, width, morphology and even ~~its~~ presence or absence (*Cárdenas et al., 2012*). No consensus has ever been provided to consider a given morphological deviation as enough to erect a new species, a fact that remains arbitrary. We have found differences in the spicular morphometries between the specimens of the Balearic Islands and specimens of other areas of the Mediterranean and the North Atlantic Ocean, which happens to a greater or lesser extent in all species here reported. Since the dispersive potential, long-distance~~s~~ connectivity, and speciation mechansims of sponges are poorly understood, most of the species names assigned in the present work have been chosen under a conservative approach, only proposing new species when we found solid evidences. Taking this into account, facts like vast geographical distances, presence of oceanographic barriers or minor morphometric differences are not considered enough for species delimitation, unless supported by genetic differences. ~~Highlight~~ the case of *Calyx* cf. *tufa*, ~~yet~~ its potential conspecificity with the North Atlantic species *C. tufa* cannot be ruled off. We did not get access to any material of *C. tufa*, no sequences are available to compare and the original description is to vague and general. However, and as stated above, we consider notable the absence of any intermedium re~~p~~ort of such a big, ~~notorious~~, and easily recognizable sponge. Also, Atlantic re~~p~~orts of *C. tufa* are much deeper than the re~~p~~orts of *C.* cf. *tufa* (219 and 300 m versus 105-114 m). Future works will ~~conclude~~ if both species are synonyms, or if *C.* cf. *tufa* is a new species for science.

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Figure 1

Map of the studied area showing the location of the sampling stations of beam trawl (BT), bottom trawl type GOC73 (GOC), rock dredge (RD) and remote operated vehicle (ROV). The characteristics of these sampling stations are shown in Table 1.

(A) general view of the Balearic Islands. (B) detail of Ses Olives. (C) detail of Ausias March.

(D) detail of Emile Baudot.

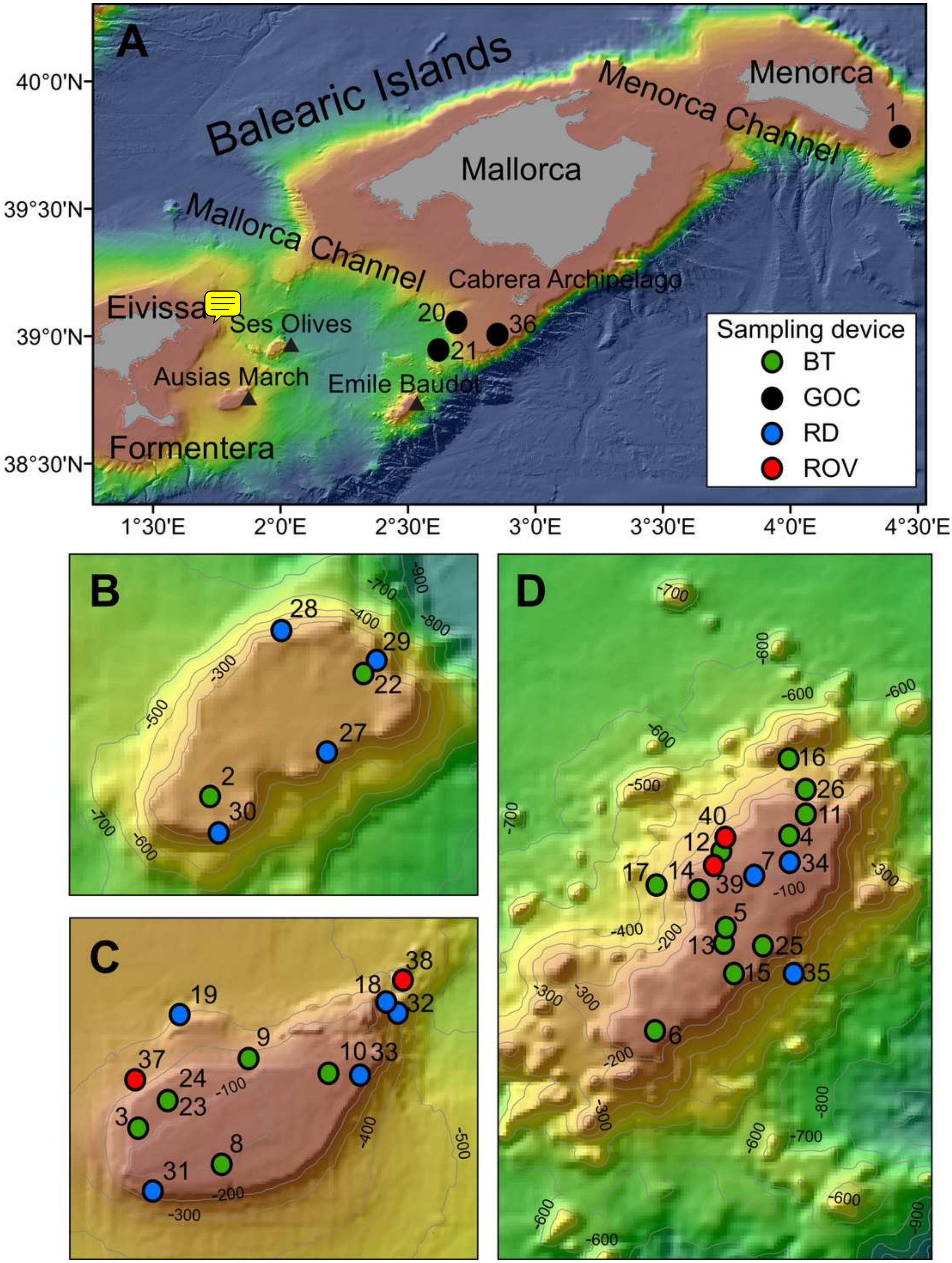
A
Balearic Islands
Menorca
Menorca Channel
Mallorca
Mallorca Channel
Cabrera Archipelago
Eivissa
Ses Olives
Ausias March
Emile Baudot
Formentera
1
20
21
36
40°0'N
39°30'N
39°0'N
38°30'N
1°30'E
2°0'E
2°30'E
3°0'E
3°30'E
4°0'E
4°30'E
Sampling device
BT
GOC
RD
ROV
B
28
29
22
27
2
30
-300
-400
-500
-600
-700
-800
-900
C
19
9
37
24
23
3
8
31
18
38
32
10
33
-100
-200
-300
-400
-500
D
16
26
11
4
40
12
7
34
17
14
39
5
13
25
15
35
6
-100
-200
-300
-400
-500
-600
-700
-800
-900

Figure 2

Remote Operated Vehicle (ROV) images of the sponge fauna from the seamounts of the Mallorca Channel, Ses Olives (SO), Ausias March (AM) and Emile Baudot (EB).

(A) specimen of Polymastia polytylota collected at 409 m depth in AM. (B) Holotype of Pseudoaplysina balearica **sp. nov.** collected at 129 m depth in the AM summit. (C) specimen of Phakellia ventilabrum collected at 132 m depth in the EB summit. (D) uncollected specimen of Phakellia sp. at 374 m depth in the north knoll of AM. (E) specimen of Haliclona (Soestella) fimbriata collected at 131 m depth in the EB. (F) rhodolith bed at 110 m depth in the summit of AM, with different sponge species, including Q. balearica **sp. nov.** (arrow), (G) uncollected specimen of Calyx vaceleti **sp. nov.** at 106 m depth in the summit of AM, (H) coralligenous bottom at 97 m depth in the summit of AM, with several sponges, including Q. balearica **sp. nov.** (arrow).

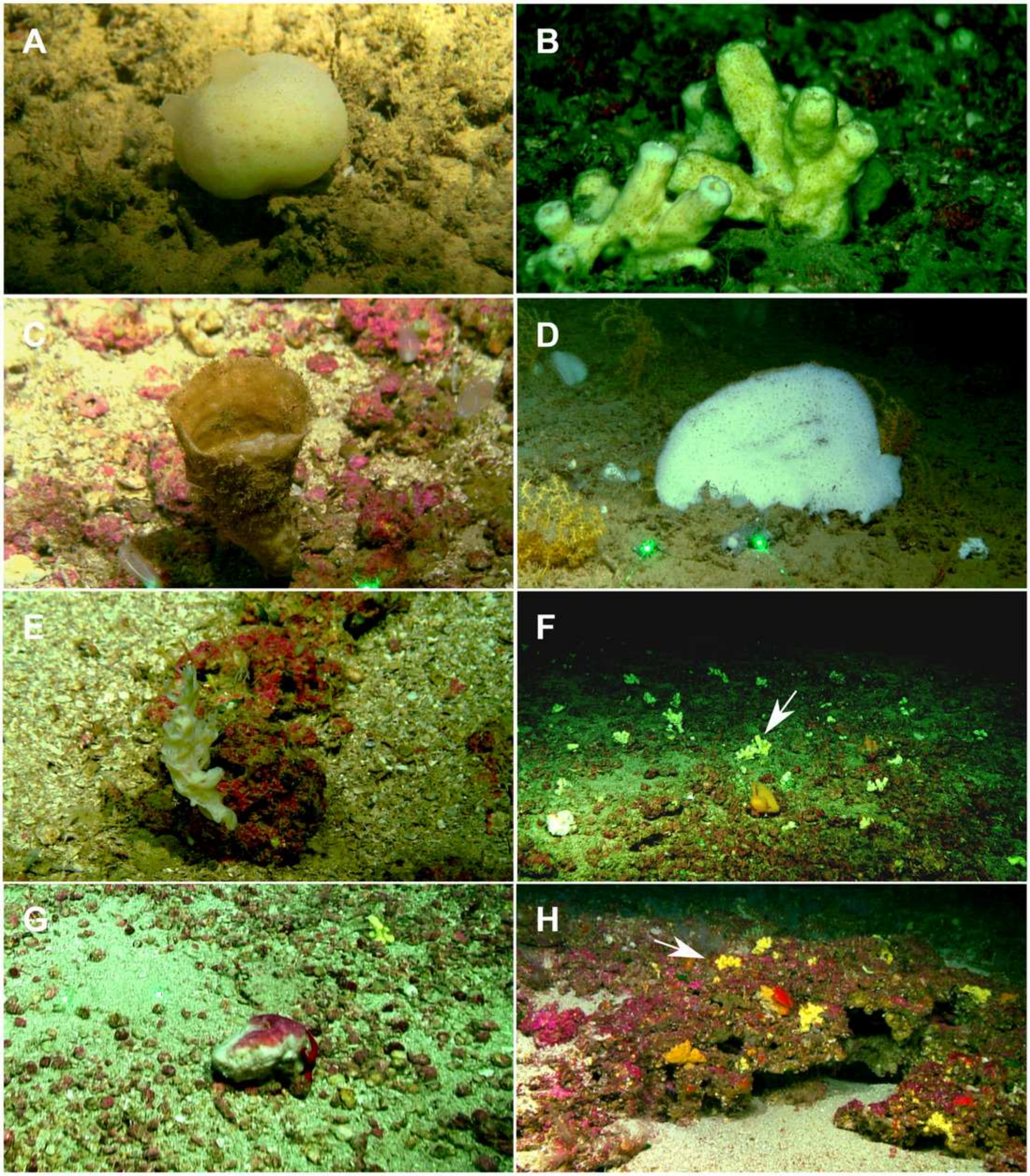
A
B
C
D
E
F
G
H

Figure 3

Pseudoaplysina balearica sp. nov.

(A) habitus of CFM-IEOMA-7356/i802 (holotype) in fresh state, with (A1), detail of the oscula and the dermal membrane (dm) and (A2), macroscopic view of the grooves at the skin. (B-F) SEM images of the spicules from CFM-IEOMA-7358/i293_1. (B-D) styles. (E) rhabdostyles. (F) oxea.

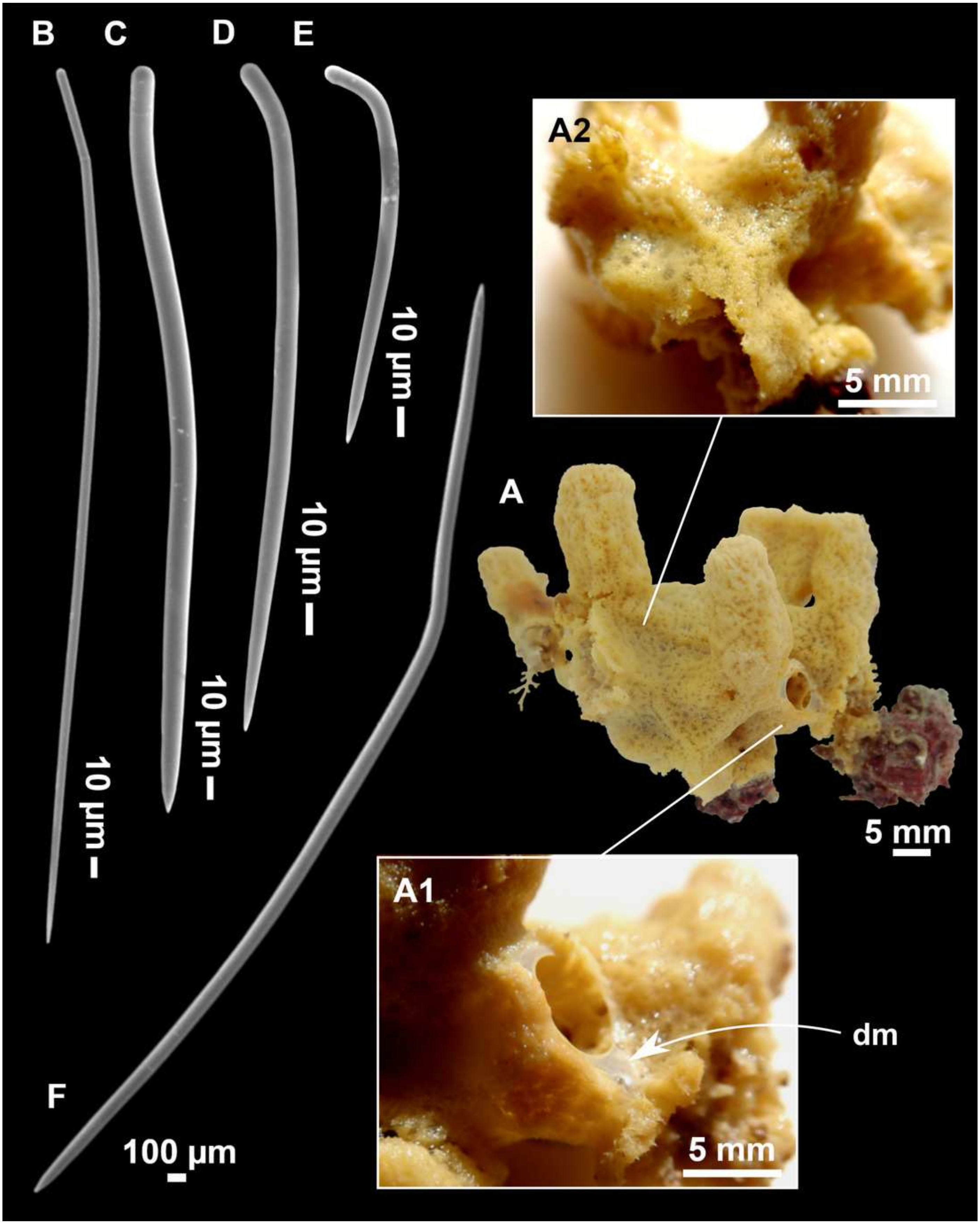
B
C
D
E
A2
5 mm
10 µm
10 µm
10 µm
10 µm
A
5 mm
A1
dm
5 mm
F
100 µm

Figure 4

Skeletal arrangement of *Pseudoaplysina balearica* sp. nov., holotype (CFM-IEOMA-7356/i802).

(A-C) transversal sections. (D-E) tangential images of the surface~~,~~ showing the dermal membrane (dm).

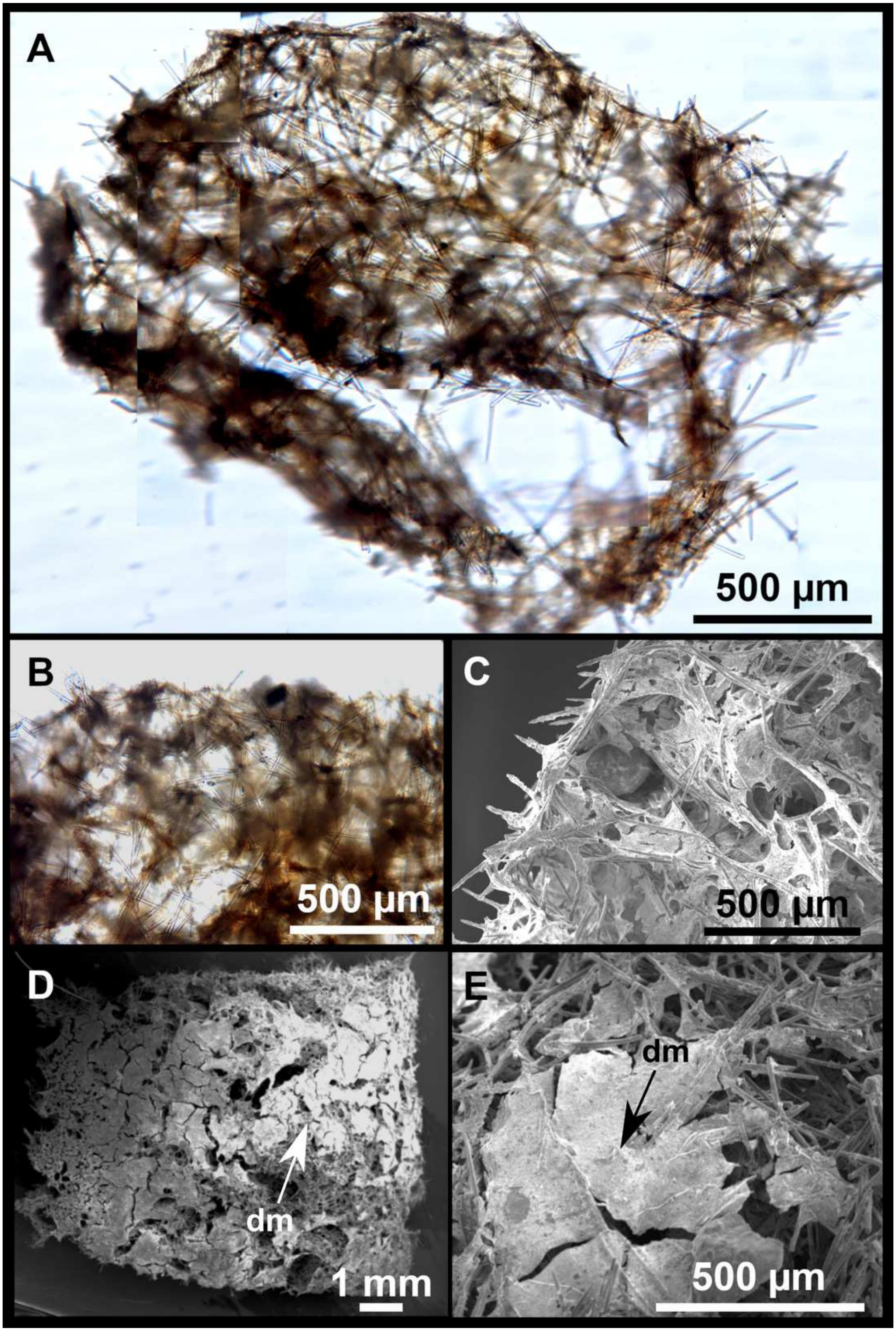
A
500 µm
B
500 µm
C
500 µm
D
dm
1 mm
E
dm
500 µm

Figure 5

Pseudoaplysina minuta sp. nov.

(A) habitus of CFM-IEOMA-7362/i439 (Holotype) on fresh state. (B) on deck image of CFM-IEOMA-7363/i474 (paratype). (C-H) optic microscope images of the skeletal elements of the Holotype. (C-D) styles. (E-F) rhabdostyles. (G) ectosomal skeleton. (H) detail of the dermal membrane.

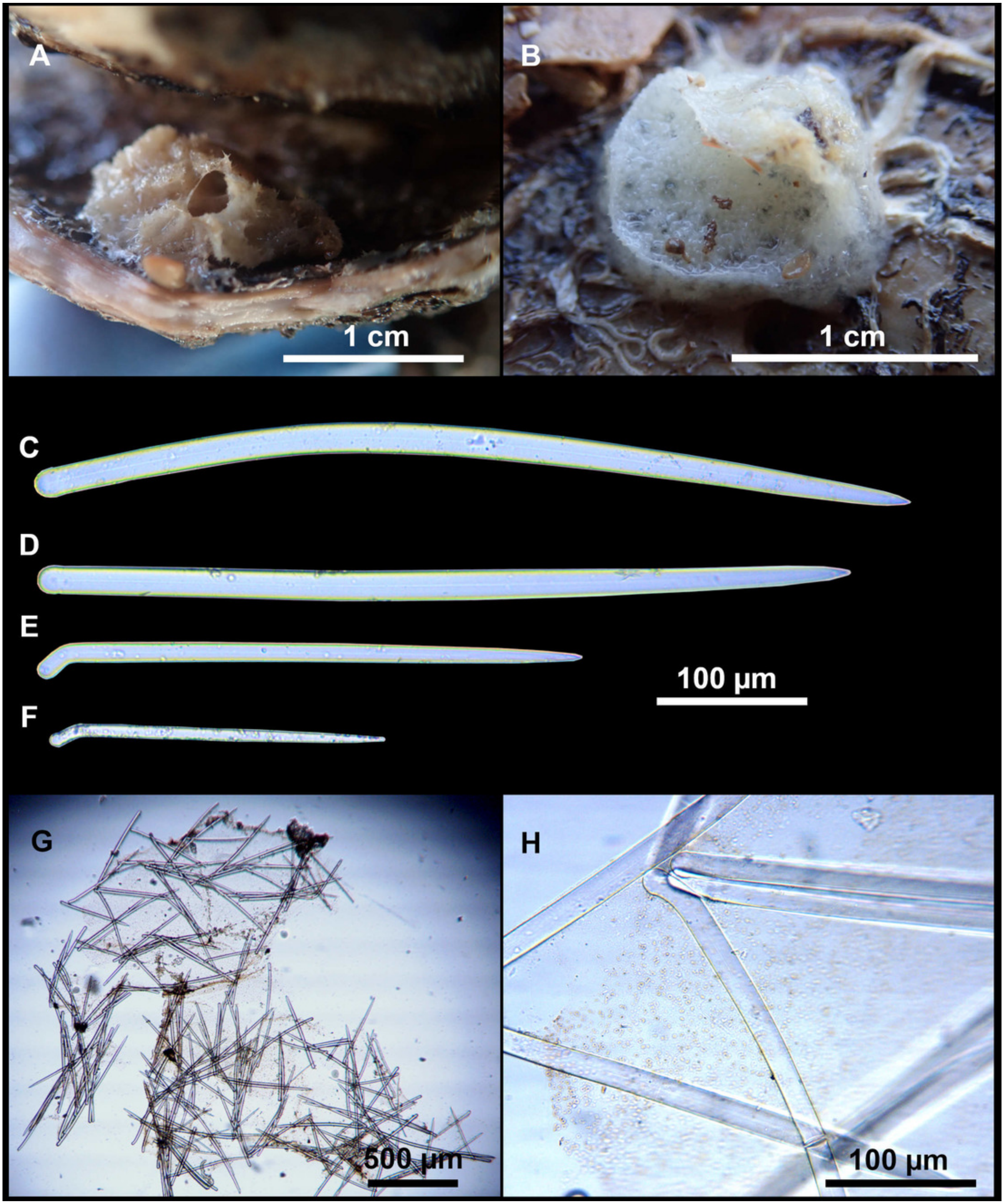
A
1 cm
B
1 cm
C
D
E
F
100 µm
G
500 µm
H
100 µm

Figure 6

Phylogenetic tree topology for specimens of Pseudoaplysina balearica sp. nov., Pseudoaplysina minuta sp. nov. described in the present study and other related Agelasids.

The t~~h~~ree was constructed with Maximum likelihood and Bayesian inference, based on COI (A) and 28S (B) fragments. Posterior probabilities and bootstrap support values are shown at the nodes. ~~A~~ sequence of Suberites domuncula and Suberites ficus are used as outgroups in both trees.

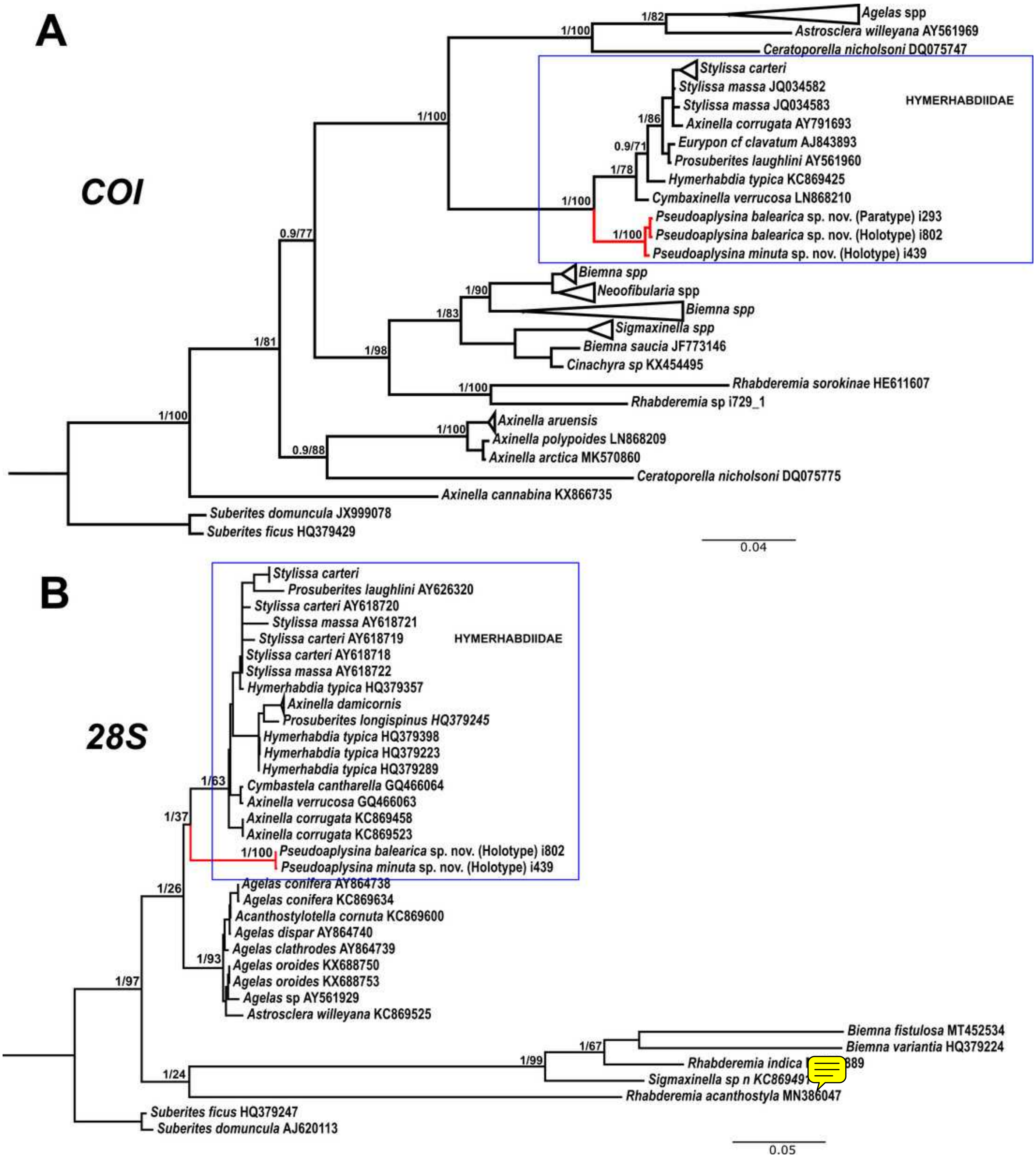
A
COI
1/82
Agelas spp
1/100
Astrosclera willeyana AY561969
Ceratoporella nicholsoni DQ075747
Stylissa carteri
Stylissa massa JQ034582
Stylissa massa JQ034583
HYMERHABDIIDAE
1/100
1/86
Axinella corrugata AY791693
0.9/71
Eurypon cf clavatum AJ843893
Prosuberites laughlini AY561960
1/78
Hymerhabdia typica KC869425
1/100
Cymbaxinella verrucosa LN868210
0.9/77
Pseudoaplysina balearica sp. nov. (Paratype) i293
1/100
Pseudoaplysina balearica sp. nov. (Holotype) i802
Pseudoaplysina minuta sp. nov. (Holotype) i439
Biemna spp
1/90
Neoofibularia spp
1/83
Biemna spp
Sigmaxinella spp
1/81
1/98
Biemna saucia JF773146
Cinachyra sp KX454495
1/100
Rhabderemia sorokinae HE611607
Rhabderemia sp i729_1
1/100
Axinella aruensis
1/100
Axinella polypoides LN868209
0.9/88
Axinella arctica MK570860
Ceratoporella nicholsoni DQ075775
Axinella cannabina KX866735
Suberites domuncula JX999078
Suberites ficus HQ379429
0.04
B
Stylissa carteri
Prosuberites laughlini AY626320
Stylissa carteri AY618720
Stylissa massa AY618721
Stylissa carteri AY618719
HYMERHABDIIDAE
Stylissa carteri AY618718
Stylissa massa AY618722
Hymerhabdia typica HQ379357
Axinella damicornis
Prosuberites longispinus HQ379245
28S
Hymerhabdia typica HQ379398
Hymerhabdia typica HQ379223
Hymerhabdia typica HQ379289
1/63
Cymbastela cantharella GQ466064
Axinella verrucosa GQ466063
1/37
Axinella corrugata KC869458
Axinella corrugata KC869523
1/100
Pseudoaplysina balearica sp. nov. (Holotype) i802
Pseudoaplysina minuta sp. nov. (Holotype) i439
Agelas conifera AY864738
1/26
Agelas conifera KC869634
Acanthostylotella cornuta KC869600
Agelas dispar AY864740
Agelas clathrodes AY864739
1/93
Agelas oroides KX688750
Agelas oroides KX688753
1/97
Agelas sp AY561929
Astrosclera willeyana KC869525
Biemna fistulosa MT452534
1/67
Biemna variantia HQ379224
1/99
Rhabderemia indica
889
Sigmaxinella sp n KC869491
1/24
Rhabderemia acanthostyla MN386047
Suberites ficus HQ379247
Suberites domuncula AJ620113
0.05

Figure 7

Axinella spatula Sitjà & Maldonado, 2014.

(A) photograph of fresh material deposited under CFM-IEOMA-7364-7366/i338_1A-1C. (B) habitus of CFM-IEOMA-7366/i338_1C preserved in EtOH. (C) long styles with (C1) subterminal swelling. (D) regular shaped style. (E) style with rhabdose modification. (F) oxea asymmetrically curved. (G) oxea ~~centrocurved~~. (H) oxea ~~centrotylota~~. (I-J) small oxeas. (K) SEM images of the skeletal structure of CFM-IEOMA-7366/i338_1C. (K1) detail of the inner ectosomal layer, with trichodragmata (tri).

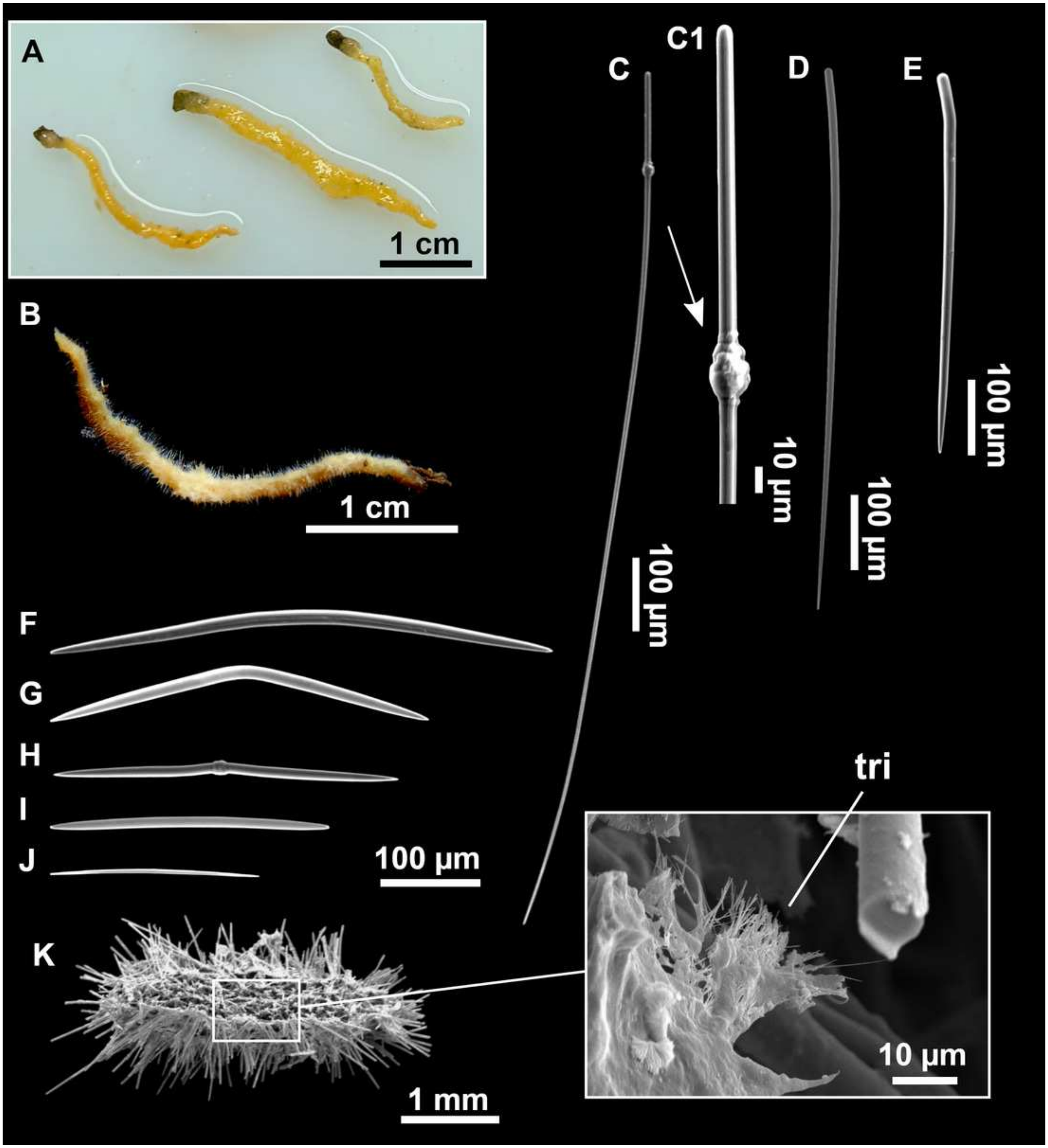
A
1 cm
B
1 cm
C
C1
D
E
100 µm
10 µm
100 µm
100 µm
F
G
H
I
J
100 µm
K
1 mm
tri
10 µm

Figure 8

Phakellia robusta Bowerbank, 1866.

(A) habitus of CFM-IEOMA-7371/i417 preserved in EtOH. (B-G) SEM images of CFM-IEOMA-7371/i417 spicules. (B-E) monactinal spicules. (B-C) stylote spicules (D-E) oxeot~~a~~ spicules with (E1) detail of the head of (E). (F-G) vermiform spicules. (F1-F2) detail of the tips of (F).

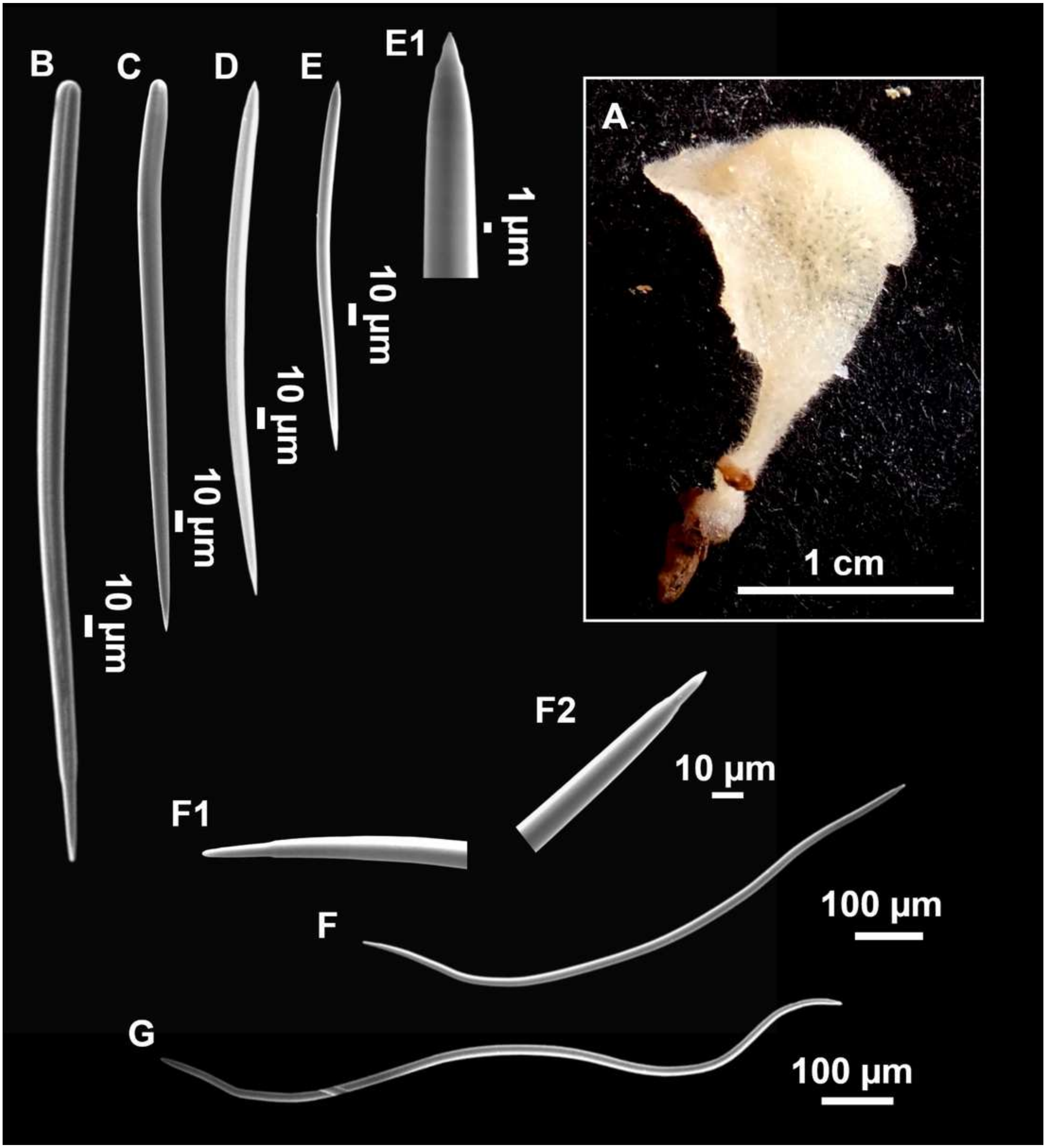
B
C
D
E
E1
A
1 µm
10 µm
10 µm
10 µm
10 µm
1 cm
F2
10 µm
F1
100 µm
F
G
100 µm

Figure 9

Average percentage values of the three monactinal spicule modifications (Ox: oxeot~~a~~. St: styloxeot~~a~~. S: stylot~~a~~) per size range of the three *Phakellia* species studied.

Size ranges are adapted to the spicule length range of each species. For *P. robusta* and *P. ventilabrum:* small <300 µm, medium 300-500 µm and large >500 µm. For *P. hirondellei* small <500 µm, medium 500-700 µm and large >700 µm. Error bars are not represented for *P. ventilabrum* since only one individual has been analyzed.

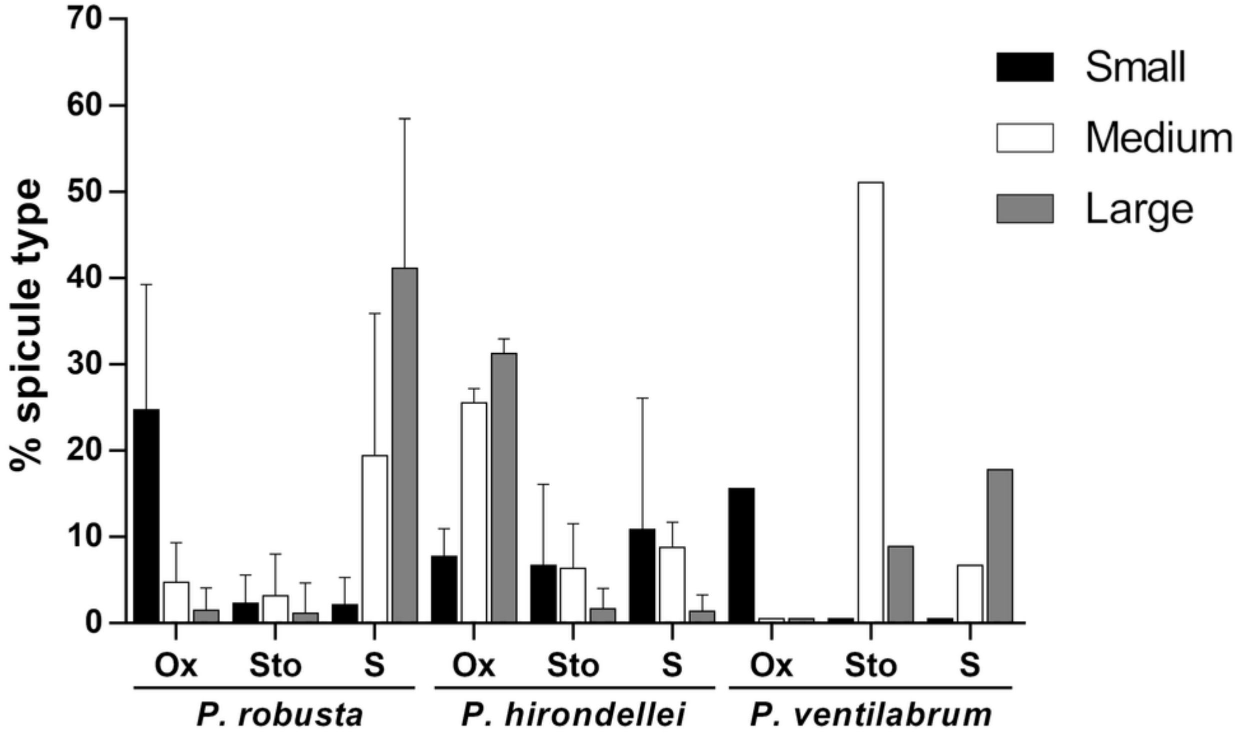

Figure 10

Phakellia ventilabrum (*Linnaeus, 1767*).

(A) habitus of CFM-IEOMA-7376/i822_1 on fresh state. (B-E) monactinal spicules. (B) monactinal stylot~~a~~. (B1) detail of the roundish head. (C-E) mona~~n~~ctinal oxeot~~as~~. (C1-E1) detail of the stepped heads. (F-G) vermiform spicules.

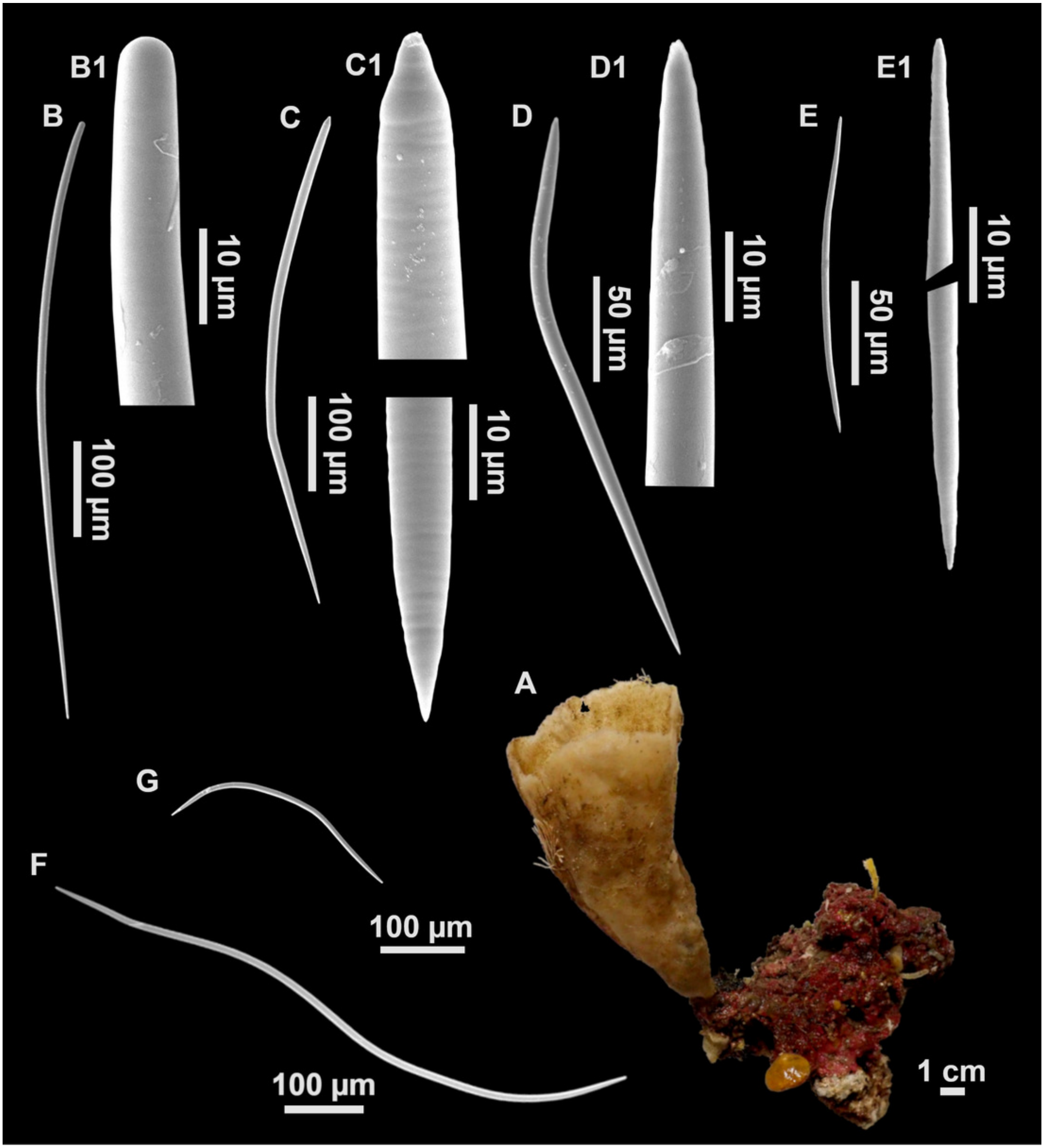
B1
B
10 µm
100 µm
C1
C
100 µm
10 µm
10 µm
D1
D
50 µm
10 µm
E1
E
50 µm
10 µm
A
G
F
100 µm
100 µm
1 cm

Figure 11

Phakellia hirondellei Topsent, 1890.

(A) habitus of CFM-IEOMA-7377/i353 preserved in EtOH. (B-D1) non vermiform spicules. (E-E1) vermiform spicules. (F) tangential section of the skeleton in ~~individual~~ CFM-IEOMA-7378/i623, showing the primary (pt) and secondary (st) trac~~ks~~.

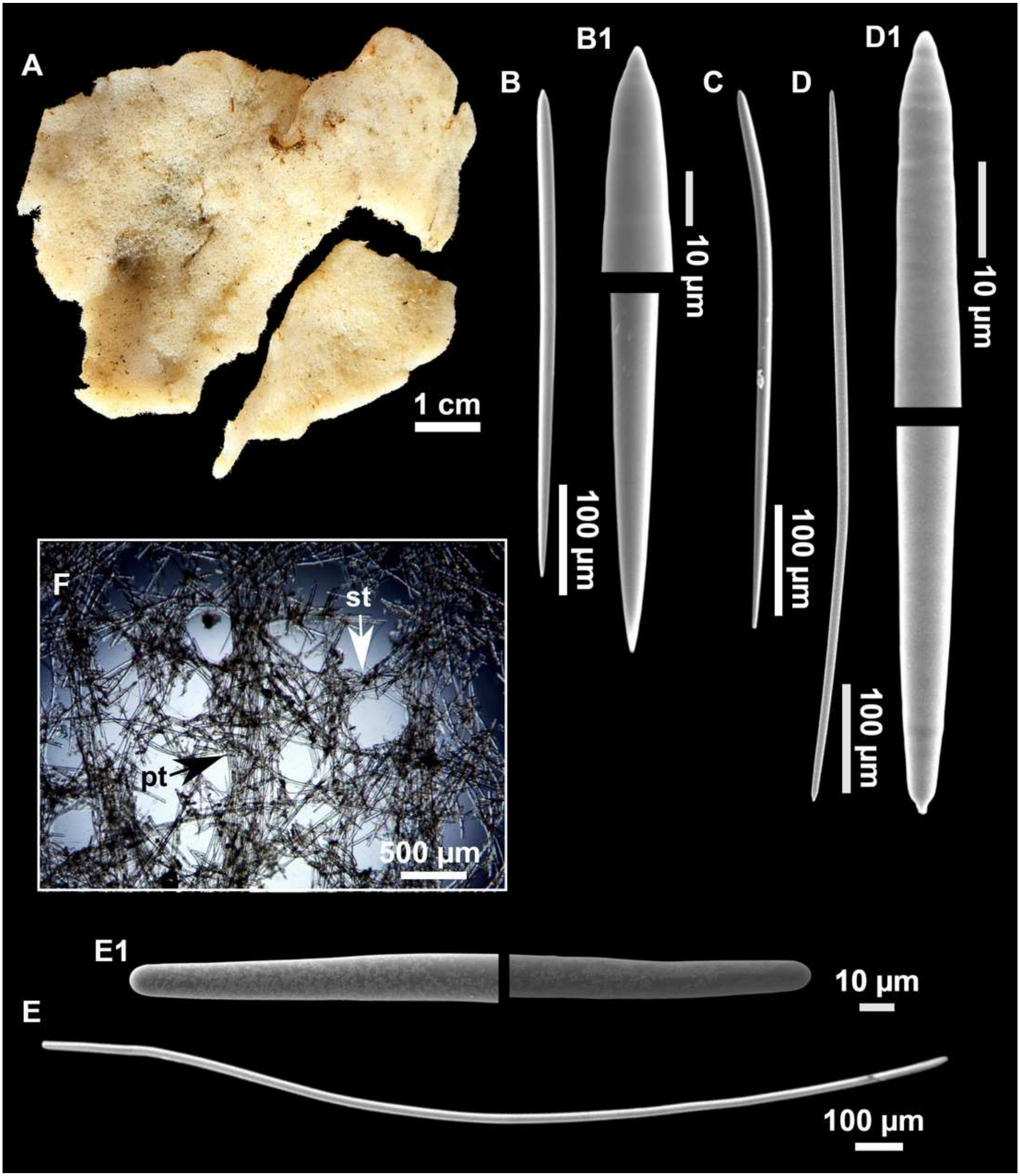
A
1 cm
B
100 µm
B1
10 µm
C
100 µm
D
100 µm
D1
10 µm
F
st
pt
500 µm
E1
10 µm
E
100 µm

Figure 12

Heteroxya mediterranea sp. nov.

(A) habitus of CFM-IEOMA-7380/i726 (holotype) in fresh state. (B) habitus of CFM-IEOMA-7382/i461 (paratype) in fresh state (large patch). (C-H) SEM images of CFM-IEOMA-7379/i727 (paratype). (C) large oxeas I. (D-F) small oxeas II. (G-H) detail of polyactinal teratogenic modifications of oxeas II. (I) optical microscope image of spicules from the holotype, showing small oxeas and a style (St).

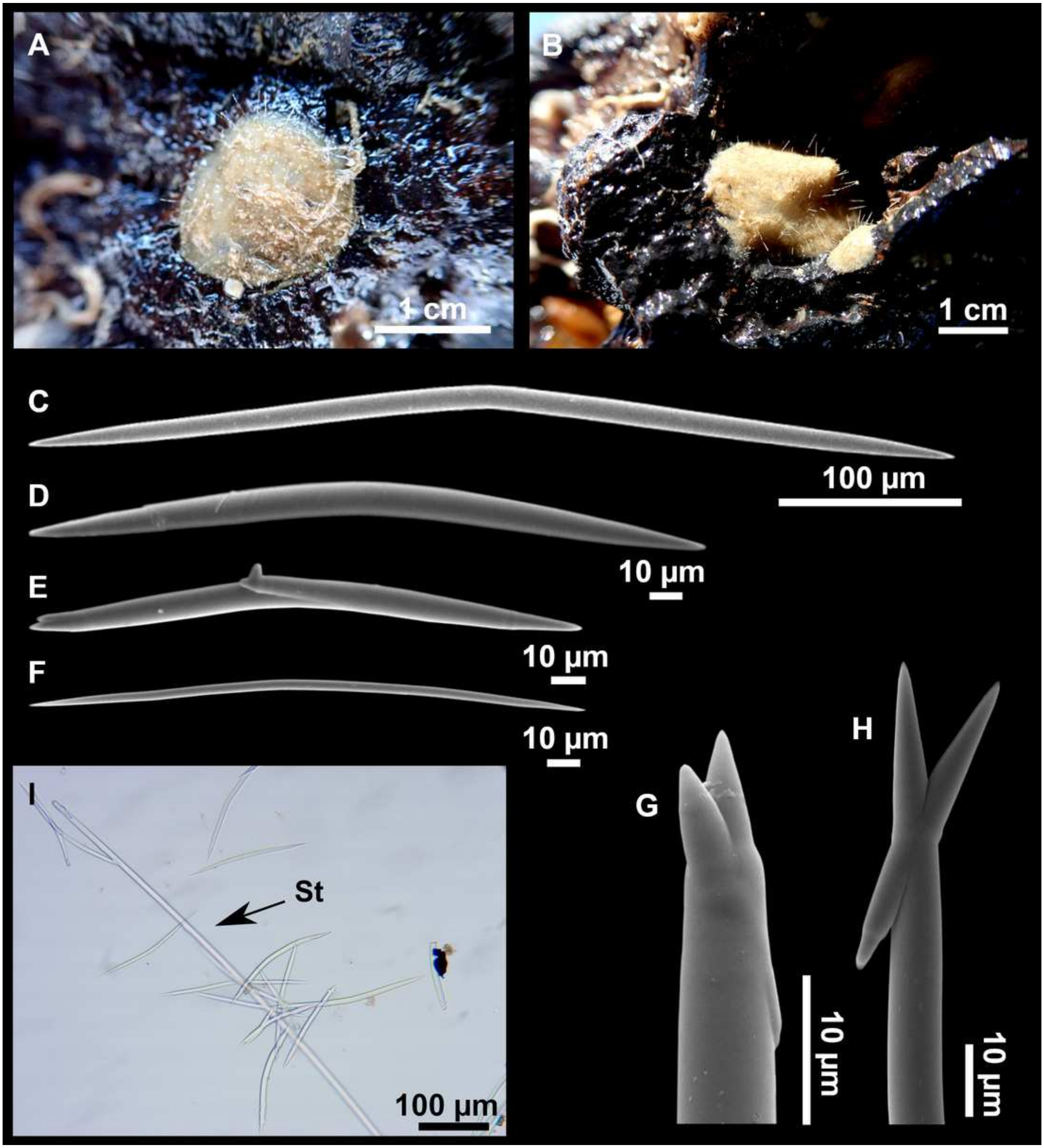
A
1 cm
B
1 cm
C
100 µm
D
10 µm
E
10 µm
F
10 µm
G
10 µm
H
10 µm
I
St
100 µm

Figure 13

Transversal skeleton of Heteroxya mediterranea sp. nov. *specimen* CFM-IEOMA-XX/i487.

(A) general view. (B) body arrangement on a thick area. (C) body arrangement on a thin area. (ox I) oxea I. (ox II) oxea II. (bl) basal lamina. (ect) ectosome. (ch) choanosome. (tr) spicule tracks.

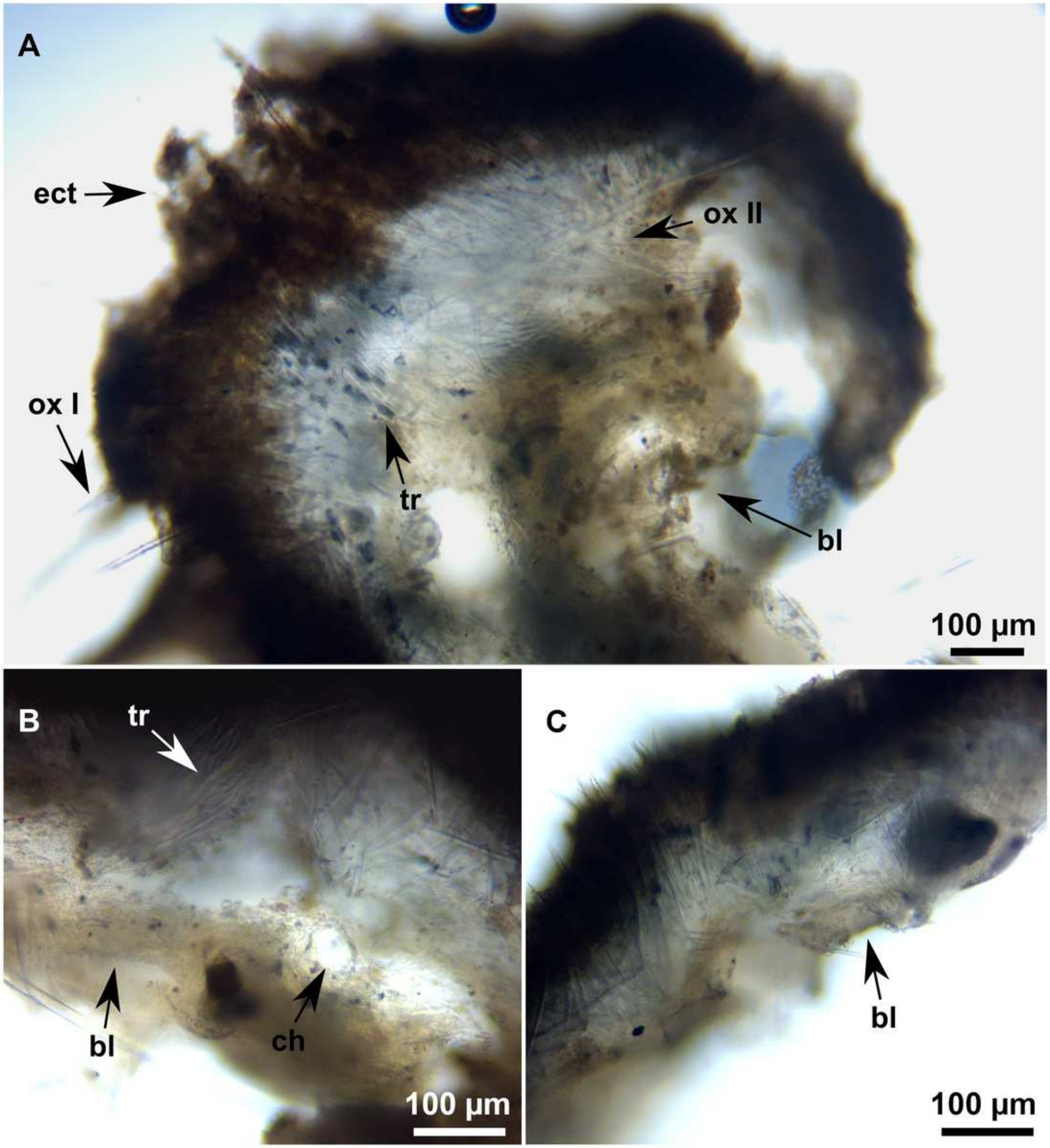
A
ect
ox II
ox I
tr
bl
100 µm
B
tr
bl
ch
100 µm
C
bl
100 µm

Figure 14

Paratimea massutii sp. nov.

(A-B) habitus of the holotype CFM-IEOMA-7383/i403 in fresh state, on its upper (A) and lower (B) sides. (C) habitus of the paratype CFM-IEOMA-7384/i420 preserved in EtOH. (D-I) SEM images of the Holotype. (D) oxea I, (E) oxea I (auxiliar spicule). (F-I) oxyasters (all with same bar scale).

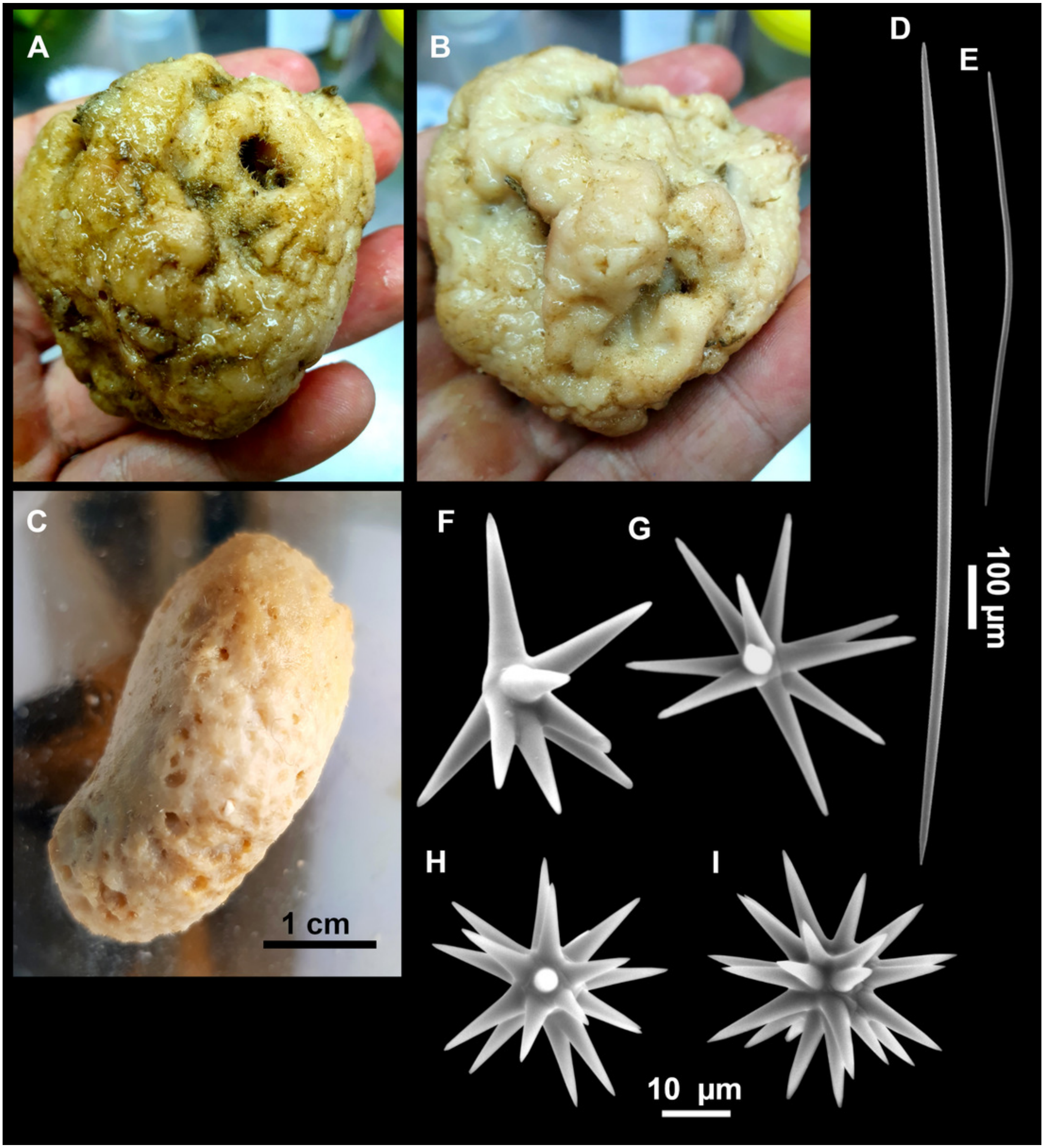
A
B
C
1 cm
D
E
100 µm
F
G
H
I
10 µm

Figure 15

Rhabdobaris implicata Pulitzer-Finali, 1983.

(A) habitus of CFM-IEOMA-7385/i338_2_1 preserved in EtOH. (B-K) SEM images of the spicules from CFM-IEOMA-7385/i338_2_1. (B-C) spined rhabdostyles, with (C1) detail of spines of (C). (D) smooth rhabdostyle. (E) tylostyle. (F) smooth strongyle. (G) acanthostrongyle. (H) acanthoxea. (I) smooth oxea. (J) smooth oxea with a central swelling. (K) single raphide.

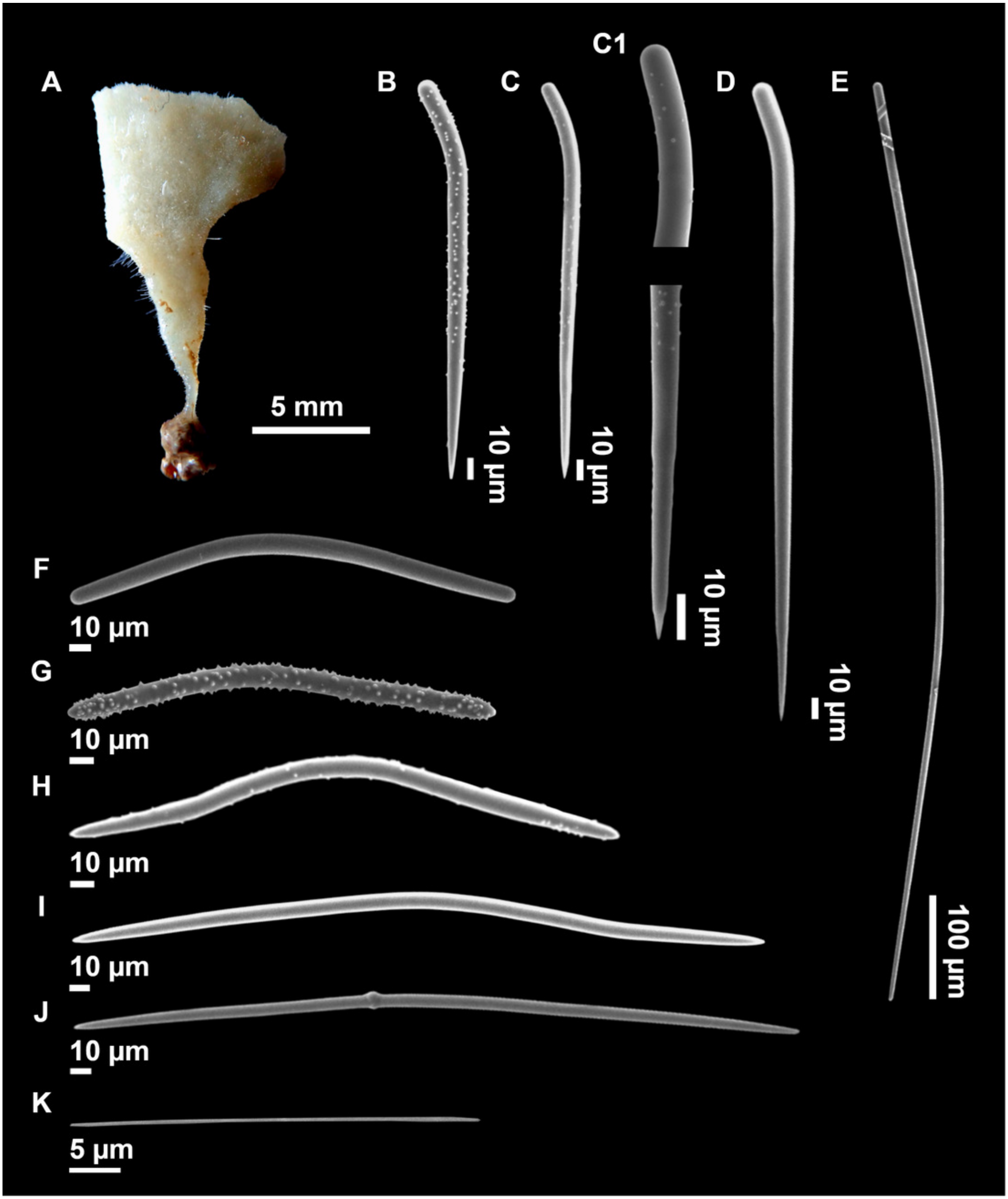
A
5 mm
B
10 µm
C
10 µm
C1
10 µm
D
10 µm
E
100 µm
F
10 µm
G
10 µm
H
10 µm
I
10 µm
J
10 µm
K
5 µm

Figure 16

Dragmatella aberrans (*Topsent, 1890*).

(A) habitus of CFM-IEOMA-7388/i175 preserved in EtOH. (B-B1) mycalostyles. (C) raphides with (C1) detail of the hook-shaped ends and central irregularities. (D-F) SEM images of the skeletal structure of CFM-IEOMA-7388/i175. (D) general view of the skeletal arrangement. (E) view of the ascending choanosomal tylostyle tracks. (F) detail of the ectosome.

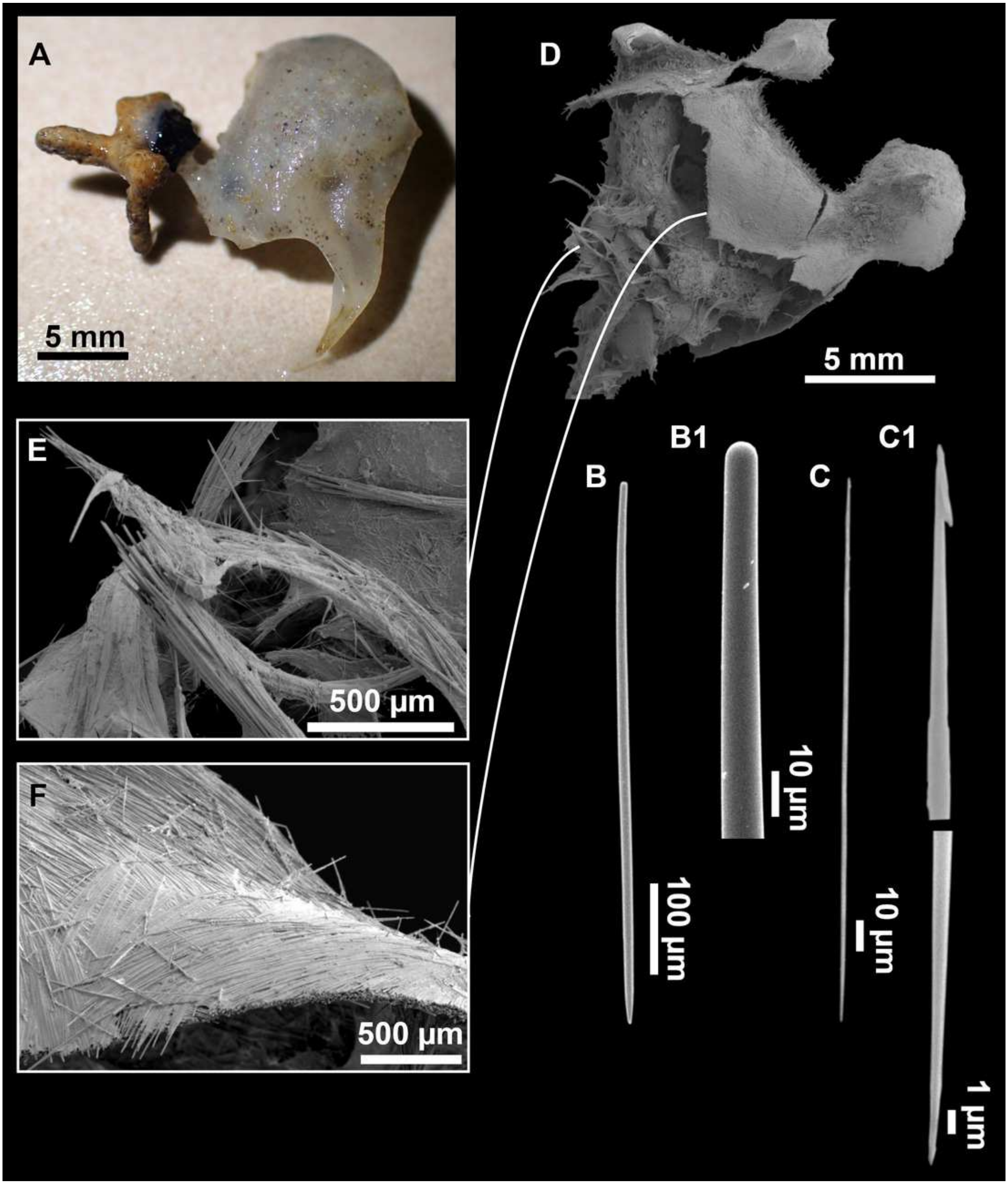
A
5 mm
D
5 mm
E
500 µm
F
500 µm
B
100 µm
B1
10 µm
C
10 µm
C1
1 µm

Figure 17

Haliclona (Soestella) fimbriata Bertolini & Pansini, 2015.

(A-B) habitus of CFM-IEOMA-7389/i825_1 in fresh state. (C-E1) SEM images of the oxeas with detail of the tips (E1).

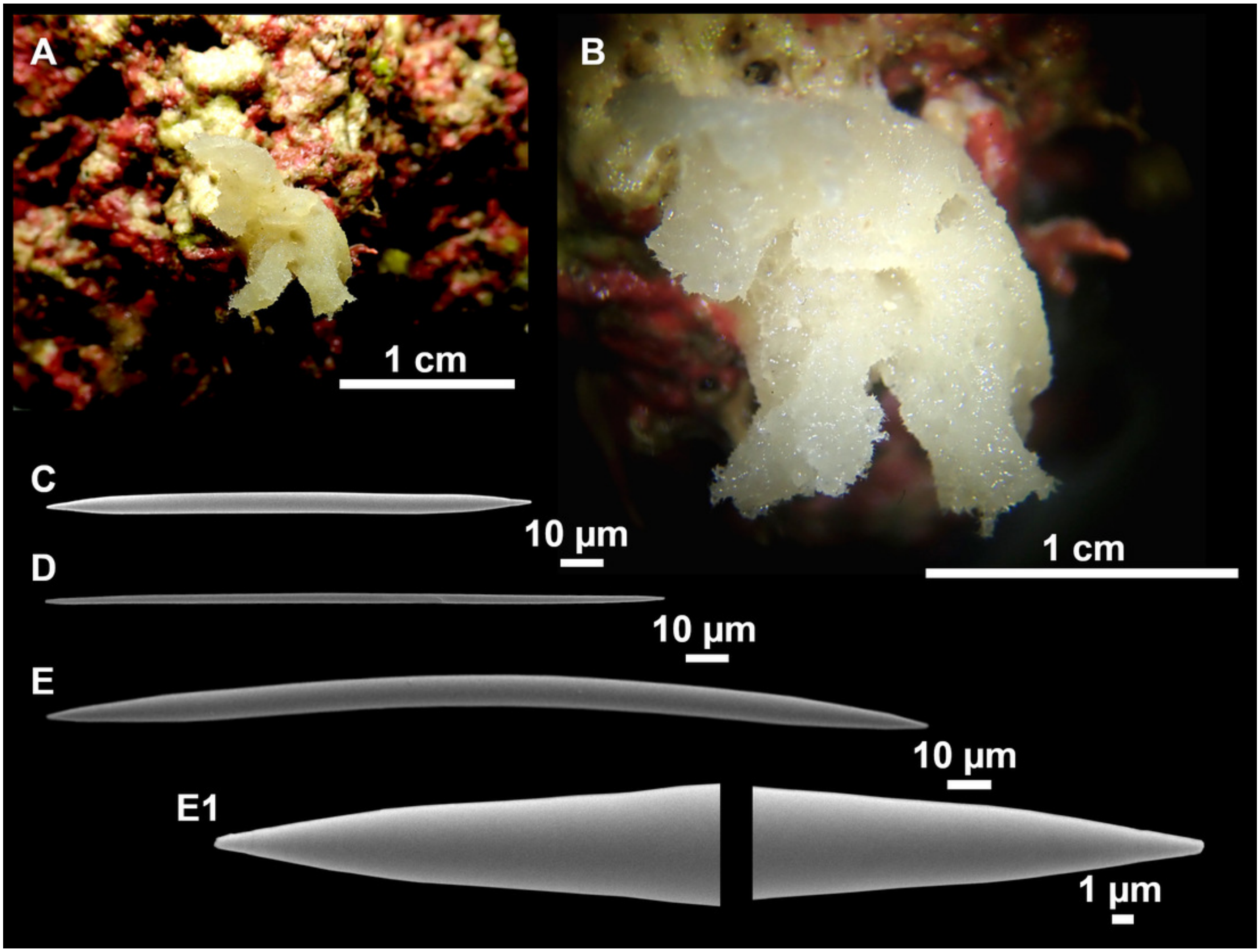

Figure 18

Petrosia (Strongylophora) vansoesti Boury-Esnault, Pansini & Uriz, 1994.

(A) habitus of CFM-IEOMA-7393/i313_G in fresh state. (B) habitus of CFM-IEOMA-7395/i694 in fresh state. (C) habitus of CFM-IEOMA-7393/i313_G preserved in EtOH. (D-H) SEM images of CFM-IEOMA-7390/i192_A. (D) large oxeas. (E) small oxeas. (F) strongyles. (G) transversal section. (H) detail view of the transversal section, showing the palisade of oxeas in the ectosome (arrow).

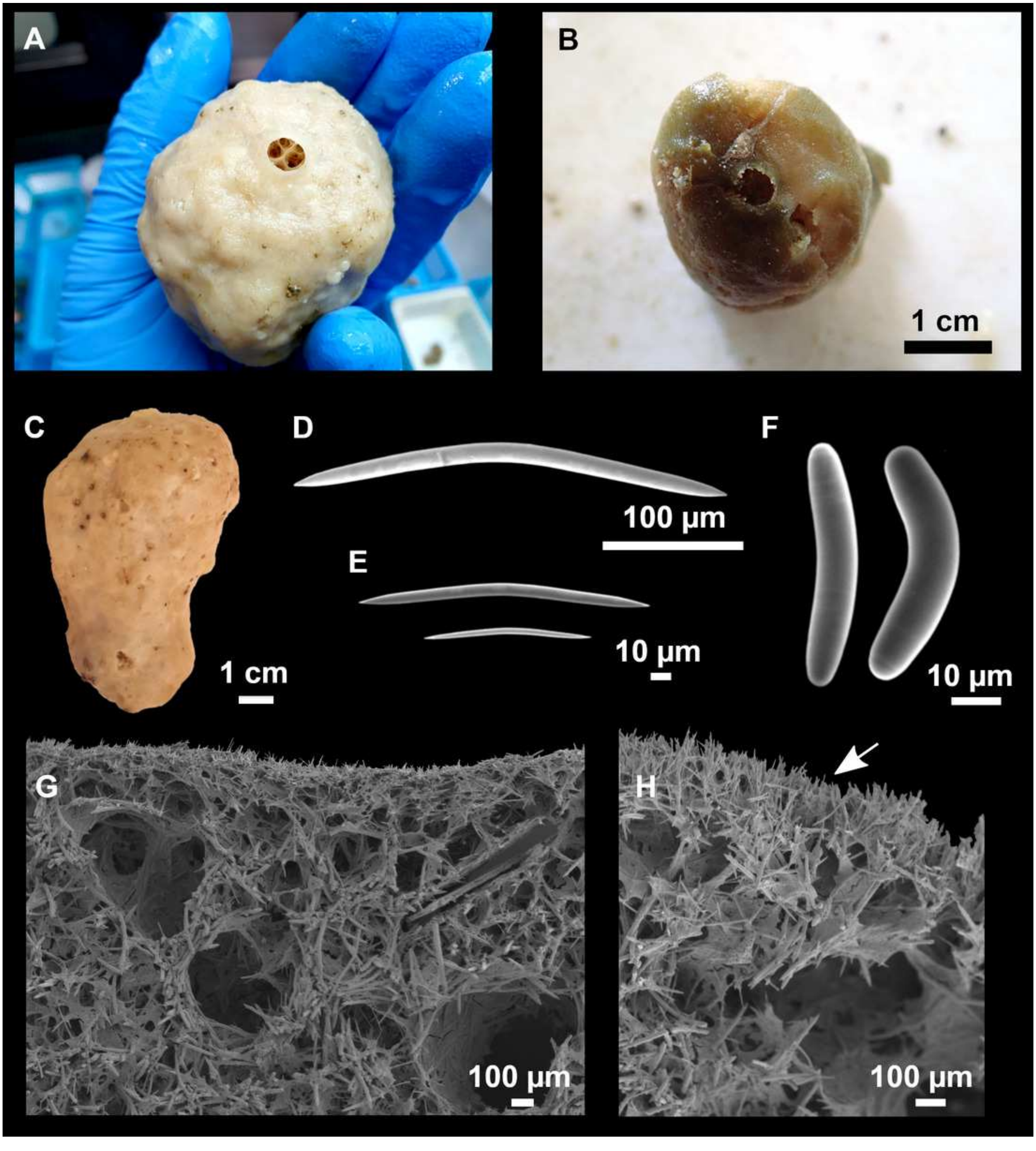
A
B
1 cm
C
1 cm
D
100 µm
E
10 µm
F
10 µm
G
100 µm
H
100 µm

Figure 19

Petrosia (petrosia) raphida Boury-Esnault, Pansini & Uriz, 1994.

(A) habitus of CFM-IEOMA-XX/i242, preserved in EtOH. (B) oxeas. (C) young stages of oxeas. (D-D1) acanthoses raphides. (E-E1) smooth raphides.

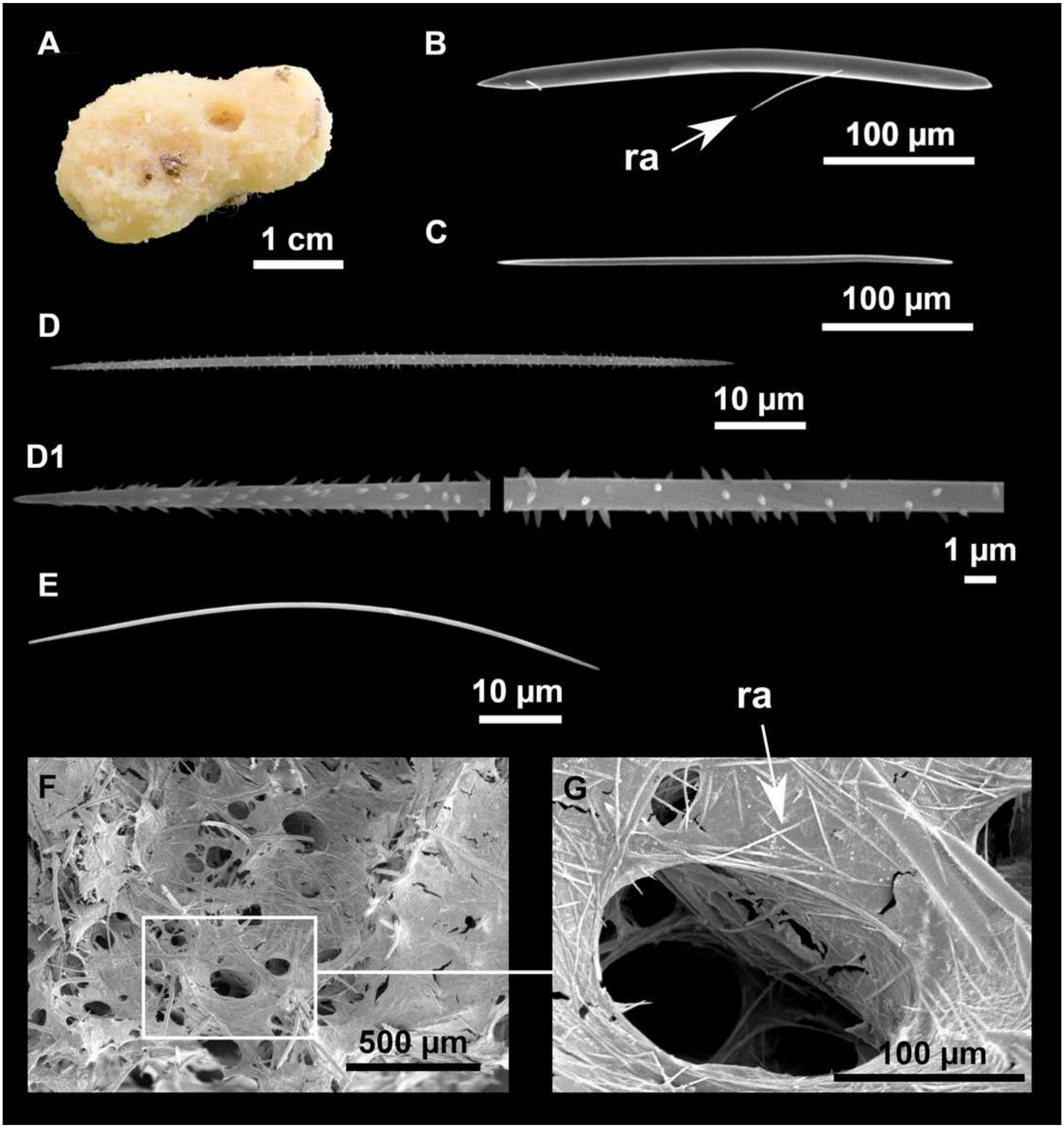
A
1 cm
B
ra
100 µm
C
100 µm
D
10 µm
D1
1 µm
E
10 µm
ra
F
500 µm
G
100 µm

Figure 20

Calyx *cf.* tufa.

(A) habitus of CFM-IEOMA-7403/i525 in fresh state. (B) detail of the ectosome with poral areas. (C-D) immature and mature oxeas, with (D1) detail of the tips of (D). (E) view of a poral area of the ectosome with spherulous cells (arrow). (F) transversal section of the choanosome. (G) detail of the reticulation of the choanosome.

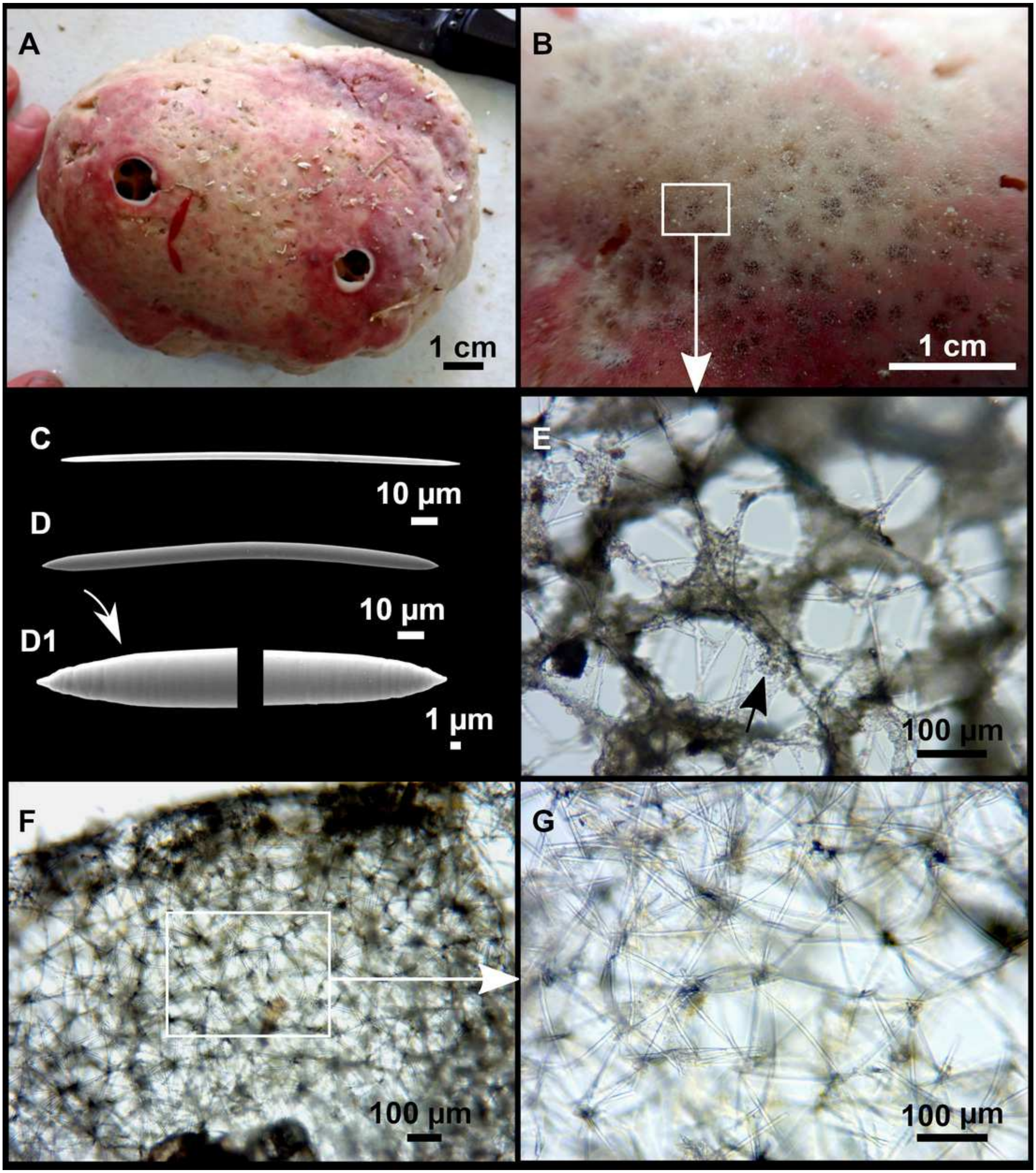
A
1 cm
B
1 cm
C
10 µm
D
10 µm
D1
1 µm
E
100 µm
F
100 µm
G
100 µm

Figure 21

Melonanchora emphysema (Schmidt, 1875).

(A) habitus of CFM-IEOMA-7404/i573 on fresh state, attached to a rodolith. (B-C) tornotes. (D-E) spheranchoras. (F) anchorate isochela I. (G) anchorate isochela II.

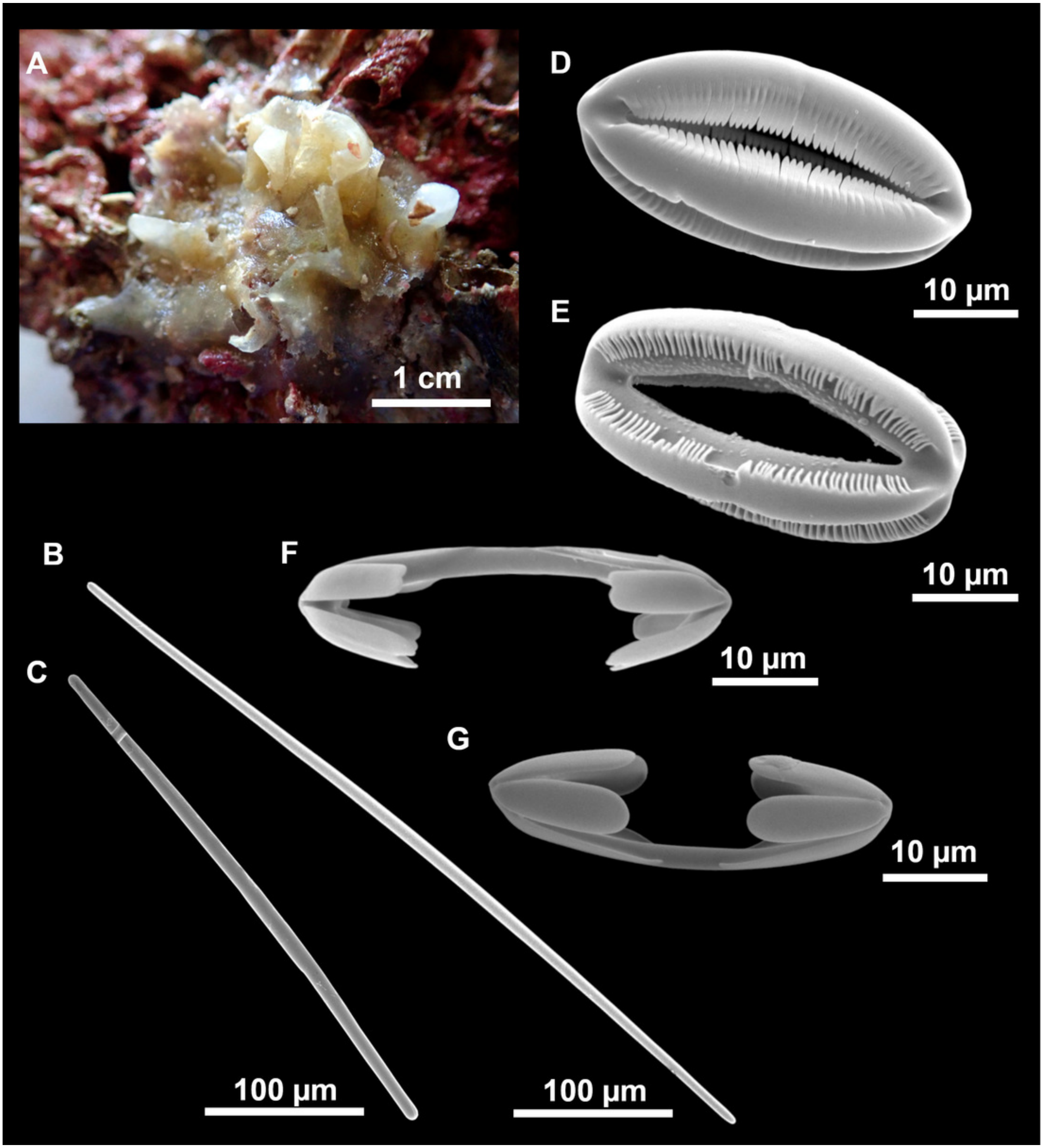
A
1 cm
D
10 µm
E
10 µm
B
F
10 µm
C
G
10 µm
100 µm
100 µm

Figure 22

Polymastia polytylota Vacelet, 1969.

(A-B) habitus of CFM-IEOMA-7405/i810, on fresh state (A), and preserved in EtOH (B). (C-C1) principal subtylostyles with detail of the tyles in the shaft (arrows). (D) Intermediary tylostyles with (D1) detail of the head. (E) ectosomal tylostyles with (E1) detail of the head.

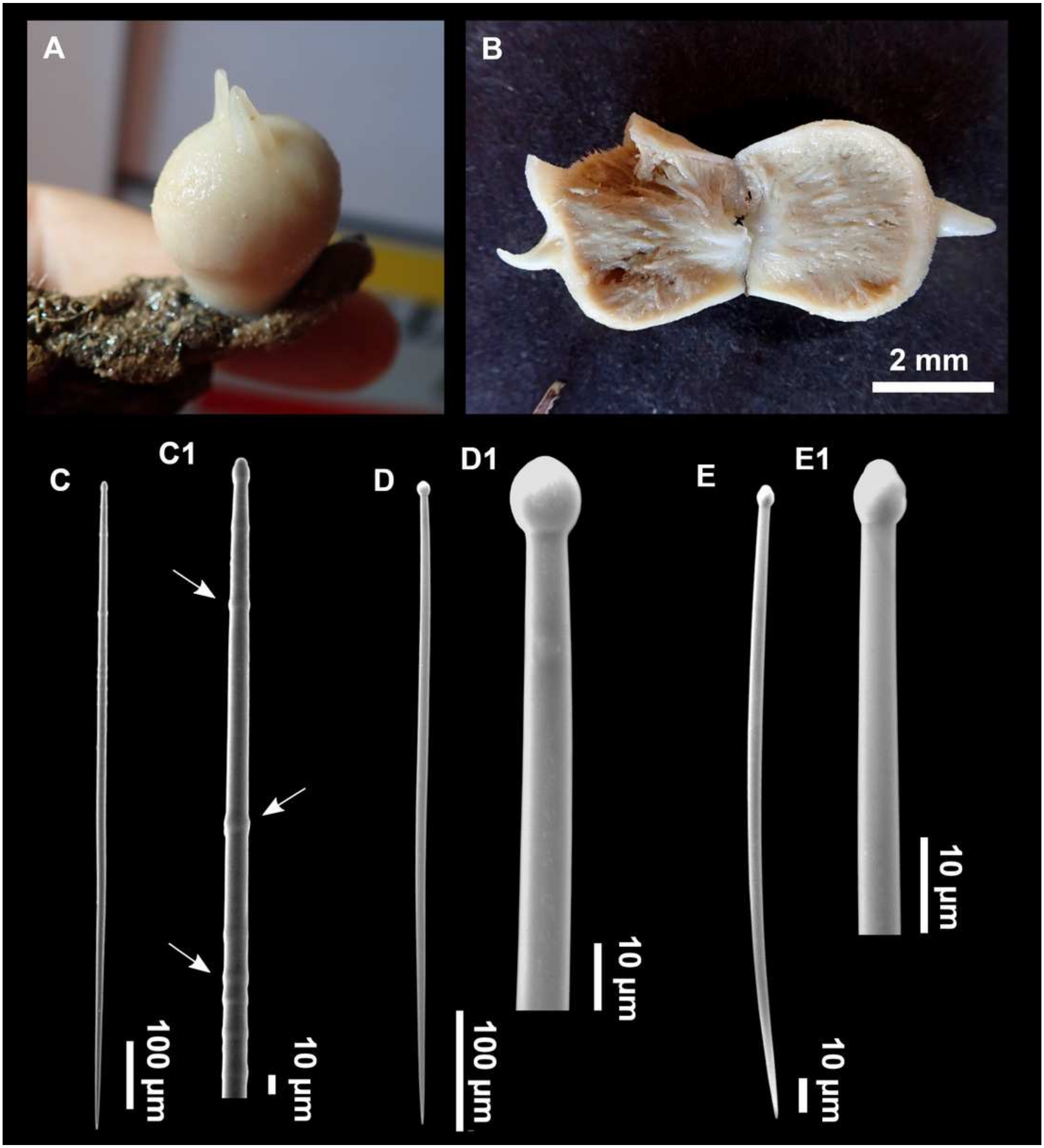
A
B
2 mm
C
C1
D
D1
E
E1
100 µm
10 µm
100 µm
10 µm
10 µm
10 µm

Figure 23

Pseudotrachya hystrix (*Topsent, 1980*).

(A) habitus of CFM-IEOMA-7407/i613 on fresh state. (B-B1) anisoxeas. (C) microxeas. (D-D1) SEM images of the skeletal structure. (po) palisade of oxeas.

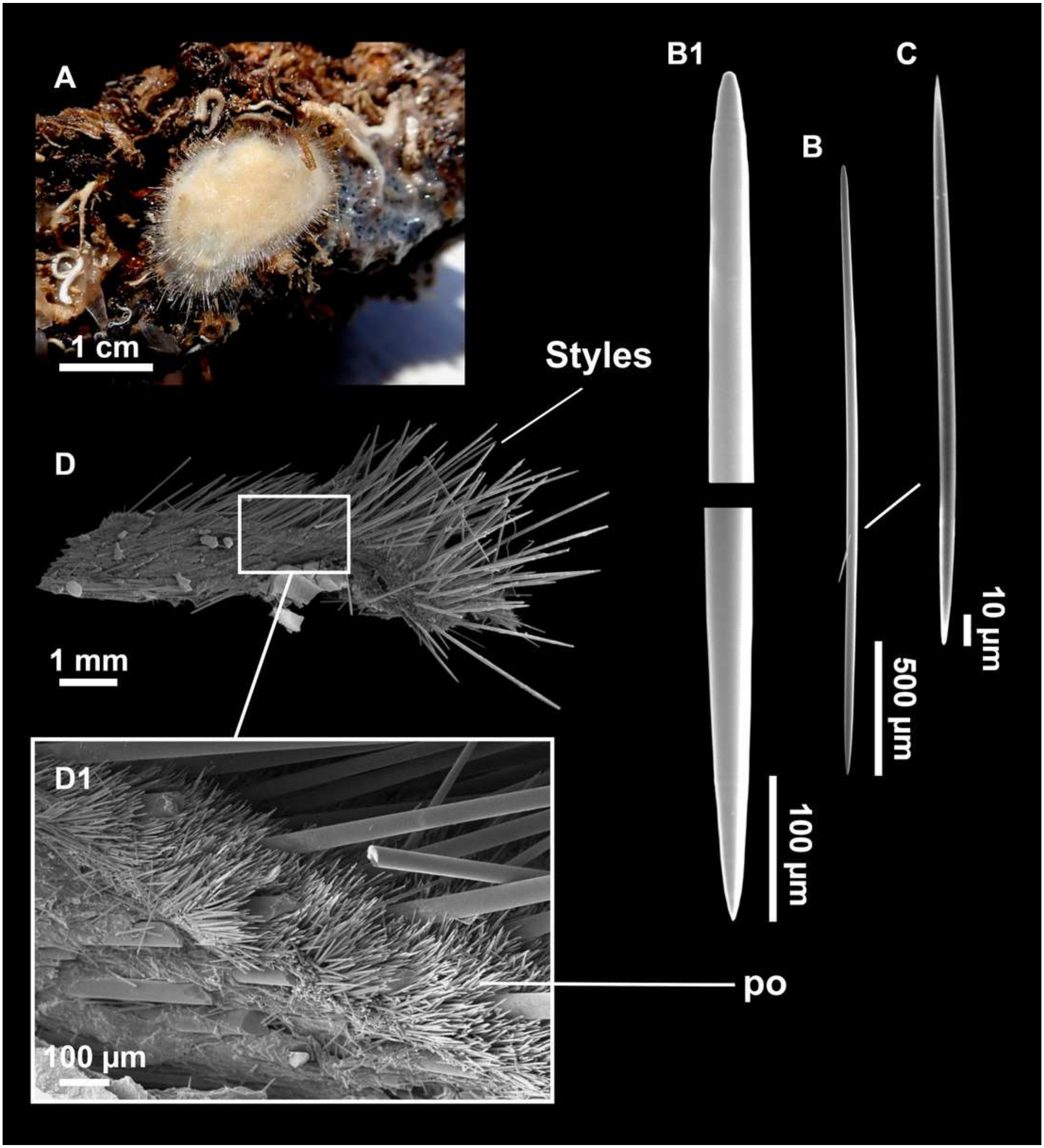
A
1 cm
B1
B
C
Styles
D
1 mm
10 µm
500 µm
100 µm
D1
po
100 µm

Figure 24

Hemiasterella elongata Topsent, 1928.

(A) habitus of CFM-IEOMA-7408/i149_4 preserved in EtOH. (B) style, with (B1) detail of head and tip. (C-F) spherostrongylasters.

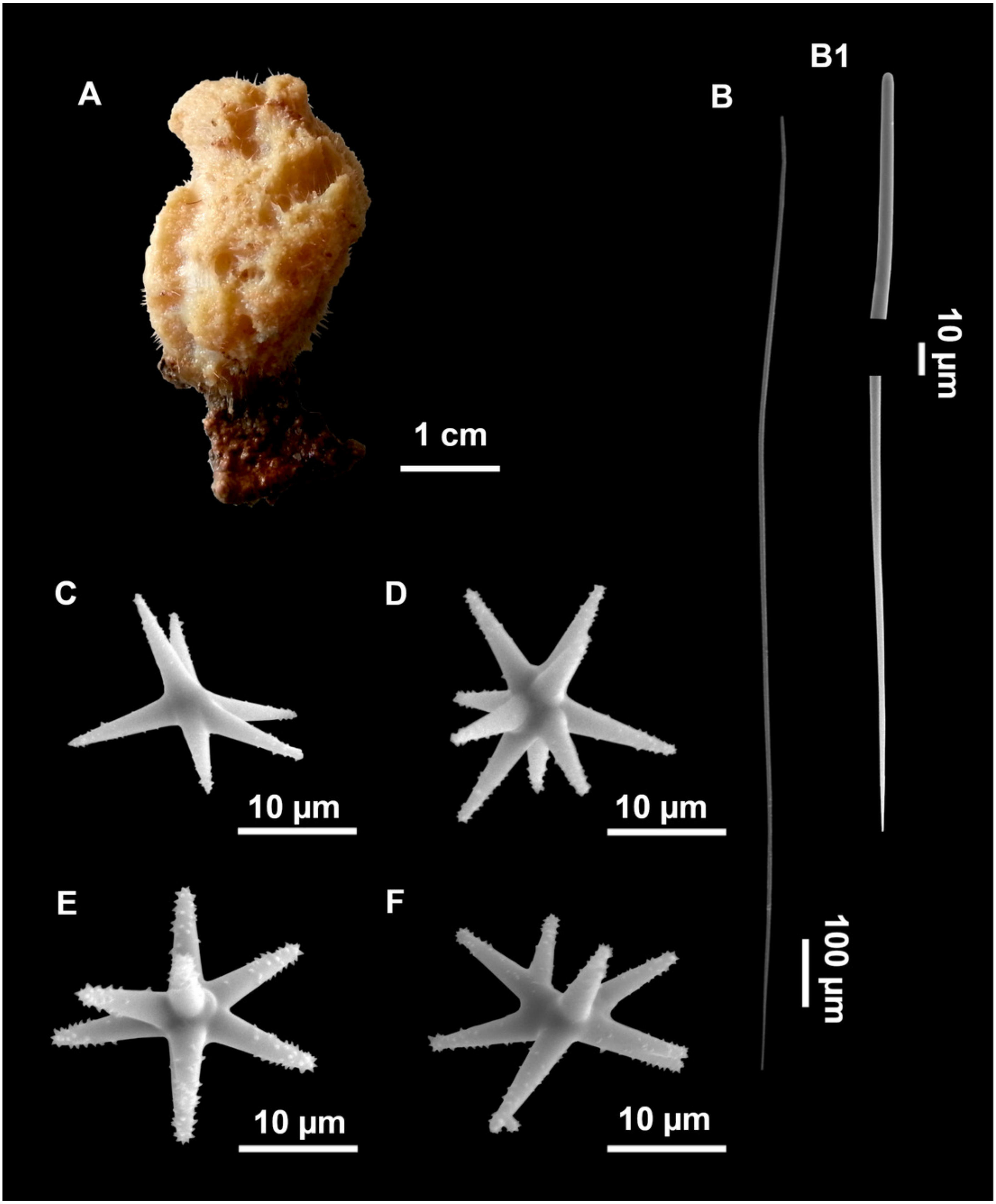
A
1 cm
B
B1
10 µm
100 µm
C
10 µm
D
10 µm
E
10 µm
F
10 µm

Figure 25

Lanuginella pupa Schmidt, 1870.

(A) habitus of CFM-IEOMA-7413/i286_2 (left), CFM-IEOMA-7412/i286_1 (middle), i286_3/CFM-IEOMA-7414 (right) preserved in EtOH. (B-I) SEM images of spicules from CFM-IEOMA-7412/i286_1. (B) choanosomal diactine with (B1) detail of the four central tubercles. (C) choanosomal hexactine. (D) hypodermal pentactine. (E) stauractine. (F-G) atrial~~a~~ hexactines with (G1) detail of the spines of (G). (H) discohexaster. (I) agglomeration of discohexasters, with a strombiloplumicome (sp) beneath.

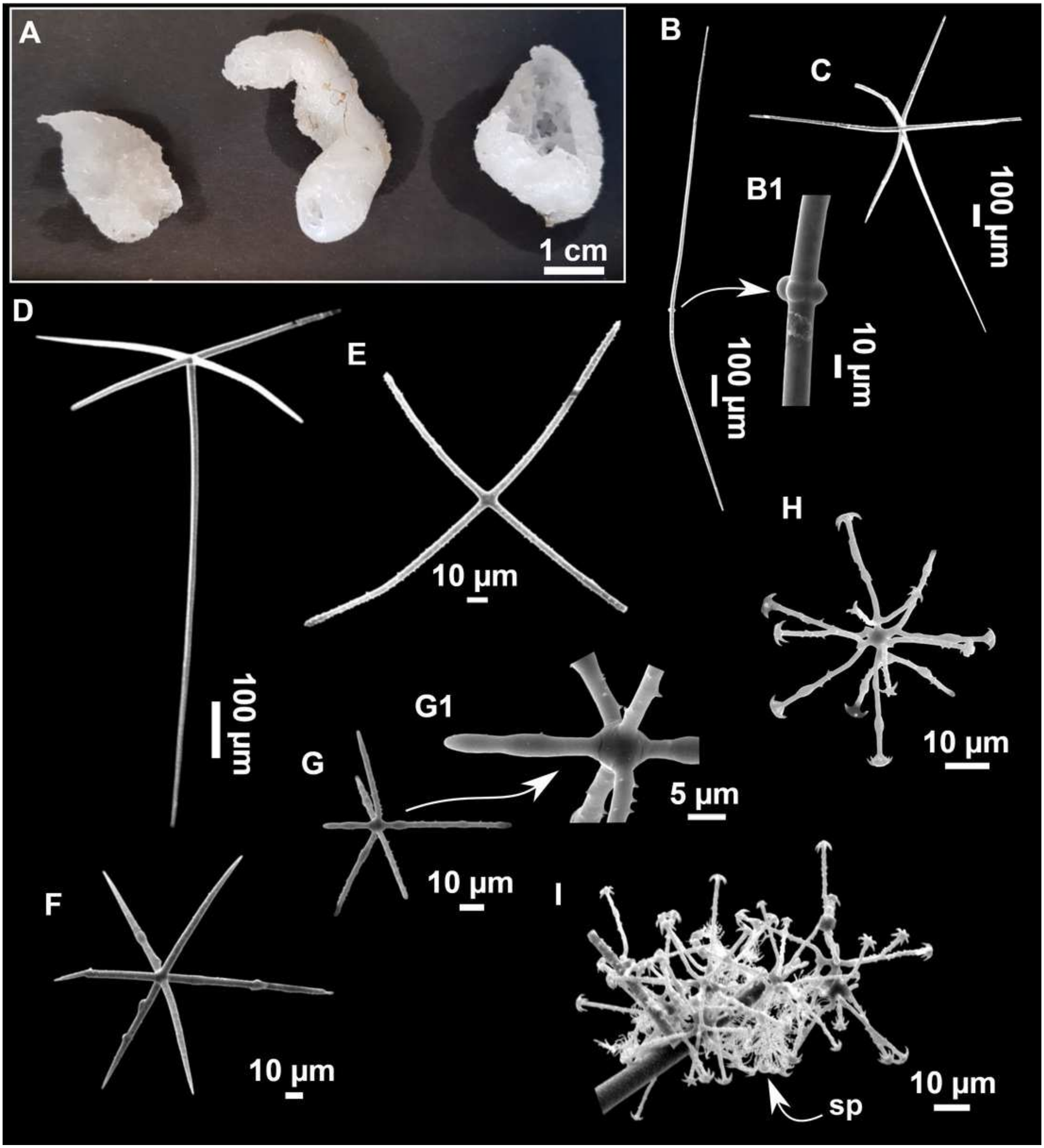
A
1 cm
B
C
100 µm
B1
100 µm
10 µm
D
E
10 µm
100 µm
H
10 µm
G1
G
5 µm
10 µm
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Table 1(on next page)

Details of the sampling stations.

(R_{survey}) reference number in the survey. (R_{study}) correspondent reference in the present study. (GOC-73) experimental bottom trawl net. (BT) beam trawl. (DR) rock dredge. (ROV) Remote Operated Vehicle Liropus 2000. (SO) Ses Olives. (AM) Ausias March. (EB) Emile Baudot. (E Me) eastern Menorca. (SW Ca) south-western Cabrera Archipelago.

R_{survey}	R_{study}	Year	Sampling device	Depth (m)	Coordinates Initial	 Final	Area	Seabed characteristics
206	1	2017	GOC-73	135	39º47’37,2’’N 4º26’15,4’’E	39º47’37,2’’N 4º26’15,4’’E	E Me	Fishing ground, sedimentary bottom
20	2	2018	BT	275	38º56’6’’N 1º57’58,3’’E	38º56’6’’N 1º57’43,9’’E	SO	Detrital bed of muddy sand
22	3	2018	BT	105	38º44’30,5’’N 1º46’5,9’’E	38º44’30,5’’N 1º45’53.3’’E	AM	Rhodolith bed with invertebrates
51	4	2018	BT	128	38º44’53,9’’N 2º30’41,4’’E	38º44’58,9’’N 2º30’54,7’’E	EB	Coarse sand with dead rhodoliths
60	5	2018	BT	138	38º43’13,1’’N 2º29’29,4’’E	38º43’5,5’’N 2º29’20,4’’E	EB	Coastal detrital with sand
66	6	2018	BT	146	38º41’13,9’’N 2º28’11,3’’E	38º41’7,1’’N 2º28’1,9’’E	EB	Coastal detrital with sand and small dead rhodoliths
52	7	2018	RD	109	38º44’13,2’’N 2º30’3,6’’E	38º44’12,5’’N 2º30’12’’E	EB	Rhodolith bed
50	8	2019	BT	102	38º43’33,6’’N 1º48’12,6’’E	38º43’34,7’’N 1º48’23,4’’E	AM	Rhodolith bed with invertebrates
99	9	2019	BT	131	38º46’20’’N 1º48’54,7’’E	38º46’29,3’’N 1º49’36,1’’E	AM	Coastal detrital with sand and sponges
104	10	2019	BT	118	38º45’57,6’’N 1º51’2,5’’E	38º46’4,8’’N 1º51’8’’E	AM	Coastal detrital
124	11	2019	BT	152	38º45’19,1’’N 2º31’0,5’’E	38º45’20,9’’N 2º31’8,4’’E	EB	Detrital border
135	12	2019	BT	169	38º44’42,7’’N 2º29’25,8’’E	38º44’21,2’’N 2º29’15,8’’E	EB	Detrital border with sand
136	13	2019	BT	147	38º44’42,7’’N 2º29’25,8’’E	38º43’13,1’’N 2º29’21,5’’E	EB	Detrital border with gross black sand
166	14	2019	BT	433	38º44’3,1’’N 2º28’12,7’’E	38º43’44,4’’N 2º28’1,2’’E	EB	Detrital mud
167	15	2019	BT	151	38º42’21,6’’N 2º29’37,3’’E	38º42’12,6’’N 2º29’29,4’’E	EB	Detrital border with sand
175	16	2019	BT	410	38º46’21’’N	38º46’31,1’’N	EB	Detrital mud

					2º30’44,3’’E	2º31’5,9’’E		
177	17	2019	BT	156	38º43’57,7’’N 2º28’54,1’’E	38º43’47’’N 2º28’53,4’’E	EB	Detrital border with sand
95	18	2019	RD	275-220	38º47.8’0’’N 1º52.6’0’’E	38º47.7’0’’N 1º52.4’0’’E	AM	Rocky slope
103	19	2019	RD	302-231	38º47.4’0’’N 1º47.2’0’’E	38º47.3’’0’’N 1º47.2’0’’E	AM	Rocky slope
224	20	2019	GOC-73	252	39º3’3,6’’N 2º42’2,9’’E	39º5’15,7’’N 2º42’13,3’’E	SW Ca	Fishing ground, sedimentary bottom
225	21	2019	GOC-73	754	38º57’11,5’’N 2º37’54,1’’E	39º0’2,9’’N 2º38’33’’E	SW Ca	Fishing ground, bathyal mud
1	22	2020	BT	289	38º58’0,5’’N 2º0’22,7’’E	38º58’14,9’’N 2º0’0’’E	SO	Detrital with encrusting sponges and small crustaceans
17	23	2020	BT	113	38º45’15,5’’N 1º46’53,4’’E	38º45’4,7’’N 1º46’36,1’’E	AM	Rhodolith bed with invertebrates
18	24	2020	BT	114	38º45’15,5’’N 1º46’53,4’’E	38º45’16,2’’N 1º46’54,1’’E	AM	Rhodolith bed with invertebrates
45	25	2020	BT	147	38º42’51,8’’N 2º30’13,7’’E	38º42’28,1’’N 2º29’24’’E	EB	Coarse sand and gravel with crustaceans and sponges
52	26	2020	BT	320	38º45’47,5’’N 2º31’0,5’’E	38º45’56,9’’N 2º30’37,1’’E	EB	Organogenic sediments, shells rests and gravel with sponges
3	27	2020	RD	288-318	38º56’4,7’’N 1º59’48,1’’E	38º56’44,5’’N 1º59’46,3’’E	SO	Rocks and rests of fossil Ostreids
7	28	2020	RD	325-255	38º58’41,9’’N 1º59’2,4’’E	38º58’33,6’’N 1º59’8,5’’E	SO	Rocks, rests of fossil Ostreids and fossil corals
8	29	2020	RD	315-295	38º58’11,3’’N 2º0’30,6’’E	38º58’12’’N 2º0’25,2’’E	SO	Rocks and rests of fossil Ostreids
14	30	2020	RD	325-270	38º55’33,6’’N 1º58’5,6’’E	38º55’45,1’’N 1º58’1,2’’E	SO	Mud, rocks and fossil Ostreids
20	31	2020	RD	104-138	38º42’51,1’’N 1º46’28,2’’E	38º43’14,5’’N 1º46’27,5’’E	AM	Rhodolith bed with sponges
27	32	2020	RD	222-195	38º47’31,2’’N 1º52’43,7’’E	38º47’28,7’’N 1º52’31,8’’E	AM	Carbonated rocks with encrusting sponges and gravels

28	33	2020	RD	135-140	38º45’56,5’’N 1º51’51,5’’E	38º46’3,7’’N 1º51’45,7’’E	AM	Rhodolith bed and rocks with sponges
43	34	2020	RD	118-116	38º44’25,1’’N 2º30’40,3’’E	38º44’26,9’’N 2º30’33,5’’E	EB	Rhodolith bed and rocks with sponges
46	35	2020	RD	280-306	38º42’21,6’’N 2º30’44,3’’E	38º42’31,3’’N 2º30’42,5’’E	EB	Basaltic rocks and fossil Ostreids with encrusting sponges
94	36	2020	GOC-73	142	39º1’13,8’’N 2º51’2,5’’E	39º2’16,8’’N 2º49’43,7’’E	SW Ca	Fishing ground, sedimentary bottom
07_1	37	2020	ROV	249-122	38º45’44,7’’N 1º46’0,8’’E	38º45’22,3’’N 1º46’22,1’’E	AM	Sedimentary slope and rhodolith bed with sponges
13	38	2020	ROV	465-352	38º48’22,3’’N 1º52’57’’E	38º48’26,3’’N 1º52’39,4’’E	AM	Rocky slope with large sponges
23	39	2020	ROV	133-169	38º44’27,6’’N 2º29’15’’E	38º44’40,2’’N 2º29’43,4’’E	EB	Rocky slope, rhodolith bed with sponges and corals
24	40	2020	ROV	150-134	38º44’46’’N 2º29’28,3’’E	38º44’57,5’N 2º29’54,2’’E	EB	Rocky slope and summit, rhodolith bed with sponges and corals

Table 2(on next page)

Comparative characters of *Pseudoaplysina balearica* sp. nov. and *Pseudoaplysina minuta* sp. nov.

Depth (m), area (SO: Ses Olives; AM: Ausias March; EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where the~~se~~ specimens were collected ~~are also shown~~. Spicule measures are given as minimum- mean -maximum ~~for total length/minimum- mean-maximum for total width.~~ A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection. np: not present.

Specimen	Style	Rhabdostyle	Oxea	Depth	Area
Pseudoaplysina balearica **sp. nov.**					
CFM-IEOMA-7356/i802 Holotype	188-378-492/6-11-14	90-179/4-7 (n= 9)	456-609/9-11 (n= 3)	249-122	AM St 13
CFM-IEOMA-7357/i144 Paratype	197-378-501/4-9-12	108-164/3-5 (n= 5)	249-493-656/4-8-12 (n= 15)	128	EB St 4
CFM-IEOMA-7358/i293_1 Paratype	179-356-516/3-8-14	138-179/3-6 (n= 5)	328-527-763/3-8-13	127	AM St 9
CFM-IEOMA-7361/i824_4 Paratype	177-403-634/5-9-13	92-165/3-6 (n= 9)	600/9 (n= 1)	133-169	EB St 39
Pseudoaplysina minuta **sp. nov.**					
CFM-IEOMA-7362/i439 Holotype	283-509-658/9-14-21	175-262/7-9 (n= 7)	np	318-288	SO St 26
CFM-IEOMA-7363/i474 Paratype	244-416-555/10-14-20	147-232/7-9 (n= 4)	np	315-295	SO St 28

Table 3(on next page)

Compar~~ative~~ characters of the collected specimens of *Axinella spatula* *Sitjà & Maldonado, 2014*, and those reported for the type material (*Sitjà & Maldonado, 2014*).

Depth (m), area (EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum-mean -maximum for total length~~/~~minimum- mean -maximum for total width (or as they appear in the cited texts). A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection for the Balearic specimens and the reference numbers of Invertebrate Collection of the National Museum of Natural Sciences (MNCN) of Madrid for *Sitjà & Maldonado, (2014)* specimens.

Specimen	**Styles**	**Oxeas**	**Trichodragmata**	**Color**	**Depth**	**Area**
MNCN-Sp145-BV33A *Sitjà & Maldonado, (2014)* Holotype	165-1050/3-15	180-520/2.5-15	25-30/5-8	Beige after EtOH	134-173	Alboran Island
MNCN-Sp188-BV41A *Sitjà & Maldonado, (2014)* Paratype	119-1400/4-15	190-750/5-20	25-35/5-8	Beige after EtOH	102-112	Alboran Island
MNCN-Sp57-BV21B *Sitjà & Maldonado, (2014)* Paratype	245-1225/8-18	120-432/9-12	25-30/6-10	Black after EtOH	93-101	Alboran Island
CFM-IEOMA-7364/i338_1A This work	349-613-1161/7-13-16 (n=20)	187-374-507/5-11-16	32-39-47/5-7-10	Orange in life orange beige after EtOH	152	EB St 11
CFM-IEOMA-7365/i338_1B This work	248-900-1304/ 11-17-26 (n=17)	219-377-485 / 7-11-16	36-45-56/5-7-8 (n=9)	Orange in life orange beige after EtOH	152	EB St 11
CFM-IEOMA-7366/i338_1C This work	332-638-1265/4-12-17 (n=23)	247-332-493 / 7-10-16	32-39-52/5-7-11	Orange in life orange beige after EtOH	152	EB St 11

Table 4(on next page)

Compara~~tive~~ characters of representative ~~reports~~ of *Phakellia ventilabrum*, *P. robusta* and *P. hirondellei* ~~at~~ the North-Western Atlantic and the Mediterranean Sea, ~~with~~ those studied in the present ~~work~~ from the Balearic Islands.

Depth (m), area (SO: Ses Olives; AM: Ausias March; EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length~~/~~minimum- mean -maximum for total width (or as they appear in the cited ~~texts~~). A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/author collection. nr: not reported.

Species/Specimen	Sinuous spicules	Non-sinuous spicules	Size (cm)	Depth	Area
Phakellia ventilabrum					
Hooper & Van Soest, (2002) Neotype	630-897-1060/13-14-18	360-505-710/10-12-15 Flexuous, may be bent near the head	10-23x10-20	nr	North Sea (Norway)
Boury-Esnault, Pansini & Uriz (1994)	600-1065-1650/15-20-25	300-460-640/12-12-15	nr	362 and 1535	Ibero-Maroccan Gulf (Saharan Upwelling)
Vacelet, (1961)	235-860/3-11	200-600/7-9	10x20x0.4	63-103	South of Corsica (Bonifacio)
Topsent, (1913)	870-990/12-17	440-530/7-12	nr	440	North Sea (must check)
Ackers, (1992)	420-525-620/8	220-420-500/8 Styles may be supplemented or even replaced by (aniso-) oxeas	nr	30	Celtic Sea~~s~~ (North off Ireland)
Bowerbank, (1866)	nr	nr	nr	nr	North Sea (Shetland Islands)
CFM-IEOMA-7376/i822_1 This work	447-633-935/4-8-12	183-435-820/4-7-10 Larger spics with oxeot~~a~~ and stylot~~a~~ terminations Smaller spics most with oxeot~~a~~ terminations	11x7x0.1	169-133	EB St36
Phakellia robusta					
Bowerbank, (1866)	nr	nr	nr	nr	North Sea
Boury-Esnault, Pansini & Uriz, (1994)	550-960-1010/17-20-25	400-525-680/12-14-20	nr	390- 394 and 518-524	Atlantic, close to the strait of Gibraltar
Topsent, (1925)	nr	nr	medium, 11x7x0.1	20	Tyrrhenian Sea, Gulf of Naples

Topsent, (1904)	800-1000/6-20 (mostly 18-20)	oxeas to styles, slightly curved, much smaller than the vermicular oxeas (size not provided)		200	Azores
CFM-IEOMA-7367/i347_2 This work	568-871-1204/4-13-19 (n=16)	223-550-1311/5-10-17 (n=27) Larger spics with stylota terminations Smaller spics most with oxeota terminations	Small 2x1x0.1	169	EB St12
CFM-IEOMA-7368/i405 This work	467-690-1110/4-9-12 (n=17)	132-554-1152/3-9-17 Larger spics with stylota terminations Smaller spics most with oxeota terminations	Small 2x1x0.1	151	EB St15
CFM-IEOMA-7371/i417 This work	608-891-1334/7-13-18 (n=17)	130-468-1276/3-9-15 Larger spics with stylota terminations Smaller spics most with oxeota terminations	Small 2x1x0.1	156	EB St 17
CFM-IEOMA-7372/i712 This work	491-799-1145/6-11-15 (n=20)	202-519-1004/4-9-17 Larger spics with stylota terminations Smaller spics most with oxeota terminations	Small 2.5x1x0.1	147	EB St 25
CFM-IEOMA-7369/i409 This work	547-867-1314/10-14-18	88-316-995/2-6-10 Larger spics with stylota terminations Smaller spics most with oxeota terminations	Medium (fragment) ?x12x0.2	151	EB St15
CFM-IEOMA-7370/i414_2 This work	310-809-1365/9-15-22 (n=28)	218-685-1258/6-12-23 Larger spics with stylota terminations	Medium 4.5x4x0.2	410	EB St 16

		Smaller spics most with oxeota terminations			
CFM-IEOMA-7373/i731 This work	579-1003-1486/9-19-27 (n=20)	135-396-960/4-9-14 (n=25) Larger spics with stylota terminations Smaller spics most with oxeota terminations	Medium 4x3x0.1	306-280	EB St 35
CFM-IEOMA-7374/POR760 This work	520-772-1062/8-17-22	230-482-1177/6-11-17 Larger spics with stylota terminations Smaller spics most with oxeota terminations	Large (fragment) ?x20x0.5	252	Southwest of Cabrera Archipelago St 20
CFM-IEOMA-7375/POR762 This work	516-750-1058/12-17-22	210-458-888/7-12-17 Larger spics with stylota terminations Smaller spics most with oxeota terminations	Large 35x25x0.5	754	Southwest of Cabrera Archipelago St 21
Phakellia hirondellei					
Topsent, (1892)	Long and flexuous, from Styles, oxeas to strongyles. Up to 1500 / 25		11x30x(0.6-0.7)	134	North of Spain (Asturias)
Boury-Esnault, Pansini & Uriz, (1994)	Oxeas, not very flexuous, some quite straight, sometimes centrotylota, with asimetric tips 550-819-1320/10-15-24	Styles, of same size as flexuous oxeas	0.5 in width	Atlantic stations: 518-526 Med Stations: 110-400	Alboran Sea Gulf of Cadiz
CFM-IEOMA-7377/i353 This work	1157-1706-2341/14-22-28	402-693-1305/6-13-26 Larger spics with oxeota terminations Smaller spics both stylota and oxeota	Medium (fragment) 4x6x0.2	146	EB St 13

CFM-IEOMA-7378/i623 This work	1110-1438-1669/14-20-24	328-697-1454/9-14-21 Larger spics with oxeota terminations Smaller spics both stylota and oxeota	Large (fragment) 10x10x0.2	135-140	AM St 33

Table 5(on next page)

Comparative characters of species of the genus *Heteroxya*.

Depth (m), area (SO: Ses Olives; EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/author collection. np: not present, nm: not measured.

Specimen	**Oxea I**	**Oxea II**	**Style**	**Depth**	**Area**
Heteroxya corticata					
Topsent, (1898) Syntypes redescribed by *Morrow et al., (2019)*	1600-1700-2000/26-32-37, Microspined ends	235-310-420/12-23 Pronounced spination (more at the tips)	np	1165-1240	Azores
Heteroxya beauforti					
Morrow et al., (2019) Holotype	622-1030-1385/10-16-21 Smooth	207-280-370/11-14-16 Smooth	5000-5650-6300/23-25-27	629-1469	Celtic Seas
Heteroxya mediterranea **sp. nov.**					
CFM-IEOMA-7380/i726 Holotype	434-569/7-13 (n=7) Smooth	107-180-287/4-6-9 Smooth	broken	280-306	EB St 35
CFM-IEOMA-7381/i444 Paratype	319-467-580/6-10-14 (n=23) Smooth	104-171-257/4-6-8 Smooth (n=23)	1151-3502/8-14 (n=3)	288-318	SO St 27
CFM-IEOMA-7382/i461 Paratype	327-460-586/6-10-15 Smooth	167-233-286/3-7-9 Smooth	broken	255-325	SO St 28
CFM-IEOMA-7379/i727 Paratype	420-530-623/9-12-15 (n=18) Smooth	142-192-293/6-8-10 Smooth	broken	280-306	EB St 35
CFM-IEOMA-XX/i487 Paratype	nm	nm	nm	270-325	SO St 30

Table 6(on next page)

Comparative characters of *Paratimea* ~~spp.~~ from the Mediterranean and the north-eastern Atlantic~~, including~~ *Paratimea massutii* sp. nov.

Depth, area (EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length~~/~~minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/author collection. np: not present, nr: not reported.

Species/Specimen	Megascleres	Accessory Oxeas	Oxyaster	Other spicules	External morphology	Depth	Area
Paratimea massutii **sp. nov..**							
CFM-IEOMA-7383/i403 Holotype	Oxeas 910-1419-1711/16-24-33 (n=17)	469-681-827/3-8-10 (n=7)	Smooth, 25-36-45 9-25 rays	np	Massive, lobate surface, whitish with diatom brownish on the upper site	151 m	EB St 15
CFM-IEOMA-7384/i420 Paratype	Oxeas 1130-1374-1561/11-20-28	556-755-862/3-6-8	Smooth, 27-39-57 7-20 rays (occasionally 2 rays)	np	same as i403	156 m	EB St 17
Paratimea oxeata Pulitzer-Finally, (1978)							
Holotype	1000-1450/14-24	250-650/3-7	40-60	np	Thickly incrusting, up to 4 x 5 x 0,4 cm, drab color in life, white after formalin and EtOH	60 and 100-110 m	Bay of Naples
Beertolino et al., (2013)	810-961-1200/15-18-25	300-547-700/3-5-5	25-42-60	np	Very small (0.5 cm^2) insinuating sponge, grey colored in dry state.	35 m	Ligurian Sea
Morrow et al., (2019)	1000-1500/14-24	250-650/3-7	20-40 but up to 60 when reduced rays 4-12 rays	np	Massive lobose, surface conulose, oscules arranged on top of raised humps, Pale yellow-cream	Caves, 15-20 m	Gulf of Lion
Paratimea loricata (*Sarà, 1958a*)							
Holotype	Oxeas, poliaxonic and aberrant terminations. Mostly non-centrotylota. 320-420/5-7	Centrotylota 105-180/2-3	Large: 40-50 Small (uncommon): 12-20	Tylostyles, trilobated head 130-170/4-7	Encrusting, elastic but friable, whitish-yellow after EtOH	Not specified, infralittoral	Ligurian Sea

	(most common) and 600/15 (n=1)						
Paratimea pierantonii (*Sarà, 1958b*)							
Holotype and paratypes	Styles and Subtylostyles : 1530-2550/12-18	650-1175/4-10, centrocurved, non-centrotylot~~a~~	15-25	np	Cushion shaped with papillae Hispid, smooth consistency. Orange yellow at the surface, brownish inside.	30 cm, tidal cave	Tyrrhenian Sea
Paratimea arbuscula (*Topsent, 1928*)							
Holotype	Curved or flexuous, centrotylot~~a~~. Some modified to styles. 560-1000/5-12	nr	Without centrum, with conical, ~~A~~canthose actines, 15-60 most with 12 rays	np	Small arbuscular sponge, up to 1 cm in heigh 1 mm in width, hispid. Whitish. Asters concentrated at the periphery	650-914 m	Azores
Paratimea duplex (*Topsent, 1927*)							
~~..~~Reproduced from the redescription in *Morrow et al., (2019)*	centrotylote oxeas 2000-2600/20-40, styles to subtylostyles 1600-1800/25-35	Weakly centrotylote 360-770/7-9	Without centrum, smooth rayed, 50–100 10–15 rays	np	cushion shaped, 3 mm thick, with a conulose surface	240-2165 m	North Atlantic Ocean
Paratimea constellata (*Topsent, 1904*)							
Holotype, reproduced from *Morrow et al.,*	Long, slender tylostyles 2500-	Centrotylote oxeas 379-670-900/8-	Smooth-rayed euasters 14-30-46	np	Cushion shaped, 2-3 mm thick, yellow gold	40 m	Roscoff, Celtic sea~~s~~

(2019)	3000/13-14	10					
Paratimea loenbergi (*Alander, 1942*)							
Reproduced from the redescription of the Holotype in *Morrow et al., (2019)*	1350-3000/10-13-15 (n=4); head, 16-20-27	Slightly bent, 530-712-930/5-5-6 (n=7)	Smooth 22-28-36	Small category of tylostyles not found by *Morrow et al. (2019)* but mentioned in the original description, measuring 180-225/12-15	Thin, hispid crust. Pale yellow.	60 m	Väderö fjord, Sweden
Paratimea hoffmannae Morrow & Cárdenas, 2019							
Holotype, original description	Large, curved oxeas, occasionally centrotylote 2056-2187-2250/25-26-28	Rare, bent, occasionally centrotyle 353-446-520/3-4-5	Asymmetic 42-60-81 µm 7-18 smooth, tapering rays	np	Massive, subspherical. Holotype is ~7 in diameter. Surface covered in large conules, 1-4 mm in height. Creamish white.	328 m (Holotype) 1500 m (Paratype)	Norway (Holotype) Ireland (Paratype)

Table 7(on next page)

Comparative characters of *Rhabderemia implicata Pulitzer-Finali, 1983*.

Depth (m), area (EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum-mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/author collection. np: not present, nr: not reported, nf: not found.

Specimen	Spined Rhabdostyles	Smooth rhabdostyles	Hispidation styles	Smooth Strongyles	Spined oxeas	Smooth oxeas	Spined strongyle	Trichodragmata	Depth	Area
Pulitzer-Finali, (1983) Holotype	115-500/7-12 (spined and smooth ones measured together)		nr	250-360/7-12 (measured together)			140-280/7-12	20-27	121-149	Calvi
Sitjà &Maldonado, (2014) Paratype	125-187/6-11	137-304/5-13 (growth stages 107-212/3-6	754-1557/8-16	160-310/14-15 (less abundant)	120-280/7-9	222-405/5-10 (growth stages 185-285/1-3)	129-409/5-12	22-50/10-20	96-100	Alboran Island
CFM-IEOMA-7385/i338_2_1 This work	181-196-213/8-9-12	135-290-405/4-10-14	645-1614/5-12	274-314/10-12-13	182-220-279/7-9-11	259-337-431/5-9-12	139-191-228/7-9-12	32-35/4-6-9	152	EB St 11
CFM-IEOMA-7386/i698 This work	272/9 (n=1)	179-264-431/5-7-10	653-893-1319/4-6-9 (n=7)	nf	nf	176-312-414/3-6-9	113-144-178/4-4-4 (n=4)	25-40-59/4-6-9	118-116	EB St 34

Table 8(on next page)

Comparative characters of representative reports of *Dragmatella aberrans*.

Depth (m), area (SO: Ses Olives; EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/author collection.

Specimen	Styles	Raphides	Depth	Area
Topsent, (1892)	600	180	135-134	Cantabric Sea
Topsent, (1928)	600-800/9-11.5	70-200/12-20	552-1262	Cap Sines (Portugal)
Vacelet, (1969)	350-600/6-13	150-210	250-324	Cassidaigne (Gulf of Lion)
Pulitzer-Finali, (1983)	400-600/6-14	200	128-150	off Calvi (Corsica)
Boury-esnault et al, (1994)	315-571-631/5-11-16	95-207-260/0.4-2-3	485 (Atlantic) 195 (Mediterranean)	Atlantic and Alboran Sea
CFM-IEOMA-7387/i52_b1 This work	349-555-676/6-9-13	162-197-222/1-2-3	275	SO St 2
CFM-IEOMA-7388/i175 This work	351-539-651/8-11-15	163-193-214/1-2-3	138	EB St 5

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Table 9(on next page)

Compar~~ative~~ characters ~~from published~~ records of *Petrosia (Strongylophora) vansoesti Boury-Esnault, Pansini & Uriz, 1994* and present work.

EB: Emile Baudot, n.p: not present, n.p.: not present. Depth (m), area (SO: Ses Olives; AM: Ausias March; EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum-mean -maximum for total length~~/~~minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/ author collection.

Specimen	Large Oxeas/Strongyles	Small oxeas	Small strongyles	Depth (m)	Locality
(*Boury-Esnault, Pansini & Uriz, 1994*) As in the original description	All sizes of oxeas: 54-90-140/3-4-5		All sizes of strongyles: 22-128-338/8-12-22	285 and 362	Ibero-Morrocan gulf, North Atlantic Ocean
Costa et al., (2019)	Oxeas: 43-164-243/1-5-13 Styles: 140-190-235/5-8-13		All sizes of strongyles: 50-162-213/5-9-13	2	Matrona Cave, Ionian Sea
CFM-IEOMA-7390/i192_A This work	220-260-292/9-13-18	52-139-266/2-5-8	29-47-75/6-10-13	146	EB St 6
CFM-IEOMA-7391/i192_B This work	211-270-314/12-15-19	52-132-245/2-6-10	30-52-85/6-11-14	146	EB St 6
CFM-IEOMA-7392/i313_P This work	217-271-322/11-16-19	52-119-211/2-5-9	31-50-89/6-9-11	152	EB St 11
CFM-IEOMA-7393/i313_G This work	223-268-291/12-15-18	49-135-233/2-5-10	27-47-95/8-11-14	152	EB St 11
CFM-IEOMA-7394/i351 This work	205-258-307/10-13-16	64-128-243/2-4-7	31-51-78/8-9-11	146	EB St 13
CFM-IEOMA-7395/i694 This work	179-207-247/10-12-15	53-124-216/2-4-7	37-53-79/6-10-12	116-118	EB St 35

Table 10(on next page)

Comparative characters ~~from~~ published records of *Petrosia (Petrosia) raphida Boury-Esnault, Pansini & Uriz, 1994* and present work.

Depth (m), area (SO: Ses Olives; AM: Ausias March; EB: Emile Baudot) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/author collection.

Specimen	**Oxeas**	**Raphides**	**Depth**	**Area**
Boury-Esnault, Pansini & Uriz, (1994) Holotype	354-449-499/26-32-36 (strongyles)	81-95-108/1	580	Gibraltar
Sitjà et al., (2019)	290-500/20-25 (rarely ~~down to~~ 7.5)	75-100/1 (some without spines)	530-573	Volcano of Gulf of Cadiz (Pipoca)
CFM-IEOMA-7396/POR406 This work	271-369-432/9-13-16	62-78-91/1-1-2	134	South-east of Menorca St 1
CFM-IEOMA-7397/i178_3 This work	242-378-450/10-16-19	72-80-89/2-3-4	138	EB St 5
CFM-IEOMA-XXX/i242 This work	268-333-380/11-14-17	70-80-91/1-2-2	101	AM St 8
CFM-IEOMA-7398/i254_2 This work	300-378-426/9-15-19	66-75-86/1-2-2	101	AM St 8
CFM-IEOMA-7399/i305 This work	242-346-394/9-15-19	65-75-88/1-2-2	118	AM St 10
CFM-IEOMA-7400/i312_1 This work	349-403-453/8-15-19	70-79-95/1-2-2	152	EB St 11

Table 11(on next page)

Compar~~ative~~ characters ~~from~~ *Calyx* cf. *tufa* and *Calyx tufa Ridley & Dendy, 1886*.

Depth (m), area (AM: Ausias March) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum-mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection. nr: not reported.

Specimen	**Oxeas**	**External morphology**	**Depth**	**Area**
Calyx cf. *tufa*				
CFM-IEOMA-7403/i525 This work	146-170-189/6-7-8	Large, massive, and semicircular. Surface smooth~~, ~~stony hard and uncompressible. Ectosomal crust present. Beige with pink tints at the upper side. Whitish beige after EtOH	114	AM St 24
CFM-IEOMA-7402/i515 This work	140-171-205/4-7-9	As the Holotype	113	AM St 23
CFM-IEOMA-7401/i75 This work	132-178-206/4-6-9	As the Holotype	105	AM St 3
Calyx tufa				
Ridley & Dendy, (1886) Holotype	200/10	Massive, cake-like. Firm, almost stony, but brittle. Surface smooth but uneven. Dermal membrane (=ectosomal crust) readily peeling off. Vents rather small, circular, ~~level with surface~~. Greyish yellow.	219	St Lago, Cape Verde
Topsent, (1892)	nr	Firm but crumbly. Without ectosomal crust due to injuring[illegible]ght brown.	300	Cantabrian Sea

Table 12(on next page)

Comparative characters from *Polymastia polytylota Vacelet, 1969*.

Depth (m), area (AM: Ausias March) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection.

Specimen	**Principal tylostyles**	**Intermedium tylostyles**	**Ectosomal tylostyles**	**Depth**	**Area**
Boury-Esnault, (1987) Redescriotion of the Holotype	650-990/10-13	210-490/7-10	70-180/2-5	165-270	Toulon, but also in Corsica
Boury-Esnault, Pansini & Uriz, (1994)	668-854-1108/5-13-16	276-403-509/5-11-13	94-115-143/3-3-4	Alboran:480 Atl: 362-485	Alboran Sea and North Atlantic
Pulitzer-Finali, (1983)	650-810/10-13	210-490/7-10	80-120/2-3	117	Nor~~d~~ of Corsica
CFM-IEOMA-7405/i810 This work	438-909-1154/8-11-15	308-443-586/6-7-9	121-166-200/2-3-5	352-465	AM St 3

Table 13(on next page)

Comparative characters from *Pseudotrachya hystrix* (*Topsent, 1890*).

Depth (m), area (AM: Ausias March) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum-mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection. nr: not reported.

Specimen	Anisoxeas	Microxeas	Depth (m)	Area
Topsent, (1892) Holotype	up to 7000/70	185/6	318 and 454	Azores
Topsent, (1928)	nr	nr	650-914	Azores
Sarà, (1959)	4000-5000/35-45	150-240/3-5	100	Tyrrenhian sea
Boury-Esnault, Pansini & Uriz, (1994)	2000-3400-4300/18-44-63	200-235-330/5-6-7	153-568	Alboran Sea,
Vacelet, (1969) (Various specimens)	St15: 1000-1250/22-30 St23:>2000/30-35 St34: 1600-6600/18-40 St46:1100-4500/20-60	110-250/3-5 some larger (2[illegible]0-320) Stylota modifications	St 15: 180 St 23: 210-240 St 34: 270 St 46: 450-550	St 15: Cassidaigne St 23: Corse St 34: Cassidaigne St 46: Cassidaigne
CFM-IEOMA-7406/i303_A This work	834-1689-3358/10-25-42	156-185-217/4-5-6	231-302	AM St 19
CFM-IEOMA-7407/i613 This work	768-2088-3402/18-32-45	152-203-270/3-5-6	195-222	AM St 32

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Table 14(on next page)

Comparative characters from *Hemiasterella elongata* (*Topsent, 1928*).

Depth (m), area (EB: Emile Baudot, AM: Ausias March) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum- mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection. nf: not found.

Specimen	**Styles**	**Oxeas**	**Spheroxyasters**	**Depth**	**Area**
Topsent, (1928) Holotype	1500-2000/25-60	1900-2345/20-60 rare	15-18	875	Cape Verde
Sitjà & Maldonado, (2014)	1316-2250/10-30	1825/10 very rare	14-23	93-173	Alboran Island
CFM-IEOMA-7408/i149_4 This work	1451-1956-2409/9-14-21 (n=21)	1685/8	11-18-26	109	EB St 7
CFM-IEOMA-7409/i337 This work	1151-1870-2302/7-16-21	719-1876/3-6 (n=4)	regular: 14-20-25 3 actinal: 29	152	EB St 11
CFM-IEOMA-7410/i531 This work	1383-1961-2657/14-24-34 (n=17)	1618/7	13-20-24	114	AM St 24
CFM-IEOMA-7411/POR1066 This work	1570-1967-2434/15-23-34 (n=21)	nf	14-19-24	142	South-west Cabrera Archipelago St 36

Table 15(on next page)

Comparative characters from *Lanuginella pupa Schmidt, 1870*.

Depth (m), area (AM: Ausias March) and sampling station (St; see R*study* in Table 1) where these specimens were collected are also shown. Spicule measures are given as minimum-mean -maximum for total length/minimum- mean -maximum for total width. A minimum of 30 spicules per spicule kind are measured, otherwise it is stated. All measurements are expressed in µm. Specimen codes are the reference numbers of the CFM-IEOMA/and author collection. nr: not reported, nf: not found.

	Parenchimalia		**Dermalia**		**Gastralia**	**Hexasters**			
Specimen	**Choanosomal Diactin**	**Choanosomal Hexactin**	**Hypodermal Pentactin**	**Other**	**Atrial hexactins**	**Discohexasters**	**Strombiplumicomes**	**Depth**	**Area**
Schmidt, (1870) Holotype	nr								Cape Verde (Atlantic Ocean)
Schulze, (1897)	nr	nr	nr	Stauractins: 160-200	nr	32-80-100	40	201	Little Ki Island (Banda Sea)
Ijima, (1904) Several specimens	up to 4000/22	variable in size, up to 2000/ 30 (as oxyhexactin)	1000/34	Stauractins rarely tauactins, 220-330 (average length) /7	220-330/7	40-90	34-76	183-572	Döketsba, Okinose, Mochiyama (Japan), Vries Island (Vries Strait, Pacific Ocean)
Okada, 1932	3500-5000/100	3000/60	nr	nr	nr	45-80	50	180	Kagoshima Gulf (Eastern China Sea)
Burton, 1956	nr								
Sitjà & Maldonado, (2014)	325-3000/4-7	250-850/6-13	Perp: 170-850/4-10 Prox: 242-950/8-12	Abundant stauractins, scarce pentac	46-150/2-6	30-70	nf	690	Gulf of Cadiz (Mud volcano, North Atlantic Ocean)

				tins, tauactins and hexactins 43-140/2-6					
CFM-IEOMA-7412/i286_1 This work	586-1900/7-14 (n=6)	664-983/10-25 (n=3)	Perp: 175-343-435/6-13-20 (n=13) Prox:323-777/7-19 (n=3)	Stauractins: 61-91/3-5 (n=5) Hexactins: Perp: 101/6 (n=1) Prox: 151/7 (n=1) Dist: 105/6 (n=1) Paratetractins: 77-4 (n=1)	Prox: 108-113/5-6 (n=2) Dist: 70-95/4-7 (n=2) Perp: 71-150/4-7 (n=9)	43-57-70 (n=12)	20-38 (n=5)	220-275	AM St 18
CFM-IEOMA-7413/i286_2 This	245-1726-2586/3-9-12 (n=19)	492-920/16-20 (n=4)	Perp: 242-519/8-15 (n=7)	Stauractins: 79-132/3-5	Prox: 107/4 (n=1) Dist: 97/5 (n=1)	49-76 (n=7)	nf	220-275	AM St 18

work				(n=5) Hexactins: Perp: 68-110/2-5 (n=2)	Perp: 83-145/3-6 (n=7)				
CFM-IEOMA-7414/i286_3 This work	528-1533-2611/3-9-15	349-926/10-19 (n=5)	Perp: 137-437/9-17 (n=8) Prox: 516-831/11-14 (n=5)	Stauractins: 67-91-111/3-4-5 (n=13) Hexactins: n.f.	Prox: 119-159/4-6 (n=5) Dist: 79-102/4-6 (n=5) Perp: 70-96/4-6 (n=5)	45-53-62 (n=10)	20 (n=1)	220-275	AM St 18