Abc Taxa

Marine and Freshwater Sponges of Peru

Identification Guide

Philippe Willenz
Eduardo Hajdu

Volume 22 (2022)

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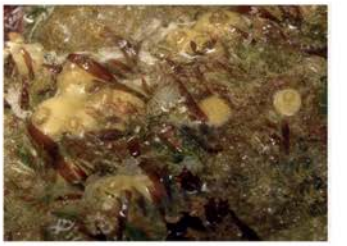

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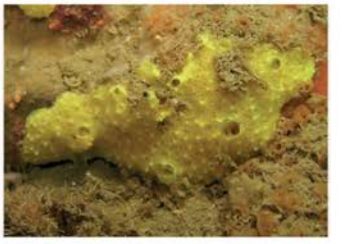

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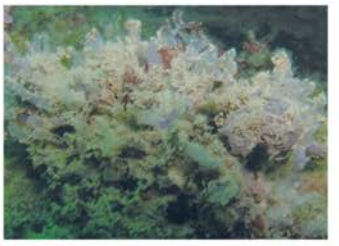

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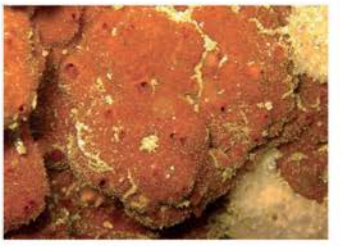

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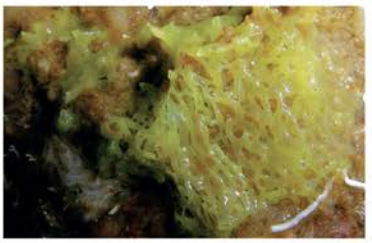

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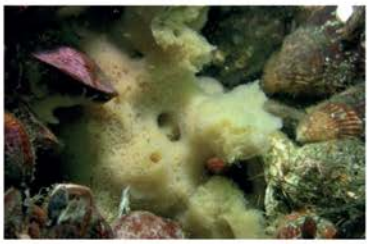

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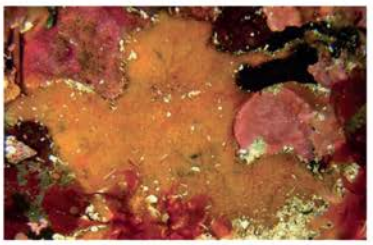

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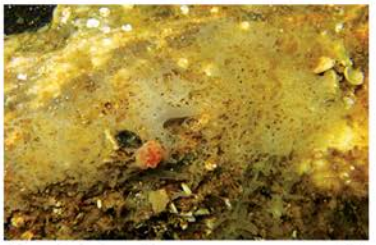

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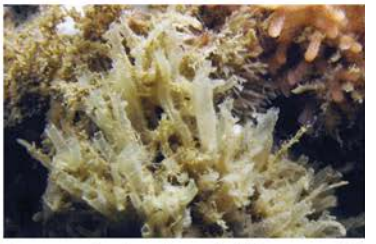

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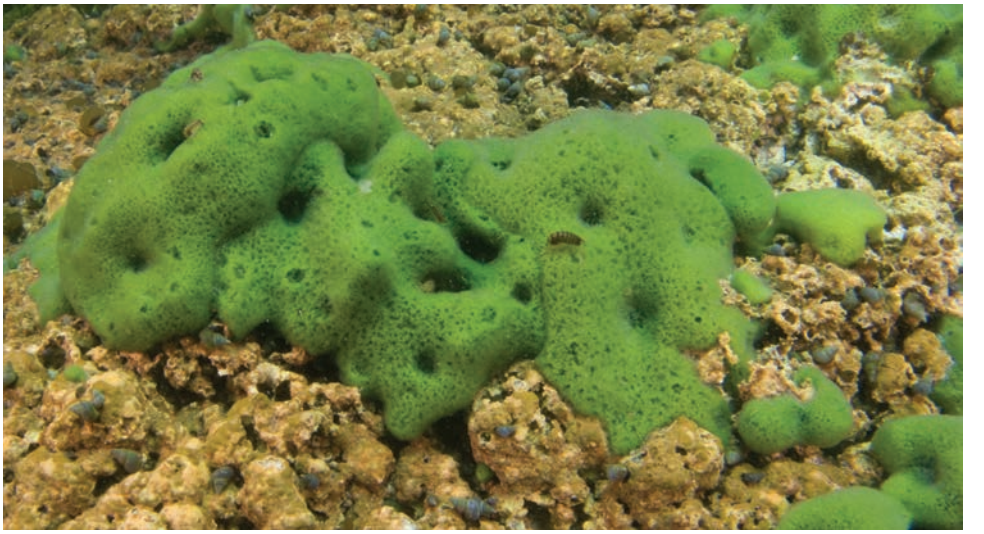

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This book is dedicated to our late colleagues Ruth Desqueyroux-Faúndez who enthusiastically supported this project since its first stages and Professor Gisèle Van de Vyver who introduced the first author to the biology of sponges with passion, as he was her student.

Foreword

The origin of this book dates back almost twenty years ago. At the time, the southeast Pacific had one of the least studied sponge faunas in the world. A series of cooperative projects were first implemented under the auspices of Belgian, Brazilian, Chilean and Swiss institutions from 2003 to 2009 to acquire new knowledge on Chilean and Argentinian marine sponges. Following on our experience on this biodiversity inventory, Peru came to us as a natural continuation, thanks to the happy marriage of resources, meager inventory of sponge diversity, and a motivated team.

Prior to our own collections and published results, the literature reported only 13 sponge species from the Peruvian sea, mainly collected by dredging at the end of the 19th and the beginning of the 20th centuries. The little that was known about the species' starkly composition and geographic distribution of Peruvian marine sponges markedly contrasted to their recognized importance, both as keystone coenoses in several marine communities at nearly every latitude, as well as potential sources of economical revenue. The Phylum Porifera is one of the dominant groups on hard substrates of marine habitats, being abundant in all seas, on rocks, mollusc shells, corals and man-made artificial substrates in ports, marinas, oil platforms, etc. Sponges have different roles in these benthic communities; they frequently serve as substrate used as a shelter by different organisms, and contribute to the steadiness of benthic biodiversity. Sponges are well known for the effectiveness of their specialized diet on bacteria and similarly sized organic particles, having thus been connected to ecosystem health on several occasions. Sponges comprise today the richest natural source of new chemical structures, most of which present varied biological activities and are currently under pharmaceutical screening for new drug leads against several human diseases.

Contacts were set up with the Universidad Peruana Cayetano Heredia (UPCH) to lead field expeditions along the entire Peruvian coast. In 2007, the ESPER (Esponjas del Peru) Project was granted to RBINS, funded by the Belgian Directorate-General for Development Cooperation (DGD), within the framework of the CEBioS programme (Belgian Global Taxonomy Initiative NFP). In this same year, EsponjAS Project was granted by CNPq (Brazil), thus facilitating the participation of Brazilian scientists and students in the studies in Peru. In total, 17 scientists and students of both countries were successively involved in fieldwork. As it was infeasible to make an extensive exploration of the entire Peruvian coast (more than 3.000 km long) within a short period of time, three successive expeditions, over one month long each, were funded from 2007 to 2009. In total, 109 localities were visited and 120 dives allowed collecting nearly 900 sponge specimens. Each one was divided and distributed to each of the four collaborating institutions (RBINS, MNRJ, UPCH and MHNG) for deposit and study. Analysing them all to prepare this volume was unrealistic and a selection had to be carried out. Specimens were first sorted based on their habit and resemblance. After a survey of their spicule composition, a selection based on their abundance and on the specimens with the best photos appeared necessary. As a consequence, this book might not be a comprehensive representation of the sponge diversity found

in shallow waters of the Peruvian coast. Out of 86 species described here, 31 were new to science. Time was needed to publish these before the book went into press, to avoid the otherwise inevitable extensive use of incomplete identifications. It will, nevertheless, be clear to the reader that new species await complete formal description among those presented here. It is likely that many new species will still be found along the Peruvian coast in the future. We hope this guide will stimulate the interest of Peruvian undergraduate and graduate students, researchers and teachers to explore the absorbing world of sponges.

Philippe Willenz
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May 2022

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1. Brief historical account of the taxonomic study of Peruvian sponges

The taxonomic study of Peruvian sponges started 146 years ago with the single record of *Dysidea ligneana* (as *Spongelia I*.) to Zorritos, in the region of Tumbes, next to a very brief description stressing the sponge's smooth surface, tight meshed skeleton and fibres full of debris (Hyatt 1877). It took nearly four decades for the next records to be made, and these were most notable. Usually, an inventory starts where it is easier, such as in shallow bays and rocky coasts, and only subsequently moves into areas of more difficult access, among which the notorious deep-sea. But precisely the opposite happened, and in 1915 nine hexactinellid sponges were recorded from Peruvian waters in the bathymetry of 4062–5203 m, collected by the "*Albatross*" expeditions between 1899 and 1905 (von Lendenfeld 1915). For many decades Peru had a unique sponge biodiversity pattern, with 90% of the species belonging in the Hexactinellida, and coming from the abyssal zone. In the 1990's three more demosponges were recorded, two of which from the deep sea (200–735 m; Desqueyroux-Faúndez & van Soest 1996), thus strengthening the bathymetric bias in the inventory. The third species, was also the first insular, from Islas Lobos de Afuera (van Soest 1991). This is where the inventory arrived prior to Projects Esponjas del Perú (ESPER) and Esponjas da América do Sul (EsponjAS). The known diversity reached 13 species.

The first species described from materials collected between 2007 and 2009 by projects ESPER and EsponjAS came out in 2011 (Aguirre *et al*. 2011). A single species from northern Peru, exhibiting two contrasting chromotypes (yellow and red), and occurring on rocky, as well as biological substrates (see *Clathria aculeofila* below). This was the first description of a Peruvian sponge (demosponge) by two Peruvian authors, the first to include images of a Peruvian sponge alive, and the first to describe an ecological association by a Peruvian sponge. In 2015, another two records were made from the same collections, of the commonest of all sponge morphologies, the crustose form (Hajdu *et al*. 2015). These included one new species, and another previously reported from several localities in the NE Pacific, both Tropical and Temperate. In the same year, the first records of an entire Class were made, those of Calcarea, including eight species, five of which were new to science (Azevedo *et al*. 2015). This publication was also the first to apply an integrative approach to the study of Peruvian sponge taxonomy, using molecular markers to boost the identification and classification of these sponges. It confirmed the occurrence in Peru of sponges previously known only from another ocean, the Atlantic, and included two Peruvian authors, among whom the third Peruvian author participating in a taxonomic study of Peruvian sponges. In 2019, the latter two Peruvian authors described another two new Calcarea (Cóndor-Luján *et al*. 2019), the first belonging to the Subclass Calcaronea. A fourth Peruvian author took part in the description of another new demosponge from Peru in 2020 (Arroyo *et al*. 2020), a new genus record for the entire eastern Pacific (*Ciocalypta*). Another three new crustose demosponge species came out in the same year (Recinos *et al*. 2020), with a new genus record for the south-east Pacific (*Plocamione*). The next year a monographic study was published on a single species of Calcarea,

where morphological variability, phylogeographic pattern and population genetic structure of *Clathrina aurea* were assessed across its geographic range. This study, lead by the third Peruvian author (Cóndor-Lujan *et al*. 2021) confirmed once again the identity of Peruvian records of this species. The genetic analyses performed indicated isolation, restricted gene flow and reduced genetic diversity in Peruvian populations of the species, suggesting a possible non-natural dispersion may account for the observed results. The subject appears not to be entirely settled. The largest publication on Peruvian sponges came out last year (Bispo *et al*. 2022) and included 14 new species belonging to the demosponge order Haplosclerida. This was the largest study dedicated to this order worldwide for many decades, and a shiny symbol of how rudimentary the inventory of Peruvian sponges still is. The same year, a second publication on Peruvian sponges proposed another three new crustose species of demosponges belonging in the Hymedesmiidae (Salani *et al*. 2022), one of which also reported from Chile in the same publication. The latest publication reporting eight shallow species of Suberitida, including one new species, raises their number in Peru from two to nine (Cóndor-Luján *et al*. 2023).

Finally, projects ESPER and EsponjAS resulted in the publication of 31 new species, which are included in this book. In total, the book comprises 86 species, among which 84 were unknown in Peru. This is a nearly 7-fold increase in the 1990 number. Despite the fact that assembling the ESPER and EsponjAS collections took only a few months in total, the rhythm of subsequent publication of species descriptions highlights the enormous gap observed between both stages of the biodiversity inventory, both needing commitment in the form of resources. While collecting can in principle be done by anyone with minimum snorkeling or diving and underwater photography skills, describing a species is not quite the same. The training of Peruvian specialists took several years before they finally participated in the description of Peruvian sponge biodiversity: Aguirre and Hooker in Aguirre *et al*. (2011), Cóndor-Luján and Hooker in Azevedo *et al*. (2015), Cóndor-Luján & Hooker in Cóndor-Luján *et al*. (2019, 2021), and Arroyo and Cóndor-Luján in Arroyo *et al*. (2020). In spite of the fact that the ESPER and EsponjAS collections were split among the interested parties (Belgium, Brazil, Peru and Switzerland), both for long-term security of the materials, but as well as with the hope that this might speed up their subsequent study, all taxonomic studies reported above since 2011, with the noble exceptions of Arroyo *et al*. (2021) and Cóndor-Luján *et al*. (2022), were undertaken in Belgium and Brazil.

2. General presentation of Porifera

Sponges (or Porifera) are filter-feeding sedentary invertebrates, which are generally restricted to marine environments, except for a single suborder of freshwater demosponges (Spongillina). They display the simplest stage of metazoan organization, with a reduced number of cell types and have no digestive tract, no mouth, no anus, nor circulatory, nervous or muscular system and no gonads. The shape of sponges is highly diversified, varying from thinly encrusting to erect, arborescent, digitate, foliaceous, globular or tubular with many intermediate variations. Their body size varies as much as their shape, ranging from a few

millimetres up to more than 2 meters wide. The shape is supported by a mineral and/or organic skeleton. However, some Homoscleromorpha (*Oscarella* spp.), Verongiida (*Hexadella* spp.), Chondrillida (*Halisarca* spp.), etc. are devoid of any hard skeleton (Fig. 1E–F).

The consistency of sponges varies from compressible to elastic, fragile, tough, firm, incompressible or hard, depending on the composition and density of their skeleton. The latter is composed of collagen fibrils, spongin fibres, and inorganic elements of calcium carbonate or silicon, either represented by separate spicules, connected or fused spicules, or/and a massive mineral skeleton, or even merely by trapped sediment grains. Sponges of a same species can be highly polymorphic, their size and shape often depending of their environment and predominant hydrodynamic conditions. Their colour can also vary, depending on the degree of exposition to light, or to unknown factors, as in the case of *Balliviaspongia wirrmanni*, *Clathria aculeofila*, *Hymeniacidon perlevis*, *Tethya* cf. *socius* (described below). Currently, at least 15,000 sponge species are estimated to exist worldwide, of which only approximately 10,000 are described in the literature. This number is constantly increasing due to the taxonomic study of materials collected in SCUBA-diving explorations, snorkelling or even wading at low tide in poorly known regions, or that have been gathered through oceanographic inventories, usually from far greater depths, and deposited in collections around the world.

Their greatest diversity occurs in relatively shallow tropical and subtropical waters, but species down to 8800 m deep are known. Off Peru, sponges were described from deeper than 5000 m (*Holascus edwardsi* von Lendenfeld, 1915), over one century ago. Poriferans feed mainly on the smallest organic fractions, such as dissolved organic matter (DOM) and picoplankton (plankton < 2 µm), and can be highly efficient in performing this task (ingesting more than 99% of the bacteria present in the inhaled water, and up to 30 × greater DOM intake than the amount intaken by bacteria (de Goeij *et al*. 2013). It has already been calculated that sponges present in a coral reef have the ability to filter the entire water column over the reef within a few days (Reiswig 1971; McMurray *et al*. 2014). Likewise, the description of the “sponge loop” by de Goeij *et al*. (2013) unequivocally established the role of sponges in bentho-pelagic coupling by transforming DOM into POM (particulate organic matter), indispensable for energy balance in oligotrophic environments, such as many coral reefs. Sponges can also participate in the primary production through their symbiotic cyanobacteria or unicellular algae (Wilkinson 1987; Rützler 1990); and carnivorous habit has been described for the group as well (Vacelet & Boury-Esnault 1995; Lopes *et al*. 2011), with several supposedly carnivorous species already known from South America deep-waters. Sponges, primarily those of family Clionaidae, are the main responsible for bioeroding limestone substrates, therefore, being key elements in the dynamics of coral reefs. Not only do they weaken reefs through bioerosion, but they strengthen the reef by cementing coralligenous debris during sponge growth. Peru houses several species of excavating sponges (*Cliona* spp. and *Pione* sp. below). The use of Porifera as biomonitors of environmental quality has already been proposed by some authors (Muricy 1989; Wulff 2001), based on the ability of these animals to concentrate diverse pollutants.

More than any other marine invertebrate, sponges produce secondary metabolites for chemical defence against predation and fouling. Many of these natural compounds have beneficial potent biological applications (anti-microbial, anti-tumour, anti-viral or anti-inflammatory). Drugs such as AZT, Discodermolide and Halaven, for example, can be traced back to molecules extracted from Porifera. AZT is a potent antiviral derived from Ara-A, used in the treatment of AIDS (940,000 deaths worldwide in 2017) and Herpes, and Ara-C, used in the treatment of some forms of leukemia (over 300,000 deaths worldwide in 2020). Ara molecules are synthetic nucleoside analogues extracted from the Caribbean sponge *Tectytethya crypta* (Bergmann & Feeney 1950). Discodermolide, a potent inhibitor of tumor cell growth in several multidrug resistant (MDR) cancer cell lines was first isolated in 1990 from the Caribbean marine sponge *Discodermia dissoluta* (Gunasekera *et al*. 1990). *Halaven*, the trade name of eribulin mesylate, a synthetic analogue of halichondrin B (Hirata & Uemura 1986), originating from the sponge *Halichondria okadai*, is used in the treatment of metastatic breast cancer (approximately 700,000 deaths worldwide in 2020) and liposarcoma. For these reasons, in the past decades there has been an increasing interest from the pharmaceutical industry in collecting and screening sponges and their associated microbiota to discover novel bioactive compounds and develop sponge biotechnology.

The Phylum Porifera is subdivided into four classes: Calcarea, Demospongiae, Homoscleromorpha and Hexactinellida. Recent molecular phylogenies using complete genomes re-established the monophyly of the Phylum. This far, Peru has representatives of all classes, but Homoscleromorpha.

Class Calcarea

Calcarea sponges (or Calcispongiae) represent about 8.5% of the phylum Porifera. Members of this class have a skeleton composed of spicules of calcite ($CaCO_3$), which are mostly three-rayed, rarely associated to a basal skeleton of calcite or aragonite (Fig. 1A). They occur from the intertidal zone to around 4,000 m of depth. Calcarea species can be asymmetrical or present a cylindrical or radial symmetry. It is the only class to possess all types of aquiferous systems: asconoid, syconoid, sylleibid, leuconoid or solenoid. Here, nine genera from Peru are described, including eight species recently reported for Peru from our 2007–2009 collections.

Class Demospongiae

Demospongiae comprises by far most of the living species today. They represent 83% of the global sponge fauna and include all of the relatively few freshwater species. One of them present in Altiplano lakes (Junin, Titicaca) is described in this book (Figs 68–70, p. 159–161). Almost all Demospongiae possess a mineral skeleton composed of spicules made of opaline silica (SiO_2) united by collagen fibrils and often combined with spongin fibres. However, some genera completely lack spicules and possess only spongin fibres, as commercial bath sponges for example. A few living demosponges, occurring mostly in cryptic habitats of coral reefs, secrete both a massive calcitic or aragonitic basal skeleton combined with free siliceous spicules (Fig. 1B–D). Formerly grouped in a separate class, once called “sclerosponges”, they are now recognized as polyphyletic and are referred

to as “hypercalcified or coralline sponges” (Vacelet *et al*. 2010). They are related to important reef builders from the early Palaeozoic to the end of the Mesozoic eras (500 to 100 mya). Demospongiae live from the intertidal zone to around 8,800 m of depth [*Lycopodina occidentalis* (Lambe, 1893) in Koltun (1970, as *Asbestopluma occidentalis*)]. All have a leuconoid organization, except a group with complete or partial reduction of the aquiferous system: the family Cladorhizidae, comprising several carnivorous species feeding on mesoplanktonic preys.

Class Homoscleromorpha

Until recently, Homoscleromorpha were considered as a subclass of Demospongiae. But molecular and morphological studies demonstrated it is actually the sister-taxon to Calcarea, and do not belong in Demospongiae (Gazave *et al*. 2012). Accordingly, they were allocated to a fourth class of living Porifera. This relatively small batch (about 1.3% of all sponges) comprises only nine genera divided in two groups, one with siliceous spicules and the other without any spicules (Fig. 1E–F). Unlike other sponges, Homoscleromorpha are considered evolutionary, as the most advanced Porifera by presenting, among other things, a basement membrane lining choanocytes and basopinacocytes, a needed step towards formation of true tissues. No representative of this class was found y*et al*ong the Peruvian coast.

Class Hexactinellida

Also called “glass sponges” for the intact skeleton with fused spicules left behind when the organism dies (Fig. 1G). Hexactinellida differs from other sponges in that their body cells are connected with cytoplasmic bridges, forming a continuous mass of cytoplasm with many nuclei, called trabecular syncytium. Hexactinellida represent around 7% of Porifera and possess a skeleton of six-rayed siliceous spicules (hexactines). Most of them show a radial symmetry. This class if mostly found at depths ranging from 450 to 900 m in all oceans of the world, and they may be a dominant component of the Antarctic benthos and of North East Pacific fjords. As mentioned below, nine hexactinellids are known from deep Peruvian waters for over a century. The shallow water occurrence of hexactinellids is rare worldwide. In the Antarctic only two species occur as shallow as 33 meters under the ice (Barthel & Tendal 1994). In South Georgia one species was found at 10 meters (Goodwin *et al*. 2012). In the Mediterranean one species occurs as shallow as 18 metres in a cave with deep-water upwelling (Boury-Esnault *et al*. 2015).

Class Archaeocyatha

Archaeocyatha comprises extinct sponges with an aspiculate porous calcium carbonate skeleton, showing a close affinity with the Demospongiae (Debrenne & Vacelet 1984). They diversified into hundreds of species from the Lower (542–513 mya) to the Upper Cambrian (500–490 mya). Despite their small size, their abundance contributed to the first metazoans bioconstructions in warm tropical and subtropical waters. The decline of these reef builders, only known today as fossils, coincided with a rapid diversification of the demosponges.

2.1. Internal organization of Demospongiae, Calcarea and Homoscleromorpha

Demospongiae, Calcarea and Homoscleromorpha are constituted by only two epithelial cell layers. Externally, the pinacoderm, made of flat cells (pinacocytes), covering the body and the walls of the aquiferous canals. Internally, the choanoderm, formed by flagellated cells (choanocytes). Between both layers is a matrix (mesohyl) containing several types of highly mobile cells, microbial symbionts and elements of the skeleton. Porifera display various body organizations based on the aquiferous system and the position of its choanocyte chambers. Traditionally four systems are recognized: asconoid, syconoid, leuconoid and sylleibid. More recently, another grade was recognized, the solenoid aquiferous system (Cavalcanti & Klautau 2011). However, only Calcarea show all these.

Aquiferous system

The adult is a filtering organism with a body wall perforated by a multitude of inhalant pores (ostia) opening into the aquiferous system (Fig. 2). A network of canals leads to flagellated cells, choanocytes, grouped in chambers. Choanocytes ensure two functions: on one hand the beating of their flagella gives rise to a water flow, on the other hand they filter and digest particles the size of bacteria by phagocytosis. Filtered water flows out through exhalant canals opening to the outside through one or several large tubes visible to the naked eye, the oscula (Fig. 2). The water flow brings in food and oxygen and also removes metabolic waste (exo-metabolome). In part, the latter can act as a shield against fixation of larvae from space competitors.

Ultrastructure of the living tissues

Today, details of sponge cells are observed either in transmission electron microscopy (TEM) or in scanning electron microscopy (SEM), not only to better understand the physiology of this group, but also as a taxonomical tool in some cases. The following definitions are essentially based on these techniques which require special fixation methods not developed in details in this book.

The pinacoderm epithelium

The pinacoderm, composed of pinacocytes, is subdivided in three structures. The exopinacoderm is the external cover of the sponge, the endopinacoderm forms the walls of the aquiferous canals and the basopinacoderm is the squamous sheet attaching the sponge to the substratum. Hence, three main types of pinacocytes are distinguished.

Exopinacocytes (Fig. 3) are, depending of the species, either flat polygonal cells covering the outer surface of the animal or are “T-shaped”, seen in cross section, with their cell body projecting deep in the collagenous middle layer. In Homoscleromorpha, exopinacocytes are ciliated. The exopinacoderm bears microscopic apertures (ostia) through which water enters the aquiferous system. Ostia are either inter cellular like in most Demospongiae and Homoscleromorpha,

or are part of a different cell type (porocytes) like in freshwater sponges and Calcarea. The size of ostia is adjustable, depending on the activity of the sponge. In freshwater sponges, exopinacocytes are able to engulf and digest food particles by phagocytosis (Fig. 4).

Endopinacocytes (Fig. 5) line the internal surfaces such as canals and lacunae, with a distinct sub-category for cells situated on the water flow before (prosopinacocytes) or after (apopinacocytes) the choanocyte chambers.

In Homoscleromorpha, all endopinacocytes are ciliated. Whereas in Demospongiae, only endopinacocytes lining the inner side of the oscula can be ciliated.

Basopinacocytes (Fig. 5) form the base of the sponge, fixing the animal to the substratum or in some species (hypercalcified sponges) secreting a massive calcareous skeleton.

The choanoderm epithelium

Choanocytes (Figs 6 & 7) arranged as a palisade epithelium form the choanoderm and display various shapes, from cylindrical to flattened with cubic intermediates according to the species or to the physiological state of the sponge. The flagellum, situated at the apex of the cell, is surrounded by a collar of microvilli, which are finger-like extensions arising from the cell membrane. An additional periflagellar sleeve situated at the base of the flagellum is a taxonomic characteristic of certain genera like *Willardia* and *Halisarca*. In some freshwater sponges the flagellum bears wing-shaped glycocalyx structures acting like paddles bracing the water.

Central cells (Fig. 7F) occur at the distal side of the choanocyte chambers of some species and are crossed by canals where the flagella of several choanocytes pass through. They probably participate in the regulation of the amount of water flowing through the choanocyte chamber.

Cells of the mesohyl (Figs 8 & 9)

The mesohyl bound by the pinacocytes and the choanocytes contains a matrix consisting of collagen fibres, an organic skeleton constituted of spongin fibres (ex: Verongiida, Dendroceratida) and/or an inorganic skeleton made of mineral spicules. Some species lack any mineral skeleton. A variety of mobile cells occur within the mesohyl as well as symbiotic bacteria in some species.

Archaeocytes are highly mobile cells characterised by a large nucleolated nucleus and pseudopods, they display an active phagocytosis and an intense digestive activity. Archaeocytes are totipotent, able of changing into other cell types to perform different tasks in some circumstances. They are also precursors of female gametes.

Bacteriocytes present large vacuoles containing symbiotic prokaryotic cells. In some species bacteriocytes migrate into the larvae to insure the vertical transmission of symbionts to the next generation.

Different **constructing cells** are also contained in the mesohyl.

Spongocytes synthetize spongin fibres forming the fibrous skeleton, responsible of the flexibility, as well as shear and crumbling resistance of many demosponges.

Lophocytes secrete collagen bundles arranged in fibres while moving through the mesohyl which are the main constituent of the extracellular matrix. Sponges lacking a mineral skeleton, present abundant collagen ensuring the cohesion of the animal.

Sclerocytes incorporate silica or induce the precipitation of calcium to form spicules. In Demospongiae and Hexactinella, spicules are synthetized by single cells, while in Calcarea several sclerocytes are involved in the formation of spicules, usually one for each actine (ray).

Cells with inclusions represent, in many but not all sponge species, a heterogeneous category of secretory cells with a variety of cytoplasmic inclusions corresponding to reserve substances (glycogen, lipids), secondary metabolites (toxic and antibacterial metabolites) or pigments. Their structure and their content observed in transmission electron microscopy is particularly useful in the taxonomy of sponges lacking spicules or spongin fibres, such as some Homoscleromorpha. The principal cells with inclusions are spherulous cells of different types: granular and microgranular cells, rhabdiferous cells, glycocytes, pigment cells and vacuolar cells. The role of each of them is still poorly understood. Recently, a process of exudation of defensive bioactive compounds in the water column after release through the oscula, called “spherulization”, has been elegantly demonstrated (Ternon *et al*. 2016). Other functions might still be found with the development of metabolomics-based approaches.

Symbionts present in the mesohyl (Fig. 10)

Most, if not all sponges have associated microorganisms. Sponge species are usually classified as LMA (Low Microbial Abundance) and HMA (High Microbial Abundance), which is also reflected somehow on the diversity pattern of microorganisms present. On top of this, the associated microbiome of a given sponge species has a transient and a core component, the former more readily influenced by the environment, and thus markedly variable within the species, and within the same locality or individual even, and the latter, holding a steadier evolutionary signal, more stable across vast geographic areas. Among these specific associations, several groups of microorganisms can produce bioactive compounds, including antimicrobials, which are beneficial for the hosts chemical defense system against predators. Screening for microorganisms producing these metabolites regularly leads to the discovery of substances with biomedical or biotechnological potential.

2.2. Sexual reproduction (Figs 11 & 12)

Sponges lack gonads and present different mechanisms to produce gametes, resulting from the differentiation of choanocytes into spermatozoa and archaeocytes and/or choanocytes into oocytes, according to the taxa.

Some species are gonochoric, with individuals producing either male or female gametes, while other species are hermaphroditic, spermatozoa and oocytes being produced in a same individual, simultaneously, sequentially in the form of protogyny or protandry, or with alternating sexes. Sequential changes in sex may occur during the same reproductive season or over consecutive years.

In addition, sexual reproduction exhibits other characteristics. Most sponge species are viviparous: male gametes are released in the water column and penetrate the female sponge through its aquiferous system. Fertilization occurs in the mesohyl where the embryo develops into a mature larva, which will then be released. Some other exceptions, considered as oviparous, actually expel mostly zygotes or early embryos. True oviparous, with male and female gametes shed into the sea where they meet and form the zygote, are uncommon.

Regardless of the mode of fertilization and incubation, the sexual reproduction of sponges always involves the formation of zygote, embryo, and larva.

Male gametes. In Hexactinellida, Demospongiae and Homoscleromorpha, spermatogenesis evolves within spermatic cysts (spermatocysts), spherical structures surrounded by flattened somatic cells. In the subclass Calcaronea, because of the limited number of observations of the process, the presence of such cysts is still unclear. Spermatozoa generally take origin from choanocytes that progressively lose their flagella and collar, undergo meiosis, and form a new flagellum. Commonly, an entire chamber undergoes transformation into a sperm follicle (or sperm cyst) with all its choanocytes turning into spermatozoa. This may or may not occur synchronously within the choanosome.

Female gametes. In both oviparous and viviparous sponges, female gametes originate from archaeocytes that develop diffusely or sometimes in small clusters within the mesohyl, undergoing meiosis. The transformation into large oocytes always requires a period of important nutrition. Vitelline reserves intended to nourish the future embryo are either produced by auto synthesis or by nurse cells surrounding the oocyte. Symbiotic bacteria can also be endocytosed and digested by oocytes to be transformed into lipidic material.

Embryonic development. In most sponges, the development is indirect; the embryo will become a larva (except for one genus: *Tetilla*, order Spirophorida). Usually the embryo develops within an envelope made of flattened cells that isolates it from the mesohyl. The nutrition of the embryo is mainly ensured by the absorption of nutritive cells of maternal origin, which can also transmit symbiotic microorganisms to it.

Several types of larvae are described in the literature, based on their structure. Most are spheroidal in shape, ranging from 50 µm to 5 mm according to the species. We have spotted larvae in several species described in this book (for example *Mycale* cf. *magnirhaphidifera*). In summary, hollow larvae are composed of a reduced number of cells organized in a monostratified “epithelium” surrounding a central cavity containing maternal cells or nutritive fluid, while solid larvae have their internal space filled with several cell types, a mesohylar cavity, spicules and microorganisms. In freshwater sponges, the solid larva contains a large anterior

secondary cavity with role of buoyancy control. Almost all sponge larvae are externally ciliated and able of swimming or even crawling on the substratum in some species. Despite the series of comparative embryological studies used to understand the phylogenetic relationships within the Porifera, it is still hypothetical that taxa sharing the same development type can be considered monophyletic.

Sponges being sessile animals, the larval stage is an important opportunity to disperse. Larvae exit through the parent aquiferous system and are released through the osculum or, if close to the pinacoderm, breaking the surface of the sponge. Generally, free-swimming larvae are relatively short-lived lecithotrophs, their dispersal phase lasting from a few hours to a few days, while rare crawling larvae can survive up to 3 weeks. Some exceptions are reported in the literature: larvae of *Tedania ignis* can feed on dissolved organic materials; those of *Halichondria* (*Halichondria*) *panicea* phagocytose bacteria and nanoflagellates through their exopinacocytes. Planctonic larvae become demersal at the end of their period of dispersal, their buoyancy decreases with age as their skeletal mass increases and as the buoyant yolk is consumed. After settling, the sponge forms a pinacoderm in order to isolate its internal medium from the surrounding environment, develops choanocyte chambers, channels, pores and oscules and builds its skeleton. Within a few days, a functional sponge is formed, able to filter water and obtain its own food. This first functional individual is called olynthus in Calcarea, and rhagon in Demospongiae. When genetically identical larvae settle side by side, as they grow and touch, they merge to constitute a single individual.

2.3. Asexual reproduction (Figs 13 & 14)

In addition to sexual reproduction, all poriferan clades present cases of asexual reproduction occurring either as dormant encapsulated structures (gemmulation) or as fragmentation or even budding. Demosponges displaying asexual multiplication in the life cycle often have a regular permutation of sexual and asexual reproduction within the same individuals.

Gemmulation appears in most freshwater sponges and a few marine species to resist extreme changes in environmental conditions like drought or freezing. Gemmules also serve as a means of dispersal of these species (Fig. 14). They consist in a collagen envelope usually reinforced by specific spicules and contain a mass of archaeocytes along with thesocytes (reserve cells containing mainly vitelline platelets). Gemmules are able to survive several years and when convenient seasonal conditions return, archaeocytes start to come out through an aperture (micropyle) and reorganize a new sponge.

Fragmentation occurs in demosponges bearing projections or in encrusting species, as a result of the growth of their body. No change in the cell composition of the parent individual precedes the disconnection of the fragment, which is released free in the water.

Budding may occur in almost all groups of sponges and consists in an initial dense accumulation of archaeocytes at the parent sponge surface. No aquiferous

system exists within the bud until it settles independently on the substrate and starts to grow. A classical example of budding is seen in sponges belonging to *Tethya*, a couple species to be found in the descriptions below (Figs 109–110, p. 243 and 245).

2.4. Nutrition (Fig. 15)

Food particles like bacteria or yeast contained in the water transported through the aquiferous system are mainly retained by choanocytes. Particles first adhere to the surface of the cells, outside the base of the collar of microvilli and are progressively phagocytosed. Digestion is initiated when phagosomes containing food fuse with lysosomes that release digestive enzymes (acid phosphatase) to form phagolysosomes. Simultaneously, phagosomes are transferred to archaeocytes where the same digestion process is developed. Afterwards, wandering archaeocytes transfer the produce of their digestion to feed other cells in the mesohyl. *In vitro* experimental incubations of latex beads or bacteria with a freshwater sponge have shown that exopinacocytes play also an important role in phagocytosis of particles and their digestion.

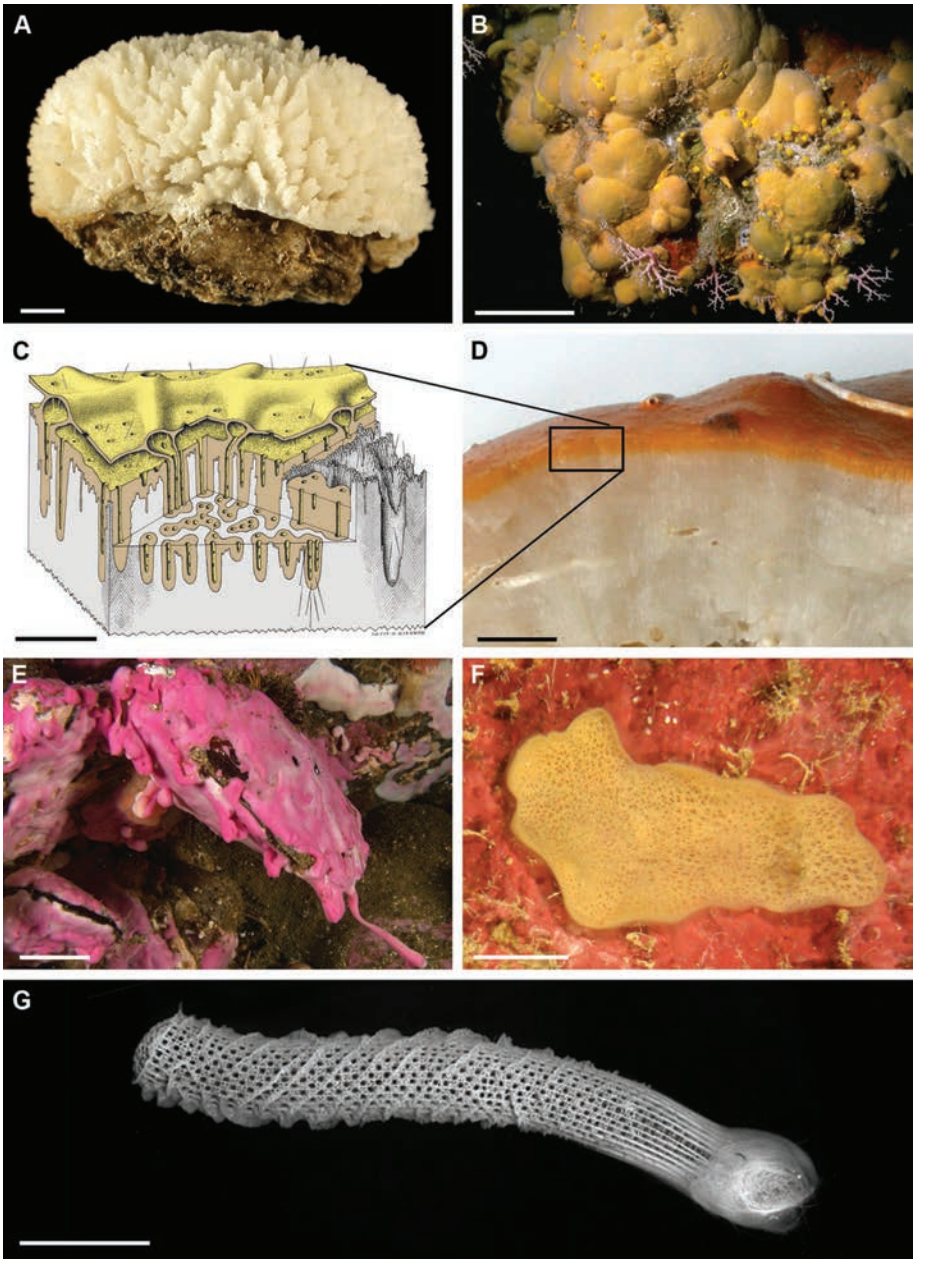


Fig. 1. Distinct supportive structures. A, massive calcitic skeleton of a hypercalcified Calcarea after removal of the superficial tissues (*Petrobiona massiliana* from Marseille); B, hypercalcified demosponge (*Ceratoporella nicholsoni* from Jamaica); C, schematic organization of a hypercalcified demosponge (*Stromatospongia norae* from Jamaica); D, fractured skeleton of B with superficial living tissues above massive aragonitic skeleton; E, Chondrillida (*Halisarca magellanica* from Chilean fjords); F, Homoscleromorpha (*Plakina nathaliae* from Martinica) both lacking any mineral or organic skeleton; G, Hexctinellida skeleton (*Euplectella aspergillum* from Western Pacific).

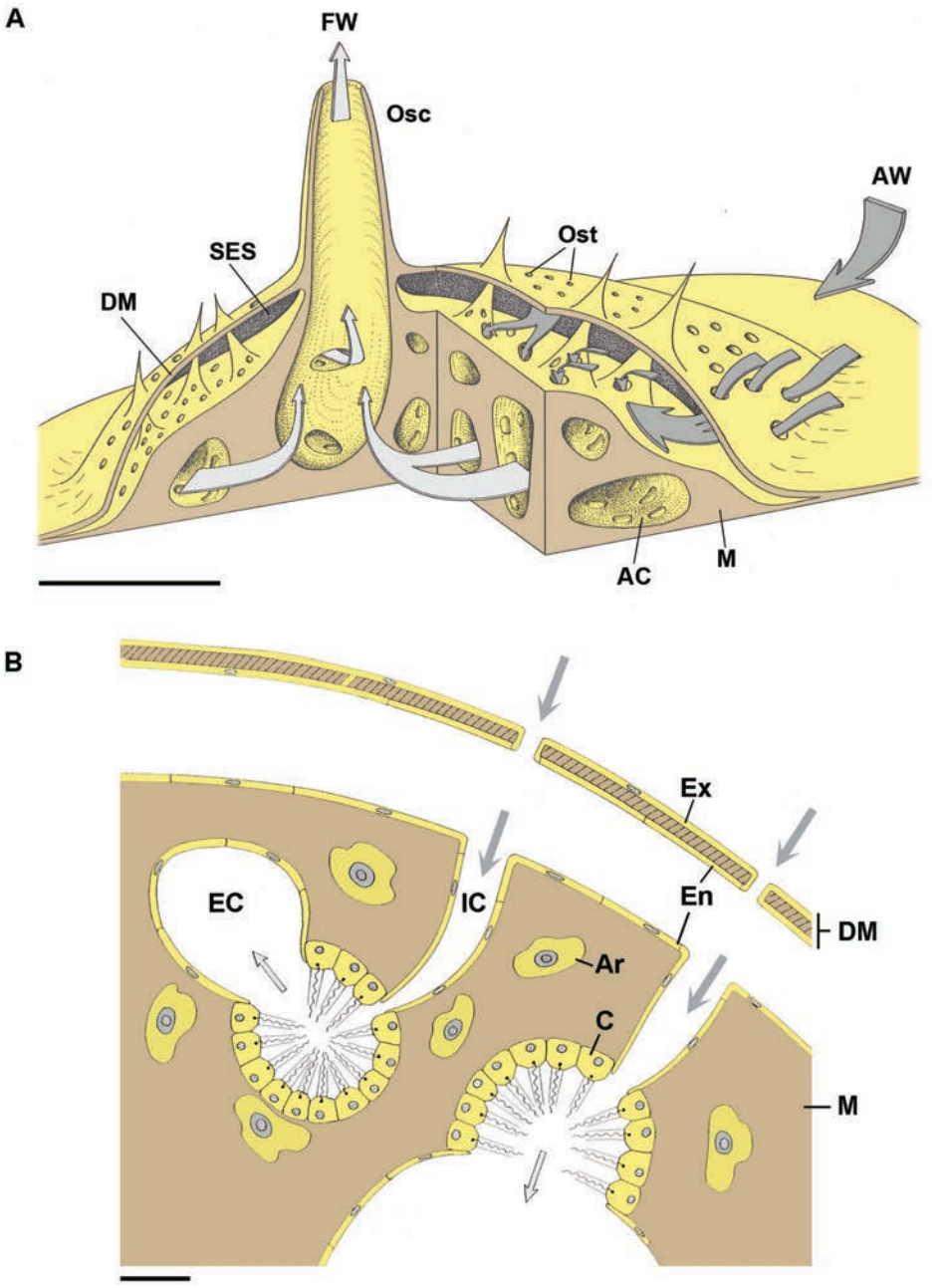


Fig. 2. Aquiferous system. A, Three-dimensional schema of a demosponge. B, detailed schema at the cellular level of the water flow through the tissues. Abbreviations: AC, aquiferous canal; AW, ambient water; DM, dermal membrane; EC, exhalant canal; Ex, exopinacocytes; En, endopinacocytes; FW, filtered water; IC, inhalant canal; M, mesohyl; Osc, osculum; Ost, ostia; SES, sub ectodermal space. Scale bars: A, 500 µm; B, 10 µm.

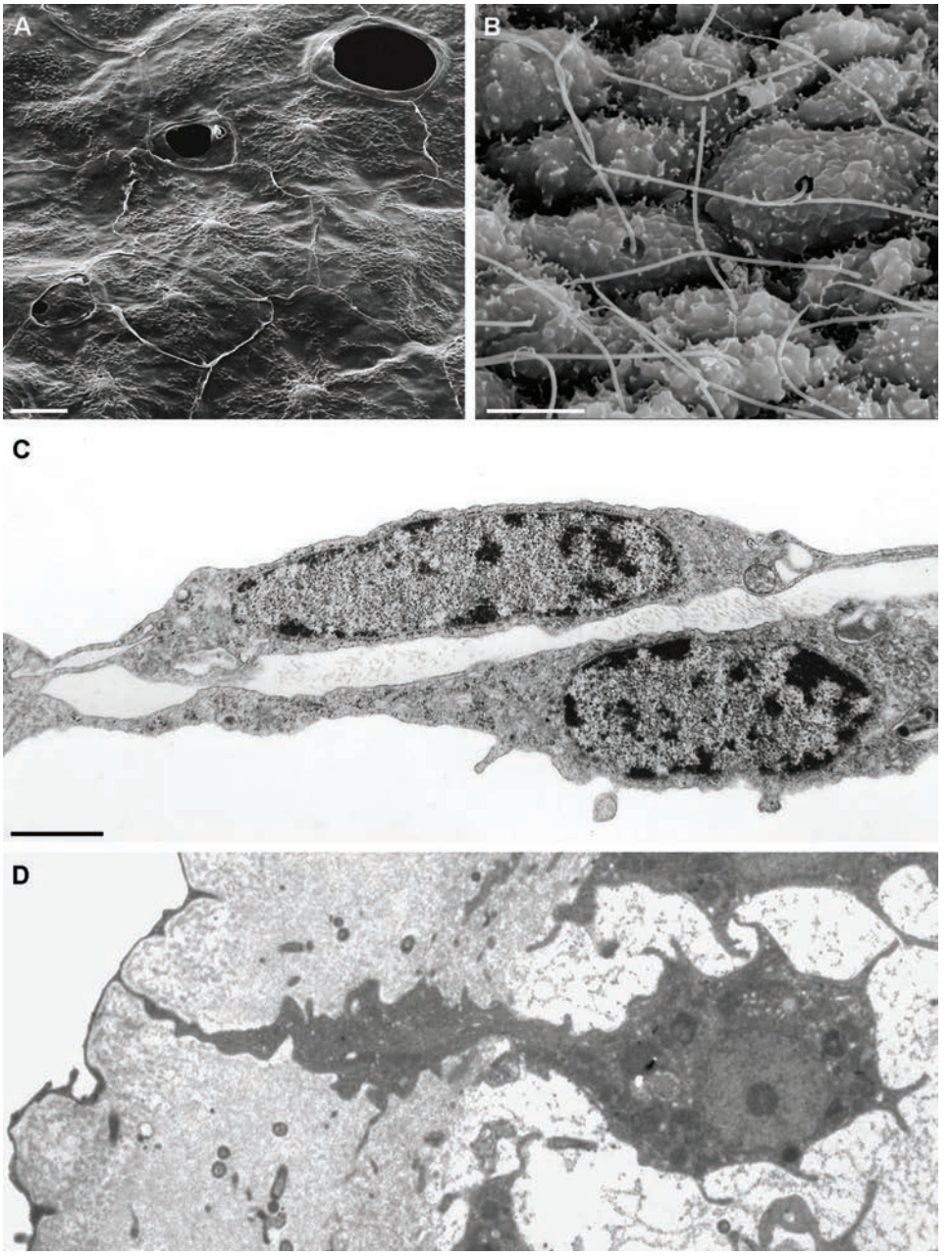


Fig. 3. Exopinacocytes. A, polygonal exopinacocytes of a Spongillida with central nucleated bulge seen in SEM (*Ephydatia fluviatilis*). Porocytes at different stages of aperture of their ostia are inserted among exopinacocytes; B, ciliated exopinacocytes of an Homoscleromorpha (*Oscarella* sp.); C, transversal section of the dermal membrane with collagen fibers of the mesohyl between exo- and endopinacocytes seen in TEM at the level of nuclei (*Ephydatia fluviatilis*); D, typical "T-shaped" exopinacocyte of a Chondrillida (*Halisarca magellanica*). Scale bars: A, 10 µm; B, 5 µm; C, 1 µm; D, 5 µm.

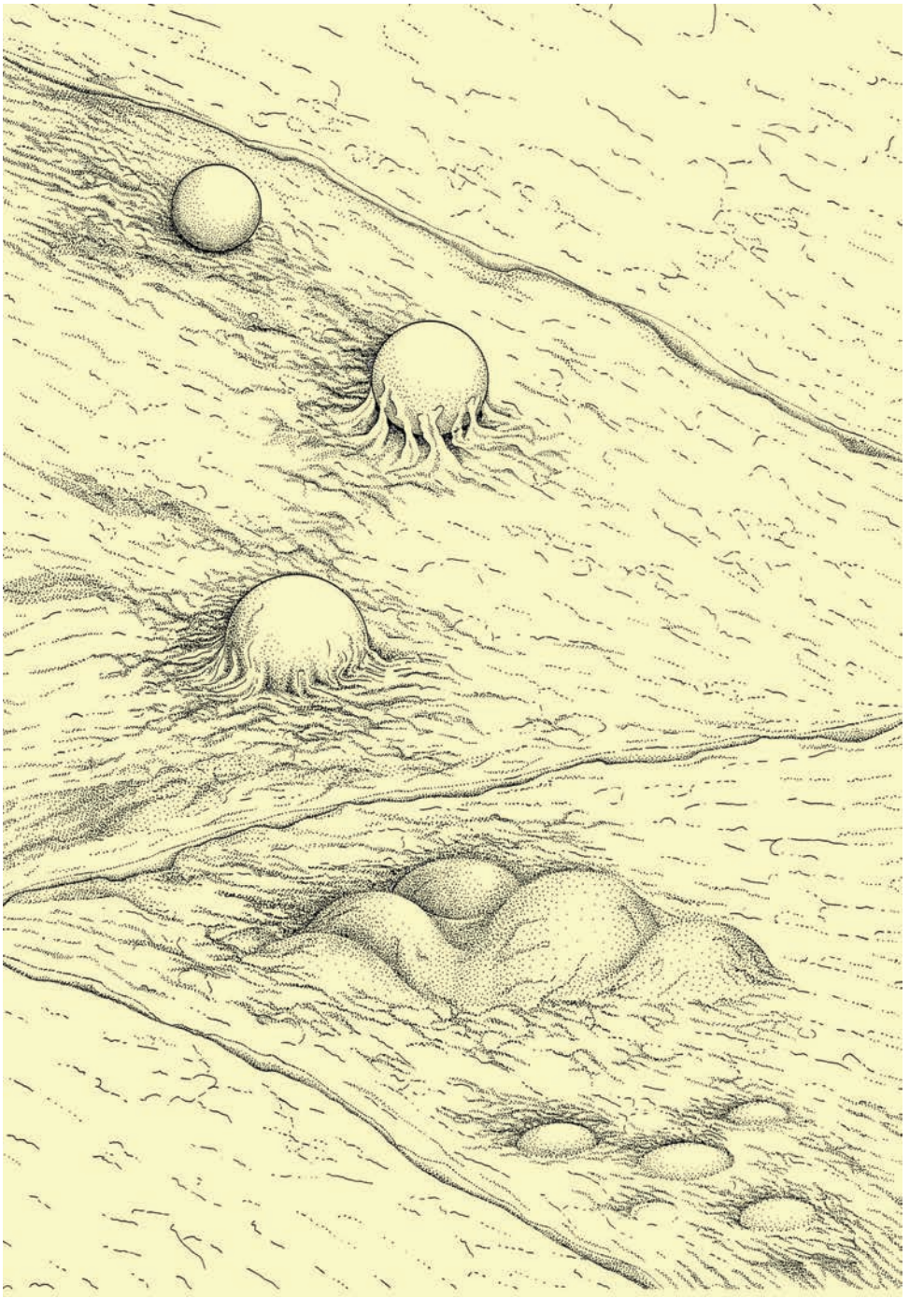


Fig. 4. Exopinacocytes. Compound representation from SEM pictures of the dynamical steps of experimental phagocytosis of polystyrene beads by exopinacocytes of a Spongillida (*Ephydatia fluviatilis*).

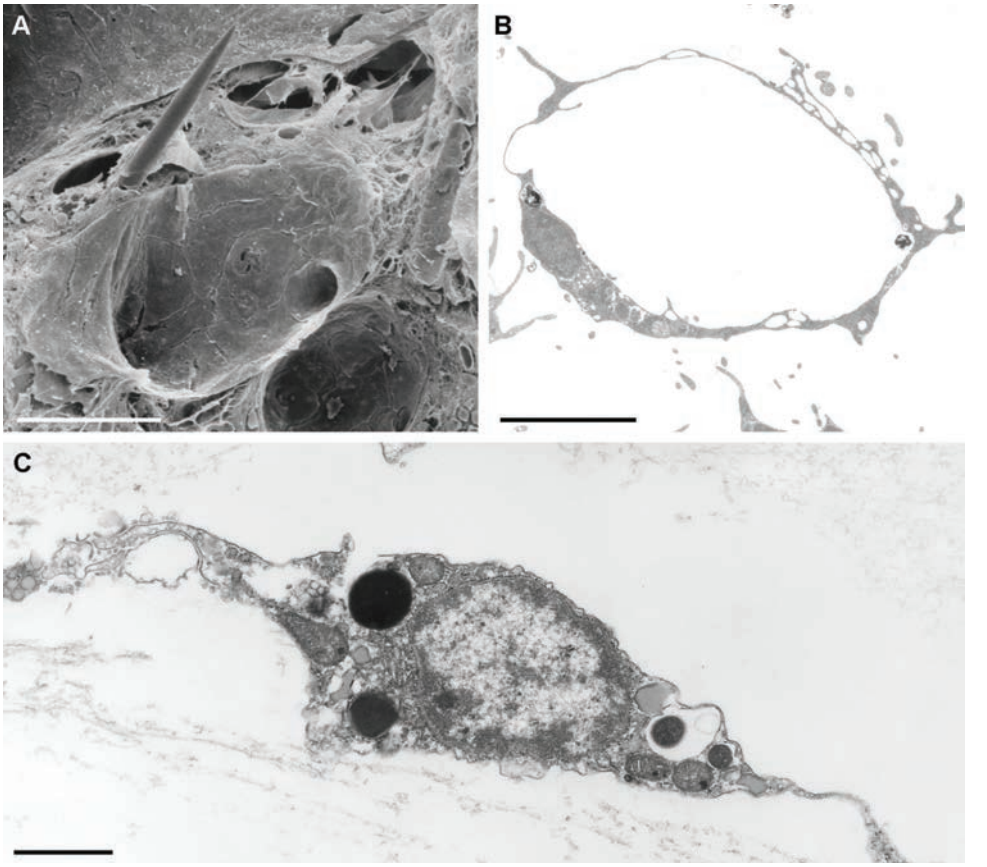


Fig. 5. Endopinacocytes. A, inner view of an aquiferous canal lined with endopinacocytes of a hypercalcified Agelasida (*Hispidopetra miniana*); B, transverse section of an aquiferous canal of a Chondrillida (*Halisarca desqueyrouxae*); C, basopinacocyte of a hypercalcified sponge after dissolution of the basal skeleton of a hypercalcified Agelasida (*Ceratoporella nicholsoni*). Scale bars: A, 50 µm; B, 5 µm; C, 1 µm.

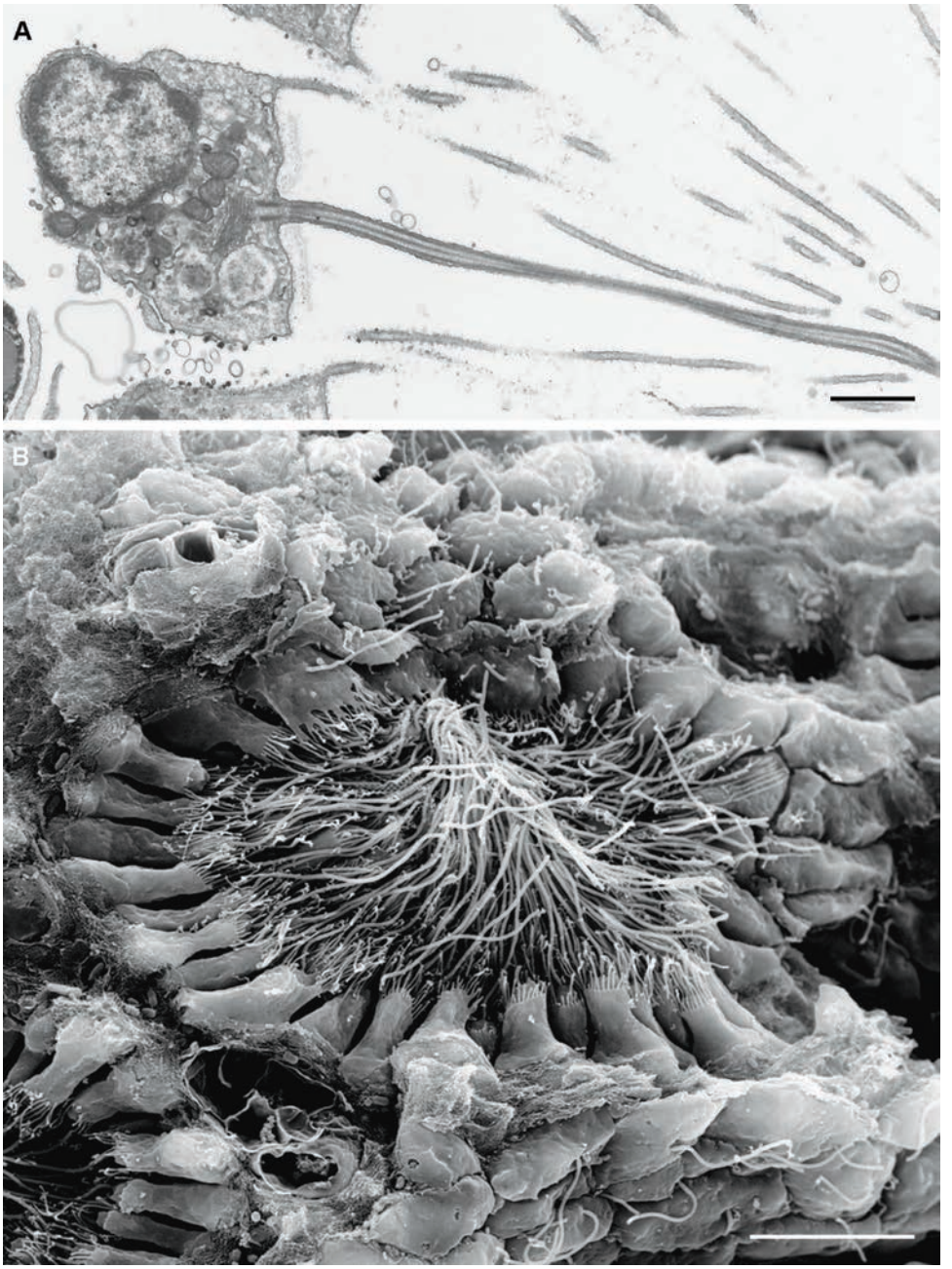


Fig. 6. Choanoderm. A, choanocyte of a hypercalcified Haplosclerida in sagittal section with basal nucleus and particularly long collar of microvilli (*Calcifibrospongia actinostromarioides*) (TEM); B, choanocyte chamber of an Homoscleromorpha with extended cell body and very short microvilli (*Oscarella ruthae*) (SEM). Note the ciliated endopinacocytes on the right bottom of the picture. Scale bars: A, 1 µm; B, 10 µm.

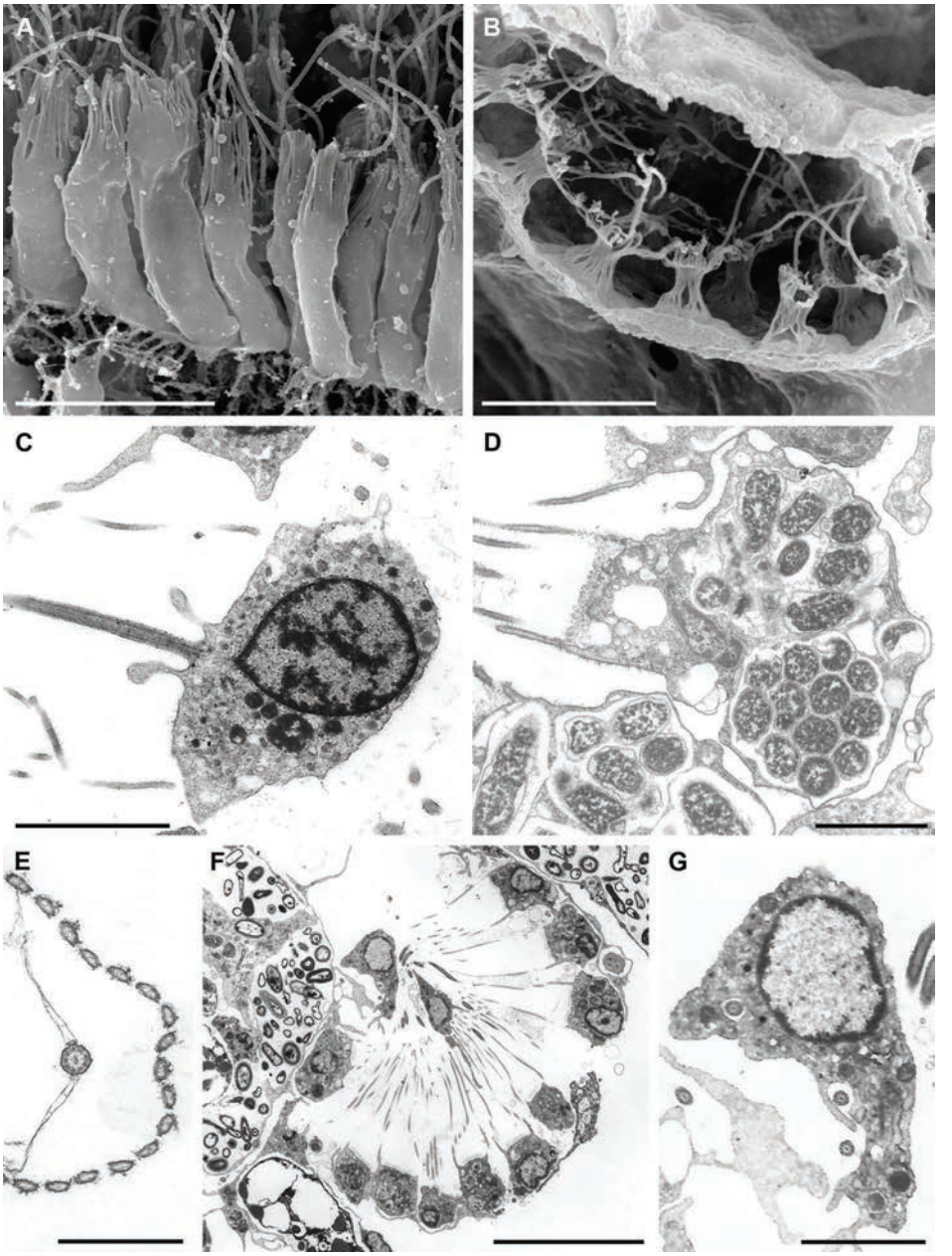


Fig. 7. Choanoderm. A, cylindrical choanocytes of a Chondrillida (*Halisarca magellanica*); B, flattened choanocytes with flaring collar of a hypercalcified Agelasida (*Goreauiella auriculata*); C, choanocyte with periflagellar sleeve of a hypercalcified Clionaida (*Willardia caicosensis*); D, choanocyte of a Spongillida with bacteria engulfed in phagosomes (*Ephydatia fluviatilis*); E, transversal section of a choanocyte collar with flagellum bearing a wing-shaped glycocalyx structure (*Ephydatia fluviatilis*); F, central cell (*Willardia caicosensis*); G, detail of F with flagella crossing the central cell. Scale bars: A, B, F, 2 µm; C, D, G, 2 µm; E, 1 µm.

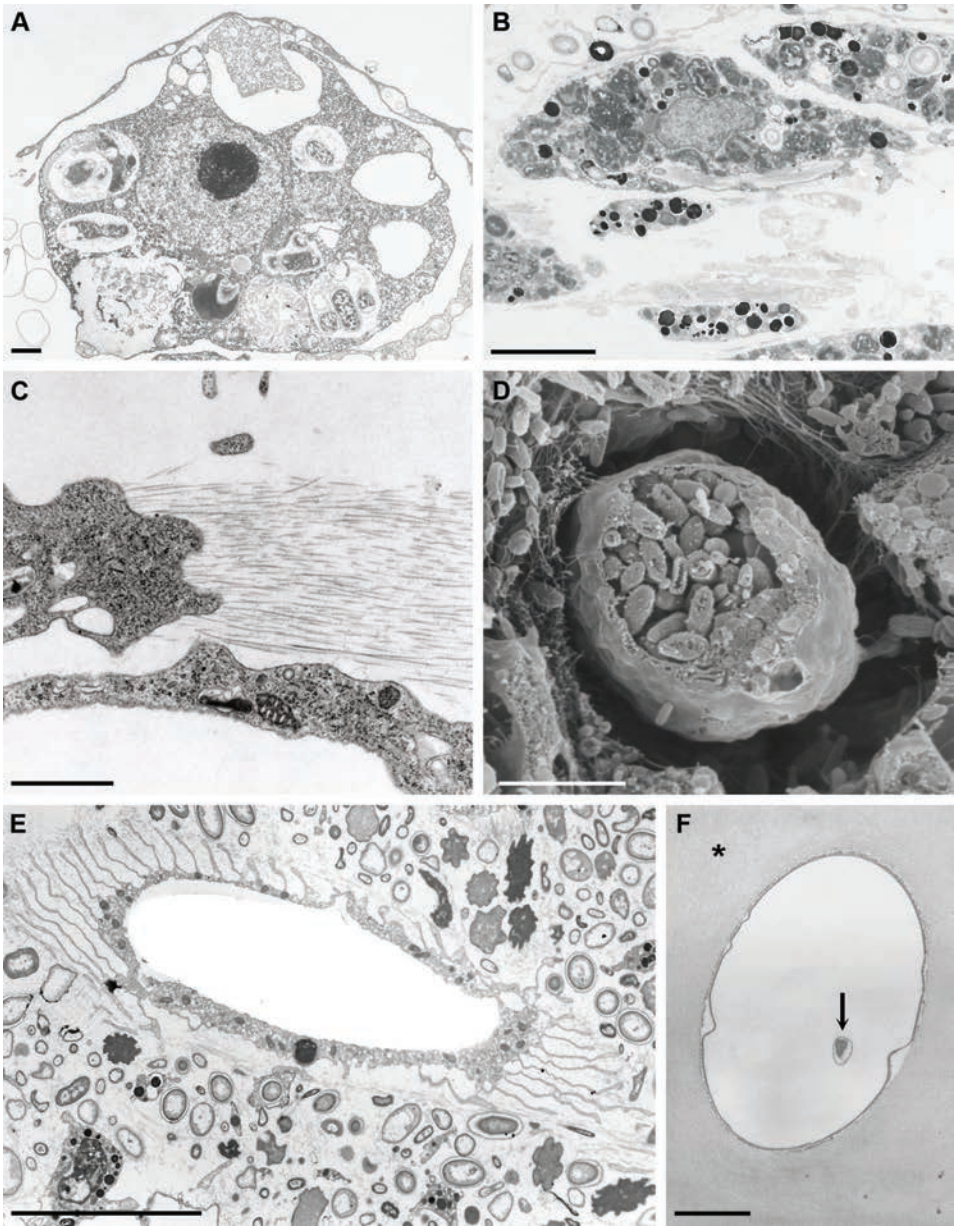


Fig. 8. Mesohylar cells. A, archaeocyte of a Spongillida with bacteria engulfed in phagosomes (*Ephydatia fluviatilis*); B, lophocyte of a hypercalcified Agelasida with numerous electron dense inclusions (*Ceratoporella nicholsoni*); C, detail of the basal side of a lophocyte with its "tail of collagen" being secreted (*Ephydatia fluviatilis*); D, fractured bacteriocyte of a hypercalcified Agelasida (*Stromatospongia vermicola*); E, transversal section of a sclerocyte with abundant filopodia extending the surface of the cell membrane, the large central space was occupied by the spicule before dissolution (*Ceratoporella nicholsoni*); F, spongin (*) around a transversally sectioned spicule with its axial filament (arrow) after dissolution (*Ephydatia fluviatilis*). Scale bars: A, C, 1 µm; B, D, F, 5 µm; E, 10 µm.

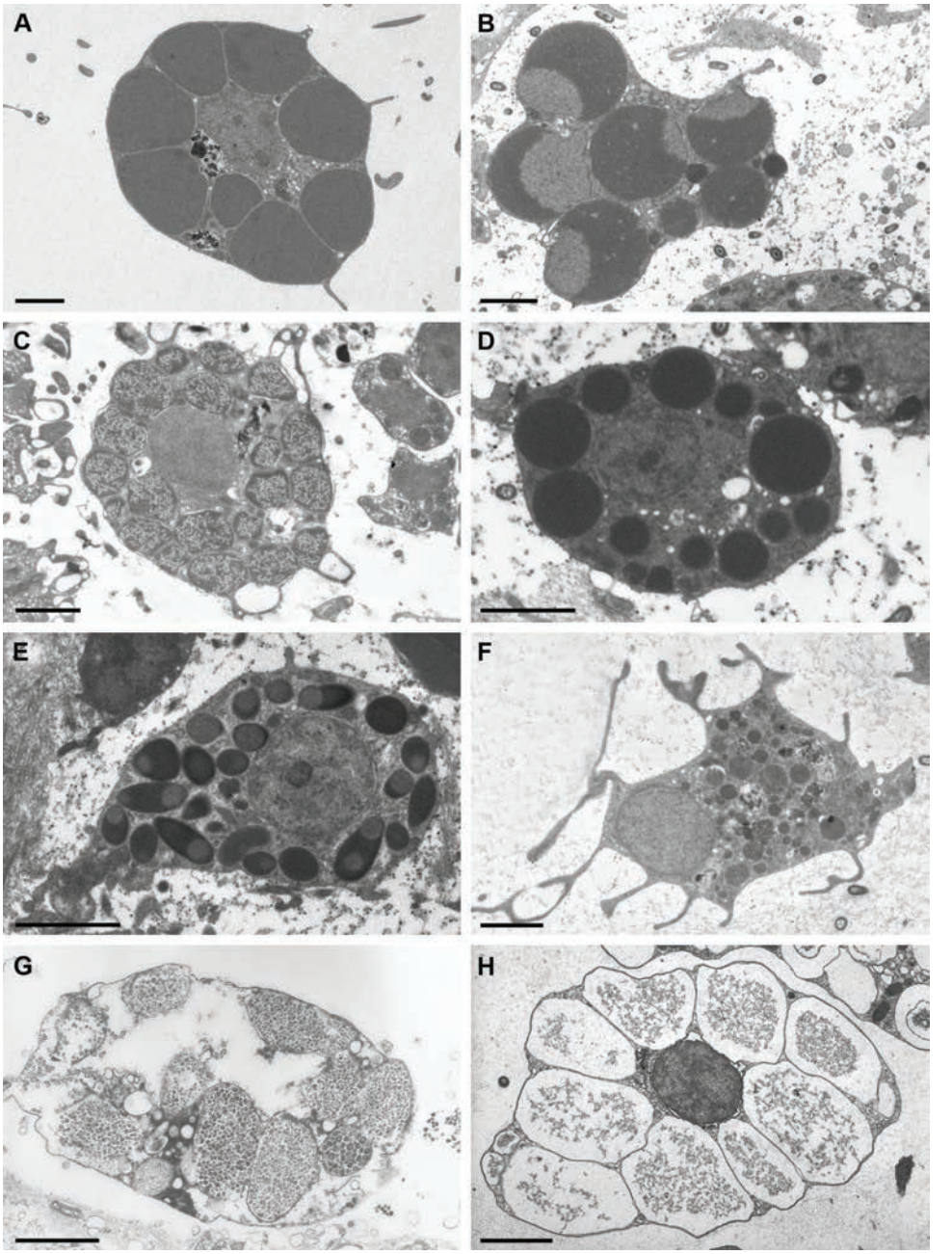


Fig. 9. Mesohylar cells with inclusions. A, spherulous cell type I of a Chondrillida (*Halisarca desqueyrouxae*); B, spherulous cell type II (*Halisarca magellanica*); C, spherulous cell type III (*H. desqueyrouxae*); D, granular cell (*H. magellanica*); E, rhabdiferous cell (*H. magellanica*); F, microgranular cell (*H. magellanica*); G, glycocyte of an Homoscleromorpha (*Plakina nathaliae*), H, vacuolar cell of a Poecilosclerida (*Hemimycale columella*). All scale bars 2 µm.

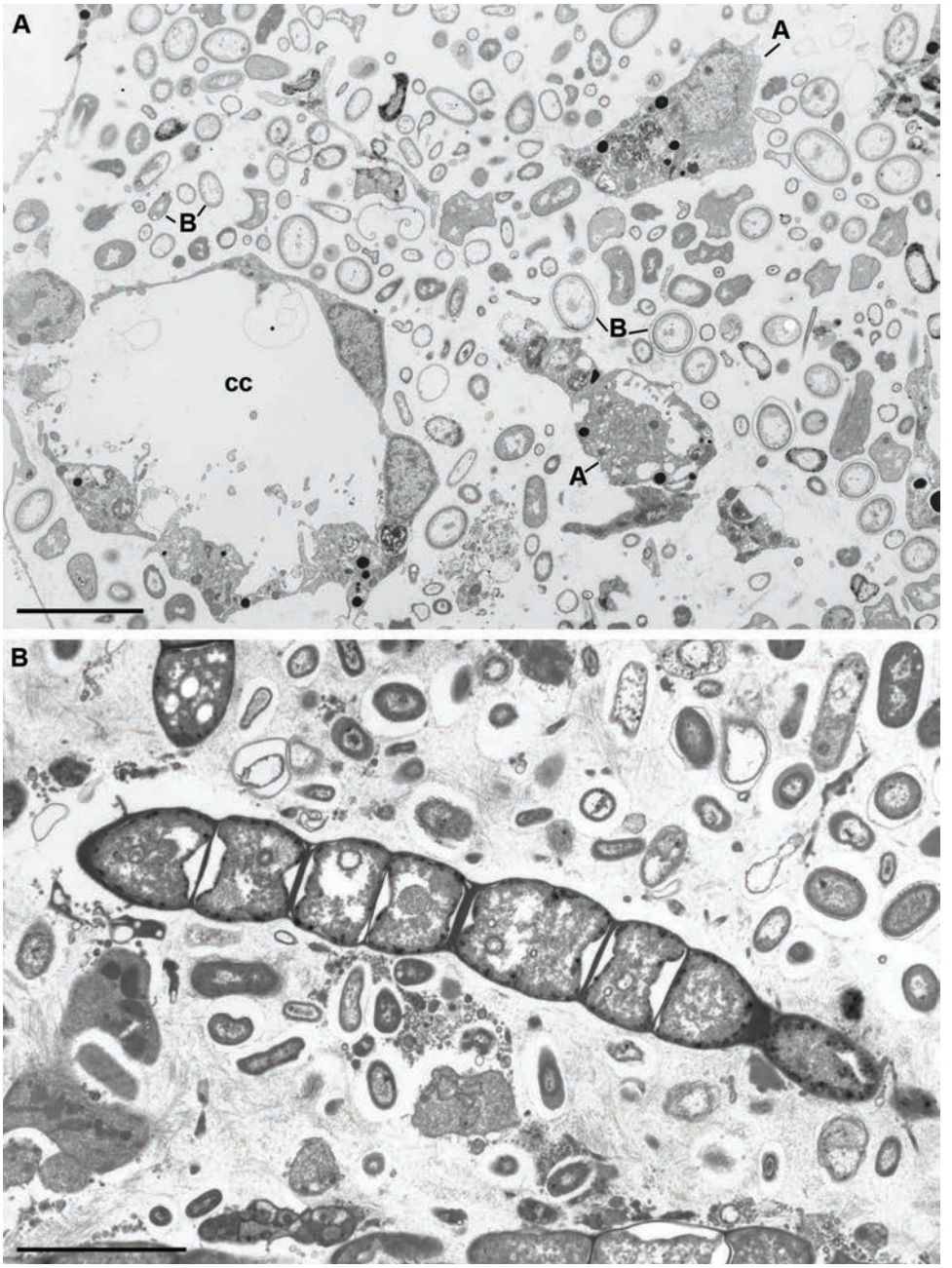
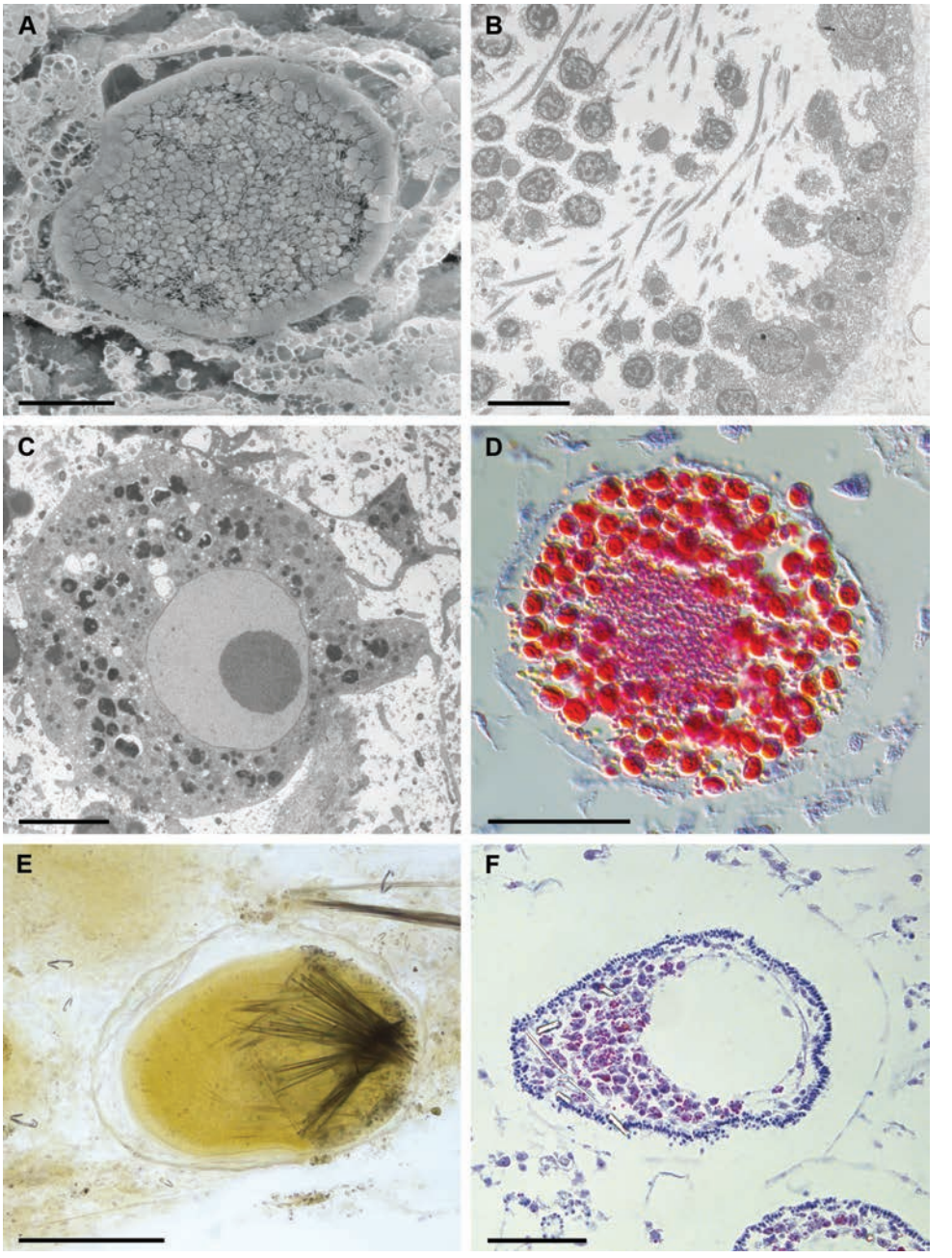


Fig. 10. Symbionts in the mesohyl. A, TEM section in the mesohyl of a hypercalcified Agelasida with abundant symbiotic bacteria (*Ceratoporella nicholsoni*); B, filamentous eubacteria (*Entotheonella* sp.) in the mesohyl of a Tetractinellida (*Discodermia dissoluta*). Abbreviations: A, archeocytes; B, bacteria; cc, choanocyte chamber. Scale bars 5 µm.


A
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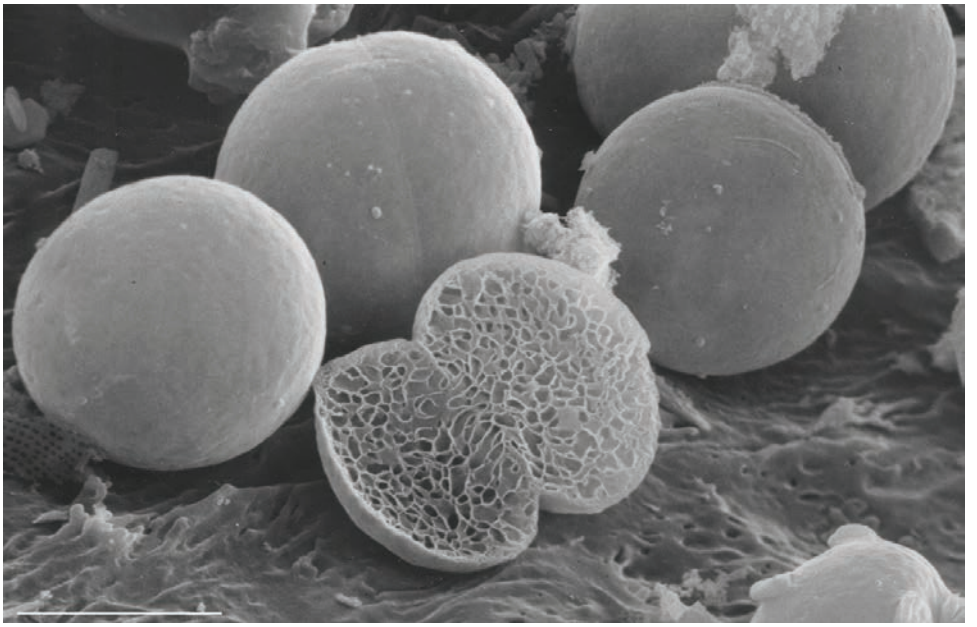


Fig. 12. Oviparous sexual reproduction. Rare view of zygotes adhering to the surface of their mother sponge shortly after release and external fertilization. Cryofracture observed in SEM of a stage 2 blastomere seen in front of a stage 4 blastomere Scale bar: 10 µm.

Fig. 11 (opposite page). Sexual reproduction. A, cross section of a spermatic cyst containing nearly mature spermatids of a Homosclerophorida seen in SEM (*Plakina nathaliae*) with follicle cells compacted around the cyst; B, detail of a spermatic cyst with thick layer of follicle cells surrounded by collagen in TEM (*Plakina nathaliae*); C, vitellogenic oocyte with large nucleolated nucleus of a Chondrillida seen in TEM (*Halisarca magellanica*); D, light microscopy of an oocyte of a Spongillida, with vitellus stained in red with Herlant's tetrachrome, surrounded by trophocytes (*Ephydatia fluviatilis*); E, mature parenchymella larva within the mesohyl of a Poecilosclerida, surrounded by its cellular follicle, with tylostyles grouped in fan and anisochelae at the posterior pole (*Mycale* cf. *magnirhaphidifera*); F, section of a mature parenchymella larva of a Spongillida, with its large secondary internal cavity, within an aquiferous canal (*Ephydatia fluviatilis*). Scale bars: A, 20 µm; B–C, 5 µm; D, 50 µm; E, 200 µm; F, 50 µm.

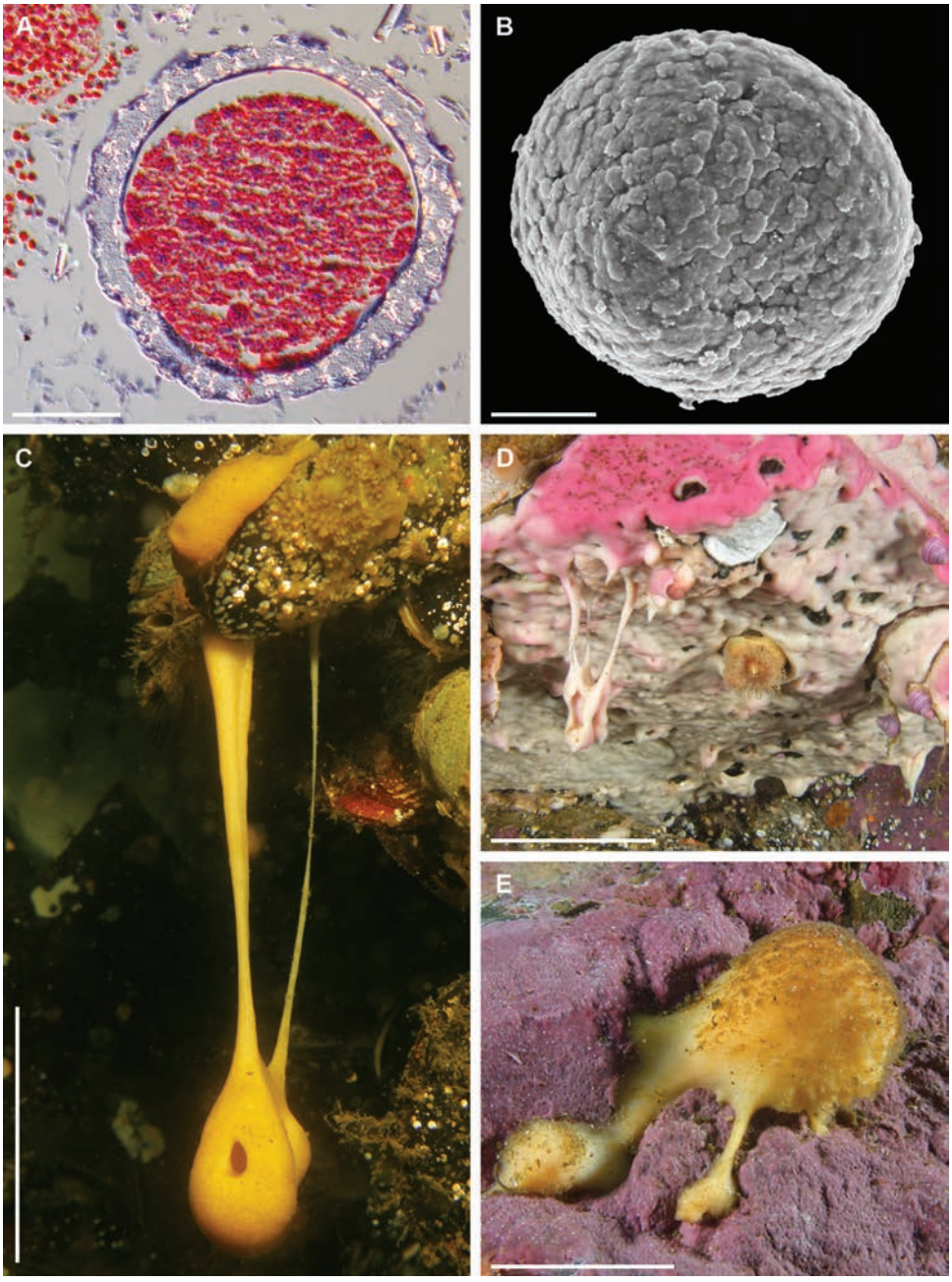


Fig. 13. Asexual reproduction. A, cross section of a gemmule inside the mesohyl of a Spongillida in light microscopy, stained with Herlant's tetrachrome (*Ephydatia fluviatilis*); B, gemmule isolated from the same species; C, typical fragmentation of a Chondrillida lacking a hard skeleton (*Halisarca desqueyrouxae*); D, fragmentation of a Chondrillida from its parent individual growing under a overhang (*Halisarca magellanica*); E, asexual reproduction by budding of a Tethyida (*Tethya papillosa*). Scale bars: A–B, 100 µm; C–D, 5 cm; E, 1 cm.

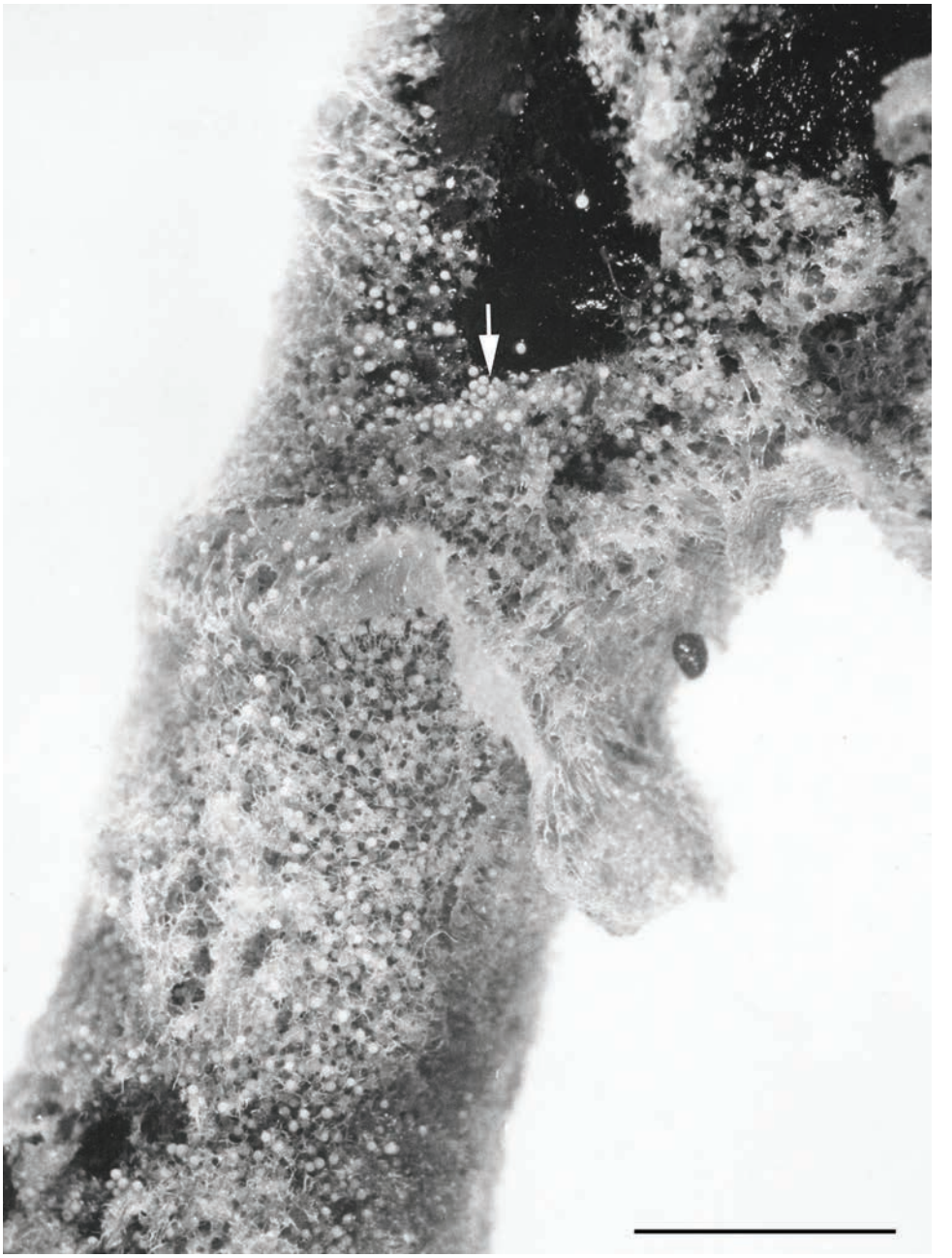


Fig. 14. Asexual reproduction. Accumulation of gemmules (arrow) in a freshwater sponge (*Ephydatia fluviatilis*) at the end of the summer. Scale bar: 1 cm.

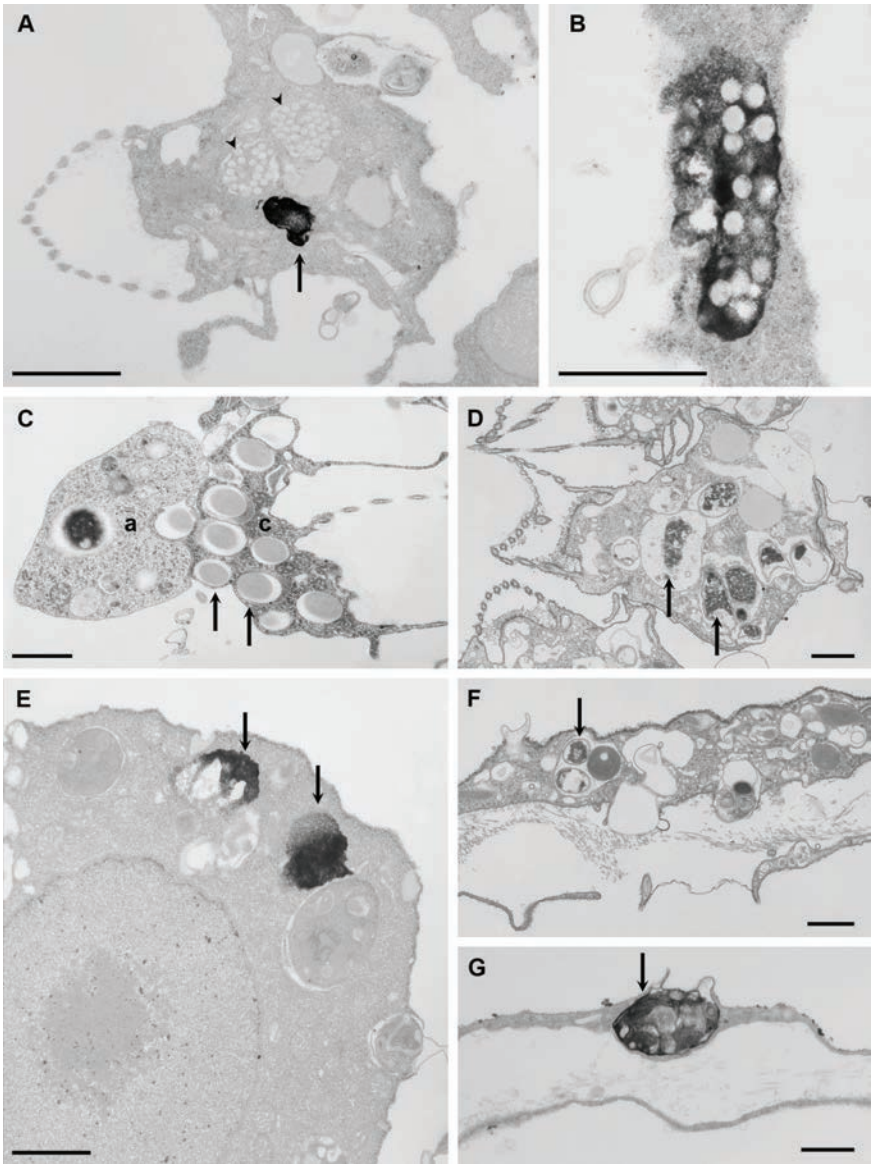


Fig. 15. Nutrition. Cells of a freshwater sponge (*Ephydatia fluviatilis*) after *in vitro* feeding experiments (TEM sections). A, highlighting of acid phosphatase presence in a lysosome of a choanocyte (arrow) close to a phagosome containing calibrated latex beads (arrowheads); B, phagolysosome in a choanocyte in the same experimental conditions. The dark precipitate corresponds to the enzymatic activity surrounding the latex beads simulating food particles; C, ingested particles (arrows) transfer from a choanocyte (c) to an archaeocyte (a); D, phagosomes with bacteria at different stages of digestion (arrows) in a choanocyte; E, highlighting of enzymatic activity (acid phosphatase) in lysosomes of an archaeocyte (arrows); F, exopinacocyte with bacteria in a phagosome (arrow); G, highlighting of acid phosphatase in an exopinacocyte (arrow). Scale bars: all 1 µm, except B = 0.5 µm).

Fig. 16. Departure to Islas Lobos de Afuera from Chiclayo on October 3, 2007. An eight hour trip on a fishing boat powered by a 40 HP outboard engine. A week later, the return trip occurred at night to take advantage of a calmer sea and took more than ten hours.

3. How to collect, preserve and identify sponges (Fig. 16)

Although some species described in this book are intertidal and can be collected at low tide, most sponges are only accessible through scuba diving. The aim of this book is not to be a dive guide but be aware that sea conditions and currents along the Peruvian shore are usually far from being calm. Infrastructures for scuba diving are not frequent along the Peruvian coast and any field trip implying successive dives requires carrying a compressor to refill the tanks and basic safety equipment including an oxygen rescue kit.

All dives performed during the joint ESPER and EsponjAS Projects were operated from small fishing boats. In addition, several days were spent diving in the Titicaca Lake, where sailboats or rowing boats were used. Safety precautions did not permit dives below 35 m and diving rules had to be scrupulously respected, since no specialized diving rescue service (i.e. DAN) was accessible in the country.

3.1. Field notes and labels (Fig. 17)

Detailed data should always be linked to any collected specimen. Therefore, field notes should be registered after each dive. A tailored made field book prepared as a series of forms helps consistency and serves as a dive log book as well. The following data are essential: Dive number, divers names or initials, locality, date, geographical coordinates, max depth, time in, time out, total bottom time, sea conditions, temperature, visibility, bottom description, etc. The tag number of each specimen should be recorded with macroscopical features (habit, surface characteristics, consistency) and preliminary identification if possible.

3.2. Collecting sponges (Fig. 18 A–B)

Underwater *in situ* photography is essential to record information concerning shape, habitat and colour, which is lost after preservation. Before collecting a specimen, several pictures of the whole undisturbed sponge, with a scale bar included in one of them, as well as close-ups showing surface characteristics should be taken.

At the collection site, carefully record all available information such as microhabitat and substrate. Depth and water temperature can rapidly be recorded by photographing the depth gauge before moving to the next sample. Photographs should be copied to a laptop, renamed at the end of the day with consistent numbering as indicated in the data log book.

ESPER 2008 EXPEDITION

Dive number	01	Locality name	Punta Coles 1
Date	06.XI.2008	Loc. abbrev.	P. Coles 1
Weather conditions	Cloudy	GPS position	Lat: 17° 42' 00"
Sea conditions	Very calm + gentle swell		Long: 71° 22' 51.2"
Air temperature	19°C	Current	None
Water temperature	12°-13°C	Depth (max)	15.3 m
Time in	10:30	Divers	YH_MR_PhS
Time out	11:19	Lancheros:	Fausto Ordano Alca
Total bottom time	49 min		Carlos Alberto Maguiña

Dive description	Substrate	Inclination	Visibility	Major fauna
0 - 10 m				
10 - 20 m	Rocks			Laminaria
20 - 30m				

MNRJ numbers	Remarks	Preliminary ID	MNRJ	RBINSc	UPCH	MHNG
12066		Haplo	✓	✓	✓	✓
12068		Raspailia?	✓	✓	✓	✓
12069		Cliona	✓	✓	✓	✓
12078		Hymedesmia	✓	✓	✓	✓
12079		Myxilla ?	✓	✓	✓	✓
Nomenclature for picture numbers		EP2-YYYY-mm-DD-D#-Locality-Initials-Pict#-MNRJ#				

Fig. 17. Field note form. A printed log form used for each dive is useful to methodically record essential information.

Fig. 18. Sample collection, preservation and storage. A, simple scale bar, 5 cm long, made of cable ties is included in each series of photographs of a specimen; B, specimen with its tag, wrapped in individual bag; C, fixing the catch of the day in ethanol and taking notes; D, vouchers in sealed bags, ready for dispatching to each of the four institutions where they will be deposited; E, vouchers transferred to leak proof glass vials (RBINS); F, storage of vials (RBINS).

Many sponges are slow growing and live up to several decades. Some are rare and collection of specimens should not be done without necessity. The interest of conservation should always be kept in mind. Only a few specimens per dive should be collected to avoid confusion. The whole specimen should only be collected if it gives essential information about its shape and when *in situ* photography is not possible. Quite often a representative voucher including basal and surface tissue is sufficient for identification. It is likely that the part left behind will heal and regenerate. Encrusting sponges should be collected with their substrate (look for barnacles, mussels, clams etc. when possible, since hard rocky substrates are often impossible to remove). It is necessary to wrap each specimen individually in a polyethylene bag at the time it is collected to avoid cross contamination. Bags with a wire closure should be prepared in advance with a waterproof printed tag bearing a serial number sealed at their bottom to avoid loss at the time it is used underwater (we recommend *Whirl Pack*® from Nasco 14 × 20 cm). A final picture of the bag *in situ* with the voucher and its tag number inside helps avoiding confusion when returning to the lab.

In addition to the classical diving equipment, not listed here, the following material is necessary for collecting sponge specimens.

Required equipment for collecting sponge specimens:

Knive, hammer and cold chisel.

Plastic bags with incorporate tag numbers (Whirl Pack).

Collecting net to gather bags during dives.

Underwater compact camera with external flash.

Plastic scale bar.

Cooler with ice pack to protect samples before returning to the shore.

Global Positioning System (GPS).

3.3. Preservation of sponges (Fig. 18 C–D)

Most sponges contain microorganisms in their tissue and once they are collected they will not stay fresh for more than a few hours, for which reason they should be fixed in 92–96% ethanol. Large specimens may cause too much dilution and the ethanol should be changed after 1–2 days. On the long run, preservation is undertaken in 70–80% ethanol. Preservation in formalin, which was commonly used formerly, is unsatisfactory. Dry preservation should be avoided as well.

Vouchers should be individually packed in thermo-sealed plastic bags containing a label with the serial number and stored in watertight plastic kegs for safe transportation. All specimens collected during the Esper expeditions were split, to be shared between four Institutions (MNRJ, RBINS, MHNG and UPCH).

3.4. Storage of samples (Fig. 18 E–F)

For long term storage, vouchers need to be transferred with their tag in tight glass collection vials. At RBINS, glass vials and small jars of 3 different sizes were used and sorted in plastic storage boxes.

Required equipment for preserving and packing specimens:

Ethanol 95°.

Plastic bags of different sizes.

Dissecting tray.

Dissecting tools (razor blades, scissors, tweezers of different length).

Thermo sealer (optional).

Watertight plastic keg.

3.5. How to identify sponges

The classical method for sponge identification is based on two complementary methods: 1) the examination of the spicules to determine their shape, categories and dimensions. 2) the observation of the skeleton framework. This leads to two different microscope slide preparations. Both involve the use of highly harmful chemicals and should be undertaken only in laboratory conditions.

3.5.1. Preparation of spicules

For Demospongiae, a small piece (< 1 cm^3) including the surface, the choanosome and the base of the sponge should be used — generally, the harder the sponge, the denser its spicule content and the smaller the fragment needed for a spicule preparation. For very thick specimens, it is best to sample in different parts of the specimen, selecting areas, which might have a different array of spicules (i.e. base, surface, walls of cavities, oscular region, etc.). The fragment is placed in a test tube made of thermo-resistant glass (i.e. Pyrex). Very gently, 1–2 ml of concentrated nitric acid (HIGHLY DANGEROUS, to be handled under fume hood) is added to the tube. As the reaction can be very strong, it is recommended to wait for a while, to avoid the risk of overflow, before carefully heating the tube over a Bunsen with constant agitation, holding the tube with wooden tongs until the tissue is completely dissolved When no coloured vapours evaporate anymore, the tube is left aside to cool down. An alternative to nitric acid is sodium hypochlorite (bleach) which is less toxic, but still dangerous. Distilled water is then carefully added and mixed. The spicules are either allowed to settle down for 2 hours or gently centrifuged (at low speed to avoid breaking the spicules). The supernatant is removed with a pipette. The rinsing is repeated 4–5 times until all the nitric acid has been removed (pH test strips can be used to check). To remove the water, spicules are washed 3 times

with ethanol using the same approach described in the above step. Finally, the amount of ethanol is reduced by pipetting. For light microscopy, one or two drops of the spicule suspension are spread on a clean microscope slide. Pipettes should have a 2–3 mm opening; otherwise larger spicules may be prevented from getting in, which might compromise ability to identify species correctly. Slides are dried in the oven, checked under a dissecting microscope or regular light microscope for the desired amount of spicules and mounted under a cover slip with a permanent mounting media. For SEM observation, a drop of the spicule suspension is spread on a stub previously covered with a circular coverglass of the same diameter, glued with silver mount to obtain a clean and contrasted background of the pictures. After observation, stubs are kept in storage boxes (SPI Supplies®) as a reference (Fig. 19 A). This can be useful when a second examination is necessary to detect minute or rare spicules that might have been overlooked in a first run. The remaining spicules suspended in ethanol are saved in 2 ml cryogenic vials with screw caps (*Nalgene*®) for additional slides or stubs preparations if these appear necessary. Vials are stored in appropriate racks (Fig. 19 B). For Calcarea, since calcareous spicules would dissolve in nitric acid, a treatment with bleach (sodium hypochlorite) is required without heating or centrifugation. For the other steps, the same procedure as for Demosponges can be followed.

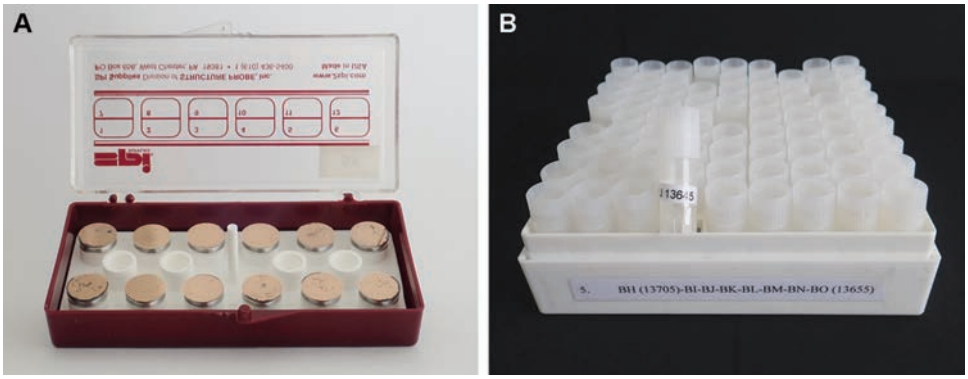


Fig. 19. Spicule preparations storage. A, SEM stubs storage; B, back-up spicules in ethanol stored in vials (RBINS).

3.5.2. Preparation of skeleton sections

Three different methods can be applied to prepare microscope slides to observe sections of the skeleton.

3.5.2.1. Paraffin sections

For Demospongiae, freehand sections cut with a fresh razor blade, are usually preferred to microtome sections to avoid breaking too many spicules. Sections should be thick enough to contain sufficient spicules, but thin enough to allow a

cover slip to be mounted flat on the slide. This is a matter of practice! Slices should be taken perpendicular to the surface to include spicules from the ectosome and from the choanosome as well. For some groups, a section tangential to the surface is also necessary (i.e. haplosclerid sponges). Sponges frequently have different spicule categories in the basal region. This region has also to be included. Sections are dehydrated by immersion in 2 absolute ethanol baths in a small Petri dish (2 × 10 min). Sections will be cleared by immersion in a non-toxic terpene-based solvent. *Histo-Clear*® is now commonly used as a substitute of xylene, which is highly toxic and needed to be handled under a fume hood. A milky appearance indicates that the section contains water and needs to go back into absolute ethanol until completely dehydrated. Section(s) are mounted on a slide with Canada balsam or Euparol, or any other mounting agent for microscopy and secured with a cover slip.

For Calcarea, a fragment of the sponge is generally stained with alcoholic acid fuchsin, then dehydrated, embedded in paraffin and sectioned at various thicknesses.

3.5.2.2. Epoxy ground sections (Figs 20 & 21)

A more sophisticated method for Demospongiae consists in preparing thin slides as for geological samples. This method has been vastly applied in this book. A small fragment is dehydrated in absolute ethanol progressively impregnated with epoxy resin for several hours, placed in moulds and cured in an oven at 60°C overnight. Sections about 1 mm thick are obtained with a low speed diamond saw, glued on a microscope slide with the same resin and also cured at 60°C overnight. The sections are then hand ground on waterproof silicon carbide grinding paper of different grit sizes (360, 600 and 800) using water as lubricant. Regular controls under the microscope allow to reach the most appropriate thickness. Sections are finally permanently mounted under coverslips. Since the same epoxy resin is used for embedding, gluing and mounting, each layer on the slide has the same refraction index, which allows a scratchproof observation of the skeleton. This method is particularly well suited to preserve the basal structure of the skeleton of encrusting specimens that can stay attached to their substrate. Any hard substrate is easily sectioned by the diamond saw. For species requiring tangential sections of the ectosome, a thin fragment is impregnated with resin and set on a microscope slide facing down (Fig. 21). After polymerisation the fragment is hand ground and mounted as described above. It is always advisable to prepare sections in triplicate to ensure observation of possibly different thicknesses.

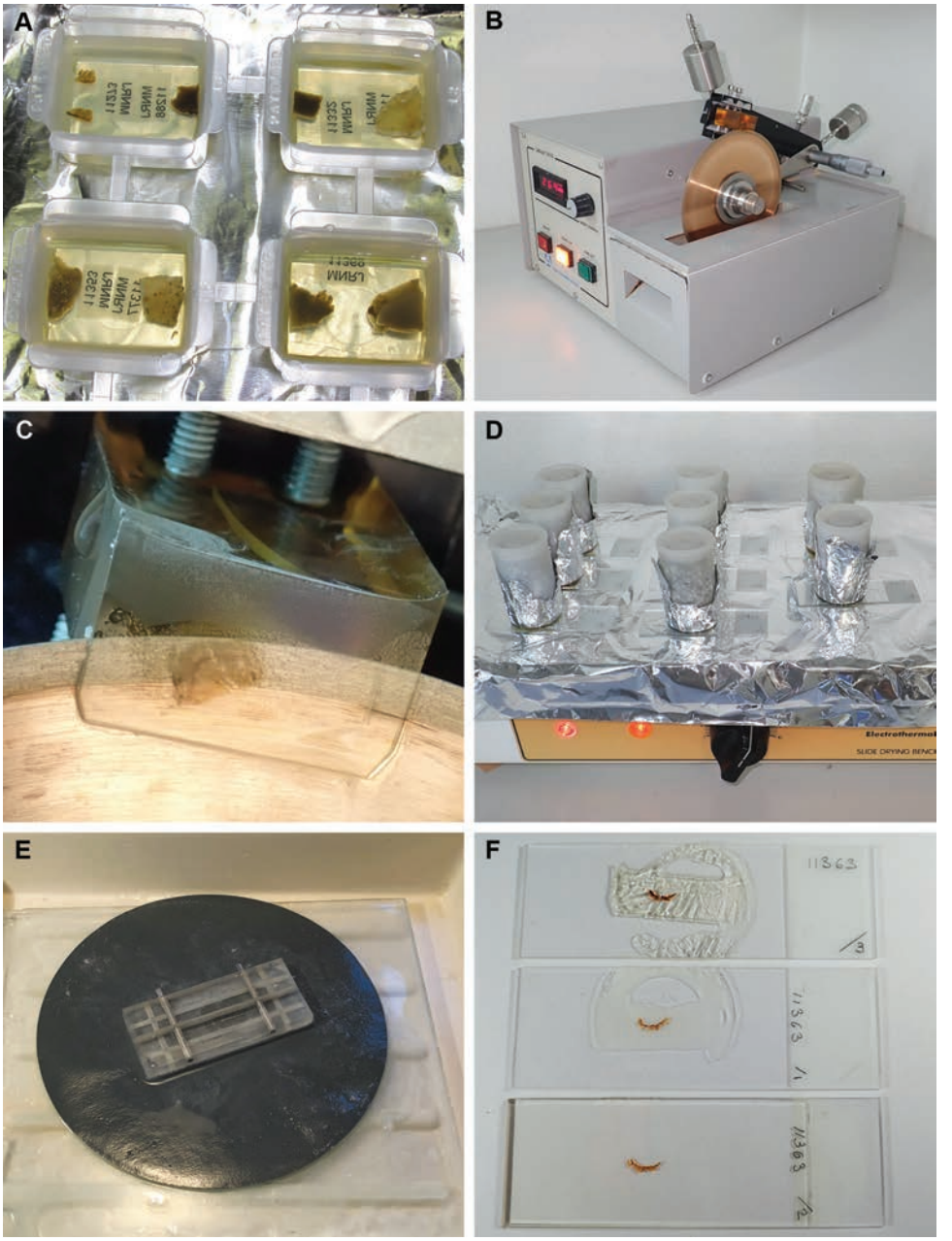


Fig. 20. Epoxy ground section. A, fragments embedded in epoxy resin still in their moulds; B, low speed diamond saw in function; C, detail of an embedded sponge fragment being sectioned; D, sections glued with epoxy on microscope slide and cured overnight on a hot plate. Aluminium foil prevents the weight from adhering to the section; E, hand grinding on water-lubricated silicon carbide grinding paper; F, three slides of a same fragment at different stages of preparation.

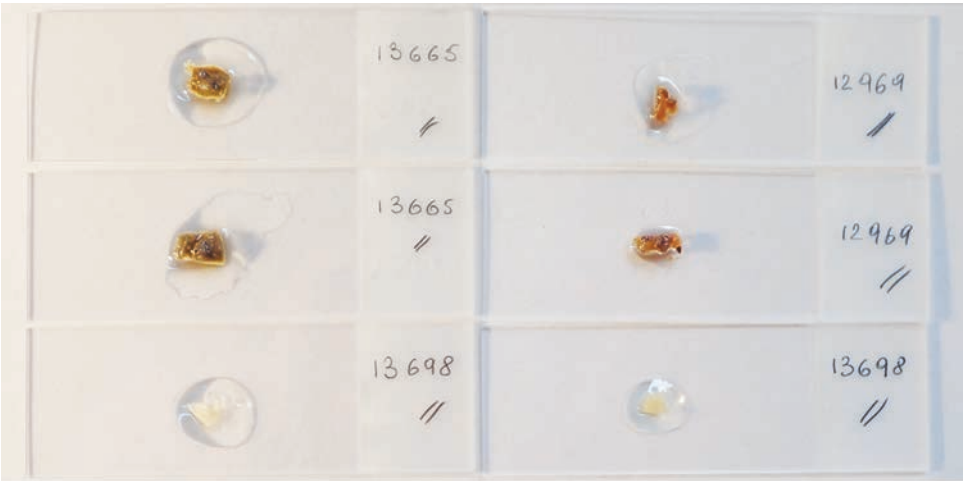


Fig. 21. Tangential sections of the ectosome. After complete impregnation of a thin fragment in epoxy resin, it is set, face down, on a microscope slide, polymerised and ground to the required thickness. All slides are prepared in duplicate or triplicate.

3.5.2.3. Papain digestion (Fig. 22)

For Keratosa, since their skeleton lacks spicules, it is necessary to prepare a three dimensional view of the spongin organization. An excellent technique consists in macerating tissues in a solution of papain to remove the cellular tissues (For details, see Pinheiro & Hajdu 2001). Inappropriate squeezing of the spongin fibres when sandwiched between slide and cover glass can be avoided, using microscope slides with a single concave depression well, or by gluing a plumbing fibre flat washer on regular slides to create a permanent thick preparation.

Fig. 22. Thick skeleton preparation. Plumbing fibre flat washers used to prevent spongin skeleton to be crushed between slide and cover glass (*Aplysina chiriquensis*).

3.5.3. How microscopy images for this book were taken

Staining is not essential but some histological details and spongin were highlighted by *in toto* staining of fragments in a saturated solution of acid fuchsin in absolute ethanol for a few seconds before embedding and sectioning. Sections of the skeleton architecture being unavoidably thick, the depth of field of all photomicrographs in this book was increased by image stacking (Leica DFC 450C camera mounted on a Leica DM 5500B microscope, and Leica Application Suite LAS v. 4.8). SEM photographs were taken with a FEI/Philips XL30 ESEM TMP Microscope.

4. Geographical features of the coast

Facing the South East Pacific Ocean, the coast of Peru extends along the Pacific Ocean on more than 3.000 km between the borders with Ecuador on the north (3° S) and with Chile on the south (18° S). Arid conditions characterize most of the coastal zone, with deserts that may lack any rainfall for years (Fig. 23 A), crossed by rare fertile vegetated valleys formed by rivers originating from the western slopes of the Andes (Fig. 23 B). The shore offers a variety of biotopes to the benthic communities under the influence of different oceanographic conditions. Its northern part (3° to 5° S) fits in the southernmost limit of the Tropical East Pacific province permanently influenced by tropical warm waters. However, no coral reef occurs off Peru. The central and southern portions of Peru coastal waters, in turn, correspond to the northernmost ecoregions of the Warm Temperate Southeastern Pacific province, with Central Peru and Humboldtian Ecoregions. Both latter ecoregions are under the influence of a cold, low salinity oceanic current that flows north from southern Chile to northern Peru: the Humboldt Current, also known as the Peruvian Current. Named after the German naturalist Alexander von Humboldt in 1846, this current brings water with temperatures ranging from 13° to 18°C up to around 5° S, where it intersects with tropical waters coming from the Central Pacific, blown by the trade winds. Additionally, the Southeastern trade winds blowing northward along the coast combined with the Coriolis force along with friction forces in the water column generate a westward deflection, perpendicular to the coast, called Ekman transport that constrains deeper water to rise. This superficial coastal upwelling system bringing up cold, low-oxygen and nutrient-rich water determines the enormous productivity of Peruvian coastal waters, reaching almost 20% of the world's industrial fishing production (Tarazona & Arntz 2001). Winds sustain this upwelling process throughout the year with an inter-annual ecosystem variability induced by the El Niño-Southern Oscillation (ENSO) cycle. ENSO in its warm phase weakens the Humboldt Current, thus allowing the incursion of tropical waters further south, below 6° S. Such a complex coastal oceanography is the main driver of patterns of diversity and distribution of marine organisms along the Peruvian coast, one of the most productive marine ecosystems on the planet. In spite of this, it is still poorly studied and certainly among the poorest known in the world for sponge biodiversity. Severe acyclic disturbance caused by El Niño and La Niña most likely hampers the establishment of truly diverse benthic communities along the Peruvian coast.

5. Investigation sites

In this guide, 86 species of sponges are described, among which 85 have never been reported for Peru and 31 have been published as new to science while we progressed in this project.

Sponges were mainly collected by scuba at sites accessed with fishing boats from small artisanal harbours (Fig. 23 A), some were also collected from intertidal zones. A variety of biotopes along the coast were accessed, including mangroves (Fig. 24), sandy bottoms (Fig. 25), rocky shores (Fig. 26), offshore guano-producing islands (Figs 27–28) and additionally freshwater lakes (Fig. 29). The principal localities investigated are indicated in Fig. 30 with their detailed geographical coordinates listed in Table 1.

Fig. 23. Arid coast and rare fertile valleys. A, Punta Coles artisanal harbour (17° S – Moquega Region); B, mouth of the Rio Camaná (16° S – Arequipa Region).

Fig. 24. Mangrove environment. A-B, Mangrove of Tumbes (03° S – Tumbes Region).

Fig. 25. Sandy shores. A, Bahia Sechura (05° S – Piura Region); B, Punta Coles (17° S – Moquega Region).

Fig. 26. Rocky shores. A, Bahia Sechura (05° S – Piura Region); B, Quilca (16° S – Arequipa Region).

Fig. 27. Islands. A, Isla Foca (05° S – Piura Region); B, Islas Macabi (07° S – La Libertad Region).

Fig. 28. Islands. Islas Guañape (08° S – La Libertad Region).

Fig. 29. Freshwater lakes. A, Lago Titicaca with Isla Taquile in the background; B, Collecting *Balliviaspongia wirrmanni* in shallow water at Suasi, Lago Titicaca (15° S – Puno Region).

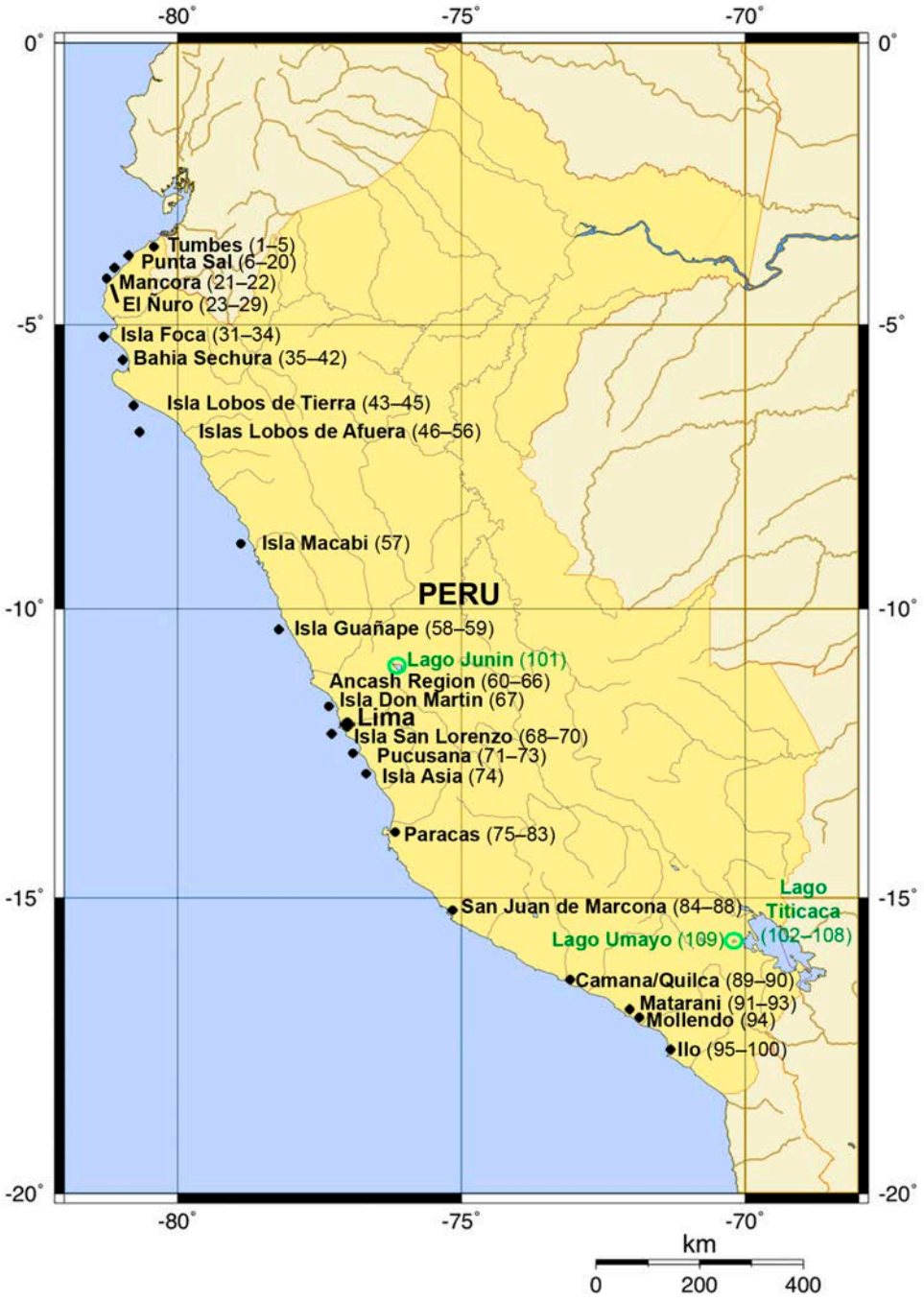


Fig. 30. Map of Peru with principal collection localities investigated. Numbers refer to collection sites of marine species, detailed with their geographical coordinates in Table 1. Collection sites of freshwater species are indicated in green.

Table 1. List of 109 collection sites with their geographical coordinates.

N	Locality	Geographical position
1	**Manglares de Tumbes**, Punta Capones, Tumbes Region	03°24'05.30" S–80°18'18.00" W
2	**Manglares de Tumbes**, Punta Norte Isla la Chalaquera, Tumbes Region	03°25'31.80" S–80°16'37.20" W
3	**Manglares de Tumbes**, Banco la Chalaquera, Tumbes Region	03°25'44.00" S–80°16'35.70" W
4	**Manglares de Tumbes**, Boca Canal Zarumilla, Tumbes Region	03°26'07.70" S–80°16'57.00" W
5	**Manglares de Tumbes**, Canal Zarumilla, Tumbes Region	03°26'25.00" S–80°17'21.30" W
6	**Cancas**, Rocas la Chavelera, Tumbes Region	03°55'14.10" S–80°54'29.90" W
7	**Cancas**, Tumbes Region	03°56'31.70" S–80°56'37.60" W
8	**Punta Sal**, Baja Guaraguau, Tumbes Region	03°56'32.00" S–80°56'46.30" W
9	**Punta Sal**, Muelle Cancas, Tumbes Region	03°56'38.10" S–80°56'25.60" W
10	**In front of Punta Sal**, site 1, Tumbes Region	03°56'42.54" S–80°56'44.70" W
11	**In front of Punta Sal**, site 2, Tumbes Region	03°56'42.80" S–80°56'46.80" W
12	**Punta Sal**, Baja de la Antena, Tumbes Region	03°57'00.30" S–80°57'42.90" W
13	**Punta Sal**, Club Punta Sal fondeadero, Tumbes Region	03°57'13.80" S–80°57'28.80" W
14	**Punta Sal**, La Antena, Tumbes Region	03°57'15.60" S–80°57'57.80" W
15	**Punta Sal**, Baja Luperio, Tumbes Region	03°57'30.96" S–80°58'18.54" W
16	**Punta Sal**, Baja de Diego, Tumbes Region	03°57'37.80" S–80°58'22.40" W
17	**Punta Sal**, Resort fondeadero, Tumbes Region	03°58'04,10" S–80°58'09.30" W
18	**Punta Sal**, Baja El Burro, Tumbes Region	03°58'34.10" S–80°59'06.00" W

N	Locality	Geographical position
19	**Punta Sal**, Tumbes Region	03°58'52.90" S–80°59'20.60" W
20	**Punta Sal**, Resort, Tumbes Region	03°59'02.70" S–80°59'11.40" W
21	**Mancora Beach**, "El Point", Piura Region	04°06'21.00" S–81°03'21.00" W
22	**Mancora Pier**, Piura Region	04°06'36.65" S–81°04'02.41" W
23	**El Ñuro**, site 1, El Ñuro Pier, Piura Region	04°13'00.00" S–81°12'50.00" W
24	**El Ñuro**, site 2, "Puerto Rico", Piura Region	04°13'12.90" S–81°11'54.90" W
25	**El Ñuro**, site 3, Piura Region	04°13'20.40" S–81°12'04.70" W
26	**El Ñuro**, site 4, North of Quebrada Verde, Piura Region	04°13'22.30" S–81°12'24.10" W
27	**El Ñuro**, site 5, Baja de Quebrada Verde, Piura Region	04°13'27.40" S–81°12'21.20" W
28	**El Ñuro**, site 6, South of Quebrada Verde, Piura Region	04°13'30.40" S–81°12'31.60" W
29	**El Ñuro**, site 7, South of Quebrada Verde, Piura Region	04°14'01.00" S–81°12'46.00" W
30	**Isla Foca**, site 1, Piura Region	05°11'43.70" S–81°12'57.80" W
31	**Isla Foca**, site 2, "Bajo Norte", Piura Region	05°12'02.80" S–81°12'31.30" W
32	**Isla Foca**, site 3, Piura Region	05°12'06.80" S–81°12'29.70" W
33	**Isla Foca**, site 4, "La Cabrillera", Piura Region	05°12'09.30" S–81°12'39.90" W
34	**Isla Foca**, site 5, "Islilla", Piura Region	05°12'17.43" S–81°12'24.31" W
35	**Bahía de Sechura**, site 1, "Mantacaballo–Chullachi", Parachique, Piura Region	05°33'27.10" S–80°57'15.00" W
36	**Bahía de Sechura**, site 2, "Mantacaballo–Chullachi", Parachique, Piura Region	05°34'22.10" S–80°56'08.80" W
37	**Bahía de Sechura**, site 3, "Mantacaballo–Peña Negra", Parachique, Piura Region	05°36'52.80" S–80°50'28.20" W

N	Locality	Geographical position
38	**Bahía de Sechura**, site 4, Parachique, Piura Region	05°44'24.10" S–80°57'05.60" W
39	**Bahía de Sechura**, site 5, "Puerto Rico", Parachique, Piura Region	05°46'49.50" S–81°04'07.70" W
40	**Bahía de Sechura**, site 6, "Puerto Rico", Parachique, Piura Region	05°46'49.70" S–81°04'04.70" W
41	**Bahía de Sechura**, site 7, Parachique, Piura Region	05°47'35.30" S–80°57'08.70" W
42	**Bahía de Sechura**, site 8, Parachique, Piura Region	05°50'27.30" S–80°57'08.70" W
43	**Isla Lobos de Tierra**, site 1, Piura Region	06°25’02.97" S–80°51’14.15" W
44	**Isla Lobos de Tierra**, site 2, Piura Region	06°24’22.27" S–80°31’44.20" W
45	**Isla Lobos de Tierra**, site 3, Piura Region	06°23’26.77" S–80°51’37.77" W
46	**Islas Lobos de Afuera**, San Cristobal, Lambayeque Region	06°54'52.50" S–80°42'55.90" W
47	**Islas Lobos de Afuera**, Islote Santo Domingo, Lambayeque Region	06°55'09.80" S–80°44'09.40" W
48	**Islas Lobos de Afuera**, El Moño, Lambayeque Region	06°55'11.20" S–80°42'47.10" W
49	**Islas Lobos de Afuera**, Bajo El Chile, Lambayeque Region	06°55'18.00" S–80°43'13.60" W
50	**Islas Lobos de Afuera**, Cristo Salva, Lambayeque Region	06°55'21.70" S–80°42'30.70" W
51	**Islas Lobos de Afuera**, Caleta San José, Lambayeque Region	06°55'48.50" S–80°43'16.20" W
52	**Islas Lobos de Afuera**, Bahía Independencia, Lambayeque Region	06°55'53.20" S–80°43'26.50" W
53	**Islas Lobos de Afuera**, Bahía Ladron, Lambayeque Region	06°56'00.59" S–80°42'58.70" W
54	**Islas Lobos de Afuera**, Islote El Lagarto, Lambayeque Region	06º56'01.20" S–80°42'19.90" W

N	Locality	Geographical position
55	**Islas Lobos de Afuera**, El Callejón, Lambayeque Region	06°56'02.30" S–80°43'08.00" W
56	**Islas Lobos de Afuera**, Callejón Lagartos, Lambayeque Region	06°56'12.90" S–80°42'18.40" W
57	**Isla Macabí**, La Libertad Region	07'48'31.70" S–79°29'50.60" W
58	**Islas Guañape North**, Trujillo, La Libertad Region	08°31'46.10" S–78°57'51.70" W
59	**Islas Guañape South**, La Libertad Region	08°33'34.50" S–78°57'50.30" W
60	**Isla Blanca**, Ancash Region	09°06'07.30" S–78°36'46.80" W
61	**Islas Ferrol**, Ancash Region	09°09'15.46" S–78°37'00.66" W
62	**Bahía de Samanco**, Caleta Colorada, Chimbote, Ancash Region	09°11'10,80" S–78°23'21,00" W
63	**Bahía de Samanco**, North of Caleta Colorada, Chimbote, Ancash Region	09°11'40.80" S–78°32'21.00" W
64	**Bahía de Samanco**, Punta Zamora, Chimbote, Ancash Region	09°12'58.10" S–78°33'09.90" W
65	**Bahía Tortuga**, Casma, Ancash Region	09°22'02.50" S–78°25'31.00" W
66	**Bahía Tortuga**, Casma, Ancash Region	09°22'37.62" S–78°26'20.22" W
67	**Isla Don Martin**, Lima Region	11°01'10.70" S–77°40'13.50" W
68	**Isla San Lorenzo**, site 1, Lima Province	12°03'52.19" S–77°14'20.06" W
69	**Isla San Lorenzo**, site 2, Lima Province	12°04'01.44" S–77°13'44.95" W
70	**Isla San Lorenzo**, site 3, Lima Province	12°04'04.76" S–77°15'10.43" W
71	**Pucusana**, Islote Chicla, Lima Province	12°28'19.10" S–76°47'54.10" W
72	**Pucusana**, Grano de Oro, site 1, Lima Province	12°29'19.30" S–76°47'53.50" W
73	**Pucusana**, Grano de Oro, site 2, Lima Province	12°29'20.10" S–76°47'58.10" W
74	**Isla Asia**, Cañete, Lima Province	12°46'57" S–76°37'12" W

N	Locality	Geographical position
75	**Isla San Gallan**, site 1, Paracas, Ica Region	13°50'19.20" S–76°28'05.51" W
76	**Isla San Gallan**, site 2, Paracas, Ica Region	13°49'06.84" S–76°27'19.88" W
77	**Paracas**, Candelabro, Ica Region	13°49'38.71" S–76°18'07.41" W
78	**Paracas**, Lagunilla, Ica Region	13°53'44.68" S–76°18'55.23" W
79	**Paracas**, Roquedal, Laguna Grande, Ica Region	14°09'11.80" S–76°15'01.30" W
80	**Paracas**, Bocana, Laguna Grande, Ica Region	14°09'31.10" S–76°14'55.90" W
81	**Paracas**, Isla Vieja, Bahía Independencia, Ica Region	14°17'23.10" S–76°10'28.40" W
82	**Paracas**, Isla Santa Rosa, site 1, Ica Region	14°19'10.20" S–76°09'52.40" W
83	**Paracas**, Isla Santa Rosa, site 2, Ica Region	14°19'11.30" S–76°09'30.10" W
84	**San Juan de Marcona**, Caleta El Marmol, Ica Region	15°21'17.70" S–75°11'00.30" W
85	**San Juan de Marcona**, La Baja, Ica Region	15°22'11.70" S–75°12'19.10" W
86	**San Juan de Marcona**, Punta San Juan, Ica Region	15°22'03.23" S–75°11'18.41" W
87	**San Juan de Marcona**, Islota El Avion, Ica Region	15°23'26.02" S–75°10'45.02" W
88	**San Juan de Marcona**, Las Tres Hermanas, Ica Region	15°26'32.40" S–75º04'14.70" W
89	**Quilca**, Caleta north of Quilca, Ica Region	16°42'06.10" S–72°26'54.00" W
90	**Quilca**, Islota Farallon, Ica Region	16°44'22.30" S–72°25'11.50" W
91	**Matarani**, Caleta Ancupita, Arequipa Region	16°50'13.30" S–72°17'28.30" W
92	**Matarani**, Punta Hornillos, Arequipa Region	16°52'49.90" S–72°17'18.39" W
93	**Matarani**, Isla Blanca, Arequipa Region	17°00'31.50" S–72°07'19.90" W

N	Locality	Geographical position
94	**Mollendo**, Playa Catarindo, Tacna Region	17°01'08.93" S–72°02'03.25" W
95	**Ilo**, Playa Hotel de Turistas, Moquega Region	17°38'11.63" S–71°20'28.99" W
96	**Ilo**, Muelle ENAPU, Moquegua Region	17°38'43.40" S–71°29'04.60" W
97	**Ilo**, Mocho Tres Hermanos, Moquegua Region	17°39'13.40" S–71°21'33.10" W
98	**Ilo**, Puerto Ingles, Moquegua Region	17°39'50.03" S–71°21'30.00" W
99	**Ilo**, Punta Coles, site 1, Moquegua Region	17°42'00.00" S–71°22'51.02" W
100	**Ilo**, Punta Coles, site 2**,** Moquegua Region	17°42'18.74" S–71°22'40.64" W
101	**Lago Junin** (**Lago Chinchaycocha**), Junin Region	11º02'56.02" S–76º08'18.08" W
102	**Lago Titicaca**, Isla Suasi, "La Ventana", Puno Region	15°27'00.68" S–69°28'08.68" W
103	**Lago Titicaca**, Isla Suasi, Takillani, Puno Region	15º27'19.57" S–69°28'55.66" W
104	**Lago Titicaca**, Isla Suasi, Muelle, Puno Region	15°27'09.75" S–69°28'39.19" W
105	**Lago Titicaca**, Sucuni, Puno Region	15°29'22.16" S–69°23'02.12" W
106	**Lago Titicaca**, Ccotos, Puno Region	15°38'41.76" S–69°46'45.43" W
107	**Lago Titicaca**, Isla Taquile, Muelle, Puno Region	15°45'04.10" S–69°91'12.20" W
108	**Lago Titicaca**, Isla Taquile, Puno Region	15°46'39.66" S–69°41'09.81" W
109	**Lago Umayo**, Sillustani, Puno Region	15°44'04.20" S–70°09'11.82" W

6. Species descriptions

Order Clathrinida

Arthuria spirallata

Arturia spirallata Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015

REFERENCES: Klautau, Azevedo, Cóndor-Luján *et al*., 2013; Azevedo, Cóndor-Luján, Willenz *et al*., 2015; Azevedo, Padua, Moraes *et al*., 2017; Cóndor-Luján, Louzada, Hajdu *et al*., 2018.

Description – Sponge thickly encrusting or massive, 3.0 × 1.5 × 0.8 cm. Massive forms frequently spherical. Consistency compressible. Cormus formed by irregular and frequently tightly anastomosed tubes, 0.5−1.0 mm. Water–collecting tubes present, some specimens with a single osculum. Granular cells not observed. Aquiferous system asconoid. Colour in life opaque white or translucent light beige and beige in ethanol.

Skeleton – Without any special organization, composed of three size categories of triactines and one size category of tetractines. Tetractines are very rare.

Spicules – Triactines I. Large, regular, equiangular and equiradiate. Actines conical or slightly conical, with sharp tips, 99–*146*–190 × 16 µm. Found mainly outside the tubes. **Triactines II**. Intermediate, regular, equiangular and equiradiate or sagittal. Actines slightly conical with sharp tips. Size highly variable, 88–*125*–170 × 12 µm. The most frequent type of spicule. **Triactines III**. Small, regular, equiangular and equiradiate. Actines conical with sharp tips. Size highly variable, 29–*60*–94 × 8 µm. **Tetractines**. Very rare. Size highly variable, 63–*117*–159 × 12 µm. Apical actines frequently spiraled, straight forms also occur.

Reproduction – Unknown.

Ecology – Lives in habitats with moderate to high amounts of sediment at 1–13 m depth. Some individuals growing on gastropod shells (*Crepidula* sp.) and others underneath boulders, near polychaete reefs. Specimens found sharing the substrate with bryozoans, lophophorates, and serpulid polychaetes as well as some other calcareous sponges (*Soleneiscus pedicellatus* and *Leucosolenia* sp.). Some polychaetes may occur amongst the tubes of the cormus of some specimens.

Distribution – North and south coasts of Peru (05°–14° S).

Remarks – The genus *Arthuria*, recently proposed (Klautau *et al*. 2013) was rapidly changed for *Arturia* (Azevedo *et al*. 2017). It comprises today eight valid species: *A*. ***africana*** from South Africa, *A*. ***alcatraziensis*** from Brazil, *A*. ***canariensis*** from Gulf of Mexico, Azores, Canary and Madeira Islands, Adriatic Sea and European waters, *A*. ***dubia*** from Australia, *A*. ***hirsuta*** from South Africa, *A*. ***tenuipilosa*** from the Red Sea and Sri Lanka and *A*. ***vansoesti*** from Curaço. *Arturia* ***spirallata*** the only one from Tropical Eastern Pacific, differs from all of these by the presence of three categories of triactines and one of tetractines, which are very rare. The frequent spiral shape of the apical actines is also characteristic.

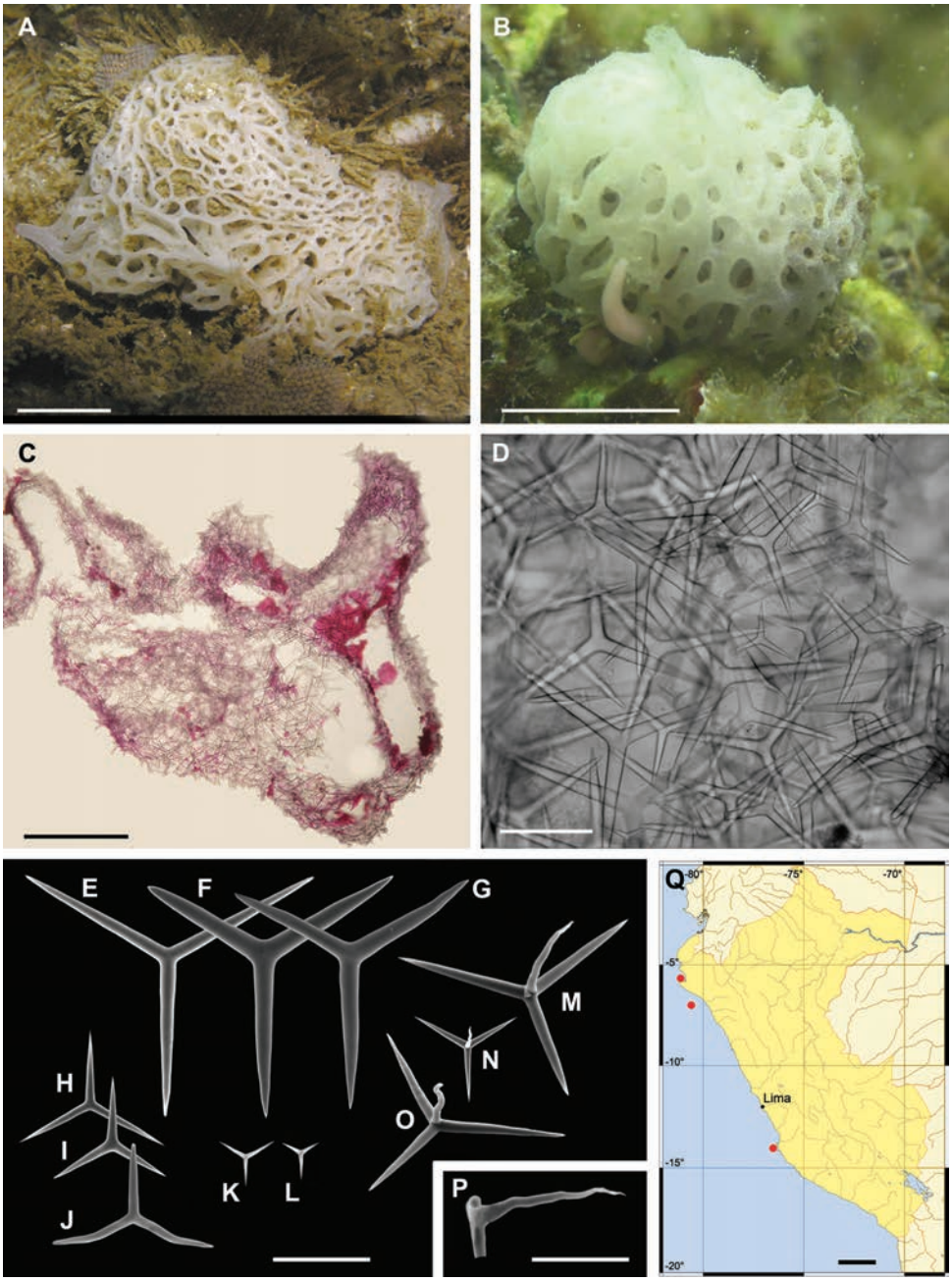


Fig. 31. *Arturia spirallata* Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015. A, holotype; B, paratype; C, cormus anastomosis in cross section; D, spicules in the wall of a tube (tangential section); E–G, triactines I; H–J, triactines II; K–L, triactines III; M–O, tetractines; P, apical actine of tetractine; Q, distribution map. Scale bars: A, 1 cm; B, 0.5 cm; C, 500 µm; D, 100 µm; E–O, 100 µm; P, 50 µm; Q, 200 km.

Clathrina antofagastensis Azevedo, Hajdu, Willenz & Klautau, 2009

REFERENCE: Azevedo, Hajdu, Willenz *et al*., 2009.

Description – Sponge varying from thin to thickly encrusting or massive, 1.5 × 1.0 × 0.2 cm. Consistency is compressible. Cormus is formed by irregular and tightly anastomosed tubes, 0.3−0.5 mm. Water collecting tubes are present. Granular cells were not observed. Aquiferous system is asconoid. Colour in life is white and beige in ethanol.

Skeleton – Without any special organization and composed of two size categories of triactines.

Spicules – Triactines I. Large, regular, equiangular and equiradiate. Actines conical, straight, or slightly undulated with blunt tips, 60–*78*–100 × 8 µm.

Triactines II. Small, regular, equiangular and equiradiate. Actines conical, straight, with blunt or sharp tips, 33–*40*–50 × 6 µm.

Reproduction – Several oocytes were observed inside tubes of a specimen in September 2007 and asexual buds were observed at the surface of another specimen in December 2008.

Ecology – Lives in habitats with moderate to high amounts of sediment, predominantly underneath boulders, protected from sunlight. Known bathymetric distribution extends from the intertidal to 10 m depth.

Distribution – From Bahía Sechura (05°46' S – Piura Region); North of Caleta Colorada, Chimbote and Punta Zamora, Bahía Samanco (09°11' S and 09°12' S – Ancash Region); Isla San Lorenzo, Callao (12°04' S – Callao Region); Isla Chicla, Pucusana (12°28' S – Lima Region); Lagunillas, Paracas (13°53' S – Ica Region); Isla Vieja and Isla Santa Rosa, Bahía Independencia, Paracas (14°17' S and 14°19' S – Ica Region) and Las Tres Hermanas, San Juan de Marcona (15°26' S – Ica Region). Originally from Peninsula Mejillones, Antofagasta, north coast of Chile (23° S).

Remarks – *Clathrina antofagastensis* was originally described from and considered endemic to the north coast of Chile (Azevedo *et al*. 2009). It was first recorded from the Peruvian coast by Azevedo *et al*. (2015). *Clathrina antofagastensis* is the Calcarea with the largest geographical extension in Peru.

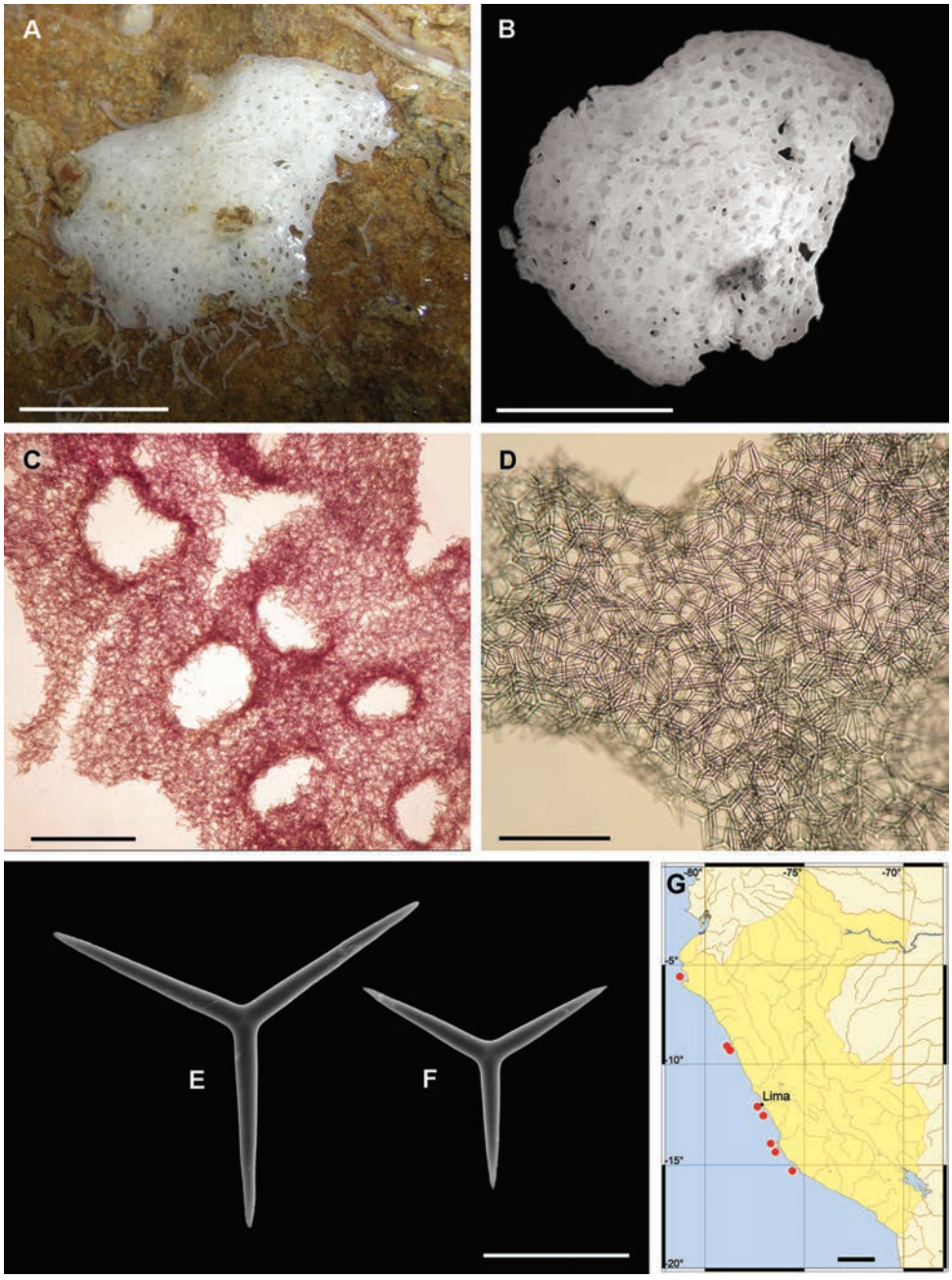


Fig. 32. *Clathrina antofagastensis* Azevedo, Hajdu, Willenz & Klautau, 2009. A, live specimen; B, specimen in ethanol; C, cormus anastomosis in cross section; D, spicules in the wall of a tube in tangential section; E, triactine I; F, triactine II; G, distribution map. Scale bars: A–B, 1 cm; C, 500 µm; D, 200 µm; E–F, 50 µm; G, 200 km.

Clathrina aphrodita Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015

REFERENCES: Azevedo, Cóndor-Luján, Willenz *et al*., 2015; Klautau, Azevedo, Cóndor-Luján *et al*., 2013.

Description – Massive sponge with subspherical shape, 2.5 × 2.0 × 1.0 cm. Consistency is friable and compressive. Cormus formed by irregular and frequently tightly anastomosed tubes, 0.2−0.5 mm, although loosely anastomosed tubes were also observed in a few specimens. Several conspicuous oscula present at the surface. Water-collecting tubes and granular cells not observed. Aquiferous system asconoid. Colour in life translucent beige or light pink in reproducing specimen and dirty beige or grey in ethanol.

Skeleton – Without any special organization and composed of regular and subregular triactines.

Spicules – Triactines. Regular, equiangular and equiradiate or subregular, equiangular with two or three actines of different sizes. **Actines** conical or slightly conical, and straight with blunt tips, 60–*91*–100 × 10 µm.

Reproduction – One specimen, with a pink colour, filled with oocytes individually packed inside hexagonal follicles was collected in November 2009. Two other specimens, collected at the same period of that year were white in colour, with abundant spherical buds at the surface of the external tubes. This asexual reproduction by budding is exceptional in Calcinea and begins with the constriction of tubes localized at the surface of the sponge.

Ecology – Lives in habitats with moderate amounts of sediment. Some individuals were found under boulders protected from sunlight, whereas others, encrusting the substrate, were exposed to light. Known bathymetric distribution extends from 1 to 19 m depth.

Distribution – North coast of Peru, from Cancas (Tumbes Region – 03°55' S) to El Ñuro (Piura Region – 04°13' S).

Remarks – The genus *Clathrina* comprises 31 valid species. Amongst these, *C*. ***cribrata*** from Norway is the one that most resembles *C*. *aphrodita*, in the presence of numerous and conspicuous oscula at its surface. However, the oscula of *C*. *cribrata* have a sieve, which is not found in *C*. *aphrodita*. In addition, the skeleton of *C*. *cribrata* is exclusively composed of regular triactines, whereas *C*. *aphrodita* has conspicuous and abundant subregular triactines, which have two or three actines of different lengths.

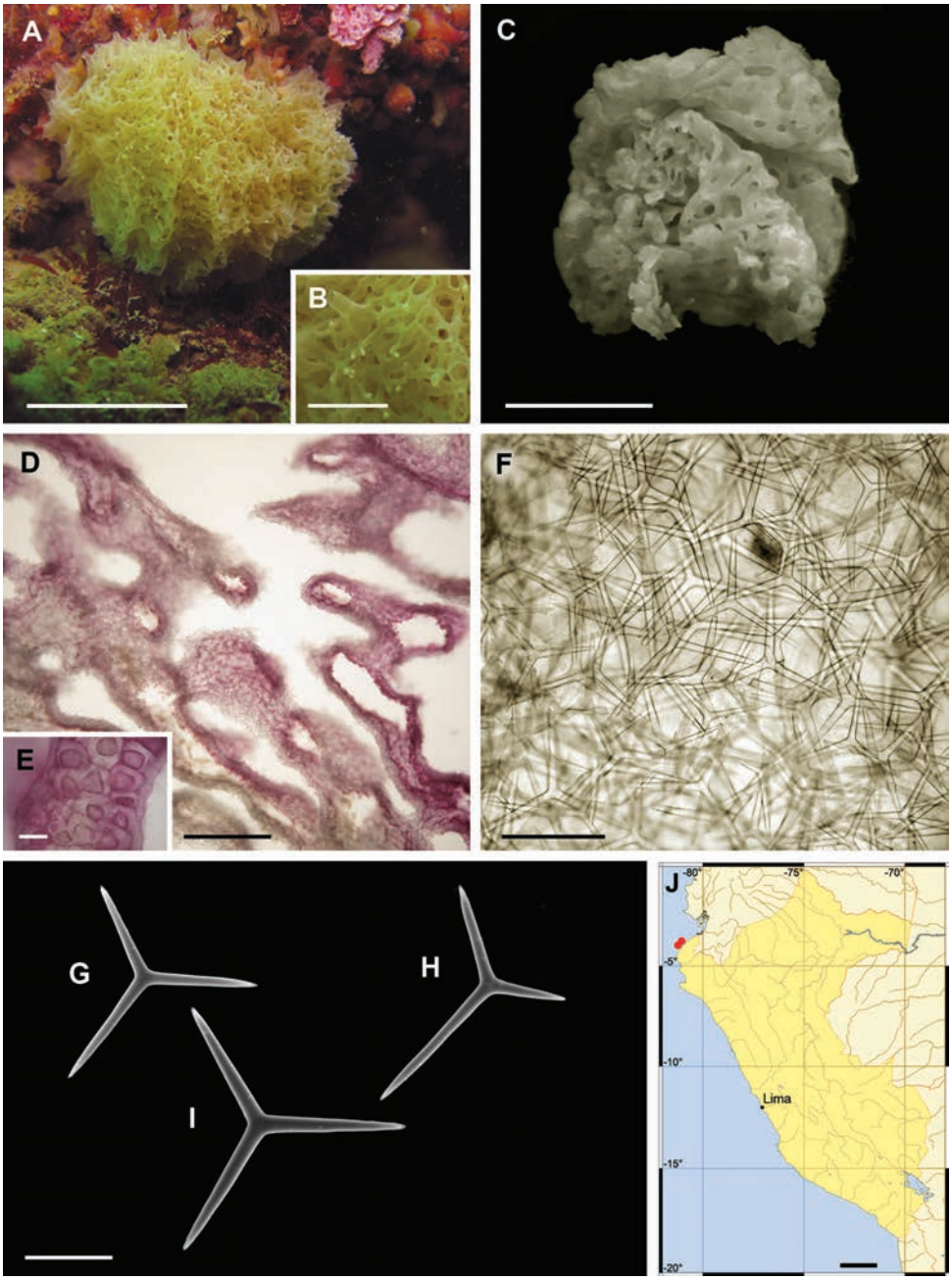


Fig. 33. *Clathrina aphrodita* Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015. A, live specimen; B, detail of spherical buds at the sponge surface; C, specimen in ethanol; D, cormus anastomosis in cross section; E, detail of oocytes inside hexagonal follicles in the cormus; F, spicules in the wall of a tube in tangential section; G–H subregular, slightly conical, triactines; I, regular, conical, triactine; J, distribution map. Scale bars: A, 2 cm; B–C, 0.5 cm; D, 500 µm; E, 100 µm; F, 200 µm; G–I, 50 µm; J, 200 km.

Clathrina aurea Solé-Cava, Klautau, Boury-Esnault, Borojevic & Thorpe, 1991

REFERENCES: Solé-Cava, Klautau, Boury-Esnault *et al*., 1991; Cóndor-Luján, Leocorny, Padua *et al*., 2021.

Description – Very small thinly encrusting sponge, 1.3 × 1.0 × 0.2 cm. Consistency soft and fragile. Cormus formed by irregular, very thin, and loosely anastomosed tubes, 0.1–0.4 mm. Water-collecting tubes absent and oscula abundantly spread throughout the cormus. Granular cells not observed. Aquiferous system asconoid. Colour in life bright yellow and white in ethanol.

Skeleton – Without any special organization and exclusively composed of triactines.

Spicules – Triactines. Regular, equiangular and equiradiate. Actines are cylindrical to slightly conical, and undulated with rounded to blunt tips, 53–*73*–95 × 6 µm.

Reproduction – Unknown.

Ecology – Lives in cryptic habitats, such as underneath boulders, with low to moderate amounts of sediment. Low diversity of fauna was found near this species, restricted to a red ascidian, some incrusting demosponges (Chalinidae), and the calcareous sponges *Clathrina peruana* and *Grantia* sp. Known bathymetric distribution ranges from the intertidal zone to 30 m depth, but in Peru it has been found down to 8 m depth.

Distribution – North-east, south-east, and south coasts of Brazil (04°–27° S), south coast of Peru (14°–15° S) and Eastern Caribbean.

Remarks – *Clathrina aurea* was considered endemic to Brazil before being recorded from the Pacific (Peru) and the Caribbean Sea. The evolutionary history of *C*. *aurea* was recently studied with different methods. Phylogenetic analyses indicated a higher genetic variability in individuals from Brazil and Caribbean, compared to Peru. Phylogeographic analyses indicated that Brazil had the oldest population of *C*. *aurea*, suggesting the expansion of this species under the plume of the Amazon River to the Caribbean and its connectivity through intermediate populations. Population structure analyses also revealed high levels of genetic connectivity between the Caribbean and northeast Brazil and among southeast Brazilian localities. All analyses indicated isolation or restricted gene flow between Pacific and Atlantic populations. This, combined with the reduced genetic diversity in Peru and the supposedly limited larval dispersal capability, suggest a possible non-natural dispersion; however, other hypotheses are not excluded.

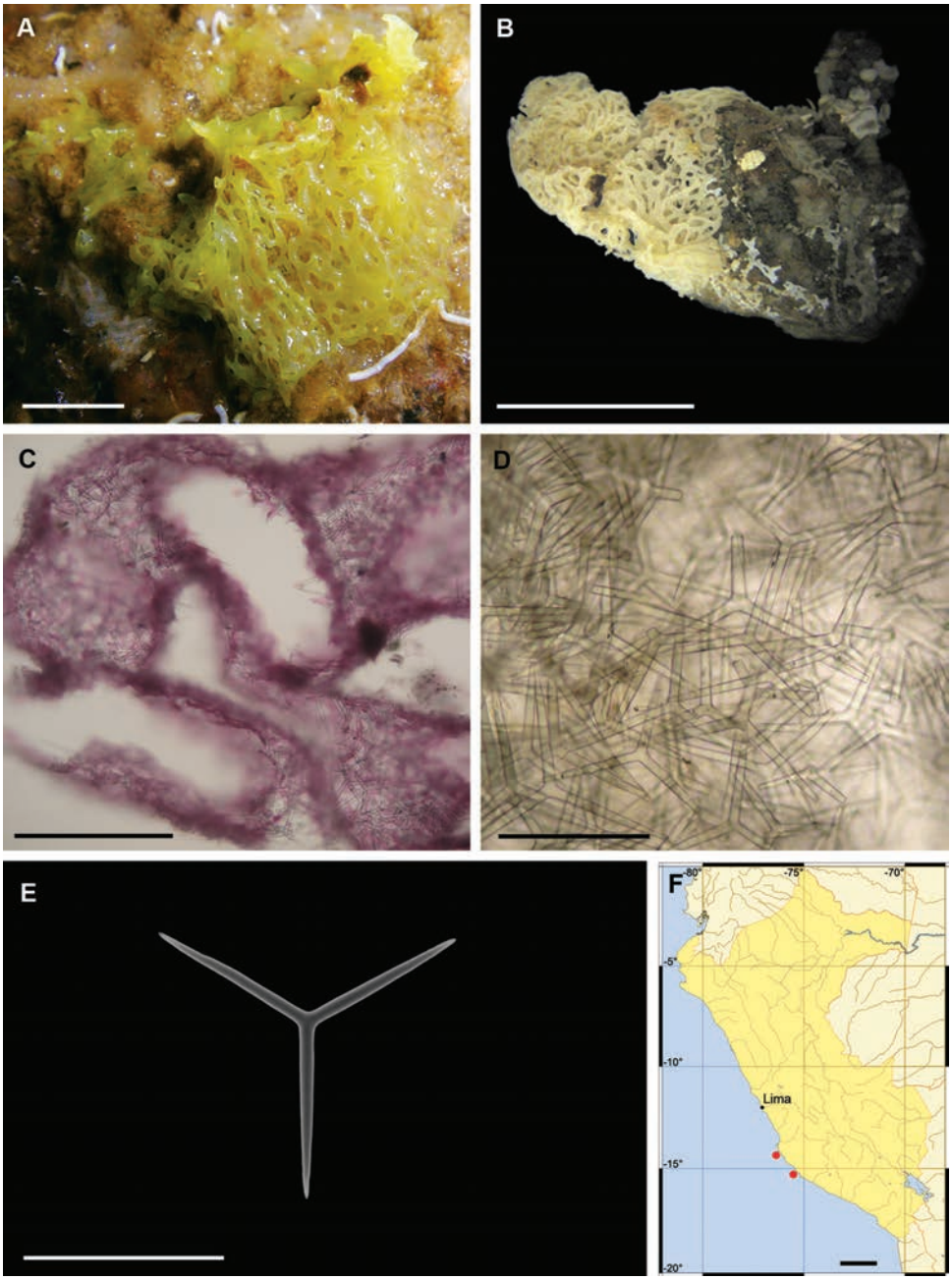


Fig. 34. *Clathrina aurea* Solé-Cava, Klautau, Boury-Esnault, Borojevic & Thorpe, 1991. A, live specimen; B, specimen in ethanol; C, cormus anastomosis in cross section; D, spicules in the wall of a tube in tangential section; E, triactine I; F, distribution map. Scale bars: A–B, 1 cm; C, 500 µm; D–E, 100 µm; F, 200 km.

Clathrina nuroensis Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015

REFERENCE: Azevedo, Cóndor-Luján, Willenz *et al*., 2015.

Description – Sponge thickly encrusting in life (5.0 × 3.0 × 0.3 cm), but completely flattened after ethanol preservation. Consistency is friable. Cormus is formed by irregular and apparently tightly anastomosed tubes (0.2–0.5 mm). Water-collecting tubes are present. Granular cells were not observed. Aquiferous system is asconoid. Colour is white in life and light beige in ethanol.

Skeleton – Without any special organization and composed of three categories of triactines.

Spicules – Triactines I. Regular, equiangular and equiradiate. Variable in size. Actines are slightly conical, straight, with sharp tips, 75–*89*–100 × 8 µm.

Triactines II. Regular, equiangular and equiradiate or sagittal. Actines conical, straight, with sharp tips, 63–*77*–95 × 8 µm. **Triactines III**. Regular, equiangular and equiradiate. Very similar to triactines II, but smaller. Actines conical, straight, with sharp tips, 28–*40*–50 × 7 µm.

Reproduction – Unknown

Ecology – Lives in habitats with high amounts of sediment. Lophophorate, ramified colonial bryozoans, encrusting tunicates, and serpulid polychaetes were found sharing the same substrate. The calcareous sponges *Soleneiscus pedicellatus*, *Leucosolenia* sp., *Sycon* sp., and *Grantia* sp. also occurred near this species. Single specimen found at 5 m depth.

Distribution – El Ñuro Pier (04°13' S – Piura Region).

Remarks – Among all 31 species of *Clathrina*, only one has its skeleton composed of three size categories of triactines like *C*. *nuroensis*: *C*. ***laminoclathrata*** from Australia. However, the average sizes of spicules of *C*. *laminoclathrata*, 188 × 18 µm, 132 × 13 µm, 72 × 8 µm, markedly exceed those of *C*. *nuroensis*, drawing a line between both species. Furthermore, Australia and Peru are too distant to postulate conspecificity.

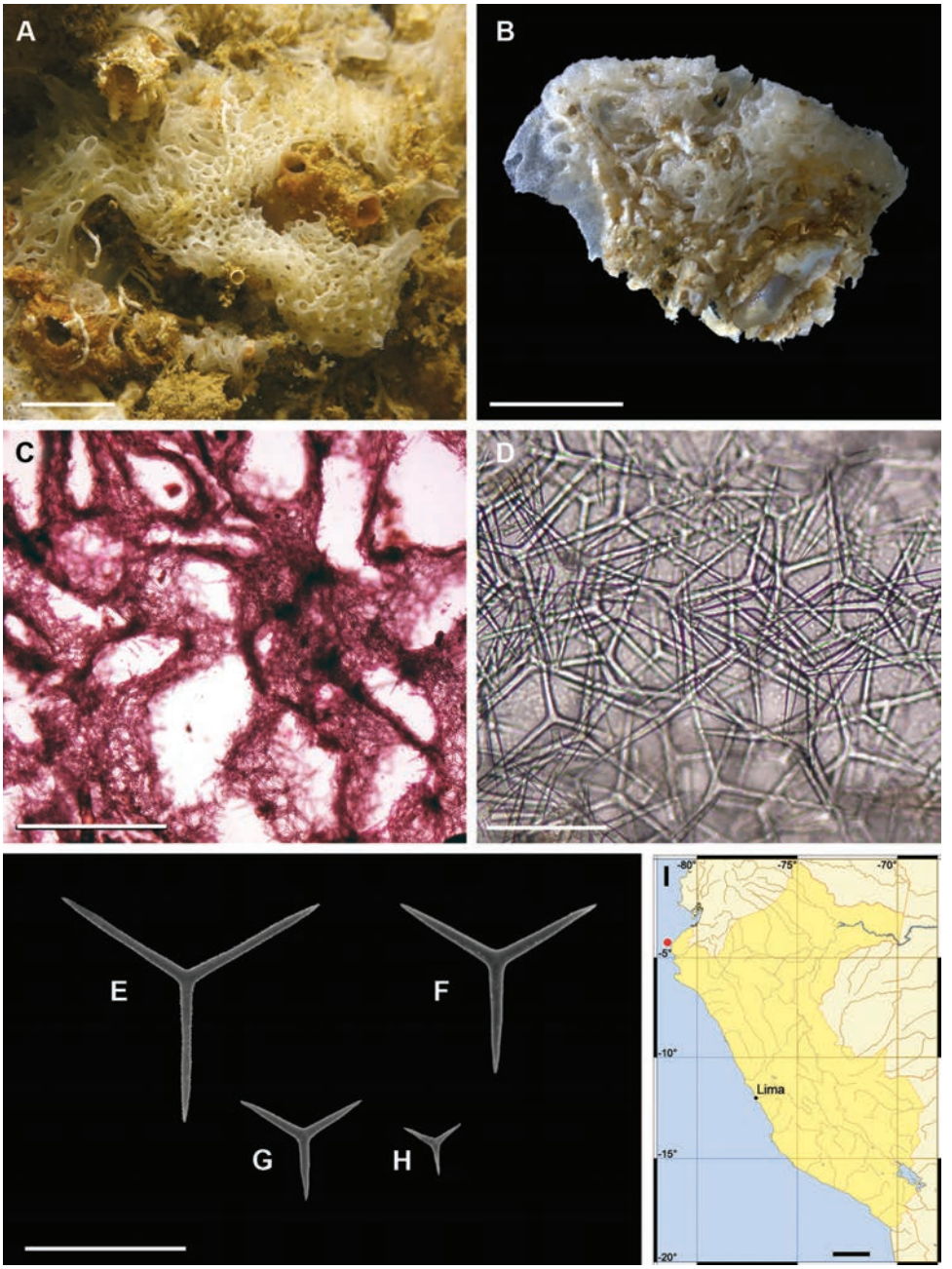


Fig. 35. *Clathrina nuroensis* Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015. A, detail of live specimen; B, specimen in ethanol; C, cormus anastomosis in cross section; D, spicules in the wall of a tube in tangential section; E, triactine I; F, triactine II; G–H, triactines III; I, distribution map. Scale bars: A–B, 0.5 cm; C–H, 100 µm; I, 200 km.

Clathrina peruana Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015

REFERENCE: Azevedo, Cóndor-Luján, Willenz *et al*., 2015.

Description – Encrusting to slightly massive sponge, 1.0 × 0.8 × 0.2 cm. Consistency soft and fragile. Cormus formed by irregular and loosely anastomosed tubes, 0.3−0.7 mm. Water-collecting tubes present. Granular cells abundant. Aquiferous system asconoid. Colour opaque white in life and brown in ethanol.

Skeleton – Without special organization, with a single category of triactines.

Spicules – Triactines. Regular, equiangular and equiradiate. Actines cylindrical, slightly undulated towards the distal part, with sharp or blunt tips, 81–*105*–146 × 8 µm.

Reproduction – Unknown**.**

Ecology – Lives in habitats with low to moderate amounts of sediment. Individuals occurred underneath boulders protected from sunlight. A low diversity of fauna was found near this species: only serpulid polychaetes and demosponges. Some intertidal specimens were always found side by side with *C*. *aurea*. Bathymetrical distribution extends from the intertidal to 8 m depth.

Distribution – From Isla Tortuga (09°22' S – Ancash Region) to San Juan de Marcona (15°26' S – Ica Region).

Remarks – Among all 31 valid species of *Clathrina*, six share white colour, irregular and loosely anastomosed tubes, and only one category of triactine with cylindrical actines: *C*. ***cribrata*** from Norway, *C*. ***cylindractina*** from Brazil, *C*. ***heronensis*** from Australia, *C*. ***hispanica*** from Spain, *C*. ***parva*** and *C*. ***wistariensis*** from Australia. *Clathrina peruana* is easily distinguished from *C*. *cylindractina*, *C*. *cribrata*, and *C*. *hispanica* by the presence of water-collecting tubes and granular cells, which are absent in the three latter species. The three Australian species, *C*. *heronensis*, *C*. *parva*, and *C*. *wistariensis*, similarly to *C*. *peruana* also have granular cells. However, *C*. *heronensis* and *C*. *wistariensis* do not have water-collecting tubes. Although *C*. *parva* shares water collecting tubes and granular cells with *C*. *peruana*, it has consistent differences in the shape and size of the spicules. The actines in *C*. *peruana* are shorter and thinner than in the holotype of *C*. *parva* (143 × 14 µm, 129 × 10 µm. Moreover, *C*. *peruana* has strongly undulated actines near the tips, whereas the undulation is very subtle in *C*. *parva*.

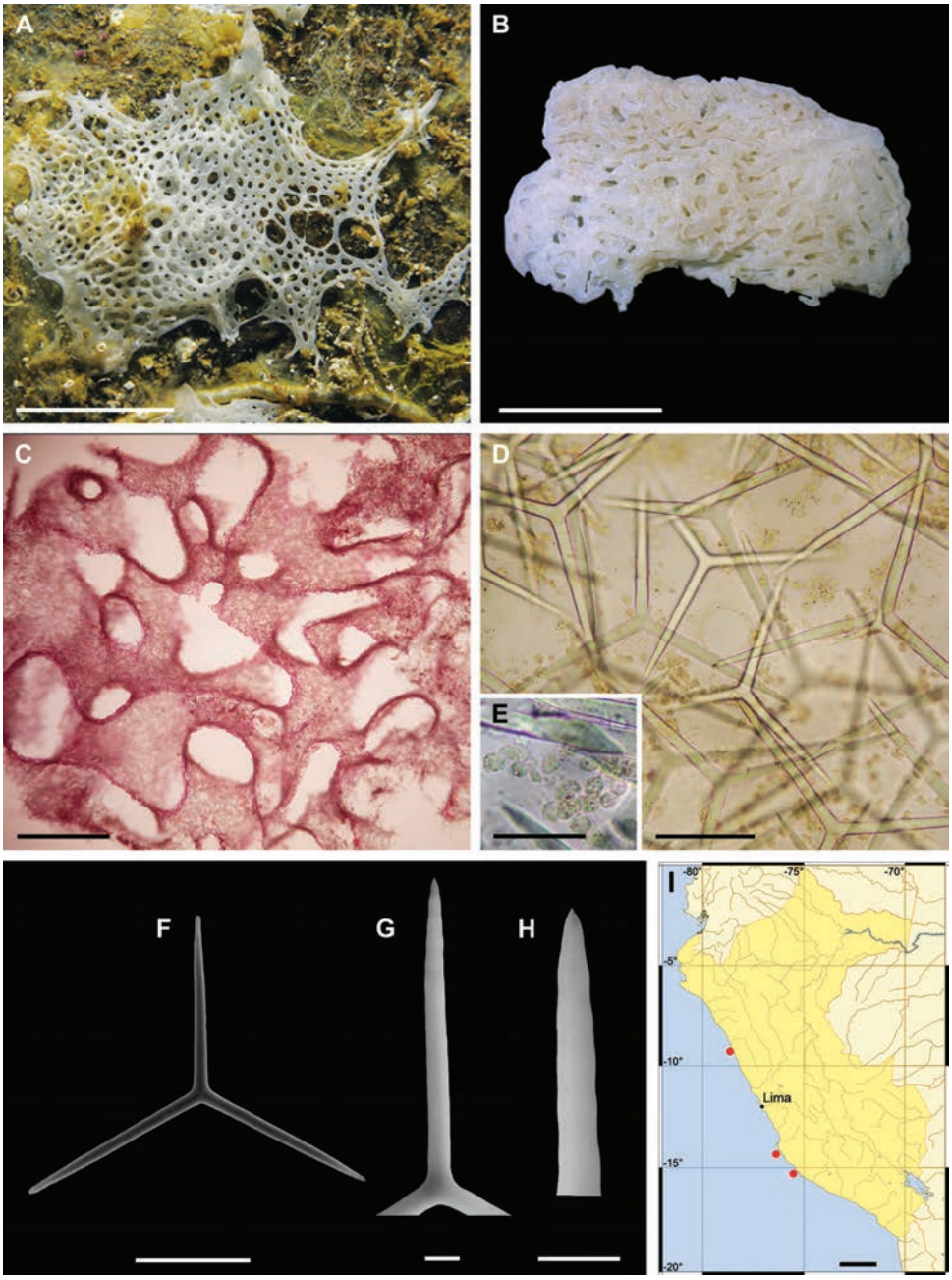


Fig. 36. *Clathrina peruana* Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015. A, live specimen; B, specimen in ethanol; C, cormus anastomosis in cross section; D, spicules in the wall of a tube in tangential section; E, detail of granular cells; F, triactine; G–H, detail of an actine; I, distribution map. Scale bars: A, 1 cm; B, 0.5 cm; C, 500 µm; D, 100 µm; E, 25 µm; F, 50 µm; G–H, 10 µm; I, 200 km.

Ernsta tetractina (Klautau & Borojevic, 2001)

REFERENCES: Klautau & Borojevic, 2001; Klautau, Azevedo & Cóndor-Luján, 2021.

Description – Thinly encrusting sponge, 2.5 × 1.0 × 0.2 cm. Consistency soft and fragile. Cormus formed by irregular and loosely anastomosed tubes, 0.2–0.5 mm. Water-collecting tubes present, 1.5 mm in diameter. Granular cells absent. Aquiferous system asconoid. Colour white in life and light beige in ethanol.

Skeleton – Without any special organization, composed of abundant tetractines and few triactines.

Spicules – Triactines. Regular, equiangular and equiradiate. Actines are conical, straight, with sharp tips, 70–*94*–115 × 8 µm. **Tetractines**. Regular, equiangular and equiradiate. Actines conical, straight, with sharp tips, 65–*94*–110 × 9 µm. Apical actine straight, smooth, very thin, and frequently longer than the basal ones, 29–*79*–130 × 4 µm.

Reproduction – Unknown**.**

Ecology – Lives in habitats with low amounts of sediment. Individuals were found underneath boulders, protected from sunlight. Chitons and serpulid polychaetes as well as a finely incrusting yellow demosponge were found sharing the same substrate; however, these were fairly distant from *E*. *tetractina*. Some sea urchin spines were also found nearby. Bathymetrical distribution varies from 11 to 20 m depth.

Distribution – Islas Lobos de Afuera (06°56' S – Lambayeque Region) and south-eastern coast of Brazil (23° S).

Remarks – The genus *Ernstia*, mistakenly proposed (Klautau *et al*. 2013) was changed for *Ernsta* (Klautau *et al*. 2021). It comprises five species. *Ernsta tetractina* was originally described from and considered endemic to the coast of Brazil, where its distribution is restricted to the south-east coast. Its first report outside Brazil raises the need for a population genetics study.

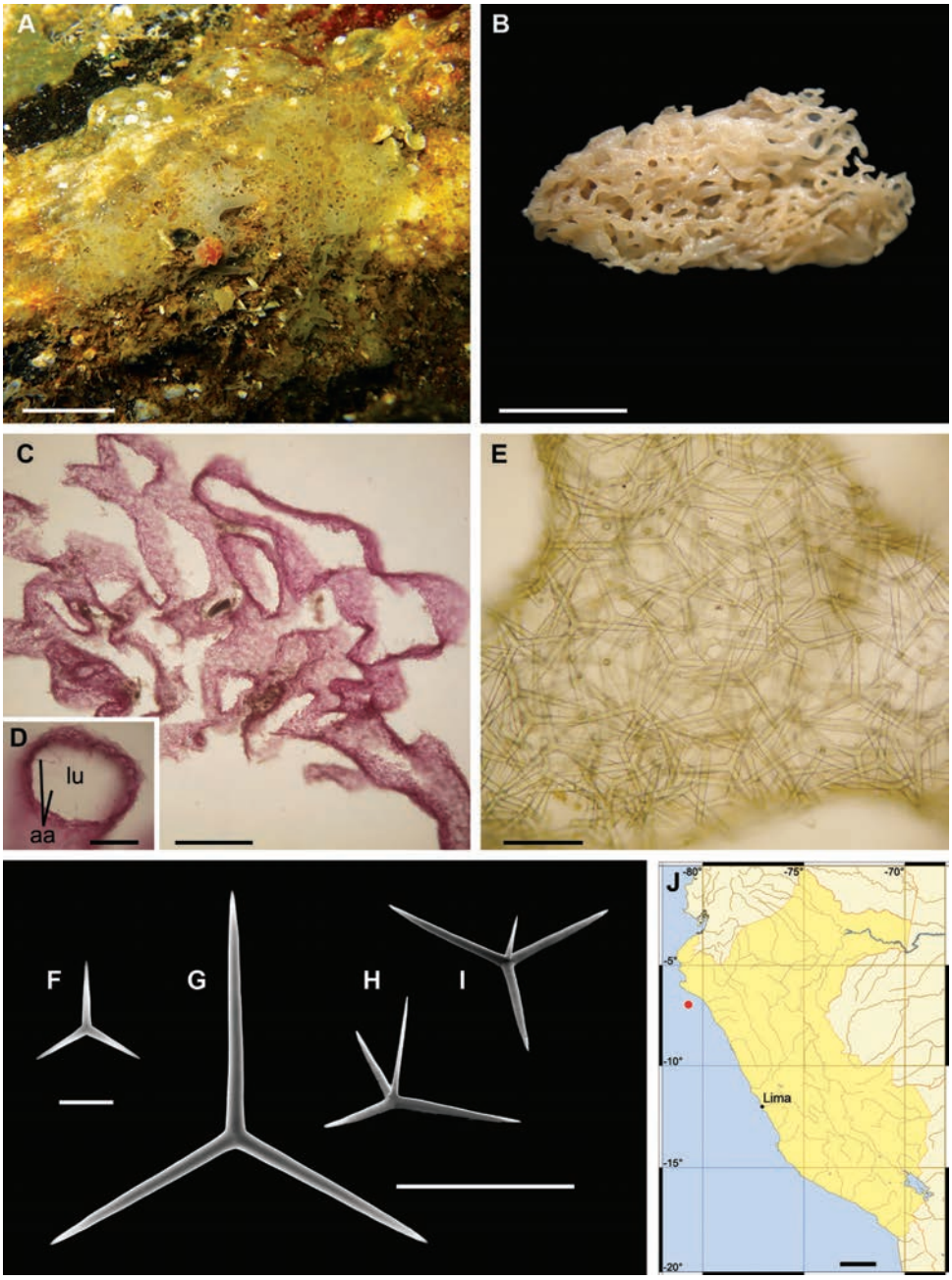


Fig. 37. *Ernsta tetractina* (Klautau & Borojevic, 2001). A, live specimen; B, specimen in ethanol; C, cormus anastomosis in cross section; D, detail of a tube (lu = lumen; aa = apical actines); E, spicules in the wall of a tube in tangential section; F–G, triactines; H–I, tetractines; J, distribution map. Scale bars: A–B, 0.5 cm; C, 500 µm; D, 200 µm; E, 100 µm; F, 30 µm; G–I, 100 µm; J, 200 km.

Soleneiscus pedicellatus Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015

REFERENCE: Azevedo, Cóndor-Luján, Willenz *et al*., 2015.

Description – Small solitary individuals, 0.7 cm high, gathered in abundance and densely covering the substrate in patches reaching 25 cm^2. Consistency fragile. Tubular body very similar to olynthi (juvenile Calcarea), with simple apical osculum, without ornamentation and stalk, 1.0 mm attached to substrate. Some individuals bud from the stalk of others, but there is no anastomosis between adults. Granular cells not observed. Aquiferous system asconoid. Colour white in life as well as in ethanol.

Skeleton – Composed of only parasagittal triactines. The unpaired actine always basipetally directed.

Spicules – Triactines. Parasagittal. Actines slightly conical, straight, with tips varying from blunt to sharp and possibly different lengths. The unpaired actine, 62–*81*–109 × 3 µm, basipetally orientated, always longer and frequently thicker than the paired ones, 34–*43*–70 × 3 µm.

Reproduction – Unknown.

Ecology – Lives in habitats with moderate to high amounts of sediment. Individuals were found underneath boulders, covering a gastropod shell (*Crepidula*) and a calcareous alga (coralline algae). Bryozoans, serpulid polychaetes, encrusting demosponges (Chalinidae) and calcareous sponges (*A*. *spirallata* and *Leucosolenia* sp.) were found close to this species. *Leucosolenia* sp. grows attached to *S*. *pedicellatus*. Bathymetrical distribution extends from 7 to 12 m depth.

Distribution – Only known today from Islas Lobos de Afuera (06°56' S – Lambayeque Region).

Remarks: Among the nine species of the genus *Soleneiscus*, *S*. *pedicellatus* is the single one with only triactines.

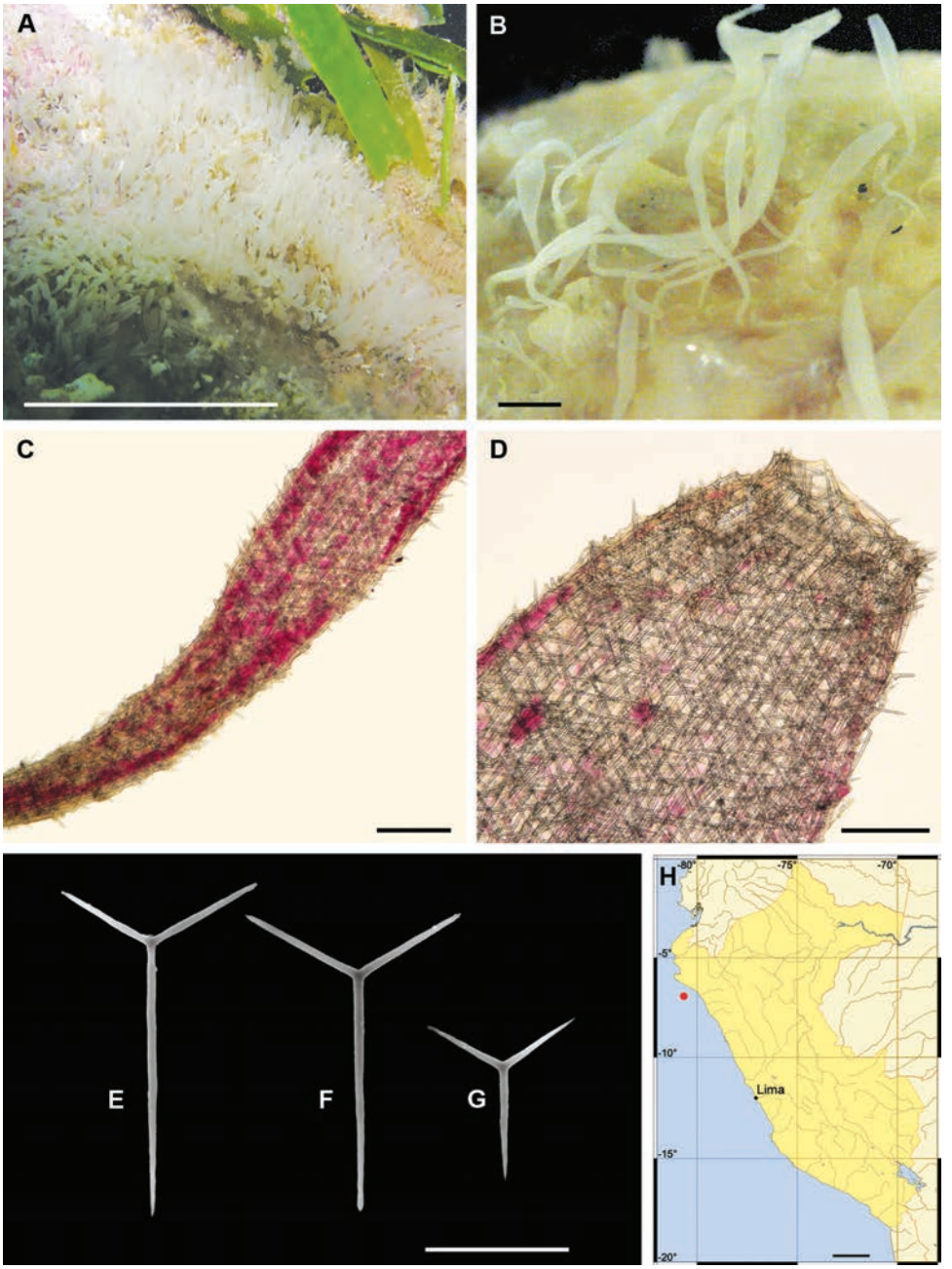


Fig. 38. *Soleneiscus pedicellatus* Azevedo, Cóndor-Luján, Willenz, Hajdu, Hooker & Klautau, 2015. A, live specimen; B, specimen in ethanol; C, basal and median regions of tubular body in cross section; D, detail of apical region of tubular body in cross section; E–F, parasagittal triactines; G, subregular triactine; H, distribution map. Scale bars: A, 2 cm; B, 1 mm; C–D, 100 µm; E–G, 50 µm; H, 200 km.

Order Leucosolenida

Leucandra losangelensis

Leucosolenia cf. *variabilis* (Haeckel, 1870)

REFERENCES: Haeckel, 1872; Burton, 1963; Azevedo, Hajdu, Willenz *et al*., 2009; Condór-Luján, 2011.

Description – Specimens of small size (largest is 3 × 1.5 × 0.2 cm). Long ramified asconoid tubes connected by a stolon. Apical osculum without crown at the end of each tube. Surface relatively soft. Consistency brittle. Colour in life greyish white.

Skeleton – Composed of diactines, triactines and tetractines tangential to the surface. Apical actine of the tetractines projected inside the lumen.

Spicules – Diactines. Curved and straight, with sharp tips. One of the tips is lance-shaped and the other one is slightly bent, 78–*208*–425 µm. **Triactines.** Generally sagittal. Actines are slightly conical, straight to curved, with sharp tips. Unpaired actines a little longer than paired ones. Parasagittal triactines also found. Paired actines, 57–*93*–112 µm. Unpaired actines, 55–*103*–138 µm. **Tetractines.** Mainly sagittal. Unpaired actines a little longer than paired ones. Apical actines much shorter than basal ones and sometimes, curved. Parasagittal tetractines also found. Paired actines, 75–*103*–130 µm. Unpaired actines, 62–*106*–138 µm. Apical actines slightly conical, straight to curved with sharp tips, 39–*50*–75 µm.

Reproduction – Unknown

Ecology – Found associated with bryozoans and other calcareous sponges on vertical substrates. Depth 15 m.

Distribution – Only found in Cancas and Punta Sal (03°56'S and 03°59'S – Tumbes Region).

Remarks – Similarities in spicule shape found between *L*. *variabilis* (*sensu* Burton 1963) and the Peruvian specimens suggest their conspecificity. However, differences in spicule dimensions were found. Compared to *L*. *variabilis*, the actines of the triactines and tetractines of the Peruvian specimens are narrower and the length of the diactines only corresponds to one of the categories observed by Burton. These differences may be attributed to geographical variation since the spicule dimensions of *L*. *variabilis* correspond to specimens from Norway. On the other hand, it has been suggested that this proposed cosmopolitan species (*L*. *variabilis*) would eventually constitute a complex of sibling species (Azevedo *et al*. 2009). Based on the similarities found, the Peruvian specimens would constitute one of the species of the *Leucosolenia* "*variabilis"* complex.

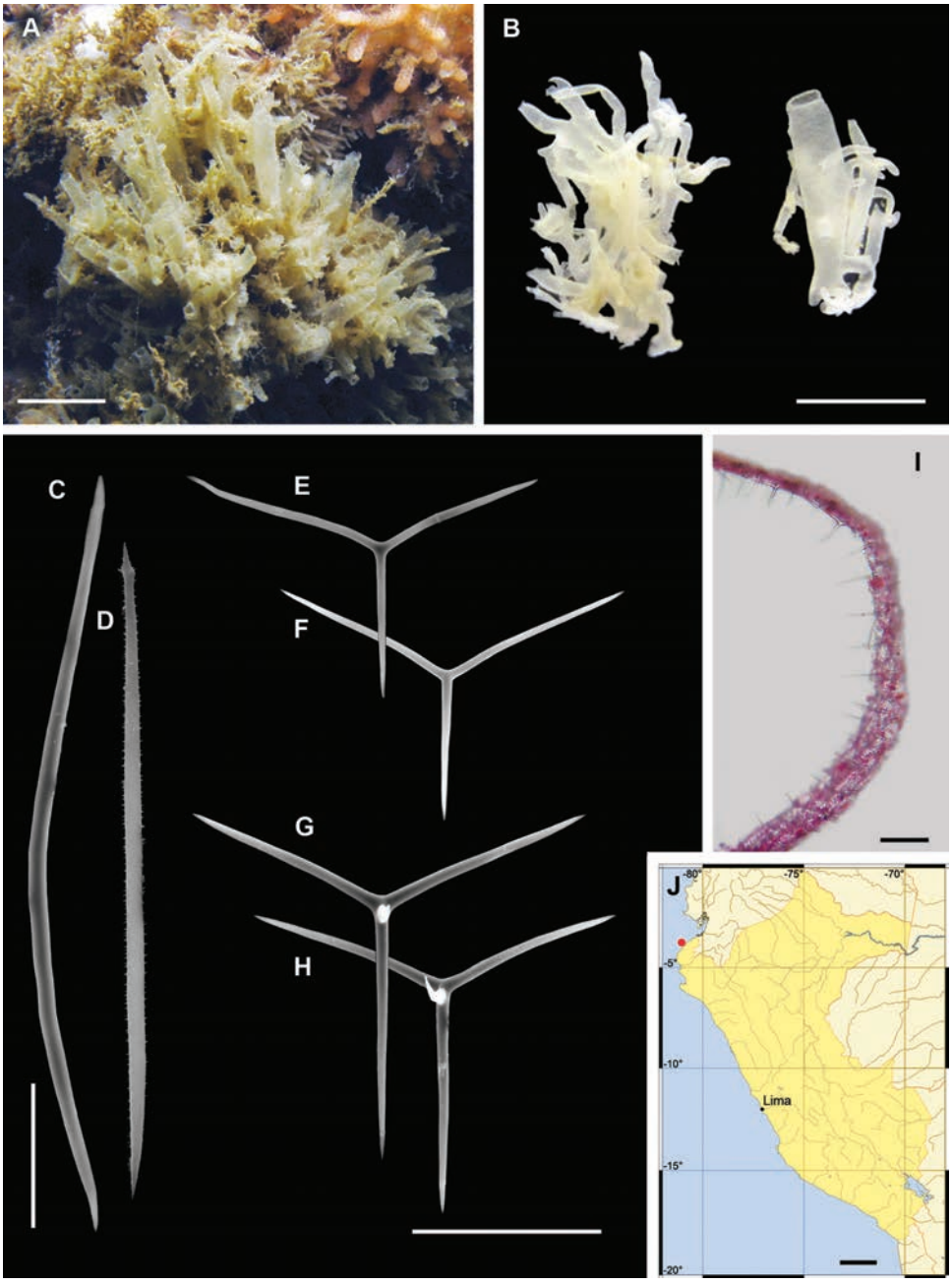


Fig. 39. *Leucosolenia* cf. *variabilis* (Haeckel, 1870). A, live specimen; B, preserved fragment; C, diactine; D, microdiactine; E–F, triactines; G–H, tetractines; I, transversal section with apical actine of the tetractines penetrating into the lumen; J, distribution map. Scale bars: A, 1 cm; B, 0.5 cm; C–D, 40 µm; E–H, 100 µm; I, 50 µm; J, 200 km.

Grantia sp. 1

REFERENCES: Fleming, 1828; Lambe, 1893; Hôzawa, 1940; Borojevic, Boury-Esnault & Vacelet, 2000.

Description – Grantiidae with syconoid organization. Specimens solitary cylindrical or bushy with terminal cylindrical oscules. Surface shaggy. Osculum surrounded by a thin crown of trichoxeas. Colour white in life and beige in ethanol.

Skeleton – Cortex composed of tangential triactines with crossing diactines protruding from the external surface and trichoxeas invading a large part of the choanosome region, with one of the ends projecting distally, making the external surface very hispid in its two thirds towards the base. Tubar skeleton comprises triactines of variable width. Subatrial skeleton with triactines having paired actines straight or curved. Atrial skeleton with triactines and tetractines.

Spicules – Diactines I. Large and thick, 315–*506*–687 × 30 µm. **Diactines II**. Small, fusiform, 151–*203*–286 × 9 µm. **Trichoxeas**. Thin and straight, 156–*199*–299 × 3 µm. **Cortical triactines.** Paired actines, 62–*86*–151 × 8 µm. Unpaired actines, 36–*57*–86 × 9 µm. **Tubar triactines.** Paired actines, 57–*84*–96 × 8 µm. Unpaired actines, 65–*84*–104 × 9 µm. **Subatrial triactines.** Paired actines, 52–*69*–83 × 7 µm. Unpaired actines, 73–*101*–130 × 7 µm. **Atrial triactines.** Paired actines, 34–*47*–73 × 7 µm. Unpaired actines, 138–*171*–195 × 7 µm. **Atrial tetractines.** Paired actines, 86–*98*–109 × 8 µm. Unpaired actines, 143–*183*–218 × 8 µm. Apical actines, 26–*36*–42 × 8 µm.

Reproduction – Unknown.

Ecology – Lives among bryozoan in area with abundant thin sediment and algae. Bathymetric distribution extends from the intertidal zone to 10 m depth.

Distribution – From Punta Sal (03°59' S – Tumbes Region) to Paracas (13°54' S – Ica Region).

Remarks – From the 39 valid species of the genus *Grantia*, only two species were previously reported for the Eastern Pacific: *Grantia* ***comoxensis*** and *Grantia* ***mexico***, but they differ from *Grantia* sp. 1 in the spicule composition and their sizes. However, among the other 37 remaining species, six share the same skeletal composition with *Grantia* sp. 1. They are: *G*. ***capillosa***, *G*. ***compressa***, *G*. ***extusarticulata***, *G*. ***foliacea***, *G*. ***nipponica*** and *G*. ***vosmaeri***. The external morphology of *G*. *foliacea*, which is foliaceus, differentiates it from *Grantia* sp. 1, which possesses solitary cylindrical or branched growth form. Finally, the spicular sizes of the other five species differ considerably from *Grantia* sp. 1. Also, the particular shape of the diactines described for *G*. *compressa* were not found in *Grantia* sp. 1.

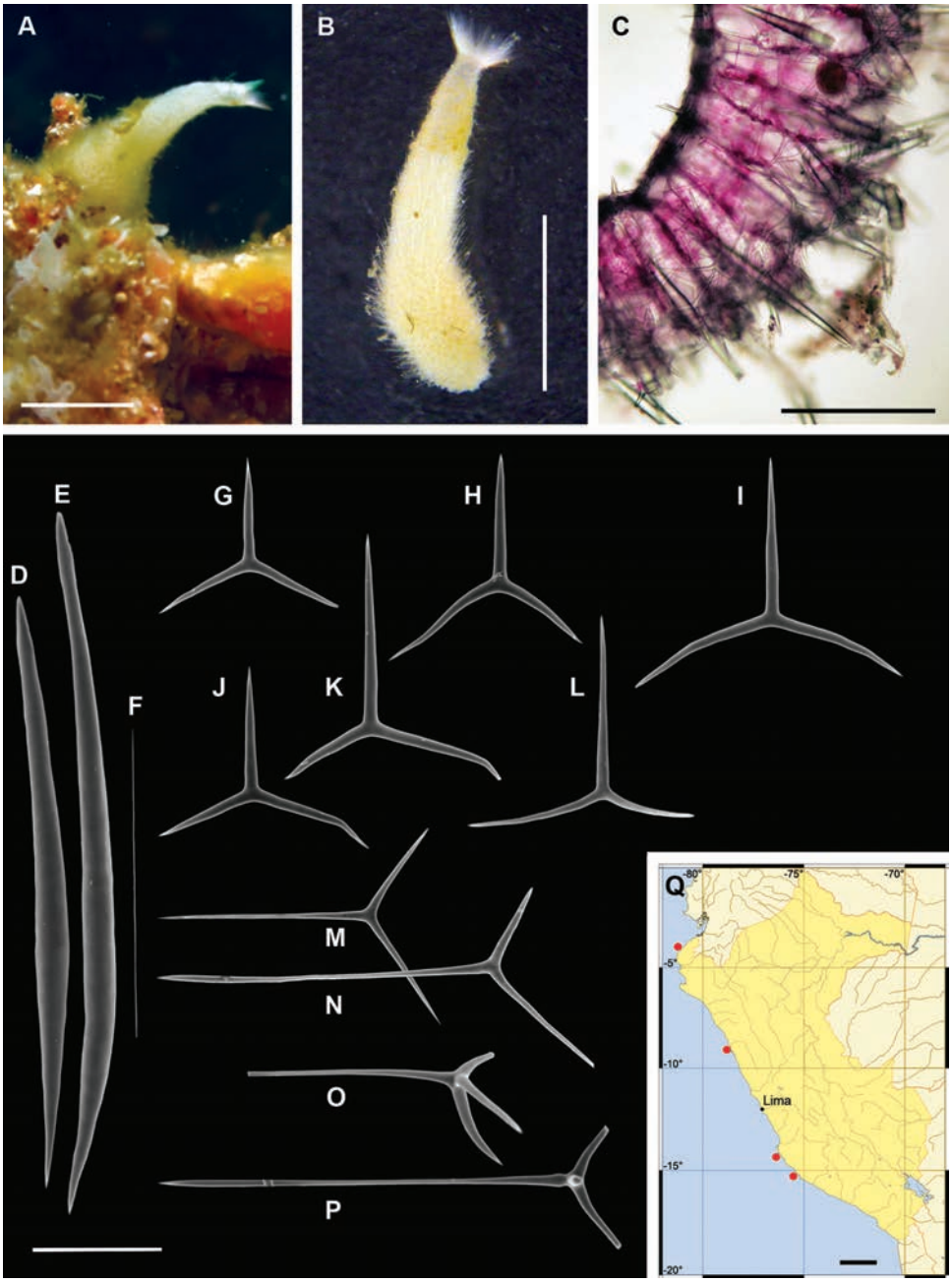


Fig. 40. *Grantia* sp. 1. A, live specimen; B, preserved specimen; C, cross section of the atrium with diactines crossing the choanosome and apical actine of the tetractines; D–E, diactines; F, trichoxea; G–I, cortical triactines; J–K, tubar triactines; L, subatrial triactine; M–N, atrial triactines; O–P, atrial tetractines; Q, distribution map. Scale bars: A–B, 0.5 cm; C, 200 µm; D–P, 100 µm; Q, 200 km.

Grantia sp. 2

REFERENCES: Fleming, 1828; Lambe, 1893; Hôzawa, 1940; Borojevic, Boury-Esnault & Vacelet, 2000.

Description – Grantiidae with syconoid organization. Specimens solitary, globular with terminal oscular opening. Surface slightly rough. Osculum surrounded by a thin crown of trichoxeas. Colour beige in life and in ethanol.

Skeleton – Cortex composed of tangential triactines with crossing diactines protruding from the external surface barely penetrating the choanosomal region. Tubar skeleton comprises triactines and tetractines. Subatrial skeleton with triactines having paired actines straight or curved. Atrial skeleton with triactines only.

Spicules – Diactines. Fusiform, 52–*113*–211 × 4 µm. **Cortical triactines.** Paired actines, 73–*98*–130 × 8 µm. Unpaired actines, 49–*75*–112 × 8 µm. **Tubar triactines.** Paired actines, 78–*98*–122 × 9 µm. Unpaired actines, 73–*108*–146 × 9 µm. **Tubar tetractines.** Paired actines, 75–*96*–112 × 10 µm. Unpaired actines, 70–*101*–140 × 10 µm. Apical actines, 26–*37*–49 × 7 µm. **Subatrial triactines.** Paired actines, 73–*99*–143 × 7 µm. Unpaired actines, 117–*150*–177 × 8 µm. **Atrial triactines.** Paired actines, 125–*185*–73 × 8 µm. Unpaired actines, 112–*139*–182 × 8 µm.

Reproduction – Unknown.

Ecology – Lives among anemone and algae in area with abundant thin sediment. Bathymetric distribution provisionally restricts to the intertidal zone.

Distribution – Punta Sal (03°55' S – Tumbes Region).

Remarks – Two new species of *Grantia* are likely to occur in Peru but further sampling and molecular analysis are necessary to confirm this in detail. *Grantia* sp. 2 differs from *Grantia* sp. 1 in the skeletal composition being easily distinguished one from another, as the former has triactines and tetractines in the tubar skeleton while the later has only triactines, and also shorter and thinner diactines.

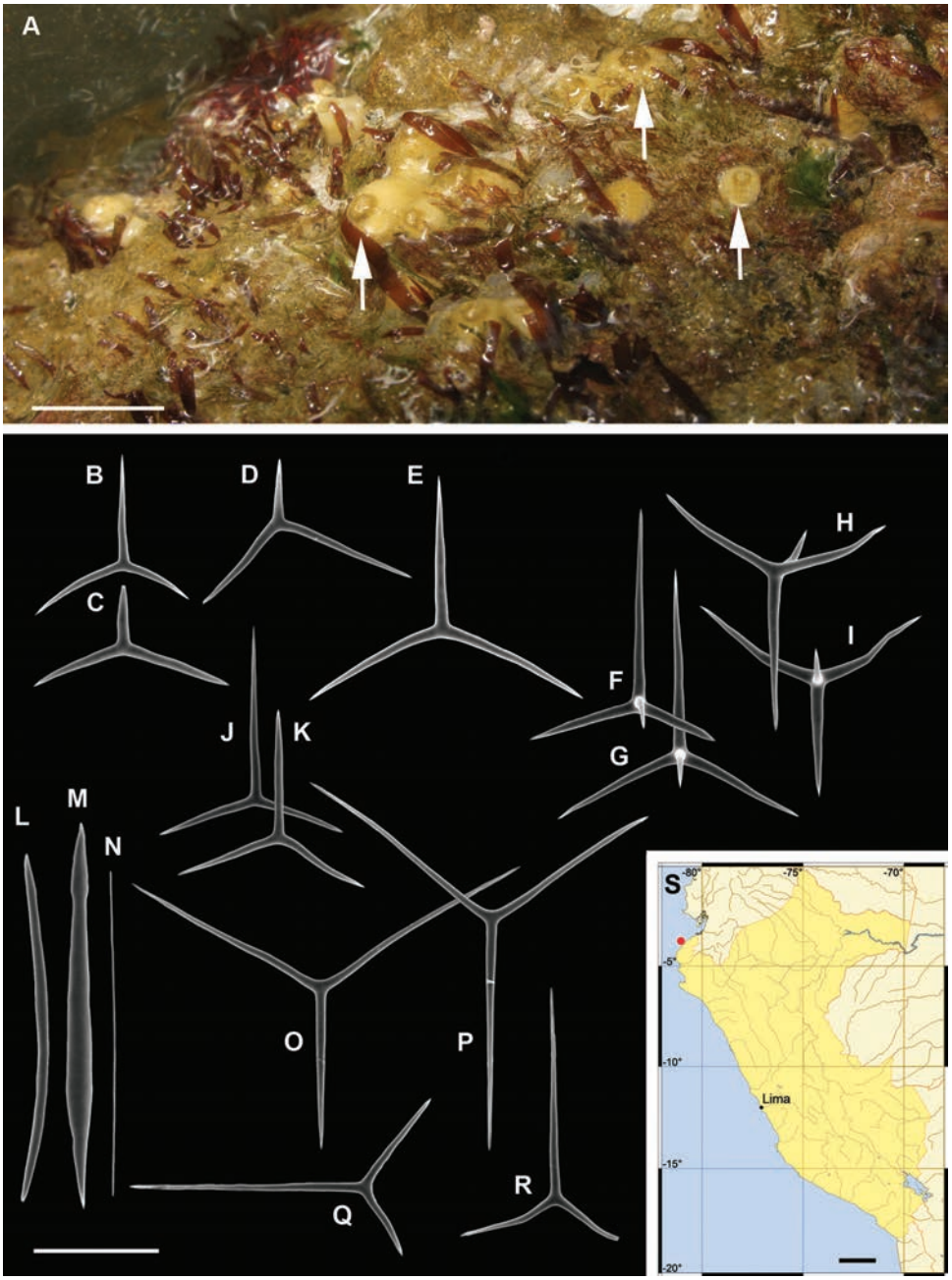


Fig. 41. *Grantia* sp. 2. A, live specimens (arrows); B–E, cortical triactines; F–I, tubar tetractines; J–K, tubar triactines; L–M, diactines; N, trichoxea; O–Q, atrial triactines; R, subatrial triactines; S, distribution map. Scale bars: A, 1 cm; B–R, 100 µm; S, 200 km.

Leucandra losangelensis (de Laubenfels, 1930)

REFERENCES: de Laubenfels, 1930; Borojevic, Boury-Esnault & Vacelet, 2000.

Description – Massive and ramified, composed of many ridged tubes united at the base (8.0 × 4.0 cm). Each tube has an apical osculum with varying diameter (0.8–0.3 cm), ending in a thin and bright membrane. Consistency is friable and texture is rough. Aquiferous system is leuconoid. Colour is light beige in life and in ethanol.

Skeleton – Disorganized skeleton typical of the genus *Leucandra*. Cortical skeleton composed of a few layers of tangentially arranged triactines of variable shapes and sizes. Microdiactines of at least three different types scattered in the cortical (forming a reticule around the inhalant apertures) and atrial membranes, and occurring also around canals in the choanosome. Choanosomal skeleton composed of conspicuous regular to subregular triactines of a wide range of sizes, with sagittal triactines scattered like those of the cortex. Discontinuous layer of triactines Y-shaped or pseudo-sagittal-like supporting a subcortical skeleton. Canals surrounded by T-shaped triactines and sagittal tetractines, with curved paired actines and short or long unpaired actine. Typical sub-atrial triactines irregularly inserted in a layer adjacent to the atrial skeleton. Atrial skeleton composed of a dense layer of particular sagittal triactines and tetractines possessing paired actines facing each other at an angle higher than 160º.

Spicules – Microdiactines. Different categories difficult to recognize under light microscopy, 38–*52*–100 µm × 3 µm. **Cortical triactines.** Sagittal. Paired, 150–*232*–300 µm × 13 µm. Unpaired, 120–*183*–310 µm × 14 µm. **Subcortical triactines.** Pseudosagittal-like. Paired, 33–*48*–70 µm × 3 µm. Unpaired, 55–*75*–92 µm × 4 µm. **Choanosomal triactines I**. Large, regular, equiangular and equiradiate, or subregular. Actines are conical with blunt tips, 400–*507*–730 µm × 37 µm. **Choanosomal triactines II**. Small, regular, equiangular and equiradiate, or subregular, 260–*331*–390 µm × 23 µm. **Choanosomal/canal triactines T shaped.** Sagittal. Paired, 140–*216*–290 µm × 13 µm. Unpaired, 160–*286*–360 µm × 14 µm. **Choanosomal/canal tetractines I.** Sagittal. Paired, 155–*213*–275 × 15 µm. Unpaired, 180–*257*–348 µm × 17 µm. Apical, 20–*37*–55 µm × 9 µm. **Choanosomal/canal tetractines II.** Sagittal. Paired, 125–*200*–255 µm × 12 µm. Unpaired, 75–*116*–158 µm × 13 µm. Apical, 25–*47*–65 µm × 7 µm. **Subatrial triactines.** Sagittal. Paired, 200–*242*–300 µm × 15 µm. Unpaired, 180–312–420 µm × 18 µm. **Atrial triactines T-shaped.** Very sagittal. Paired, 140–*216*–290 µm × 13 µm. Unpaired, 160–*286*–360 µm × 14 µm. **Atrial tetractines T-shaped.** Very sagittal. Paired, 130–*208*–295 µm × 13 µm. Unpaired, 63–*89*–133 µm × 14 µm. Apical, 10–*28*–45 µm × 7 µm.

Reproduction – Unknown.

Ecology – Single individual found on boulder covered by encrusting red algae, sharing the substrate with hydrozoans at 3 m depth.

Distribution – Máncora Pier (04°06' S – Piura Region).

Remarks – No possible confusion with other species.

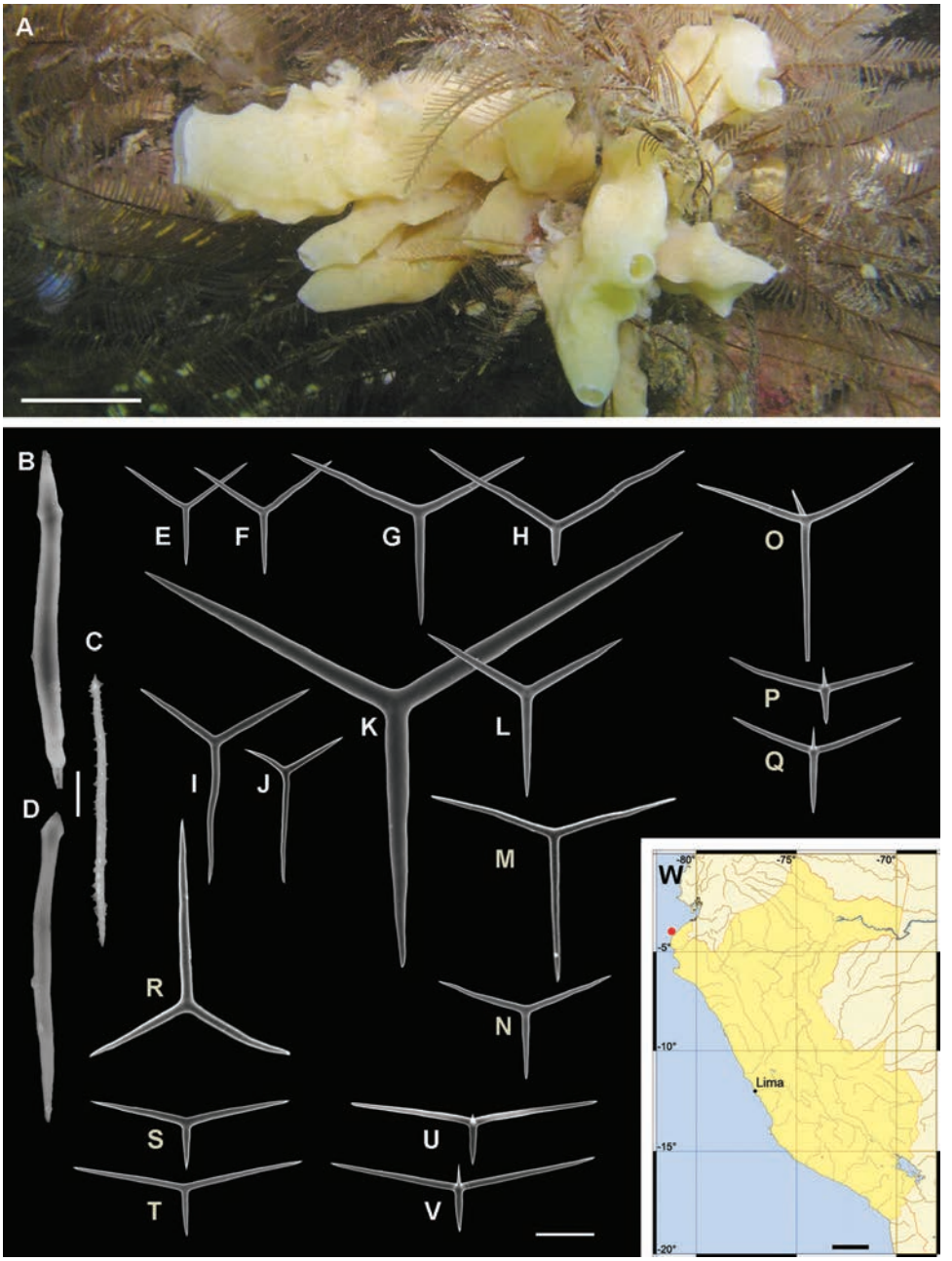


Fig. 42. *Leucandra losangelensis* (de Laubenfels, 1930). A, live specimen; B–D, microdiactines; E–H, cortical triactines; I–J subcortical triactines; K, large choanosomal triactine; L, small choanosomal triactine; M–N canal triactines; O–Q, canal tetractines; R, subatrial triactine; S–T, atrial triactines; U–V, atrial tetractines; W, distribution map. Scale bars: A, 2 cm; B–D, 10 µm; E–V, 100 µm; W, 200 km.

Leucandra sp. 1

REFERENCES: Haeckel, 1872; Borojevic, Boury-Esnault & Vacelet, 2000.

Description – Sponge amorphous, semi-globular or pouch-like form (ca. 2 cm), unique or multiple apical oscula, at the top of a structure resembling a chimney, and without ornamentation crown. Consistency is fragile and brittle, not compressible. Surface is rough and slightly hispid. Aquiferous system is leuconoid. Colour in life is white or beige, and beige to yellowish in ethanol.

Skeleton – Cortical skeleton composed of trichoxeas (forming sparse perpendicular bundles) and microdiactines (both can also be found in the atrial membrane, but barely), including a variety of forms and sizes of triactines. Some triactines seem to be inserted in the subcortical region, similarly as a pseudosagittal triactine. Choanosomal skeleton is disorganized, formed by sizes from intermediate to large triactines, tetractines in the canals and lacunae. Atrial skeleton exclusively formed of abundant tetractines with the apical actine penetrating the atrium.

Spicules – Trichoxeas (not represented). Hair-like straight linear spicules. **Microdiactines.** Spined, with one lanced-head and the other one sharp, 58–*77*–88 µm × 3 µm. **Cortical triactines I**. Large, sagittal**.** Paired actines, 100–*156*–190 µm × 11 µm. Unpaired actines, 100–*148*–230 µm × 11 µm. **Cortical triactines II**. Small, sagittal**.** Paired actines, 83–*112*–150 µm × 12 µm. Unpaired actines, 100–*156*–250 µm × 10 µm. **Choanosomal triactines.** Intermediate to large. Sagittal. Paired actines, 210 µm × 20 µm. Unpaired actines, 300 µm × 20 µm. Subregular to regular (large), equiangular and equiradiate or unequiradiate. Basal actines 260–*426*–630 µm × 31 µm. This is the most frequent type of spicule. **Choanosomal/ canal tetractines.** Sagittal. Paired actines, 120–*173*–240 µm × 10 µm. Unpaired actines, 120–*171*–240 µm × 10 µm. **Subatrial triactines T-shaped.** Sagittal. Paired actines, 83–*112*–150 µm × 12 µm. Unpaired actines, 100–*156*–250 µm × 10 µm. **Atrial tetractines I.** Large, sagittal with short apical actine. Very abundant. Paired actines, 150–*176*–220 µm × 11 µm. Unpaired actines, 130–*168*–190 µm × 10 µm. **Atrial tetractines II**. Small, sagittal with short apical actine. Very abundant. Paired actines, 120–*204*–250 µm × 12 µm. Unpaired actines, 60–*121*–170 µm × 11 µm.

Reproduction – Unknown.

Ecology – Specimens were found in shallow waters underneath boulders with moderate amount of sediment in association with bryozoans and other marine invertebrates such as sponges, gastropods, polychaetes, as well as macroalgae or abandoned fishing nets. Bathymetrical distribution extends from 1 to 13 m depth.

Distribution – From Islas Lobos de Afuera (06°56' S – Lambayeque Region) to Isla Santa Rosa, Paracas (14°19' S – Ica Region).

Remarks – See appendix 13.1 page 330.

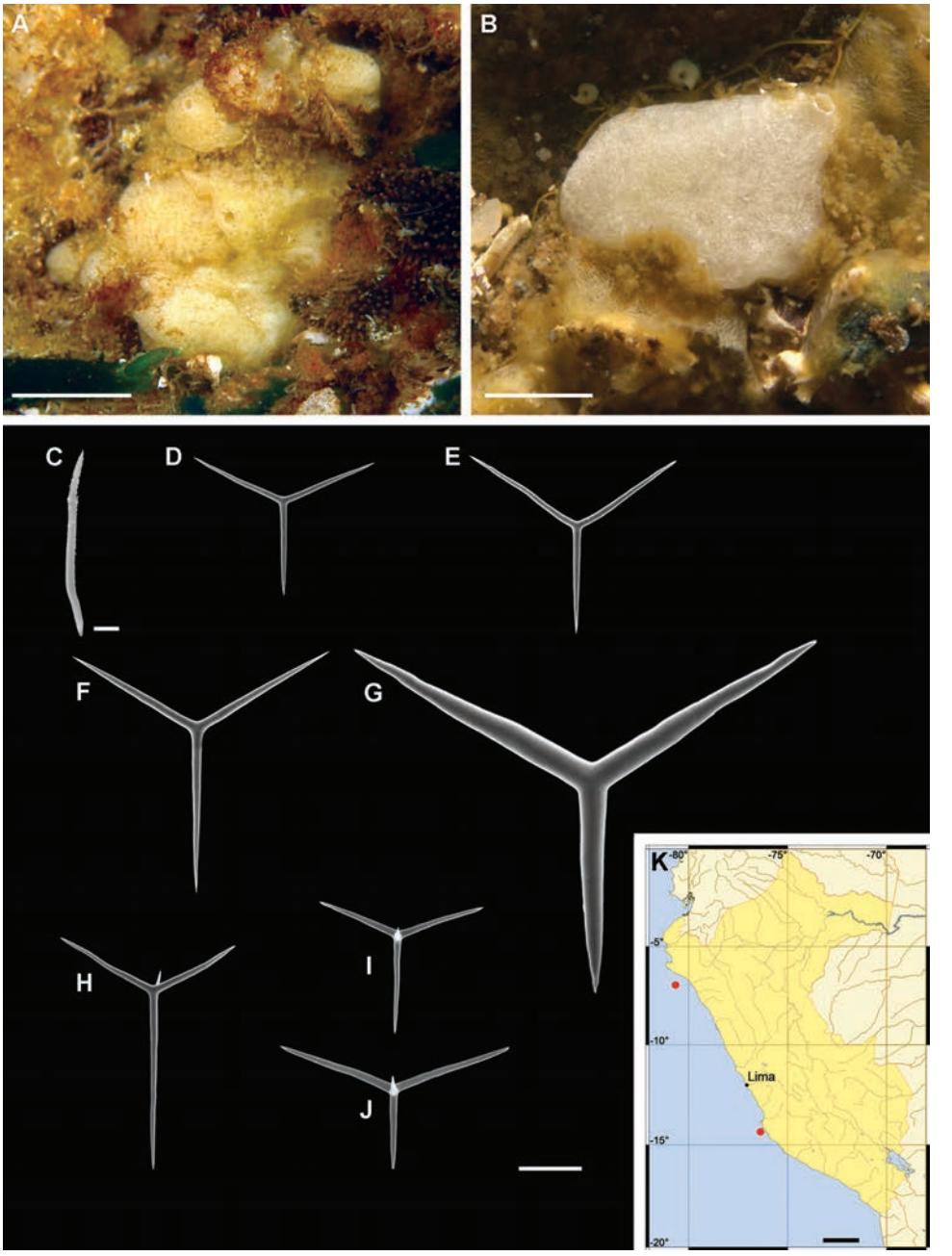


Fig. 43. *Leucandra* sp. 1. A–B, live specimens; C, microdiactine; D–E, cortical triactines; F–G, choanosomal triactines; H, choanosomal/canal tetractine; I–J, atrial tetractines; K, distribution map. Scale bars: A, approx. 1 cm; B, approx. 0.5 cm; C, 10 µm; D–J, 100 µm; K, 200 km.

Leucandra sp. 2

REFERENCES: Haeckel, 1872; Borojevic, Boury-Esnault & Vacelet, 2000.

Description – Amorphous sponge or nearly globular (4 × 2.5 × 2 cm), with an elliptical or rounded base from where one or few short conical tubes emerge, ending in oscular apertures. Apical oscula without ornamentation crown. Consistency is fragile and brittle, not compressible. Surface is rough and hispid. Aquiferous system is leuconoid. Colour in life and in ethanol varying from white, dirty white, light beige.

Skeleton – Cortical skeleton composed of triactines with a variety of shapes and sizes, with predominancy of small ones. Some can also occur in the choanosome region. Choanosomal skeleton disorganized, formed of intermediate to large triactines. Large triactines also sustain the subcortical skeleton. Canals or lacunae opening from the atrial margin, extending in the choanosome, where rare tetractines are present (not shown here). Subatrial skeleton not well structured, but intermediate T-shaped triactines can be found sparsely disposed in this region or around the lacunae. Atrial skeleton exclusively composed of abundant triactines. No microdiactine, diactine or thrichoxea.

Spicules – Cortical triactines I. Large, sagittal, very variable in shape and size. Paired actines, 170–*236*–370 µm × 15 µm. Unpaired actines, 190–*275*–410 µm × 17 µm. **Cortical triactines II.** Small, sagittal, very variable in shape and size. Paired actines, 130–*225*–330 µm × 20 µm. Unpaired actines, 50–*173*–250 µm × 20 µm. **Subcortical** and **choanosomal triactines**. Large, regular, equiangular and equiradiate to subregular, equiangular, but actine size vary. Basal actine, 350–*537*–800 µm × 50 µm **Choanosomal triactines** Intermediate, subregular. Basal actine, 240–*346*–410 µm × 19 µm. **Subatrial triactines T-shaped**. Intermediate, sagittal. Disposed sparsely in the subatrial region. Paired, 160–*216*–260 µm × 14 µm. Unpaired, 220–*263*–340 µm × 16 µm. **Atrial triactines**. Small, strongly sagittal. Very abundant with short unpaired actine. Paired, 120–*209*–270 µm × 11 µm. Unpaired, 60–*105*–150 µm × 11 µm. Rare tetractines are also present in the choanosomal and atrial skeleton, not measured.

Reproduction – Unknown.

Ecology – Lives preferentially underneath boulders, also over stone or attached in the algal turf, in habitats with moderate amount of sediment. Specimens were found sharing the substrate with a variety of marine invertebrates and algae**.** Ophiuroids, bryozoans, sponges, gastropods, polychaetes, brachiopods, and coralline algae. Bathymetrical distribution extends from intertidal to 11 m depth.

Distribution – From Máncora (04°06' S – Piura Region), Islas Lobos de Afuera (06°56' S – Lambayeque Region).

Remarks – All eight *Leucandra* species recorded from the Eastern Pacific, namely, *L*. ***apicalis*** (California), *L*. ***heathi*** (California), *L*. ***losangelensis*** (California), *L*. ***masatierrae*** (Juan Fernandez), *L*. ***meandrina*** (Australia), *L*. ***platei*** (Punta Arenas), *L*. ***pyriformis*** (Vancouver Island), and *L*. ***reniformis*** (southern Chile) bear diactines or microdiatines in their skeletons, as well as *Leucandra* sp. 1 described above, which are spicule categories not observed in *Leucandra* sp. 2. This feature alone supports *Leucandra* sp. 2 as a new species from Peru.

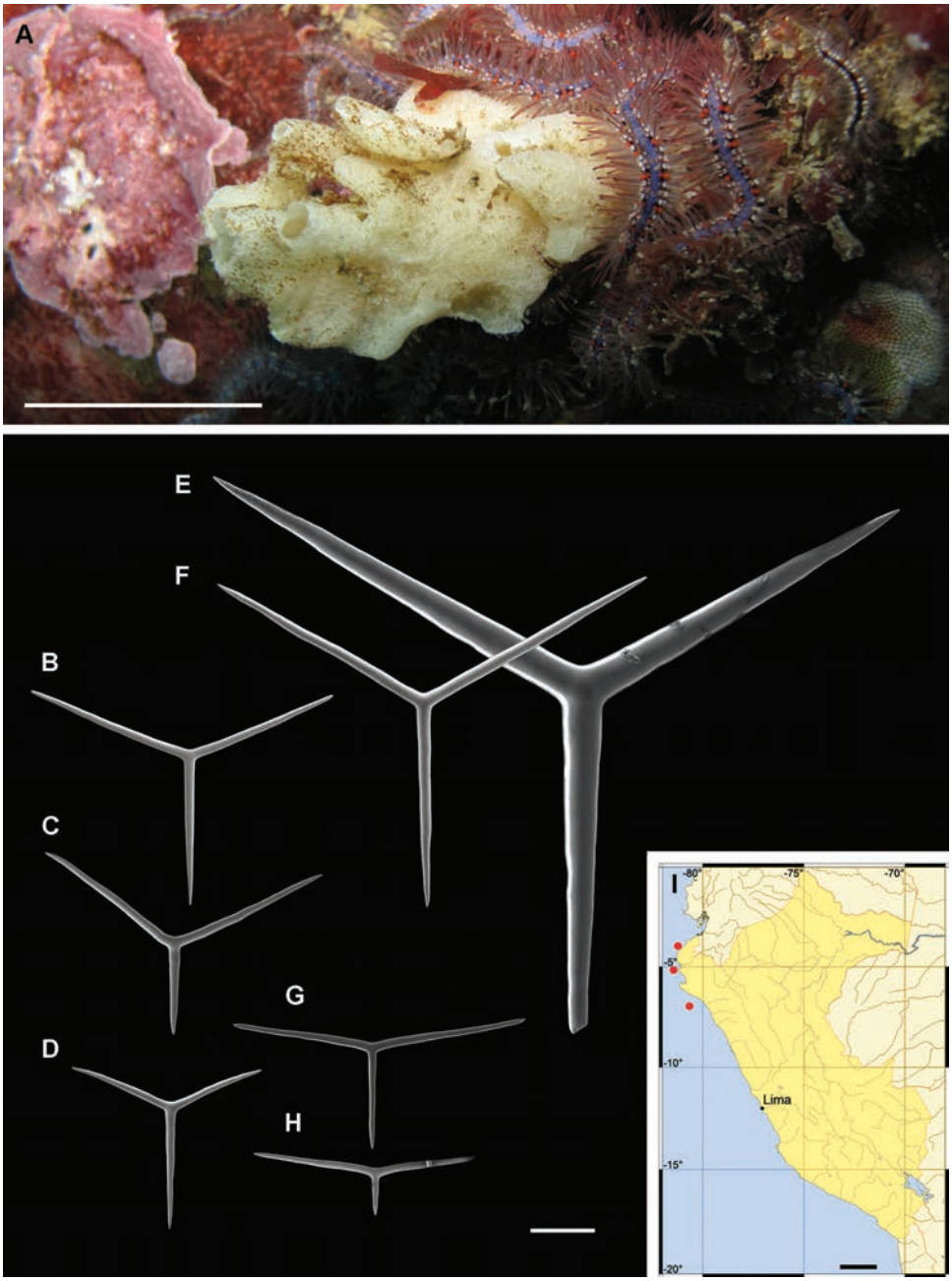


Fig. 44. *Leucandra* sp. *2*. A, live specimen; B–C, cortical triactines; D, subatrial T-shaped triactine; E, subcortical and choanosomal large triactine; F, choanosomal intermediate triactine; G–H, atrial triactines; I, distribution map. Scale bars: A, 2 cm; B–H, 100 µm; I, 200 km.

Leucilla mancoraensis Cóndor-Luján, Azevedo, Hajdu, Hooker, Willenz & Klautau, 2019

REFERENCES: Cóndor-Luján, Louzada, Hajdu *et al*., 2018; Cóndor-Luján, Azevedo, Hajdu *et al*., 2019.

Description – Sponge with a tubular to ovoid body and an apical osculum supported by sagittal tetractines and with a feeble crown of trichoxeas. The holotype measures 1.5 × 4.5 × 4.0 mm. Surface rough and consistency friable. Aquiferous system sylleibid, with several spherical chambers ranging, in their largest diameter, from 110 to 176 µm. Colour yellowish–beige in life and white in ethanol.

Skeleton – Osculum ornamented with short and delicate trichoxeas, imperceptible under the stereomicroscope. Oscular margin composed only of tetractines. Cortical skeleton composed of triactines, the basal system of giant tetractines and few scattered trichoxeas. Triactines and tetractines are tangentially distributed on the cortex, whereas trichoxeas are arranged perpendicularly. Choanosomal skeleton inarticulate, formed by the apical actine of the giant cortical tetractines and the unpaired actine of the subatrial triactines. Apical actine of the tetractines crosses the choanosome. Atrial skeleton formed by tetractines bearing a very short apical actine projected into the atrium.

Spicules – Cortical triactines. Sagittal. Actines are conical, straight with sharp tips. Paired actines can be longer than the unpaired ones, 130–378 × 11–32 µm. Unpaired, 118–410 × 11–27 µm. **Cortical tetractines**. Sagittal. Actines are conical, straight with sharp tips. The apical actine is the longest one and can be distally undulated. Paired, 140–583 × 16–54 µm. Unpaired, 313–658 × 11–54 µm. Apical, 184–994 × 16–54 µm. **Subatrial triactines**. Sagittal. Actines are conical, straight with sharp tips. The unpaired actine is frequently longer than the paired ones. Paired, 118–389 × 11–43 µm. Unpaired, 238–616 × 11–43 µm. **Atrial tetractines**. Sagittal. Actines are conical with sharp tips. Paired actines are often shorter than the unpaired ones and are curved. Paired, 84–227 × 10–18 µm. Unpaired, 103–284 × 10–19 µm. Apical, 19–59 × 7–12 µm.

Ecology – This species was found from the intertidal zone down to 15 m depth. Associated with bryozoans and algae, in a highly silted area.

Distribution – Provisionally endemic to the northern coast of Peru, Piura and Tumbes Regions (04° S).

Remarks – The species that most resemble *Leucilla mancoraensis* are *L*. ***micropilosa*** from Curaçao and *L*. ***nuttingi*** from California, as they have a sylleibid aquiferous system and share similar spicule composition. *Leucilla micropilosa* is well-characterised by the presence of cortical microdiactines, which are absent from *L*. *mancoraensis*. Unlike *L*. *mancoraensis*, *L*. *nuttingi* has a stem and microdiactines protruding through the cortex. *Leucilla mancoraensis* is the first *Leucilla* reported from the southern Pacific coast.

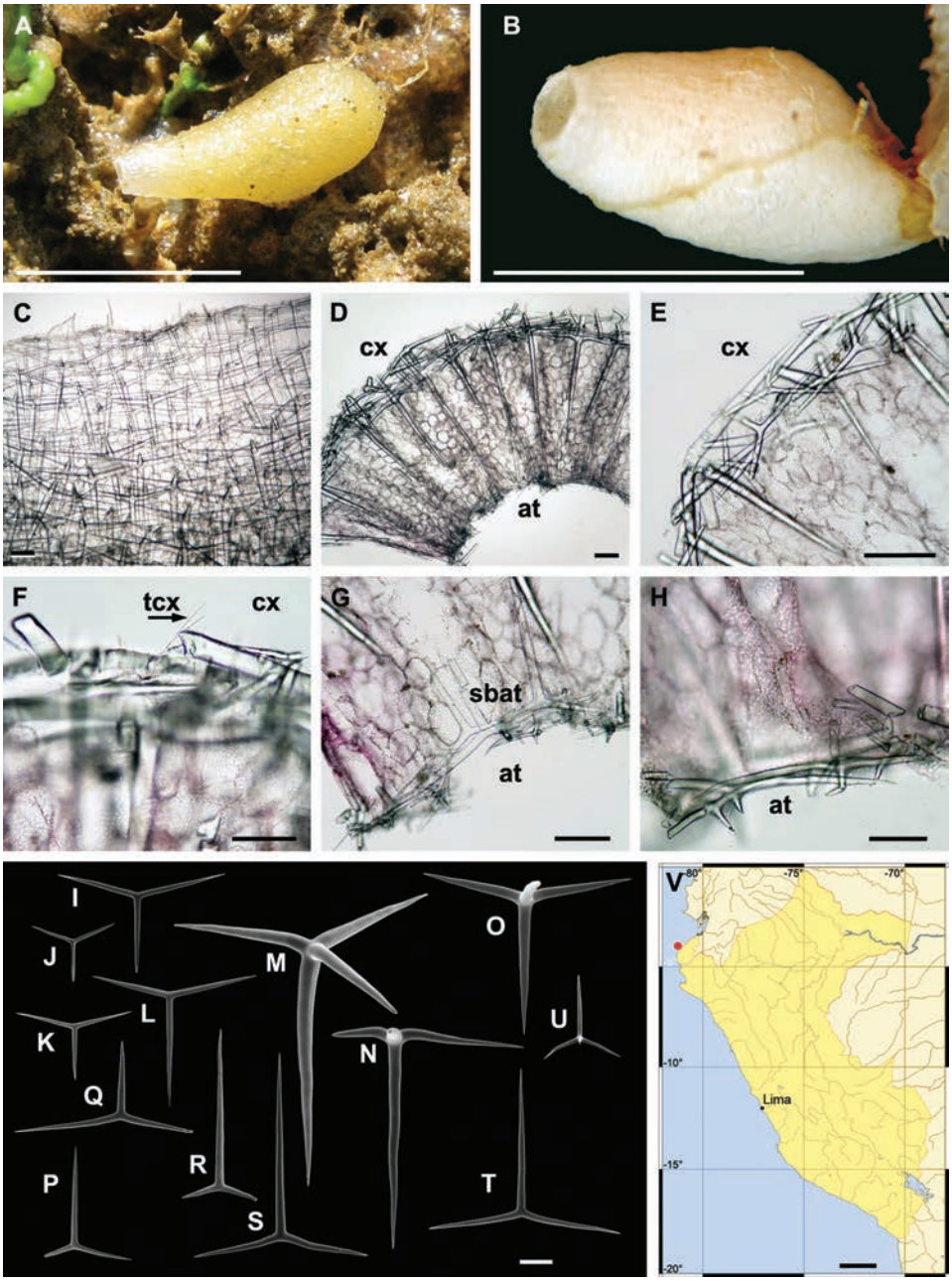


Fig. 45. ***Leucilla mancoraensis*** **Cóndor-Luján, Azevedo, Hajdu, Hooker, Willenz & Klautau, 2019.** A, specimen *in vivo*; B, specimen after fixation; C, oscular margin supported by tetractines; D, cross section of the skeleton; E, cortex with triactines and tetractines; F, cortex with trichoxeas; G, subatrial triactines; H, atrium with apical actines of tetractines; I–L, cortical triactines; M–O, cortical tetractine; P–T, subatrial triactines; U, atrial tetractine; V, distribution map. Abbreviations: cx, cortex; at, atrium; tcx, trichoxeas; sbat, subatrial triactine. Scale bars: A–B, 0.5 cm; C–E, 200 µm; F, 100 µm; G, 200 µm; H–U, 100 µm; V, 200 km.

Paraleucilla tarazonai Cóndor-Luján, Azevedo, Hajdu, Hooker, Willenz & Klautau, 2019

REFERENCES: Dendy, 1893; Cóndor-Luján, Azevedo, Hajdu *et al*., 2019.

Description – Massive body, osculum without crown. The holotype measures 12.0 × 10.0 × 4.0 mm. Consistency firm but friable. Osculum supported by triactines and sagittal tetractines, as the body wall. Surface rough and scarcely hispid because of presence of a few diactines. Aquiferous system leuconoid and choanocyte chambers subspherical, ranging from 98 to 130 µm in diameter. Colour unknown in life and beige in ethanol.

Skeleton – Cortical skeleton composed of microdiactines, few large diactines, rare triactines and a basal system of tetractines. Microdiactines and diactines are perpendicular to the cortex. Microdiactines frequently organised in tufts. The triactines and the basal system of the tetractines lay tangentially to the surface. Choanosomal skeleton typical of the genus, being inarticulate near the surface (outer region) and without organisation below the subatrial skeleton (inner region). The outer region is formed by the diactines, the apical actine of the cortical tetractines and the unpaired actine of subatrial triactines. The apical actine of the cortical tetractines crosses the choanosome and can even reach the atrium. The inner region is evident only when the body wall of the sponge is thick. Triactines similar to those of the subatrial skeleton and subregular triactines are scattered in this region. Atrial skeleton formed by triactines and tetractines. The apical actine of the atrial tetractines is not conspicuous.

Spicules – Diactines. Fusiform with sharp tips, >1100 × 27 µm. **Cortical microdiactines.** Straight, spined, with one sharp and one lanceolated tip, 54–189 × 1–3 µm. **Cortical triactines.** Sagittal. Actines are conical, straight, with sharp tips, Paired, 86–265 × 4–14 µm. Unpaired, 70–170 × 4–12 µm. **Cortical tetractines.** Sagittal. Basal actines are slightly conical to conical, straight, with sharp tips. The apical actine is slightly undulated and longer than the other actines. Paired, 118–400 × 11–43 µm. Unpaired, 32–230 × 11–27 µm. Apical, 178–745 × 13–65 µm. **Subatrial triactines.** Sagittal. Actines are conical, straight, with sharp tips. Paired actines are shorter than the unpaired one. Paired, 89–300 × 11–38 µm. Unpaired, 150–535 × 11–38 µm. **Atrial triactines.** Sagittal. Actines are slightly conical, with sharp tips. Paired, 103–262 × 7–13 µm. Unpaired, 78–338 × 4–12 µm. **Atrial tetractines.** Sagittal. Actines are conical, straight with sharp tips. The apical actine is the shortest one. Paired, 89–300 × 5–16 µm. Unpaired, 127–263 × 5–16 µm. Apical, 33–135 × 5–11 µm.

Ecology – Found on an oyster shell at 4–5 m depth.

Distribution – Provisionally endemic to El Ñuro, north of Quebrada Verde (04°13' S – Piura Region).

Remarks – Among the 13 valid species of *Paraleucilla*, *P*. ***crosslandi*** from the Red Sea and *P*. ***proteus*** from the Indian Ocean present a similar skeleton composition as that of *P*. *tarazonai*. However, differently from the latter, *P*. *crosslandi* and *P*. *proteus* do not have diactines, nor microdiactines.

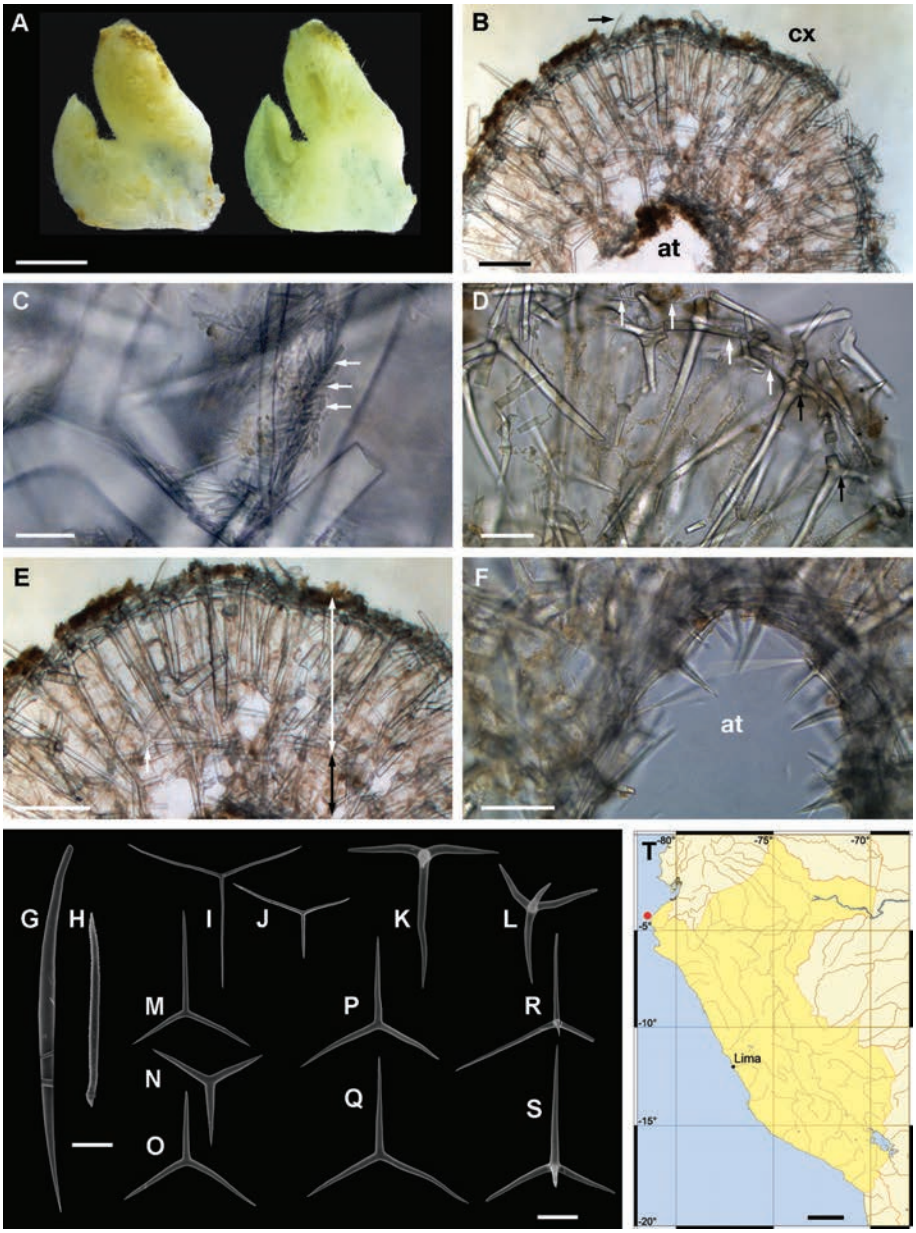
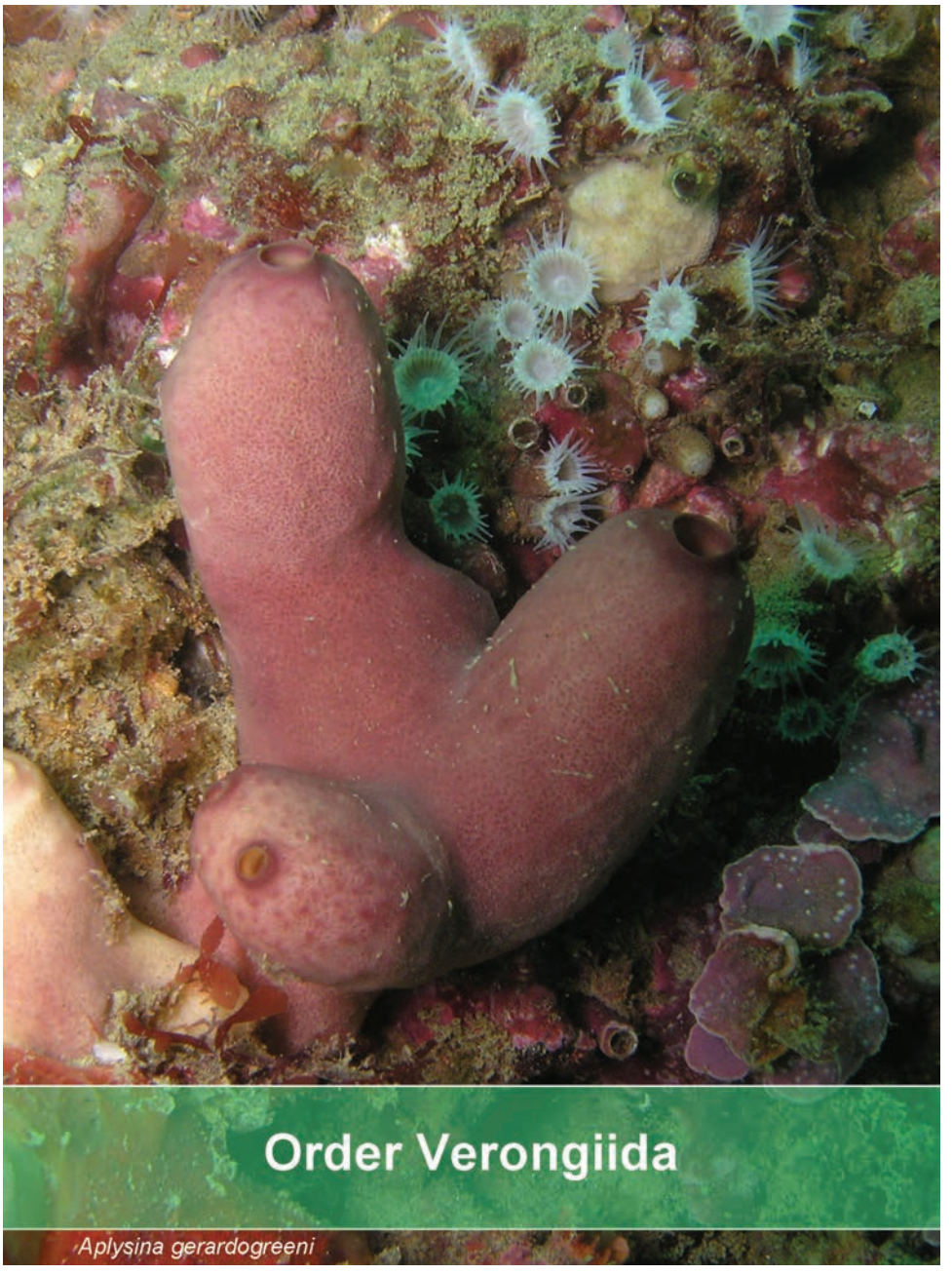


Fig. 46. ***Paraleucilla tarazonai*** **Cóndor-Luján, Azevedo, Hajdu, Hooker, Willenz & Klautau, 2019.** A, specimen after fixation; B, cross-section with diactines crossing the choanosome (arrow); C, cortical microdiactines (arrows); D, cortical triactines (arrows) and tetractines; E, cross-section showing the outer (white double arrow) and inner (black double arrow) regions with subatrial triactines (arrow); F, atrium with the apical actine of the tetractines; G, diactines; H, microdiactines; I–J, cortical triactines; K–L, cortical tetractines; M–O, subatrial triactines on the inarticulate skeleton; P–Q, subatrial triactines adjacent to the atrium; R–S, atrial tetractines; T, distribution map. Abbreviations: cx, cortex; at, atrium; Scale bars: A, 0.5 cm; B, 200 µm; C, 20 µm; D, 50 µm; E, 200 µm; F, 100 µm; G–H, 10 µm; I–S, 100 µm; T, 200 km.


Order Verongiida
Aplysina gerardogreeni

Aplysina chiriquiensis Diaz, van Soest, Rützler & Guzman, 2005

REFERENCE: Diaz, van Soest, Rützler *et al*., 2005.

Description – Specimens can reach over 20 cm in height, and usually comprise a few or many branches up to 2.5 cm thick. Most specimens present a short, variously slender peduncle. Surface is usually smooth, albeit irregular, but can also be slightly rugose. Oscula are very small (1–2 mm diameter) and mostly scattered on the sides of the branches. Consistency cartilaginous, resilient. Colour alive varies from light yellow to ochre to orangey, becoming dark purple in ethanol.

Skeleton – Dendritic arrangement close to surface, and reticulate deeper in the sponge. Spongin fibres thin out towards the surface, close to which they bear small irregular tubercles. Reticulation made of polygonal tridimensional meshes usually under 1 mm in diameter. Fibres mostly under 100 µm thick, but up to 150 µm, composed of a yellow bark, and granular pith. The latter is not too dark, and occupies 25–50% of fibre diameter.

Spicules – Autochthonous spicules absent.

Ecology – Specimens are not very common, occurring on both vertical and horizontal surfaces around 10 m depth, usually carrying epibionts (algae, bryozoans, ophiuroids).

Distribution – Originally described from Pacific Panamá, the species has subsequently been reported from Galápagos and Pacific Colombia. This is the first record of the species for the SE Pacific, where it has been collected from Cancas and Punta Sal (03°55' S and 03°58' S – Tumbes Region).

Remarks – The taxonomy of *Aplysina* species does not go much farther beyond a detailed characterization of their external morphology. Anatomical features are so variable within each individual, as to render them mostly useless in species comparisons. Measurements offered above fall well within the variation known for the species since its original description. However, this is the first time that tuberculate apices of choanosomal fibres are reported. Identification rested mostly on the pedunculate and ramose habit of the Peruvian specimens, with dimensions and colour in life, all matching previous Panamanian, Colombian and Galápagos records.

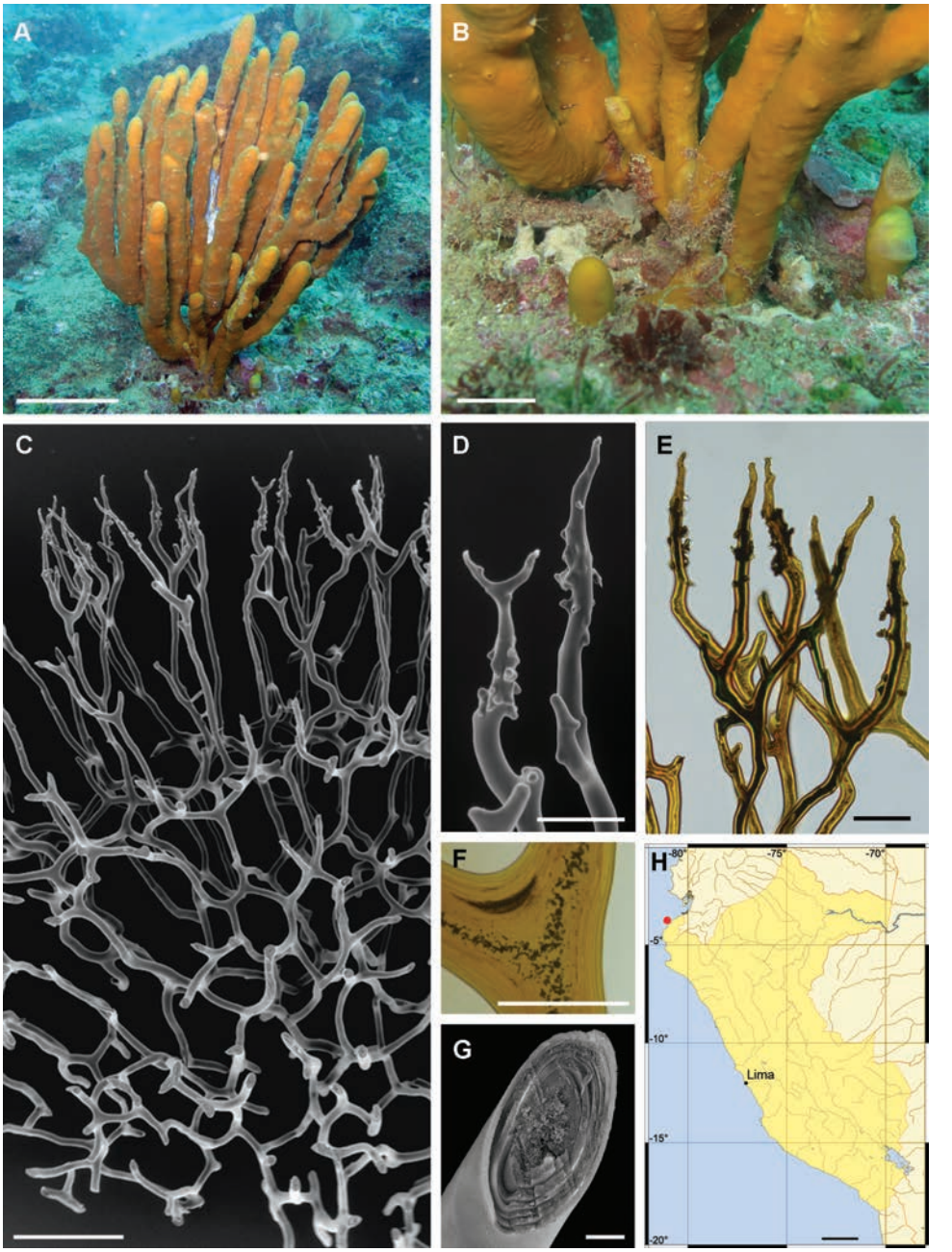


Fig. 47. *Aplysina chiriquiensis* Diaz, van Soest, Rützler & Guzman, 2005. A, live specimen; B, base of a specimen with broken and regenerating peduncles; C, general structure of the skeletal architecture; D, detail of C; E, dendritic spongin fibres; F, detail of anastomosed fibre; G, sectioned fibre; H, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 1 mm; D–E, 250 µm; F, 100 µm; G, 25 µm; H, 200 km.

Aplysina cf. *chiriquiensis*

REFERENCE: Diaz, van Soest, Rützler *et al*., 2005.

Description – Erect, with about 15 irregularly cylindrical branches and a short peduncle, branches 1–3 cm wide, specimen 15–20 cm high. Surface rough, micro-convoluted. Oscula are very small (likely 1–2 mm across), scattered or slightly aligned on the sides of the branches. Consistency cartilaginous, resilient. Colour alive ochre-yellow to orangey, depending on light intensity, turning dark brown in ethanol.

Skeleton – Dendritic arrangement close to surface, and reticulate deeper in the sponge. Fibres thin out towards the surface, where they occasionally show some tuberculate protuberances. Reticulation made of polygonal tridimensional meshes usually under 1 mm in diameter. Fibres mostly 50–100 µm thick, but up to 200 µm, composed of a yellow bark, and granular pith. The latter is not too dark, and occupies 25–60% of fibre diameter.

Spicules – Autochthonous spicules absent.

Ecology – The single specimen collected was attached to the horizontal surface of a small crevice, seemingly located in a relatively large vertical wall at 10 m depth. The substrate carries considerable silt, as well as abundant small algae, a tunicate, and polychaete tubes.

Distribution – Only known from Punta Sal (03°59' S – Tumbes Region).

Remarks – Overall this specimen fits well in *Aplysina* ***chiriquiensis***, but the latter has always been described with a smooth surface. We preferred to separate its description, to highlight this difference.

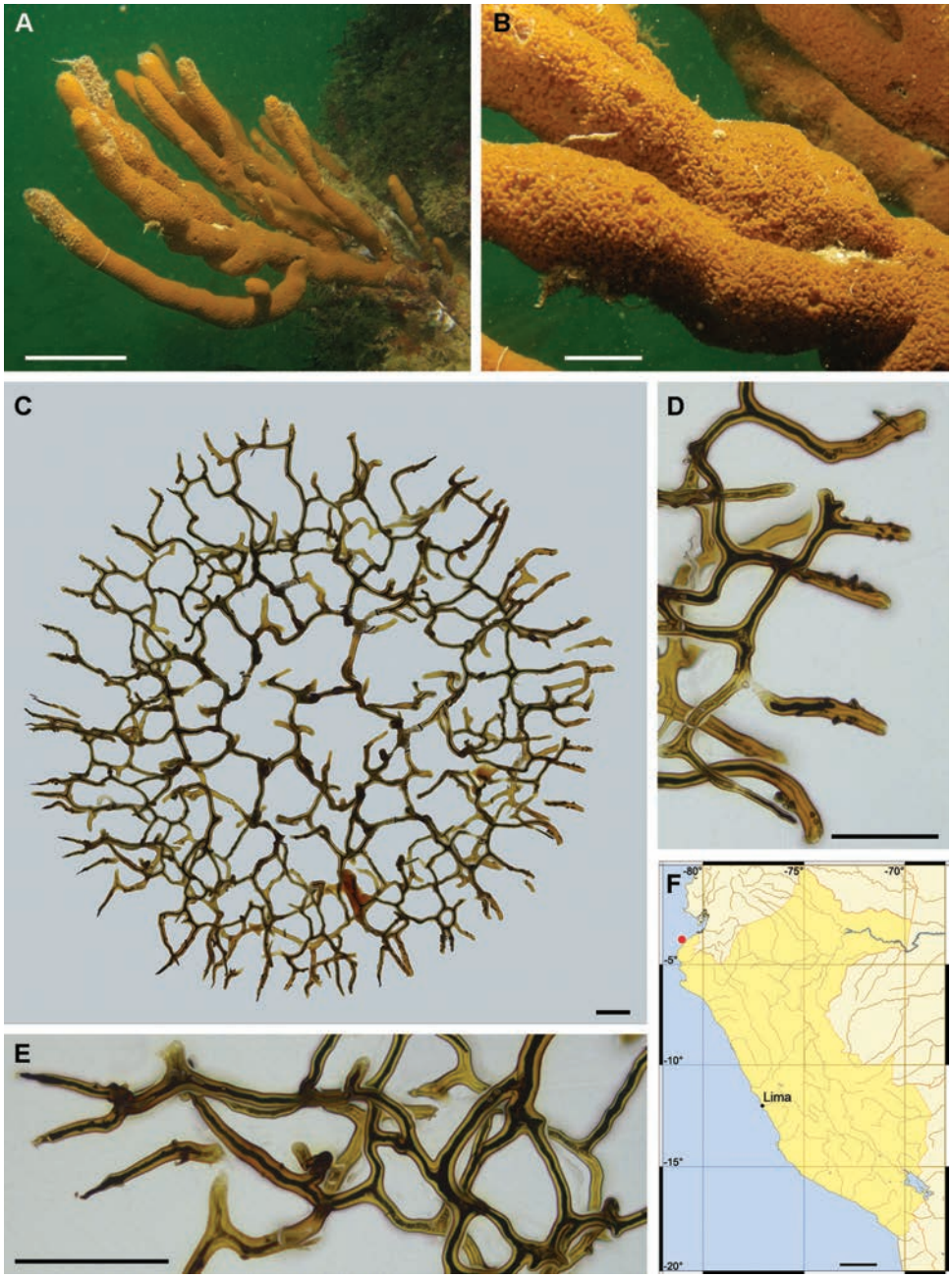


Fig. 48. *Aplysina* cf. *chiriquiensis* Diaz, van Soest, Rützler & Guzman, 2005. A–B, live specimen; C, cross section of the skeleton; D–E, details of C; F, distribution map. Scale bars: A, 5 cm; B, 2 cm; C–E, 500 µm; F, 200 km.

Aplysina gerardogreeni Gómez & Bakus, 1992

REFERENCES: Gómez & Bakus, 1992; Cruz-Barraza, Carballo, Rocha-Olivares *et al*., 2012; Gómez, González-Acosta, Sánchez-Ortíz *et al*., 2018; Lizarazo, Zea, Chasqui *et al*., 2020.

Description – Specimens usually comprise several short tubular lobes, often fused extensively into flattened ridges, occasionally bifurcating. Dimensions commonly 5–10 cm in diameter, with individual projections no thicker than 3.5 cm, usually lower than 4 cm, and slightly fusiform. Apical oscula, 2–5 mm across, surrounded by a short membrane, which can be darker than the rest of the specimen in lighter-coloured individuals. Consistency soft, elastic. Live colour most frequently purple, but also beige, which occurs also as spots on otherwise purple individuals. Sponge turns black in ethanol.

Skeleton – Dendritic arrangement close to surface and reticulate deeper in the sponge. Fibres thin out towards the surface. Meshes up to 1.2 mm in diameter. Fibres mostly under 100 µm thick, but up to 130 µm, composed of a yellow bark and pith that can be either of the same colour, or totally black and takes up over 50% of the total thickness.

Spicules – Autochthonous spicules absent.

Ecology – Specimens occur on both vertical and horizontal surfaces between 7 and 10 m depth, and usually do not carry epibionts. A few ophiuroids were seen around the tubular projections though, and specimens are usually surrounded by a rich benthic community where seagrass and algae predominate, but cnidarians, bryozoans and tunicates are also frequent.

Distribution – Previously known from the entire Mexican coast, Pacific Panamá and Ecuador. This is the southernmost record of the species on the Pacific coast of South America, with specimens collected from Cancas and Punta Sal (03°55' S and 03°57' S – Tumbes Region) and El Ñuro (04°13' S – Piura Region).

Remarks – The *A. gerardogreeni* specimens studied have a skeleton not as dendritic as that of *A. **airapii*** from Pacific Mexico, neither as reticulate as that of *A. **sinuscaliforniensis*** (also from Pacific Mexico) and many more usual *Aplysina* spp., both in the Atlantic and the Pacific. Genetically, given the single molecular marker whose sequences are available this far (ITS1–5.8S–ITS2 nrDNA), *A. gerardogreeni* and *A. airapii* are 100% identical in BLAST, and less than 2% distinct according to the ITS2 sequences, and judging from their external morphology, quite alike indeed. It appears a more detailed comparison of both is needed to soundly establish their status as separate species. Since *A. gerardogreeni* is the older name, it is the variability of its anatomical features that needs to be more thoroughly studied to verify if both species do inhabit distinct morphospaces. In parallel, the third molecular marker suggested for a multilocus approach towards sponge identification, 28S rRNA (C2–D2), might be a good target for further exploring the genetic affinities of both species.

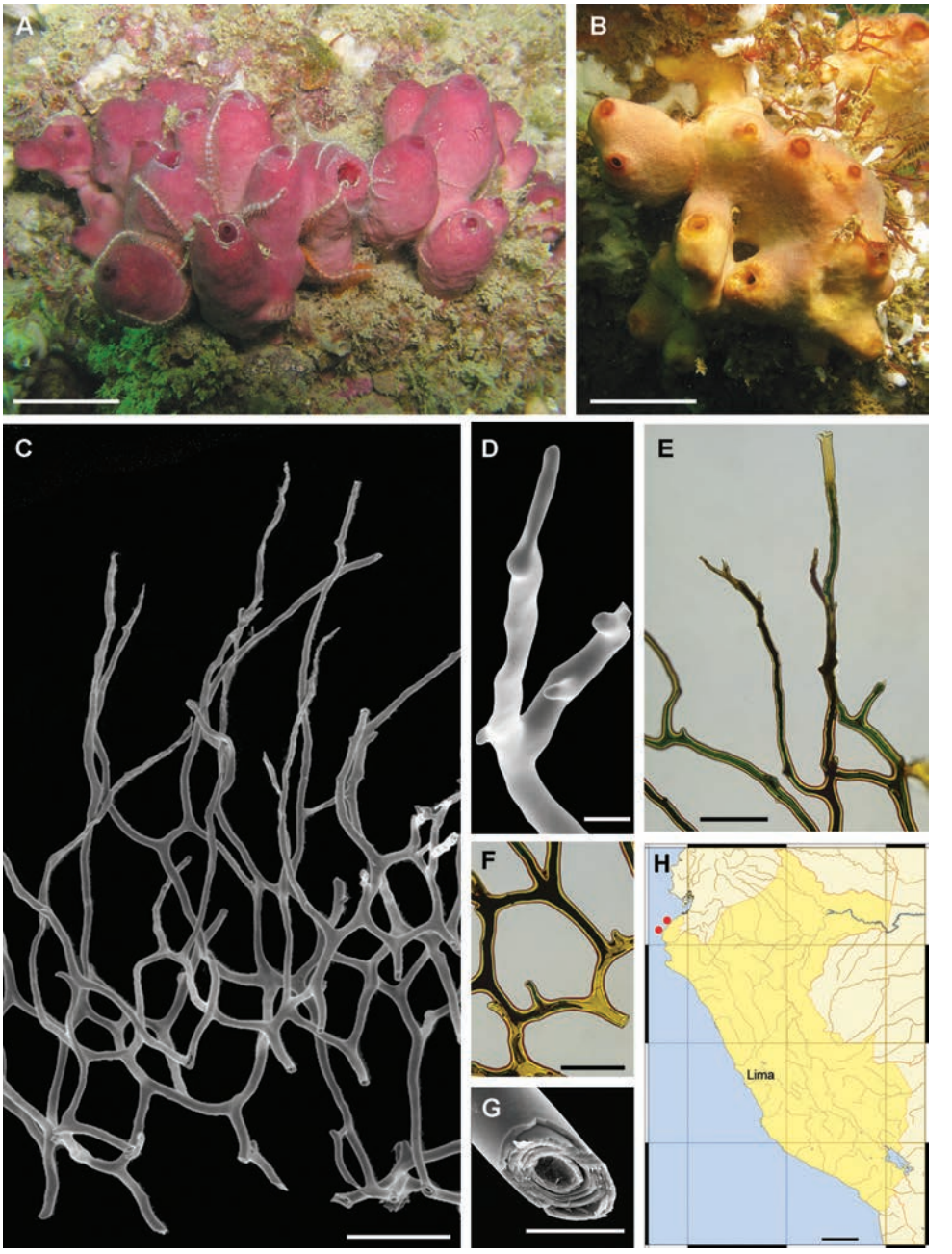


Fig. 49. *Aplysina gerardogreeni* Gómez & Bakus, 1992. A–B, live specimens; C, general structure of the skeletal architecture; D, detail of C; E, dendritic spongin fibres; F, detail of spongin fibres; G, sectioned spongin fibre; H, distribution map. Scale bars: A–B, 2 cm; C, 1 mm; D, 100 µm; E–F, 500 µm; G, 100 µm; H, 200 km.


Order Dendroceratida
Aplysilla sp.

Aplysilla cf. *sulfurea* Schulze, 1878

REFERENCES: Thiele, 1905; Picton, Morrow & van Soest, 2011; de Voogd, Alvarez, Boury-Esnault *et al*., 2022.

Description – Tiny, roundish, less than 2 cm in maximum diameter, or cushion-shaped, up to 5 cm long, and no thicker than 3–4 mm. Surface conulose, smooth in between conules, an area bearing a delicate reticulated membrane. Conules 1–2 mm high, and 2–3 mm apart. Consistency soft, fragile. Colour in life an intense yellow, turning beige or purple in ethanol.

Skeleton – Made up of sparse, slender, branching or not, somewhat sinuous, markedly laminated spongin fibres, thinning out towards the conules; and originating on expanded, tripodal in one case, seemingly disk-shaped bases of attachment (diameter 200–400 µm). Fibres are thicker (up to 100 µm) on sections where branching is taking place, and thin down (to 10–15 µm) considerably at their tips. Some short branches do not reach the ectosome. Fibres contain no foreign matter, as embedded sand grains or spicules.

Spicules – Autochthonous spicules absent. There may be a few sequestered from the sediment, of varied morphology, and frequently broken.

Ecology – Collected from hard substrate at 1–14 m depth, at temperatures ranging from 14 to 21º C. Organisms occurring in direct contact or very close to the specimens included other sponges (*Cliona*, *Dysidea*), bryozoans, polychaete tubes and tunicates.

Distribution – Originally reported from the Adriatic Sea, this species has subsequently been recorded on several corners of the globe, including the channels in southern Chile. Here we report its first finding in the Tropical eastern Pacific (Punta Sal, 03°58' S – Tumbes Region; Islas Lobos de Afuera, 06°56' S – Lambayeque Region), and Humboldtian Pacific (Paracas, 14°09' S – Ica Region).

Remarks – Records other than those from the northeast Atlantic and Mediterranean are deemed inaccurate, for the unlikelihood that a sponge can be so widely distributed, not only geographically, but also ecologically, from warm Tropical to cold Temperate waters. Pending a molecular revision of samples from many areas around the world, it is unlikely these doubts will be clarified, for the very meager morphologic dataset provided by these sponges. Another possibility to bring light into this likely species complex might be through histology and ultrastructure.

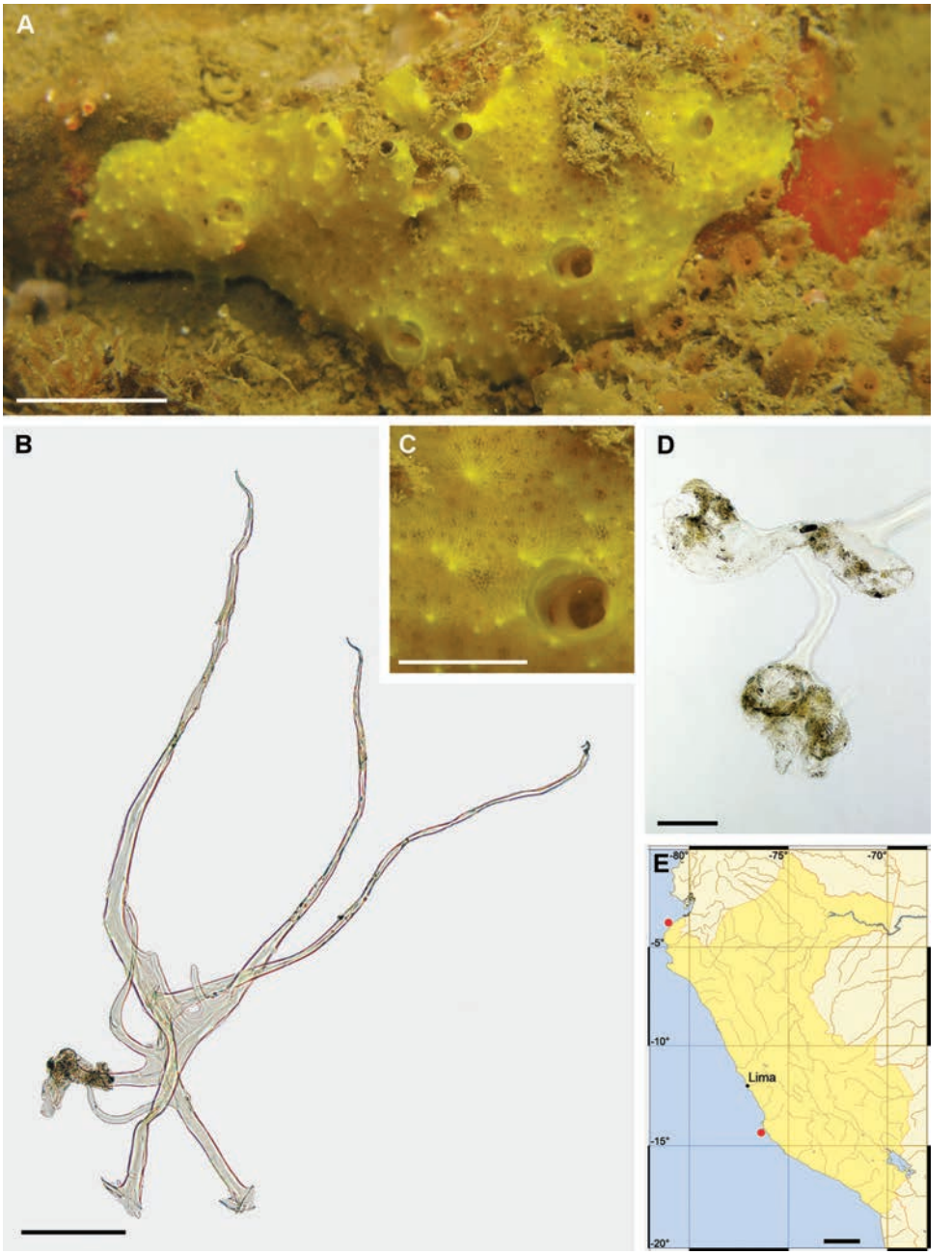


Fig. 50. *Aplysilla* cf. *sulfurea* Schulze, 1878. A, live specimen; B, upright horny fibres detached from the basal plate of spongin; C, enlargement of A; D, base of the fibres; E, distribution map. Scale bars: A, 1 cm; B, 500 µm; C, 0.5 cm; D, 200 µm; E, 200 km.


Order Dictyoceratida
Dysidea cf. ligneana

Aplysinopsis sp.

REFERENCES: Bergquist, 1995; Cook, 2007; van Soest, Kaiser & van Syoc, 2011.

Description – Specimens up to 15 cm wide and a few millimetres thick only. Cushion-shaped, with short irregular, lamellar, lobate (up to 2–3 cm tall) or monticulate projections, mostly topped by oscula (1 mm in diameter). Consistency firm, somewhat flexible; texture smooth, but bearing a slight rugosity. Colour a lighter or a darker shade of grey, the former possibly the consequence of a microbial mat coating parts of the sponge, which is otherwise substantially covered by sediment and epibionts (zoanthids, polychaetes, bryozoans). Keeps its colour in ethanol.

Skeleton – Ectosome charged with a crust of sediment (0.5–2 mm thick) including a large proportion of spicules, pierced here and there by ascending primary fibres cored by sediment, which end up in short conules at the surface. Choanosome bears a variously irregular network of ascending primaries (up to 80–250 µm thick) that can bifurcate or trifurcate, abundantly connected by sediment-free secondaries (up to 40–65 µm thick), sometimes forming small patches of secondary webbing. The occurrence of (pseudo)tertiaries (ca. 15 µm thick) is occasional. Fibres markedly laminated under differential interference contrast microscopy (DIC), forming irregular meshes up to 1 mm in largest diameter.

Spicules – Autochthonous spicules absent. There are many sequestered from the sediment, of varied morphology, and frequently broken.

Ecology – Both specimens collected on nearly vertical, hard substrate. The largest, from 19 m depth, bears many epibionts as related above.

Distribution – Only known from Punta Sal (03°57' S – Tumbes Region) and El Ñuro (04°13' S – Piura Region).

Remarks – There are only three valid species recognized in *Aplysinopsis*, up to now registered from Australia, Japan and Clipperton Island. The current one is the only record from the SE Pacific, quite possibly representing a new species.

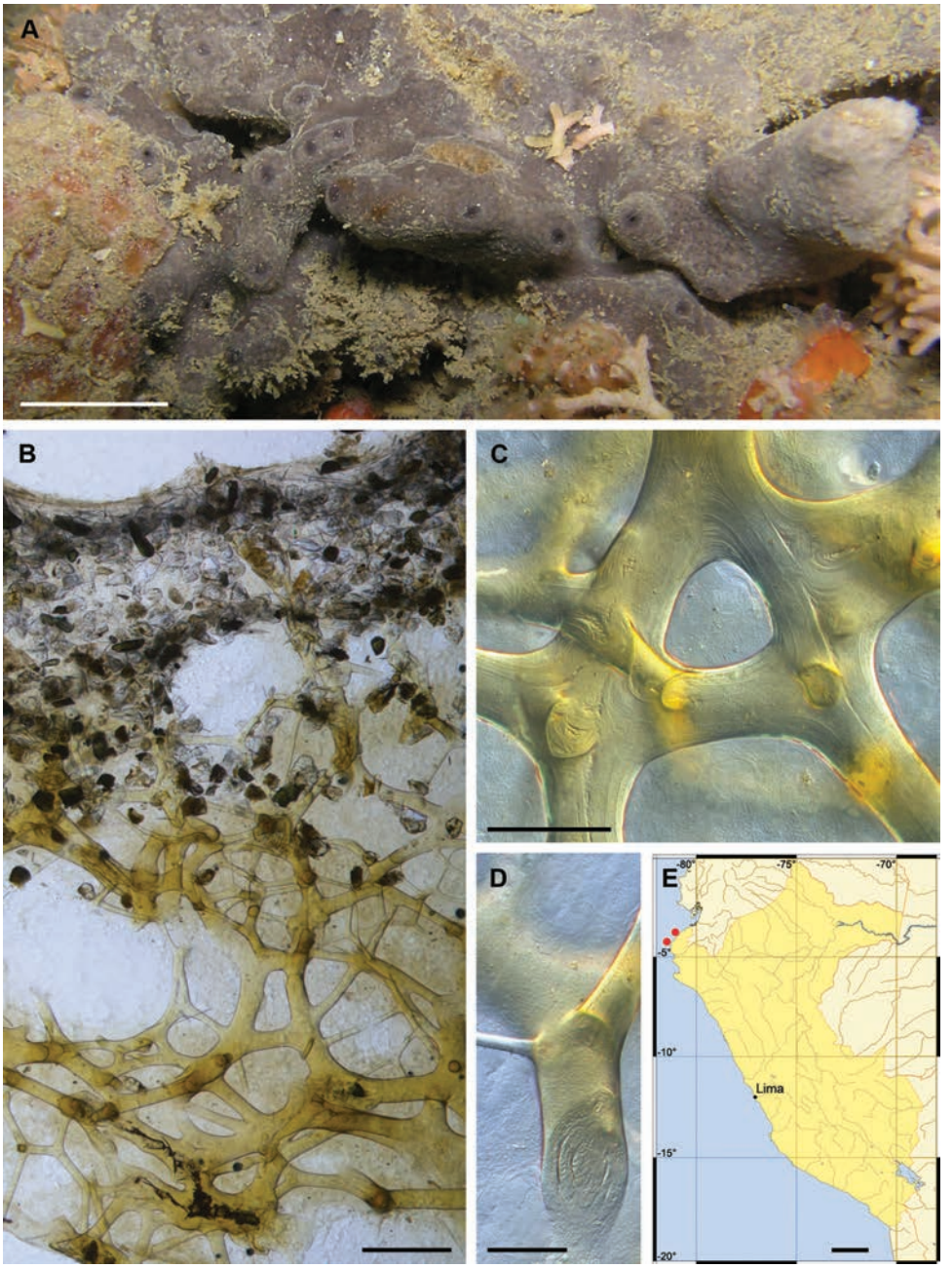


Fig. 51. *Aplysinopsis* sp. A, live specimen; B, architecture in transverse ground section; C, detail of B; D, sectioned fibre; E, distribution map. Scale bars: A, 2 cm; B, 500 µm; C, 200 µm; D, 100 µm; E, 200 km.

Dysidea cf. *ligneana* (Hyatt, 1877)

REFERENCE: Hyatt, 1877.

Description – Specimens are commonly cushion-shaped, but can be stouter, lobate, or encrusting. They are irregularly outlined and bear short mounds and lobes, a conulose surface. Oscula are small (1–3 mm), scattered over the entire surface, which bears a variously translucent and neatly reticulated membrane. Consistency softish and off white (light-grey, light beige) to grey colour in life, turning beige to brown in ethanol.

Skeleton – Ectosomal architecture unspecialized formed by the apical ends of stout, sinuous, primary, longitudinal, sediment cored choanosomal fibres that support the surface membrane. Secondary, transversal fibres, occur all over the choanosome, distributed at relatively regular intervals, also bearing embedded sediment, but in less abundance. Secondaries appear to increase in abundance closer to the substrate. Fibres are neatly laminated.

Spicules – Autochthonous spicules absent. There are many sequestered from the sediment, of varied morphology, and frequently broken.

Ecology – Specimens seemed to prefer rock substrate closer to the coarse sand substrate (2–24 m). The many specimens observed were covered with a red algae or a microbial mat, and one specimen was mobile, carried by a dromiid crab. Associations with seagrass, green- and brown-algae, encrusting sponges, anemonae (*Anthothoe chilensis*), bryozoans and polychaete-tubes were frequent.

Distribution – Abundant in Bahía Sechura (05°40' S – Piura Region) and Islas Lobos de Afuera (06°56' S – Lambayeque Region).

Remarks – *Dysidea ligneana* was described very briefly by Hyatt (1877), and an essential information to aid in its recognition is missing. What was its original colour in life? From Hyatt's description, points that do not precisely match the specimens observed here are the hard consistency, darker external part, and exceedingly dense skeleton with very small meshes. Anyhow, these differences ought to be considered carefully as a hard consistency may show up on dried specimens, the darker external part may be linked to certain types of substrates and not others, and the exceedingly dense skeleton needs absolute values before any meaningful comparison can be achieved. Thus, irrespective of *D*. *ligneana*'s type locality (Zorritos) falling quite close to our collecting grounds, we prefer to leave our identification inconclusive for now, pending re-examination of the holotype, and search for topo-typical specimens.

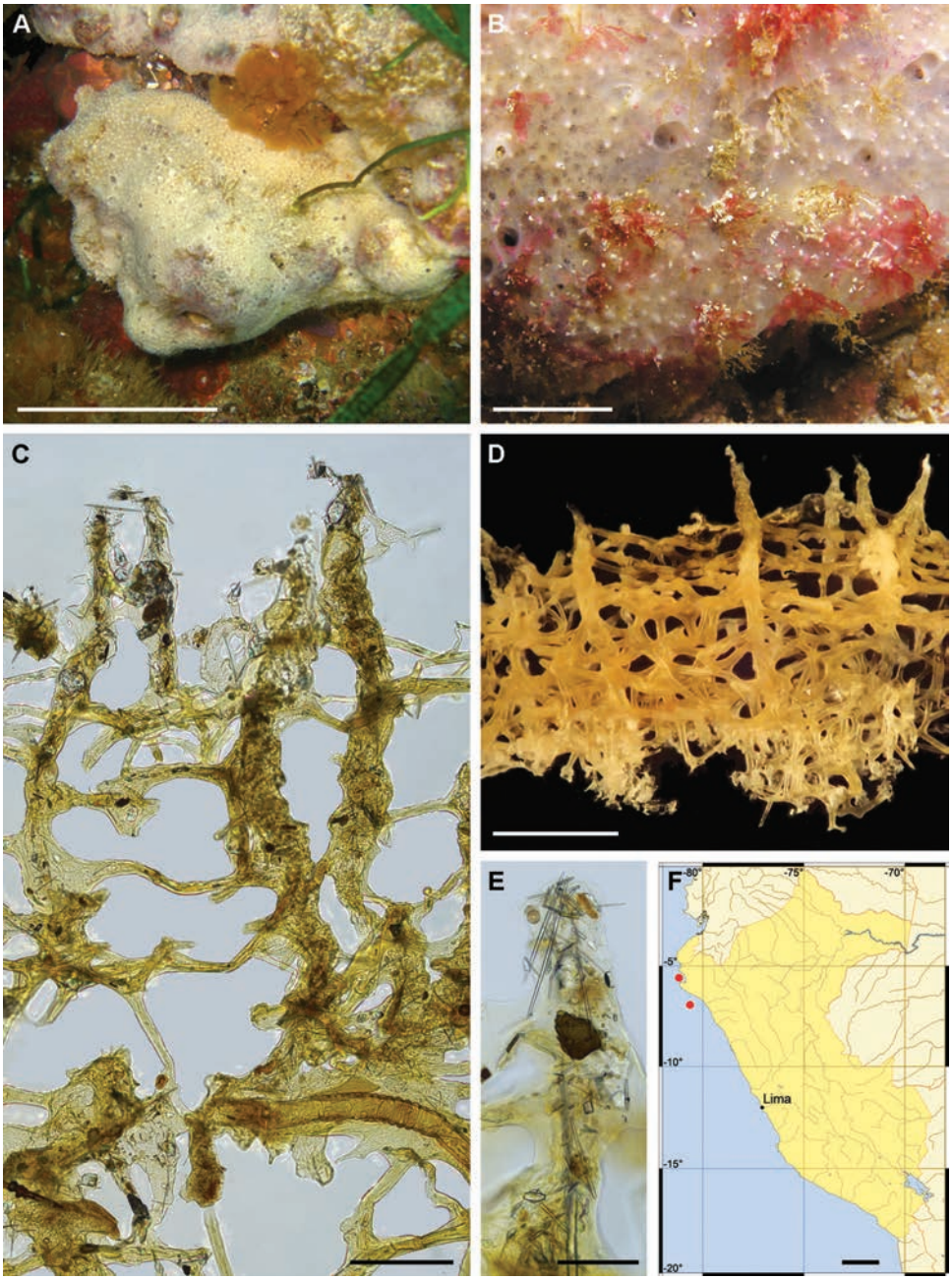


Fig. 52. *Dysidea* cf. *ligneana* (Hyatt, 1877). A–B, live specimen; C–E, architecture of the skeleton (after papain digestion of the cells); F, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 500 µm; D, 2 mm; E, 200 µm; F, 200 km.


Order Haplosclerida
Niphates ruthecitae

Identification key to Peruvian Haplosclerida

(1) Microscleres are sigmas and toxas ..... *Haliclona* (*Gellius*) *concreta* (p. 130)
Microscleres absent 2

(2) Oxeas do not exceed 95 µm,
yellow colour alive ..... *Haliclona* (*Reniera*) *parvuloxea* (p. 142)
Oxeas exceed 105 µm, other colours 3

(3) Presence of multispicular primary tracts 4
Absence of multispicular primary tracts 5

(4) Choanosomal skeleton very regular, with abundant
spongin enveloping the spicule tracts ..... *Niphates ruthecitae* (p. 150)
Choanosomal skeleton not very regular, with scarce spongin, neverenveloping
the spicule tracts ..... *Pachychalina lupusapia* (p. 152)

(5) Ectosomal skeleton specialized,
a dense, uni- to paucispicular, isotropic reticulation 6
Ectosomal skeleton unspecialized, absent 10

(6) Pink(ish) colour alive 7
Other colours alive 9

(7) Repent-ramose habit ..... *Haliclona* (*Halichoclona*) *marcoriosi* (p. 134)
Encrusting habit 8

(8) Oscula aligned in rows on ridges,
and oxeas 108–198 µm ..... *Haliclona* (*Halichoclona*) *multiosculata* (p. 136)
Oscula not aligned in rows on ridges,
and oxeas 87–135 µm ..... *Haliclona* (*Halichoclona*) *arequipaensis* (p. 132)

(9) White colour alive, with translucent surface,
and hastate oxeas ..... *Haliclona* (*Halichoclona*) *pellucida* (p. 140)
Beige colour alive, no translucent surface,
and acerate oxeas ..... *Haliclona* (*Halichoclona*) *paracas* (p. 138)

(10) Secondary lines only one spicules long 11
Secondary lines one and more than one spicules long 13

(11) Without projections,
purplish blue colour alive ..... *Haliclona* (*Rhizoniera*) *baslaviae* (p. 144)
Lobate projections, other colours 12

(12) Oscula apical, lateral or basal on the projections;
olive-green to yellow colour alive .. *Haliclona* (*Rhizoniera*) *manglarensis* (p. 146)
Oscula mostly flush with the surface;
light-brown colour alive ..... *Haliclona* (*Rhizoniera*) *zanabriai* (p. 148)

(13) Branches present, short, distal, bifurcating and anastomosing,
beige to pinkish beige colour alive ..... *Chalinula ramiculosa* (p. 128)
Branches absent,
beige to light yellow colour alive ..... *Chalinula chelysa* (p. 126)

Definitions of the subgenera of *Haliclona* found in Peru

***Haliclona* (*Gellius*)** – Chalinidae with a choanosomal skeleton consisting of a rather confused, subhalichondroid reticulation of pauci- to multispicular primary lines, irregularly connected by unispicular secondary lines. Ectosomal skeleton, if present, either a regular, tangential, unispicular, isotropic reticulation, or consisting of irregularly strewn, tangentially orientated spicules. Microscleres, if present, may be toxas, sigmas or raphides or a combination of these.

***Haliclona* (*Halichoclona*)** – Chalinidae with a choanosomal skeleton consisting of a subisotropic, somewhat confused reticulation, commonly intercepted by many choanosomal spaces. Ectosomal skeleton of the same structure as the choanosome, usually very loosely overlaying the choanosome, from which it may be separated by extensive subectosomal spaces. Spongin absent or very scarce, at the nodes of the spicules. Megascleres usually acerate or hastate oxeas. Microscleres, if present, microxeas or sigmas. Sponges commonly relatively crisp and brittle, only slightly compressible

***Haliclona* (*Reniera*)** – Chalinidae with a choanosomal skeleton consisting of a delicate, regular, unispicular, isotropic reticulation. Ectosomal skeleton, if present, also a tangential, unispicular, isotropic, very regular and continuous reticulation. Spongin always present at the nodes of the reticulation, but never abundant. Oxeas frequently blunt-pointed or strongylote. Microscleres, if present, toxas and sigmas. Sponges commonly soft and fragile.

***Haliclona* (*Rhizoniera*)** – Chalinidae with an anisotropic, ladder-like choanosomal skeleton consisting of uni- to multispicular primary lines, connected by irregular unispicular secondary lines. Ectosomal skeleton usually absent; if present, consisting only of some vaguely strewn tangentially oriented oxeas. Spongin moderate to absent. Megascleres usually slender oxeas with acerate points. No microscleres.

Chalinula chelysa Bispo, Willenz & Hajdu, 2022

REFERENCES: Thiele, 1905; de Laubenfels, 1954; Desqueyroux-Faúndez & Valentine, 2002; Bispo, Willenz & Hajdu, 2022.

Description – Small specimens, only a few centimetres wide, thinly encrusting, or more cushion-shaped, with occasional irregular lobate projections. Surface smooth, punctate. Oscula 1–2 mm wide, circular, mostly scattered, occasionally aligned on top of short irregular ridges, flush with the surface or on top of little bumps. Consistency soft. Colour in life beige to light-yellow, turning white to translucid in ethanol.

Skeleton – No specialized ectosomal skeleton. Choanosome with relatively regular anisotropic reticulation, with ascending, somewhat sinuously, primary uni-, to paucispicular tracts, 1–3 spicules thick, mostly orthogonally connected by unispicular secondary tracts, and 1–2 spicules long; overall construction quite loose, with large lacunae, up to 0.8 mm in diameter, and a few, likely younger spicules, scattered all around. There is a tendency of the skeleton to become isotropic in some areas. Spongin, if any, very scarce, nodal.

Spicules – Oxeas, fusiform, straight, or more frequently subtly bent at centre, sharp acerate points, 73–*129*–169 × 1.0–*5.5*–9.0 µm.

Ecology – Specimens were found on shallow (7–15 m deep) rocky substrates, or epibiont over mytillids; some occurred in a rich association with barnacles, brachiopods, ophiuroids, anemonae, crabs, polychaetes, mollusks and other sponges. The water temperature during collection ranged from 11° to 18° C.

Distribution – Known from Bahía Tortuga (09°22' S – Ancash Region), Ilo, (17°39' S – Moquegua Region), Matarani (16°50' S – Arequipa Region), Isla La Vieja and Isla Santa Rosa (14°17' S and 14°19' S – Ica Region).

Remarks – Only five species of *Chalinula* are registered along the Eastern Pacific. *Chalinula* ***ecbasis*** (digitate or ramose, colour brown, tan, purple, or lavender) from California, *C*. ***ignobilis*** (thickly encrusting, pinkish brown colour) from Punta Arenas (Chile), *C*. ***variabilis*** (ovate to finger-shaped, pale brown to greyish purple colour) from Punta Arenas and Juan Fernandez Archipelago (Chile), *C*. ***nematifera*** (vibrant purple colour with white threads standing out at the surface) from Isla Isabel and Cabo Pulmo (Mexico), and *C*. cf. ***molitba*** (lilac colour) from Galápagos (Ecuador). *Chalinula chelysa* (thinly encrusting, or more cushion-shaped, beige to light-yellow colour) differs from all of the above based on shape, colour and aspects of its skeletal architecture.

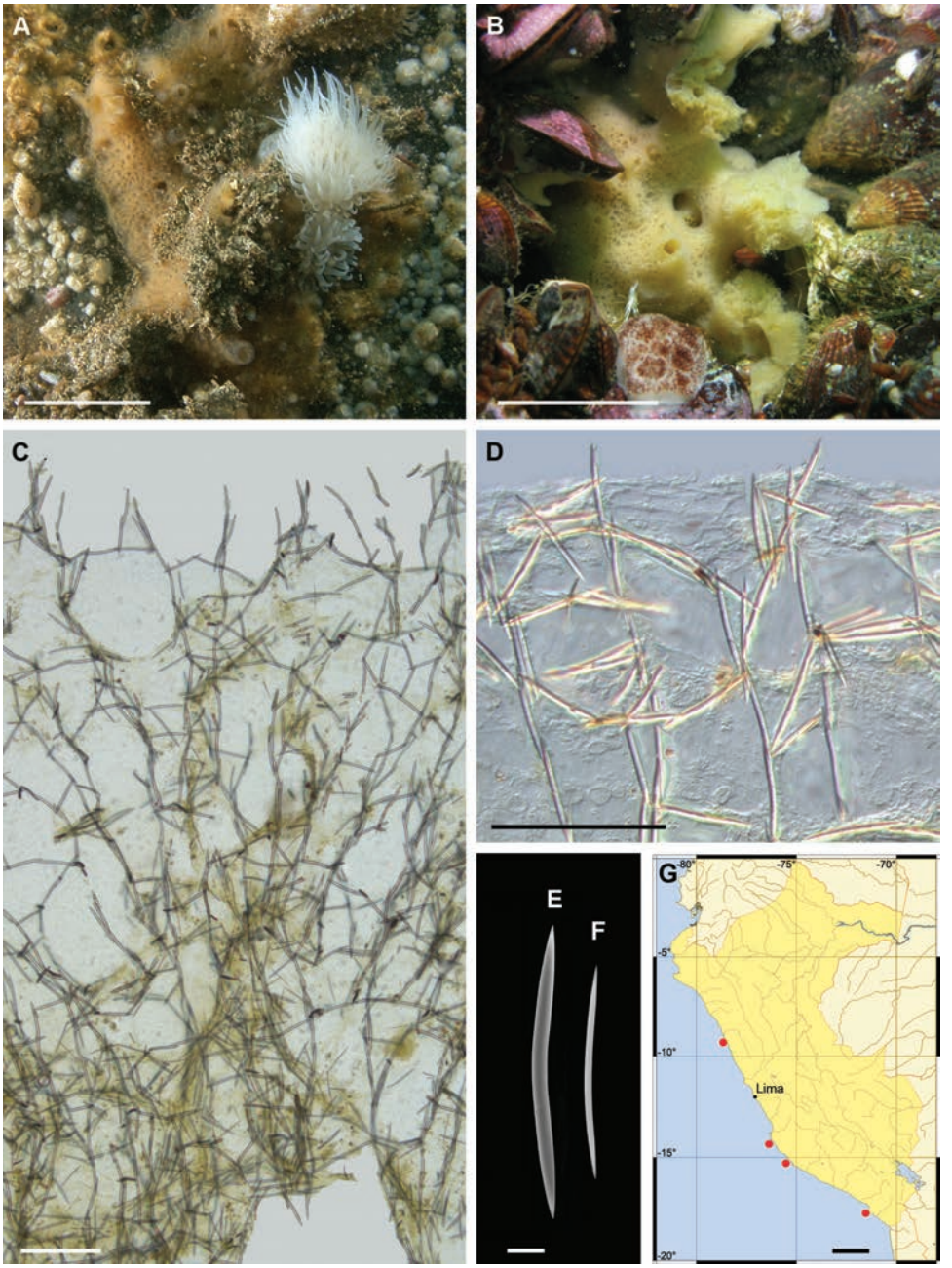


Fig. 53. *Chalinula chelysa* Bispo, Willenz & Hajdu, 2022. A–B, live specimens; C, skeleton architecture in transverse ground section; D, detail of C (DIC microscopy); E–F, oxeas; G, distribution map. Scale bars: A–B, 2 cm; C, 250 µm; D, 100 µm; E–F, 20 µm; G, 200 km.

Chalinula ramiculosa Bispo, Willenz & Hajdu, 2022

REFERENCES: de Laubenfels, 1932; Bispo, Willenz & Hajdu, 2022.

Description – Massive, irregularly outlined, or a dense mass of short, irregular, often bifurcating or anastomosing branches widening apically. Specimens reaching 15 cm in largest diameter, and 5 cm in thickness. Surface smooth, albeit somewhat irregular, with tangential, longitudinal subectosomal strands, and a slight reticulation, both visible upon zooming in on underwater images taken *in situ*. Oscula 0.8–4 mm diam., common, circular, mostly located at the base of branches, slightly elevated on short volcaniform projections. Consistency soft, compressible. Colour in life beige, darkening to purplish-brown after exposure to the air, turning light beige in ethanol.

Skeleton – No specialized ectosomal skeleton, but loose, even abundant tangential oxeas may be spread at the surface. Choanosomal architecture a confused unispicular, isotropic reticulation, with only seldom recognizable loose primary tracts and even fewer connecting lines, two spicules long. Spongin very scarce, only at the nodes of the reticulation.

Spicules – Oxeas, fusiform, straight, or more frequently subtly bent at centre, sharp acerate points, 81–*123*–150 × 1.3–*5.5*–9.0 µm.

Ecology – Attached to rock, or epibiontic on bivalves or *Codyum*-like algae in the very shallow subtidal (3–7 m depth). The mass of sponge and algae branches houses ophiuroids and crabs, and can be markedly overlaid by fine sediment.

Distribution – Only known from Paracas and Isla La Vieja (13°49' S and 14°16' S – Ica Region).

Remarks – The main pattern observed in *C*. *ramiculosa* skeleton is a unispicular, isotropic reticulation, almost without primary and secondary lines. However, there are some areas where an anisotropic reticulation is apparent, with secondary lines more than one spicule long, bringing the new species close to *Chalinula*. Such a variation in the skeleton is present in several species of this genus. The only additional *Chalinula* in the Peruvian coast is *C*. ***chelysa***. However, the massive shape and the presence of abundant, small, irregularly-anastomosed branches in *C*. *ramiculosa* set both species apart. Another Eastern Pacific Chalinidae resembling somehow the habit of *C*. *ramiculosa* is the Californian *Haliclona* (*Rhizoniera*) ***enamela***. Even so, both are readily distinguished based on the mainly isotropic and unispicular skeleton with scarce spongin of *C*. *ramiculosa*, in contrast to the stout reticulation of multispicular primary lines cored by 6–8 spicules, and spongin rich architecture of *H*. (*Rh*.) *enamela*.

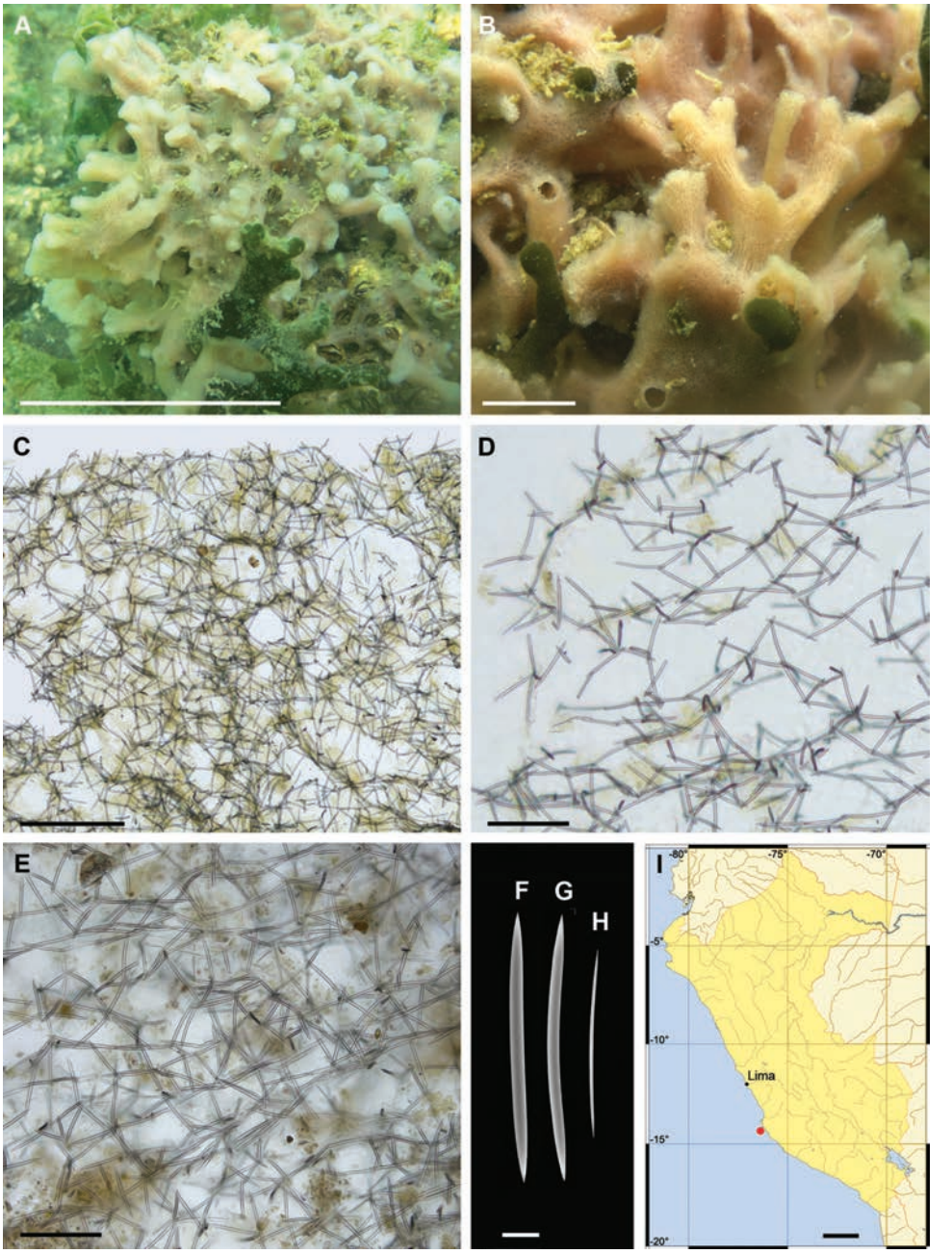


Fig. 54. *Chalinula ramiculosa* Bispo, Willenz & Hajdu, 2022. A–B, live specimens; C, skeleton architecture in transverse ground section; D, detail of C (sponge surface on the left); E, ectosomal skeleton architecture in tangential ground section; F–H, oxeas; I, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 500 µm; D–E, 200 µm; F–H, 20 µm; I, 200 km.

Haliclona (*Gellius*) *concreta* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Encrusting sponge, up to 7 mm thick, up to 20 cm wide. Surface optically smooth, commonly covered by small patches of turf. Oscula, circular to oval, 1–6 mm wide, flush with the surface, or at the top of small elevations or tubular projections, 6–8 mm high. Consistency hard, firm, just slightly compressible. Colour alive greyish lilac, turning dirty white in ethanol.

Skeleton – No specialized ectosomal skeleton. Choanosome a confused isotropic reticulation, becoming denser towards its inner parts. Spongin scarce

Spicules – Megascleres. **Oxeas**, mostly slightly curved, sharp acerate points, some modified to styles, 190–*257*–324 × 2.9–*10*.9–15.2 µm. **Microscleres**. **Toxas**, rare, in a single category with a rather variable degree of shaft curvature, with recurved apices, 19–*41*–73 × 0.2–*1.4*–2.9 µm. **Sigmas**, variable in abundance, in a single category, C-shaped, few with straight shaft, 5.4–*7.6*–9.2 × 0.4–*0.7*–1.0 µm.

Ecology – Occurring on rocky substrate in the shallow subtidal, from 5–8 m deep.

Distribution – Known from Bahía de Sechura (05°36' S – Piura Region), Islas Lobos de Afuera (06°55' S – Lambayeque Region), Islas Macabi (07°48' S – La Libertad Region) and Isla Tortuga (09°22' S – Ancash Region).

Remarks – The single haplosclerid species in the Eastern Pacific with a similar spicular complement of oxeas, sigmas and toxas is *Oceanapia* ***microtoxa*** from the Galápagos. Nevertheless, both genera differ markedly in sponge habit and skeletal construction, and the Ecuadorean species has much larger oxeas and sigmas in three categories. Three additional *Haliclona* (*Gellius*) spp. are known to occur in the Eastern Pacific, *H*. (*G*.) ***laubenfelsi*** from Hawaii and Clipperton Island; *H*. (*G*.) ***perforata*** from Panama; and *H*. (*G*.) ***textapatina*** from California. The Peruvian species is easily distinguished from all by clearcut spicule categories and dimensions, such as the much larger oxeas of *H*. (*G*.) *laubenfelsi*, the larger sigmas of *H*. (*G*.) *perforata* and *H*. (*G*.) *textapatina*, and the latter two species' lack of toxas. *Haliclona* (*Gellius*) ***tenerrima*** from the Tropical Western Atlantic, is a seemingly closely-related species, presenting a greyish colour, oxeas, sigmas and toxas of similar shape and within the same size range. Besides the conflicting biogeography, both species can be differentiated by the conspicuousness, larger dimensions, hard consistency and easily seen oscula of the Peruvian species.

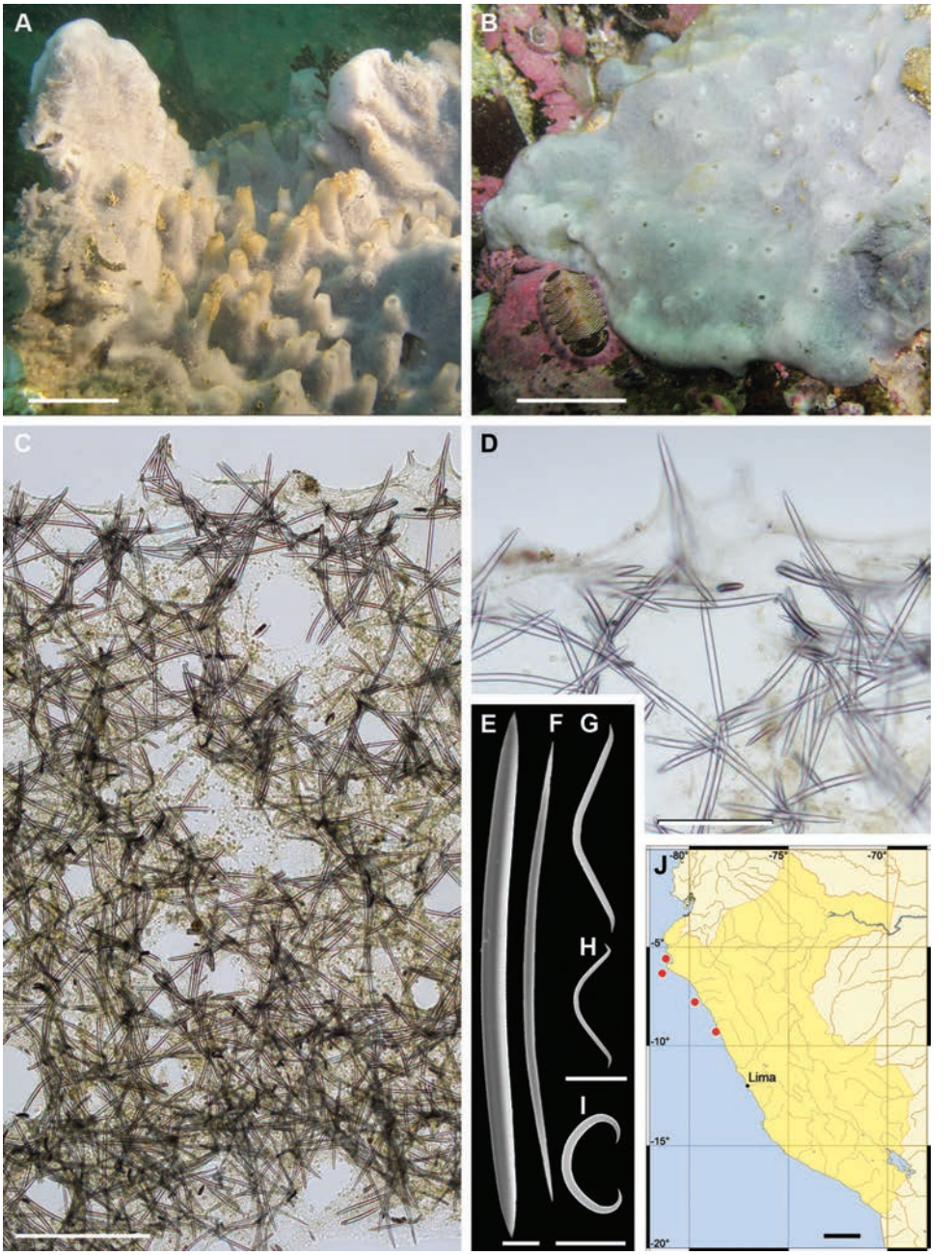


Fig. 55. *Haliclona* (*Gellius*) *concreta* Bispo, Willenz & Hajdu, 2022. A–B, live specimen; C–D, skeleton architecture in transversal ground section; E–F, oxeas; G–H, toxas; I, sigma; J, distribution map. Scale bars: A–B, 2 cm; C, 500 µm; D, 200 µm; E–H, 20 µm; I, 5 µm; J, 200 km.

Haliclona (*Halichoclona*) *arequipaensis* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Thickly crustose, up to 5 mm thick, over 30 cm in largest diameter, forming erect, lamellate or crest-like projections up to 60 mm high × 20 mm wide × 5 mm thick. Surface regularly smooth to the naked eye, minutely reticulated upon closer inspection. Oscula, 1–2 mm in diameter, spread all over the sponge surface, apical on abundant, 1 mm high volcaniform bumps. Consistency resilient, flexible. Colour in life dull pink, turning pale beige in ethanol.

Skeleton – Ectosome a dense, slightly confused, tangential isotropic reticulation. Choanosome a dense, uni- to multispicular isotropic reticulation, with 2–10 oxeas by knot, pierced here and there by subectosomal and choanosomal spaces, up to 900 µm in diameter. Tracts nearly totally absent, the few seen were loose, paucispicular, parallel to the surface, albeit deep in the choanosome. Spongin scarce, only observed at the nodes of the reticulation.

Spicules – Oxeas, fusiform, straight, or more frequently subtly bent at centre, sharp acerate points. Holotype, 123–*161*.*3*–198 × 2.4–*7*.*1*–12.6 µm. Paratype, 108–*147*.*2*–178 × 2.2–*7*.*3*–11.9 µm.

Ecology – Specimens collected from erect rocky substrate; co-occurring with limpets, shrimps, anemones, additional sponges (including *Niphates ruthecitae*), and large sea stars. Several crabs (hermit crabs and others) were observed on the surface of *H*. (*Halich*.) *arequipaensis*. The paratype carried a thin brown (turf?) mat in parts of its surface. Recorded depth 4 to 15 m.

Distribution – Only known from areas close to Matarani and Mollendo (16°52' S and 17°01' S – Arequipa Region).

Remarks – Seven additional *Haliclona* spp. occur along the Eastern Pacific that approach *H*. (*Halich*.) *arequipaensis* the most regarding its shape and/or skeletal architecture, namely *H*. (*Halich*.) ***gellindra***, from California; *H*. (*Re*.) ***algicola*** and *H*. (*Halich*.) ***thielei***, from Chile; *H*. (*Halicl*.) ***dianae*** from Galápagos; *H*. (*Halich*.) ***paracas***, from Peru; and *H*. ***agglutinata*** and *H*. ***rapanui***, from Easter Island, the latter two not assigned to a subgenus yet. Among the above, *H*. *gellindra* with its encrusting shape, punctate surface, confused subisotropic skeleton, and pale lavender colour in life is the most similar to *H*. *arequipaensis*, despite its quite smaller oxeas (105–122 µm). Further distinction between both stems from its few and irregular oscula with raised collars, and on biogeographic grounds, from its distribution restricted to California and the Gulf of California, which are separated from the southern Peruvian coast by the warmer waters of the Tropical Eastern Pacific. The other six species clearly differ from *H*. *arequipaensis* in their shape, surface structure, thickness, colour, as well as details in their skeleton organization and oxeas' sizes.

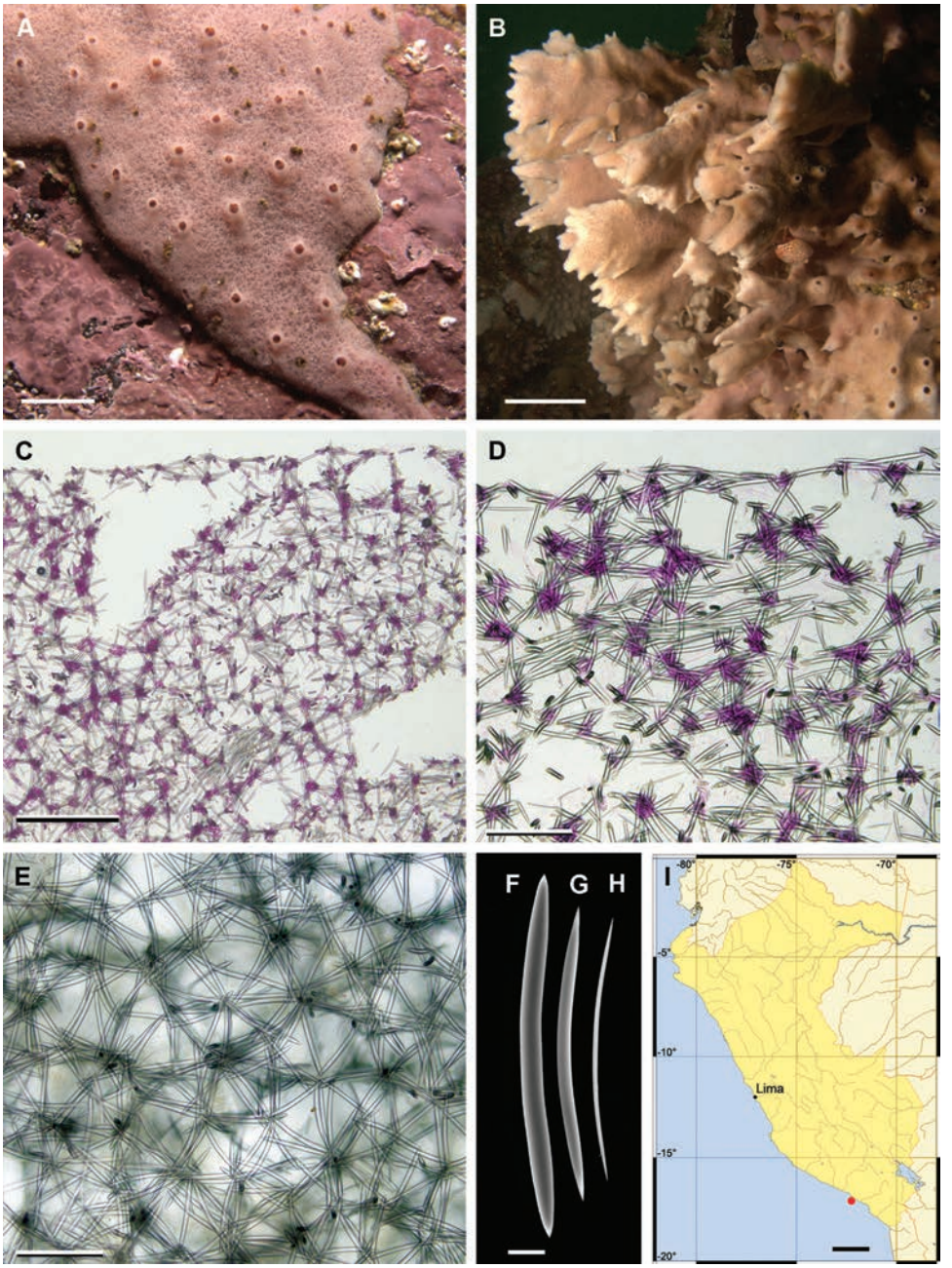


Fig. 56. *Haliclona* (*Halichoclona*) *arequipaensis* Bispo, Willenz & Hajdu, 2022. A–B, live specimens; C–D, skeleton architecture in transversal ground section; E, ectosomal skeleton architecture in tangential ground section stained with acid fuchsine; F–H, oxeas; I, distribution map. Scale bars: A, 1 cm; B, 2 cm; C, 500 µm; D–E, 200 µm; F–H, 20 µm; I, 200 km.

Haliclona (*Halichoclona*) *marcoriosi* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Sponge mainly repent-ramose, irregular, with abundant tubular or lobate projections of varied sections (from nearly circular to variously elliptic, 10–50 mm high), mostly not isodiametric (4–14 mm wide), bearing oscula on their sides, or more frequently apically, which are usually surrounded by a thin membrane (2–7 mm high). Occasional blind fistules/thorns present, especially close to the oscula. Surface smooth, even, punctate. Oscula circular to oval, 1–9 mm wide. Consistency firm, but brittle and fragile. Colour alive predominantly pink, but whitish and yellowish parts also occur, fading away in ethanol to an off-white to beige overall colouration.

Skeleton – Ectosome a dense and confused isotropic skeleton. Choanosome a unispicular isotropic reticulation more regular than the ectosome, though still dense, creating triangular meshes, but also with many spicules in confusion, and presence of spaces (221–866 µm in diameter); some poorly defined paucispicular tracts also observed, but without a clear orientation. Spongin scarce, barely observable at the nodes of the reticulation.

Spicules – Oxeas, acerate, most slightly curved, some straight, 97–*137*–164 × 1.6–*5.7*–9.0 µm.

Ecology – Found on rocky substrate, growing alone or interwoven with other benthic invertebrates, such as calcareous bryozoans or octocorals. Depth ranging from 10 to 17 m.

Distribution – Only known from Cancas and Punta Sal (Tumbes Region 03°56' S and 03°57' S).

Remarks – *Haliclona* (*Halichoclona*) *marcoriosi* is quite distinct from its eight congeners in the Eastern Pacific. A few approach it in terms of live-colour, namely: *H*. ***agglutinata***, from Easter Island; *H*. (*Reniera*) ***caduca***, from the Los Lagos Region in Chile; *H*. (*Haliclona*) ***clairae*** and *H*. (*Soestella*) ***roslynae***, from Galápagos. They differ, however, by their shape, skeleton architecture and oxeas size.

There are then a few more erect species, thus approaching *H*. (*Halich*.) *marcoriosi* in terms of habit. These include the ramose *H*. (*Halicl*.) ***ambrosia***, from the Gulf of California, but this one does not develop tubular projections and has oxeas in two categories that can reach considerably larger dimensions. Two other tubular species are classified in *H*. (*Soestella*) instead, which translates in rather distinct skeletal architecture. These are *H*. (*S*.) ***auletta*** and *H*. (*S*.) ***chilensis***, from the Los Lagos Region in Chile, which are further distinguished by the hastate oxeas of *H*. *auletta* and the blunt-pointed ones of *H*. *chilensis*. In turn, *H*. (*Halicl*.) ***spinosella***, from the Strait of Magellan, is another tubular species, but with a surface much more irregular and verrucose than observed in *H*. (*Halich*.) *marcoriosi*.

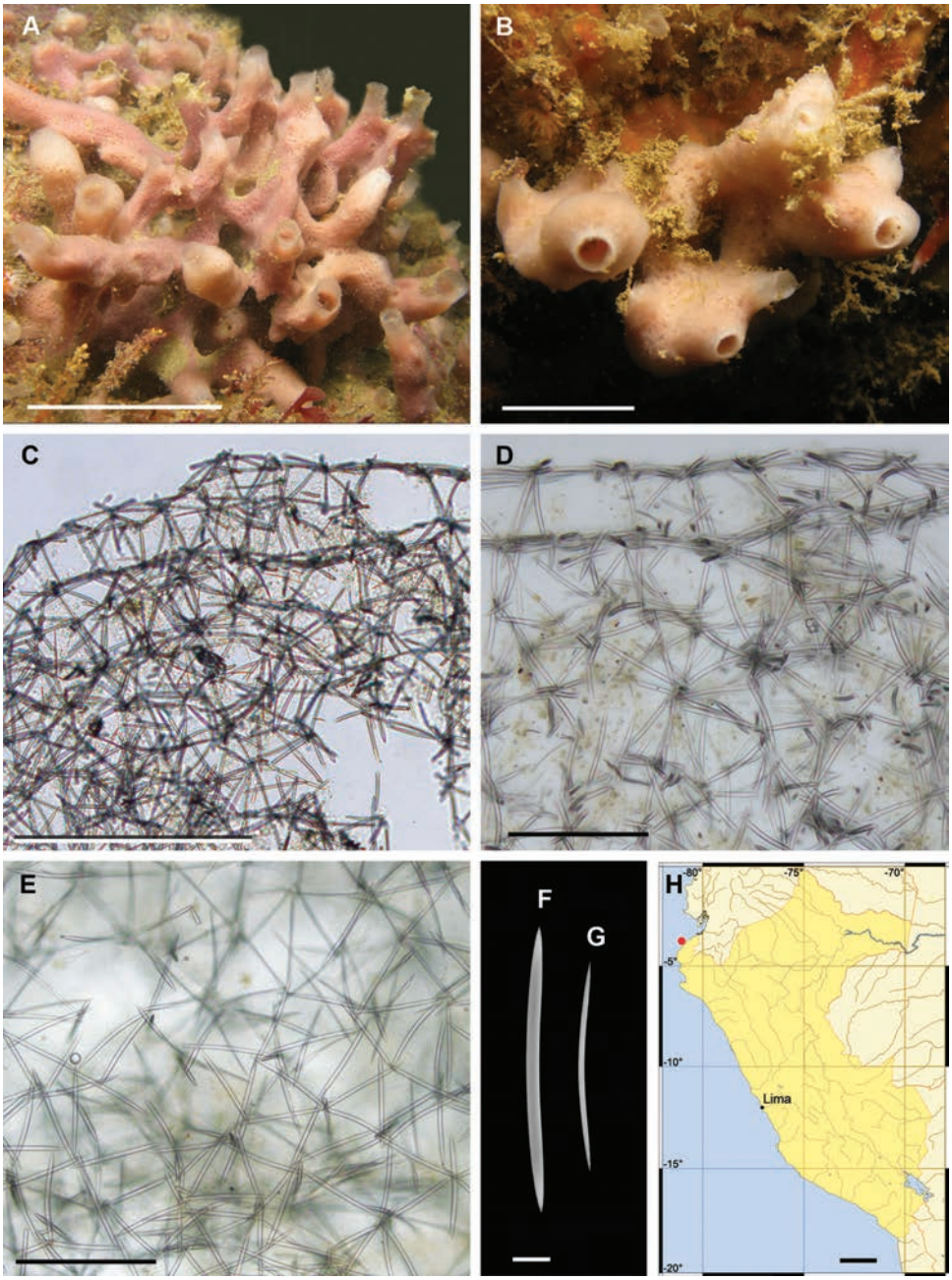


Fig. 57. *Haliclona* (*Halichoclona*) *marcoriosi* Bispo, Willenz & Hajdu, 2022. A–B, live specimens; C–D, skeleton architecture in transversal ground section; E, ectosomal skeleton architecture in tangential section; F–G, oxeas; H, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 500 µm; D–E, 200 µm; F–G, 20 µm; H, 200 km.

Haliclona (*Halichoclona*) *multiosculata* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Encrusting, up to ca. 6 mm thick, covering large areas up to 15 × 20 cm. Surface rough. Oscula abundant, circular, ca. 1–4 mm wide, frequently aligned in rows on ridges. Consistency firm. Colour in life light pink, turning light beige in ethanol.

Skeleton – Ectosome a dense isotropic reticulation, with some discernible triangular to squared meshes, slightly confused. Choanosome of the same structure as the ectosome, but denser. Spongin scarce, only found at the nodes of the reticulation.

Spicules – Oxeas, slender, subtly bent at centre, sharp hastate points, 87–*116*–135 × 1.9–*6.2*–8.7 µm.

Ecology – Found on rocky substrate around 15 m depth, associated with many ophiuroids.

Distribution – Only known from Isla Foca (05°12' S – Piura Region).

Remarks – There are no clear relatives of *H*. (*Halich*.) *multiosculata* in the Eastern Pacific. *Haliclona* ***agglutinata*** appears most similar with colour alive off-white with pinkish areas, a choanosomal skeleton of comparable architecture, and oxeas within a similar size range (102–140 µm). Nevertheless, *H*. (*Halich*.) *multiosculata* is much thinner than *H*. *agglutinata*, has oscula commonly aligned on ridges, and skeleton without paucispicular tracts. Other comparable Eastern Pacific *Haliclona* spp. include three *H*. (*Halichoclona*) spp., i.e. *H*. (*Halich*.) ***conica***, *H*. (*Halich*.) ***gellindra***, and *H*. (*Halich*.) ***thielei***; and one species classified in a distinct subgenus, *H*. (*Reniera*) ***sordida***. *Haliclona* (*Halich*.) ***conica*** has a thicker, conical habit and oxeas that can reach 165 µm. The other two *H*. (*Halichoclona*) spp. have distinct colour in life, and oscula that are fewer and smaller, or differently organized. In addition, *H*. (*Halich*.) *gellindra* can also be distinguished by its fragile consistency. Finally, *H*. (*Re*.) *sordida*, besides a skeletal architecture with loose ascending tracts, is further differentiated by its smaller oscula and larger oxeas.

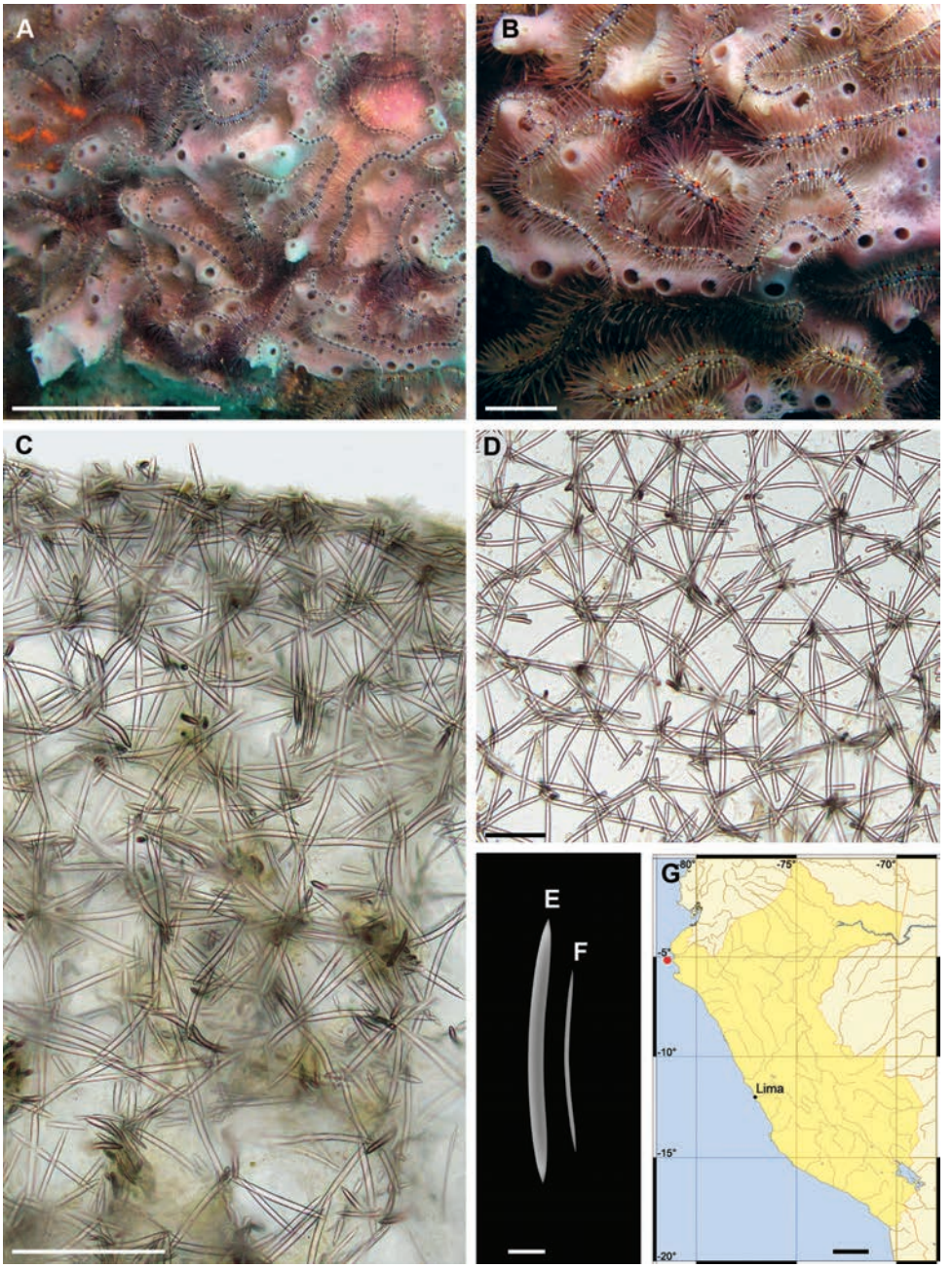


Fig. 58. *Haliclona* (*Halichoclona*) *multiosculata* Bispo, Willenz & Hajdu, 2022. A–B, live specimen; C, skeleton architecture in transverse ground section; D, skeleton in tangential paraffin embedded section; E–F, oxeas; G, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 200 µm; D, 100 µm; E–F, 20 µm; G, 200 km.

Haliclona (*Halichoclona*) *paracas* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Thinly encrusting, ca. 1–3 mm thick, occupying an area of ca. 6.0 × 3.5 cm. Surface smooth, punctate, with small volcaniform projections, 1.0–1.6 mm high, topped by an oscule. Oscula common, circular, 0.8–1.2 mm wide. Consistency firm, but compressible. Colour alive beige, colour in ethanol yellowish cream.

Skeleton – Ectosomal skeleton a dense, uni- to paucispicular, isotropic reticulation, slightly confused, but with some discernible triangular to squared meshes. Choanosome of the same structure as the ectosome, albeit there are some subectosomal and choanosomal spaces, 600–1500 µm. Spongin scarce, only observed at the nodes of the reticulation.

Spicules – Oxeas, slightly curved, acerate, 157–*187*–211 × 5.1–*10.2*–12.8 µm.

Ecology – Found on rocks at 8 m depth, together with other sponges and sea anemones.

Distribution – Only known from Isla Santa Rosa (14°19' S – Ica Region).

Remarks – Eastern Pacific *Haliclona* spp. with encrusting shape and/or colour similar to *H*. (*Halich*.) *paracas* include 13 species. Only two of these are classified in the same subgenus, namely *H*. (*Halich*.) ***gellindra*** from California, and *H*. (*Halich*.) ***thielei*** from Chile**,** thus further sharing anatomic traits with *H*. (*Halich*.) *paracas*. The Californian species appears indeed quite close, differing by its pale-lavender colour and rare, irregular oscula; while the Chilean species has much smaller oxeas. Since the skeletal architecture of *H*. (*Halich*.) *paracas* approaches at parts the *Reniera* condition, it is important to remark upon another four species, the Chilean *H*. (*Re*.) ***algicola***, *H*. (*Re*.) ***sordida*** and *H*. (*Re*.) ***topsenti***, and the Galapagosean *H*. (*Re*.) ***oberi***. The first of these has light-grey colour and a much more irregular and looser reticulation. The next, grey-brown colour, verrucose surface and ascending paucispicular tracts in the choanosome. The other two are more easily differentiated by the quite smaller dimensions of their oxeas.

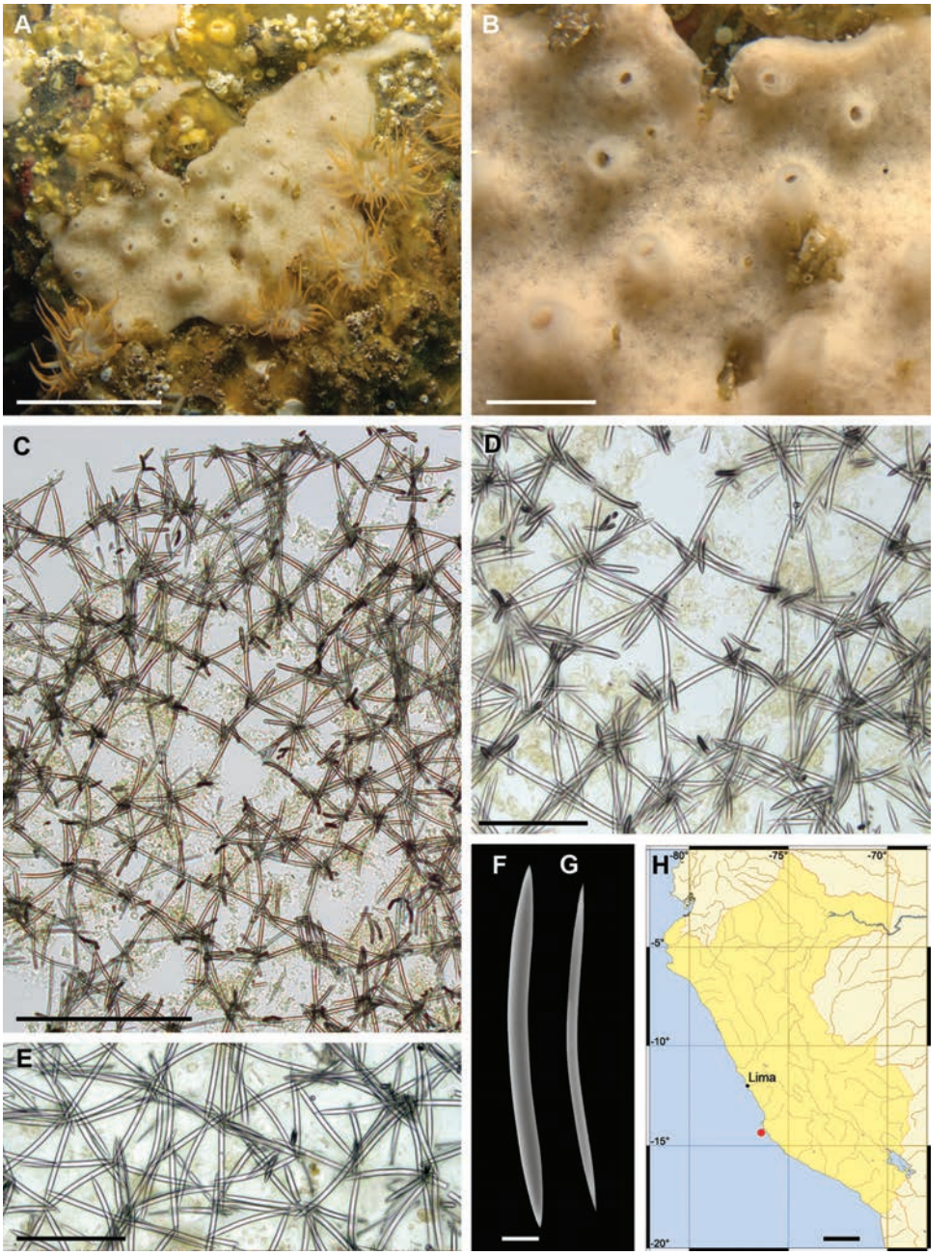


Fig. 59. *Haliclona* (*Halichoclona*) *paracas* Bispo, Willenz & Hajdu, 2022. A–B, live specimen; C–D, skeleton architecture in transverse ground section; E, ectosomal skeleton architecture in tangential section; F–G, oxeas; H, distribution map. Scale bars: A, 2 cm; B, 0.5 cm; C, 500 µm; D–E, 200 µm; F–G, 20 µm; H, 200 km.

Haliclona (*Halichoclona*) *pellucida* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Thickly encrusting to cushion-shaped, ca. 7 mm thick, spreading laterally to cover an area larger than 20 × 7 cm. Surface smooth, but uneven, just slightly punctate, translucent. Oscula common, circular, 1–3 mm wide, just slightly elevated or at the top of small volcaniform projections, up to 5 mm high. Consistency firm, nearly incompressible. Colour alive is white, with a translucent surface that gives to the sponge an icy aspect. Icy transparent in ethanol.

Skeleton – Ectosomal skeleton a dense isotropic reticulation, with some ill-defined paucispicular tracts without a clear orientation. Choanosomal skeleton a dense and confused isotropic reticulation with occasional ill-defined paucispicular (1–4 spicules) tracts perpendicular to the surface. In some parts, the skeleton becomes a regular isodictyal reticulation, of uni- to bispicular triangular to squared meshes, Choanosomal spaces are common, especially closer to the surface, 284–756 µm wide. Spongin at the nodes of the reticulation

Spicules – Oxeas, hastate, mostly curved, 129–*161*–184 µm × 3.0–*7.5*–12 µm.

Ecology – Found on rocky substrate, underneath an overhang at about 11 m depth, co-occurring with shrimps and other sponges.

Distribution – Only known from Matarani (16°50' S – Arequipa Region).

Remarks – Two species that are similar to *H*. (*Halich*.) *pellucida* in shape and colour are the Easter Island endemics *H*. ***rapanui*** and *H*. ***translucida***. The former is close to *H*. (*Halich*.) *pellucida* in face of its thickly encrusting habit, small oscula and similar sized oxeas. However, the two species differ in aspects of their surface, anatomy and more varied spicule morphology in *H*. *rapanui*. *Haliclona translucida* appraoches the new species in colour alive, habit, oscula diameter, and reticulated architecture with no spicule tracts. However, the latter and *H*. (*Halich*.) *pellucida* have non-overlapping dimensions of oxeas.

Haliclona (*Halich*.) *pellucida* is similarly close to *H*. (*Halich*.) ***arequipaensis***, *H*. (*Halich*.) ***paracas***, *H*. (*Re*.) ***algicola***, and *H*. (*Soestella*) ***spuma*** given their habit (overall similar shape, and somewhat similar colouration). The last two are classified in distinct subgenera, which translates in distinct skeletal architectures. The first two, however close in overall skeletal structure, have a punctate surface, which is not distinctly translucent as observed in *H*. (*Halich*.) *pellucida*, as well as more frequently acerate, instead of more frequently hastate oxeas as seen in the species illustrated here.

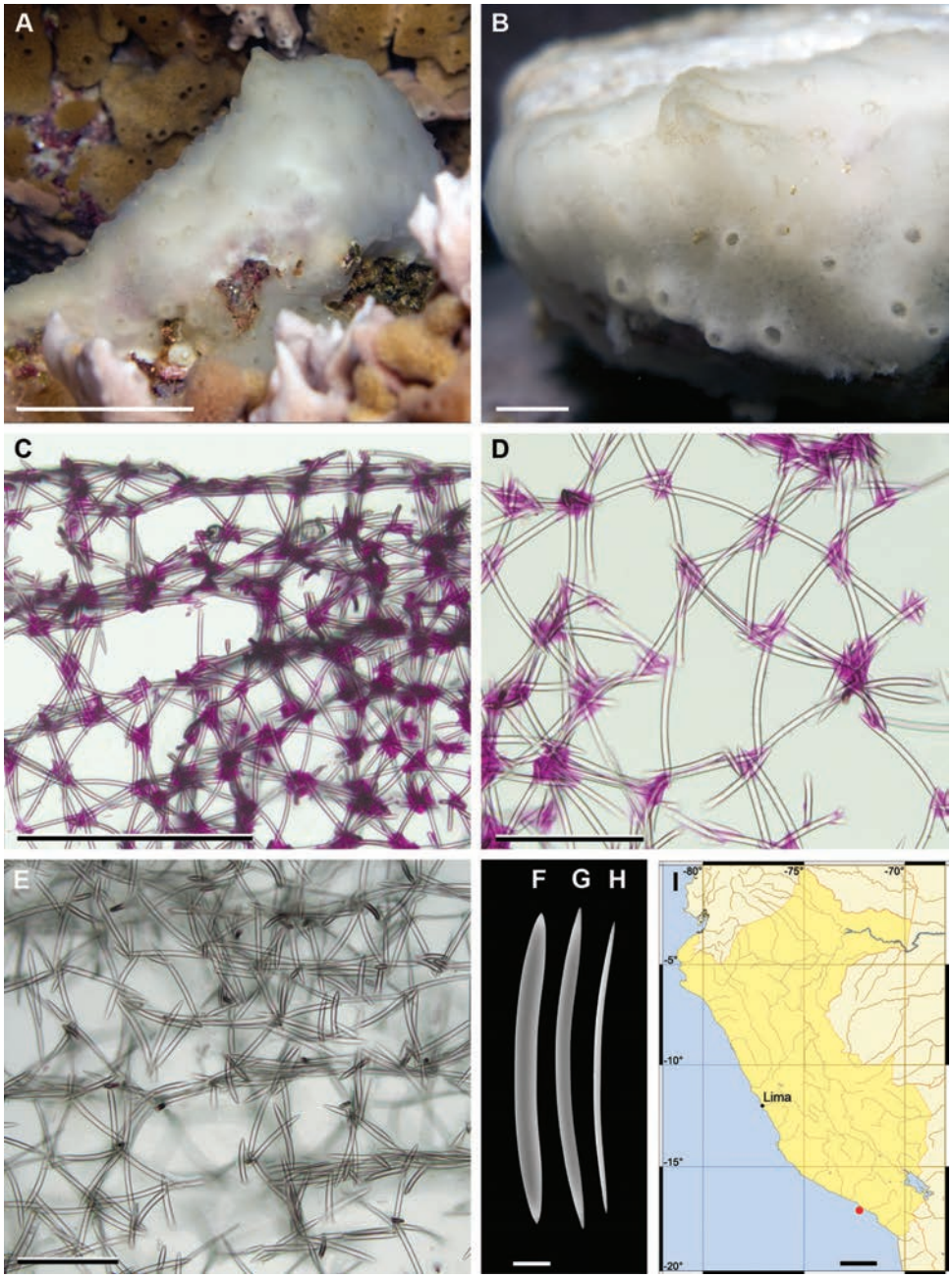


Fig. 60. *Haliclona* (*Halichoclona*) *pellucida* Bispo, Willenz & Hajdu, 2022. A–B, specimen alive; C–D, skeleton architecture in transverse ground section (stained with acid fuchsin); E, ectosomal skeleton architecture in tangential section (unstained); F–H, oxeas; I, distribution map. Scale bars: A, 5 cm; B, 2 cm; C, 500 µm; D–E, 200 µm; F–H, 20 µm; I, 200 km.

Haliclona (*Reniera*) *parvuloxea* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Encrusting, with abundant, short, up to 5 mm high, cylindrical or irregular, frequently bifurcate, lobate projections; several blind fistules present; often with small, circular, apical oscula, 0.4–1.3 mm in diameter. Surface smooth, shiny out of water. Consistency soft. Colour in life yellow, turning dark brown to black in ethanol.

Skeleton – Ectosome an isodictyal to isotropic, unispicular reticulation. Choanosome an isotropic, unispicular reticulation, more regular in some parts, isodictyal; in others somewhat disorganized. Mesohyl heavily pigmented, rendering a brownish colour that even hampers skeleton observation. Spongin scarce, at the nodes of the reticulation when present.

Spicules – Oxeas, slender, subtly bent at centre, short acerate points, 62–*80*–91 × 1.0–*2.5*–4.0 µm.

Ecology – Intertidal, epibiotic over unidentified mangrove tree roots.

Distribution – Only known from Punta Capones, Mangroves of Tumbes (03°24' S – Tumbes Region).

Remarks – Little is known of the sponge biodiversity in mangroves along the Tropical Eastern Pacific. Unsurprisingly, so far this is the only yellow *Haliclona* with small oxeas from mangrove habitats in the Tropical Eastern Pacific. Other congeners from the tropical sector of the Peruvian coast include *H*. (*Halich*.) ***marcoriosi*** and *H*. (*Halich*.) ***multiosculata***, but dissimilarities in colour, shape, skeletal architecture, spicule dimensions and habitat clearly differentiate these species from *H*. (*Re*.) *parvuloxea*. Comparison with *H*. (*Rhizoniera*) ***manglarensis***, also occurring in the Tumbes mangrove, is made in the remarks section of that species. Yellowish-coloured *Haliclona* spp. in the Eastern or Central Pacific are the Chilean *H*. (*Rh*.) ***anceps***, *H*. (*S*.) ***auletta***, *H*. (*Halicl*.) ***macropora***, *H*. ***siphonella***, *H*. (*Halicl*.) ***spinosella*** and *H*. ***translucida***; and the Hawaiian *H*. (*Halich*.) ***mokuoloea***. All these are readily distinguished from *H*. (*Re*.) *parvuloxea* due to the smaller-sized oxeas of the latter, 62–91 µm long, in addition to several differences in the habit and skeletal architecture of these species.

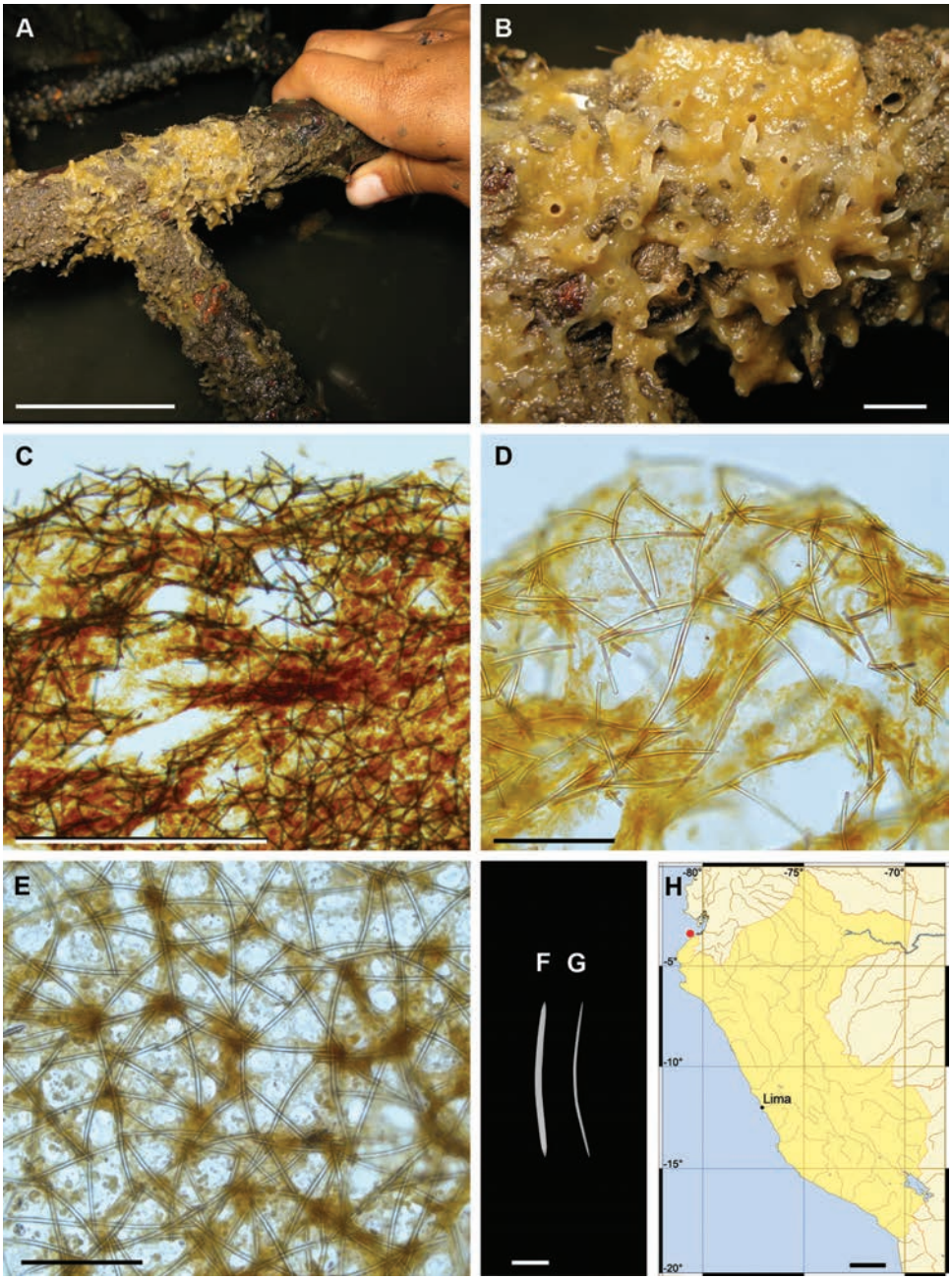


Fig. 61. *Haliclona* (*Reniera*) *parvuloxea* Bispo, Willenz & Hajdu, 2022. A–B, specimen above water on a mangrove root; C–D, skeleton architecture in transverse ground section (unstained); E, ectosomal skeleton architecture in tangential ground section; F–G, oxeas; H, distribution map. Scale bars: A, 5 cm; B, 2 cm; C, 500 µm; D–E, 100 µm; F–G, 20 µm; H, 200 km.

Haliclona (*Rhizoniera*) *baslaviae* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Small specimen, ca. 3 cm in largest diameter, thickly encrusting on an empty limpet shell. Surface smooth. Oscula rare, circular, 1 mm in diameter. Consistency soft. Colour purplish blue in life, turning light beige in ethanol.

Skeleton – Ectosome not specialized. Choanosome an irregular anisotropic reticulation, loose uni- to paucispicular primary tracts connected by unispicular secondary tracts. Few pauci- to multispicular discontinuous tracts, perpendicular to the surface, deep in the choanosome. Choanosomal and subectosomal spaces present, 150–780 µm in diameter. Many free spicules around. Spongin not visible.

Spicules – Oxeas, slender, subtly bent at centre, long acerate points, 133–*151*–169 µm × 4.0–*5.3*–6.0 µm.

Ecology – Shallow subtidal between 3 and 9 m, markedly silted habitat.

Distribution – Only known from Roquedal, Laguna Grande, Paracas (14°09' S – Ica Region).

Remarks – This is the only blue *Haliclona* found in Peru. Other *Haliclona* spp. in the Eastern Pacific showing similar blue(ish) colour when alive are the Californian *H*. (*Halich*.) ***gellindra***, and the Chilean *H*. (*Halich*.) ***thielei***, *H*. (*Re*.) ***topsenti***, and *H*. (*Halicl*.) ***verrucosa***. None is classified in *H*. (*Rhizoniera***),** and thus exhibit important differentiating anatomical features. *Haliclona* (*Halich*.) *gellindra* has a tangential ectosome and a dense, confused, subisotropic choanosomal skeleton. *Haliclona* (*Halich*.) *thielei* has a spicule reinforced form, and a spongin reinforced form. Both differ from *H*. (*Rh*.) *baslaviae*, the first, for its abundant oscula and dense and irregular skeleton, the other, for its oscula located on top of conical projections and abundant nodal spongin in the skeleton. *Haliclona* (*Re*.) *topsenti* and *H*. (*Halicl*.) *verrucosa* have oscula that are mostly located on top of verrucose projections. In addition, the former has a dense and irregular skeleton, with occasional paucispicular tracts close to the surface, while the latter has small and irregular blind verrucose projections on its surface, and abundant spongin in basal parts of the skeleton. All features listed above are not matched by *H*. (*Rh*.) *baslaviae*.

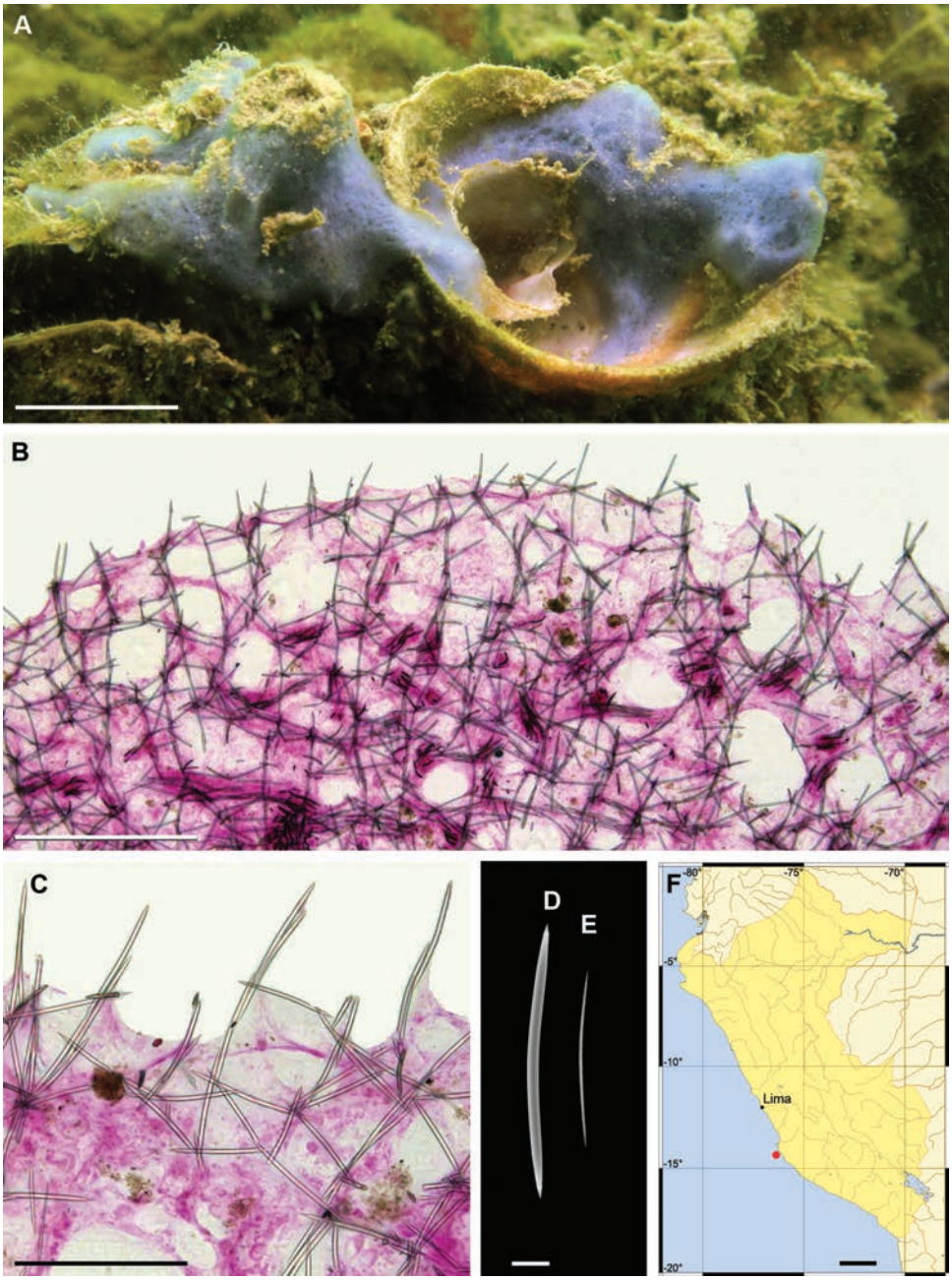


Fig. 62. *Haliclona* (*Rhizoniera*) *baslaviae* Bispo, Willenz & Hajdu, 2022. A, live specimen; B–C, skeleton architecture in transverse ground section stained with acid fuchsin; D-E, oxeas (SEM); F, distribution map. Scale bars: A, 1 cm; B, 500 µm; C, 200 µm; D–E, 20 µm; F, 200 µm.

Haliclona (*Rhizoniera*) *manglarensis* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Encrusting with abundant lobate projections, up to 3 cm high, cylindrical or irregular, frequently bifurcate. Oscula circular, 2–5 mm diam., apical, lateral or basal on the lobate projections. Surface rough, velvety out of water. Consistency soft and bristly. Colour in life olive, becoming lighter and yellowish, towards the apices of the lobes**.** Turning beige in ethanol.

Skeleton – Ectosome unspecialized. Choanosome a confused, unispicular, isotropic reticulation in the deeper parts, becoming more anisotropic close to the surface, with ill-defined uni- to bispicular primary lines irregularly connected by unispicular secondary lines. Abundant small spicules (likely juveniles), scattered all around. Mesohyl moderately pigmented, brownish. Spongin not visible.

Spicules – Oxeas, slender, subtly bent at centre, long acerate points, 92–*120*–140 µm × 1.0–*3.8*–6.0 µm

Ecology – Intertidal, epibiotic over unidentified mangrove tree roots.

Distribution – Only known from Northern Point of Isla Chalaquera, Mangroves of Tumbes (03°25' S – Tumbes Region).

Remarks – *Haliclona* (*Rh*.) *manglarensis* has no close relatives along the Eastern Pacific. The only other *Haliclona* co-occurring in the Tumbes mangroves, epibiotic on mangrove roots, is *H*. (*Re*.) ***parvuloxea***, with much smaller oxeas and the typical *Reniera* skeletal arrangement. The other ten Tropical Eastern Pacific *Haliclona* spp. do not include any *Haliclona* (*Rhizoniera*) as *H*. (*Rh*.) ***enamela*** (Clipperton Atoll and Galápagos) has recently been sinonimized with *H*. (*G*.) ***laubenfelsi***, which besides its distinct *Gellius* architecture, has toxa microscleres. Other species are classified in *H*. (*Haliclona*) [***ambrosia***, ***sonorensis***], *H*. (*Gellius*) [***perforata***], *H*. (*Reniera*) [***oberi***], and *H*. (*Soestella*) [***caerulea***, ***roslynae***, ***spuma***], or remain unassigned [***turquoisia***]. All these differ from *H*. (*Rh*.) *manglarensis* in skeletal features combined with live-colour (*oberi*, *roslynae*, *sonorensis*, *spuma*, *turquoisia*), habit (*ambrosia*, *oberi*, *sonorensis*, *spuma*), dimensions of oxeas (*ambrosia*) and/or presence of microscleres (*caerulea*, *perforata*).

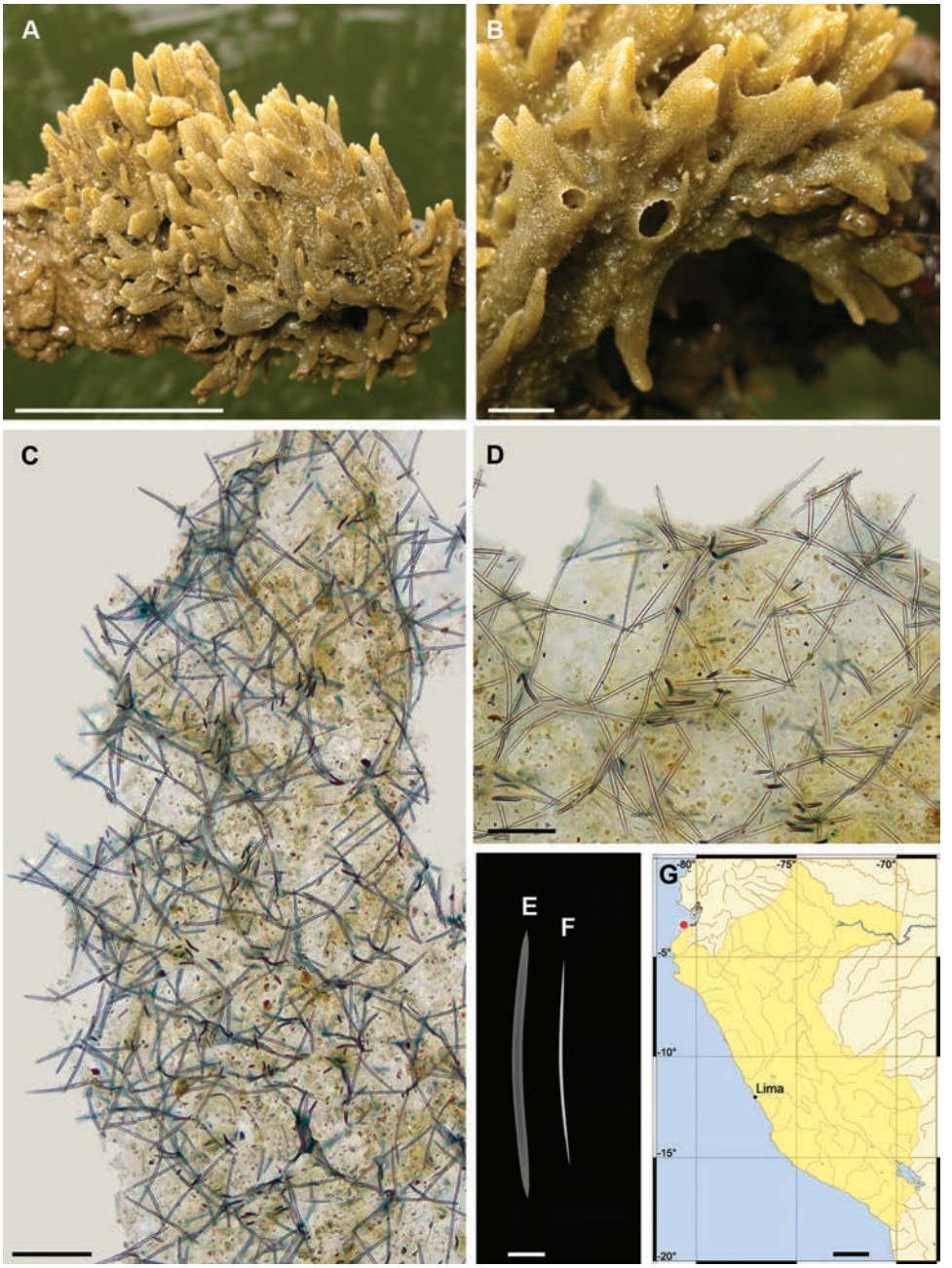


Fig. 63. *Haliclona* (*Rhizoniera*) *manglarensis* Bispo, Willenz & Hajdu, 2022. A–B, live specimen; C–D, skeleton architecture in transverse ground section; E–F, oxeas; G, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 200 µm; D–E, 100 µm; F, 20 µm; G, 200 km.

Haliclona (*Rhizoniera*) *zanabriai* Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Thickly encrusting specimen, 5–9 mm thick, with short lobate projections or small ridges, irregularly sprawling, attaining largest diameters of over 30 cm. Surface somewhat punctate. Oscula abundant, circular, 1–2 mm in diameter, mostly flush with the surface. Consistency soft, compressible. Colour in life and in ethanol light brown.

Skeleton – No specialized ectosomal skeleton. Choanosome an anisotropic reticulation with ascending, somewhat regular, primary uni- to paucispicular tracts (1–5 spicules thick), connected by mostly unispicular secondary tracts in varied angles of attachment; overall construction quite loose. Large lacunae present, up to 300 µm in diam., and a few, likely younger spicules, scattered all around. Spongin scarce, at the nodes of the reticulation.

Spicules – Oxeas, fusiform, straight, or more frequently subtly bent at centre, long acerate points, 79–*123*–163 µm × 1.0–*5.1*–9.0 µm.

Ecology – Occur on shallow rocky substrate in the subtidal zone, partly epibiont on large barnacles, and associated with red algae, shrimps, a blenny, and a dense mat of short polyps (likely *Hydractinia* sp.). Though the depth during collection was not recorded, the maximum depth reached on this dive was 20 m.

Distribution – Only known from Isla Blanca, Matarani (17°00' S – Arequipa Region).

Remarks – Several *Haliclona* spp. along the Eastern Pacific share with *H*. (*Rh*.) *zanabriai* the presence of uni- to multispicular primary lines with scarce spongin. Nevertheless, from the classification in distinct subgenera of several of these, it becomes obvious that additional features of the skeletal architecture establish their non-conspecificity. Included here are *H*. (*Halichoclona*) ***thielei***, *H*. (*Haliclona*) ***macropora***, *H*. (*Halicl*.) ***verrucosa***, *H*. (*Reniera*) ***sordida***, *H*. (*Soestella*) ***auletta***, *H*. (*S*.) ***chilensis*** and *H*. (*S*.) ***inepta***. There are anyhow two species bearing similar architecture, reflected in their classification in *H*. (*Rhizoniera*), namely *H*. (*Rh*.) ***anceps***, from Chile, and *H*. (*Rh*.) ***enamela***, from California. The Chilean species is grey-yellowish and possesses irregular meshes in the choanosomal architecture, while the Californian species has a verrucose surface and stouter lines in the choanosomal reticulation (6–8 spicules thick). These features are not present in the Peruvian species. Lastly, one species has not yet been assigned to a subgenus, *H*. *rugosa*, which is distinct by its hemispherical shape, irregular surface that may bear swellings and blue-grey colour alive.

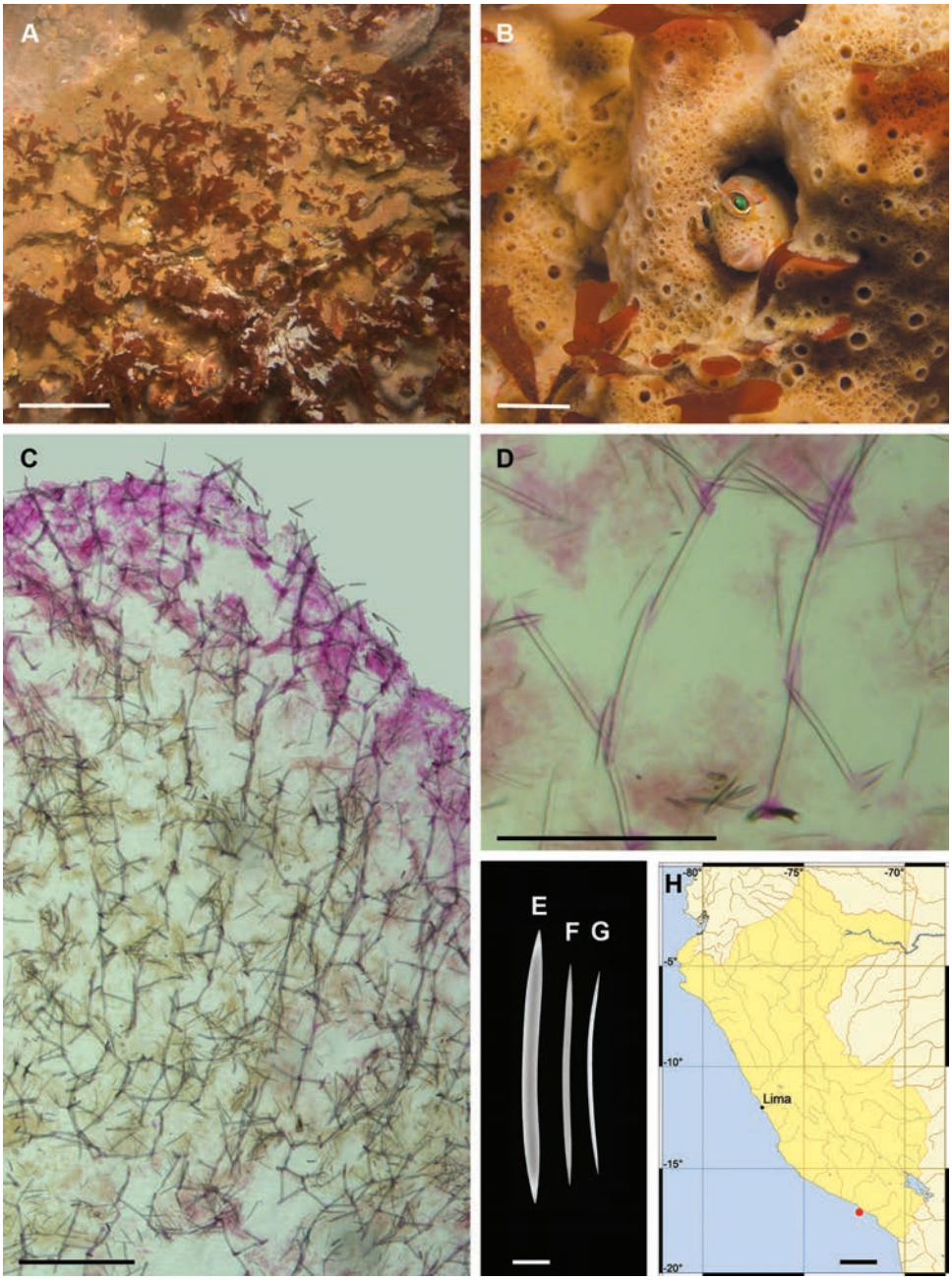


Fig. 64. *Haliclona* (*Rhizoniera*) *zanabriai* Bispo, Willenz & Hajdu, 2022. A−B, live specimen; C, skeleton architecture in transverse ground section; D, detail of C; E−G, oxeas; H, distribution map. Scale bars: A, 10 cm; B, 1 cm; C, 500 µm; D, 200 µm; E−G, 20 µm; H, 200 km.

Niphates ruthecitae Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Specimens can be large, over 30 cm in diameter, cushion-shaped, with irregular lobate or thick lamellate projections. Surface optically rough, but smoother to the touch. Oscula abundant, circular, 1–2 mm wide, randomly distributed, either flush with the surface, or on top of very low volcaniform elevations. Consistency spongy. Colour in life light brown to light pink, turning light beige in ethanol.

Skeleton – Ectosome an irregular reticulation of pauci- to multispicular tracts (13–60 µm thick), creating irregular to circular meshes (70–370 µm wide). Choanosome a reticulation of longitudinal multispicular primary tracts (50–225 µm thick), orthogonally connected, fairly regularly, by uni- to paucispicular secondary tracts (30–75 µm thick), creating squared to rectangular meshes (85–1100 µm wide). Spongin is abundant, enveloping both categories of tracts, and free spicules are abundantly scattered throughout the choanosome.

Spicules – Oxeas, fusiform, straight, or more frequently subtly bent at centre, long acerate points, 54–*96*–128 × 1.7–*6.0*–9.9 µm.

Ecology – Specimens collected from flat or vertical rocky substrate in the shallow subtidal (4–5 m), co-occurring with abundant sea-urchins.

Distribution – Only known from Quilca and Mollendo (16°42' S and 17°01' S – Arequipa Region).

Remarks – This is the only known *Niphates* in the entire south-eastern Pacific. Its single congener in the Eastern Pacific is *Niphates* ***lunisimilis*** from California. The latter shares with *N. ruthecitae* a somewhat similar shape (massive to subspherical in *N. lunisimilis*), oscula with raised edges, and drab colour (it may be light brown to light pink in *Niphates ruthecitae*). They, nevertheless, are very distinct in terms of skeletal architecture, as *N. lunisimilis* has a fragile, isodictyal skeleton superimposed by a reticulation of multispicular spongin fibres. Other *Niphates* spp. are all from the Western and Central Pacific, rendering conspecificity unlikely on purely biogeographical terms.

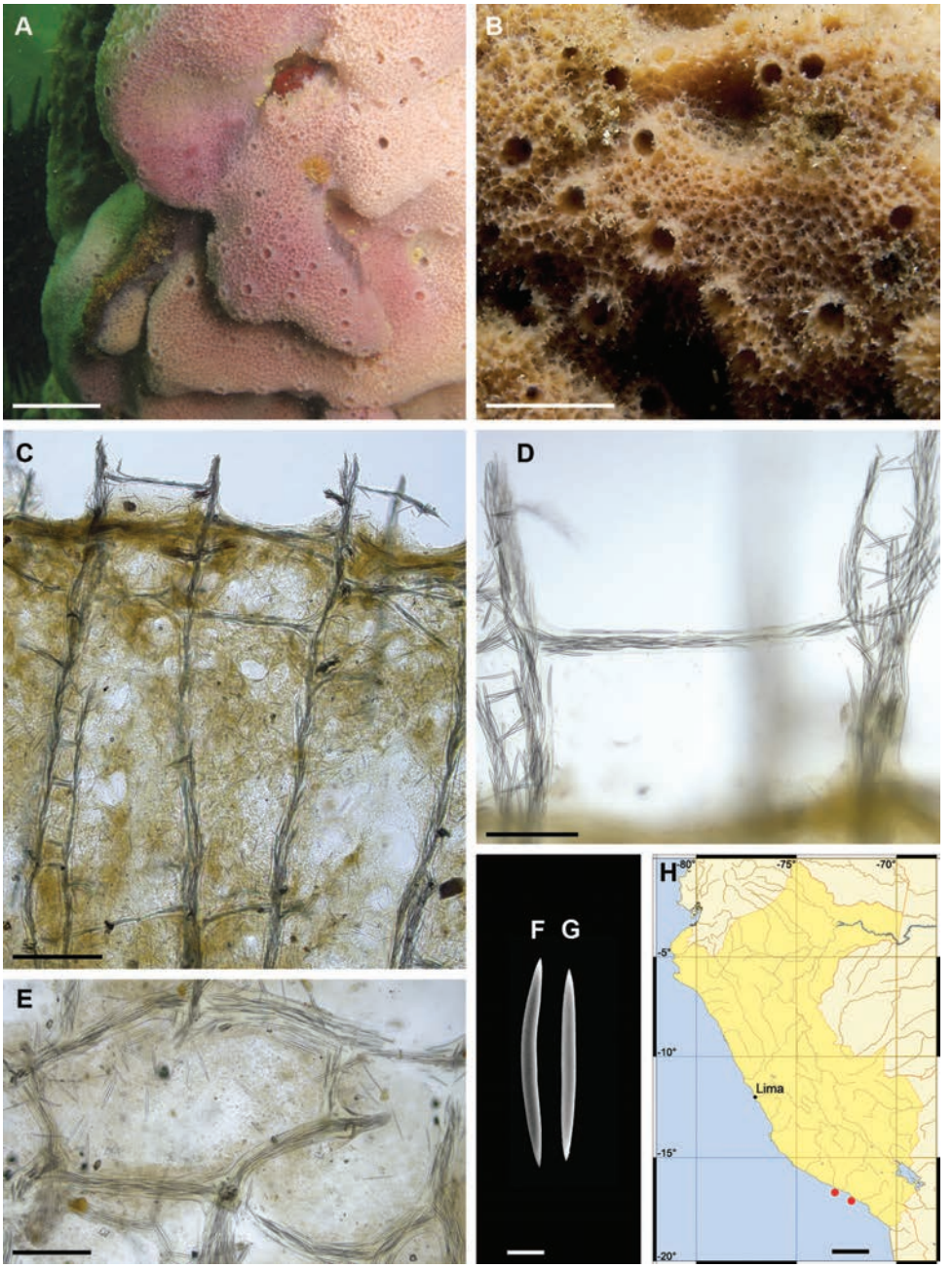


Fig. 65. *Niphates ruthecitae* Bispo, Willenz & Hajdu, 2022. A–B, live specimens; C, skeleton architecture in transverse ground section; D, detail of C; E, architecture of the ectosomal skeleton in tangential ground section; F–G, oxeas; H, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 500 µm; D–E, 200 µm; F–G, 20 µm; H, 200 km.

Pachychalina lupusapia Bispo, Willenz & Hajdu, 2022

REFERENCE: Bispo, Willenz & Hajdu, 2022.

Description – Thickly encrusting, 3–8 mm thick, occupying areas as large as 1 m, nearly flat, or bearing abundant, commonly short, cylindrical or volcaniform (0.5–1.0 cm high), seldom long, digitiform lobes (2.5–3.0 cm high). Oscula, 0.5–3.0 mm in diameter, circular, usually apical on lobes. Surface punctate. At places, mainly at margins, convergent subectosomal canals are seen in *in situ* images, but it is not clear they converge towards oscula. Consistency easily compressible, but slightly resilient. Colour in life and in ethanol light grey, with a hint of purple or violet.

Skeleton – No specialized ectosomal skeleton, only a few tangential oxeas strewn randomly amidst the orthogonal terminations of the main choanosomal tracts. Choanosomal architecture anisotropic at parts, or seemingly isotropic, with pauci- to multispicular primary longitudinal tracts (up to 55 µm thick), connected by short secondary uni- to paucispicular tracts inserted at various angles to the former. Spicule density decreases towards the periphery. Spongin is scarce.

Spicules – Oxeas, slender, mostly subtly bent at centre, long, acerate points, 90–*137*–166 × 1.6–*5.9*–9.0 µm.

Ecology – Specimens seen in nearly plane, often vertical, rocky walls, at 15 m depth. They were associated to sea urchins (cf. *Paracentrotus*), ophiuroids, chitons, tunicates, blennies, algae, and large barnacles.

Distribution – Known only from Isla Foca and Bahía Sechura (05°12' S and 05°46' S – Piura Region), and Islas Lobos de Afuera (06°55' S – Lambayeque Region).

Remarks – There are only two species of *Pachychalina* reported from the Eastern Pacific: *P. **acapulcensis*** from Mexico and *P. **tenera*** from southern Chile and Argentina. *Pachychalina acapulcensis* was described with markedly distinct habit (erect lamella, bearing several lobes, a conulose surface), and smaller oxeas (60–100 × 2–5 µm). *Pachychalina tenera* has primary and secondary multispicular tracts that are stouter than those in *P. lupusapia*, where secondary tracts are much shorter and more slender, translating in a tighter skeleton that is also more disorganized.

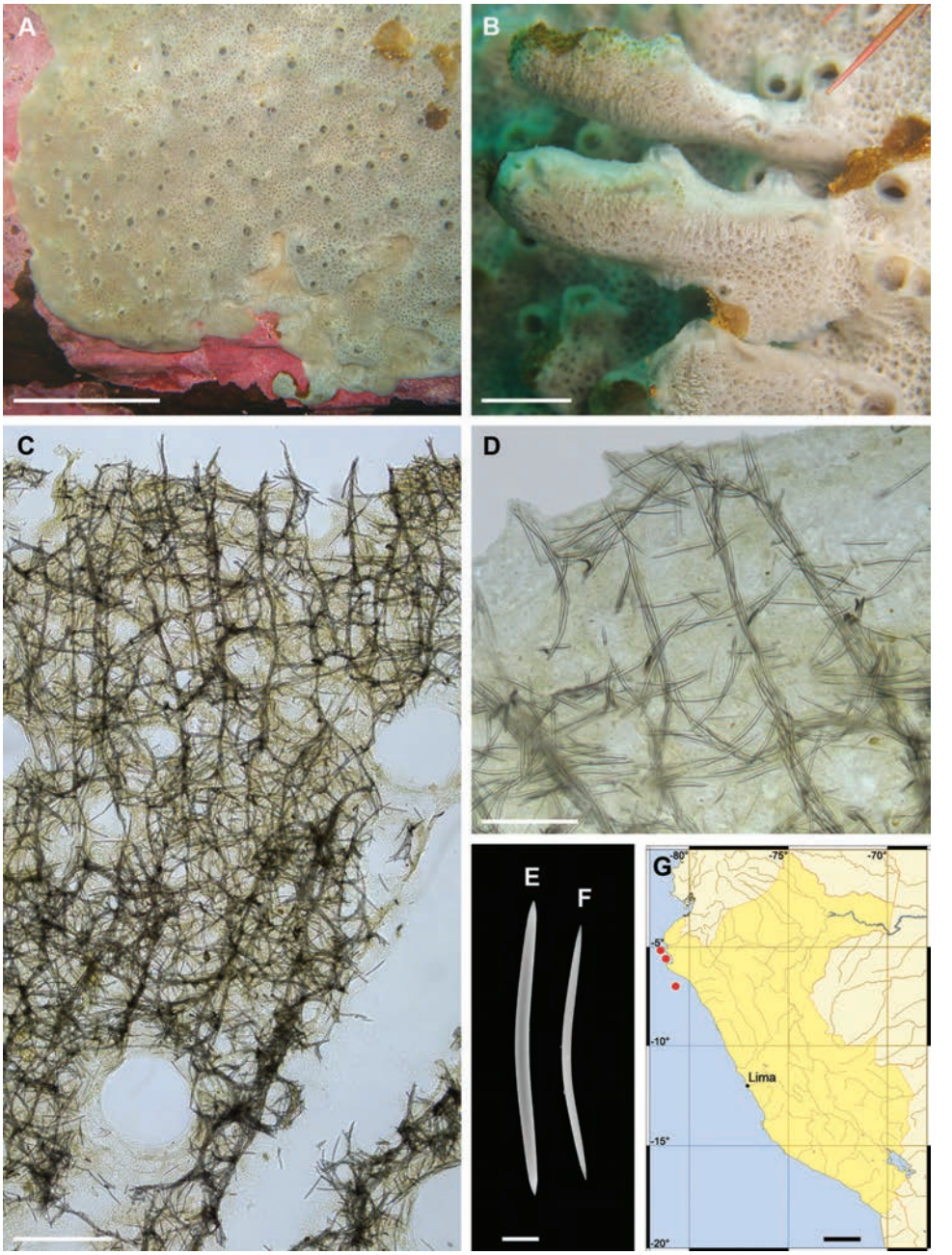


Fig. 66. *Pachychalina lupusapia* Bispo, Willenz & Hajdu, 2022. A–B, live specimen; C–D, skeleton architecture in transverse ground section; E–F, oxeas; G, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 500 µm; D, 200 µm; E–F, 20 µm; G, 200 km.

Amphimedon sp.

REFERENCES: Thiele, 1905; Desqueyroux-Faúndez & Valentine, 2002; Cruz-Barraza & Carballo, 2008; Willenz, Hajdu, Desqueyroux-Faúndez *et al*., 2009.

Description – Massive, irregular sponge (ca. 10 cm in largest diam.), with many short projections of various forms. These can be erect or repent, tubular, digitiform, lobate, or fistular, and usually are shorter than 2 cm. Small (up to 2 mm diam.), circular oscula, usually slightly apical on short mounds or lobes. Consistency soft, and surface smooth, albeit irregular. Colour in life dull shades of violet and grey in different parts, turning beige to light beige in ethanol.

Skeleton – Ectosome bearing a dense, irregular reticulation with loose primary fibres. Choanosome with an anisotropic reticulation, where primary, ascending, multispicular tracts (up to 140 µm diam.) are clearly seen, as well as the secondary reticulum connecting the primaries, made of multi- (up to 70 µm diam.), pauci-, occasionally unispicular lines inserted at various angles. Scattered sediment grains commonly seen.

Spicules – Oxeas, moderately stout, but slender, seemingly younger forms also present, mostly gently curved, occasionally subtly bent at centre, sharp hastate points, 103–*166*–214 × 2–11 µm. Two categories are hard to make out, but if they occur, dimensions would be 103–*127*–156 and 158–*189*–214 µm.

Ecology – Growing over hard substrate in shallow waters (10 m), and charged with considerable sediment.

Distribution – Only known from El Ñuro (04°13' S – Piura Region).

Remarks – There are only three valid species of *Amphimedon* reported from the Eastern Pacific, namely the Chilean *A*. ***reticulosa***, the Mexican *A*. ***texotli*** and the Californian *A*. ***trindanea***. The Peruvian *Amphimedon* sp. appears quite distinct from all these, as none comprise similar habit and spicule dimensions. Thus, quite possibly, this represents a new species.

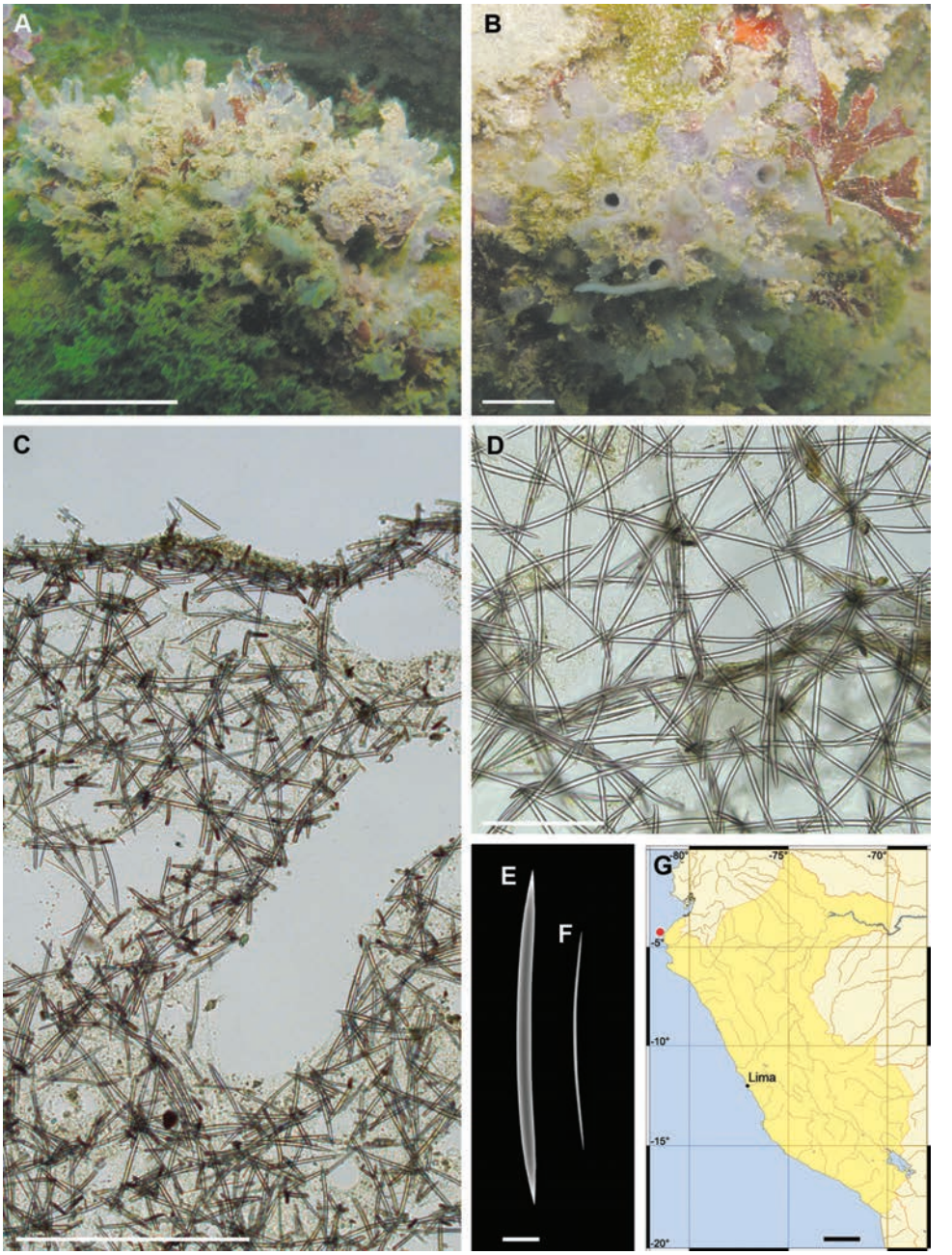
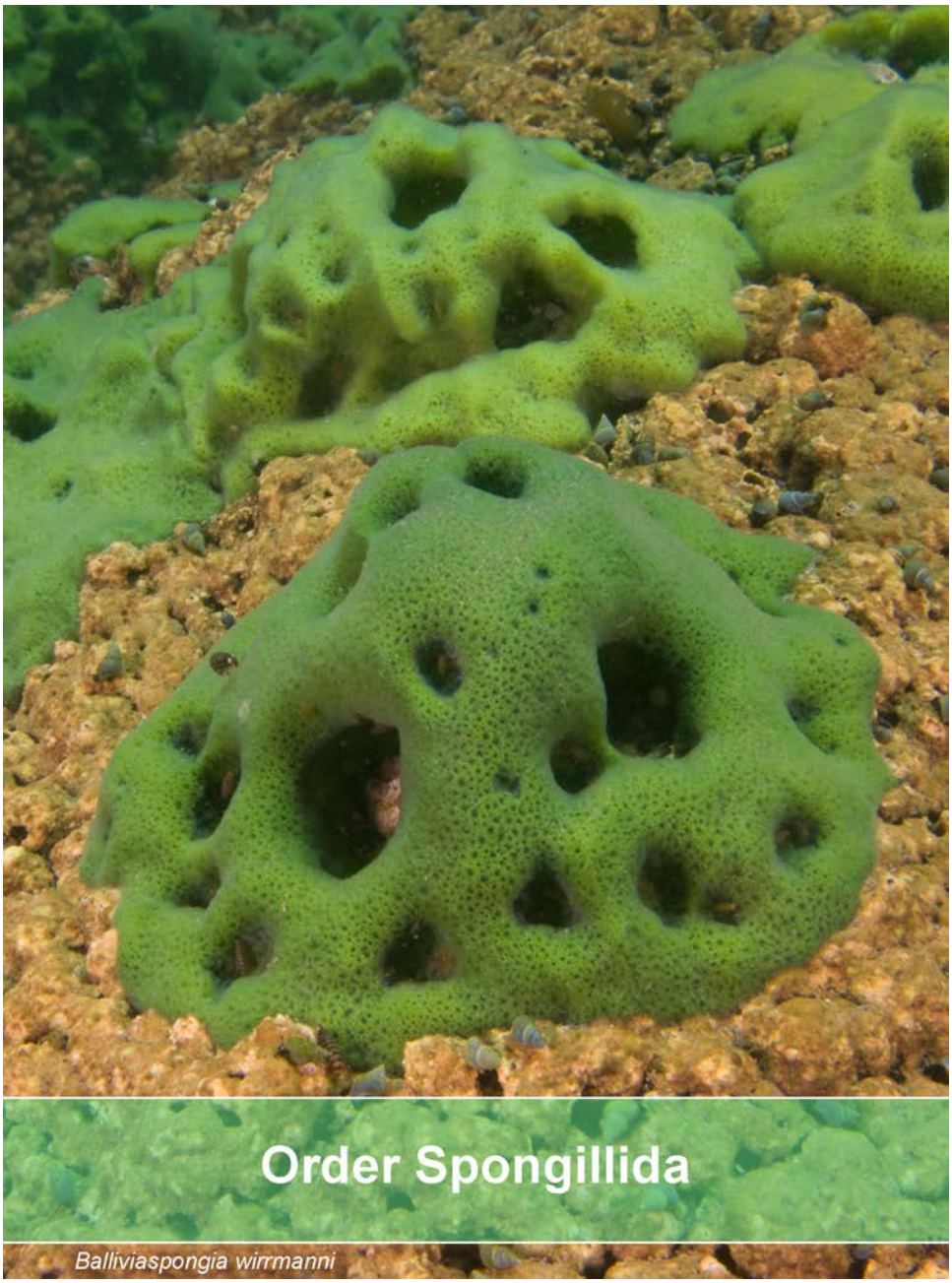


Fig. 67. *Amphimedon* sp. A–B, live specimen; C, skeleton architecture in transverse ground section; D, skeleton architecture of the ectosome in ground section tangential to the surface; E–F, oxeas; G, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 500 µm; D, 200 µm; E–F, 20 µm; G, 200 km.


Order Spongillida
Balliviaspongia wirrmanni

Balliviaspongia wirrmanni Boury-Esnault & Volkmer-Ribeiro, 1992

REFERENCE: Boury-Esnault & Volkmer-Ribeiro, 1992.

Description – Encrusting, covering large areas on rocks and stones up to 15 × 20 cm, 1.5 to 2 cm thick or forming a sheath around macrophytes. Oscula generally in depressions of the sponge surface but erected in some rare specimens. Consistency soft and brittle, surface slightly hispid. Colour in life green to buff, turning whitish beige to dark beige when preserved in ethanol.

Skeleton – Reticulate skeletal framework with parallel primary tracts perpendicular to the surface linked together by thinner irregular secondary tracts.

Spicules – Acanthoxeas, straight or slightly bent with variable abundance and size of spines. Extremities are generally smooth. Specimens from Umayo Lake show many spicules with swellings and malformations as bifid or sharply bent tips. Acanthoxeas of specimens from Lago Junin are usually markedly bent and bear only minute spines. Dimensions means vary between 218 µm and 394 µm, varying from one specimen to another in each locality.

Ecology – Abundant on rocky substrate, stones and reeds from 1 m to 25 m depth.

Distribution – Collected in Lago Titicaca, Lago Umayo (Puno Region) and Lago Junin (Junin Region).

Remarks – Acanthoxeas of specimens collected from Lago Umayo and Lago Junin seem to show specific malformations that might be caused by different compositions of the water in those lakes, but this has not been demonstrated.

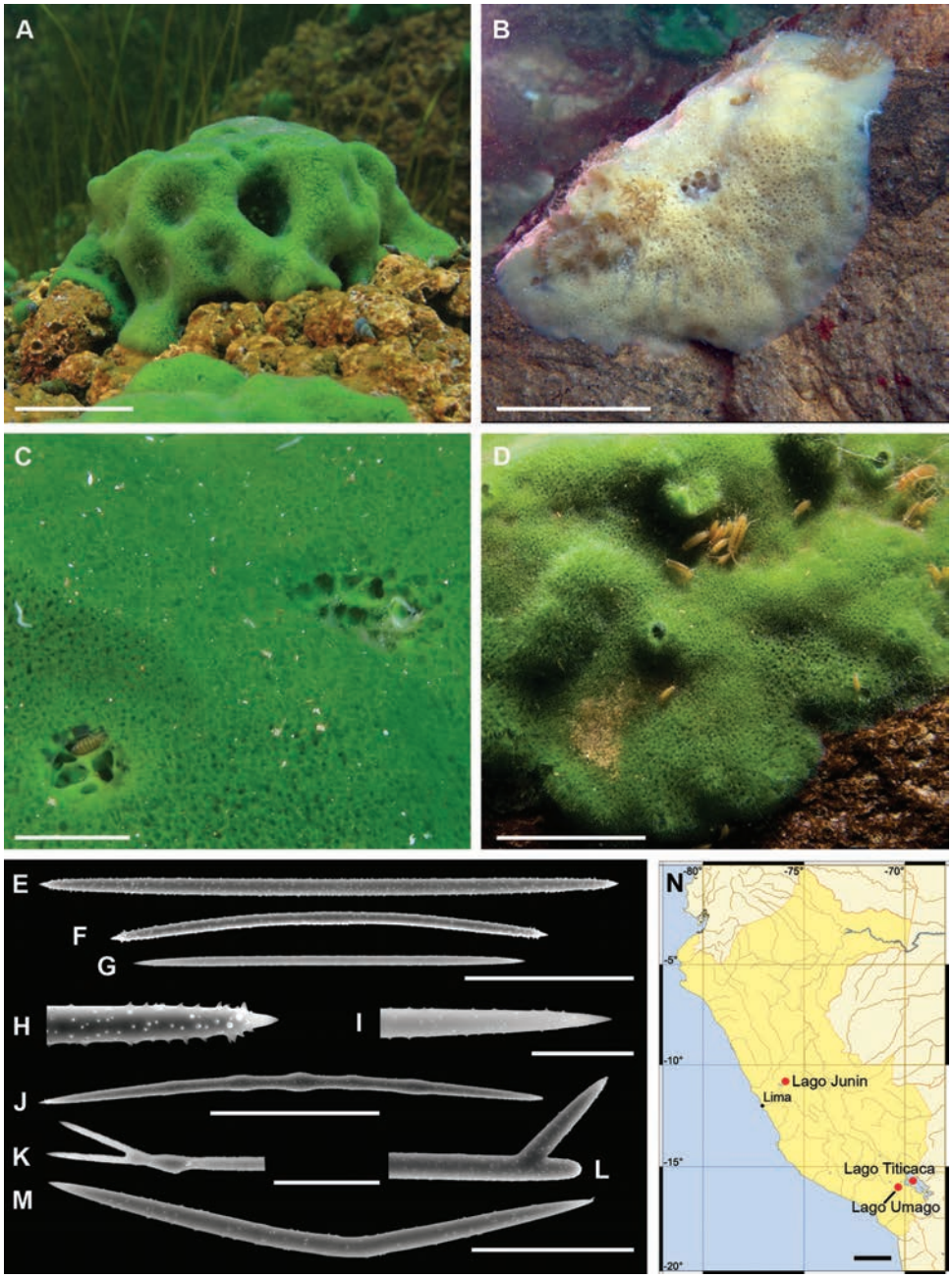


Fig. 68. *Balliviaspongia wirrmanni* Boury-Esnault & Volkmer-Ribeiro, 1992. A, C, D, live specimen exposed to the light; B, live specimen in dark habitat; E–G, acanthoxea; H, detail of acanthoxea F; I, detail of acanthoxea G; J–L, acanthoxea with malformations; M, markedly bent acanthoxea from Lago Junin; N, general distribution map. Scale bars: A, 2 cm; B, 5 cm; C, 1 cm; D, 5 cm; E–G, 100 µm; H–I, 20 µm; J, 100 µm; K–L, 40 µm; M, 100 µm; N, 200 km.

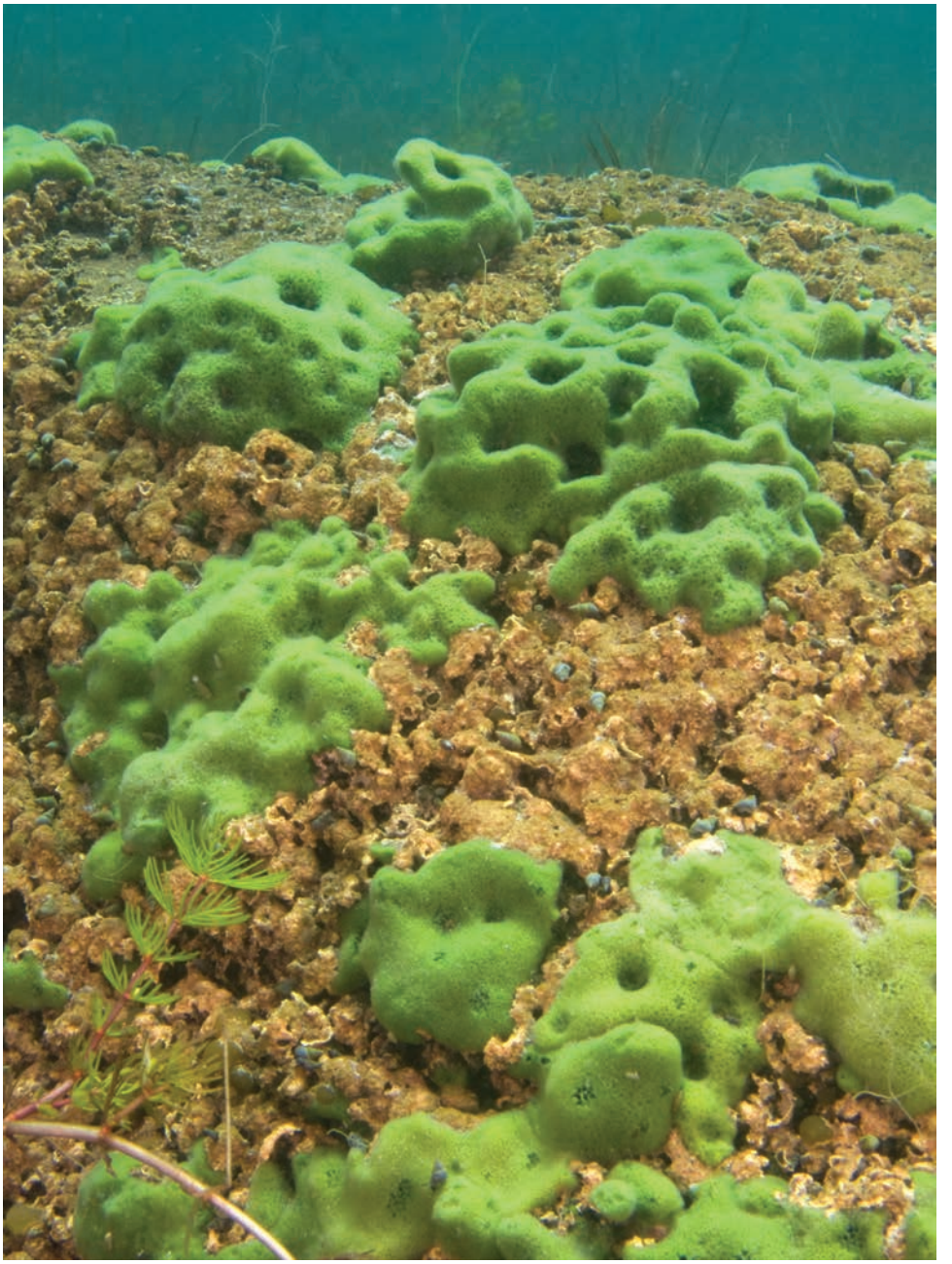


Fig. 69. *Balliviaspongia wirrmanni* Boury-Esnault & Volkmer-Ribeiro, 1992. General view demonstrating the abundance of specimens in shallow water. Isla Taquile, Lago Titicaca, 4 m depth.

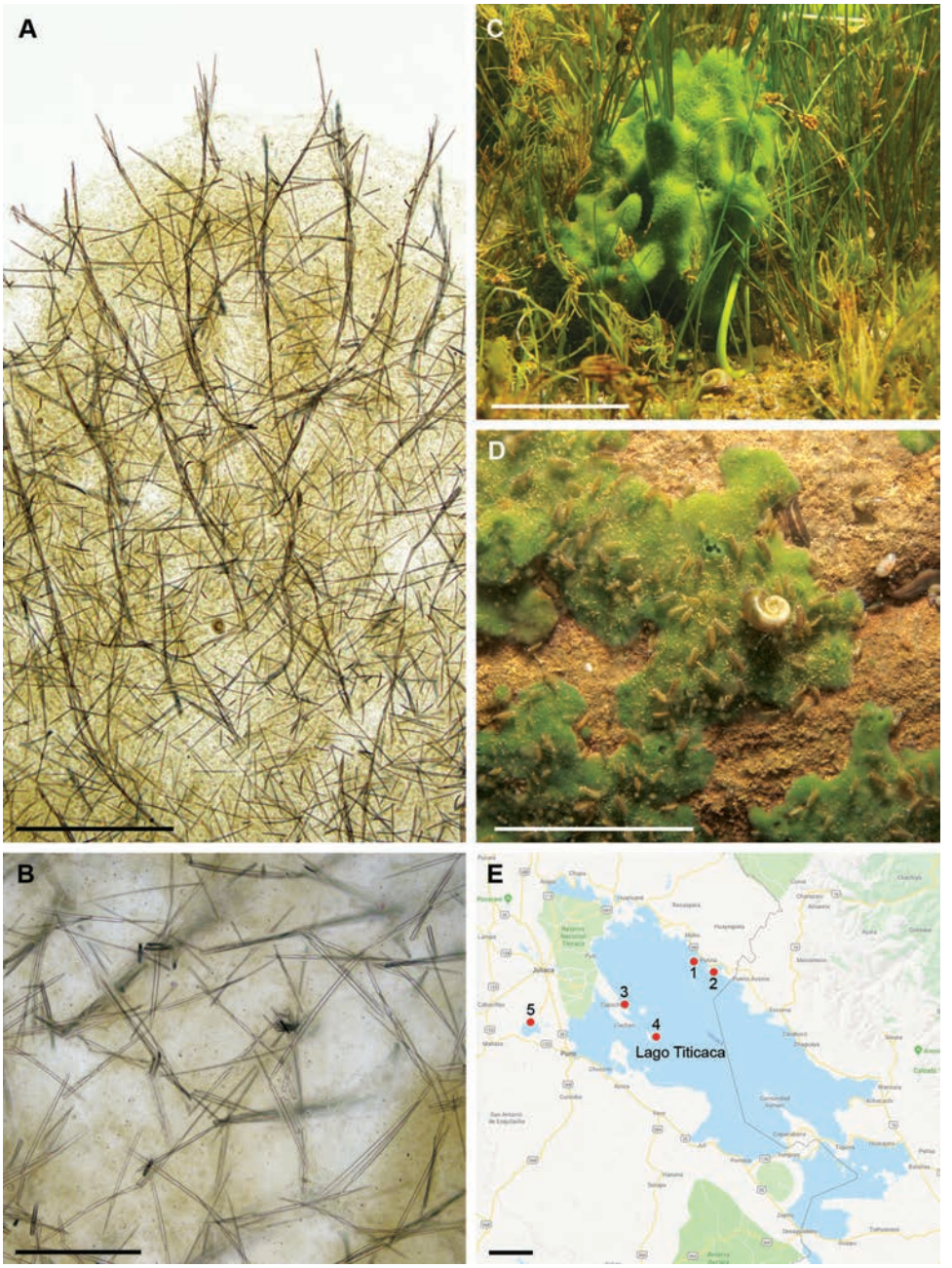


Fig. 70. *Balliviaspongia wirrmanni* Boury-Esnault & Volkmer-Ribeiro, 1992. A, skeleton architecture in transverse ground section; B, ectosomal architecture in transversal ground section; C, live specimen growing on Macrophytes (*Elodea potamogeton* and *Potamogeton strictus*); D, live specimen covered with Sisyridae larvae (Insecta, Neuroptera); E, Collection localities in Lago Titicaca and Lago Umayo (1, Isla Suasi; 2, Sucuni; 3, Ccotos; 4, Isla Taquile; 5, Sillustani, Lago Umayo). Scale bars: A, 500 µm; B, 200 µm; C–D, 5 cm; E, 20 km.

Order Axinellida

Plocamione matarani

Eurypon hookeri Recinos, Pinheiro, Willenz & Hajdu, 2020

REFERENCES: Thiele, 1905; Hooper, 2002; Aguilar-Camacho & Carballo, 2013.

Description – Crustose sponge up to a few mm thick, reaching over 15 cm in largest diameter, with rather irregular outline derived from the three-dimensional underlying substrate sometimes visible by transparency, despite the sponge's intense colour. Consistency soft. Surface optically rugose, bearing numerous, scattered, round oscules, sometimes with short chimneys, 0.5–2 mm diam. Colour deep ruby red in life, brown after preservation in ethanol.

Skeleton – Ectosome pierced by acanthostyles and (subtylo)styles, often surrounded by bouquets of smaller styles. Subectosomal and choanosomal skeletal structures microcionid, and overlapping, with short longitudinal fibre nodes cored and echinated by acanthostyles of varied dimensions and large (subtylo)styles. Fibre nodes may bifurcate, but appear not to anastomose.

Spicules – Ectosomal styles, smaller, smooth, slender, slightly curved, tapering gradually towards the apex, and occasionally also towards the base, rounded heads and hastate tips, 232–*333*–427 × 1.7–*3.8*–6.0 µm. **Subectosomal (subtylo)styles**, large, smooth, straight or slightly curved, oval heads only a little swollen, sharp apex, mucronate tips, 859–*1237*–1604 × 13–16.9–20 µm. **Echinating acanthostyles I**, large, straight or slightly curved, spined all over, but less so near the apex, spines conical or slightly bent as hooks, generally rounded heads and hastate tips, 158–*304*–463 × 12–*16*.*3*–24 µm. **Echinating acanthostyles II**, small, slightly curved or bent close to the base, spined all over, but less so near the apex, spines conical or bent as hooks, with rounded tyle and acerate tips, 107–*129*–169 × 7–*9*.*3*–11 µm.

Ecology – Specimens collected at 11–23 m depth range, from vertical rocky substrate. One was associated to a dictyoceratid sponge.

Distribution – Only known from Islas Lobos de Afuera (60°56' S – Lambayeque Region).

Remarks – The eight species of *Eurypon* known from the Central and Eastern Pacific can be easily differentiated on the basis of spicule features. Three species have additional categories of subectosomal spicules, viz. two in *E*. ***brunum*** and *E*. ***nigrum***, and three in *E*. ***miniaceum***, which contrasts to the single category present in *E*. *hookeri*. *Eurypon hookeri* differs from *E*. ***debrumi*** by the latter's lack of acanthostyles and ectosomal styles, and from *E*. ***diversicolor*** by the latter's lack of ectosomal styles. *Eurypon hookeri* has two categories of acanthostyles, thus differing from *E*. ***tylospinosum*** with only one. The most similar species appears to be *E*. ***patriciae*** from Mexico, but the latter has slightly larger and stouter subectosomal megascleres (up to 2400 × 25 µm), and smaller and thinner acanthostyles I and II (up to 180 × 7.5 µm and 87.5 × 5 µm, respectively). Besides, *E*. *patriciae* is yellow or green coloured, in marked contrast to the deep ruby colour exhibited by *E*. *hookeri*. The other Peruvian *Eurypon*, *E*. ***lacertus***, is also markedly distinct, starting from its orange colour when alive, slightly larger ectosomal and subectosomal megascleres (607 µm and 2100 µm, respectively), and possession of a single category of acanthostyles.

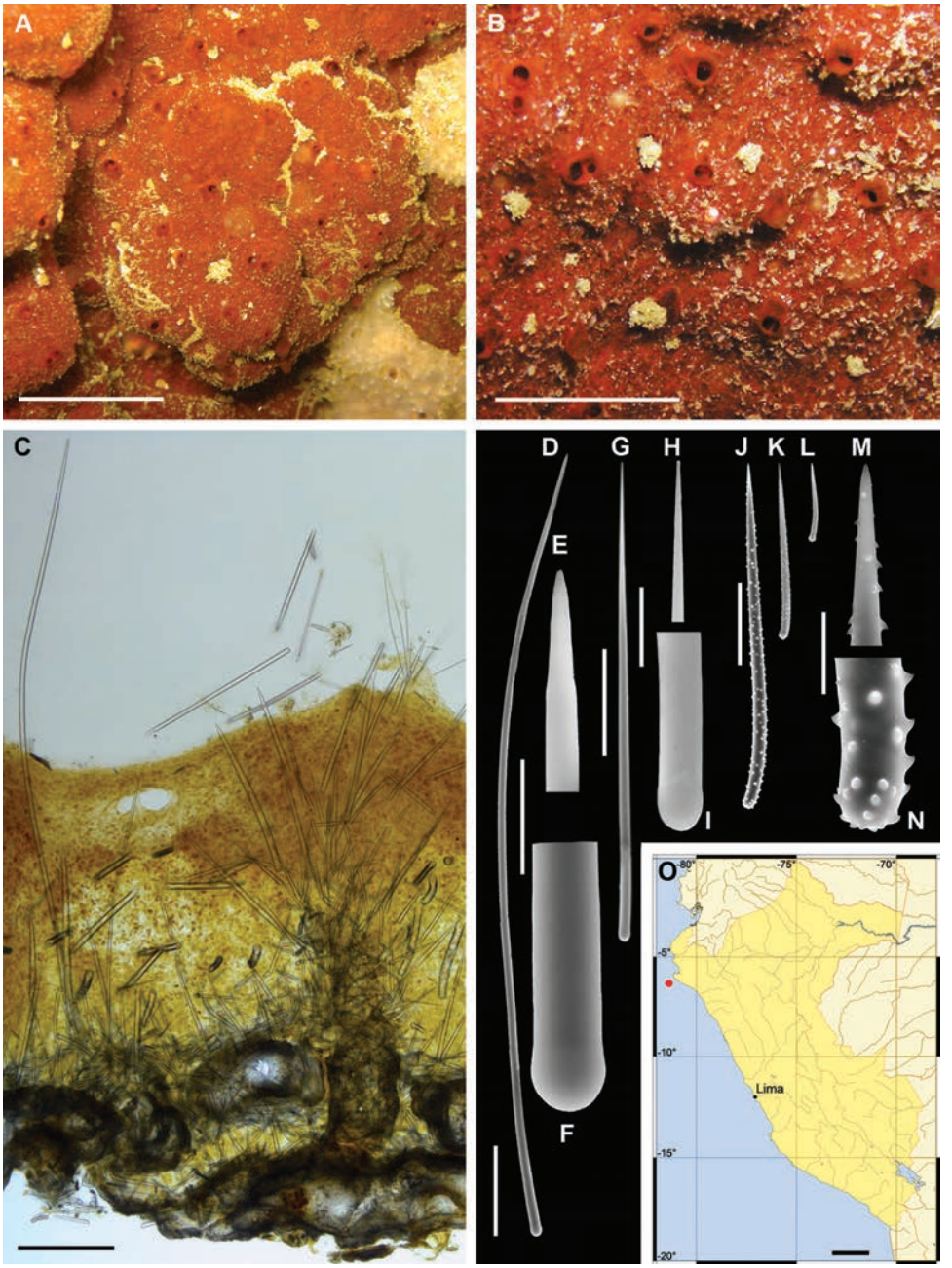


Fig. 71. *Eurypon hookeri* Recinos, Pinheiro, Willenz & Hajdu, 2020. A–B, live specimen; C, skeleton architecture in transverse ground section; D–F, large (subtylo) styles; G–I, styles; J–N, acanthostyles of different sizes; O, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 200 µm; D, 100 µm; E–F, 20 µm; G, 50 µm; H–I, 10 µm; J–L, 100 µm; M–N, 20 µm; O, 200 km.

Eurypon lacertus Recinos, Pinheiro, Willenz & Hajdu, 2020

REFERENCES: Thiele, 1905; Hooper, 2002; Aguilar-Camacho & Carballo, 2013.

Description – The single specimen collected was thinly encrusting, 5 cm in its largest diameter, and no thicker than 1 mm. Consistency soft, easily torn. Surface appears smooth, and bears barely visible subectosomal canals here and there, converging to the few, small (< 1 mm diam.), scattered oscula present. Colour orange in life, beige after preservation in ethanol.

Skeleton – Ectosomal skeleton with ectosomal anisoxeas forming plumose bouquets surrounding the subectosomal tylostyles, which markedly pierce the surface. Subectosomal and choanosomal skeletons overlapping, composed of typical hymedesmioid structure, consisting of a basal layer of spongin, with large tylostyles and small acanthostyles, both erect on the substrate. Some spicules appear scattered in the sponge, and many tylostyles lay parallel to, or flat on the substrate.

Spicules – Ectosomal **anisoxeas**, smooth, irregularly curved or bent, blunt and acerate tips, 339–*488*–607 × 4–*6.3*–9 μm. **Subectosomal tylostyles**, large, smooth, straight to slightly curved, tapering gradually, mucronate tips and round heads, 1294–*1705*–2100 × 13–*19.1*–25 μm. **Echinating acanthostyles**, slender, straight, spined all over, spines conical or bent as hooks, with rounded tyle and acerate tips, 54–*78*–112 × 6–*9.3*–13 μm.

Ecology – The sponge was collected from nearly vertical rocky substrate, near the coarse, biogenic sand bottom, at 11 m depth. It was surrounded by short red algae and thinly encrusting coralinaceous ones too.

Distribution – Only known from Islas Lobos de Afuera (60°56' S – Lambayeque Region).

Remarks – There are only eight species of *Eurypon* reported from Eastern and Central Pacific, all from shallow waters: *E*. ***brunum***, *E*. ***debrumi***, *E*. ***diversicolor***, *E*. ***miniaceum***, *E*. ***nigrum***, *E*. ***patriciae***, *E*. ***tylospinosum*** and *E*. ***hookeri***. *Eurypon lacertus* is distinguished from its congeners mainly by spicule features. The Central and Eastern Pacific Ocean species *E*. *brunum*, *E*. *diversicolor*, and *E*. *patriciae* have two categories of acanthostyles, and *E*. *debrumi* has none, in contrast to a single category in *E*. *lacertus*. Two species have two categories of subectosomal tylostyles, *E*. *miniaceum* and *E*. *nigrum*, while *E*. *lacertus* has only one. The species closest to *E*. *lacertus*, both in morphological, as well as biogeographic aspects, appears to be *E*. *tylospinosum* from Mexico, but its ectosomal and subectosomal megascleres are much smaller and thinner (up to 460 × 2.5 μm and 575 × 15 μm vs 607 × 9 μm and 2100 × 25 μm in *E*. *lacertus*). *Eurypon hookeri* described above is also distinct from its red ruby colour, smaller ectosomal and subectosomal megascleres (427 μm and 1604 μm, respectively), and possession of two categories of acanthostyles.

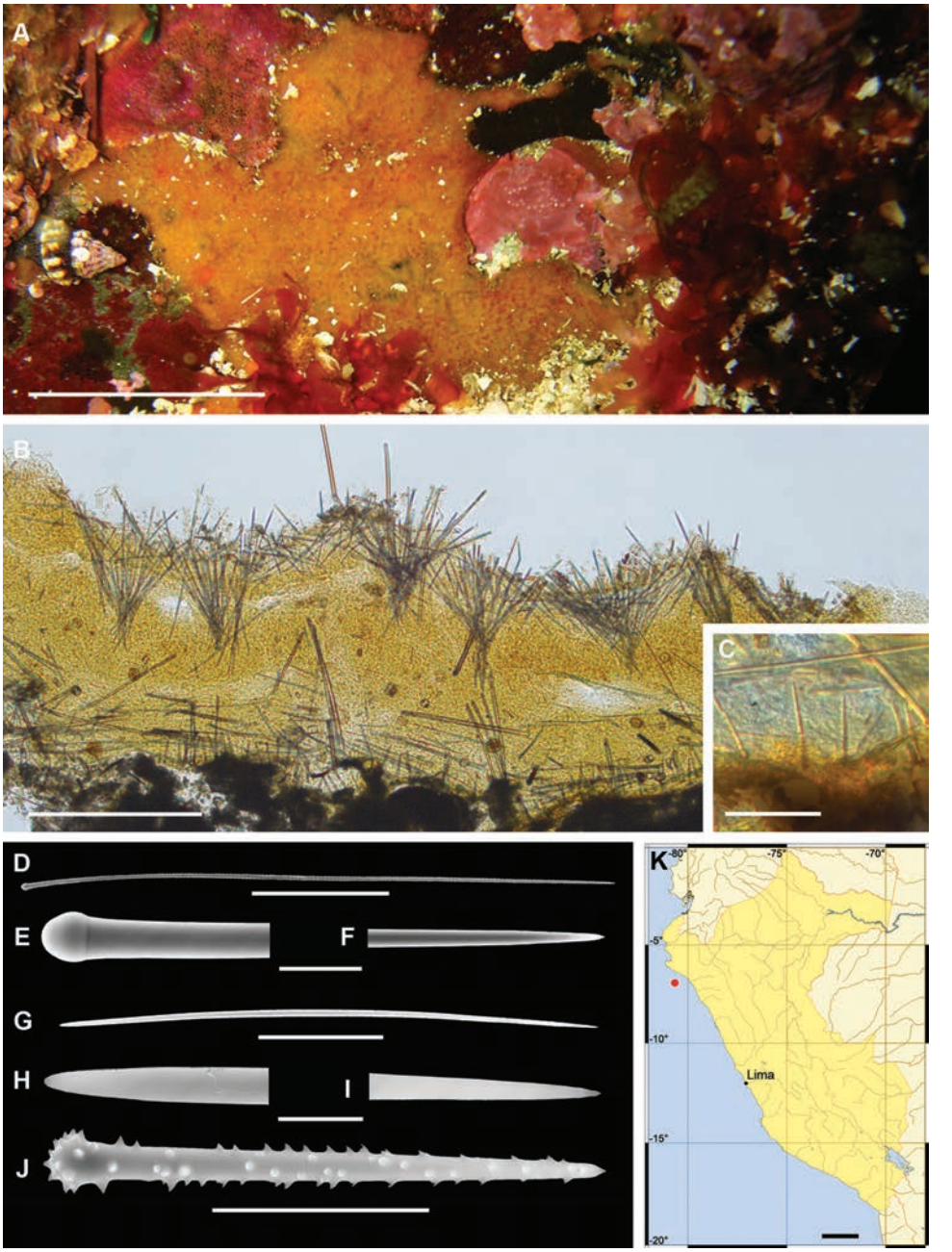


Fig. 72. *Eurypon lacertus* Recinos, Pinheiro, Willenz & Hajdu, 2020. A, live specimen; B, skeleton architecture in transversal ground section; C, detail of acanthostyles erect at the base of the skeleton; D–F, large tylostyles; G–I, anisoxea; J, acanthostyle; K, distribution map. Scale bars: A, 2 cm; B, 500 µm; C, 100 µm; D, 500 µm; E–F, 40 µm; G, 100 µm; H–I, 10 µm; J, 30 µm; K, 200 km.

Plocamione matarani Recinos, Pinheiro, Willenz & Hajdu, 2020

REFERENCES: Dendy, 1924; Lévi & Lévi, 1983; Hooper, 2002.

Description – Thinly encrusting sponge (ca. 1 mm thick), reaching over 15 cm in its largest diameter. Surface uneven, bumpy, with trapped sediment. Oscula not apparent. Colour in life orange, beige in ethanol.

Skeleton – Ectosomal skeleton of typical raspailiid architecture, with large piercing subectosomal styles surrounded by a loose bouquet of smaller styles (and possibly toxiform oxeas). Choanosomal skeleton microcionid with architecture constructed over a dense, criss-cross layer of acanthostrongyles; as fibre nodes cored by large, stout styles and echinated by acanthostyles; on top of which, although seemingly not always, sit the ectosomal bouquets.

Spicules – Ectosomal styles slender, smooth, slightly or markedly curved, tapering gradually rounded heads and hastate tips, 229–*350*–405 × 2–*4*–6 µm. **Subectosomal styles I**, large, slender, smooth, slightly curved, tapering gradually, rounded heads and hastate tips, 1068–*1296*–1551 × 12–*20*–25 µm. **Subectosomal styles II**, small, coring fibre nodes, stout, smooth, straight or slightly curved, tapering gradually to sharp apices, rounded heads and hastate tips, 263–*453*–689 × 11–*20*–26 µm. **Choanosomal acanthostrongyles**, aniso-, curved and slightly sinuous, spined at both ends only, spines conical and rounded heads, the heads vary in width, 126–*160*–363 / 5–*9*–11 / 5–*7*–10 µm, length/ width thicker/ thinner ends. **Echinating acanthostyles**, echinating fibre nodes, short, straight or slightly curved, spines generally concentrated on their apical half, a few at the base, spines conical or bent as hooks, verrucose at tyle heads, acerate tips, 93–*157*–231 × 8–*11*–14 µm. One **toxiform oxea**, was seen, possibly homologous to the styles of the bouquets.

Ecology – Sprawling over vertical rocky substrate at 33 m depth, associated to many brachiopods, anthozoans, sea urchin, and another encrusting sponge (yellow coloured).

Distribution – Known only from Isla Blanca, Matarani (17°00' S – Arequipa Region).

Remarks – There are only two species of *Plocamione* registered for the entire Pacific, namely *P*. ***ornata*** from deep-waters off New Zealand, and *P*. ***pachysclera*** from deep waters off New Caledonia. *Plocamione matarani* is quite distinct from both in terms of spicule geometry, and further differs from the latter species, by its bushy-ramose habit. It is by far the shallowest species ever found of *Plocamione*.

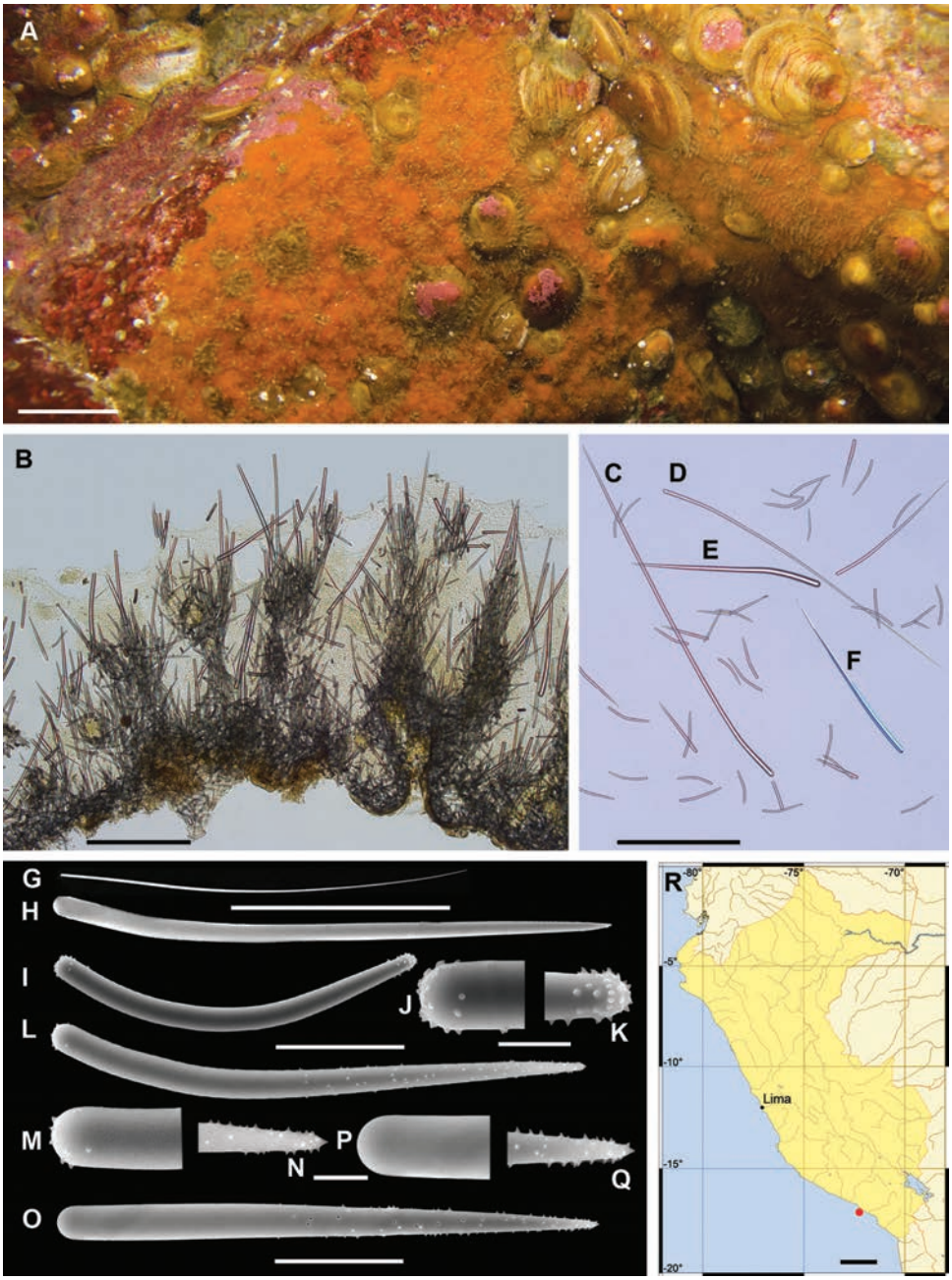


Fig. 73. *Plocamione matarani* Recinos, Pinheiro, Willenz & Hajdu, 2020. A, live specimen; B, skeleton architecture in transverse ground section showing the ectosome and choanosome; C–D, large piercing subectosomal styles I; E–F and H, subectosomal styles II; G, ectosomal style; I–K, choanosomal acanthostrongyle of the basal layer with details; L–Q, echinating acanthostyles with details of heads and tips; R, distribution map. Scale bars; A, 2 cm; B–F, 500 µm; G–H, 200 µm; I, 50 µm; J–K, 10 µm; L, 50 µm; M–N, 10 µm; O, 50 µm; P–Q, 10 µm; R, 200 km.

Order Tetractinellida

Geodia sp.

Stelletta sp. 1

REFERENCES: Sollas, 1888; de Laubenfels, 1932; Desqueyroux-Faúndez & van Soest, 1997.

Description – Thickly encrusting to sub-spherical or irregularly massive, covering 2 × 10 cm to 10 × 10 cm. Surface even, with encrusted foreign debris and a few fistules, or abundantly covered with epibionts. Consistency rather coriaceous, slightly compressible. Colour from grey to white in life and after fixation in ethanol.

Skeleton – Oxeas and plagiotriaenes radiate at the periphery of the sponge with the cladomes of the plagiotriaenes tangential to the sponge surface. Asters of variable abundance in the choanosome, usually forming a thin crust at the surface.

Spicules – Megascleres. **Oxeas**, straight, fusiform and sharply pointed, 935–2789 × 17–60 µm. **Plagiotriaenes**, with straight rhabdomes, 774–1394 × 33–64 µm, cladomes (width) 119–245 µm, clads (length) 60–169 µm. The specimen from Punta Sal has a second, smaller category of plagiotriaenes, 349–553 × 21 / 34–85 / 17–43 µm. **Microscleres**. **Oxyasters** to **strongylasters**, seemingly not separable in two categories, as dimensions, as well as distribution, overlap, rays acanthose, 8.3–19.6 µm. The single possible divergence being the larger asters' tendency to exhibit less rays, but this was only seen in the specimen from Islas Lobos de Afuera.

Ecology – Specimens occurred under stones at 11–15 m depth, partly covered by bryozoans and other encrusting sponges or under overhangs and covered by zoanthids.

Distribution – Known from Punta Sal (03°58' S – Tumbes Region) and Islas Lobos de Afuera (06°55' S – Lambayeque Region).

Remarks – Only five species of *Stelletta* were reported from the Eastern Pacific until presently. These are *S*. ***clarella*** from California, *S*. ***eduardoi*** from Galápagos, *S*. ***estrella*** also from California, *S*. ***phrissens*** and *S*. ***vosmaeri***, the latter two from southern Chile. All of these are markedly distinct from the Peruvian species, starting by the fact that all have ana- and/or dichotriaenes. The Peruvian species is thus likely new.

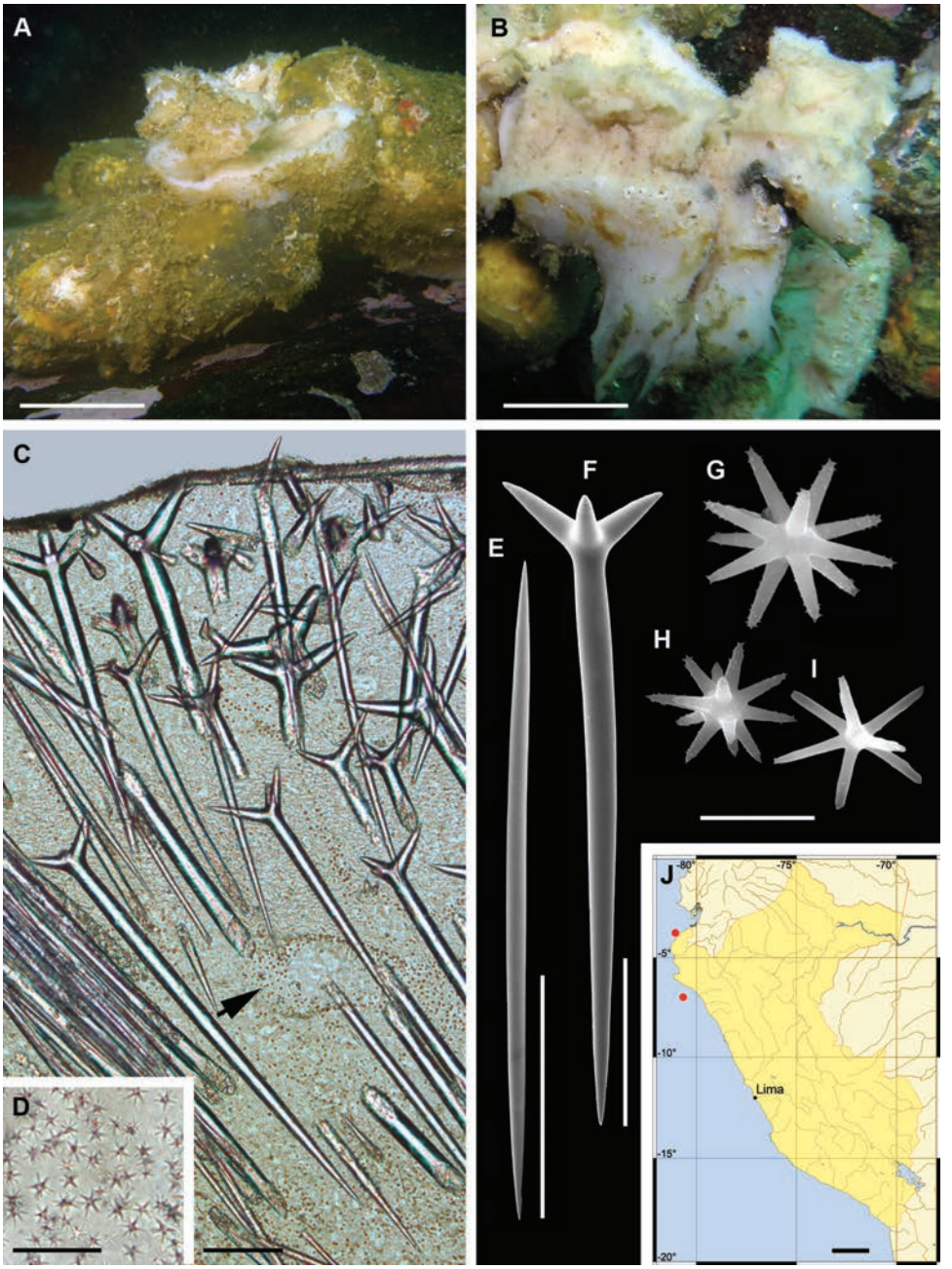


Fig. 74. *Stelletta* sp. 1. A–B, live specimen; C, skeleton architecture in transverse ground section with abundant asters in the choanosome (arrow); D, detail of the choanosomal asters; E, oxea; F, plagiotriaene; G–H, oxyasters; I, chiaster; J, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 200 µm; D, 50 µm; E, 1 mm; F, 200 µm; G–I, 10 µm; J, 200 km.

Fig. 75. *Stelletta* sp. 1. Transverse ground section with abundant asters forming a thin crust at the surface of the sponge. Scale bar: 100 µm.

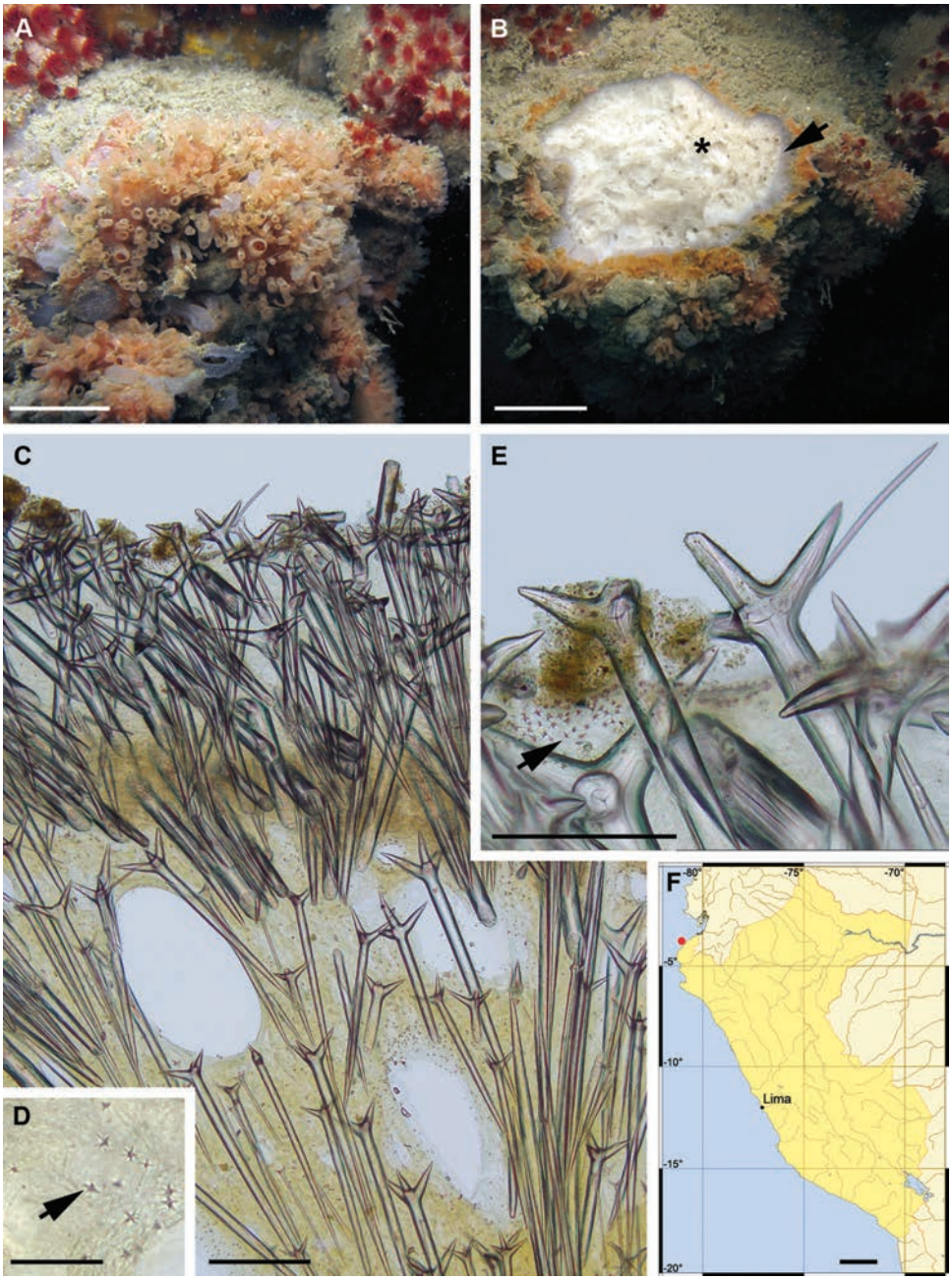


Fig. 76. *Stelletta* sp. 1. A, live specimen barely visible under epibionts; B, same specimen with choanosome (*) and ectosome (arrow) clearly distinct to the naked eye after removal of a fragment; C, skeleton architecture in transverse ground section; D, detail of the scarce choanosomal asters; E, detail of the cladomes of the plagiotriaenes emerging at the periphery of the sponge surface and asters mostly ectosomal (arrow); F, distribution map. Scale bars: A–B, 2 cm; C, 200 µm; D, 50 µm; E, 100 µm; F, 200 km.

Stelletta sp. 2

REFERENCES: Sollas, 1888; de Laubenfels, 1932; Desqueyroux-Faúndez & van Soest, 1997.

Description – Irregularly massive, seemingly cementing loose substrate, up to 5 cm diam. Surface even, with encrusted foreign debris, appearing reticulated. Consistency rather coriaceous, slightly compressible. Colour light yellow in the choanosome and off white in ectosome in life, and after fixation in ethanol.

Skeleton – Oxeas, plagiotriaenes and anatriaenes radiate towards the periphery of the sponge with the clads of the plagiotriaenes tangential to the sponge surface. Strongylasters to tylasters common, spread in the choanosome.

Spicules – Megascleres. Oxeas, straight, fusiform with blunt ends, occasionally modified to strongyles or styles, 887–1416 × 26–43 µm. **Plagiotriaenes**, with straight rhabdome, 327–411 × 10–19 µm, cladome (width) 49 µm, clads (length) 29–53 µm. **Anatriaenes**, also with straight rhabdome, 458 × 8.6–12.4 µm, cladome (width) 57–78 µm, clads (length) 34–65 µm in thickness. **Microscleres. Strongylasters to tylasters**, diameter 5.3–8 µm.

Ecology – A single specimen was found, under stones at 13 m depth.

Distribution – Known from Punta Sal (03°58' S – Tumbes Region).

Remarks – This is the 7th species of *Stelletta* reported from the Eastern Pacific. As in the case of *Stelletta* sp. 1, no dichotriaenes were seen in the studied materials, which already settles this species as distinct from those known prior to the present study. *Stelletta* sp. 2 differs from sp. 1 (briefly described above) by its much larger oxeas and plagiotriaenes, as well as lack of anatriaenes. Furthermore, its microscleres are strongylasters to tylasters (diameter 5.3–8 µm), while those in sp. 1 are oxyasters to strongylasters (diameter 8.3–19.6 µm).

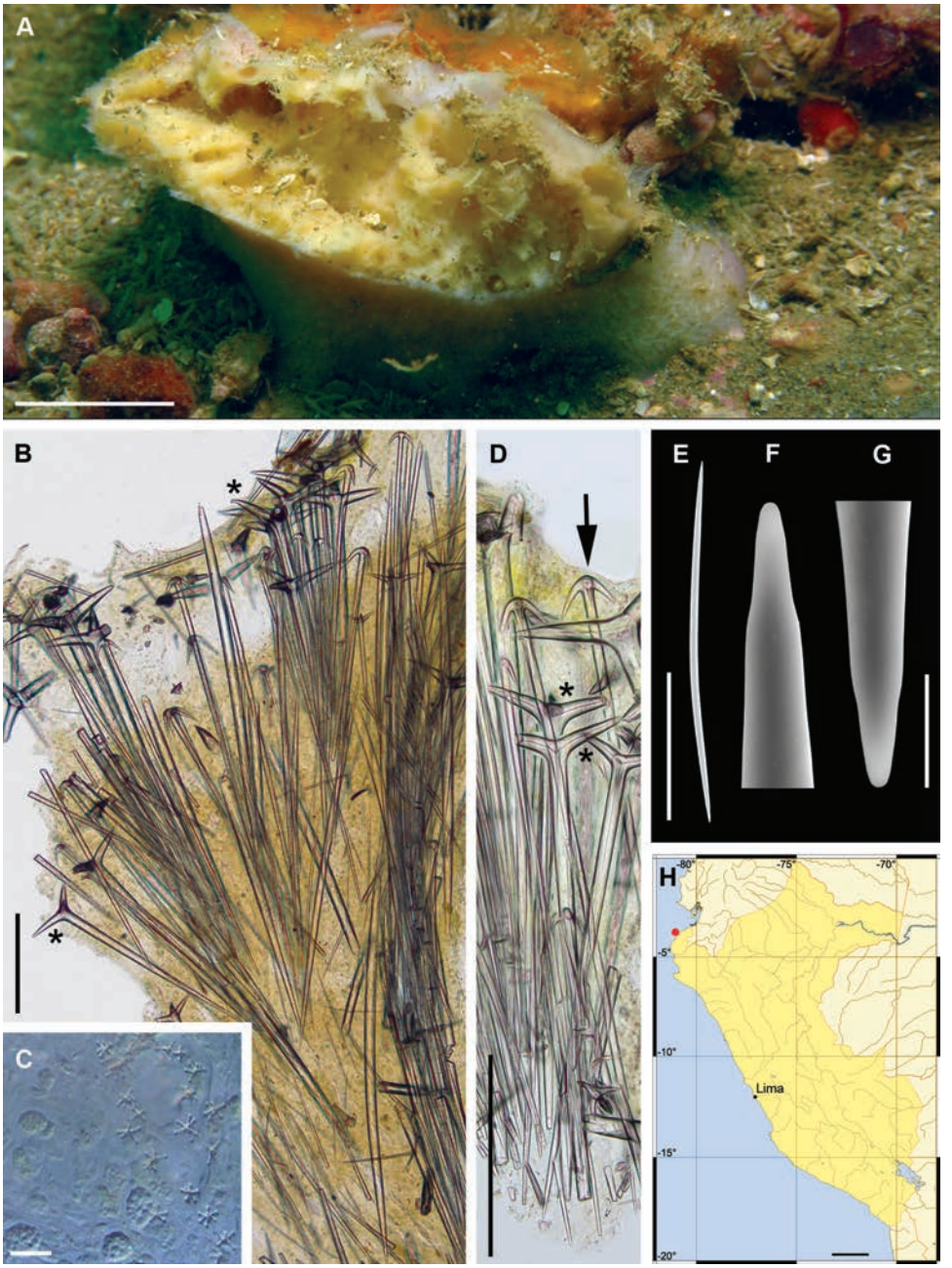


Fig. 77. *Stelletta* sp. 2. A, live specimen; B, skeleton architecture in transverse ground section, plagiotriaenes (*); C, detail of the choanosome with abundant microscleres (asters); D, anatriaenes (arrow) and plagiotriaenes (*); E, oxea; F–G, blunt ends of oxeas; H, distribution map. Scale bars: A, 1 cm; B, 200 µm; C, 10 µm; D, 200 µm; E, 500 µm; F–G, 20 µm; H, 200 km.

Neophrissospongia galapagoensis Schuster, Cárdenas, Pisera, Pomponi, Kelly, Wörheide & Erpenbeck, 2018

REFERENCES: Pisera & Lévi, 2002; Schuster, Cárdenas, Pisera *et al*., 2018.

Description – Flared vase to foliose shaped sponge; flattened walls 1–1.5 cm thick, with rounded edges. Dimensions, 20–30 cm in diameter, 17–20 cm in height. External inhalant surface with numerous barely visible ostia, inner exhalant surface with numerous oscules < 1 mm. Consistency stony. Colour in life unknown, turning brown when dried.

Skeleton – Ectosomal skeleton about 100–200 µm thick with an outermost thin layer of microscleres within which are found the cladomes of the dichotriaenes with their rhabdomes deeply inserted in the choanosome. Choanosomal skeleton made of imbricated dicranoclone desmas and acanthose microtylostyles.

Spicules – Megascleres. **Dicranoclone desmas**, with a massive, tetra or hexapodal, arched core with terminal zygomes. Central core and arms irregularly covered with tubercules. **Dichotriaenes**, with rhabdome, 261–*428*–577 × 24–36 µm long and cladome, 240–281 µm wide, upper surface of clads with irregular, conical tubercules. **Microscleres. Irregular sanidasters to amphiasters**, with short, thick rays, 8.6–*9.8*–11.8 µm (maximum diameter). **Acanthose microtylostyles**, 64–*73.6*–84 × 1.1–1.2 µm.

Ecology – Trawled from about 120 m.

Distribution – Originally described from the Galápagos, this specimen is the first record from the Northern coast of Peru. No accurate location available.

Remarks – Only two specimens in our collection, brought back by fishermen from Puerto Pizarro. There are only six additional species of *Neophrissospongia* known worldwide. *Neophrissospongia* ***nolitangere*** and *N*. ***tubulata*** from the tropical Western Atlantic; *N*. ***endoumensis***, *N*. ***nana*** and *N*. ***radjae*** from the Mediterranean Sea; and *N*. ***microstylifera*** from New Caledonia, the only other species in the Pacific. Peruvian specimens appear to have quite shorter asters than Galápagos ones, but for the rest, micrometries match. The original description of *N*. *galapagoensis* emphasized the stoutness of dichotriaenes and occurrence of microstyles in *N*. *microstylifera* as main distinguishing characters of both species, but this is likely a mistake. While dichotriaenes appear indeed stouter in the New Caledonian species, it is the somewhat larger dimensions of microstyles that render these distinct, not their mere occurrence, as *N*. *galapagoensis* also has similar microscleres. On the other hand, in spite of not clearly illustrated, the small microstrongyles in *N*. *microstylifera* do not have a correspondence in *N*. *galapagoensis*, and more remarkably, the former seems not to have asterose microscleres, which are of quite common occurrence in the Peruvian specimens of *N*. *galapagoensis*.

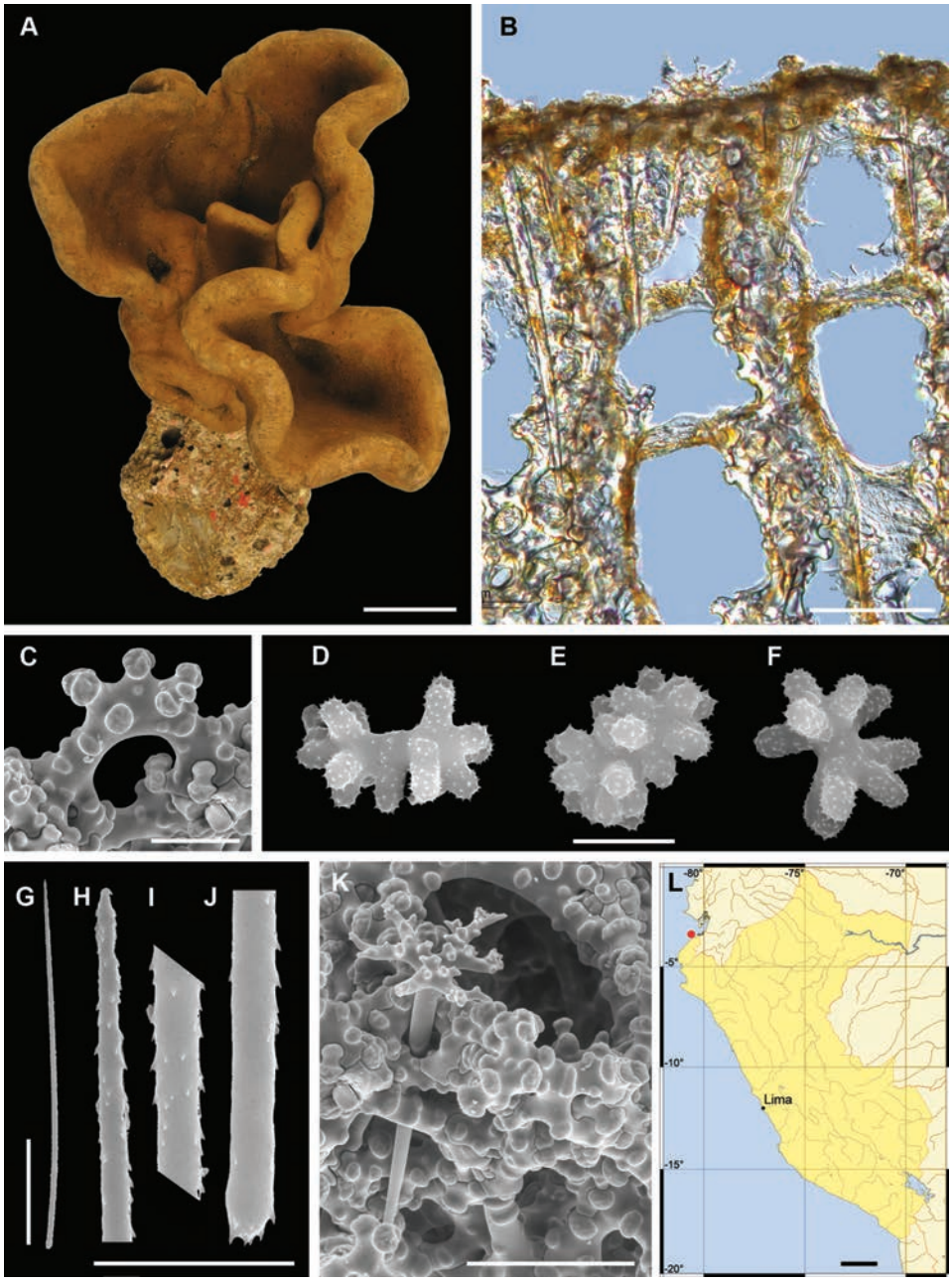


Fig. 78. *Neophrissospongia galapagoensis* Schuster, Cárdenas, Pisera, Pomponi, Kelly, Wörheide & Erpenbeck, 2018. A, dried specimen; B, skeleton architecture in transverse ground section; C, dicranoclone desma; D–F, thick sanidasters to amphiasters from the ectosomal region; G, microspinose choanosomal microtylostyle; H–J, detailed views; K, ectosomal dichotriaene with its cladome standing out of the desma and rhabdome penetrating into the choanosome; L, distribution map. Scale bars: A, 5 cm; B, 200 µm; C, 100 µm; D–F, 5 µm; G, 20 µm; H–J, 5 µm; K, 200 µm; L, 200 km.

Geodia sp.

REFERENCES: von Lendenfeld, 1910; Desqueyroux-Faúndez & van Soest, 1997.

Description – Specimens covering 10 to 15 cm^2, reaching up to 2 cm in thickness. Consistency brittle and texture rough. Surface evenly perforated, with a loose basal layer of spicules considerably piercing the sponge surface (approx. 5 mm) and looking like a beard, trapping sediments. No oscule apparent in live specimens judging from the *in situ* photos and specimens. A dense outer crust clearly visible to the naked eye upon sectioning of specimens. Colour in life and in ethanol is white.

Skeleton – Architecture comprises a dense cortical layer, and a radial choanosomal skeleton underneath. The cortex is bilayered, with a thinner outer layer comprising small oxeas organized in loose brushes, intermingled to abundant strongylasters, and a thicker inner layer composed essentially of sterrasters. Both layers are not continuous, but regularly traversed by canals leading to appertures (ostia?) at the surface. This cortex sits on the supporting cladomes of plagiotriaenes, both large and small, and occasional protriaenes. Triaenes are radially oriented, with rhabdomes pointing centripetally, and separated by a system of subcortical canals or lacunae with the approximate diameter of the cladomes of the plagiotriaenes, but appearing thinner the deeper in the choanosome they are. Protriaenes can have their cladomes nested in the layer of sterrasters, or pierce the surface slightly, as did the anatriaenes, with cladomes outside the sponge. Scattered sterrasters occur deep in the choanosome too, and this is no artifact from sectioning. Larger oxyasters are more easily seen bordering the canals. Large oxeas are found in the choanosome radiating out from the center of the sponge, among triaenes.

Spicules – Megascleres. **Oxeas I**, large 437–*1330*–2014 × 4–*21.2*–39 µm. **Oxeas II**, small, 114–*144*–210 × 3.9–*5.4*–8.9 µm. **Plagiotriaenes I**, large, 931–*1658*–2408 × 24–*39.9*–56 (rhabdome) × 204–*299.6*–357 (cladome) × 92–*139*–206 µm (clade). **Plagiotriaenes II**, small, 148–*630*–859 × 5–*16.1*–20 (rhabdome) × 36–*103*–126 (cladome) × 16–*51*–65 µm (clade). **Mesotriaenes**, 1819–2296 × 14–21 (rhabdome) × 59–92 (cladome) × 57–71 µm (clade). **Protriaenes**, 1352–*1749*–1972 × 8–*12.2*–15 (rhabdome) × 46–*62*–77 (cladome) × 20–*44*–61 µm (clade). **Anatriaenes**, 1119–*1569*–1932 × 3–*5.7*–9 (rhabdome) × 21–*41.4*–69 (cladome) × 14–*27.4*–45 µm (clade). Microscleres. **Sterrasters**, 52–*64.4*–73 µm**.** **Oxyasters**, 18–25 µm. **Oxyspherasters**, 13–16 µm. **Strongylasters I**, 35 µm. **Strongylasters II**, 4.8–*5.6*–6.8 µm.

Ecology – Specimens growing over vertical, irregular, shallow (7–17 m depth) rocky substrate. Aside the trapped sediments on the lower surface, algae, bryozoans, anthozoans and tube-worms are also in close contact, sharing the same 10 × 10 cm of rock.

Distribution – Only known from Punta Sal (03°57' S – Tumbes Region) and El Ñuro (04°13' S – Piura Region).

Remarks – There are at least 15 species of *Geodia* reported from the E Pacific, between California and the Chilean fjords, among which only three from similarly shallow waters of the Gulf of Panama (*G*. ***ataxastra***), Galápagos (*G*. ***media***)

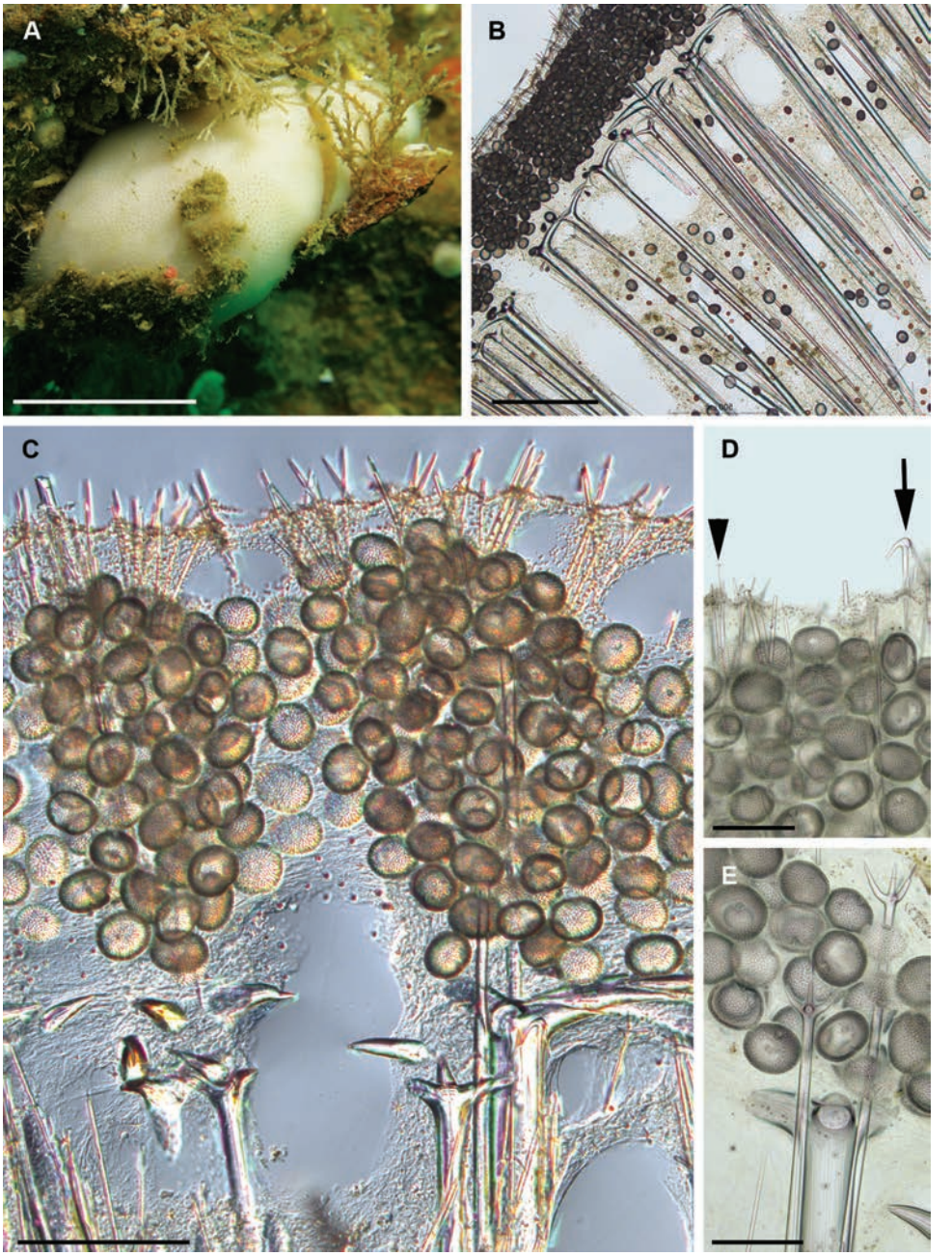


Fig. 79. *Geodia* sp. A, Live specimen; B, skeleton architecture of the cortex and choanosome in transverse ground section; C, detail of the cortex showing the thin outer layer of small oxeas organized in brushes on top of the thicker layer of sterrasters, with underlying choanosome; D, detail of the cortex with small (arrowhead) and large (arrow) anatriaenes emerging at the surface of the sponge; E, detail of the cortex near the surface with occasional thin protriaenes. Scale bars: A, 2 cm; B, 500 µm; C, 200 µm; D–E, 100 µm.

and Easter Island (*G*. ***amphistrongyla***). There are another two species from the Galápagos Islands, for which no depth was recorded (*G*. ***micropora*** and *C*. ***oxyastra***). Among the remaining, eight species were reported from depths of 33–97 m. A quick tabulation of spicule data from the literature revealed important differences to categories present and micrometric values observed in comparison to the Peruvian materials presented here, which may belong in a new species. But since depth ranges are unknown for most of these species, and shifts in dimensions and frequencies of triaenes in particular, can easily ensue mistaken identifications, a detailed comparison will be mandatory for some of the above species, ideally based on revision of original materials, as several spicule categories (triaenes and asters) turned out to be rather rare, and seemingly not universal (e.g. smaller plagiotriaenes, meso-, pro- and anatriaenes, oxyspherasters and large oxyasters) in the specimens reported here.

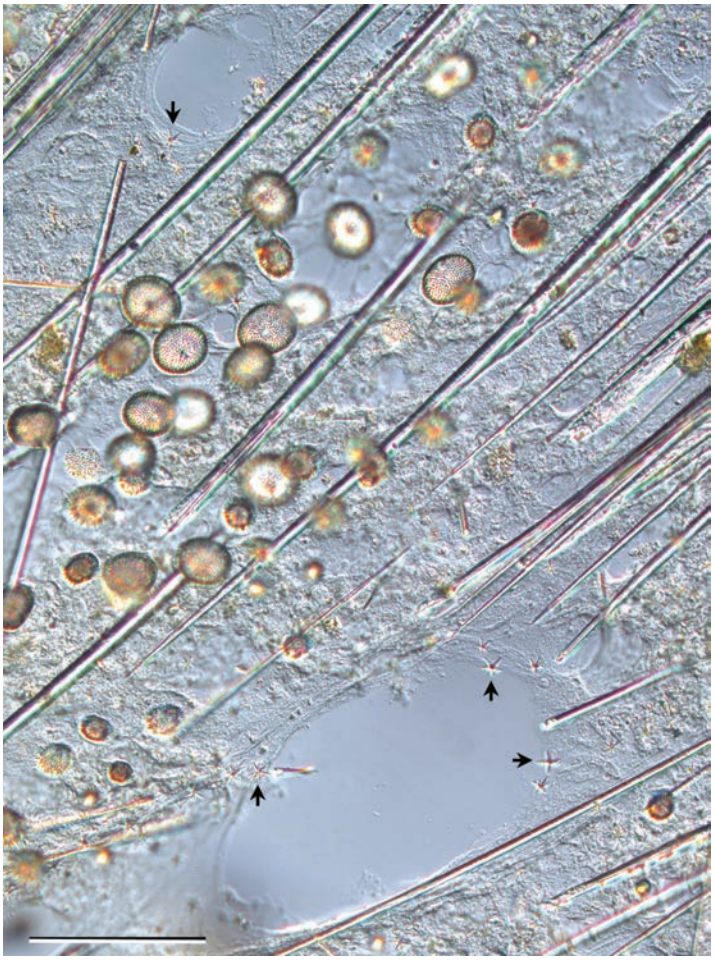


Fig. 80. *Geodia* sp. Detail of the choanosome in transverse ground section with oxyasters bordering the aquiferous canals (arrows). Scale bar 200 µm.

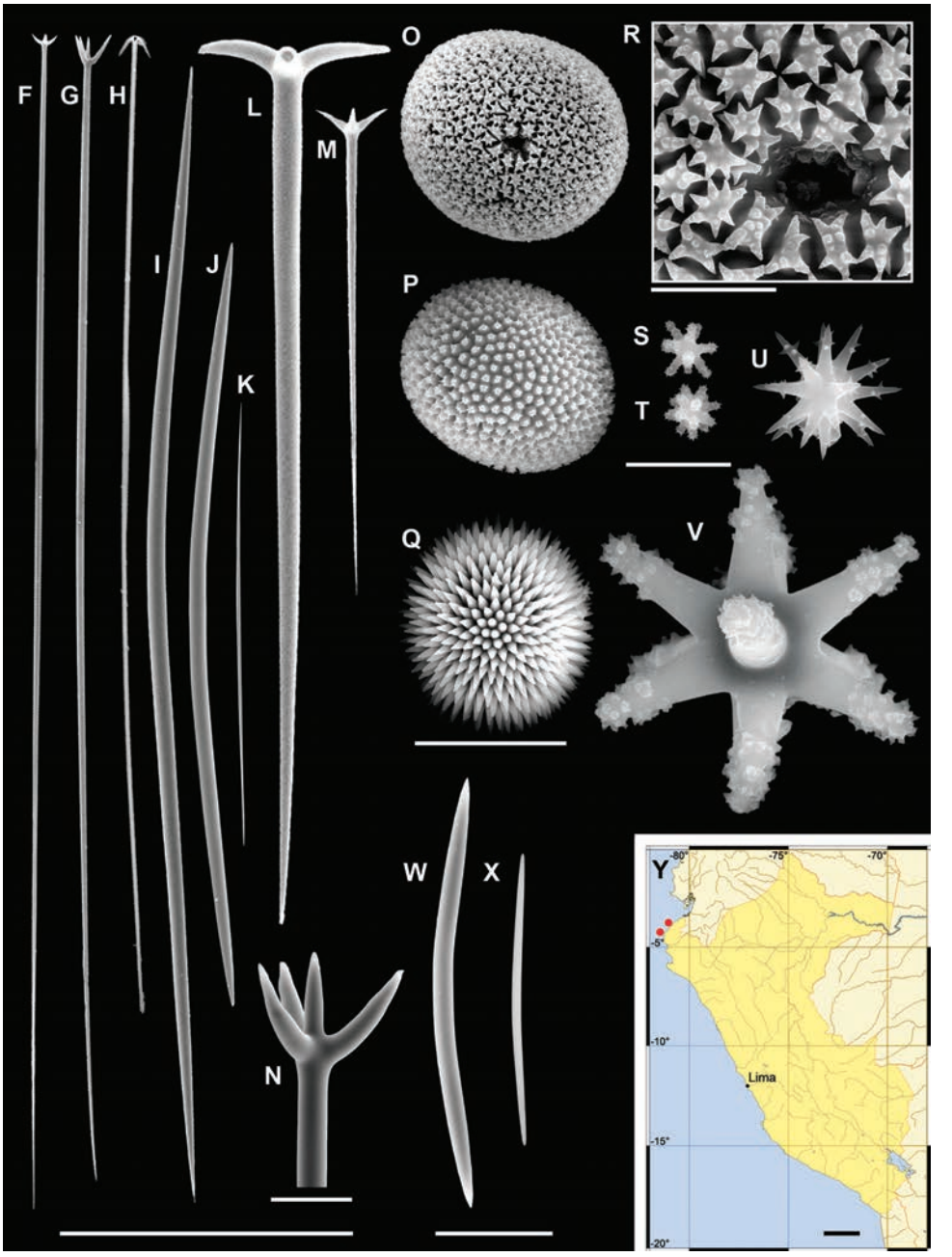


Fig. 81. *Geodia* sp. F, protriaene; G, mesotriaene; H, anatriaene; I–K, large oxeas of the choanosome; L–M, plagiotriaenes of two categories; N, cladome of a mesotriaene; O, mature sterrasters; P, sterraster near maturity; Q, immature sterraster; R, mature sterraster rosettes; S–T, small strongylasters; U, spheroxyaster; V, large strongylaster; W–X, small oxeas of the cortex; Y, distribution map. Scale bars: F–M, 500 µm; N, 50 µm; O–Q, 40 µm; R–V, 10 µm; W–X, 50 µm; Y, 200 km.

***Scleritoderma* sp.**

REFERENCES: Sollas, 1888; Schuster, Cárdenas, Pisera *et al*., 2018.

Description – Massive and flabelliform. Specimen measures 20 cm in its largest width, about 10 cm in height. Consistence stony and hard. Surface punctate with oscula openings 200–300 µm in diameter. Colour in life unknown, dark beige when dried.

Skeleton – Ectosomal skeleton with frequent acanthorhabds on the surface. Choanosomal skeleton a dense lithistid architecture of interlocked thorny rhizoclones.

Spicules – Megascleres. **Rhizoclone desmas**, with tuberculate spines. **Tylostyles**, see remarks section below. **Microscleres**. **Acanthorhabds**, slightly curved, occasionally slightly fusiform, spined all over, or with the exception of a narrow central ring, 51–*65*.*8*–89 × 4.9–*7*.*7*–9.1 µm. Rare deemed contaminant spicules like oxeas and broken acanthostyles can occur.

Ecology – Trawled at depth greater than 120 m by fishermen.

Distribution – Only known from the Northern coast of Peru. No accurate location available.

Remarks – Four species of *Scleritoderma* are known in the Indo-west Pacific, *S*. ***camusi*** from New Caledonia, *S*. ***flabelliforme*** from several locations in the West Pacific, *S*. ***nodosum*** from the Coral Triangle and Madagascar, and *S*. ***tortuga*** from Galápagos. It is tempting to stress the geographic proximity between the latter and the Peruvian species, but important differences are apparent. Tylostyles, despite their rarity in *S*. *tortuga*, were clearly shown to be proper, and are all seemingly smooth. Their position in the sponge equates best with exotyles instead, as heads are outside the sponge, the opposite of what would be expected from usual tylostyles. In Peruvian sponges tylostyles are exceedingly rare, dispar (one large and smooth, the other small and basally microspined, as in *S*. *nodosum* and *S*. *flabelliforme* from the Philippines). They were not spotted in the lithistid skeleton, so their positioning remains unverified, and their allochthonous nature cannot be confidently discarded as an option. In addition, acanthorhabds, despite common in Peruvian specimens, do not seem to form the dense layer shown by *S*. *tortuga*. Lastly, not a single sigmaspire was seen in the Peruvian specimen. It is unknown to us whether the latter was already dead at the time of collection, which might partly explain the lack of an ectosomal layer of acanthorhabds in these. The single striking feature differentiating Peruvian material from other *Scleritoderma* spp., is the frequent occurrence of a narrow smooth ring in the central segment of their acanthorhabds. A more detailed study is needed before a confident identification can be proposed for the currently described material.

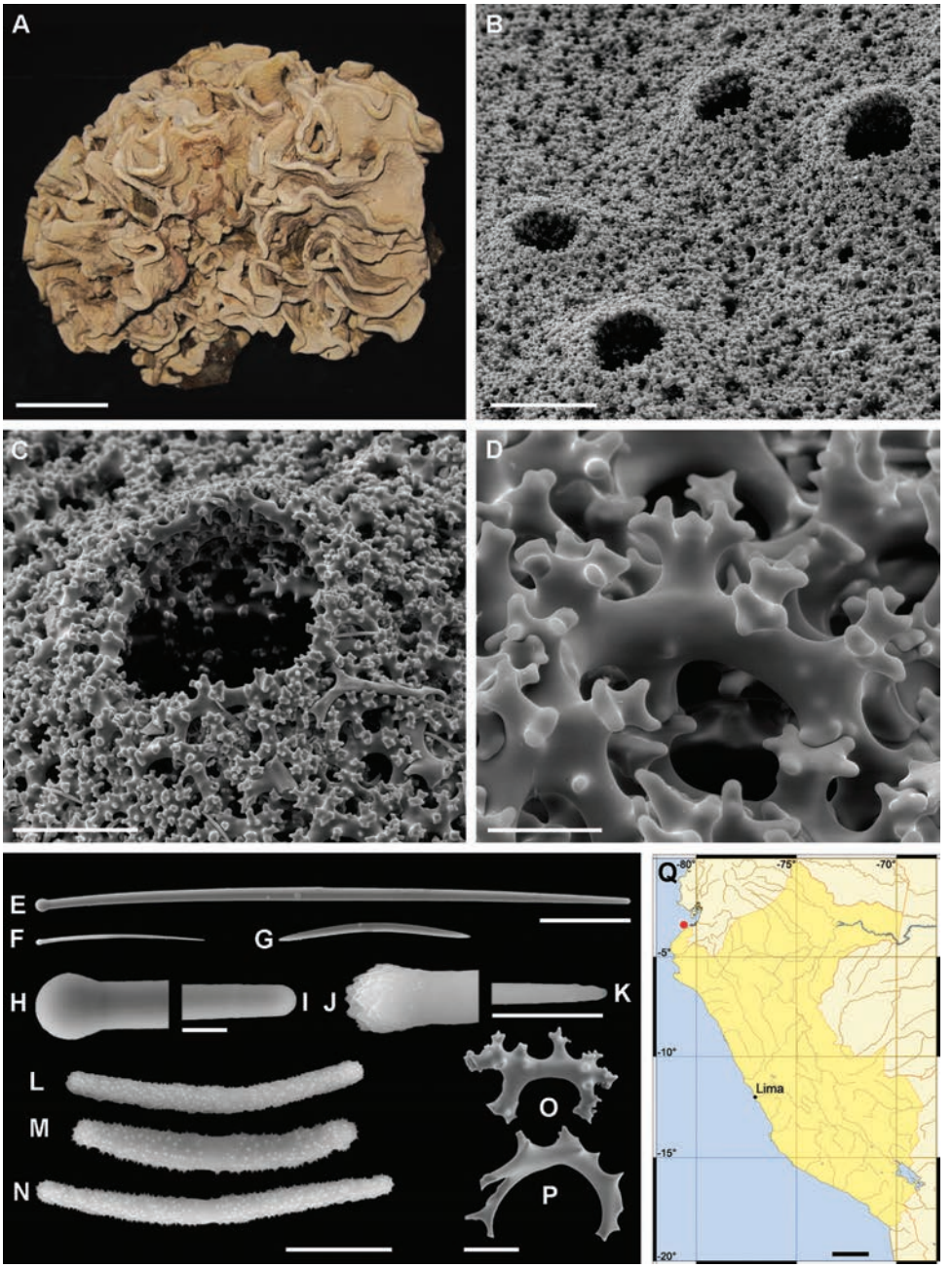
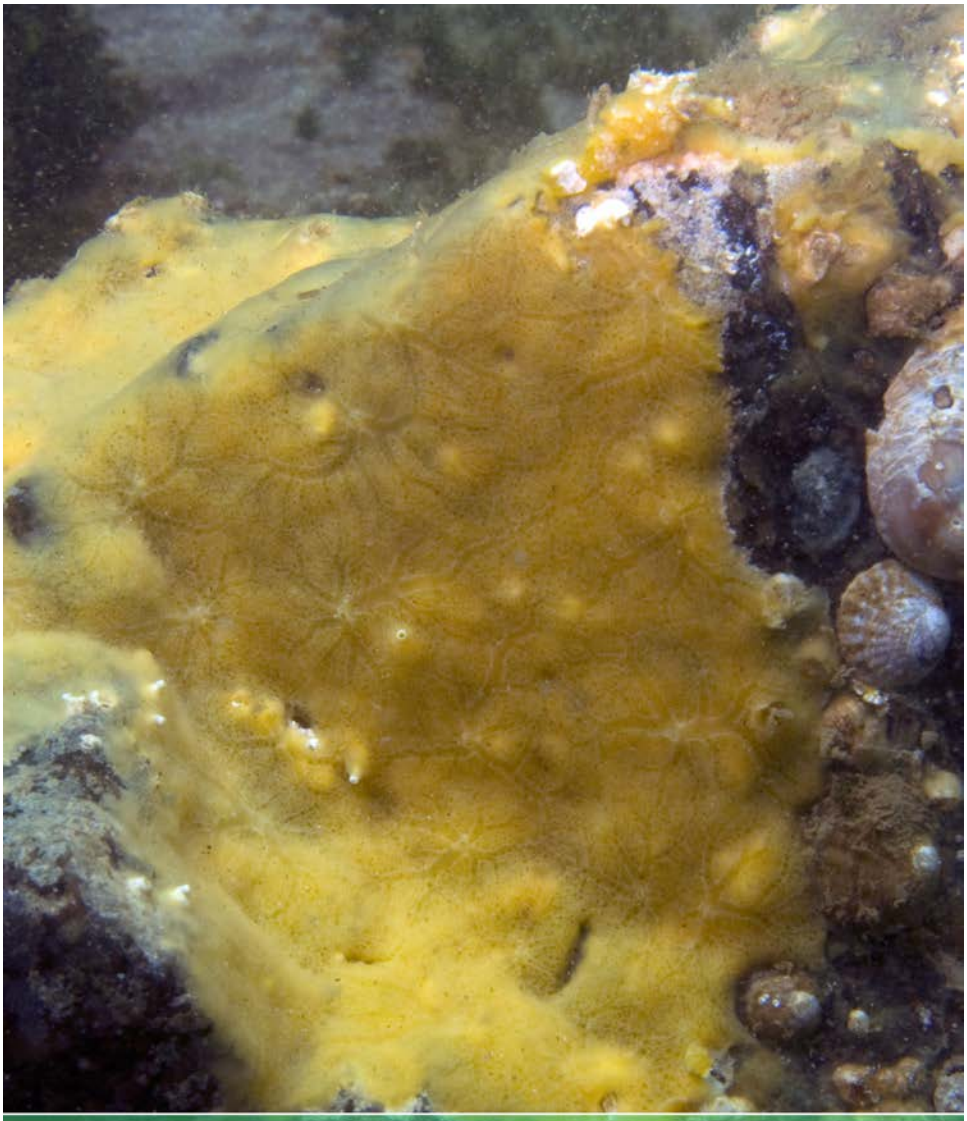


Fig. 82. *Scleritoderma* sp. A, dried specimen; B, overview of the surface with several oscules after removal of the living tissue with nitric acid; C, detail of one oscule opening; D, rhizoclone desmas; E, large tylostyle; F, small tylostyle; G, oxea; H–I, details of E; J–K, details of F; L–N, acanthorhabds; O–P, rhizoclones; Q, distribution map. Scale bars: A, 5 cm; B, 500 µm; C, 200 µm; D, 50 µm; E–G, 100 µm; H–K, 10 µm, L–N, 20 µm; O–P, 100 µm; Q, 200 km.



Order Merliida

Hamacantha (Zygherpe) hyaloderma

Hamacantha (*Zygherpe*) *desmacelloides* Hajdu, Hooker & Willenz, 2015

REFERENCE: Hajdu, Hooker & Willenz, 2015.

Description – Encrusting sponges covering over 15 × 7 cm in area on rocky surfaces, usually no thicker than 1 mm, exceptionally up to 2–3 mm maximum thickness. Surface with a clear ectosomal reticulation and generally visible subectosomal canals. Consistency is fragile with a texture mostly reflecting the underlying substratum. Colour in life is light yellow and beige in ethanol.

Skeleton – Ectosomal architecture with a loose reticulation of tylostyles, either single or in paucispicular tracts. Pores (31–56 µm diameter) are seen in the meshes, and microscleres are abundant. Diancistras are mostly arranged in loose rosettes. Choanosomal architecture consists of short, sinuous, wispy longitudinal paucispicular tracts of tylostyles supporting the tangential ectosomal architecture. Scattered megascleres are common, as well as diancistras, the latter frequently disposed in rosettes around the longitudinal tracts. The choanosomal framework arises from a discontinuous and variably thick tangential basal layer of megascleres and diancistras.

Spicules – **Megascleres**. **Tylostyles**, smooth, slender, mostly slightly curved with well pronounced heads, 138–511 × 5–13 µm. Variations are straight shafted and subtylostylote forms, the latter with elliptical, sub-terminal heads. **Microscleres**. **Diancistras**, cyrtancistra-like, large, smooth, never notched, fimbriae restricted to the inner surfaces of hooks, which may project slightly off the plane of the main shaft, 104–219 µm. **Sigmas I**, large, relatively stout, mostly contorted, apically microspined, 18–26 µm. **Sigmas II**, small, relatively stout, mostly contorted, microspined on both apical thirds or fourths, 8–16 µm.

Ecology – Specimens recorded between 3 and 14 m depth at temperatures of 13–21°C. Barnacles, brachiopods, bryozoans, ophiuroids, polychaetes, schrimps and other sponges occurred nearby.

Distribution – Ranges from Isla Foca (05°12' S – Piura Region) to Quilca (16°42' S – Arequipa Region).

Remarks – *Hamacantha* (*Zygherpe*) *desmacelloides* differs from the only other *Hamacantha* known to possess tylostyles and an encrusting habit, *H*. (*Z*.) *hyaloderma*, by its diancistras which are over three times larger and of different morphology, as well as two categories of apically microspined sigmas in contrast to two or three smooth categories in *H*. (*Z*.) *hyaloderma*.

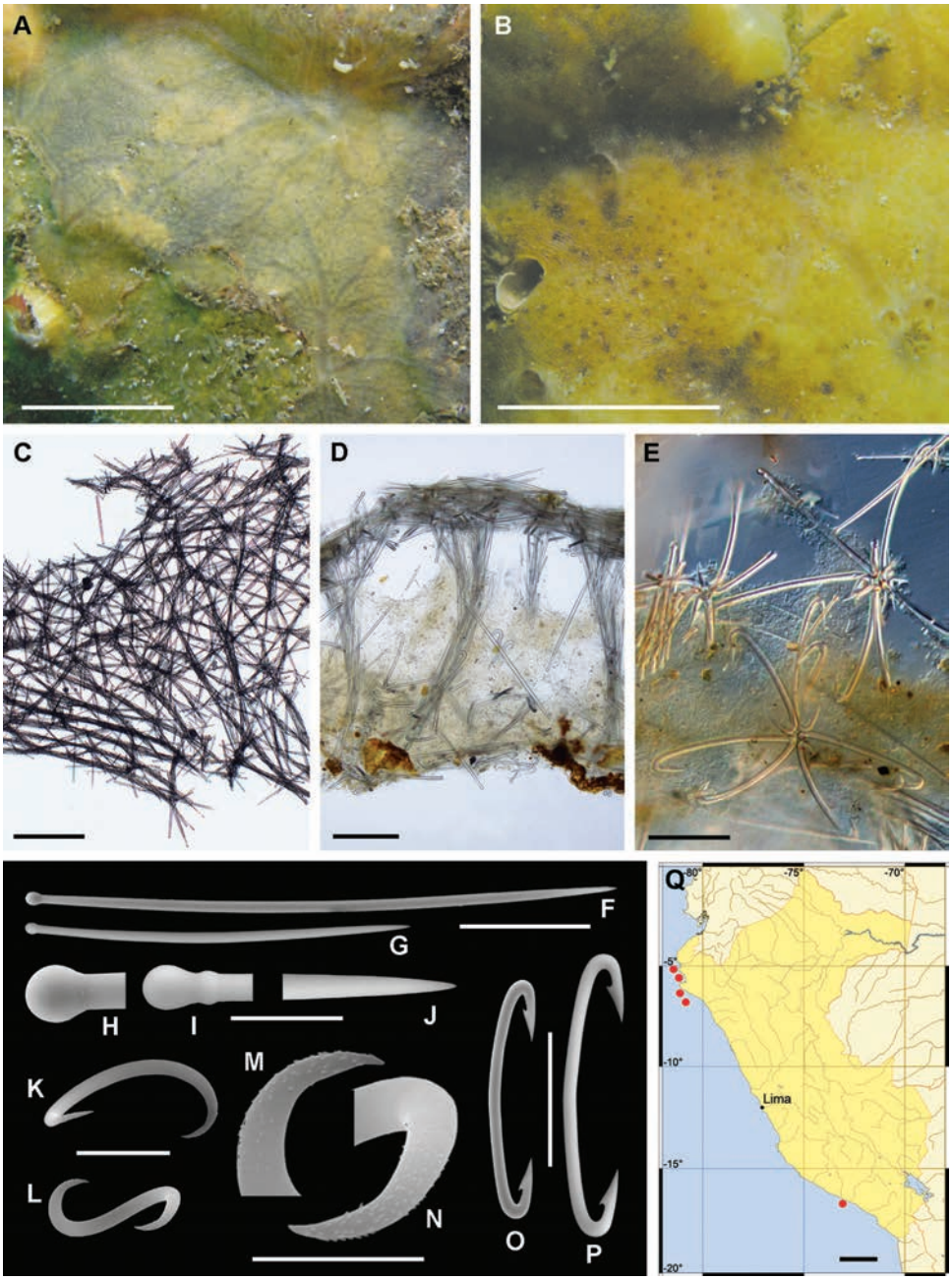


Fig. 83. *Hamacantha* (*Zygherpe*) *desmacelloides* Hajdu, Hooker & Willenz, 2015. A–B, live specimens; C, ectosomal architecture in tangential view; D, choanosomal architecture in transverse ground section; E, diancistras in rosettes; F–G, tylostyles; H–I, bases of tylostyles; J, apex of tylostyles; K, sigma I (larger); L, sigma II (smaller): M–N, terminal spination on sigmas II; O–P, diancistras; Q, distribution map. Scale bars: A–B, 1 cm; C–D, 200 µm; E–G, 100 µm; H–J, 20 µm; K–L, 10 µm; M–N, 5 µm; O–P, 100 µm; Q, 200 km.

***Hamacantha* (*Zygherpe*) *hyaloderma* (de Laubenfels, 1932)**

REFERENCES: de Laubenfels, 1932; Hajdu, Hooker & Willenz, 2015.

Description – Encrusting species covering over 20 × 10 cm in area on granitic boulders, about 1 mm thick. Surface bears conspicuous meandering subectosomal canals, leading to a few scattered oscula up to 1 mm in diameter. Texture is smooth and consistency somewhat fragile. Colour in life is yellow or orange-yellow and beige in ethanol.

Skeleton – Ectosomal architecture unspecialized. Only scattered microscleres occur, and the wispy terminations of ascending choanosomal tracts. Choanosomal architecture with sinuous ascending wispy tracts of megascleres.

Spicules – **Megascleres**. **Tylostyles**, smooth, mostly slender and straight, heads well pronounced, usually spherical, frequently subterminal, 149–240 × 4–6 µm. **Microscleres**. **Sigmas I**, large, uncommon, relatively stout, smooth, contorted, 30–89 µm. **Sigmas II**, small, abundant, relatively stout, smooth, contorted, 14–23 µm. **Diancistras**, smooth, mostly contorted, with conspicuous notches, hooks run parallel to axis which has fimbriae on both apical thirds, 26–38 µm.

Ecology – Specimens can be partly epibiontic over gastropods, cirripeds and polychaete tubes. Between 4 and 10 m depth at temperatures of 14–15°C.

Distribution – Only found from Matarani and Quilca (16°42' S and 16°50' S – Arequipa Region).

Remarks – Originally reported from California, the species has subsequently been found in Washington, Oregon, British Columbia, Lower California and finally Peru. A large geographic gap exists between the Mexican and southern Peruvian locations.

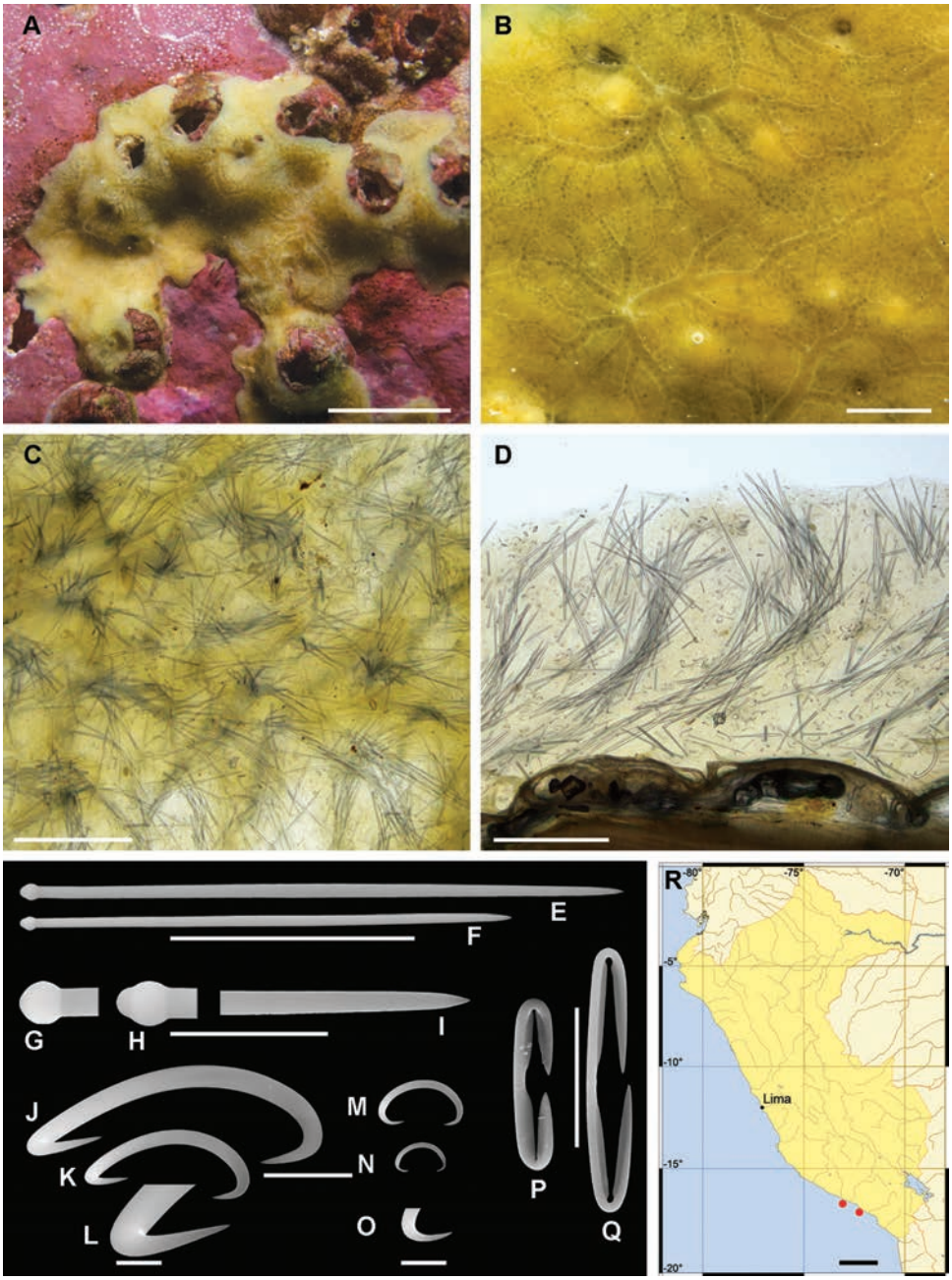


Fig. 84. *Hamacantha* (*Zygherpe*) *hyaloderma* (de Laubenfels, 1932). A–B, live specimens; C, ectosomal architecture in tangential view; D, choanosomal architecture in transverse view; E–F, tylostyles; G–H, bases of tylostyles; I, apex of tylostyles; J–K, sigmas I (large); L, smooth end of sigma I; M–N, sigmas II (small); O, smooth end of sigmas II; P–Q, diancistras, R, distribution map. Scale bars: A, 1 cm; B, 0.5 cm; C–D, 200 µm; E–F, 100 µm; G–K, 20 µm; L, 5 µm; M–N, 20 µm; O, 5 µm; P–Q, 20 µm; R, 200 km.


Order Poecilosclerida
Mycale (Carmia) cf. cecilia

Acarnus aff. *peruanus* van Soest, Hooper & Hiemstra, 1991

REFERENCES: van Soest, Hooper & Hiemstra, 1991; Aguilar-Camacho, Carballo & Cruz-Barraza, 2013.

Description – Encrusting sponge with lobes, spreads over 6 × 5 cm in area, with lobes smaller than 2 cm in largest diameter. Surface appears smooth to the eye. Consistency very soft, unless you feel the substrate underneath. No apparent subectosomal canals, one oscule for each lobe. Colour in life vermillion-red, turning to beige in ethanol.

Skeleton – The most prominent feature of its architecture is an abundance of cladotylotes of two categories, which can occur in rosettes (larger ones) or erect on the substrate (smaller ones). Both categories can also occur scattered. A few loose tracts of styles are seen here and there. Some of these styles reach the surface, where they can form loose brushes together with a few tylotes. Acanthostyles are erect on the substrate. Microscleres abound everywhere.

Spicules – Megascleres. **Tylotes**, terminally microacanthose, 133–300 µm. **Styles**, basally microacanthose, 289–347 µm. **Acanthostyles**, fully spined, 78–88 µm. **Cladotylotes I**, large, smooth or acanthose (large thorns), occasionally thickening towards the base, 118–174 µm. **Cladotylotes II**, small, three times less abundant than cladotylotes I, smooth or acanthose, 62–68 µm. **Microscleres**. **Palmate isochelae**, 13–14 µm. **Toxas**, in three categories: larger accolade, 158–264 µm, intermediary three-curved 35–84 µm, smaller "oxhorn" or deeply V-shaped, 5-8 µm.

Ecology – Encrusting on a rock at 10 m depth, in association to red and green algae.

Distribution – So far known only from El Ñuro, south of Quebrada Verde (04°13' S – Piura Region).

Remarks – This species belongs to the ***souriei*** group, as do *Acarnus peruanus*, from Islas Lobos de Afuera. The latter species was originally reported to cover several square feet in area, and be up to 2 cm thick, which in addition to its larger tylotes, and apparent lacks of toxas in the 80–160 µm range, and of small "oxhorn" toxas, make it quite distinct from the El Ñuro specimen. Additional materials of *Acarnus* were obtained in Punta Sal and Cancas, but these were still not studied in detail.

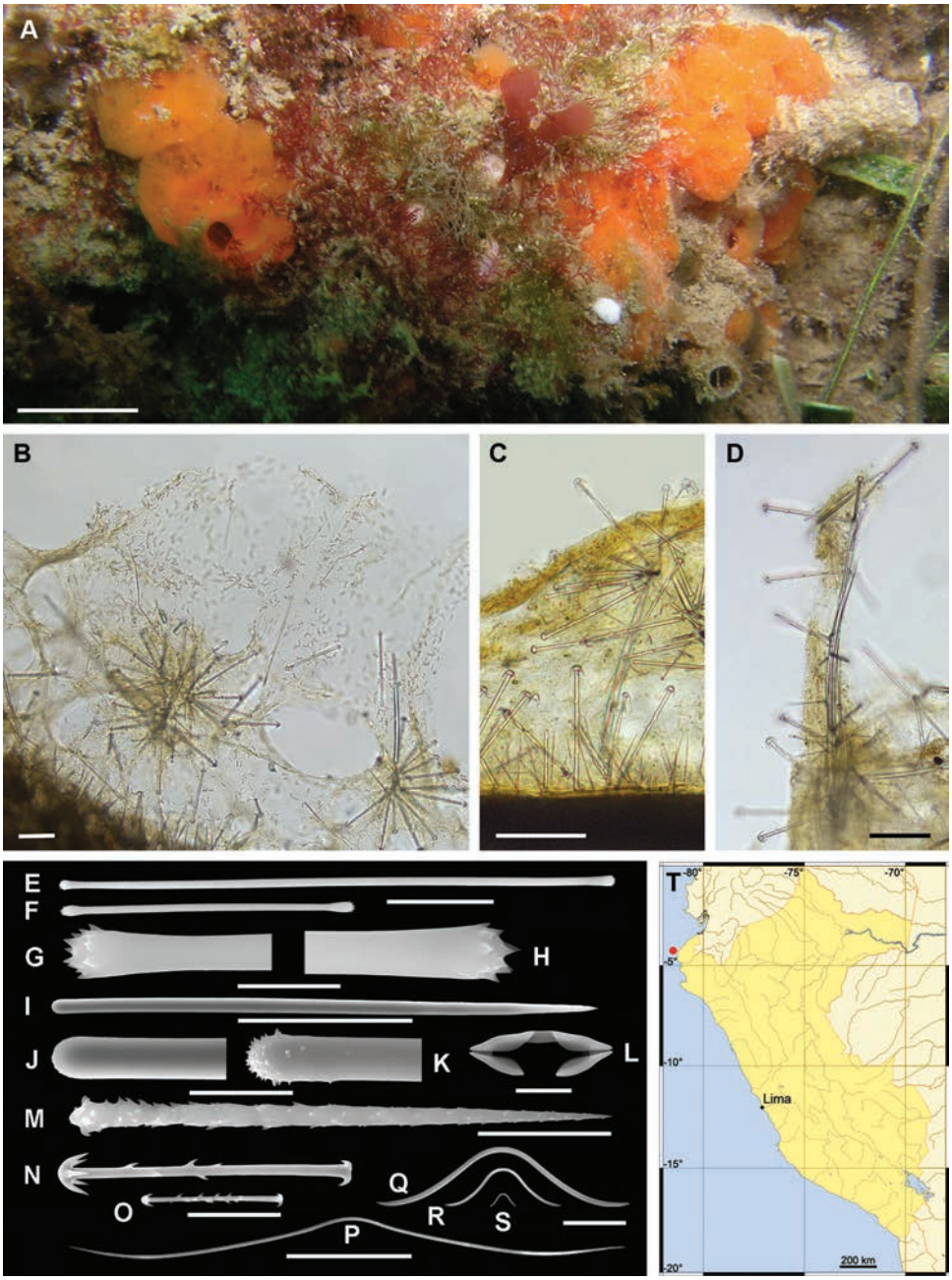


Fig. 85. *Acarnus* aff. *peruanus* van Soest, Hooper & Hiemstra, 1991. A, Live specimen; B–D, Architecture in transverse ground sections; E–F, tylotes; G–H, base and apex of tylotes; I, style; J–K, Different bases of styles; L, palmate isochelae; M, acanthostyles; N–O, cladotylotes of both categories; P, toxa (large accolade); Q–R, toxas (intermediary three-curved); S, toxa (small "oxhorn", deeply V-shaped); T, distribution map. Scale bars: A, 1 cm; B–F, 100 µm; G–H, 10 µm; I, 100 µm; J–K, 20 µm; L, 5 µm; M, 20 µm; N–P, 50 µm; Q–S, 20 µm: T, 200 km.

Celtodoryx sp.

REFERENCES: Perez, Perrin, Carteron *et al*., 2006; van Soest, de Kluiver, van Bragt *et al*., 2007; Henkel & Janussen, 2011.

Description – Specimens massive, 5–10 cm in largest diameter, about 1 cm thick, but nearly flat in terms of outline. Surface appears smooth, with few, small, roundish oscula scattered. Firm consistency. Colour alive light yellow, with or without rosy spots, light beige outside and darker inside when preserved in ethanol.

Skeleton – Five layers are apparent in the skeleton architecture: an outer, ectosomal, with a more or less continuous disposition of wispy brushes of tylotes, only slightly piercing the sponge surface; immediately underneath, an open spaced arrangement, full of lacunae, with sparse, irregular tracts of subtylostrongyles; an outer choanosomal layer with dense irregular tracts of subtylostrongyles mostly laying parallel to the surface; an intermediate choanosomal layer, also quite lacunose, but denser and more confused than the subectosomal lacunose layer; and a deeper choanosomal one, more organized, with clearly recognizable multispicular, longitudinal tracts of subtylostrongyles, despite the abundant megascleres strewn in confusion in this area too. Chelae appear commoner in the subectosomal layer. Acanthostyles, seemingly loose, sigmas and oxydragmas were more often seen in the choanosome.

Spicules – Megascleres. **Ectosomal tylotes**, aniso, straight, isodiametric, abundantly spined on both extremities, 162–*175*–184 × 7–*7.6*–8 µm. Chanosomal **strongylostyles** to **subtylostrongyles**, nearly straight or markedly curved, smooth when young, variously markedly spined on both extremities, 216–*237*–252 × 4.4–*7.9*–10 µm. **Acanthostyles**, uncommon, slender, heavily spined, with some spines looking like thorns, 65–*78*–90 × 2.4–3.5 (shaft thickness alone) × 7.3–7.6 µm (thickness with spines). **Microscleres**. **Arcuate isochelae I**, large, gently curved, relatively large hooks (each about 40% the whole microsclere length), 19–*24*-27 µm. **Arcuate isochelae II**, small, 31–*38*–49 µm. **Sigmas**, mostly slender and smooth; usually gently curved, aside the abrupt bends of both terminations, occasionally more deeply curved, with slightly notched extremities; extremities sharp, occasionally bearing a few spines, either microspines all around, or few, larger, irregular, on the inner surface of the hook, 20–*23*–29 µm. **Oxychaetes**, in oxydragmas, slender, tapering gradually, barbed all over, 44–*50*–55 µm.

Ecology – Sponges growing over rock substrate at 5–7 m depth, in close association with red algae, sea urchins and sea cucumbers. The specimen from Islas Lobos de Tierra bears a good proportion of reproductive elements.

Distribution – Found in Isla Lobos de Tierra and Islas Lobos de Afuera (06°24' S and 60°56' S – Lambayeque Region).

Remarks – There is only a single species known in the genus, *C*. ***ciocalyptoides***. It is considered an invasive species in the NE Atlantic, likely of Asian origin, transported on oyster seeds for cultivation. This species shows important distinguishing features when compared to the Peruvian materials, namely the shape and dimensions of its megascleres, the lack of acanthostyles and sigmas, as well as the larger dimensions of its isochelae I and oxychaetes, the latter also seemingly more roughly spined than those in the Peruvian materials, which likely belong to a new species.

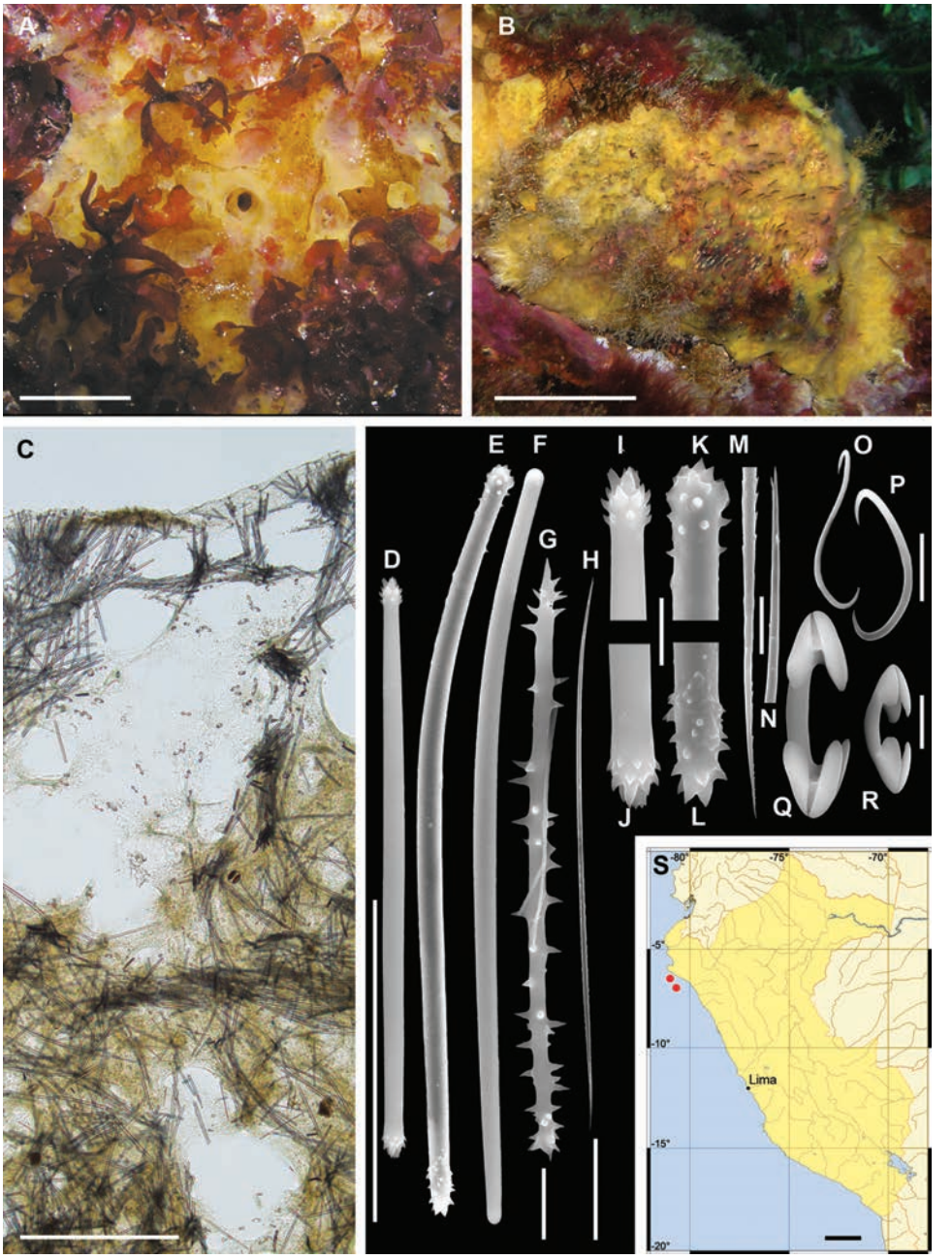


Fig. 86. *Celtodoryx* sp. A–B, live specimen; C, skeleton architecture in transverse ground section; D, tylote spined on both extremities; E, strongylostyle; F, subtylostrongyle; G, acanthostyle; H, oxychaete; I–J, details of D; K–L, details of E; M–N, details of H, O–P, sigmas; Q–R, arcuate isochelae; S, distribution map. Scale bars: A–B, 2 cm; C, 500 µm; D–F, 100 µm; G–L, 10 µm; M–N, 2 µm; O–R, 10 µm; S, 200 km.

Lissodendoryx (*Lissodendoryx*) cf. *carolinensis* Wilson, 1911

REFERENCE: Rützler, Piantoni & Diaz, 2007.

Description – Sponge massive, with short irregular projections appearing contracted from the exposure to air, and about 5 cm wide in largest diameter. Thickness up to 1 cm. Surface appears rugose, probably due to contraction. No oscules apparent. Consistency soft. Colour alive greenish yellow, turning dark brown in ethanol.

Skeleton – Ectosomal skeleton with tylotes tangential to the surface. Choanosomal skeleton supported by reticulation of tylotes bundles and strands with tylotes scattered among the meshes. Microscleres abundant in all body regions.

Spicules – Megascleres. **Ectosomal tylotes**, slender, smooth, straight, with pronounced oval terminations, 166–188 µm. **Choanosomal styles to subtylostyles**, slightly fusiform, bent at the basal third, tapering gradually to a sharp apex, occasionally slightly telescoped, 166–176 µm. **Microscleres**. **Arcuate isochelae I**, large, 23–32 µm. **Arcuate isochelae II**, small, 11–15 µm. **Sigmas I**, large, gently curved, sharp hooks, 38–44 µm. **Sigmas II**, small, gently curved, sharp hooks, 17–24 µm.

Ecology – Epibiontic on a mangrove root in the intertidal, and fully exposed to air when collected.

Distribution – A single specimen was found in Punta Capones, Mangroves of Tumbes (03°24' S – Tumbes Region).

Remarks – A similar *Lissodendoryx* with two categories of isochelae and two of sigmas is known from Pacific Mexico. *Lissodendoryx* ***carolinensis*** is considered a wider Caribbean species, where it is also known to occur on mangrove roots. A genetic study is needed to confirm the identity of the Pacific sponges.

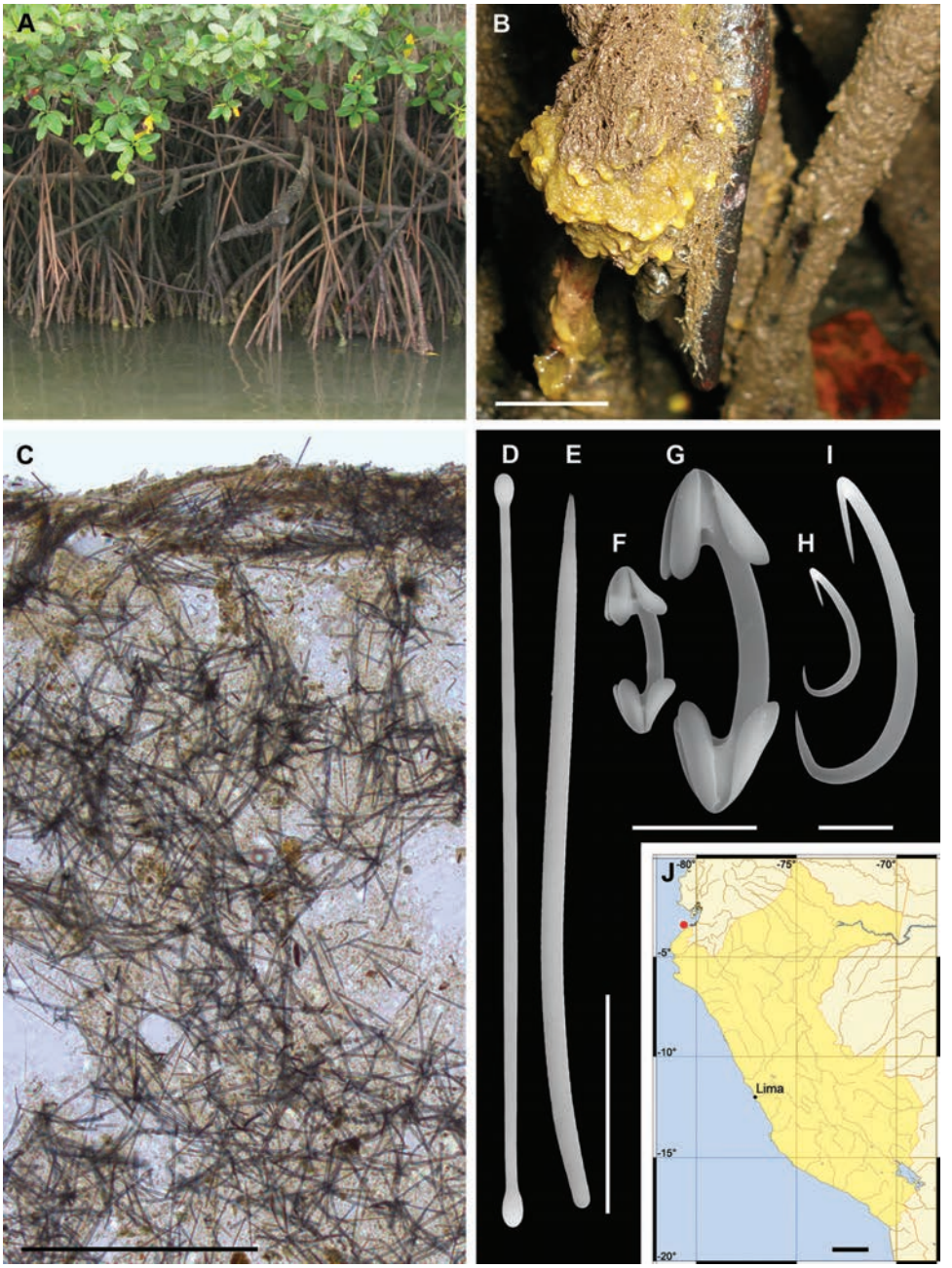


Fig. 87. *Lissodendoryx* (*Lissodendoryx*) cf. *carolinensis* Wilson, 1911. A, mangrove roots with sponges exposed to air; B, live specimen; C, skeleton architecture in transverse ground section; D, ectosomal tylotes with smooth extremities; E, choanosomal style; F–G, isochelae of two different categories; H–I, sigmas of two different categories; J, distribution map. Scale bars: B, 2 cm; C, 500 µm; D–E, 50 µm; F–I, 10 µm; J, 200 km.

Hymedesmia (*Hymedesmia*) *humboldti* Salani, Willenz, Fernandez & Hajdu, 2022

REFERENCE: Salani, Willenz, Fernandez *et al*., 2022.

Description – Thinly encrusting sponge, less than 2 mm thick, very soft and fragile. Surface smooth, with abundant and regularly spaced circular porefields (± 2 mm in diameter). Scattered oscules (0.7–3.0 mm in diameter, 1 mm high). Rare subectosomal channels. Colour in life is orange reddish, turning to beige in ethanol.

Skeleton – Ectosomal, subectosomal and choanosomal skeletons overlapping, with bundles of strongyles to subtylotes spanning all the way to the substrate. Porefield skeleton formed by many single, criss-cross strongyles forming a conical structure. Typical hymedesmioid structure present, consisting of a basal layer of spongin with large and small acanthostyles erect on the substrate. The large acanthostyles support the ectosome without piercing it. Isochelae appear concentrated in a layer close to the surface, and some are found in the choanosome.

Spicules – Megascleres. Ectosomal anisostrongyles, smooth, straight, with rounded and mucronate ends, 128–*168*–186 × 2.7–*3.7*–4.7 µm. **Choanosomal acanthostyles I**, large, acerate tips tapering gradually, rounded base, shaft slightly curved, with spines occupying the basal two thirds of its length, spines mostly slightly curved, those of the base larger than those of the shaft, 153–*216*–283 × 5.0–*11.3*–13.0 µm. **Choanosomal acanthostyles II**, small, straight, tapering gradually, mucronate tip and rounded base, entirely spined, 88–*107*–128 × 5.0–*8.3*–10.0 µm. **Microscleres. Arcuate isochelae**, one free spatulate ala and two lateral alae semi-fused with the shaft, which is characteristically curved, bow shaped, 19–*22*–24 µm.

Ecology – Specimen epibiont on dead cirripeds, bryozoans, and serpulid polychaetes from 9 to 13 m depth.

Distribution – Found in Peru at Bahía Uncupita, Matarani (16°50' S – Arequipa Region) and Punta Coles, Ilo (17°42' S – Moquega Region), and in Central-Northern Chile at Antofagasta (23°02' S) and Punta Choros (29°24' S).

Remarks: This species can be confused underwater with *H*. (*H*.) ***peruana*** by its red colour but in the lab it is easy to figure that it differs by having two categories of acanthostyles, ectosomal anisostrongyles instead of ectosomal tornotes, and a different skeleton with large acanthostyles sustaining the ectosome instead of echinating it. In addition, chelae are grouped as a crust at the surface.

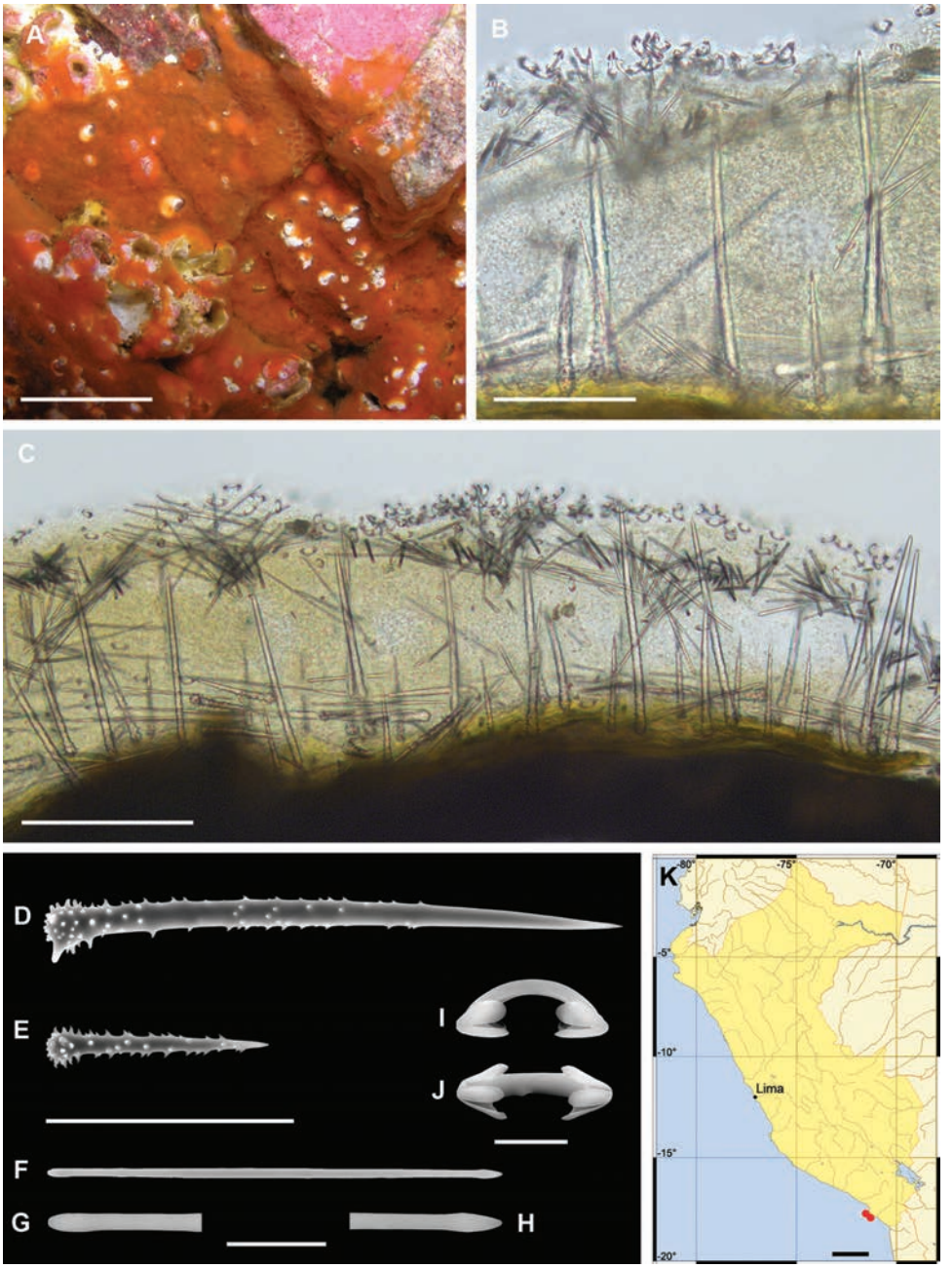


Fig. 88. *Hymedesmia* (*Hymedesmia*) *humboldti* Salani, Willenz, Fernandez & Hajdu, 2022. A, live specimen; B–C, skeleton architecture in transverse ground section; D, acanthostyle I; E, acanthostyle II; F–H, ectosomal anisostrongyle; I–J, arcuate isochelae; K, distribution map. Scale bars: A, approx. 2 cm; B, 100 µm; C, 200 µm; D–F, 100 µm; G–H, 20 µm; I–J, 10 µm; K, 200 km.

Hymedesmia (*Hymedesmia*) *peruana* Salani, Willenz, Fernandez & Hajdu, 2022

REFERENCE: Salani, Willenz, Fernandez *et al*., 2022.

Description – Thinly encrusting sponge, less than 1 mm thick, very soft and fragile. Surface smooth without apparent oscules. Colour in life is orange, turning beige in ethanol.

Skeleton – Ectosomal, subectosomal and choanosomal skeletons overlapping, with bundles of tornotes (4–7 spicules) spanning all the way to the substrate. Tornotes that are perpendicular to the surface form the pore walls, others may lay parallel to the surface, or flat against the substrate. Subectosomal channels are 45–265 µm in diameter. Choanosomal skeleton with, in addition, the typical hymedesmioid structure, consisting of a basal layer of spongin with large and small acanthostyles erect on the substrate. The large acanthostyles protrude from the ectosome, echinating the surface; the medium acanthostyles form microconules at the surface. Isochelae appear scattered in the ectosome.

Spicules – Megascleres. Ectosomal tornotes, smooth with conical tips, 117–*132*–146 × 1.6–*2.2*–2.9 µm. **Choanosomal acanthostyles I**, large, shaft slightly curved with fusiform tip, rounded head with spines occurring on two thirds of the length, 262–*301*–360 × 7.7–*8.3*–9.8 µm. **Choanosomal acanthostyles II**, small, with same morphology as acanthostyles I, 118–*183*–231 × 3.5–*6.5*–9.6 µm. **Choanosomal acanthostyles III**, straight, tapering gradually, fusiform tip and rounded head, fully spined, 66–*78*–106 × 2.6–*4.1*–6.1 µm. **Microscleres. Arcuate chelae**, slender shaft with elongated alae, 15–*16*–21 µm.

Ecology – Single specimen epibiontic on a bivalve shell at 26 m depth.

Distribution – So far found exclusively at Isla Foca (05°11' S – Piura Region).

Remarks – This is the only Peruvian *Hymedesmia* known this far with three categories of acanthostyles. Spicule categories and micrometries set this species apart from every other known from the SE Pacific, the Antarctic and Subantarctic regions.

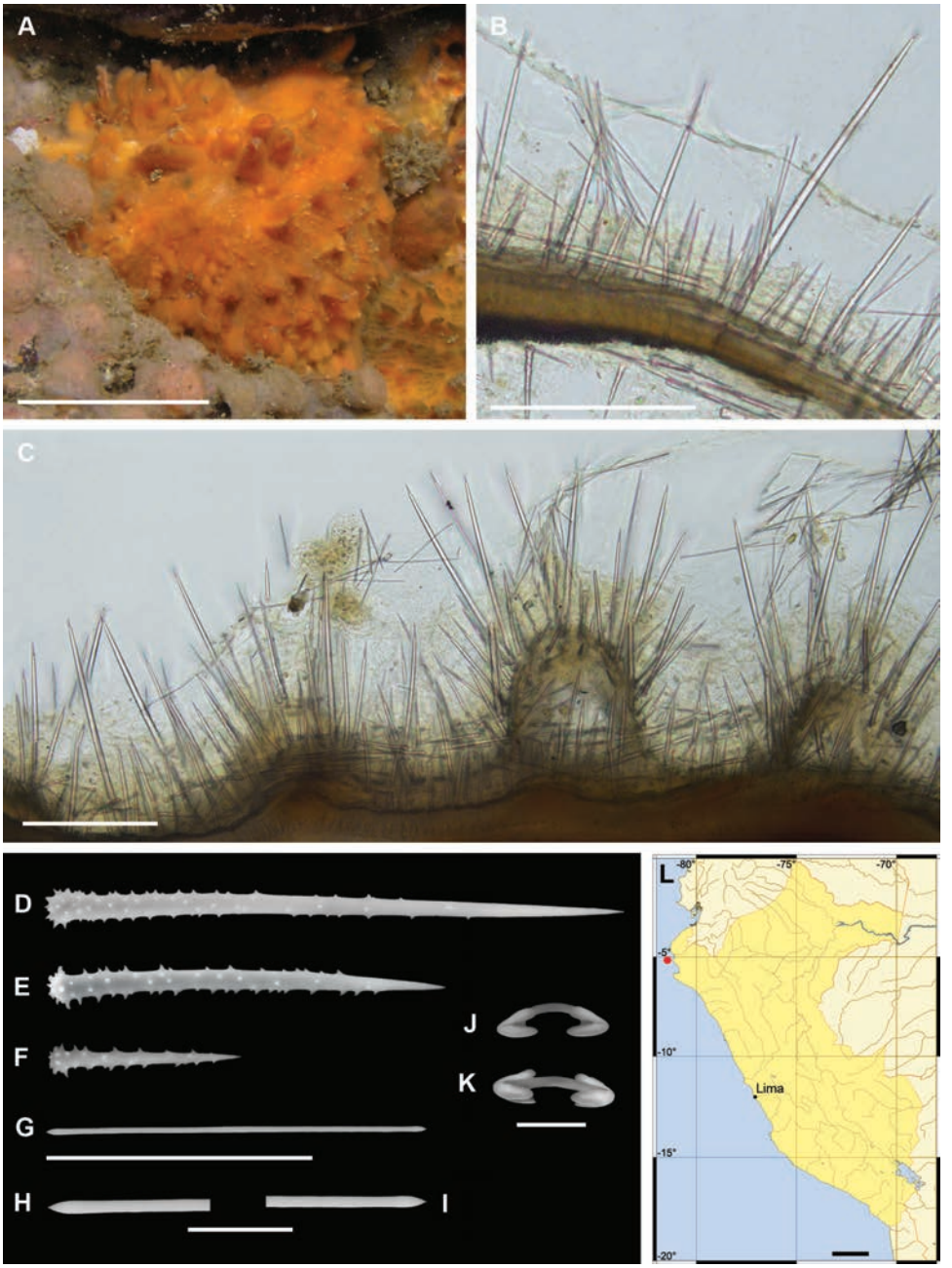


Fig. 89. *Hymedesmia* (*Hymedesmia*) *peruana* Salani, Willenz, Fernandez & Hajdu, 2022. A, live specimen; B–C, skeleton architecture in transverse ground section; D, acanthostyle I; E, acanthostyle II; F, acanthostyle III; G–I, ectosomal tornote; J–K, arcuate isochelae; L, distribution map. Scale bars: A, 2 cm; B–C, 200 µm; D–G, 100 µm; H–I, 20 µm; J–K, 10 µm; L, 200 km.

Hymedesmia (*Hymedesmia*) *santarositae* Salani, Willenz, Fernandez & Hajdu, 2022

REFERENCE: Salani, Willenz, Fernandez *et al*., 2022.

Description – Thinly encrusting sponge, less than 1 mm thick, very soft and fragile. Surface bears areolated pore fields with irregular contour. Small, slightly elevated, round oscules (± 1 mm in diameter) occur scattered outside the pore fields. Colour in life is translucent brownish beige, turning light brown in ethanol.

Skeleton – Ectosomal, subectosomal and choanosomal skeletons overlapping, with bundles of strongyles to subtylotes spanning all the way to the substrate. The typical hymedesmioid structure is present, consisting of a basal layer of spongin, with large and small acanthostyles erect on the substrate. Isochelae, sigmas and microstrogyles appear scattered in the sponge, some acanthotylostyles lay parallel to, or flat on the substrate.

Spicules – Megascleres. Ectosomal strongyles to subtylotes, smooth, straight with faintly swollen elliptical heads, 129–*153*–187 × 3.6–*4.5*–5.2 µm. **Choanosomal acanthostyles I**, large, straight or nearly so, thicker at base, spined only on the basal half, 158–*206*–270 × 5.4–*8.3*–11.1 µm. **Choanosomal acanthostyles II**, small, straight, spined from head to tip, 76–*84*–96 × 4.9–*6.1*–7.9 µm. **Microscleres. Arcuate isochelae**, stout, markedly curved, 17–*19*–21 × 2.4–4.8 µm. **Sigmas**, relatively stout, sharp points, 27–*29*–33 × 2.9–*3.2*–3.9 µm. **Microstrongyles**, smooth, massive and curved with rounded ends, 24–*29*–34 × 2.3–*3.4*–4.6 µm.

Possibility for confusion –The pore fields on the surface of this species aid in its recognition in the field, but a magnifying glass may be needed, and observations undertook *in situ*, as pore fields are bound to collapse upon collection and handling.

Ecology – Encrusting on rock at about 8 m depth, over small barnacles and calcareous polychaete tubes, in close association with red algae.

Distribution – So far, exclusively found at Isla Santa Rosa, Bahía Independéncia, (14°19' S – Ica Region).

Remarks: This species differs from all other *Hymedesmia* species by the presence of microstrongyles in addition to arcuate chelae and sigmas.

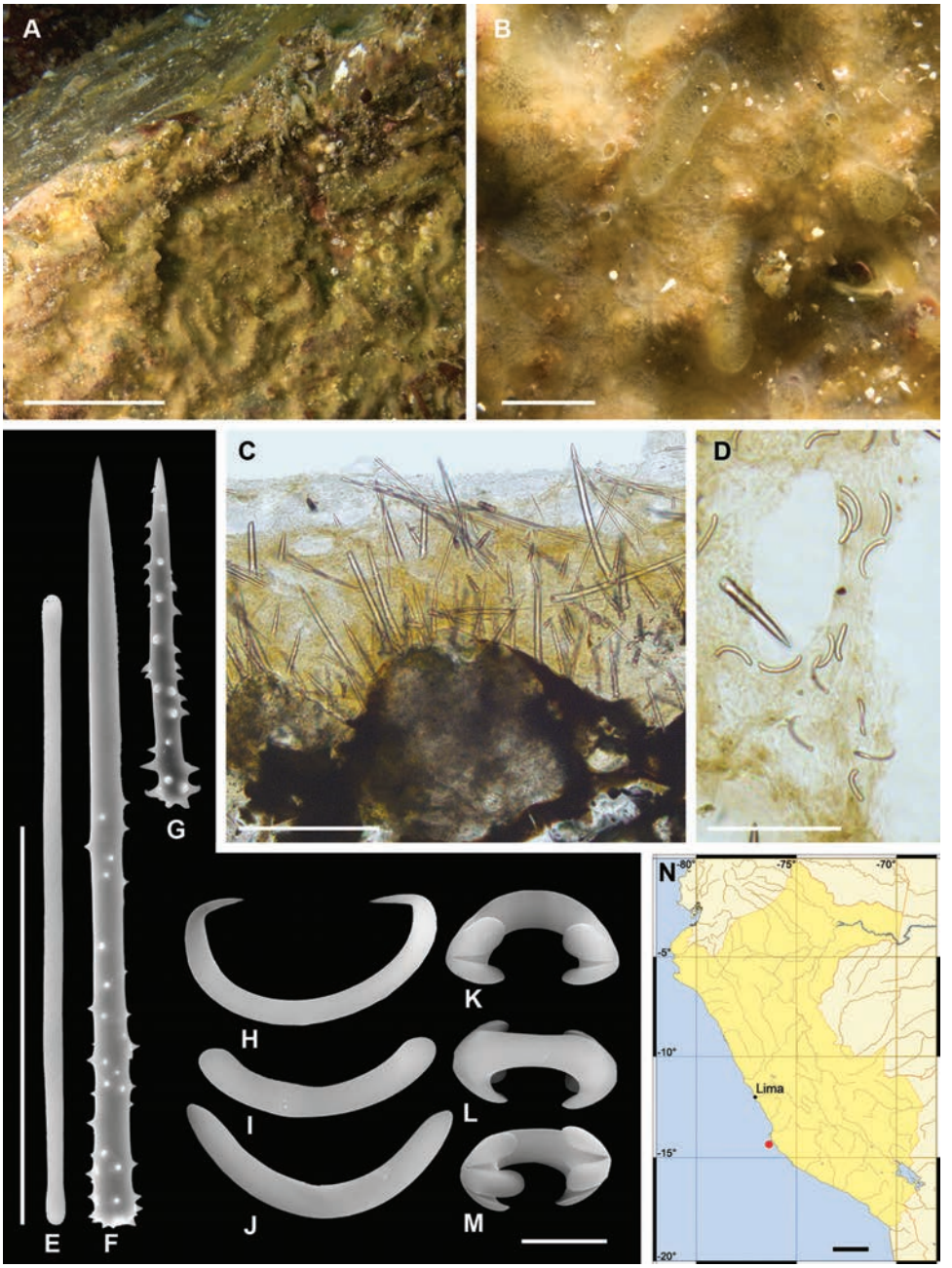


Fig. 90. *Hymedesmia* (*Hymedesmia*) *santarositae* Salani, Willenz, Fernandez & Hajdu, 2022. A–B, live specimen; C, skeleton architecture in transverse ground section; D, microstrongyles in ground section; E, ectosomal tylotes; F, choanosomal acanthostyles I; G, choanosomal acanthostyle II; H, sigma; I–J, microstrongyles; K–M, arcuate isochelae; N, distribution map. Scale bars: A, 5 cm; B, 2 cm; C, 200 µm; D–G, 100 µm; H–M, 10 µm; N, 200 km.

Antho (*Plocamia*) sp.

REFERENCES: de Laubenfels, 1927; Dickinson, 1945; Desqueyroux, 1972.

Description – The specimen was encrusting a polychaete tube, about 15 cm long. The sponge was no thicker than 2–3 mm, and had an irregular, lumpy outline. Oscules not visible. Consistency assumed to be resilient. Colour in life orange, turning to beige in ethanol.

Skeleton – Ectosomal skeleton with single auxiliary subtylostyles projecting from the ends of choanosomal fibres as loose, confused brushes; points of choanosomal principal styles from ascending plumose tracts protrude only slightly through surface. Choanosomal skeleton ill-developed, mostly consisting of ascending, rarely branching plumose tracts, to which a low, basal isodictyal reticulation of strongyles is added

Spicules – Megascleres. **Principal (subtylo)styles**, slightly curved and fusiform; base only seldom slightly swollen, entirely smooth or microspined at the base, 98–*202*–472 × 6–*13*–18 µm. **Auxiliary subtylostyles**, slender, straight; base barely swollen, smooth or bearing a little crown of sharp, straight spines; smooth shaft, with an apical mucron, 160–*208*–267 × 4–6 µm. **Basal strongyles**, stout, spined mostly at their ends, very loosely on their shafts, spines of irregular morphology, 148–*185*–204 × 14–*17*–20 µm. **Microscleres**. **Palmate isochelae**, slender, mostly twisted 90º or even 180º, 14–16 µm. **Toxas**, wing-shaped, 48–134 µm.

Ecology – Epibiontic on a coriaceous polychaete tube, at 27 m depth. Water temperature, 20ºC. The habitat was characterized by strong swell, with dense patches of polychaete tubes.

Distribution – The only specimen found was collected off Chullachy, Bahía de Sechura (05°33' S – Piura Region).

Remarks – There are six species of *Antho* reported from the East Pacific, four from California, one from the Galápagos, and one from Chile. All these considerably distinct from the Peruvian species. Three possess J-like microscleres termed crocae, not seen in the present material. The other three differ on alternative spicule characters. The Chilean *Antho* (*Plocamia*) ***inconspicua*** has much larger principal megascleres (up to 1000 µm), but lacks toxas. *Antho* (*P.*) ***karykina***, from California, has considerably smaller principal and auxiliary subtylostyles (up to 220 and 200 µm, respectively), and toxas (up to 80 µm). Also from California, *A.* (*P.*) ***karyoka*** approaches the Peruvian species further in having twisted isochelae and more comparable principal subtylostyles (up to 340 µm). Nevertheless, both the auxiliary subtylostyles and the toxas are still rather smaller than those in the Peruvian sponge (up to 200 and 80 µm, respectively).

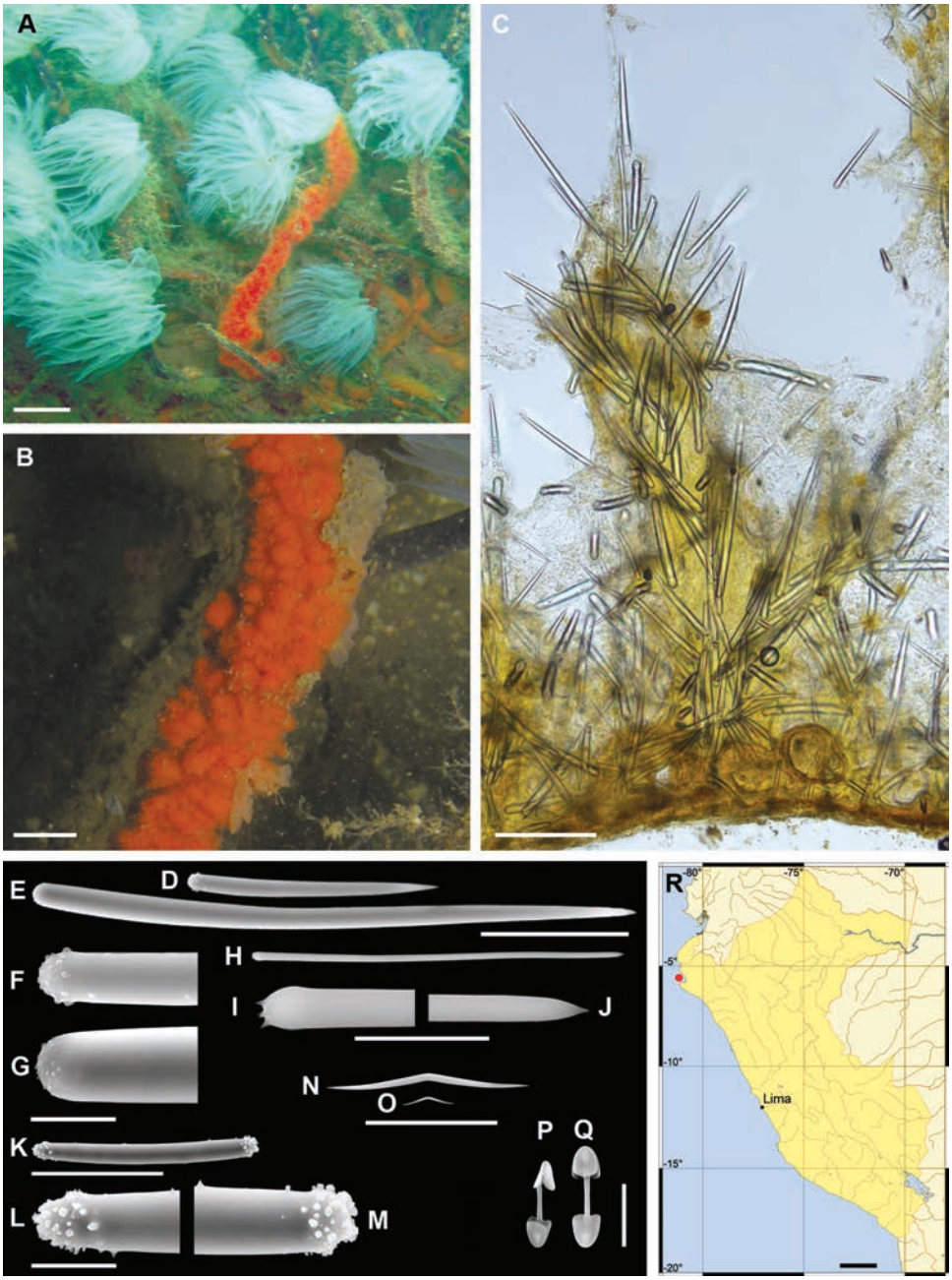


Fig. 91. *Antho* (*Plocamia*) sp. A–B, live specimen; C, skeleton architecture in transverse ground section; D–G, principal (subtylo)style; H–J, auxillary (subtylo)style; K–M, basal strongyle; N–O, toxas; P–Q, palmate isochelae; R, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 200 µm; D–E, 100 µm; F–G, 20 µm; H, 100 µm; I–J, 20 µm; K, 100 µm; L–M, 20 µm; N–O, 100 µm; P–Q, 10 µm; R, 200 km.

Clathria (*Microciona*) *aculeofila* Aguirre, Hooker, Willenz & Hajdu, 2011

REFERENCE: Aguirre, Hooker, Willenz *et al*., 2011.

Description – Thinly incrusting sponges (< 1 mm thick) that frequently occur as the main epibionts on the spines of *Eucidaris thouarsii*. Slightly thicker specimen reaching over 16 × 14 cm can be found too on rocky substrate. Surface is hispid and texture velvety. Meandering subectosomal canals, as well as scattered oscules smaller than 1 mm in diameter clearly visible in yellow specimens only. Consistency soft, but in parts it is the hard substrate that one feels when touching the sponge. Colour in life bright-red or yellow, turning to beige after preservation in ethanol.

Skeleton – Basal layer of spongin wherefrom short, echinated paucispicular fibres arise (up to 600 µm high). Principal megascleres stand erect on the substrate, but also slightly above, coring or echinating the fibres. Auxiliary megascleres arranged in disorganized (sub)ectosomal bouquets, frequently piercing the surface. Microscleres of variable abundance are scattered.

Spicules – Megascleres. **Principal subtylostyles**, slightly curved and fusiform; base slightly swollen, irregularly acanthose; smooth shaft, 65–*197*–607 × 4–*10.6*–28 µm. **Auxiliary subtylostyles**, smooth, slender, straight; base barely swollen, smooth or bearing a crown of sharp, straight spines, smooth shaft, 113–*242*–760 µm. **Accessory acanthostyles**, slightly curved and fusiform; base frequently styloid, irregularly acanthose, shaft pauciacanthose, 51–*88*–131 × 5–*7.3*–13 µm. **Microscleres**. **Toxas**, V-type, “wing-shaped”, gentle central curve and nearly no curves on extremities, 16–*65*–140 µm. **Palmate isochelae,** mostly with nearly straight, slender shafts, only seldom slightly twisted or curved, claws 38–45% the entire spicule length, 9–*13.6*–18 µm.

Ecology – Encrusting on rock or on the spines of pencil sea urchins (*Eucidaris thouarsii*). The sponge has been collected from 2 to 16 m depth, in water temperatures of 14 to 23°C. In Cancas, El Ñuro, Máncora and Punta Sal cidarid sea urchins are rather common and these have nearly always their spines covered by *Clathria aculeofila*.

Distribution – So far know from a narrow zone along the Peruvian coast, from Cancas, El Ñuro, Máncora, Punta Sal, Isla Lobos de Tierra and Islas Lobos de Afuera (03°55' S – Tumbes Region to 06°56' S – Lambayeque Region).

Remarks – Possibility for confusion – The yellow and red sponge crusts collected on rocky substrates comprise several distinct species classified in distinct genera, families and orders, so that identification should not be essayed solely on external aspects. Differentiation of these under the microscope is usually easy. On the other hand, those collected on sea urchin spines, appear all to belong to this species. We have revised data provided in the original description of the species and could not confirm the large sized isochelae (> 30 µm) reported from a few specimens. These values have been corrected here, accordingly.

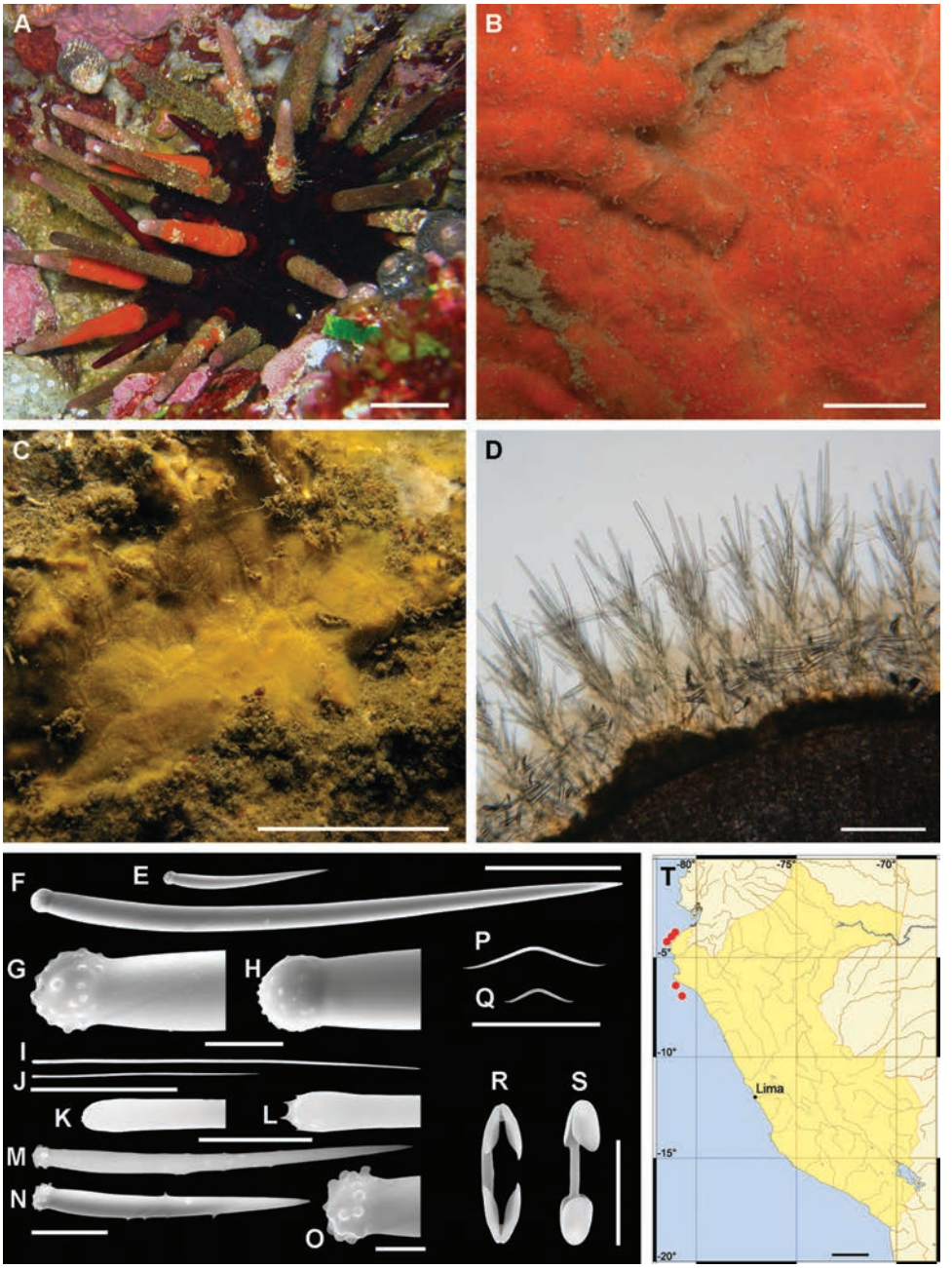


Fig. 92. *Clathria* (*Microciona*) *aculeofila* Aguirre, Hooker, Willenz & Hajdu, 2011. A–C, live specimens; D, transverse ground section of a spine of the sea urchin *Eucidaris thouarsii* covered by *Clathria aculeofila*; E–H, principal subtylostyles; I–L, auxiliary subtylostyles; M–O, accessory acanthostyles; P–Q, toxas; R–S, palmate isochelae; T, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 2 cm; D, 200 µm; E–F, 100 µm; G–H, 10 µm; I–J, 100 µm; K–L, 10 µm; M–N, 20 µm; O, 5 µm; P–Q, 100 µm; R–S, 10 µm; T, 200 km.

Clathria (*Microciona*) aff. *microjoanna* (de Laubenfels, 1930)

REFERENCES: Thiele, 1905; de Laubenfels, 1932; Desqueyroux, 1972; Aguirre *et al*., 2011.

Description – Lumpy, encrusting sponges, growing on rock or biological substrate (Brachyopoda), no more than 1–2 mm thick, and usually around 2–3 cm in diameter. Surface velvety, microhispid, punctured, with a system or meandering canals clearly visible. Oscules not seen. Live colour orangy red, turning beige to light brown in ethanol.

Skeleton – Ectosome pierced by auxiliary as well as principal subtylostyles, the latter projecting in tufts from the ends of ascending choanosomal spiculofibres. Auxiliary subtylostyles appear more spread in confusion, usually parallel or nearly so to the surface, rather than organized in brushes. Lacunae abound in the subectosomal region. Choanosomal architecture rises from a neat basal layer of spongin, with abundant, juxtaposed, erect principal subtylostyles and accessory acanthostyles. This microcionid disposition includes short, plumose, longitudinal spiculofibres cored by principal spicules, and echinated by these and accessory acanthostyles as well. Microscleres are common, seemingly more abundant in the outer regions of specimens.

Spicules – Megascleres. **Principal subtylostyles**, stout, microacanthose at the base, with short, occasional isolated spines or bumps along the shaft, 198–*291*–479 × 16–*18.5*–24 µm. **Auxiliary subtylostyles**, slender, basally microspined, 123–*196*–297 µm. **Accessory acanthostyles**, robust, spined all over, heads tuberculated, 99–*122*–145 µm. **Microscleres**. **Palmate isochelae**, 13–*14.3*–17 µm. **Toxas I**, three curved, slender, rugose extremities, 137–*197*–231 µm. **Toxas II**, similar to I, 53–55 µm (rare).

Ecology – Specimens live in close association with several organisms such as green algae, amphipods, brachyopods and polychaetes, at nearly 30 m depth, and in a recorded temperature of 13ºC.

Distribution – Both specimens were collected in San Juan de Marcona (15°23' S – Ica Region).

Remarks – Banana-like microscleres (toxas?, 10–24 µm) were seen in one preparation of dissociated spicules along with abundant *Pione* spicules. Since we could not spot the “bananas” in any of the sections undertaken, as well as on additional dissociations, we assume they are contaminant, from a yet unidentified sponge. The species approaching the Peruvian material the most is *Clathria* (*Microciona*) ***microjoanna*** (de Laubenfels, 1930). Points of distinction that can be made out from the original description of that species are the thick habit, bright scarlet-red or “rich pink” live color, and seemingly entirely smooth and smaller principal spicules.

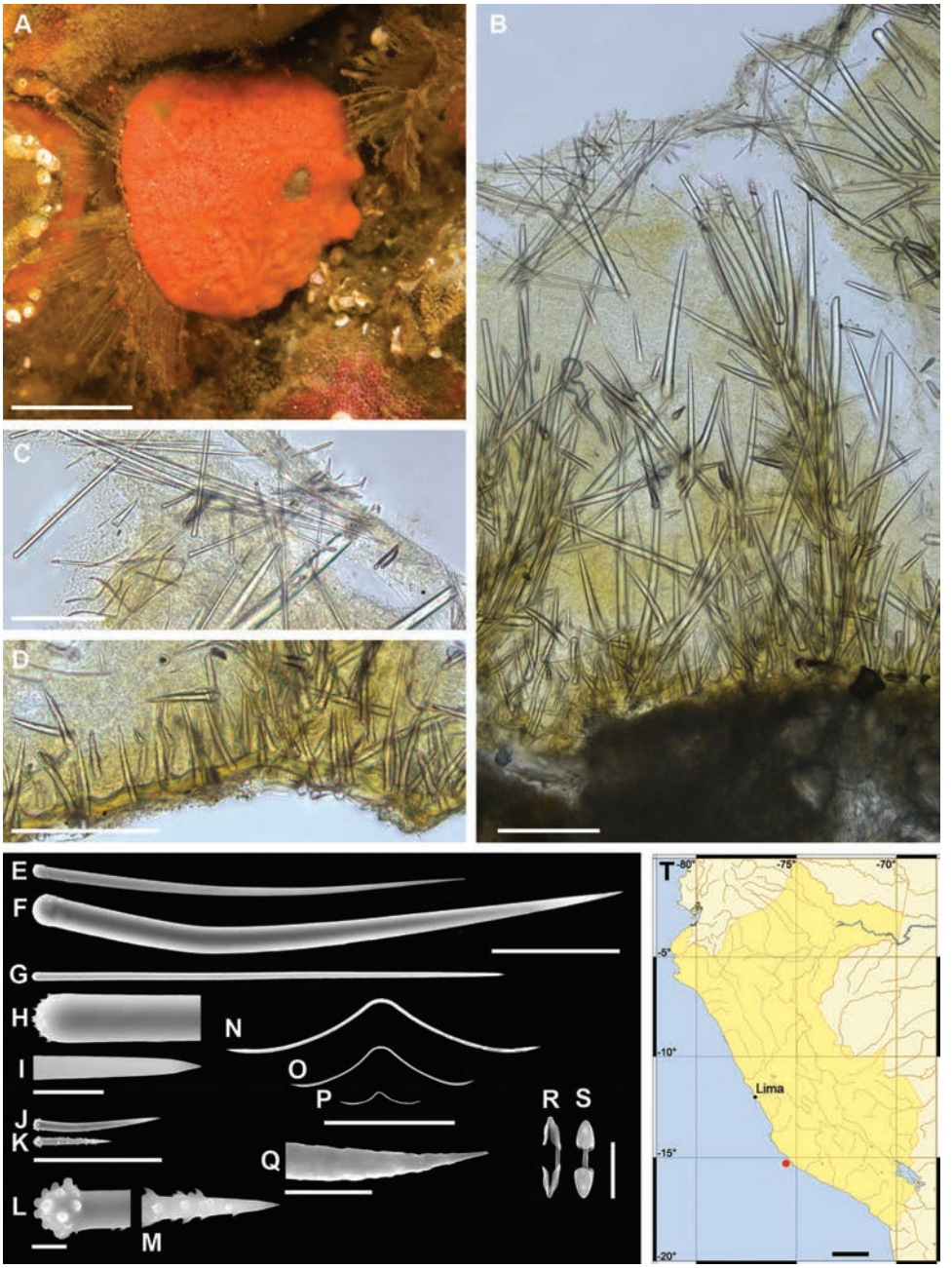


Fig. 93. *Clathria* (*Microciona*) aff. *microjoanna* (de Laubenfels, 1930). A, live specimen; B, skeleton architecture in transverse ground section; C–D, details of B; E–F, principal subtylostyles; G, auxiliary subtylostyles; H–I, details of G; J–K, accessory acanthostyles; L–M, details of K; N–O, toxas I; P, toxa II; Q, detail of O; R–S, palmate isochelae; T, distribution map. Scale bars: A, 1 cm; B, 200 µm; C, 100 µm; D, 200 µm; E–G, 100 µm; H–I, 10 µm; J–K, 100 µm; L–M, 10 µm; N–P, 100 µm; Q, 5 µm; R–S, 10 µm; T, 200 km.

Mycale (*Carmia*) cf. *cecilia* de Laubenfels, 1936

REFERENCES: de Laubenfels, 1936; Desqueyroux-Faúndez & van Soest, 1997; Carballo & Cruz-Barraza, 2010; Castillo-Paéz *et al*., 2021.

Description – Specimens formed variously thick cushions, often bearing lobate or volcaniform projections with apical oscula (1–9 mm), sometimes occurring in clusters. Dimensions reached over 20 cm in diameter and up to 5 cm in height. Surface velvety. Consistency soft. Colour in life red (reef) or orangey (mangrove), turning yellowish beige when preserved in ethanol.

Skeleton – No specialized ectosomal skeleton. A little divergence of ascending bundles when approaching the surface help in its support. Choanosome plumose/dendritic to confused, with loose, sinuous, paucispicular longitudinal bundles. Megascleres also strewn in confusion, abundantly at parts. Microscleres commoner in the outer regions, particularly right underneath the surface.

Spicules – Megascleres. **Subtylostyles**, smooth, straight, slightly curved or sinuous, mostly slender, occasionally a bit stouter, isodiametric to slightly fusiform, heads elliptical to oval, 173–257 µm (reef) and 176–273 µm (mangrove). **Microscleres**. **Palmate isochelae** of varied morphology, usually gently curved in profile, and often cleistocheloid (with frontal alae nearly touching or even overlapping each other), 14–22 µm (reef) and 12–22 µm (mangrove, possibly 12–16 and 17–22). **Sigmas**, mostly s-shaped, with sharp extremities, 26–40 µm (reef) and 30–45 µm (mangrove). **Spheroxyasters** (too small to be seen under light microscopy, seen in every reef specimen studied under SEM), 20 or more rays, usually conical, slightly irregular, and sharp, 1.1–1.6 µm.

Ecology – Specimens were attached to rocks between 2 and 12 m depth, in association with green and red algae, anemones, bryozoans, polychaetes and tunicates. Alternatively, they were attached to mangrove roots, in association to barnacles and gastropods or hermit-crabs, in a heavily silted environment.

Distribution – Originally described from the Pacific coast of Panama, the species has subsequently been reported to be quite common further north, in the Mexican Pacific, as well as on the Equator, in the Galápagos Islands. If identity is confirmed, the southernmost occurrence of the species is here widened to Peru, where it has been found between Tumbes (03º24' S – Tumbes Region) and El Ñuro (04º13' S – Piura Region).

Remarks – See appendix 13.1 page 330.

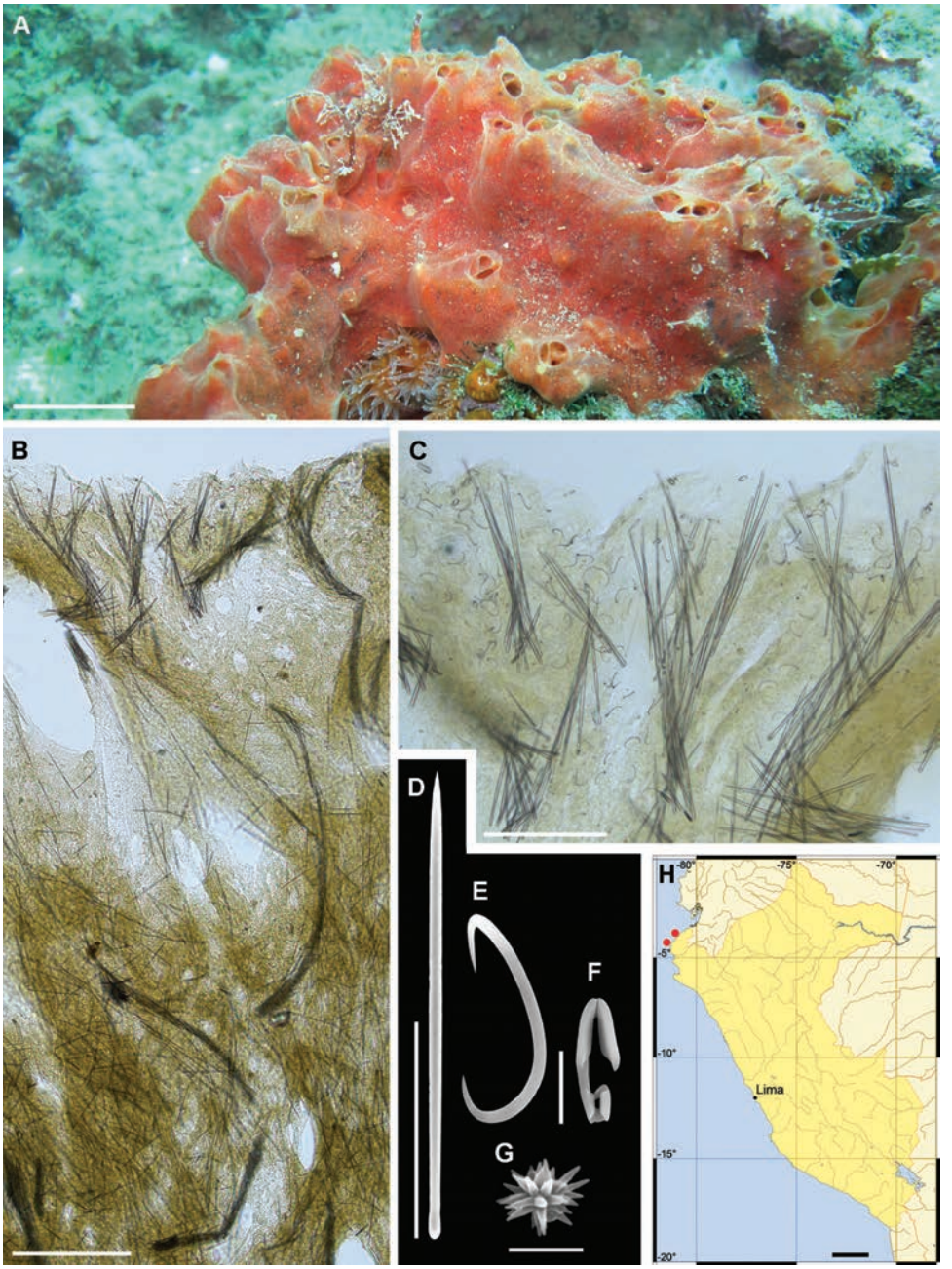


Fig. 94. *Mycale* (*Carmia*) cf. *cecilia* de Laubenfels, 1936. Large specimen. A, live specimen; B–C, skeleton architecture in transverse ground section; D, subtylostyle; E, sigma; F, palmate anisochelae; G, spheroxyaster; H, distribution map. Scale bars: A, 2 cm; B, 500 µm; C, 200 µm; D, 100 µm; E–F, 10 µm; G, 1 µm; H, 200 km.

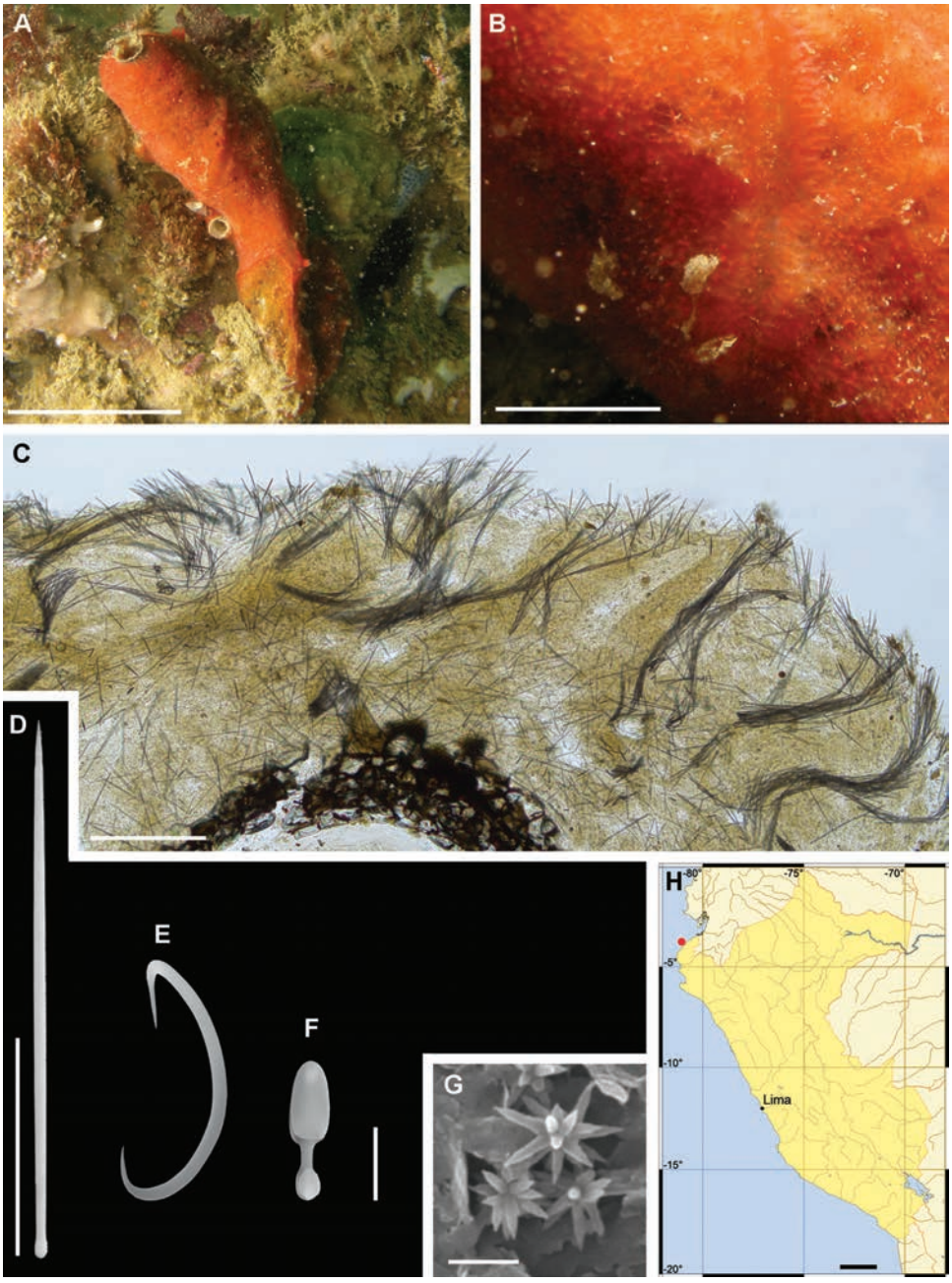


Fig. 95. *Mycale* (*Carmia*) cf. *cecilia* de Laubenfels, 1936. Small specimen. A–B, live specimen; C, skeleton architecture in transverse ground section; D, subtylostyle; E, sigma; F, palmate anisochelae; G, spheroxyaster, H, distribution map. Scale bars: A, 2 cm; B, 0.5 cm; C, 500 µm; D, 100 µm; E–F, 10 µm; G, 1 µm; H, 200 km.

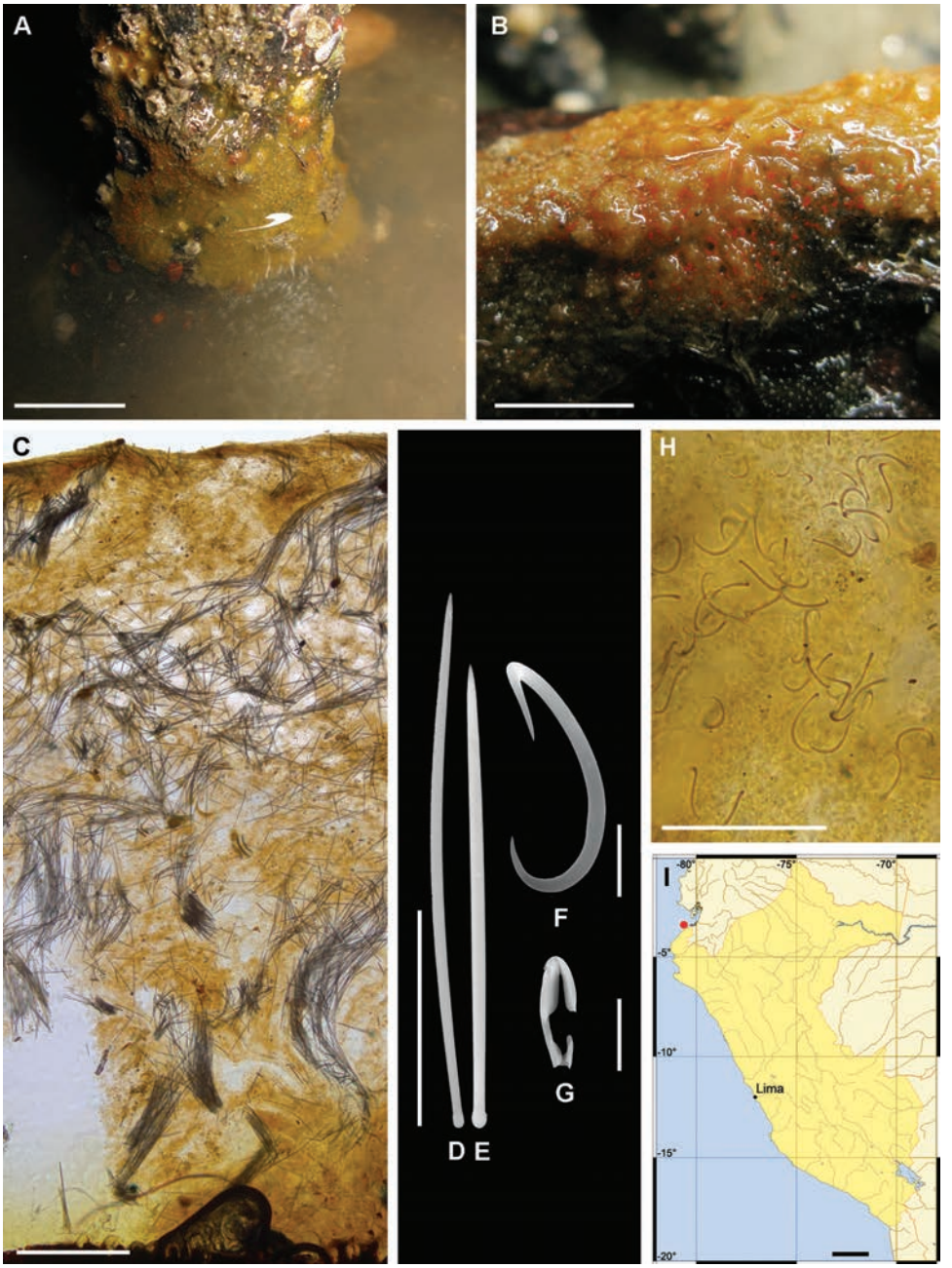


Fig. 96. *Mycale* (*Carmia*) cf. *cecilia* de Laubenfels, 1936. Specimen from the mangrove. A–B, live specimen; C, skeleton architecture in transverse ground section; D–E, subtylostyles; F, sigma; G, anisochelae; H, ground section of the mesohyle showing sigmas; I, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 500 µm; D–E, 100 µm; F–G, 10 µm; H, 100 µm; I, 200 km.

Mycale (*Carmia*) cf. *magnirhaphidifera* van Soest, 1984

REFERENCES: van Soest, 1984; Hajdu & Rützler, 1998; Carballo & Hajdu, 2001; Carballo & Cruz-Barraza, 2010.

Description – Encrusting sponges, usually no thicker than 2 mm, reaching over 10 cm in maximum diameter. Surface smooth, with conspicuous subectosomal canals converging to oscula in a starry pattern. Oscula are small (1–2 mm in diameter), circular, and nearly flat with the surface. Consistency soft, fragile. Colour alive, purple, turning light beige when preserved in ethanol. Specimens from Cancas had beautiful parenchymella larvae within the mesohyl (approximately 0.5 mm in largest diameter) carrying a nearly complete set of spicules (see Fig. 11 E).

Skeleton – Ectosome without any specialized skeleton, aside the exclusive possession of rosettes of anisochelae I, and loose brushes of megascleres representing the ends of ascending choanosomal tracts of megascleres. To the latter, sometimes megatrichodragmas may be added up to right underneath the surface. A basal plate of spongin is clearly visible, but megasclere tracts reaching over 60 µm in diameter, only seldom stand on it. Mostly they project in oblique fashion, and follow their sinuous path towards the surface. Spicules in confusion thicken the choanosomal architecture, notably, strewn megatrichodragmas (typically about 100 µm in diameter).

Spicules – Megascleres. **Subtylostyles**, straight, slender, blunt tips, conspicuous oval heads, 245–*292*–320 µm. **Microscleres**. **Anisochelae I**, large, palmate, mostly organized in rosettes in the ectosome, 33–*38.8*–43 µm; **Anisochelae II** intermediate category, 20–*24.3*–29 µm; **Anisochelae III** small category, 12–*15.2*–20 µm. **Sigmas**, slender, sharp, rather rare, 21–24 µm. **Raphides**, large, slightly bent in the middle, 256–*346*–405 µm. **Microxeas**, 7–17 µm.

Ecology – Specimens were encrusting on rock between 9 and 12 m depth, at temperatures of 23–24ºC. Red algae occurred in close association.

Distribution – Records of this species for the Pacific need genetic confirmation. The species is widely distributed in the Tropical Western Atlantic, and has recently been recorded from the Pacific coast of Mexico. In Peru it has been found only in Cancas and Punta Sal (03°55' S and 03°57' S – Tumbes Region).

Remarks – Peruvian specimens distinguish themselves from *M*. (*Carmia*) ***magnirhaphidifera*** reported from other areas by a combination of the presence of rare small sigmas, three usually neatly recognizable categories of anisochelae, and rather large magniraphides, frequently approaching 400 µm. Despite the previous recognition of this species in the Mexican Pacific coast, Brazilian specimens are those seemingly closer to Peruvian ones, which is suggestive of yet another case of possible Amphi-American taxon. This has recently been demonstrated for *Clathrina aurea* (Calcarea).

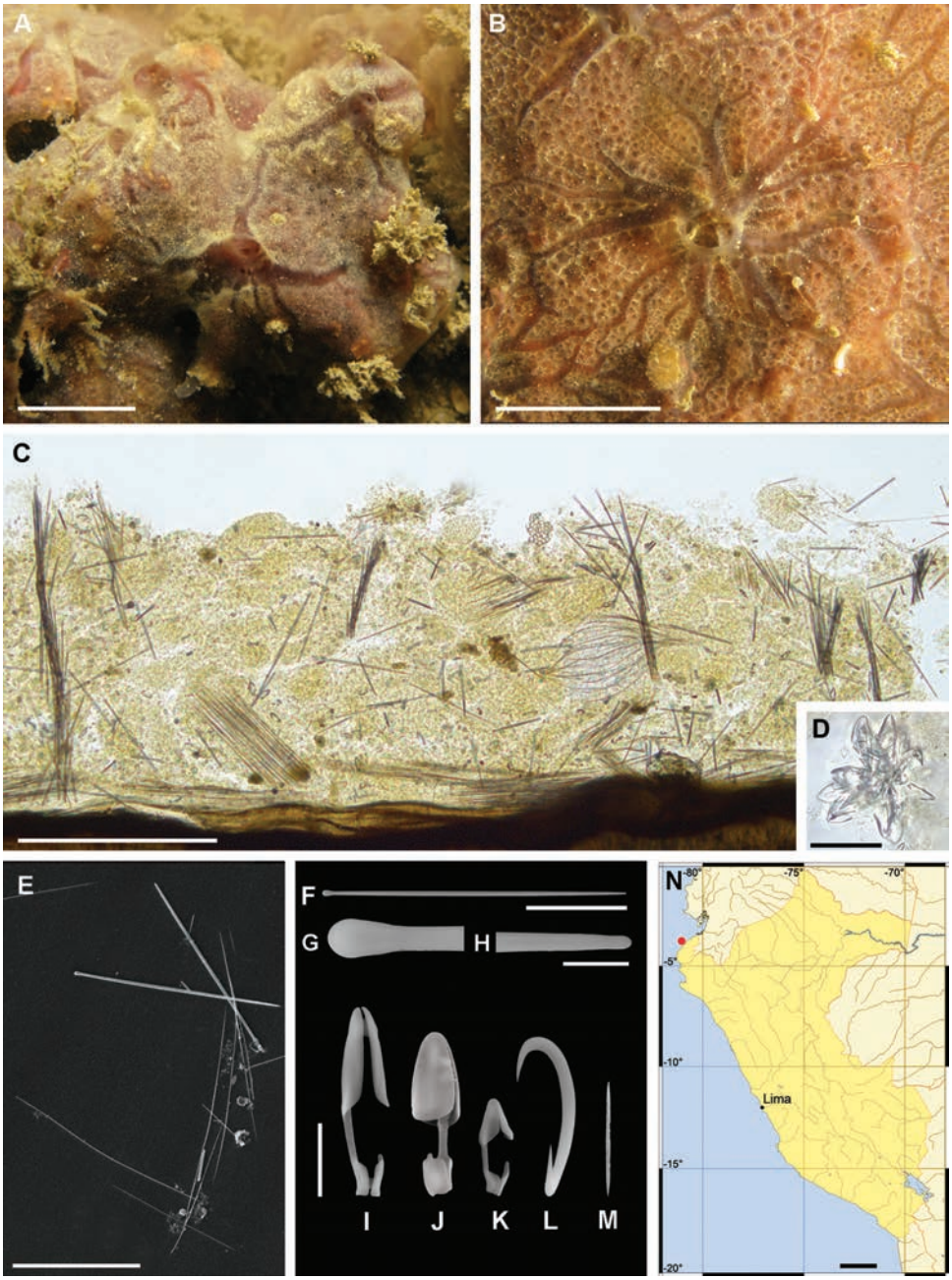


Fig. 97. *Mycale* (*Carmia*) cf. *magnirhaphidifera*. A–B, live specimens; C, skeleton architecture in transverse ground section; D, detail of the rosettes of anisochelae; E, general view of tylostyles and large trichodragmata: F, subtylostyle; G–H, details of F; I, anisochelae I; J, anisochelae II; K, anisochelae III; L, sigma; M, microxea; N, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 500 µm; D, 50 µm; E, 200 µm; F, 100 µm; G–M, 10 µm; N, 200 km.

Mycale (*Carmia*) sp.

REFERENCES: van Soest, 1984; Hajdu & Rützler, 1998; Carballo & Hajdu, 2001; Carballo & Cruz-Barraza, 2010.

Description – Encrusting sponges, usually no thicker than 3–4 mm, reaching about 5 cm in maximum diameter. The sponge has an overall irregular habit, due to the underlying substrate, seemingly of various sources. Consistency soft, fragile. Surface smooth, with conspicuous, variously wide canals seen by transparency, most of which orthogonal to the surface. Oscula are not easily seen in the *in situ* images, but a single aperture is 1–2 mm across. Colour alive spans a matte yellow to an orangy ochre, turning to light beige when preserved in ethanol.

Skeleton – Ectosome without any specialized skeleton, aside the exclusive possession of rosettes of anisochelae I, a greater abundance of sigmas, and loose brushes of megascleres representing the ends of ascending choanosomal tracts of megascleres. To the latter, sometimes megatrichodragmas may be added up to right underneath the surface. No clear basal plate of spongin is visible, but anyhow, ascending multispicular tracts of megascleres reaching over 50 µm in diameter, at parts seem to stand on the surface, where from they start their sinuous path towards the surface. Yet, at other parts, these tracts appear near flat on the substrate. The whole picture is somewhat blurred by spicules strewn in confusion all around, notably megascleres, but megatrichodragmas too.

Spicules – Megascleres. **Subtylostyles**, straight, slender, blunt tips, conspicuous oval heads, 222–*273*–309 × 4–*5.3*–7 µm. **Microscleres**. **Anisochelae I**, large, palmate, 29–*35.4*–40 µm. **Anisochelae II**, small, palmate, 9–*12.4*–14 µm. **Sigmas**, stout, sharp, 64–*71*–80 µm. **Toxas**, slender, variously curved, 24–*59.8*–111 (outlier 263) µm. **Magniraphides**, slightly bent in the middle, arranged in **megatrichodragmas**, 152–*341*–390 µm. **Microxeas**, 4–*9.6*–12 µm.

Ecology – The single specimen was encrusting on rock at 12 m depth. Bryozoans, colonial tunicates and cnidarian polyps occurred in close association.

Distribution – Only found in Punta Sal (03°57' S – Tumbes Region).

Remarks – This species approaches *M*. (*Carmia*) cf. ***magnirhaphidifera*** in many aspects, and yellow morphs had already been reported for the latter species too in the western Atlantic. Nevertheless, within Peru, live-colour appears to corroborate the distinction of both species, which is further supported by the common presence of stout sigmas, lack of an intermediate category of anisochelae, and occurrence of toxas in this species.

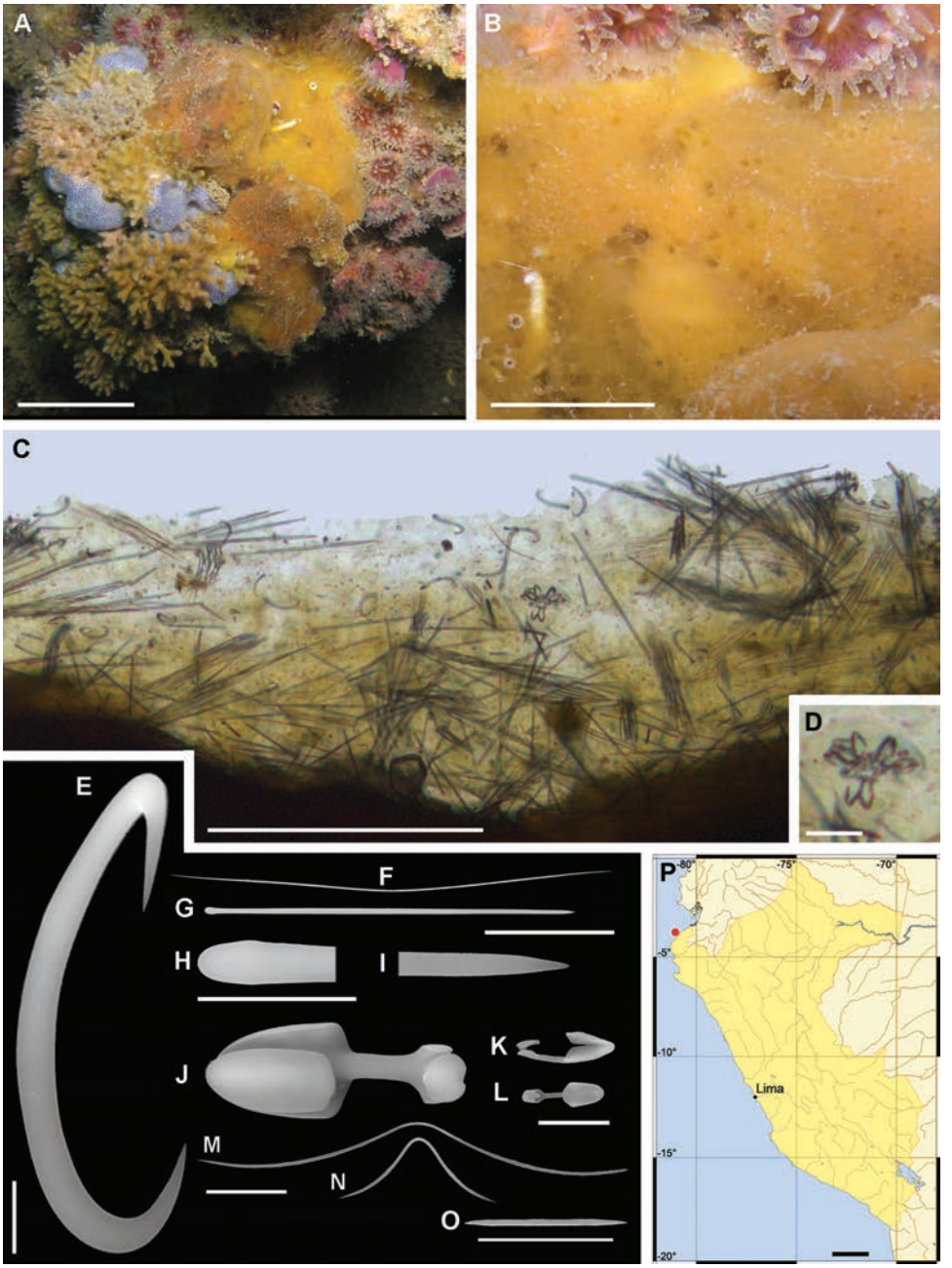


Fig. 98. *Mycale* (*Carmia*) sp. A–B, live specimen; C, skeleton architecture in transverse ground section; D, detail of a rosette of anisochelae; E, sigma; F, trichodragmata; G, subtylostyle; H–I, details of G; J, anisochelae I; K–L, anisochelae II; M–N, toxas; O, microxea; P, distribution map. Scale bars; A, 2 cm; B, 1 cm; C, 500 µm; D, 50 µm; E, 10 µm; F–G, 100 µm; H–I, 20 µm; J–L 10 µm; M–N, 20 µm; O, 10 µm; P, 200 km.

Myxilla (*Ectyomyxilla*) cf. *chilensis* Thiele, 1905

REFERENCE: Desqueyroux-Faúndez & van Soest, 1996.

Description – A single specimen, about 7 cm in maximum diameter, encrusting a bush of stiff, erect bryozoans. Oscules not visible. Consistency soft, fragile, disguised by the framework provided by the bryozoan. Live colour light yellow, with enough transparency such as to allow vision of the endobiont bryozoan all over, turning to light beige in ethanol. The specimen collected mid October 2007 carries mature parenchymella larvae with spicules inside.

Skeleton – A basal layer of spongin carries erect acanthostyles, and yields short, ascending, paucisicular tracts of tornotes running all the way up to the surface, where they fan out in loose brushes. Isochelae of both main size classes abound everywhere, but particularly near the surface, where sigmas are to be found too. Tornotes also occur scattered in the choanosome and ectosome, but in smaller amounts. Abundant isochelae and some tornotes can be seen also inside cavities of the bryozoan skeleton substrate. Overall, the architecture is plumose.

Spicules – Megascleres. **Acanthostyles I**, large, slightly curved, 144–*176*–206 µm. **Acanthostyles II**, small, straight, 73–*84*–96 µm. **Tornotes**, slender, straigh, slightly subtylote, mucronated, 116–*140*–163 µm. **Microscleres**. **Anchorate isochelae I**, large 32–*38.6*–47 µm. **Anchorate isochelae II**, intermediate (rare), 26 µm. **Anchorate isochelae III**, small, 9.5–*9.8*–10.4 µm. **Sigmas**, larger 30–*40*–48 µm; intermediate (rare), 24–25 µm; smaller, 11–*14.6*–17 µm.

Ecology – The sponge occurred as an epibiont on an erect, ramified, stiff bryozoan, at 10 m depth.

Distribution – Found only at El Ñuro, south of Quebrada Verde (04°13' S – Piura Region). This is the northernmost record of this species, which was previously known from a large area in the southern oceans comprising the Antarctic, many sub Antarctic islands, several locations in southern South America, and a single record from off Namibia.

Remarks – The material collected at El Ñuro exhibits some morphologic features not yet reported for *Myxilla* (*Ectyomyxilla*) *chilensis*, which together with the rather equatorial location, renders the identification uncertain. In particular, it has a clear, abundant and smaller, second category of sigmas. In addition, its tornotes are somewhat smaller than formerly studied Chilean materials, including the holotype. We attach minor importance to the detected intermediary size categories of both anisochelae and sigmas, as these were found to be very rare, and might have easily been overlooked in previous descriptions. Similarly, the plumose architecture is not expected in this species, which usually carries a reticulate skeletal organization. As a possible explanation, its encrusting habit and under-developed choanosomal architecture.

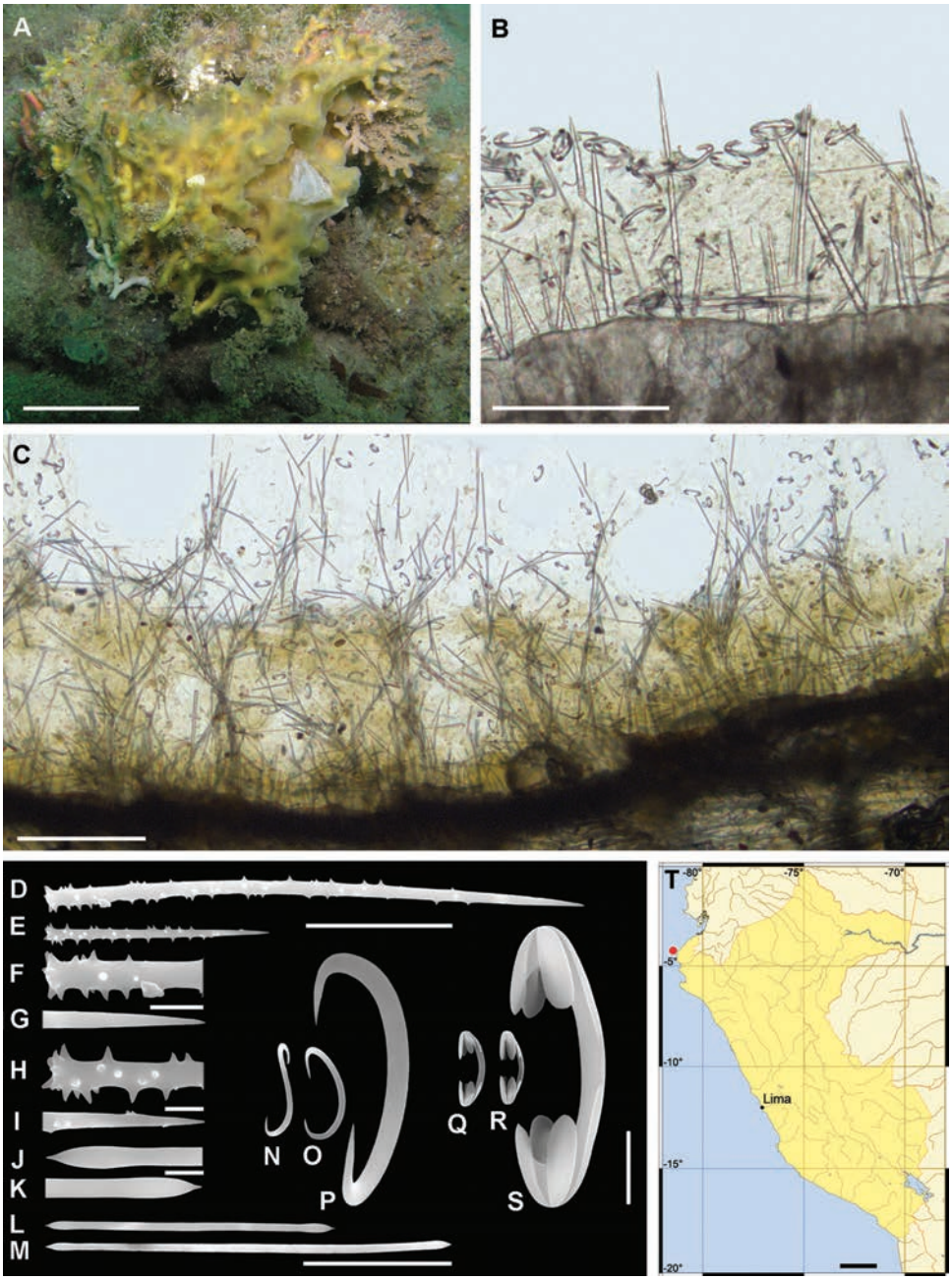


Fig. 99. *Myxilla* (*Ectyomyxilla*) cf. *chilensis* Thiele, 1905. A, live specimen; B–C, skeleton architecture in transverse ground section; D, Large acanthostyle; E, small acanthostyle; F–G, details of D; H–I, details of E; J–K, details of L; L–M, tornotes; N–O, small sigmas; P, large sigma; Q–R, small anchorate isochelae; S, large anchorate isochelae; T, distribution map. Scale bars: A, 2 cm; B, 100 µm; C, 200 µm; D–E, 50 µm; F–G, 10 µm; H–K, 5 µm; L–M, 50 µm; N–S, 10 µm; T, 200 km.

Myxilla (*Myxilla*) *mexicensis* Dickinson, 1945

REFERENCE: Desqueyroux-Faúndez & van Soest, 1996.

Description – Specimens can reach over 20 cm in largest diameter, and be over 5 cm thick. Habit can be massive, somewhat bushy-lobate, with large oscula (up to 1 cm in diameter) situated on top of these lobes, but not only there. Consistency is fragile, and plenty of mucus is produced upon collection. Surface irregular, with abundant conules and short scopiform processes, amidst grooves and ridges. A transparent membrane covers parts of the sponge surface. Colour alive orange to reddish-orange where exposed to light, and yellow in shaded areas, turning beige to white when preserved in ethanol.

Skeleton – Basal layer of spongine wherefrom short, echinated paucispicular fibres arise. Principal megascleres stand erect on the substrate, but also slightly above, coring or echinating the fibres. Auxillary megascleres arranged in (sub) ectosomal bouquets, frequently piercing the surface. Microscleres are scattered and of variable abundance.

Spicules – Megascleres. **Choanosomal acanthostyles**, spines concentrated on both extremities, 169–*181*–194 × up to 10 µm. **Ectosomal tornotes**, strongyloid, terminally microspined, 165–*174*–183 × up to 4 µm. **Microscleres**. **Anchorate isochelae I**, tridentate, large 18–*23*–26 µm. **Anchorate isochelae II**, small, 13–*14*–17 µm. But possibly only a single variable category. Sigmas with sharp terminations. **Sigmas I** (large), 17–*27*–35 µm. **Sigmas II** (small), 9–*11*–12 µm.

Ecology – Specimens were growing over diverse substrates, some of which of biological origin, such as the holdfast of an octocoral, between 10 and 13 m depth.

Distribution – Previously known only from the Galápagos and California, this is the first record of the species for the Pacific coast of South America, where is has been collected from Punta Sal (03°58' S – Tumbes Region) and El Ñuro (04°14' S – Piura Region).

Remarks – The match of Peruvian specimens to data gathered from previous records of the species from Mexico and the Galápagos is absolutely precise for spicule morphology and micrometries. Abundant production of mucus had not been reported before for this species.

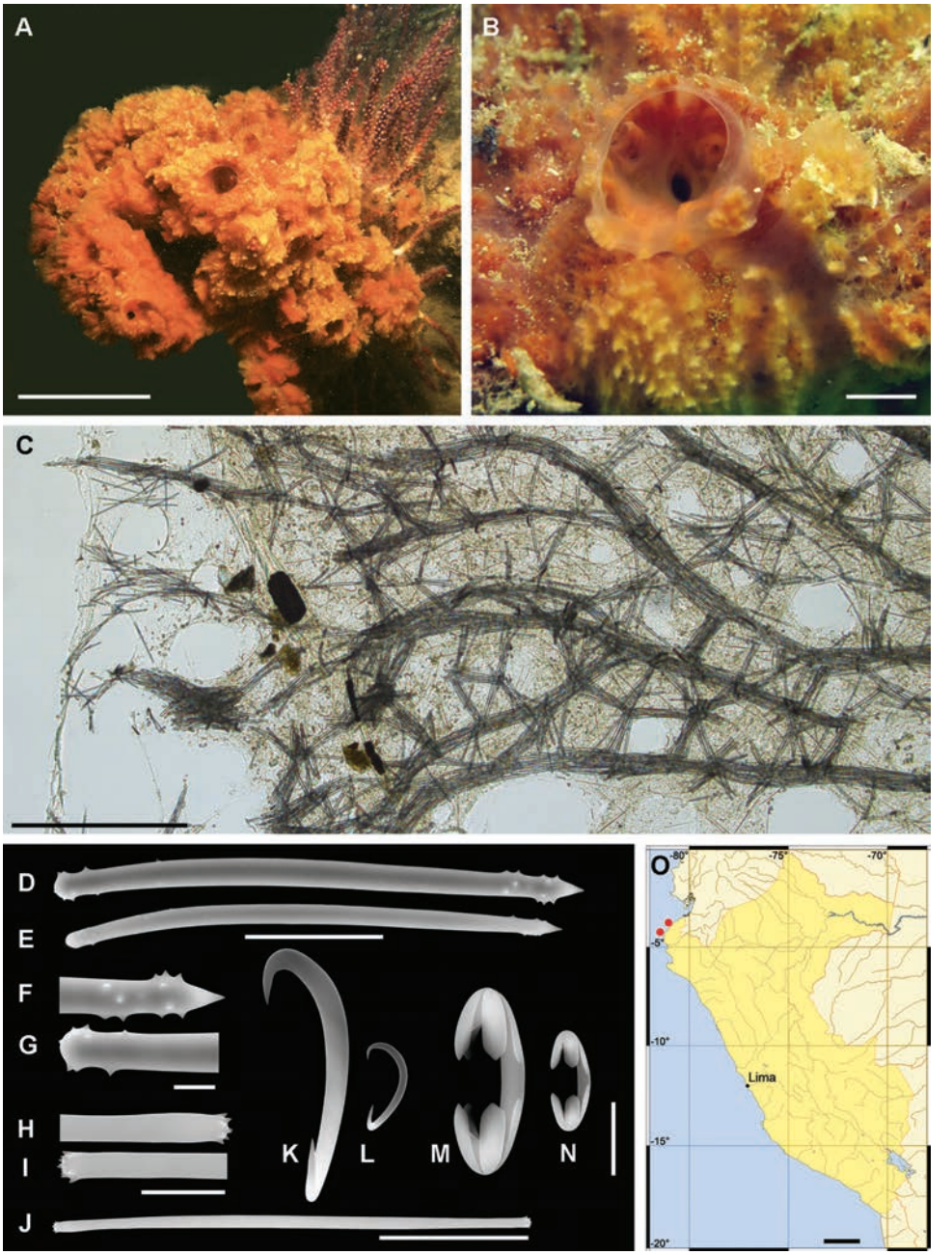


Fig. 100. *Myxilla* (*Myxilla*) *mexicensis* Dickinson, 1945. A–B, live specimens; C, skeleton architecture in transverse ground section with the sponge surface on the left side; D–E, choanosomal acanthostyles; F–G, details of D; H–I, details of J; J, ectosomal tornotes; K, sigma I; L, sigma II; M, anchorate isochelae I; N, anchorate isochelae II; O, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 500 µm, D–E, 50 µm; F–I, 10 µm; J, 50 µm; K–N, 10 µm; O, 200 km.

Plocamiancora sp.

REFERENCES: Topsent, 1927; de Laubenfels, 1932; Alander, 1942; Uriz, 1988.

Description – Thinly encrusting sponge, mostly less than 2 mm thick. Soft, fragile, with small (ca. 1 mm in diameter), scattered, round oscula. These sit on top of small mounds, and bear a membranous chimney. Subectosomal canals are visible here and there, and converge to oscula in a starry, meandering pattern. Colour in life varied from orange to yellow, turning beige to light grey in ethanol.

Skeleton – There are three main layers, basal, choanosomal, and (sub)ectosomal. The basal layer is a dense reticulation of acanthotylotes, which supports erect acanthostyles of the choanosomal skeleton. The latter reach and pierce the surface of the sponge. The (sub)ectosomal layer is formed by (para)tangentially disposed tornotes of mainly acerate subtylostyle morphology. Common anisosubtylotes to hastate subtylostyles are likely (sub)ectosomal, but we failed to spot them in the sections analysed.

Spicules – Megascleres. **Acanthostyles**, stout, slightly curved, tapering gradually to a sharp apex, spines concentrated at the base and sparsely distributed on the shaft, 119–614 µm. **Acanthotylotes**, stout, straight or slightly curved, microspined round heads, 81–99 µm. **Anisosubtylotes** to **subtylostyles** (mostly hastate), slender, straight, seemingly always microspined at base, but often not at apex, 114–*131*–166 µm. **Subtylostyles** (mostly acerate), slender, straight, seemingly always entirely smooth, 168–*195*–315 µm. **Microscleres**. **Anchorate isochelae**, unguiferate, polydentate, 10–13 µm.

Ecology – Encrusting hard substrates between 14 and 21 m depth, in waters of 11–19ºC.

Distribution – This is the first record of this genus for the SE Pacific. Despite its rarity, this species is widely distributed along the Peruvian coast, between at least El Ñuro (04°14' S – Piura Region); Isla San Gallan, Paracas (13°49' S – Ica Region) and Ilo (17º39' S – Moquega Region).

Remarks – Worldwide, there are only four species recognized in *Plocamiancora*. The one reported from the least geographic distance, *P*. ***igzo***, from California, differs from the Peruvian species in several respects, noteworthy among which, the much smaller main megascleres (tylostyles, acanthostyles), larger tylotes, and isochelae seemingly bearing far fewer teeth. All remaining species occur in the Atlantic at considerably deeper habitat, and possess much larger anchorate isochelae, up to 4–5 × as large as those observed here.

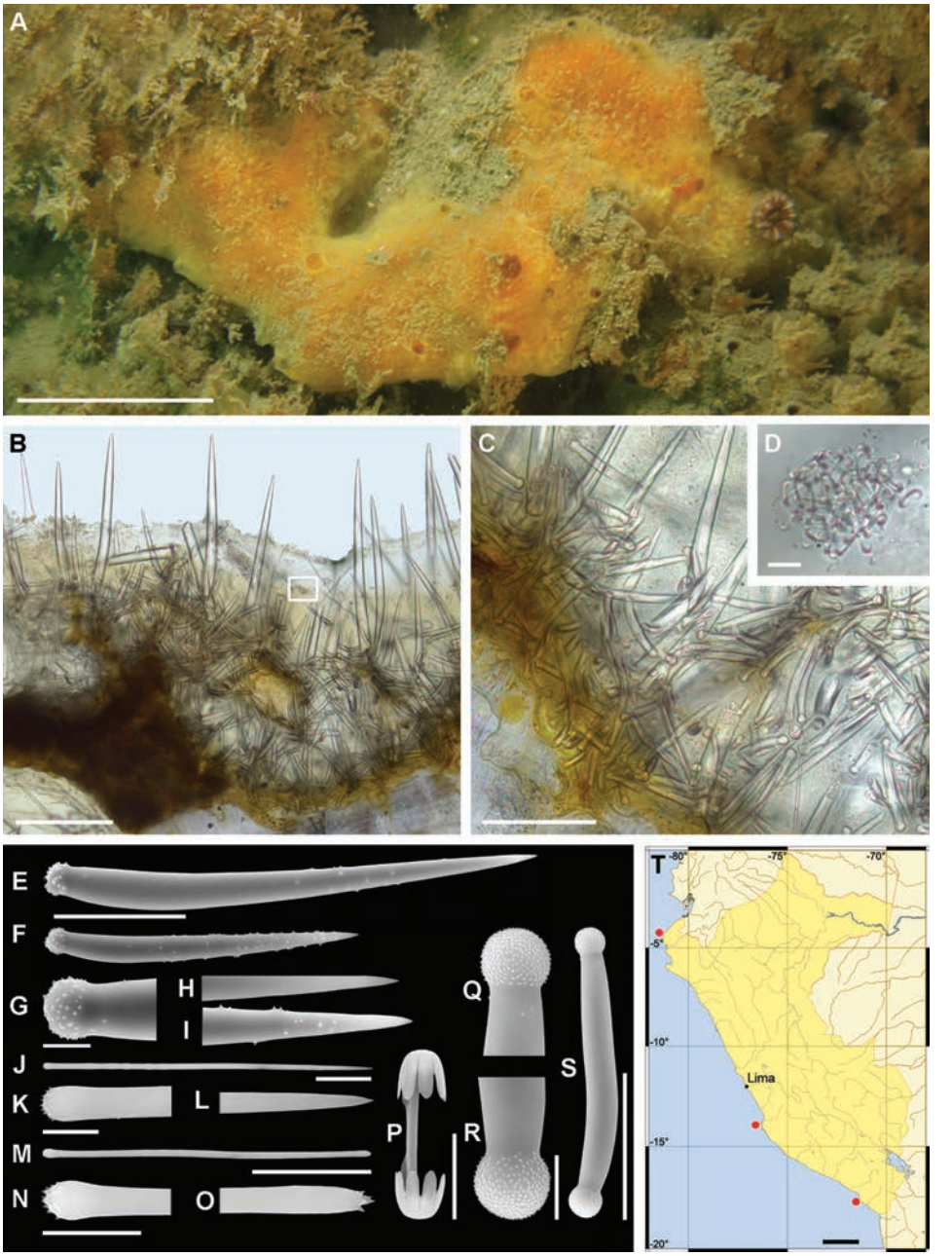


Fig. 101. ***Plocamiancora*** **sp.** A, live specimen; B, skeleton architecture in transverse ground section; C, detail of B at the base of the sponge; D, detail of the frame indicated in B with cluster of isochelae; E–F, acanthostyles; G–I details of E and F; J, subtylostyle; K–L, details of J; M, anisosubtylote; N–O details of M; P, anchorate isochelae; Q–R, details of S; S, acanthotylote; T, distribution map. Scale bars: A, 2 cm; B, 200 µm; C, 100 µm; D, 10 µm; E–F, 50 µm; G–I, 10 µm; J, 50 µm; K–L, 10 µm; M, 50 µm; N–O, 10 µm; P, 5 µm; Q–R, 10 µm; S, 50 µm; T, 200 km.

Tedania (*Tedania*) *ecuadoriensis* Jaramillo & Hajdu, 2021

REFERENCES: Aguilar-Camacho, Carballo & Cruz-Barraza, 2018; Jaramillo, Cóndor-Luján, Longakit *et al*., 2021.

Description – Thickly encrusting to massive sponge (3–4 mm thick). The largest specimen measures 9 × 13 cm. Translucent exhalant canals converge into oscula located on top of short elevations. Consistency soft and smooth. Colour in life is orange, turning dark violet when preserved in ethanol.

Skeleton – Ectosomal architecture with tylotes grouped in bouquets, some of which pierce the surface. Choanosomal architecture a dense, confused reticulation of styles. Scattered onychaetes of two categories, both in ectosomal and choanosomal skeleton.

Spicules – Megascleres. **Ectosomal tylotes**, straight or nearly so, with only slightly swollen, heavily spined heads, 145–*175*–191 × 5–6 µm. **Choanosomal styles**, smooth, slightly curved, slightly fusiform, with a variously noticeable albeit subtle narrowing of its basal segment, 151–*171*–183 × 5–8 µm. **Microscleres**. **Onychaetes I**, large, 89–*137*–188 µm. **Onychaetes II**, small, 29–*53*–74 µm.

Ecology – Specimens occur on boulders or mussels around 10 m depth.

Distribution – Previously reported from Reserva Marina El Pelado (Santa Elena), Ecuador. This is the first record for Peru: in Cancas and Punta Sal (03°56' S and 03°58' S – Tumbes Region).

Remarks – The literature reports six species of *Tedania* from the Tropical Eastern Pacific, namely *T*. (*T*.) ***fulvum*** (from Mexican Pacific); *T*. (*T*.) ***galapagensis*** (from Galápagos); *T*. (*T*.) ***obscurata*** (from California); *T*. (*T*.) ***tepitootehenuaensis*** (from Easter Island); *T*. (*T*.) ***toxicalis*** (from California) and *T*. (*T*.) ***tropicalis*** (from Mexican Pacific). *Tedania* (*T*.) *ecuadoriensis* with its short tylotes and styles is distinct from all known (sub)Tropical Eastern Pacific *Tedania* spp. which have these around 200 µm or bigger. The Peruvian specimens are only marginally distinct from Ecuadorean ones in the stoutness of megascleres, thicker in Peru, and the dimensions attained by the largest onychaetes (133 µm in Ecuador, 188 µm in Peru).

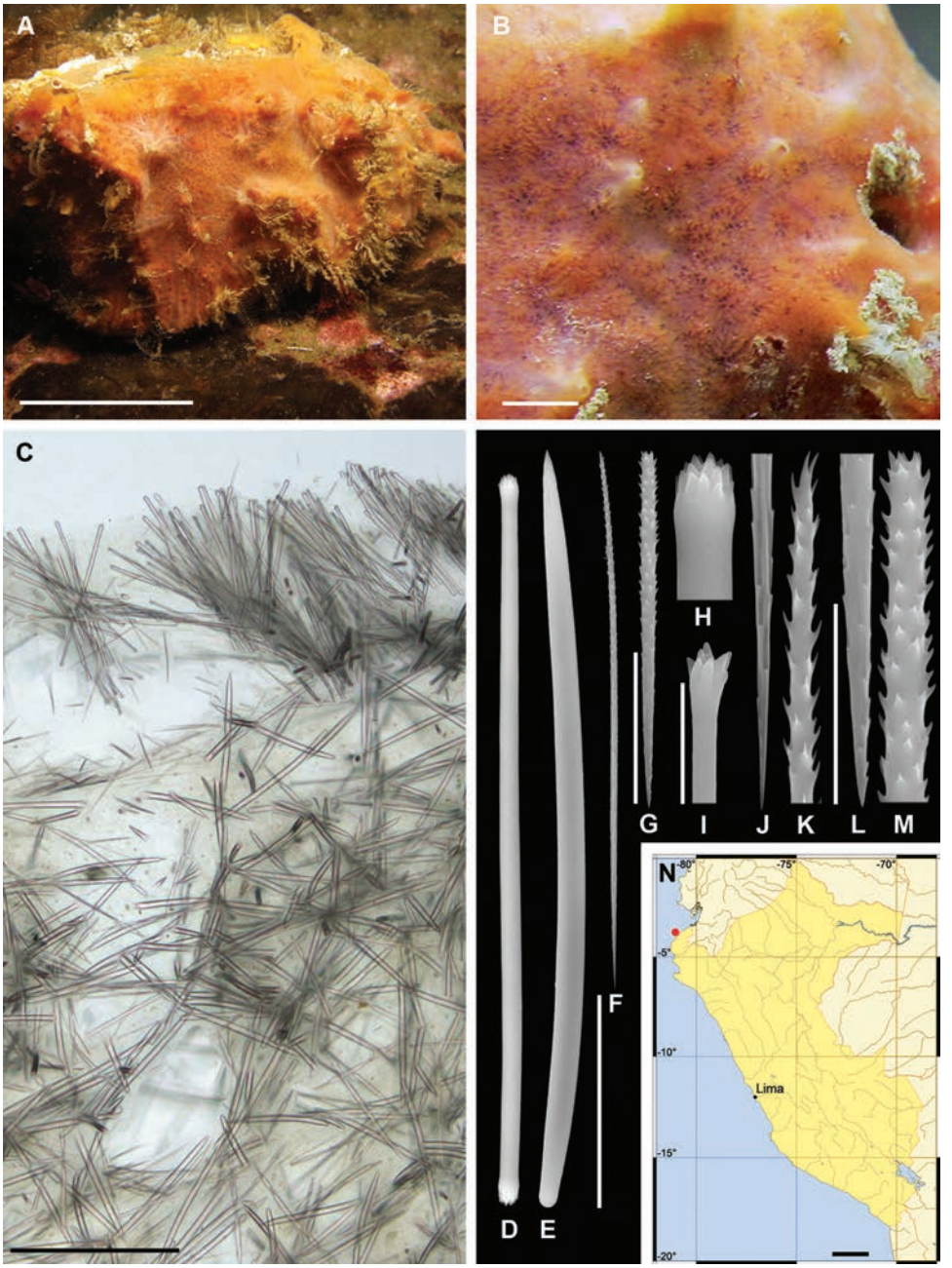


Fig. 102. *Tedania* (*Tedania*) *ecuadoriensis* Jaramillo & Hajdu, 2021. A, live specimen; B, detail of A; C, skeleton architecture in transverse ground section; D, ectosomal tylote; E, choanosomal style; F, onychaete I; G, onychaete II; H–I, detail of terminally microspined terminations of different tylotes; J–K, detail of terminations of F; L–M, detail of terminations of G; N, distribution map. Scale bars: A, 5 cm; B, 0.5 cm; C, 200 µm; D–F, 50 µm; G, 20 µm; H–M, 10 µm; N, 200 km.

Introduction to Clionaidae

Biology – Clionaida sponges typically excavate limestone substrata, creating a three dimensional network of interconnected chambers or galleries under the substrate surface. Communication with the environment is maintained through papillae provided with ostia and oscula that protrude slightly from the substrate (alpha stage) or can fuse and create a continuous sponge crust (beta stage). Some species become massive with age (gamma stage).

Limestone excavation is completed by etching metabolites produced by pseudopodial extensions of specialised cells that help releasing microscopic chips (up to about 60 µm) expelled with the excurrent water.

The main character of the skeleton is the presence of tylostyles organized in bouquets or in a palisade in the papillae and more abundantly without organization in the choanosome. Microscleres without structural importance as thin oxeas (raphides) and spirasters are present in some species.

Key to the genera and species of Peruvian Clionaidae

(1) With microscleres (acanthoxeas, microrhabds, spirasters, etc.) 2
Without microscleres, only tylostyle megascleres .... ***Cliona chilensis*** (p. 230)

(2) Microscleres include common microspined oxeas and microrhabds .....
..... ***Pione* sp.** (p. 238)
Microscleres of distinct morphology (smooth microstrongyles, raphides, spirasters) 3

(3) Microscleres are raphides 100–140 µm long, live-colour yellow .....
..... ***Cliona* aff. *amplicavata*** (p. 234)
Microscleres of distinct morphology (smooth microstrongyles, spirasters) ... 4

(4) Microcleres are abundant, stout spirasters 11–31 µm long;
tylostyles 190–350 µm long ..... ***Cliona* aff. *euryphylle*** (p. 232)
Microscleres are rare microstrongyles (30–50 µm long);
tylostyles 200–440 µm long ..... ***Cliona* sp.** (p. 236)


Order Clionaida
Cliona chilensis

Cliona chilensis Thiele, 1905

REFERENCES: Thiele, 1905; Desqueyroux-Faúndez & van Soest, 1997; Willenz, Hajdu, Desqueyroux-Faúndez *et al*., 2009; de Paula, Zilberberg, Hajdu *et al*., 2012.

Description – Burrowing sponge with characteristic inhalant papillae, approximately 4 mm in diameter, emerges from the limestone substrate. Young specimens display an alpha stage; aged specimens can reach 20 to 30 cm in diameter in the gamma stage with oscular papillae slightly prominent, approximately 3 to 6 mm in diameter usually grouped in rows. Consistency firm, cartilaginous. Colour in life is yellow, turning pale beige to dark brown in ethanol.

Skeleton – Ectosomal: dense palisade of tylostyles with points oriented outward. Choanosomal: thoroughly confused with tylostyles arranged crisscross.

Spicules – Megascleres only. **Tylostyles** slightly curved, varying from 186–*290*–358 × 6.0–*9.2*–14.0 µm to 238–*342*–415 × 8.0–*11.8*–15.0 µm. Tylostyle heads irregular, usually slightly subterminal.

Ecology – Boring into limestone substrate and bivalves shells. Found between 5 and 12 m. Specimens looking like *C*. *chilensis* were collected down to 25 m, but their identifications were not verified.

Distribution – From Punta Sal (03°57' S – Tumbes Region) to Bahía Samanco (09°12' S – Ancash Region). The species might also occur in San Juan de Marcona (15°22' S – Ica Region), Matarani, (17°00' S – Arequipa Region), Ilo (17°42' S – Moquegua Region). Elsewhere, the species has been reported from Galápagos, Chile, Argentina.

Remarks – Peruvian specimens look exactly the same as their Chilean and Argentinean cousins. This species can be impossible to distinguish from ***Clionaopsis platei*** in the field, but is easily distinguished under the microscope. On genetic grounds, *C*. *chilensis* has been shown to differ from the widely distributed *C*. *celata*. Nevertheless, it remains to be demonstrated if *Cliona* ***californiana*** is indeed distinct from *C*. *chilensis*.

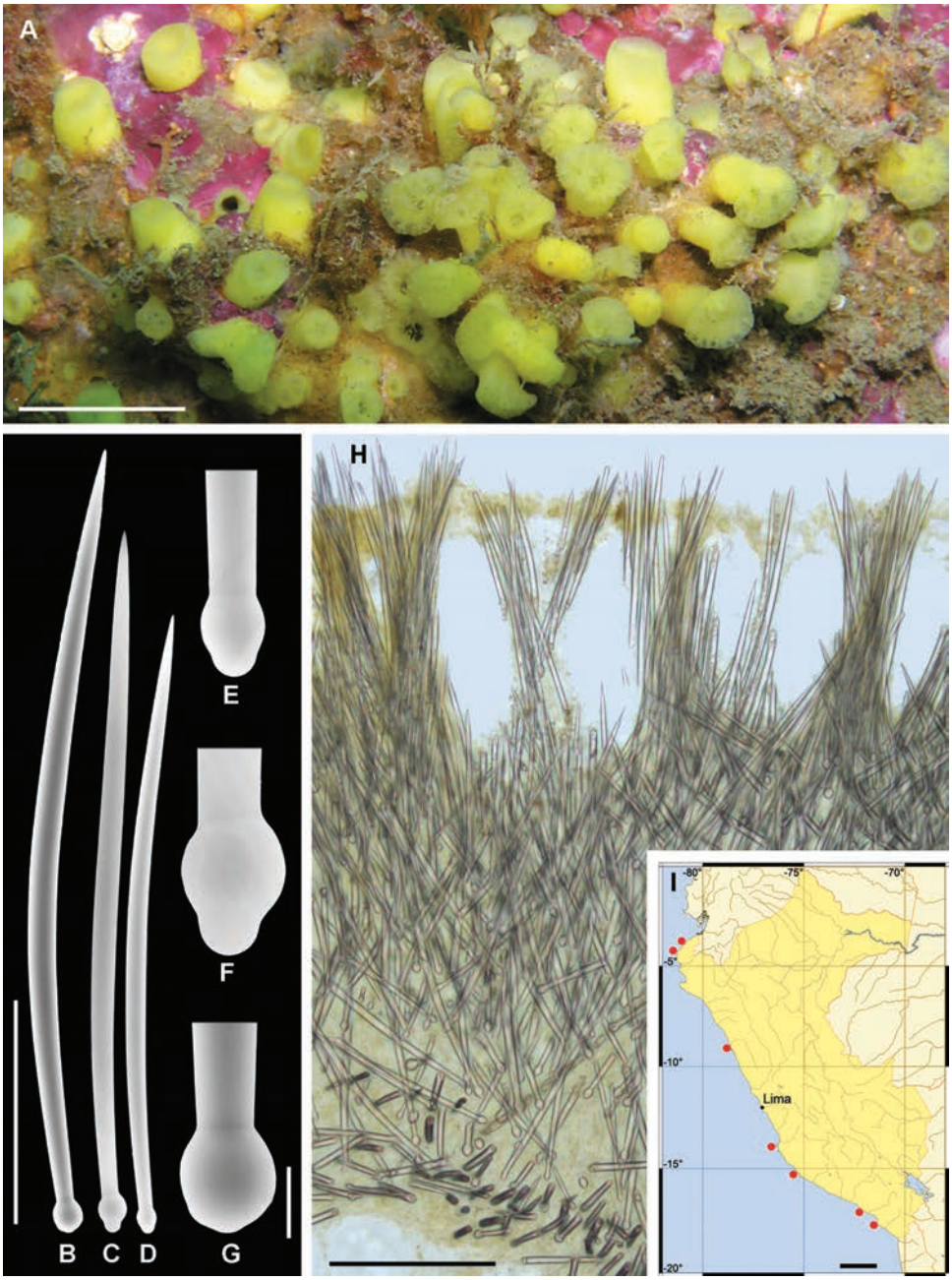


Fig. 103. *Cliona chilensis* Thiele, 1905. A, live specimen in alpha stage; B–D, tylostyles; E–G, details of tylostyles heads; H, skeleton architecture in transverse ground section; I, distribution map. Scale bars: A, 2 cm; B–D, 100 µm; E–G, 10 µm; H, 200 µm; I, 200 km.

Cliona aff. *euryphylle* Topsent, 1888

REFERENCES: Topsent, 1888; Pacheco, Carballo, Cortés *et al*., 2018; Jaramillo, Cóndor-Luján, Longakit *et al*., 2021.

Description – Sponge found in beta stage with irregular form, 1 to 4 mm thick. Papillae not very distinct but oscula protruding above substrate up to 3 mm, about 2 to 5 mm in diameter. Consistency firm. Live colour bright orange turning beige to light beige in ethanol.

Skeleton – Typical arrangement of *Cliona* species with tylostyles organized in bouquets in the ectosome and without organization in the choanosome.

Spicules – Megascleres. **Tylostyles**, straight or gently bent with rounded to oval heads, occasionally subterminal, 191–*290*–352 × 6.0–*8.5*–12.0 µm. **Microscleres**. **Spirasters** short and stout with heavy spines uniformly distributed along the convex shaft sides (11–*25.6*–31 µm).

Ecology – Boring into rocks, shells of bivalves, etc. Found between 10 and 12 m.

Distribution – Only found off Punta Sal (03°57' S – Tumbes Region). Originally reported from the Caribbean region, the species has subsequently been recorded from several localities in the Pacific, including a recent record for Ecuador, but these need to be verified.

Remarks – Pacific records of this species include Costa Rica, Ecuador, Mexico, Micronesia and New Zealand. This far, *C*. ***chilensis*** is the sole *Cliona* with confirmed interoceanic records. All other similar proposals for *Cliona* spp. need to be seen as tentative until confirmed by independent data sources.

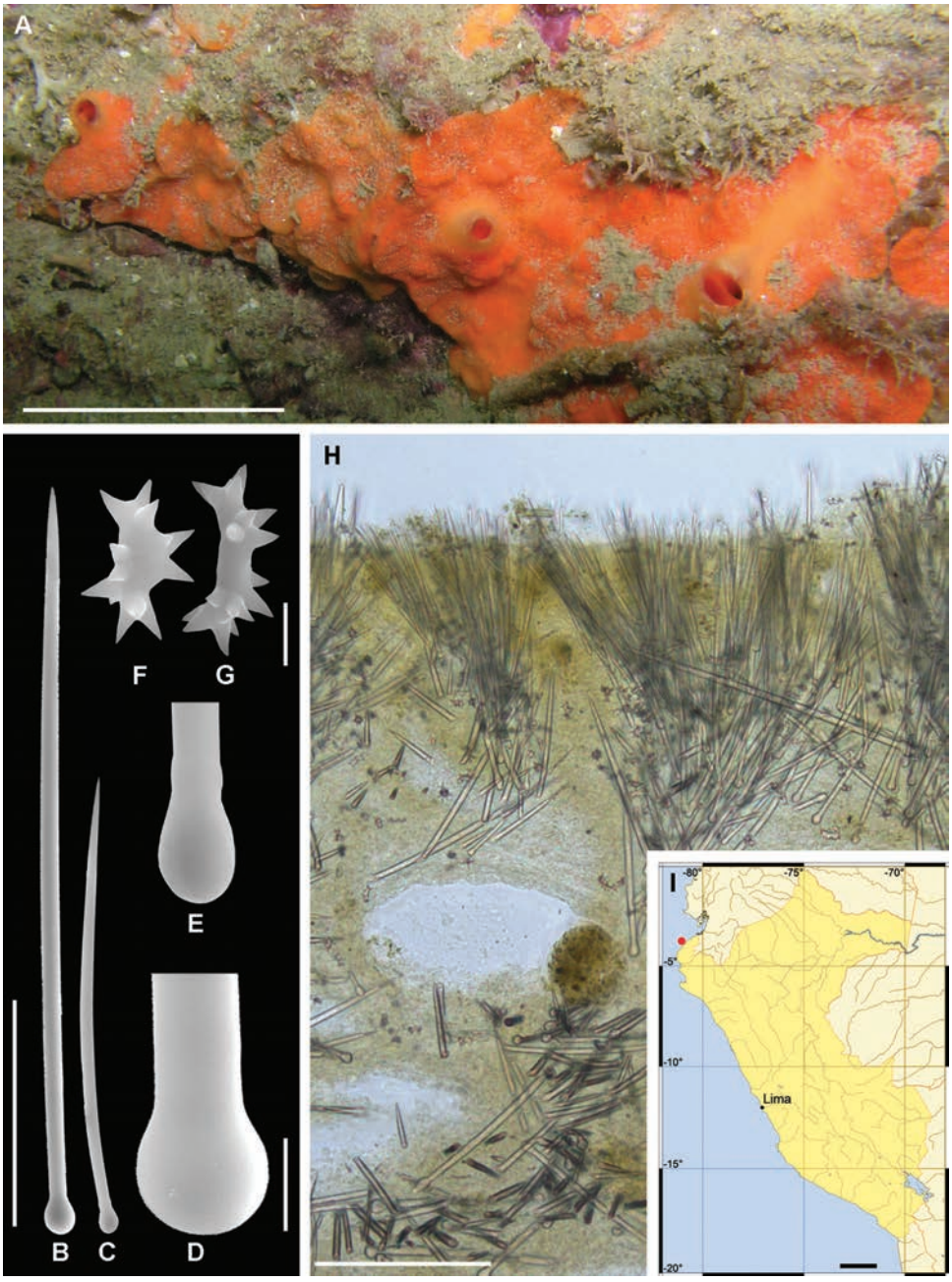


Fig. 104. *Cliona* aff. *euryphylle* Topsent, 1888. A, live specimen in beta stage; B–C, tylostyles; D–E, details of tylostyles heads; F–G, spirasters; H, skeleton architecture in transverse ground section; I, distribution map. Scale bars: A, 2 cm; B–C, 100 µm; D–G, 10 µm; H, 200 µm; I, 200 km.

Cliona aff. *amplicavata* Rützler, 1974

REFERENCE: Rützler,1974; Carballo, Cruz-Barraza & Gómez, 2004; Pacheco, Carballo, Cortés *et al*., 2018.

Description – Sponge in alpha or beta stage excavating the substrate. Specimens seen had 5–10 cm in largest diameter, and seemed to excavate at least a few centimeters deep the substrate. Papillae, mostly inhalant, are circular (2–3 mm in diameter) and protrude barely above the substrate. Oscular papillae are rare, and may be cone shaped. Colour in life beige to light-yellow on the outside, and a darker yellow on the inside, turning to light brown in ethanol.

Skeleton – Outer region with a confused assemblage of tylostyles, some emerging at the surface of the sponge, forming no palisade nor any bouquet. In the papillae a paucispicular reticulation of tylostyles is apparent around the ostia, where raphides can also be easily seen. Choanosome in the cavities, cavernous, rather paucispicular overall, with occasional ascending paucispicular tracts of tylostyles.

Spicules – Megascleres. **Tylostyles**, usually slightly curved and fusiform, 196–*336*–524 × 8–*10.5*–14 µm, heads well defined, elliptical to oval, occasionally subterminal, especially on younger spicules. **Microscleres**. **Raphides**, uncommon, thin, slightly bent in the middle, 95–*126*–142 × <1 µm.

Ecology – Boring into limestone substrate. Found between 16 and 19 m.

Distribution – Punta Sal (03°57' S – Tumbes Region) to Islote Ferrol, Chimbote (09°09' S – Ancash Region). Originally reported from the Bermuda.

Remarks – No clear separation appears when comparing Atlantic and Pacific records of this species in terms of morphology. Until confirmed by an independent set of characters, usually molecular markers, we prefer to name Pacific specimens aff. *amplicavata*, as Amphiamerican species of sponges are at best, of quite rare occurrence. The two Peruvian specimens studied exhibited important differences in terms of tylostyles dimensions and raphides abundance, which demands a more thorough study of variability.

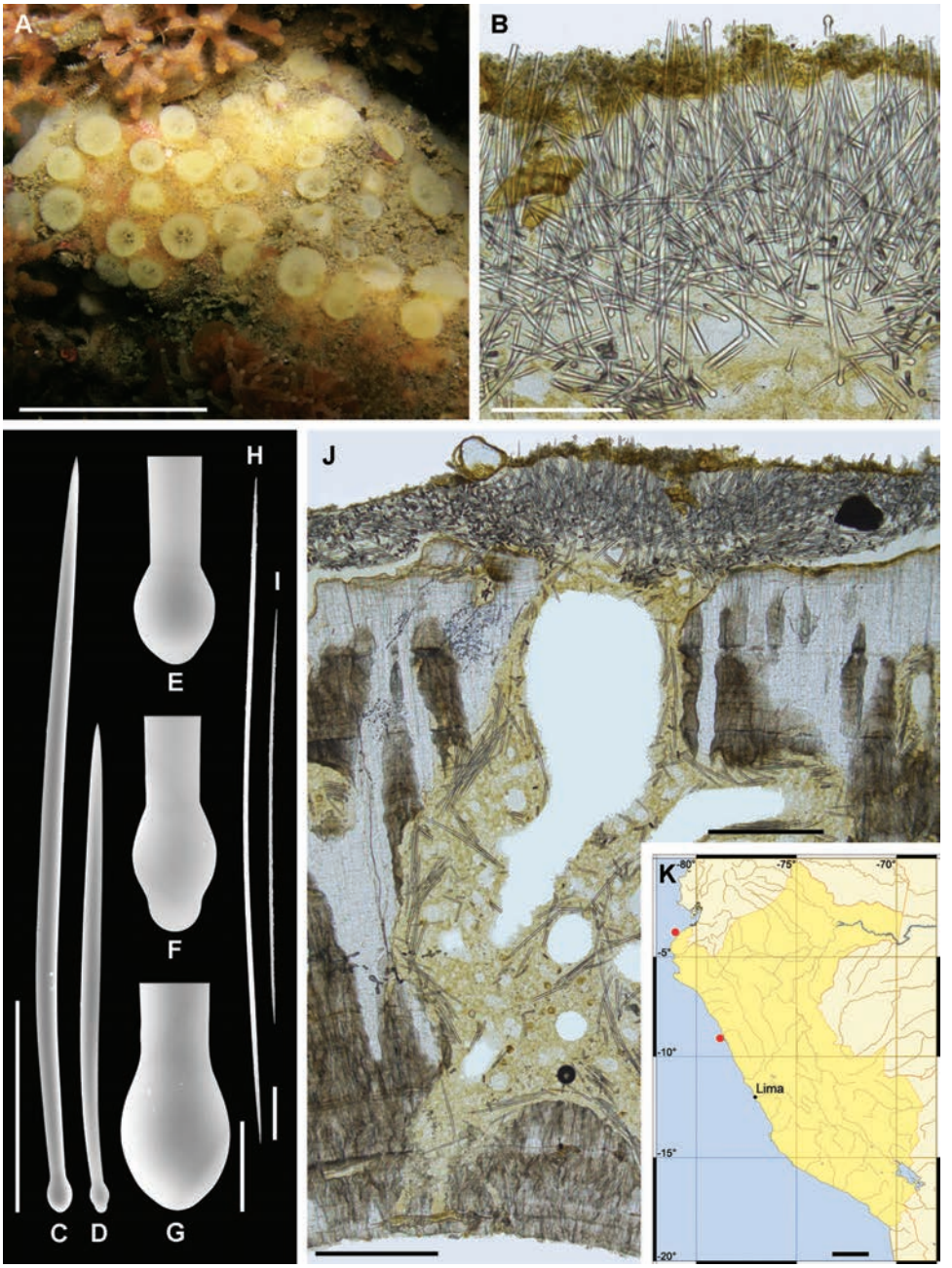


Fig. 105. *Cliona* aff. *amplicavata* Rützler, 1974. A, live specimen; B and J, skeleton architecture in transverse ground section (detail); C–D, tylostyles; E–G, details of tylostyles heads; H–I, raphids; K, distribution map. Scale bars: A, 1 cm; B, 200 µm; C–D, 100 µm; E–I, 10 µm; J, 500 µm; K, 200 km.

Cliona sp.

REFERENCES: Carballo & Cruz-Barraza, 2005; Pacheco, Carballo, Cortés *et al*., 2018.

Description – *Cliona* in alpha stage with only papillae emerging from the substrate, covered by a red, thinly encrusting bryozoan. Papillae, mainly oscular, measuring 2 to 5 mm in diameter and raising no more than 2 mm above the bryozoan, are either distant one to several cm apart from each other, or appear in irregular rows. Colour in life yellow, turning to dark beige in ethanol.

Skeleton – Confused and dense assemblage of tylostyles emerging at the surface of the sponge. Styles seemingly aligned radially around pores. Rare microstrongyles spotted loose in the choanosome.

Spicules – Megascleres. Tylostyles straight or curved, 202–*331*–436 × 4–*8.2*–14 µm. Styles to subtylostyles, straight or slightly curved, base bearing more of a rugosity than a proper head, acerate point, 113–*132*–151 × 3–5 µm. **Microscleres**. **Microstrongyles**, rare, 29–*42*–56 µm.

Ecology – Boring the limestone substrate. Covered by a bryozoan. Depth 10 m.

Distribution – Found off Islote El Lagarto, Islas Lobos de Afuera (06°56' S – Lambayeque Region).

Remarks – This is yet another yellow *Cliona*, found only in Islas Lobos de Afuera. It is distinguishable from *C*. ***chilensis*** by seemingly always being associated to an epibiont bryozoan, never reaching gamma stage, and possessing a category of small styles besides rare microstrongyle microscleres. It might also be mistaken for *C*. aff. *amplicavata*, but the latter has not been spotted with a similar epibiosis, and neither has true categories of styles or microstrongyles. The raphides present in *C*. aff. *amplicavata* settle the distinction of both species. Only a few species in *Cliona* are known with microstrongyles, and all these markedly differ from the present species in one or more important aspects of their spiculation. The only other species with small, smooth microstrongyles is the orange *C*. ***microstrongylata*** from the Gulf of California (Mexico), where these spicules are mostly smaller, stouter and kidney-shaped, aside being abundant. All these features render the Peruvian and the Mexican species well differentiated from each other.

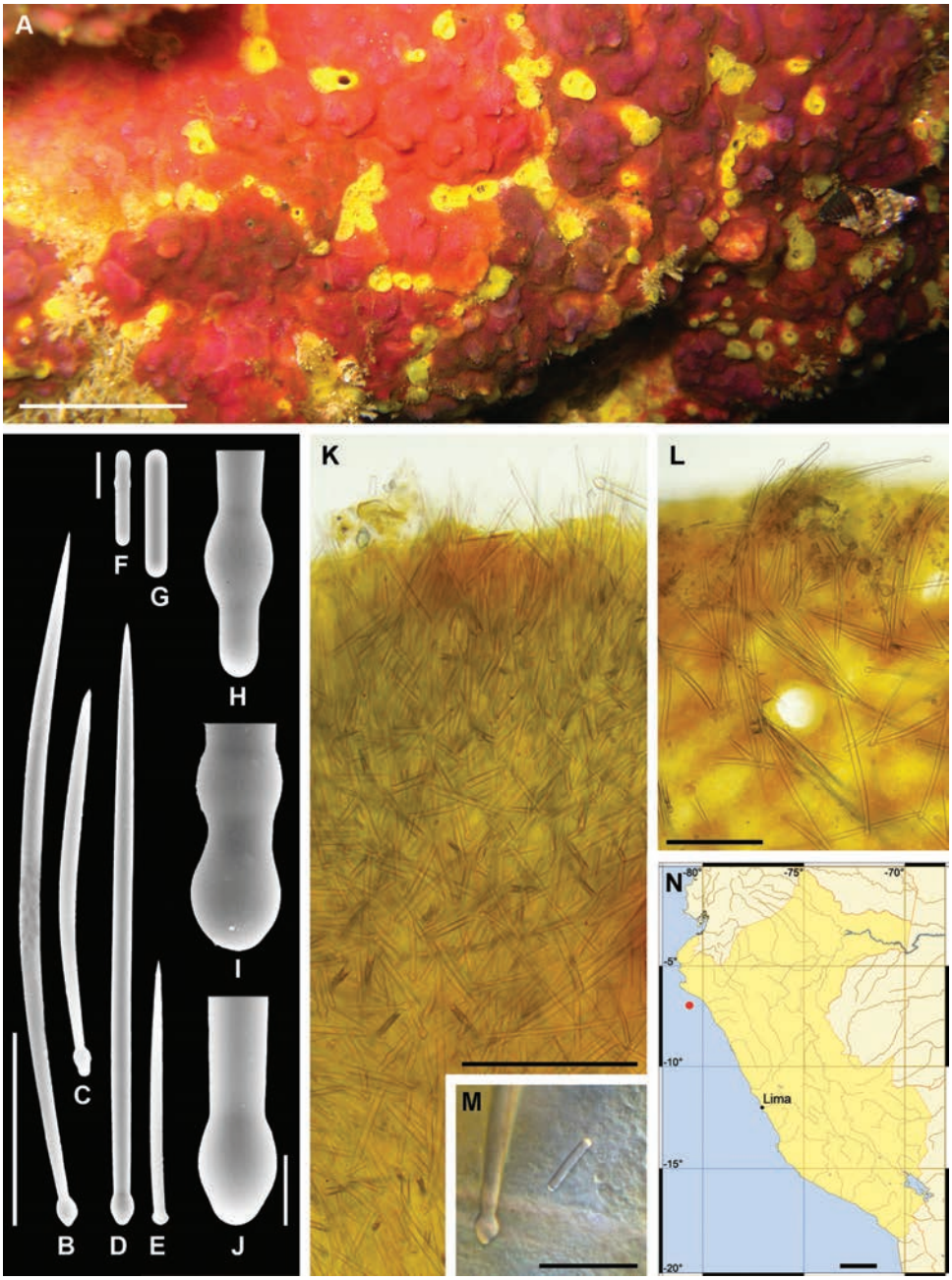


Fig. 106 . *Cliona* sp. A, live specimen; B–E, tylostyles; F–G, microstrongyles; H–J, tylostyles heads; K–L, skeleton architecture in transverse ground section; M, microstrongyle in the mesohyle; N, distribution map. Scale bars: A, 2 cm; B–E, 100 µm; F–G, 20 µm; H–J, 10 µm; K–L, 200 µm; M, 50 µm; N, 200 km.

Pione sp.

REFERENCES: Old, 1941; Rützler & Stone, 1986; Desqueyroux-Faúndez, 1990; Carballo *et al*., 2004; Austin *et al*., 2014.

Description – Thinly encrusting, less than 1 mm thick, about 10 cm in largest diam. Surface appears smooth, apertures not seen in underwater images. Colour in life an orangey red, turning white in ethanol.

Skeleton – Tylostyles are the main components, forming a thin, confused, paratangential layer close to substrate, where erect tylostyles stick their bases, apices nearing the ectosome. There, additional tylostyles form loose brushes resting on the erect ones, and pierce the surface. Microscleres cannot be made out among the tylostyles, but rather, appear abundantly inside a few cavities. No tylostyles seen in the cavities.

Spicules – Megascleres. **Tylostyles** smooth, commonly slightly curved or bent, with neat, hemispherical, terminal heads and sharp apices, 69–*193*–311 × 7–*8.7*–10 µm. **Microscleres**. **Acanthoxeas**, mostly bent at center, fusiform, fully microspined, spines sharp, facing central part, sharp apices, 34–*42.4*–55 µm; **Microrhabds**, variable morphology, but no helicoidal, wavy or centrotylote patterns seen, some devoid of spines in central third, spines blunt, short, occasionally splitting, some fully spined, spines long and sharp, also splitting occasionally, some strongyloid, some oxeoid, 6.9–*10.8*–13.1 µm.

Ecology – The single specimen was collected at 11 m depth, spreading over flat rock, where it overgrew small polychaete tubes, and was seemingly subject to being sand-brushed by abundant adjacent coarse sand.

Distribution – So far only known from Islas Lobos de Afuera (06°56' S – Lambayeque Region).

Remarks – There are currently 23 spp. of *Pione* known worldwide. The little dimensions of microscleres combined to the nearly straight aspect of the microrhabds are the main distinguishing aspects of the Peruvian species. This far only *P*. ***carpenteri***, *P*. ***gibraltarensis***, *P*. ***mazatlanensis*** and *P*. ***vastifica*** had been reported from the E Pacific. All have rather longer acanthoxeas.

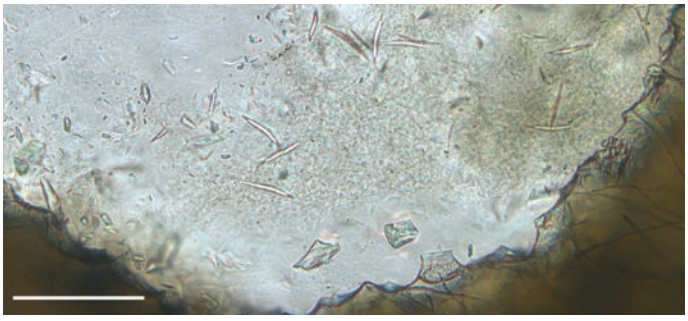


Fig. 107. *Pione* sp. Ground section with microscleres in a cavity bored in the substrate. Scale bar: 100 µm.

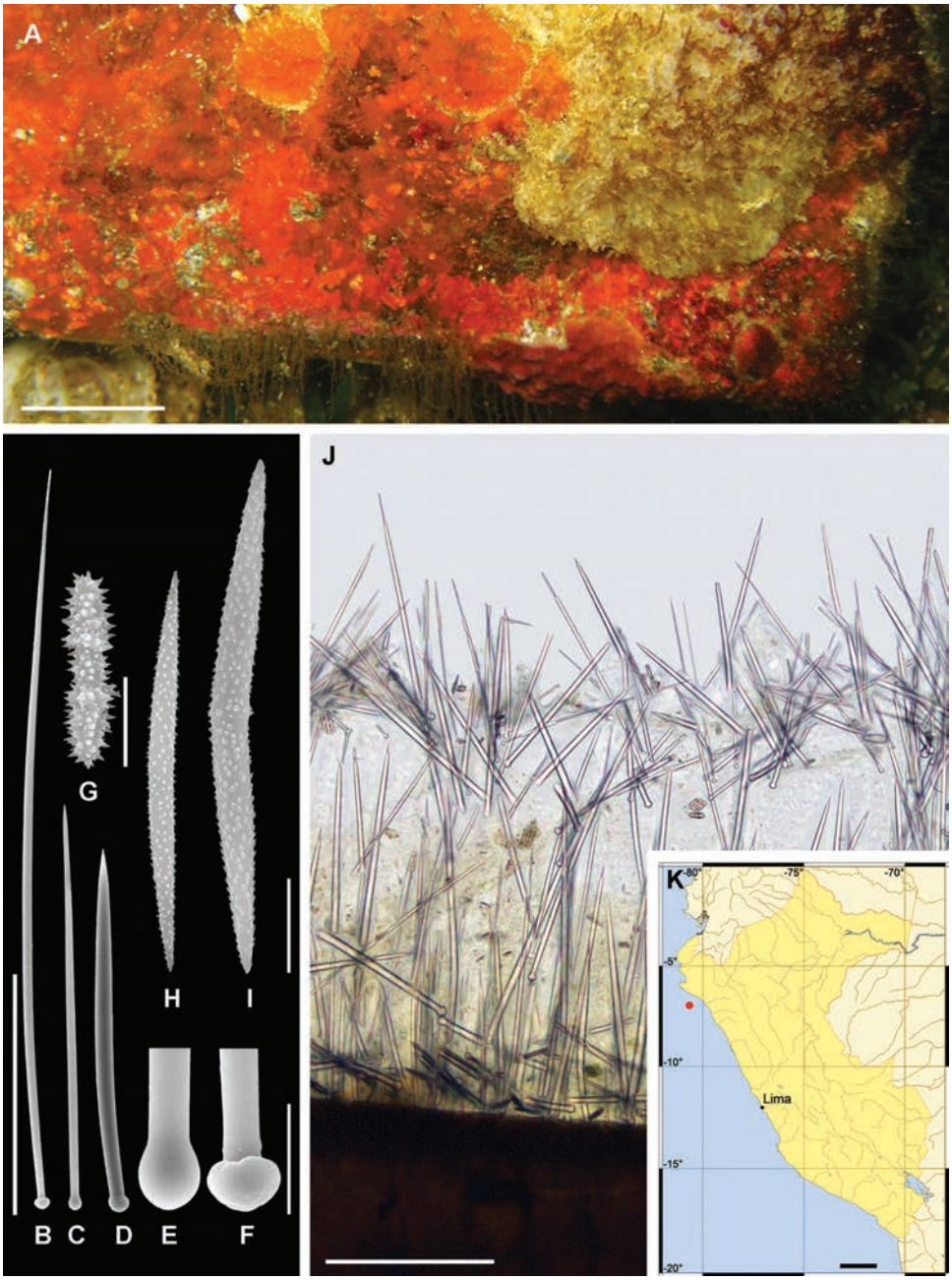
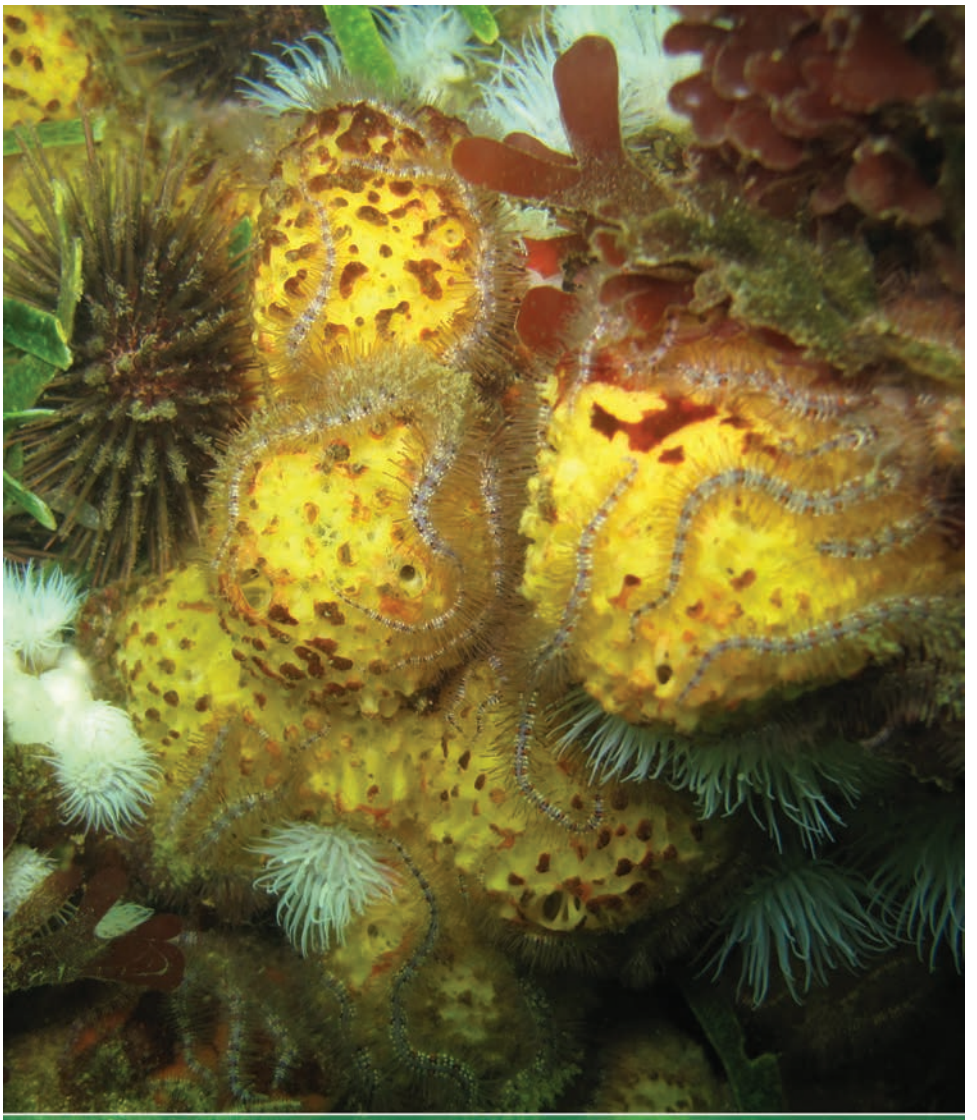


Fig. 108. *Pione* sp. A, live specimen; B–D, tylostyles; E–F, details of tylostyles heads; G, microrhabd; H–I, acanthoxeas; J, skeleton architecture in transverse ground section; K, distribution map. Scale bars: A, 2 cm; B–D, 100 µm; E–F, 10 µm; G, 5 µm; H–I, 10 µm; J, 200 µm; K, 200 km.



Order Tethyida

Tethya cf. *socius*

Tethya cf. *socius* Sarà, Gómez & Sarà, 2001 (white morph)

REFERENCES: Desqueyroux-Faúndez & van Soest, 1997; Sarà, Bavestrello & Calcinai, 2000; Sarà, Gómez & Sarà, 2001; Hajdu, Desqueyroux-Faúndez, Carvalho *et al*., 2013; Sim-Smith, Hickman & Kelly, 2021.

Description – Specimens roundish, 3–4 cm in diameter, frequently fused together in clusters with 10–20 individuals, reaching over 15–20 cm in total diameter. Fusion can be observed solely on their bases, or on complete faces. Occasionally stolons are seen, which raise the question whether this is a strategy for moving around, or asexually reproducing, alternative to the typical budding. Consistency compressible, becoming quite firmer from contraction in response to collection and handling. Surface bears abundant warts, the depressions in between the later bearing ostia visible on *in situ* images. Discrete growth of filamentous algae on each wart gives a mottled aspect to specimens. Oscula occur on the apical parts of the sponges, mostly one per individual, sometimes compound, and up to 1 cm in diameter. Live colour off-white with brownish mottles in some specimens, remaining the same in ethanol.

Skeleton – A greater concentration of microscleres right underneath the ectosome is as close as this species gets to bearing a surface crust. This is interrupted here and there by dense fanning brushes of main megascleres, about 1.5 mm in diam. The space in between these brushes houses aquiferous canals and lacunae. This cortical layer is about 1 mm thick, and bears abundant microscleres and scattered megasters. Megascleres occur exclusively in the tracts that give rise to the aforementioned brushes. It is in the radially arranged choanosome that megasclere abundance raises considerably, at the same time that microscleres nearly vanish, with the exception of a few megasters.

Spicules – Megascleres. **Strongyloxeas** (subtylostyles to oxeas), smooth, slender, slightly fusiform, 323–*1020*–1547 × 3–42 µm. **Microscleres**. **Megasters**, **oxysphaeraters** to **spheroxyasters**, stout, sharp rays, straight or sinuous, occasionally bifid or bearing single thorn half way, 67–*91*–111 µm. **Microsters**, **tylasters** (commonly varying to strongylasters, 10–12 µm, and rarely oxyasters, 11 µm), variably stout, 10–*11*.*9*–14.6 µm.

Ecology – The species occurs on shallow (2 m deep), hard substrate. Specimens were found both singly or in clusters. Other associated fauna includes anemones, zoanthids, bryozoa.

Distribution – Punta Sal and Máncora (03°58' S and 04°06' S – Tumbes Region).

Remarks – See appendix 13.1 page 330.

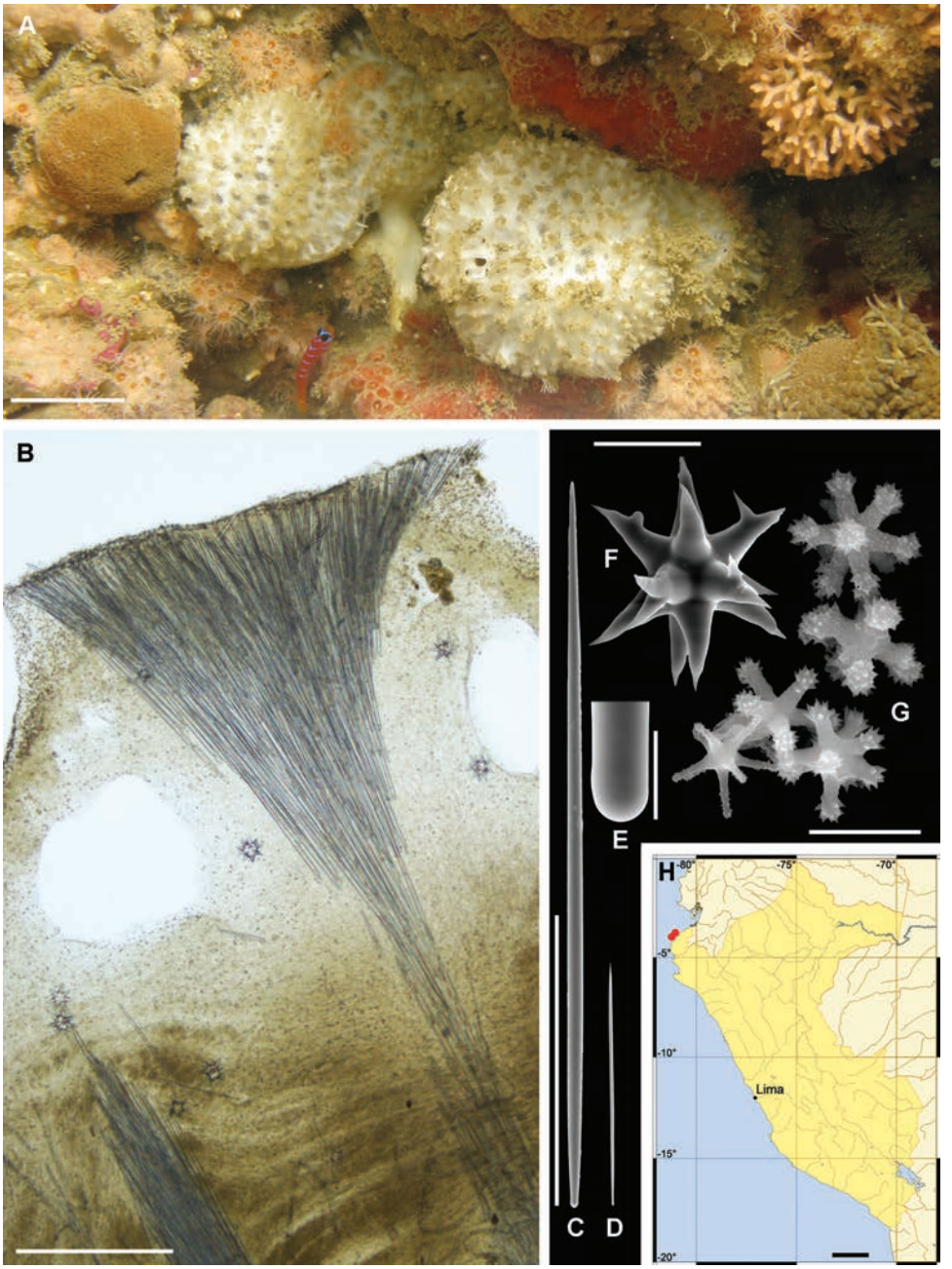


Fig. 109. *Tethya* cf. *socius* Sarà, Gómez & Sarà, 2001 (white morph). A, live specimen; B, skeleton architecture in transverse ground section; C–D strongyloxeas; E, detail of C; F, spheraster; G, microsters; H, distribution map. Scale bars: A, 2 cm; B–D, 500 µm; E, 20 µm; F, 50 µm; G, 10 µm; H, 200 km.

Tethya cf. *socius* Sarà, Gómez & Sarà, 2001 (yellow morph)

REFERENCES: Desqueyroux-Faúndez & van Soest, 1997; Sarà, Bavestrello & Calcinai, 2000; Sarà, Gómez & Sarà, 2001; Hajdu, Desqueyroux-Faúndez, Carvalho *et al*., 2013; Sim-Smith, Hickman & Kelly, 2021.

Description – Specimens roundish, 3–4 cm in diameter, frequently fused together in clusters with 10–20 individuals, reaching over 15–20 cm in total diameter. Fusion can be observed solely on their bases, or on complete faces. A few specimens seem to be epibiont on others. Consistency compressible, but becoming quite firmer from contraction in response to collection and handling. Surface bears abundant warts, the depressions in between the later bearing ostia visible on *in situ* images. Discrete growth of filamentous algae on each wart gives a mottled aspect to specimens. Oscula occur on the apical parts of the sponges, mostly one per individual, and up to 1 cm in diameter. Live colour yellow with brownish mottles, turning to whitish/beige in ethanol.

Skeleton – Two specimens were sectioned, and both differ somewhat as to their skeletal architecture. No thick, dense layer of any spicule occurs in the ectosome or cortex in both. Instead, the ectosome is supported by the terminal brushes resulting from longitudinal tracts fanning out. Brushes can be dense but scattered, or loose but approaching a palisade condition. Megasters are not very common, and in one specimen there seems to be a gradient in dimensions, with larger asters occurring mainly towards the ectosome. The cortex has an overall low spicule density, but is where most microscleres will be found. The choanosome is radially arranged, denser towards the interior of the sponge. Ascending tracts of main megascleres reach 120–260 µm in diameter where they start fanning out. Auxiliary megascleres are only clearly seen in one of the specimens. Microscleres appear to be mostly absent from this region.

Spicules – Megascleres. **Strongyloxeas** (subtylostyles to oxeas), smooth, slender, slightly fusiform, 170–*748*–1741 × 3–28 µm. **Microscleres**. **Megasters**, **oxysphaeraters** to **spheroxyasters**, stout, sharp rays, straight or sinuous, occasionally biphid or bearing single thorn half way, 32–*70.4*–124 µm. **Micrasters**, **tylasters**, variably stout, 8.4–*11.1*–14 µm. **Strongylasters**, 7.3–11.5 µm (rare). **Oxyspherasters**, 4.1–8 µm (rare). **Chiasters**, irregularly outlined, stout, rays occasionally as mere bumps, 7–10 µm (rare). **Spherules**, nearly smooth, slightly compressed, 7 µm (rare).

Ecology – The species occurs on rocky substrate, from the intertidal down to 14 m depth. Specimens not only formed clusters themselves, as were frequently an important component of multispecies complexes including sea-anemones, barnacles, sea-urchins, ophiuroids and algae.

Distribution – From El Ñuro (04°13' S – Piura Region) to Islas Lobos de Afuera (06°56' S – Lambayeque Region).

Remarks – As for *Tethya* cf. *socius* (white morph) above.

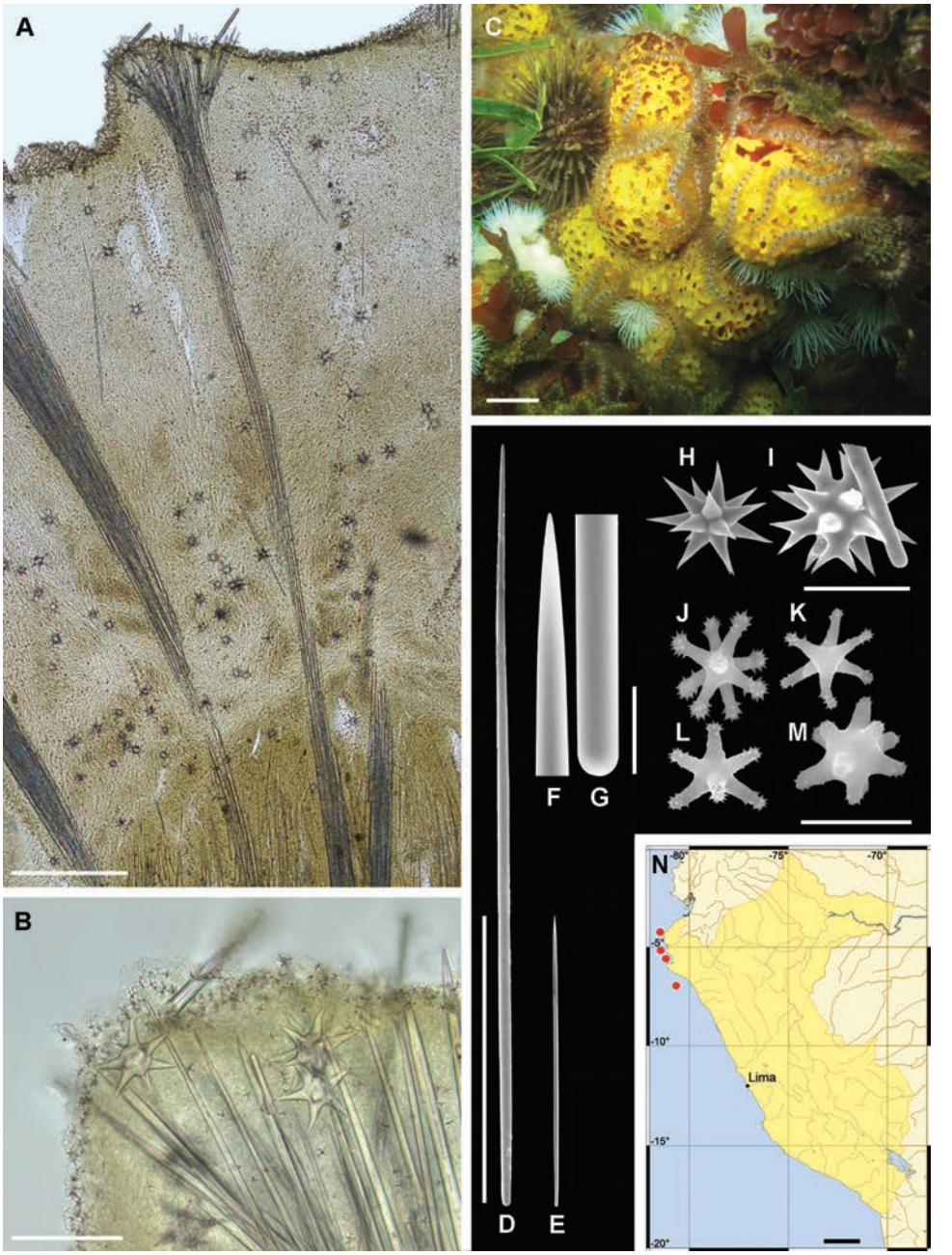


Fig. 110. *Tethya* cf. *socius* Sarà Gómez & Sarà, 2001 (yellow morph). A, skeleton architecture in transverse ground section; B, detail of A; C, live specimen; D–E, strongyloxeas; F–G, detail of D; H–I, spherasters; J–M, microrasters; N, distribution map. Scale bars: A, 500 µm; B, 100 µm; C, 2 cm; D–E 500 µm; F–G, 20 µm; H–I, 50 µm; J–M, 10 µm; N, 200 km.

Timea sp.

REFERENCES: de Laubenfels, 1932; Desqueyroux-Faúndez, 1972; Carballo & Cruz-Barraza, 2006; van Soest, Kaiser & van Syoc, 2011.

Description – Specimens thinly encrusting, up to 5 cm in largest diameter. The collected specimen might have been contracted, as its surface appears smooth and even. Other specimens seen exhibited a system of pore grooves intermingled to surface plates of common occurrence in the genus, and likely analogous to those seen in *Placospongia*. A single circular oscule, 1–2 mm in diameter is visible in one of the *in situ* images. Live colour yellowish to orangish, somewhat obscured by filamentous epibionts, turning dark beige when preserved in ethanol. The specimen collected has abundant red spots on its surface.

Skeleton – The entire structure is basically a crust of euasters, denser the closer to the surface, but also remarkably common by the substrate. Megascleres are not very common. They can be seen laying parallel to the substrate, as well as forming scattered 1–2 spicules' long erect tracts, that fan-out in approaching the surface. Aquiferous spaces are not obvious.

Spicules – Megascleres. **Subtylostyles**, slender, mostly straight, occasionally curved and/or slightly fusiform, with elliptical heads and acerate points, 195–*414*–695 × 1.5–13 µm. **Microscleres**. Diverse set of **euasters**. **Oxyspherasters**, fusiform rays, lightly spined at ray tips, 15–*19.6*–25 µm. **Strongylospherasters**, rays fusiform or isodiametric, heavily spined at rays' apical half, 15–*17.9*–26 µm. **Oxyasters** to **oxyspherasters**, rugose or smooth, rays slightly fusiform, frequently hastate, 11–*12.9*–14 µm. **Strongylasters** (**chiasters type I**), rays isodiametric, heavily spined at tips, 3.8–*4.7*–6 µm. **Spheroxyasters** (**chiasters type II**), rays conical, lightly spined at tips, 4.5 µm (rare).

Ecology – Three specimens were seen on hard substrate at about 9 m depth, co-occurring with algae, zoanthids, other sponges and tunicates.

Distribution – The species was found only in Cancas (03º55' S – Tumbes Region).

Remarks – The whole Indo west Pacific has 25 currently recognized species of *Timea*, only five of which from the Eastern Pacific. Among the later, three possess much larger megascleres, namely *T*. ***clippertoni***, *T*. ***floridusa*** and *T*. ***ohuirae***. The other two, *T*. ***chiasterina*** and *T*. ***juantotoi***, can be differentiated by the morphology and diversity of their euasters. The majority of the remaining twenty species can be easily differentiated by their megasclere dimensions. A further few, by their very peculiar euaster morphology (lophaster, calthrop-like) or large dimensions. Five species remain, *T*. ***aurantiaca***, *T*. ***granulata***, *T*. ***lowchoyi***, *T*. ***ornata*** and *T*. ***stellivarians***. The smaller or larger dimensions reached by their euasters, or the lack of abundant chiasters sets *T*. *granulata*, *T*. *lowchoyi* and *T*. *ornata* separate from the Peruvian specimen. *Timea aurantiaca* was reported with bright-yellow to red colour in life, besides the possession of euasters that always have a clearly defined centrum. Both are traits that do not match what is observed in the specimen from Cancas. Lastly, *T*. *stellivarians*, in addition to its distant Indian Ocean distribution, already suggestive of non-conspecificity, appears not to have megascleres or microscleres as small as the smallest ones found here. The set of highlights listed above is strongly suggestive of the Peruvian specimen belonging to a yet undescribed species.

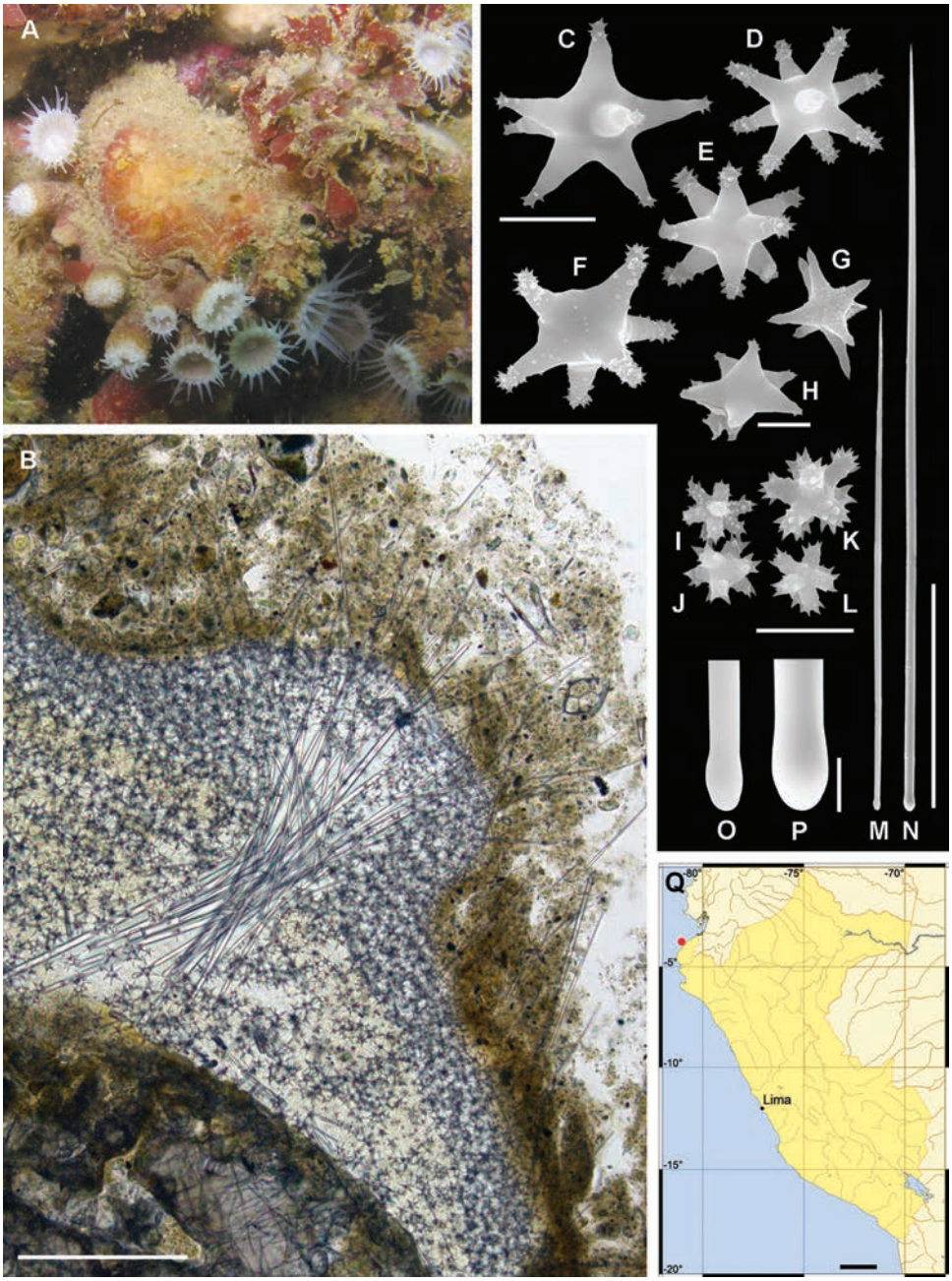


Fig. 111. *Timea* sp. A, live specimen; B, skeleton architecture in transverse ground section; C, oxyspheraster; D–F, strongylospheraster; G, oxyaster(s) to oxyspheraster(s); H, spheroxyaster; I–L, strongylasters, M–N, tylostyles of two size classes; O–P, details of M–N; Q, distribution map. Scale bars: A, 1 cm; B, 200 µm; C–G, 10 µm; H, 2 µm; I–L, 5 µm; M–N, 200 µm; O–P, 10 µm; Q, 200 km.

Order Trachycladida

Trachycladus aff. *minax*

Trachycladus aff. *minax* (Topsent, 1888)

REFERENCES: Topsent, 1888; Bergquist, 1968; Lévi, 1969; Uriz, 1988; Solórzano, 1990; Samaai & Gibbons, 2005.

Description – Both specimens collected thinly encrusting hard substrate, seemingly granitic, smooth and bearing a neat system of subectosomal canals visible to the naked eye, converging to sparse roundish oscula (ca. 1 mm in diameter) holding a short chimney-like membrane. Consistency fragile. Colour in life yellow, dull or lemon-toned, turning whitish to beige when preserved in ethanol.

Skeleton – Ectosome a crust of spinispirae pierced here and there by megascleres. The latter are mostly erect on the substrate singly in a hymedesmiod pattern, occasionally forming loose tufts, and sometimes apparently laying directionless. The choanosome has a low density of spicules, with spinispirae showing a tendency to aggregate close to the substrate too.

Spicules – Megascleres. **Tylostyles to subtylostyles**, smooth, slender, slightly curved, occasionally bent at the base of the head, apex mostly hastate, occasionally roundish, 265–*473*–686 × 4–14 µm. **Microscleres**. **Spinispirae**, helicoidal, mostly with two complete turns, maximum length and width quite similar, acanthose all over, with primary and secondary spines, the latter seen only under SEM, 10–14 × 8–11 µm.

Ecology – Collected in shallow-water, 2 to 3 m deep, with other crustose sponges and polychaete tubes.

Distribution – Cancas (03°55' S – Tumbes Region); Isla Don Martin, Huacho (11°01' S – Lima Province) and Quilca, Ensenada al norte de Quilca (16°42' S – Arequipa Region).

Remarks – Among the six known species of *Trachycladus*, the Peruvian specimens are closest to *T*. ***minax*** and *T*. ***spinispirulifer***. *Trachycladus minax* occurs in the northeast Atlantic and Mediterranean, while *T*. *spinispirulifer*, originally reported from South Africa, is believed to be much more widely distributed (southeast Atlantic and Indo-west Pacific). The few records coming along side descriptions already strongly point to the need to revise this latter species, as megascleres recorded in the subsequent literature are three times as large as originally reported. In this respect, records from Namibia and New Zealand are likely misidentifications. Both species come quite close to each other, but were never compared in detail, in spite of the several literature records for each. They both have orange-red live colour, megascleres smaller than 600 µm (if likely misidentifications are left aside), and spinispirae in the 10–20 µm range. Slight distinction stems from the ability of *minax* to secrete smaller megascleres, in the 200–300 µm range, and seemingly obligatory encrusting habit, which match the Peruvian materials best. The single remaining distinctive character for the latter is their lighter yellow live colour. On biogeographic grounds we expect the Peruvian species to be found distinct from both species compared above, but for now its identification must remain inconclusive.

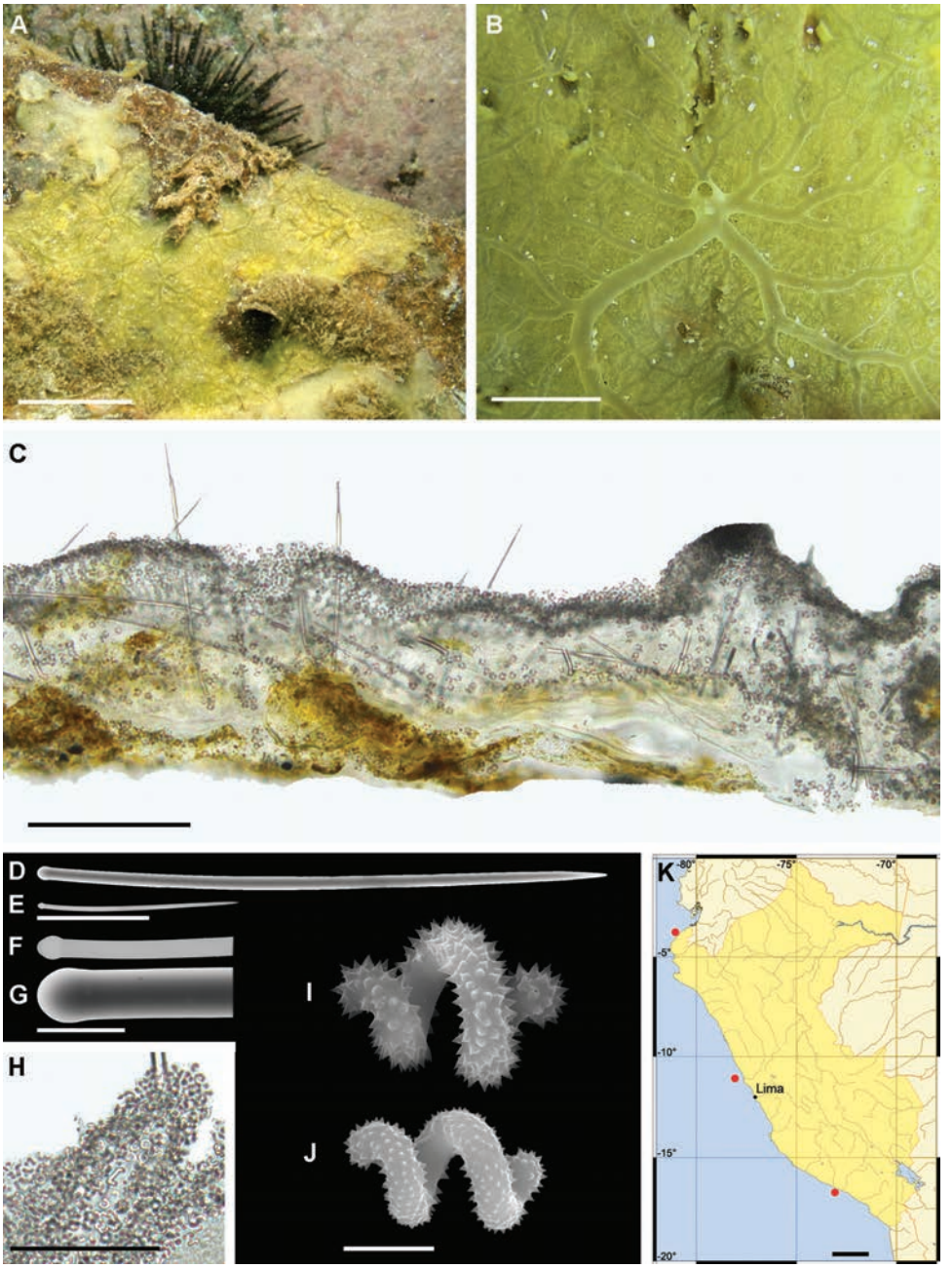


Fig. 112. *Trachycladus* aff. *minax* (Topsent, 1888). A–B, live specimens; C, skeleton architecture in transverse ground section; D–E, tylostyles; F–G, details of D and E; H, spinispirae in the ectosome; I–J, spinispirae; K, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 200 µm; D–E, 100 µm; F–G, 20 µm; I–J, 5 µm; K, 200 km.

Order Suberitida

Hymeniacidon perlevis

Halichondria (*Halichondria*) *cristata* Sarà, 1978

REFERENCES: Sarà, 1978; Gastaldi, de Paula, Narvarte *et al*., 2018.

Description – Specimens can be encrusting, thinner or thicker cushion-shaped, irregularly spreading, or bear irregular projections (lobate, digitiform, volcaniform). Largest specimens were over 10 cm diam. Oscula common or uncommon, small (1–3 mm), apical on short projections, or nearly flat, and can bear a thin membrane. Consistency compressible and surface smooth. Colour light yellow alive turning beige in ethanol.

Skeleton – Variously cavernous, with abundant canals and subectosomal lacunae. Ectosomal skeleton with a loose reticulation intersected by many obliquely disposed oxeas forming denser nodes. Choanosomal skeleton with only rare signs of tracts, or presenting loose, paucispicular radiating tracts more visible in the subectosomal area. Mostly, oxeas appear strewn at random.

Spicules. Oxeas, slightly bent at centre, tapering gradually, 205–*368*–466 × 5–*10.5*–17.4 µm.

Ecology – Abundant epibiont on sea grass at Islas Lobos de Afuera, with several individuals forming patches over 50 cm diam, but also encrusting cirripeds and densely intermingled to abundant erect, ramified bryozoans. At Independencia and Asia Islas, specimens occurred amidst anemonae (*Anthotoe chilensis*) and red-algae or associated to the holdfast of the brown algae *Eisenia cockeri*. Depth from 4 to 13 m.

Distribution – SW Atlantic: Tierra del Fuego. SE Pacific: along the coasts of Peru, including Islas Lobos de Afuera (06°55' S – Lambayeque Region), Isla Vieja, Bahia Independencia (14°16' S – Ica Region) and Isla Asia, Cañete (12°46' S – Lima Region).

Remarks – The only *Halichondria* known this far from the SE Pacific is *H*. (*Halichondria*) ***prostrata***, with oxeas only 300–320 µm long (see below). Other seven species are known from the SW Atlantic. Among these, another two were reported with yellow(ish) colour in life, *H*. (*Eumastia*) ***attenuata*** and *H*. (*Halichondria*) *cristata*, the former with a distinct densely fistular surface and oxeas that can be telescoped or mucronated. The latter, on the other hand, aside its surface reported to bear abundant laminae and ridges, appears indistinguishable from the Peruvian specimens. Sarà (1978) mentioned that the surface ornamentation was considerably less pronounced in encrusting specimens, which might explain their apparent absence in the encrusting Peruvian specimens studied.

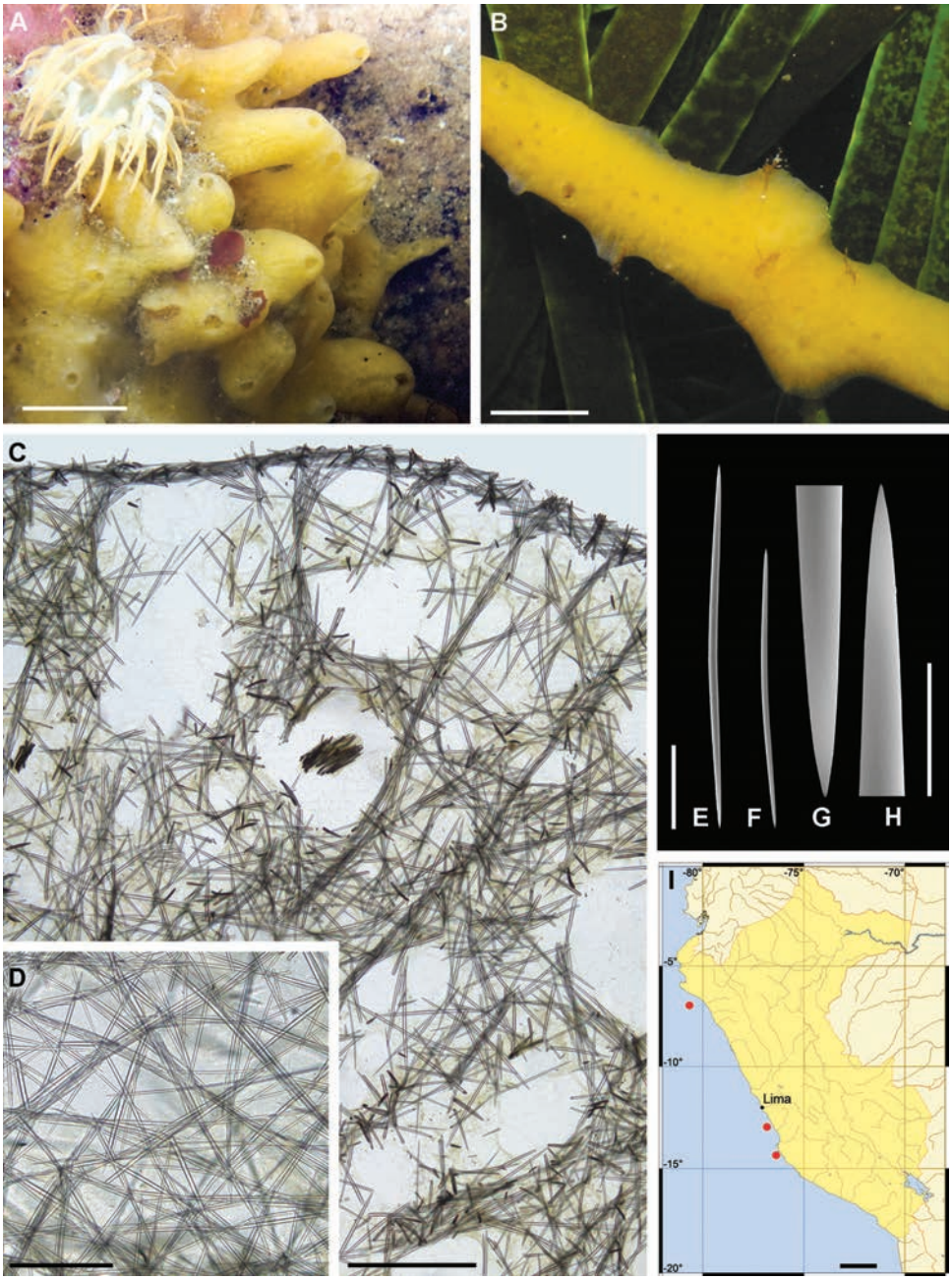


Fig. 113. *Halichondria* (*Halichondria*) *cristata* Sarà, 1978. A–B, live specimens; C, skeleton architecture in transverse ground section; D, skeleton architecture in tangential ground section; E–F, oxeas; G–H, details of E; I, distribution map. Scale bars: A–B, 1 cm; C, 500 µm; D, 200 µm; E–F, 100 µm; G–H, 20 µm; I, 200 km.

Halichondria (*Halichondria*) *prostrata* Thiele, 1905

REFERENCES: Thiele, 1905; Koltun, 1964; Gastaldi, de Paula, Narvarte *et al*., 2018.

Description – Specimens can be incrusting or irregular with abundant projections (lobate, ridged or digitiform). Surface with a transparent membrane revealing the choanosomal skeleton underneath. Oscula (max diameter = 0.2 cm) are located on top of the projections. Consistency compressible and surface smooth. Colour pale yellow in life turning to beige in ethanol.

Skeleton – Cavernous, with canals and subectosomal lacunae. Ectosomal skeleton thin and transparent, easily detachable, with spicule arrangement as a criss-cross of spicules without apparent reticulation. Choanosomal skeleton with multispicular ascendant tracts attached by spicules in some parts, abundant free spicules in confusion.

Spicules – Oxeas, slightly bent at centre, tapering gradually, 195–*314*–380 × 4.0–*8.9*–13.0 µm.

Ecology – Specimens found attached or close to polychaete tubes or anemonae. Depth from subtidal to 8 m.

Distribution – SW Atlantic: Comodoro Rivadavia (North Patagonian Gulfs). Subantarctic: South Georgia. Antarctic: Weddel Sea. SE Pacific: along the coasts of Peru, including Isla Asia, Cañete (12°46' S – Lima Region) and Isla Vieja, Bahia Independencia (13°49' S – Ica Region).

Remarks – The Peruvian specimens match *Halichondria* (*Halichondria*) *prostrata* from Chile. Although they have apparently slightly larger and stouter oxeas, when compared to the holotype (300–320 × 9 µm), this can be considered intraspecific variation. *Halichondria* ***elenae*** from Argentinian North Patagonia also comes close to the specimens from Peru, but it presents slightly stouter oxeas (5.1–19 µm) and is yellowish/greyish–green alive. Besides, preference is given here to the SE Pacific name, on account of biogeographic likelihood.

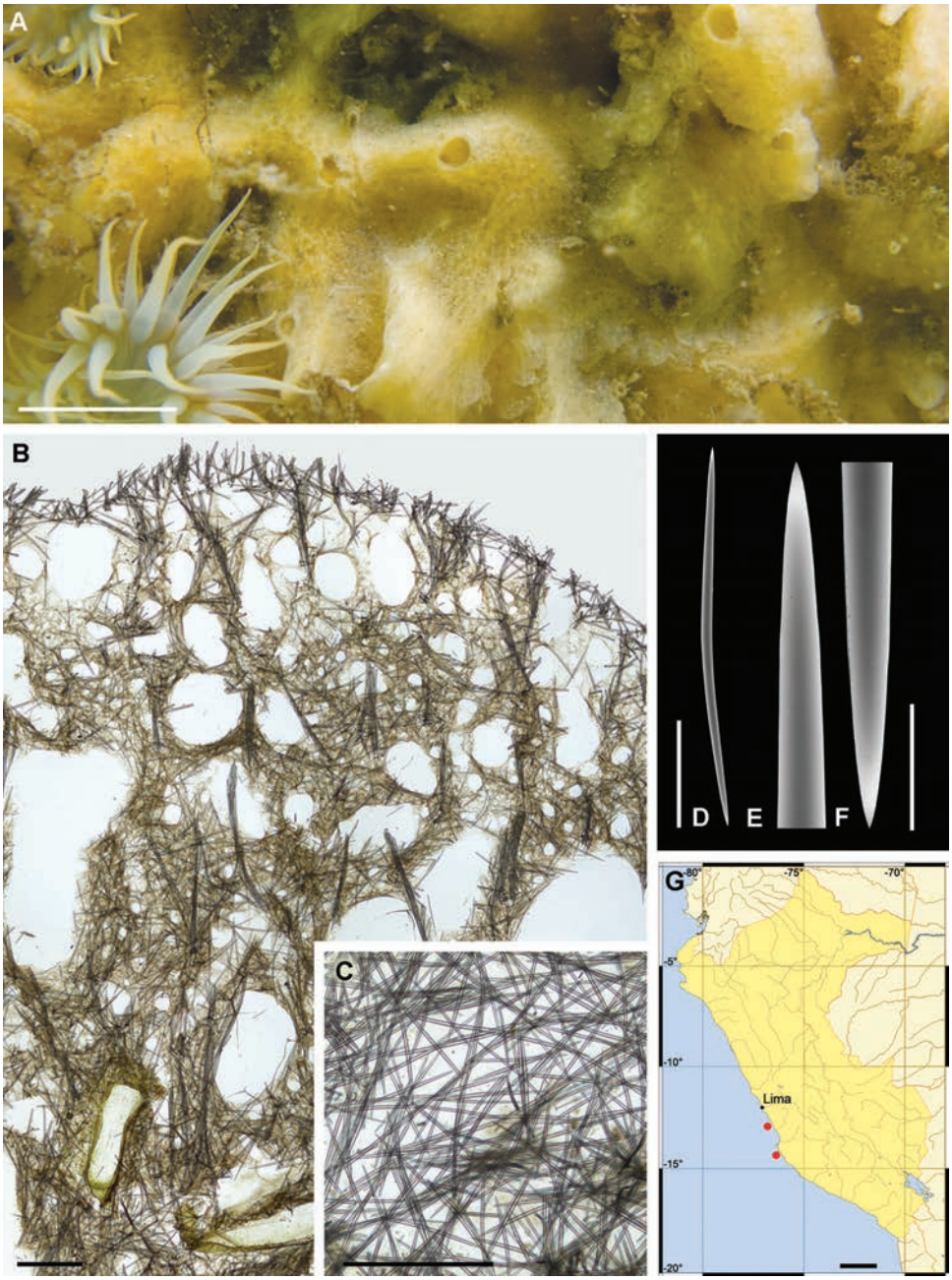


Fig. 114. *Halichondria* (*Halichondria*) *prostrata* Thiele, 1905. A, live specimen; B, skeleton architecture in transverse ground section; C, skeleton architecture of the ectosome in tangential ground section; D, oxea; E–F, details of D; G, distribution map. Scale bars: A, 2 cm; B–C, 500 µm; D, 100 µm; E–F, 20 µm; G, 200 km.

Hymeniacidon perlevis (Montagu, 1814) (yellow and orange morphs)

REFERENCES: Montagu, 1814; Erpenbeck & van Soest, 2002; Gastaldi, de Paula, Narvarte *et al*., 2018; Turner, 2020.

Description – Encrusting to massive sponge. Oscula on top of small elevations (average height = 7 mm), with one or multiple openings. Surface rough, consistency slightly compressible. Colour orange or yellow with a slightly orange tint in live and dark mustard to beige in ethanol.

Skeleton – Ectosomal architecture tangential or paratangential, reticulated or resembling a parchment arrangement in tangential view with subectosomal cavities (average diameter = 430 µm). Choanosomal architecture confused, with ascending ending in bouquets when reaching the surface.

Spicules – Styles to **subtylostyles**, smooth, straight or slightly curved, tyles small subterminal, 102–443 × 2.5–12.5 µm.

Ecology – This species lives attached to rocky substrates, sharing the habitat with macroalgae and invertebrates such as anemones, gastropods, mussels, ophiuroids and cirripeds. Depth from subtidal to 4 m.

Distribution – Cosmopolitan. N Atlantic and Mediterranean Sea, SW Atlantic, NW Pacific, E Pacific (Canada, USA, Mexico and Galápagos Islands). Along the Peruvian coast: yellow morphotype from Mancora (04°06' S – Piura Region), Pucusana (12°28' S – Lima Region) and Paracas (14°09' S – Ica Region); orange morphotype from Chimbote (09°11' S – Ancash Region), Isla Vieja, Bahia Independencia (14°16' S – Ica Region), San Juan de Marcona (15°22' S – Ica Region) and Ilo (17°39' S – Moquega Region).

Remarks – Eight valid *Hymeniacidon* species are known from the Eastern Pacific: *H*. ***actites*** and *H*. ***perlevis*** from California, *H*. ***adreissiformis*** from Lower California and Mexico, *H*. ***calva***, *H*. ***corticata***, *H*. ***fernandezi***, *H*. ***longistylus*** and *H*. ***rubiginosa*** from Southern Chile. The Peruvian specimens mostly match the descriptions of *H*. *fernandezi*, *H*. *perlevis* and *H*. *rubiginosa*, but differ from *H*. *fernandezi* and *H*. *rubiginosa* in the presence of subtylostyles, only described for *H*. *perlevis*. Since all three species have been suggested as synonyms on account of their wide morphological similarities in colour, growth form, skeleton arrangement, and spicule dimensions, we rather identify the Peruvian material as *H*. *perlevis*, which also happens to be the oldest name.

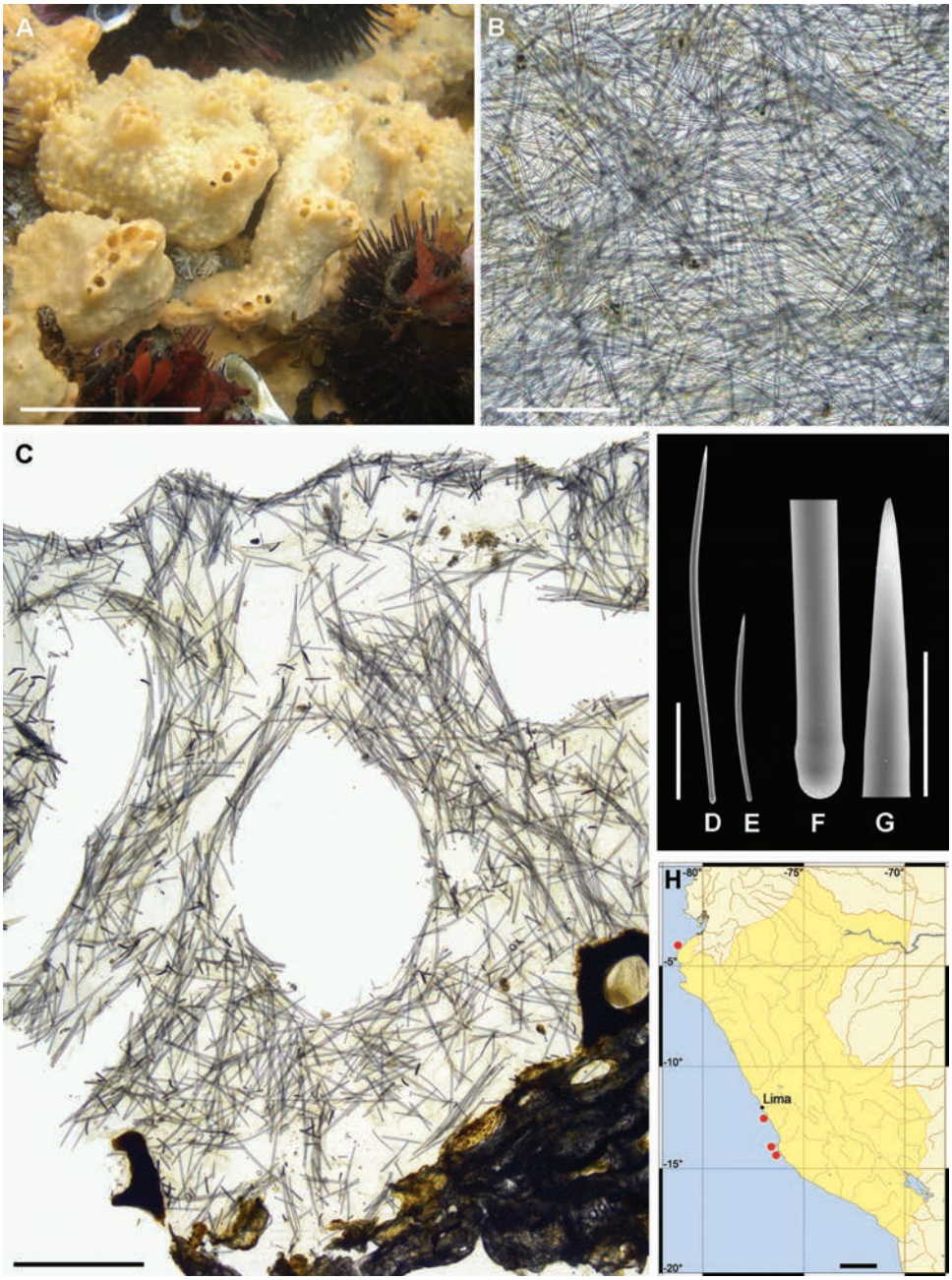


Fig. 115. *Hymeniacidon perlevis* (Montagu, 1814) (yellow morph). A, live specimen; B, skeleton architecture in tangential ground section; C, skeleton architecture in transversal ground section; D–E, oxeas; F–G, details of D; H, distribution map. Scale bars: A, 2 cm; B, 200 µm; C, 500 µm; D–E, 100 µm; F–G, 20 µm; H, 200 km.

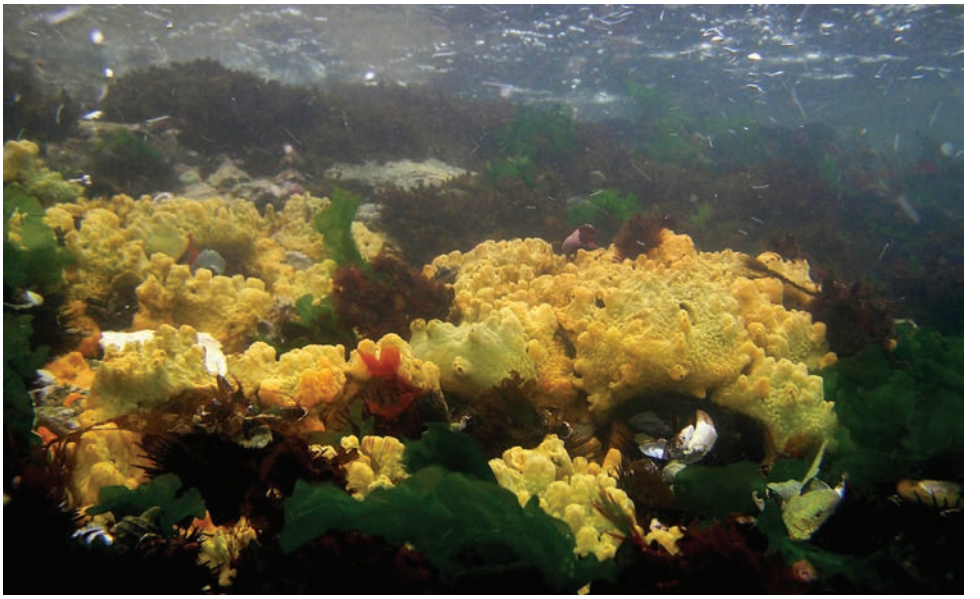


Fig. 116. *Hymeniacidon perlevis* (Montagu, 1814) (yellow morph). General view of specimens largely extending on the substrate at Pucusana.

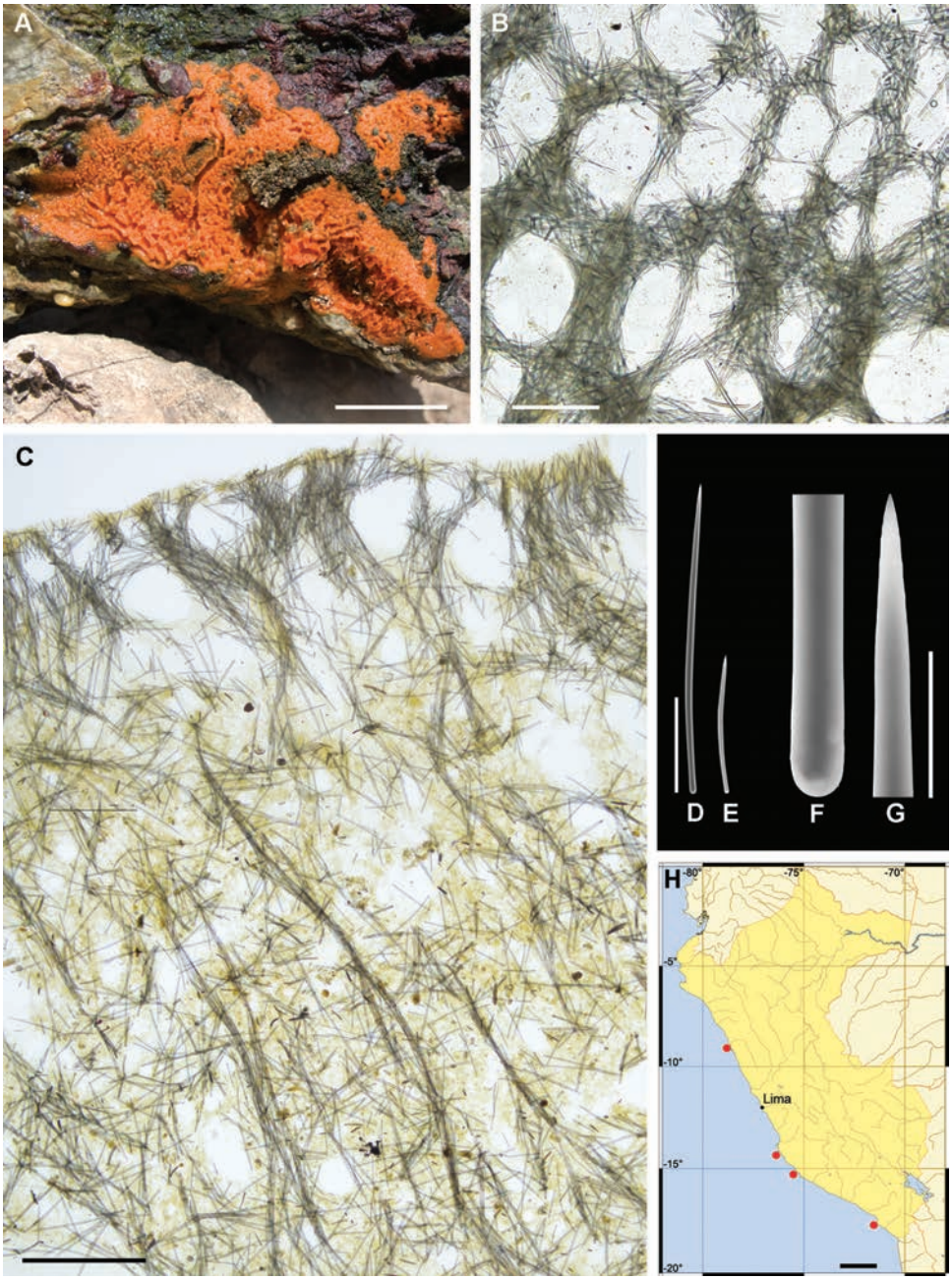


Fig. 117. *Hymeniacidon perlevis* (Montagu, 1814) (orange morph). A, live specimen; B, skeleton architecture in tangential ground section; C, skeleton architecture in transversal ground section; D–E, oxeas; F–G, details of D; H, distribution map. Scale bars: A, 2 cm; B, 200 µm; C, 500 µm; D–E, 100 µm; F–G, 20 µm; H, 200 km.

Johannesia reticulosa (Thiele, 1905)

REFERENCES: Thiele, 1905; Gerasimova, Erpenbeck & Plotkin, 2008.

Description – Massive sponge reaching patches more than 30 cm wide. Surface slightly rough and ridged. Compressible consistency. Oscula are circular (1.2 mm diameter) and randomly disposed on the surface. Differentiable and detachable ectosome. Colour in life orange turning to beige in ethanol.

Skeleton – Ectosomal, a dense, criss-crossed layer of subtylostyles forming loose brushes, slightly piercing the surface, and resting on the terminations of ascending choanosomal tracts of oxeas. The latter, much less dense, paucispicular to multispicular, irregular, loosely reticulated, overlaid by subtylostyles strewn in confusion. Large subectosomal lacunae apparent, surely rendering the ectosome easily detachable. Oxeas also seen in the ectosome, mostly laying tangentially, but in low numbers.

Spicules – Oxeas, from slightly bent or curved to markedly so, with acerate tips, 167–*494*–840 × 5.4–*13.1*–22.4. **Subtylostyles**, slightly curved, faintly pronounced heads, acerate tips, 129–*256*–465 × 4.2–*8.3*–13.1 µm

Ecology – Collected at 4–19 m depth, occurring in association to a multitude of organisms (anemonae, brachyopods, cirripeds, mytilids, schrimps and tube-worms). The largest specimen seen had tenant crabs living in galleries.

Distribution – From Isla Don Martin, Huacho (11°01' S – Lima Region) to Ilo (17°38' S – Moquega Region). Also known from northern Chile (Iquique, 20°11' S).

Remarks – The variation observed in the dimensions of spicules is remarkable. Peruvian specimens reported upon by Gerasimova *et al*. (2008) already pushed values observed in the type specimen considerably. Given this apparent variability, we judged our materials, despite the large variation in habit and micrometries, to all fit in this species. This is a likely endemic from the Humboldtian and Central-Peru Ecoregions.

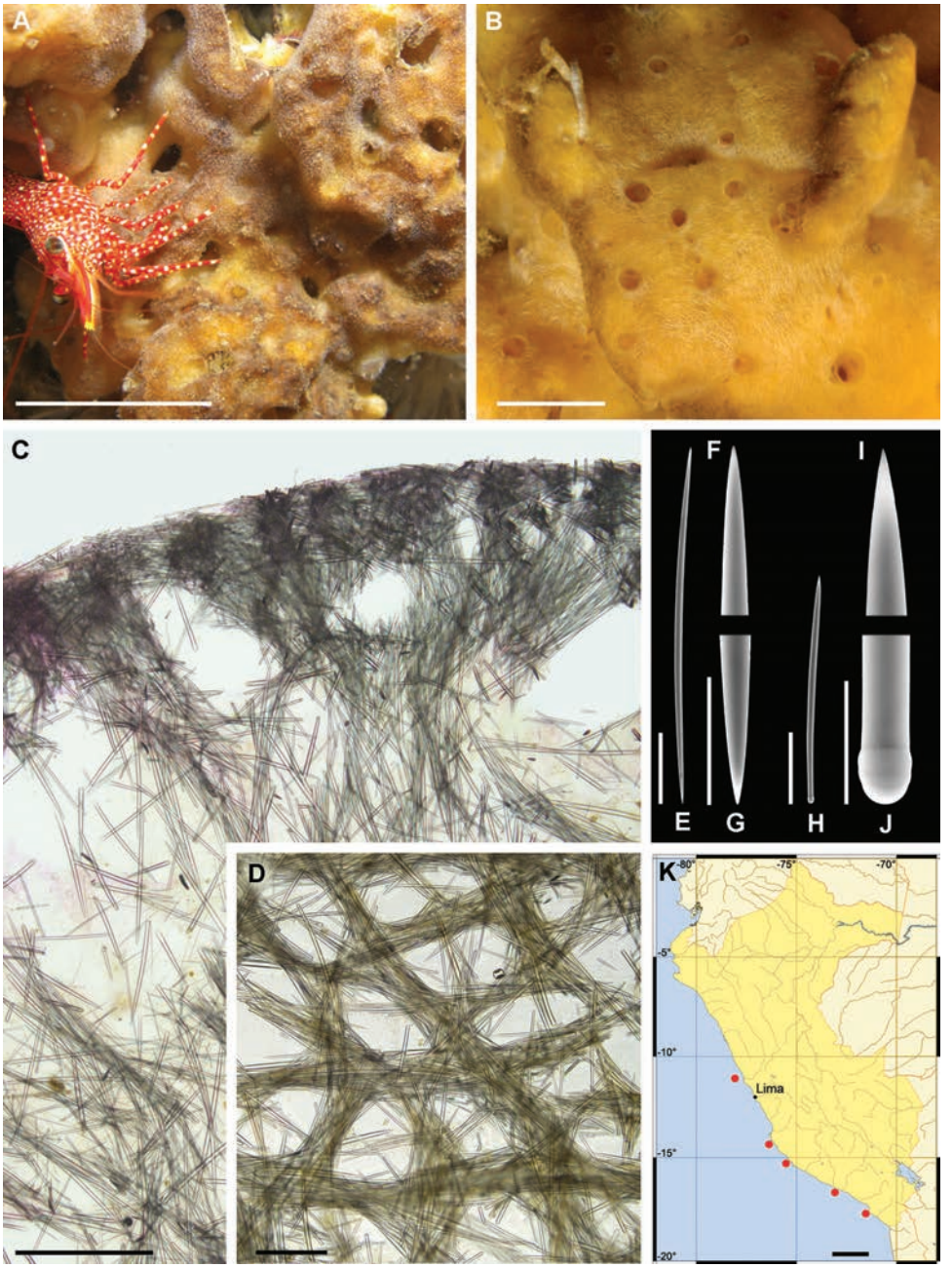


Fig. 118. *Johannesia reticulosa* (Thiele, 1905). A–B, live specimens; C, skeleton architecture in transverse ground section; D, skeleton architecture of the ectosome in tangential ground section; E, oxea; F–G, Details of E; H, tylostyle; I–J, details of H; K, distribution map. Scale bars: A, 5 cm; B, 1 cm; C, 500 µm; D, 200 µm; E, H, 100 µm; F–G, 50 µm; I–J, 20 µm; K, 200 km.

Ciocalypta magnastyla Arroyo, Hajdu, Willenz & Cóndor-Luján, 2020

REFERENCE: Arroyo, Hajdu, Willenz *et al*., 2020.

Description – Basal mass, partially covered with sediment, conical, slightly hispid, with fistular projections, with transparent, cavernous fistules 1.5–5.0 cm high, with a central axis. Oscula small, 1 mm diameter, apical on fistules. Compressible consistency. Colour in life greenish white, turning to beige with slightly orange fistules in ethanol.

Skeleton – Fistules: ectosome easily detachable, tangential to the surface, with dense skeleton of styles and few oxeas. Axial choanosomal skeleton thick (35–75 µm), central, formed by styles parallel to each other. Extra-axial tracts radiate from the central axis as numerous styles that extend towards the ectosome, supporting the latter. Subectosomal cavities present, diameter 500–1250 µm. Basal mass: ectosome easily detachable and similar to that of the fistules, choanosome a dense mass of spicules (styles and few oxeas) in ascending tracts running towards the ectosome, delimiting subectosomal cavities ranging from 150 to 250 µm.

Spicules – Styles, long and slim, slightly curved or straight, 520–*752*–1000 × 7.5–*18.1*–30.0 µm. **Oxeas**, long and slightly curved, 180–*285*–500 × 6.3– *8.9*–11.3 µm.

Ecology – Sediment was found on the surface of the sponge and among the fistules. Probably associated to soft bottom. Depth 10 m.

Distribution – Endemic to southern Peru and only known from San Juan de Marcona (15°21' S – Ica Region).

Remarks – Among 16 other species of *Ciocalypta* known from the Indo-Pacific Ocean, only two species, *C*. ***melichlora*** and *C*. ***rutila***, from Indonesia, exhibit skeletal compositions similar to *C*. *magnastyla*, presenting both styles and oxeas. Nonetheless, the oxeas of *C*. *melichlora* and *C*. *rutila* are larger (280–940 × 30–40 µm and 980 × 20 µm, respectively) than those of the Peruvian species.

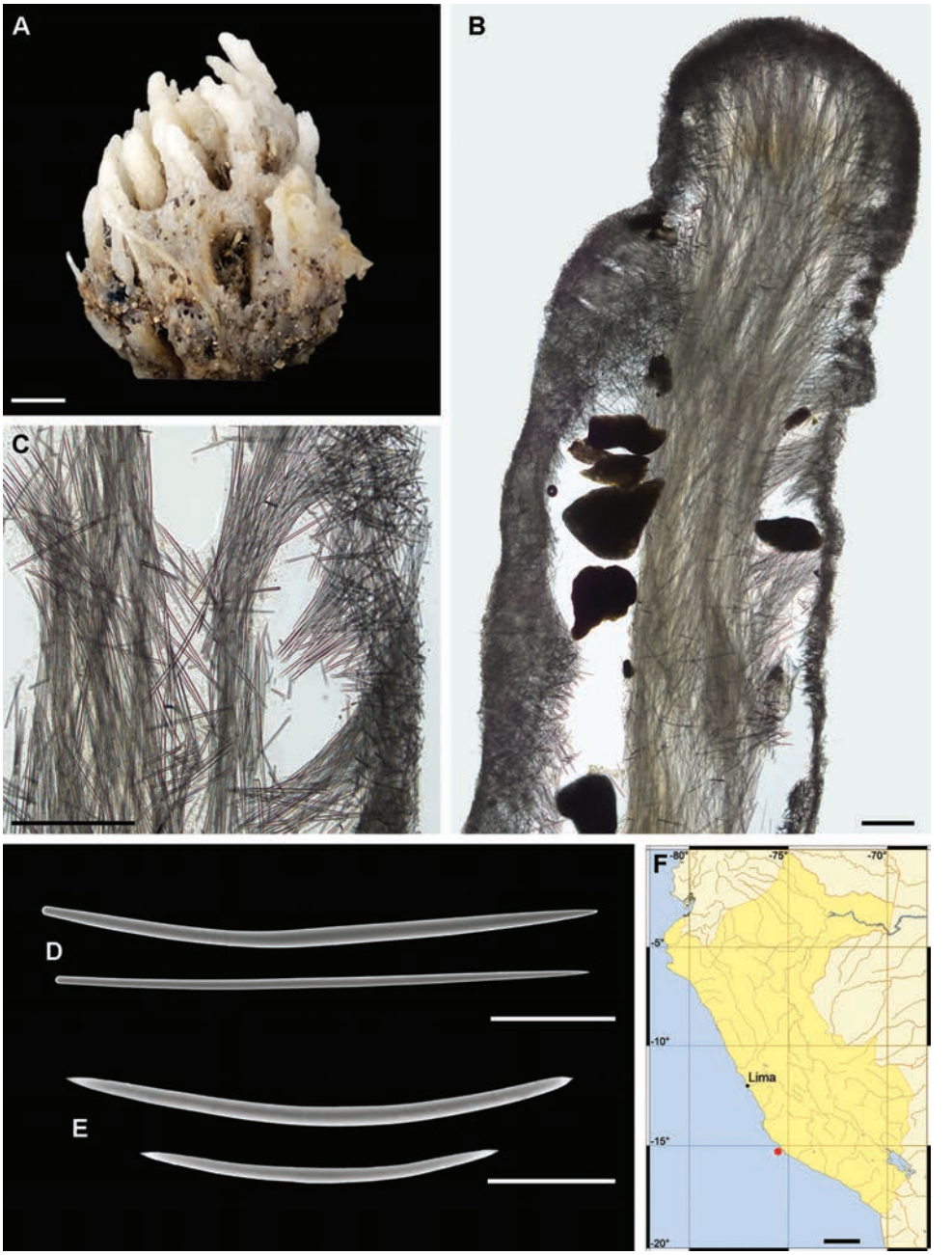


Fig. 119. *Ciocalypta magnastyla* Arroyo, Hajdu, Willenz & Cóndor-Luján, 2020. A, specimen after fixation; B, skeleton architecture of a fistule in transverse ground section with sand grains inclusions; C, axial and extra-axial skeleton of a fistule; D, styles; E, oxeas; F, distribution map. Scale bars: A, 1 cm; B–C, 500 µm; D, 200 µm; E, 50 µm; F, 200 km.

Protosuberites epiphytoides (Thiele, 1905)

REFERENCE: Thiele, 1905; de Laubenfels, 1932, 1935; van Soest, 2002.

Description – Specimens are thinly encrusting, occasionally slightly thicker when growing over irregular substrate, reaching over 30 cm in maximum diameter. Oscula are scattered, abundant, and less than 1 mm in diameter. Zooming in underwater images, surface transparency permits observation of longitudinal choanosomal lines, palisade-like near the growing edges of the sponge, and frequently splitting or anastomosing. Consistency fragile and colour in life light-lemon-yellow to orangey-yellow.

Skeleton – Ectosomal architecture made of brushes of mainly smaller tylostyles. Choanosomal, with basal and intermediary layers. Near the substrate, tylostyles, both large and small, can be erect, obliquely inserted, lay flat or parallel. The intermediate layer is essentially confused, not very dense, with large and small tylostyles scattered or arranged in short, irregular tracts, running longitudinally, albeit only seldom orthogonally, and seemingly offering support to the ectosomal brushes. Irregular canals and/or lacunae appear plentiful.

Spicules – Tylostyles, slightly curved, with roundish, subterminal tyles, nearly isodiametric shafts, tapering gradually to a sharp apex, smaller spicules much more common than larger ones, but no clear classes are apparent, 88–*150*–528 × 3–11 µm.

Ecology – Specimens were collected between 7 and 17 m depth, in close association to red algae, hydroids, molluscs and shrimps.

Distribution – From Parachique, Bahía Sechura (05°44' S – Piura Region), Matarani, Punta Hornillos and Isla Blanca (16°52' S and 17°00' S – Arequipa Region) to Ilo, Puerto Ingles and Mocho Tres Hermanos (17°30' S and 17°39' S – Moquega Region).

Remarks – There are 26 species recognized as valid in *Protosuberites*, only three of which reported from the Eastern Pacific, namely the Californian *P*. ***sisyrnus***, the Mexican *P*. ***mexicensis*** and the Chilean *P*. ***epiphytoides***. The latest appears the closest to the Peruvian one for the maximum dimensions of its tylostyles reaching only up to 450–500 µm, which are also of similar thickness, and the reported occurrence of a small cap over their heads, here interpreted as an indication that the tyle is subterminal instead. The Californian species was reported with megascleres that can be much stouter, and to bear a velvety aspect, consequence of its conspicuous hispidation, thus appearing more distantly related to the Peruvian specimens.

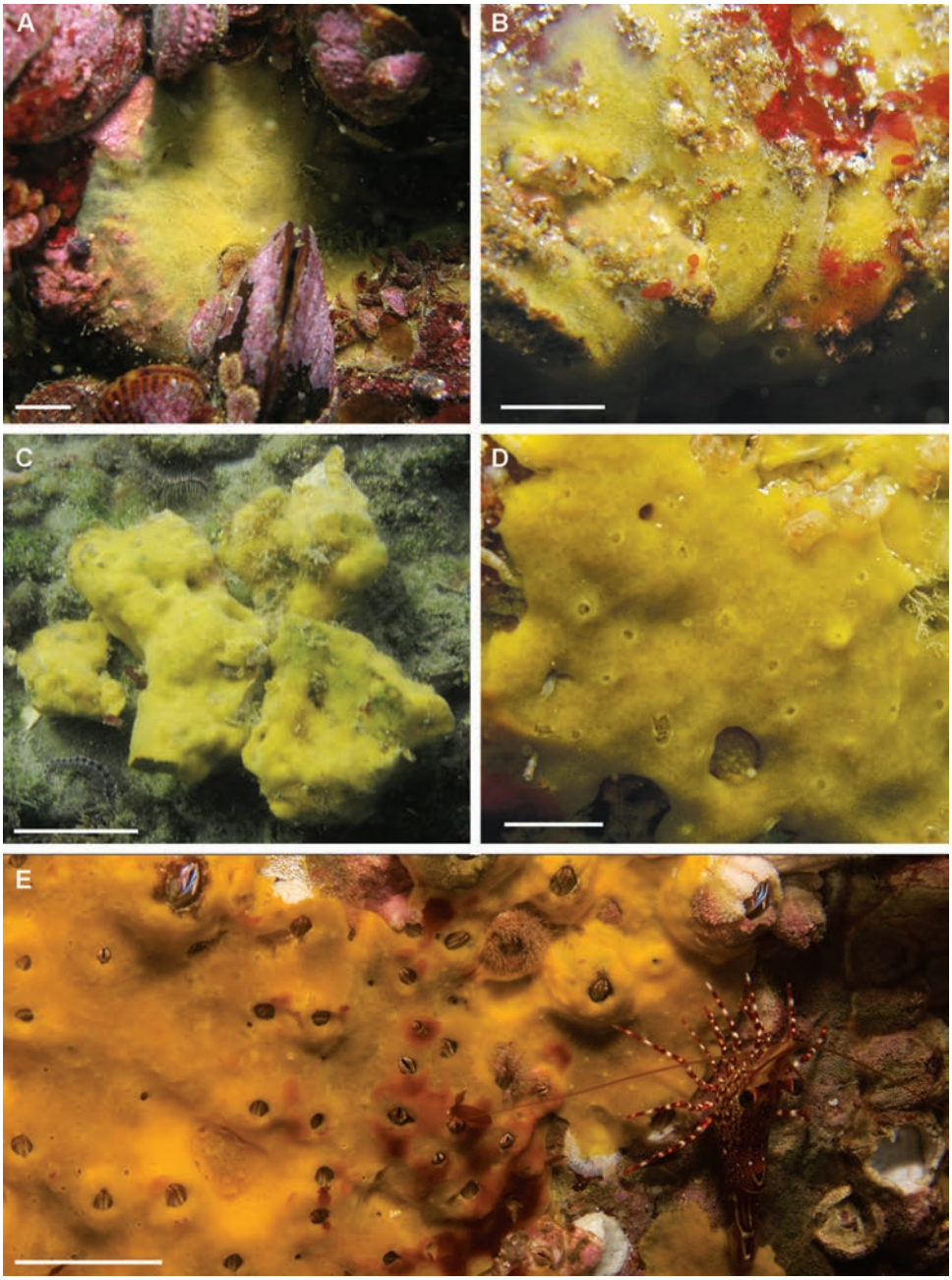


Fig. 120. *Protosuberites epiphytoides* (Thiele, 1905). Live specimens. Scale bars: A, B, D, 1 cm; C, E, 2 cm.

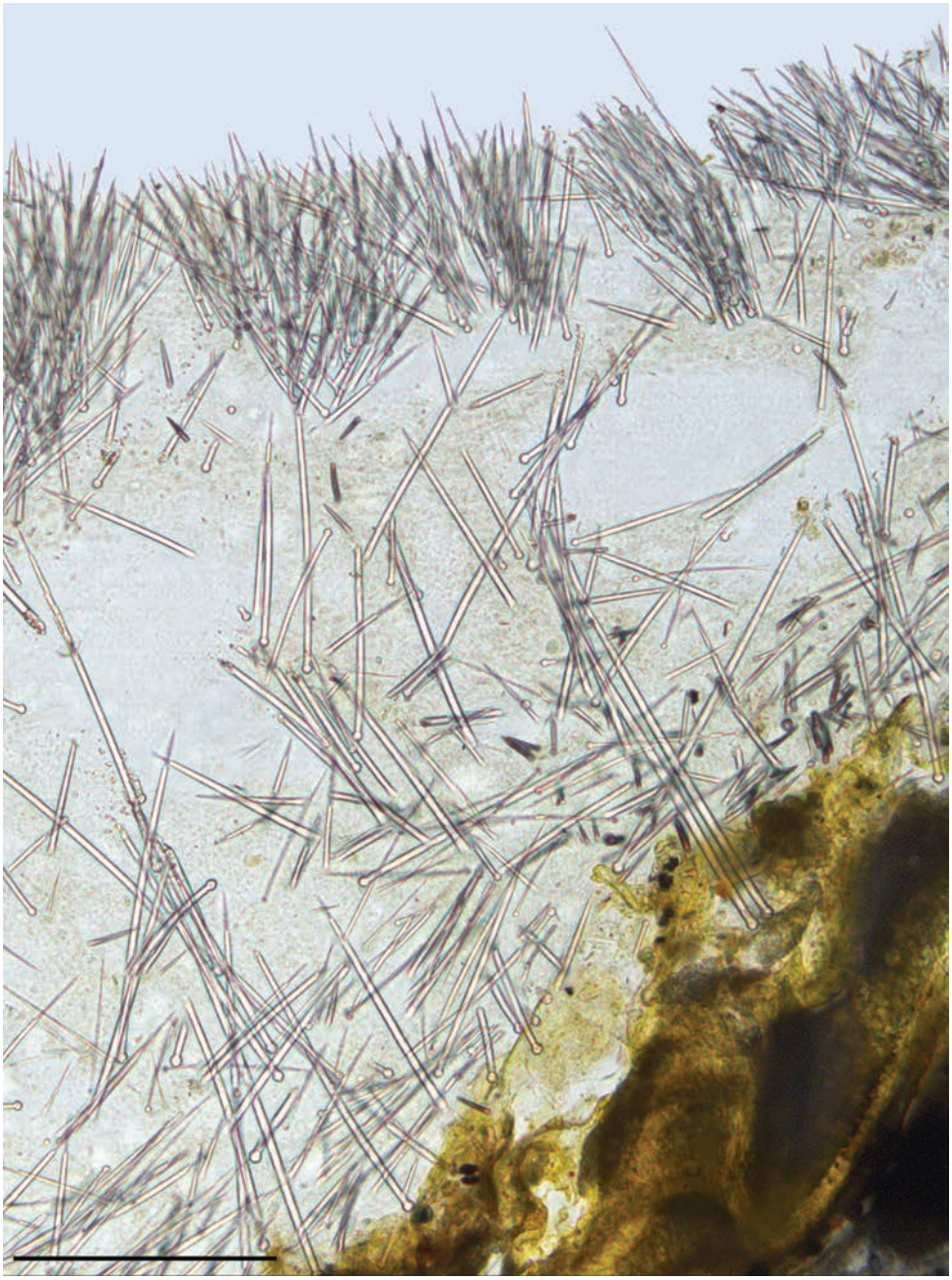


Fig. 121. *Protosuberites epiphytoides* (Thiele, 1905). Skeleton architecture in transverse ground section. Scale bar: 200 µm.

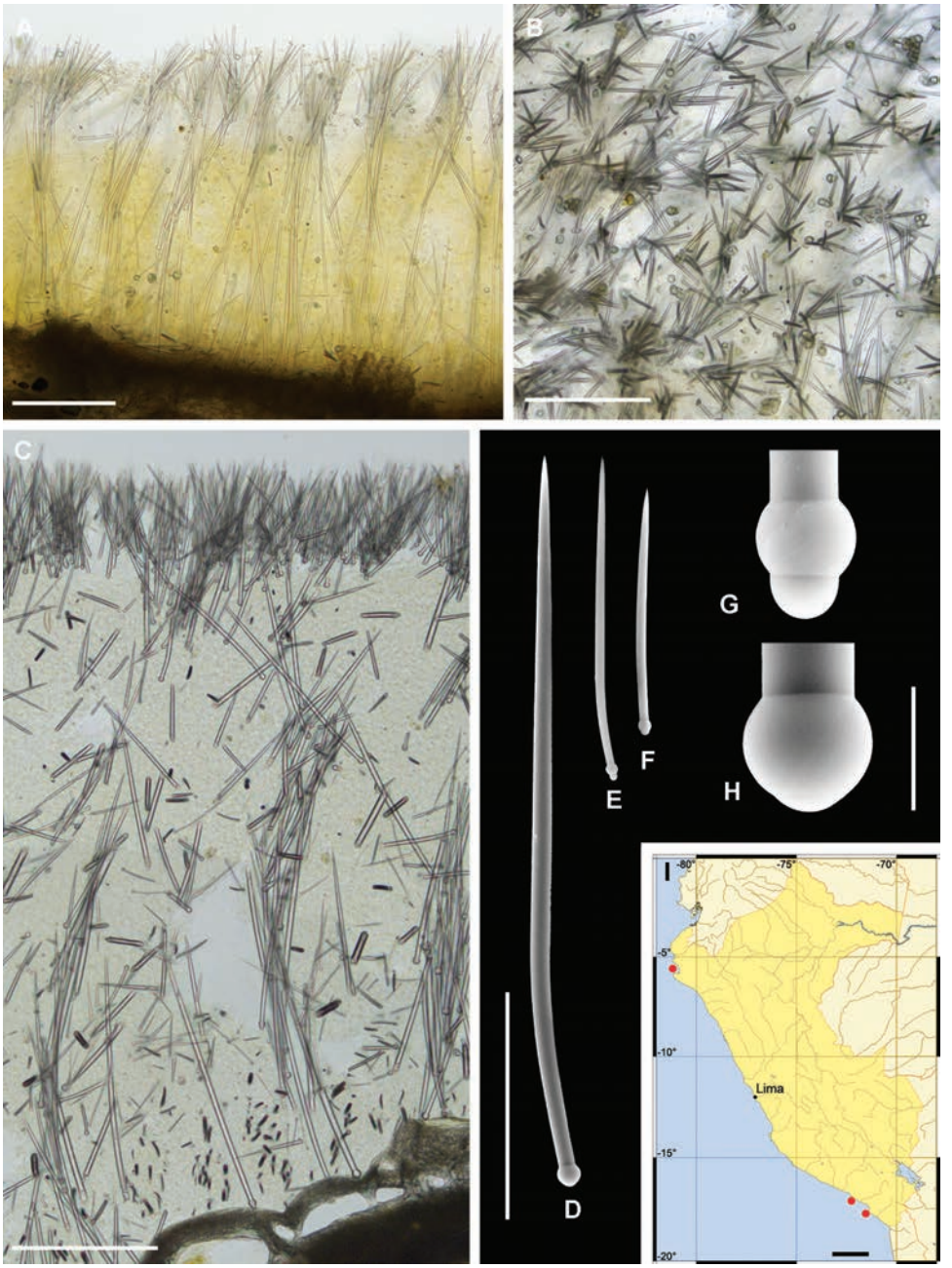


Fig. 122. *Protosuberites epiphytoides* (Thiele, 1905). A, C, skeleton architecture in transverse ground section; B, ectosomal architecture in tangential ground section; D–F, tylostyles; G–H, heads of tylostyles details; I, distribution map. Scale bars: A–C, 200 µm; D–F, 100 µm; G–H, 10 µm; I, 200 km.

Protosuberites sp.

REFERENCES: Thiele, 1905; de Laubenfels, 1932, 1935; van Soest, 2002.

Description – Thinly encrusting over biological substrates (limpets, bivalve, barnacles), about 1 mm thick. Oscula barely visible, up to 1 mm in diameter. Texture is smooth and consistency somewhat fragile. Colour in life bright orange to red, turning to beige in ethanol.

Skeleton – Ectosomal architecture made of brushes of mainly smaller tylostyles. Choanosomal, with basal and sometimes intermediary layers. Near the substrate, tylostyles, both large and small, can be erect, obliquely inserted, lay flat or parallel. The intermediate layer is essentially confused, not very dense, with large and small tylostyles scattered or arranged in short, irregular tracts, usually no bigger that 1–2 spicules long. Specimen MNRJ 11377 is so thin that the basal layer nearly reaches the ectosome. Irregular canals and/or lacunae can be seen.

Spicules – **Tylostyles**, slightly curved, with roundish, terminal tyles, nearly isodiametric shafts, tapering gradually to a sharp apex, smaller spicules rather more common than larger ones. Two classes are apparent after a study of size frequency distribution based on length alone: I, 123–*171*–261 × 6–*7.8*–11 µm; II, 281–*357*–527 × 6–*9.1*–12 µm.

Ecology – In addition to the substrate, specimens can be partly epibiontic over gastropods, cirripeds and polychaete tubes, between 9 and 10 m depth.

Distribution – Several specimens found at Islote El Lagarto and Bajo El Chile, Islas Lobos de Afuera (06°55' S – Lambayeque Region).

Remarks – As remarked upon for *Protosuberites epiphytoides*, only three species in the genus had been reported from the Eastern Pacific until now. None was reported with two categories of tylostyles, but given the brief original descriptions, lack of any revisions, and relatively to rather large variation in the reported length of tylostyles, one cannot discard the possibility that they do occur. The Californian and the Mexican species are considered more distantly related to *Protosuberites* sp. for the same reasons listed above. The present species comes also quite close to *P. epiphytoides*, but since subterminal tyles appear much less frequently here, we prefer to leave the southern Peruvian specimens tentatively identified as *P. epiphytoides*, while those from Islas Lobos de Afuera (NE Peru), as a second, yet unidentified, perhaps new species. Live colour is only known from Peruvian materials, so this character is also of little help in distinguishing among all the species concerned, but it reinforces the argument that there are two species in the Peruvian seas, irrespective of the similar overall aspect of their spicules.

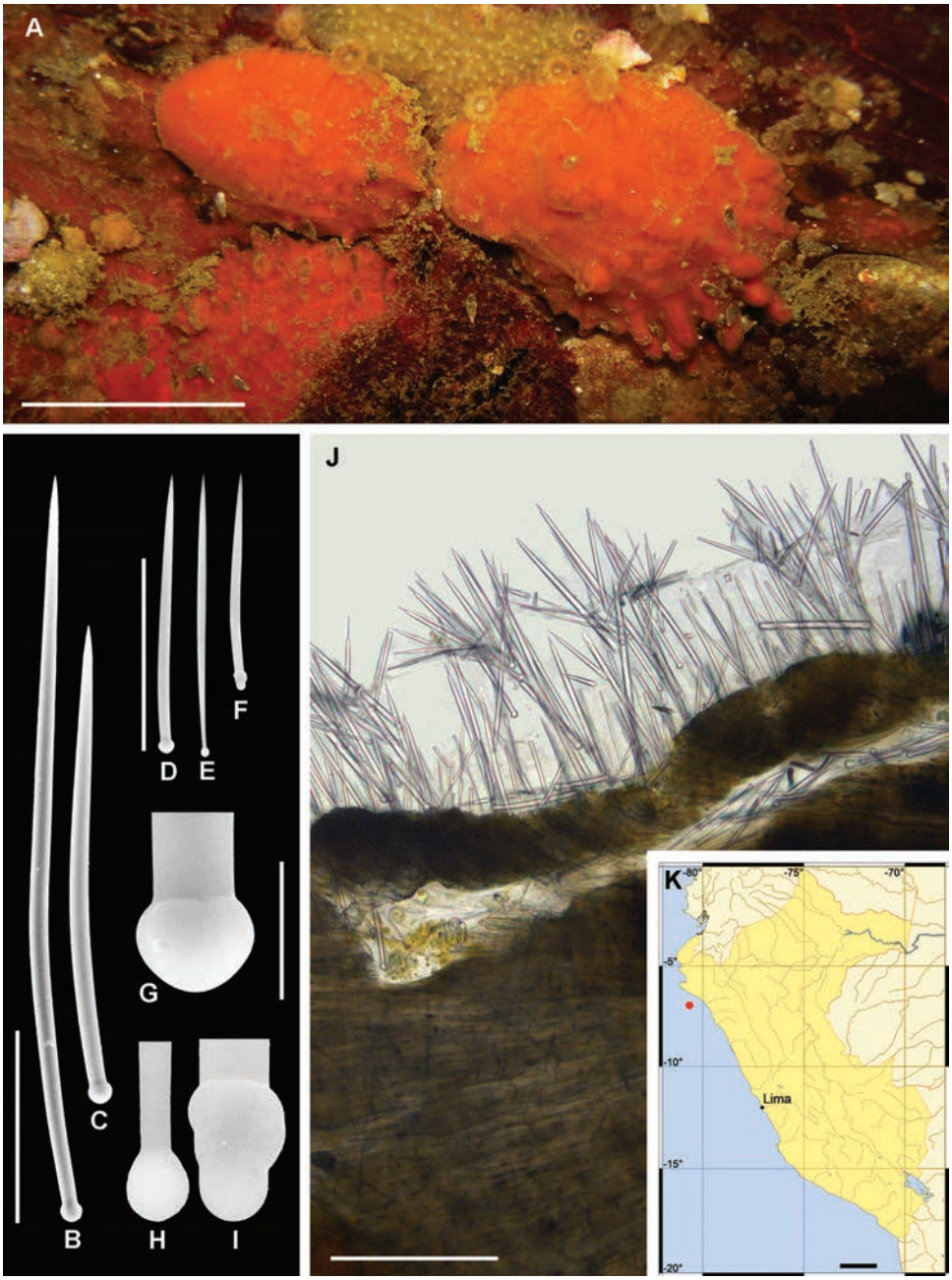


Fig. 123. *Protosuberites* sp. A, live specimen; B–F, tylostyles; G–I, details of tylostyles heads; J, skeleton architecture in transverse ground section; K, distribution map. Scale bars: A, 1 cm; B–F, 100 µm; G–I, 10 µm; J, 200 µm; K, 200 km.

Plicatellopsis expansa (Thiele, 1905)

REFERENCE: Thiele, 1905.

Description – Massive with rounded to elongated lobes that can form branches (resembling hand gloves). The largest specimen collected is 88 × 61 mm, 48 mm high). Small oscula (≤ 2 mm) scattered or arranged in rows on the surface, some on top or sides of the branches. Smooth surface, sometimes velvety. Soft texture and consistency compressible. Life colour is bright to dark yellow alive turning dirty white or light beige to beige in ethanol. Some specimens were partially covered by a thin film of red macroalgae which gave them an apparent orange coloration.

Skeleton – Ectosomal skeleton, a palisade of small subtylostyles, which can give the surface a velvety appearance or not, depending on the density of spicules. Extra-axial skeleton, bundles of larger subtylostyles. Axial skeleton, composed of tracts of large subtylostyles loosely arranged. Abundant spongin.

Spicules – Subtylostyles of two categories. **Subtylostyles** I, large, choanosomal, slender, almost straight and few slightly curved, with sharp apex, 445–*604*–760 µm × 6.0–*9.4*–12.0 µm. **Subtylostyles II**, small, ectosomal, slender, straight or slightly bent, with sharp apex, 175–*326*–452 µm × 3.0–*5.4*–7.0 µm. Tyles are weakly pronounced.

Ecology – This species occurs on rocky substrates, mostly found in light protected habitats such as crevices or roofs or growing on vertical walls. It was found associated with red macroalgae, bryozoans, cnidarian polyps, sea anemones (*Anthotoe chilensis*), echinoids (*Arbacia spatuligera*), brachiopods (*Discinisca lamellosa*), hermit crabs and nudibranchs (eggs and adults of *Okenia lunia*, *Phidiana lottini*, *Flabellina* cf. *cerverai*). Some small crustaceans were observed near or inside the oscula of a specimen. From 10 to 45 m depth.

Distribution – North of Chile (Iquique and South of Peru, from Pucusana (12°28' S – Lima Region) to Isla Blanca, Matarani (17°00' S – Arequipa Region).

Remarks – Specimens from Peru mostly match the original description of *P*. *expansa* from Iquique (Chile, 30 m depth) in skeleton organization and composition, and spicule dimensions.

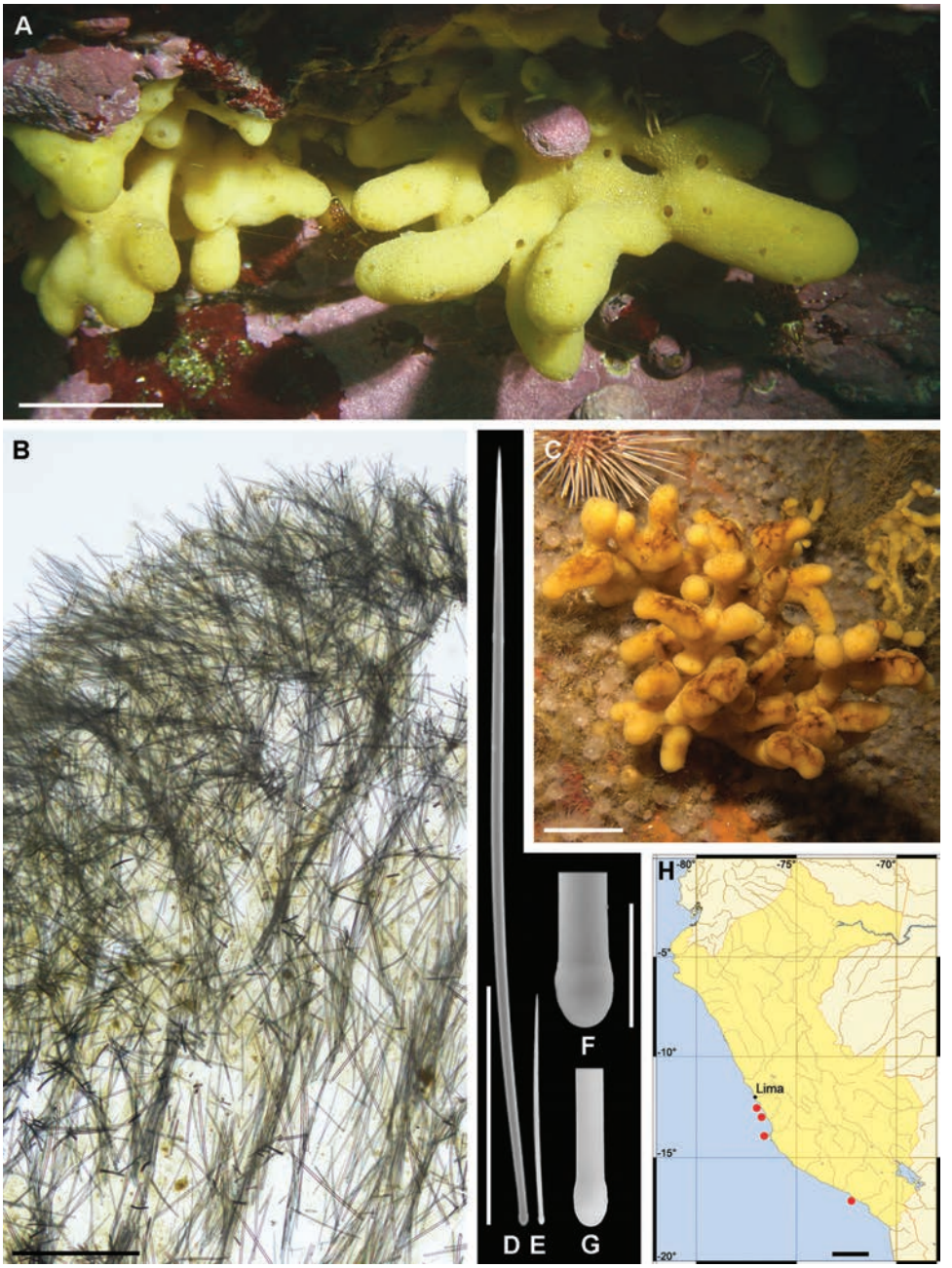


Fig. 124. *Plicatellopsis expansa* (Thiele, 1905). A, C, live specimen; B, skeleton architecture in transverse ground section; D, subtylostyles I; E, subtylostyles II; F–G, Details of D–E respectively; H, distribution map. Scale bars: A, 2 cm; B, 500 µm; C, 2 cm; D–E, 200 µm; F–G, 20 µm; H, 200 km.

Suberites inti Cóndor-Luján, Arteaga, Polo, Arroyo, Willenz & Hajdu, 2023

REFERENCE: Nardo, 1833; Cóndor-Luján, Arteaga, Polo *et al*., 2023.

Description – Massive to nearly hemispheric *Suberites* (2 × 6 cm). Oscula small and grouped, slightly elevated (2 to 3 mm). A few tiny projections, conule-like, corresponding to contracted short oscular chimneys. Surface smooth and velvety. Consistency compressible. Colour in life light orange-yellowish turning to dirty white in ethanol.

Skeleton – Ectosomal skeleton, a dense field of bouquets composed of small tylostyles Choanosomal skeleton, loose multispicular tracts of tylostyles, further obscured by many spicules strewn in confusion

Spicules – Megascleres. **Tylostyles I,** large, choanosomal, straight, with sharp, acerate apices, 423–*516*–661 × 8.0–*10.8*–13.0 µm. **Tylostyles II**, small, ectosomal, straight with sharp acerate apex, 235–*322*–457 × 5.0–*7.7*–11.0 µm. Tyles are pronounced and can be subterminal (**subtylostyles**). Category I, 10.5–16.7 µm; category II, 9.3–13.4 µm.

Ecology – This species was attached to rocky substrate, and it was found associated with ophiuroids, crabs, bryozoans, and red algae. Depth 18 m.

Distribution – Provisionally endemic to the south coast of Peru. Isla San Gallán (13°50' S – Ica Region).

Remarks – Despite similarities in skeletal composition (tylostyles), there are notorious differences among the three species of *Suberites* recorded from the Eastern Pacific, *S*. ***cranium*** from southern Chile, *S*. ***lambei*** from the Temperate Northeast Pacific, *S*. ***latus*** from the Temperate and Boreal Northeast Pacific (but see *S*. aff. *latus* below). *Suberites inti* can be distinguished by its hemispherical shape, the presence of bouquets on the ectosome and multispicular tracts on the choanosome and the dimensions of its two categories of straight tylostyles.

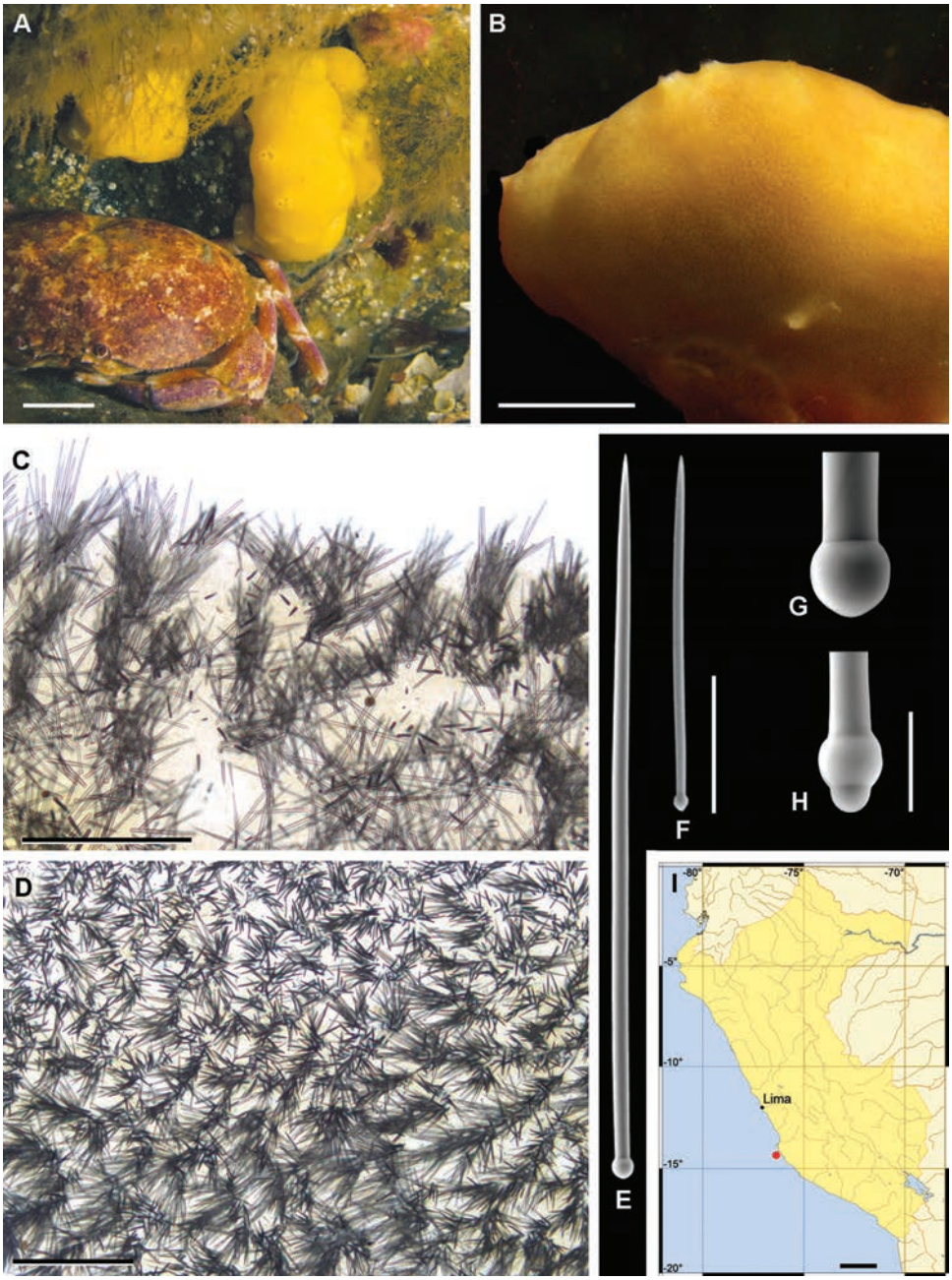


Fig. 125. *Suberites inti* Cóndor-Luján, Arteaga, Polo, Arroyo, Willenz & Hajdu, 2023. A–B, live specimen; C, skeleton architecture in transverse ground section; D, ectosomal skeleton in tangential ground section; E–F, tylostyles; G–H, details of E–F; I, distribution map. Scale bars: A, 2 cm; B, 1 cm; C–D, 500 µm; E–F, 100 µm; G–H, 20 µm; I, 200 km.

Suberites aff. *latus* Lambe, 1893

REFERENCES: Lambe, 1893; Lee, Elvin & Reiswig 2007; Austin, Ott, Reiswig *et al*., 2014.

Description – Thin encrusting to massive, with rather small lobes. The largest specimen is 88 × 41 × 59 mm. Notorious and small oscula (≤ 3 mm), scattered on the surface or situated on top of the lobes. Slightly compressible texture and somewhat hispid surface, but soft to the touch. Colour in life orange, fading into light brown, light beige, light grey or dirty white in ethanol.

Skeleton – Ectosomal skeleton, a dense layer of small and large tylostyles arranged in tufts. Choanosomal skeleton, ascending multispicular tracts of large tylostyles which form an erratic path, leaving poligonal meshes behind.

Spicules – Megascleres. **Tylostyles I**: large, ectosomal and choanosomal, slightly bent and with sharp apex (150–*226*–310 × 2–*5.8*–10 µm). **Tylostyles II**: small, ectosomal, mostly curved and with sharp apex (70–*119*–203 × 2–*3*–8 µm). All tylostyles are thickest in the center and bear well marked tyles (category I: 5–10 µm; category II: 3.8–7.5 µm). **Microscleres**. **Centrotylote strongyles** (mostly) or **oxeas** (seldom): ectosomal and spinned, common, rare, or absent (17–*31*–50 µm).

Ecology – This species was found attached to hard substrates. Specimens were close to red algae, anemones (*Anthotoe chilensis*), mytillids and decapods or growing on barnacles and subject to strong currents, or in association with small crabs and amphipods. From intertidal to 13 m depth.

Distribution – NE Pacific: British Columbia, Alaska, California, Oregon and Washington. SE Pacific: Isla Foca (05°12' S – Piura Region), Islas San Lorenzo and Pachacamac (12°05' S and 12°18' S – Lima Region), Pucusana (12°28' S – Lima Region) and Paracas (13°49' S – Ica Region).

Remarks – The Peruvian specimens match previous records of *Suberites latus* including the choanosomal skeleton arrangement, which is slightly to strongly reticulated, and the presence or absence of microscleres. Its wide but disjunct distribution in the East Pacific with unknown intermediate localities should receive attention in future studies.

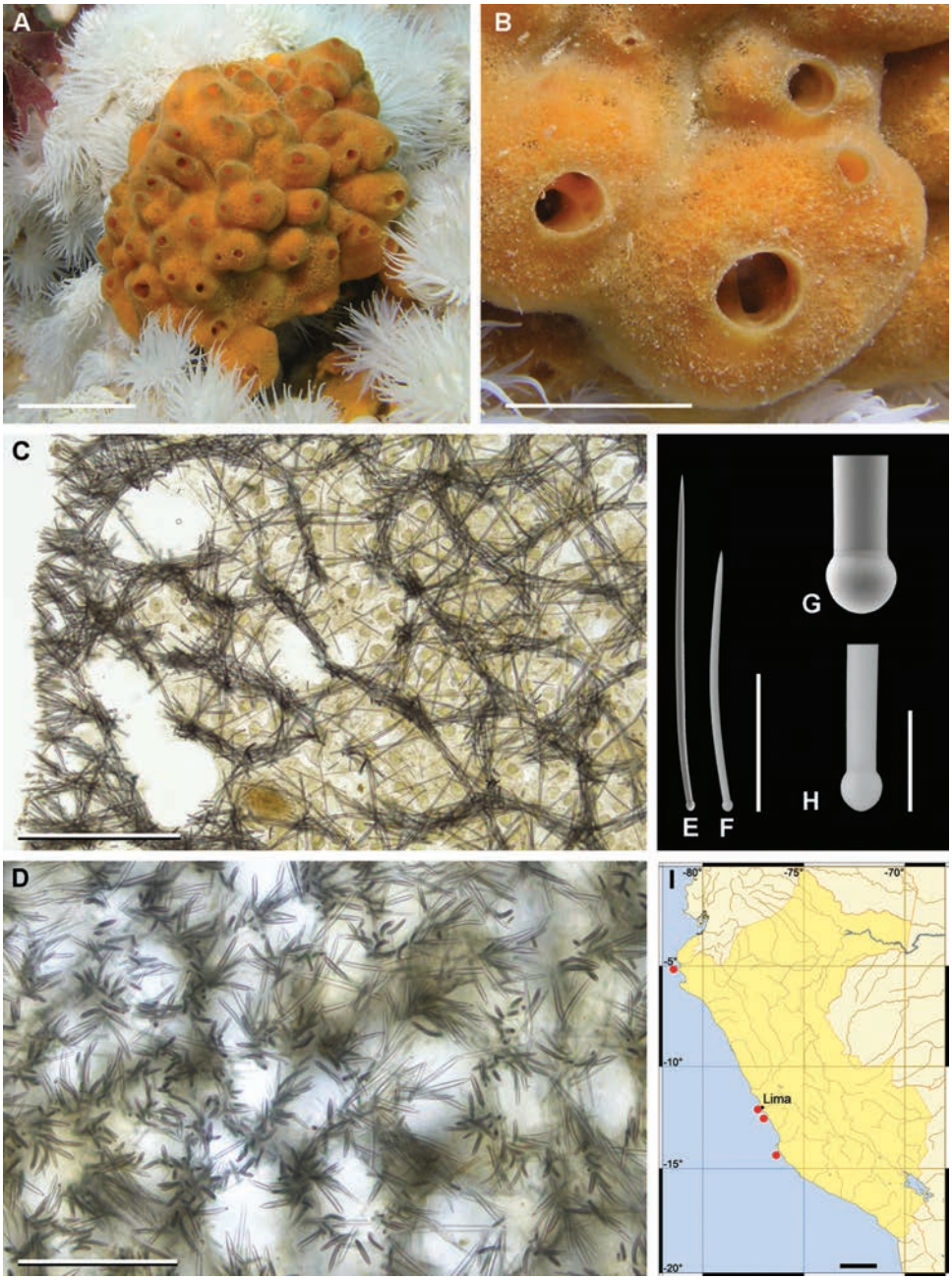


Fig. 126. *Suberites* aff. *latus* Lambe, 1893. A–B, live specimen; C, skeleton architecture in transverse ground section; D, ectosomal skeleton in tangential ground section; E–F, tylostyles; G–H, details of E–F; I, distribution map. Scale bars: A, 2 cm; B, 1 cm; C–D, 500 µm; E–F, 100 µm; G–H, 20 µm; I, 200 km.

Fig. 127. *Suberites* aff. *latus* Lambe, 1893. Skeleton architecture in transverse ground section. Ectosomal tylostyles arranged in tufts. Choanosomal tylostyles aligned in ascending multispicular tracts. Scale bar: 200 µm.

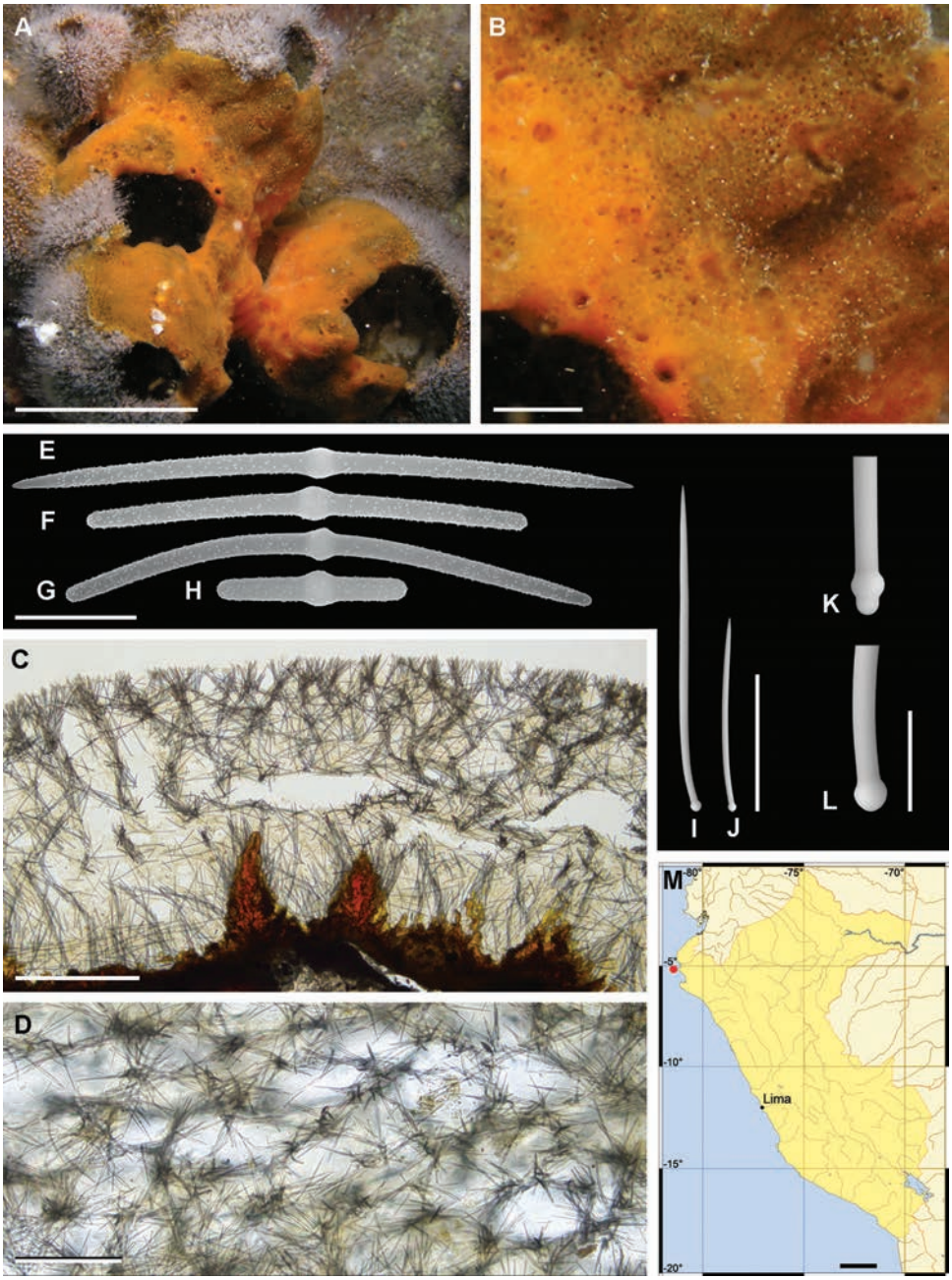


Fig. 128. *Suberites* aff. *latus* Lambe, 1893. A–B, live specimen; C, skeleton architecture in transverse ground section; D, ectosomal skeleton in tangential ground section; E–H, centrotylote strongyles (mostly) or oxeas (seldom); I–J, tylostyles; K–L, details of I and J; M, distribution map. Scale bars: A, approx. 5 cm; B, 1 cm; C, 500 µm; D, 200 µm; E–H, 10 µm; I–J, 100 µm; K–L, 20 µm; M, 200 km.

Terpios cf. *granulosus* Bergquist, 1967

REFERENCES: Bergquist, 1967; Vacelet & Vasseur, 1971; Calcinai, Belfiore, Pica *et al*., 2020.

Description – Thinly encrusting, usually less than 1 mm thick, and only up to 10 cm in maximum diameter. Fragile. Small oscula (≤ 2 mm) scattered on the surface, some on the top or sides of short elevations. Microhispid. Live colour a deep-blue (cobalt hue if subject to strong light), with green shades. Specimens retain their blue colour in ethanol.

Skeleton – There is not much of a distinction between ectosomal and choanosomal skeletons, as tylostyle tufts erect on the substrate, mostly fan out and pierce the surface up to 300 µm. Occasionally, columns (ca. 50 µm across) one spicule long can bridge the distance between substrate and the (sub)ectosomal tufts. Some tylostyles can also be seen laying parallel to the substrate. Subsurface canals or lacunae (100–300 µm in diameter) abound.

Spicules – Tylostyles, straight or slightly curved, smooth, sharp apex, with lobate, often irregular head, 101–*252*–414 × 2.4–*4.9*–8.6 µm.

Ecology – Specimens can be epibiont on gastropods, or grow directly over granitic rock. Common associates were brachiopods, zoanthids, and other sponges. Found from 1 to 2 m.

Distribution – Found at Cancas, Roca la Chavelera (03°55' S – Tumbes Region), Islas Lobos de Afuera (06°55' S – Lambayeque Region) and Isla Don Martin, Huacho (11°01' S – Lima Province).

Remarks – Thirteen species are currently recognized as valid in *Terpios*, four of which originally reported from the Pacific, but none from its eastern rim. Blueish/greenish species occur in the Pacific (*T*. ***granulosus***, *T*. ***quiza***) as well as in the Atlantic (*T*. ***fugax***, *T*. ***manglaris***). Overall, tylostyles of Atlantic species seem to attain larger dimensions, with spicules reaching over 400 µm, while both Pacific species reach at most 350 µm. Peruvian specimens can have tylostyles > 400 µm too, and suggest a revision of these species is needed. For now, the Pacific species coming closest to present materials is *T*. *granulosus*, so the name *T*. cf. *granulosus* was chosen here, on the basis of the unlikelihood of amphi-American distributions of sponges.

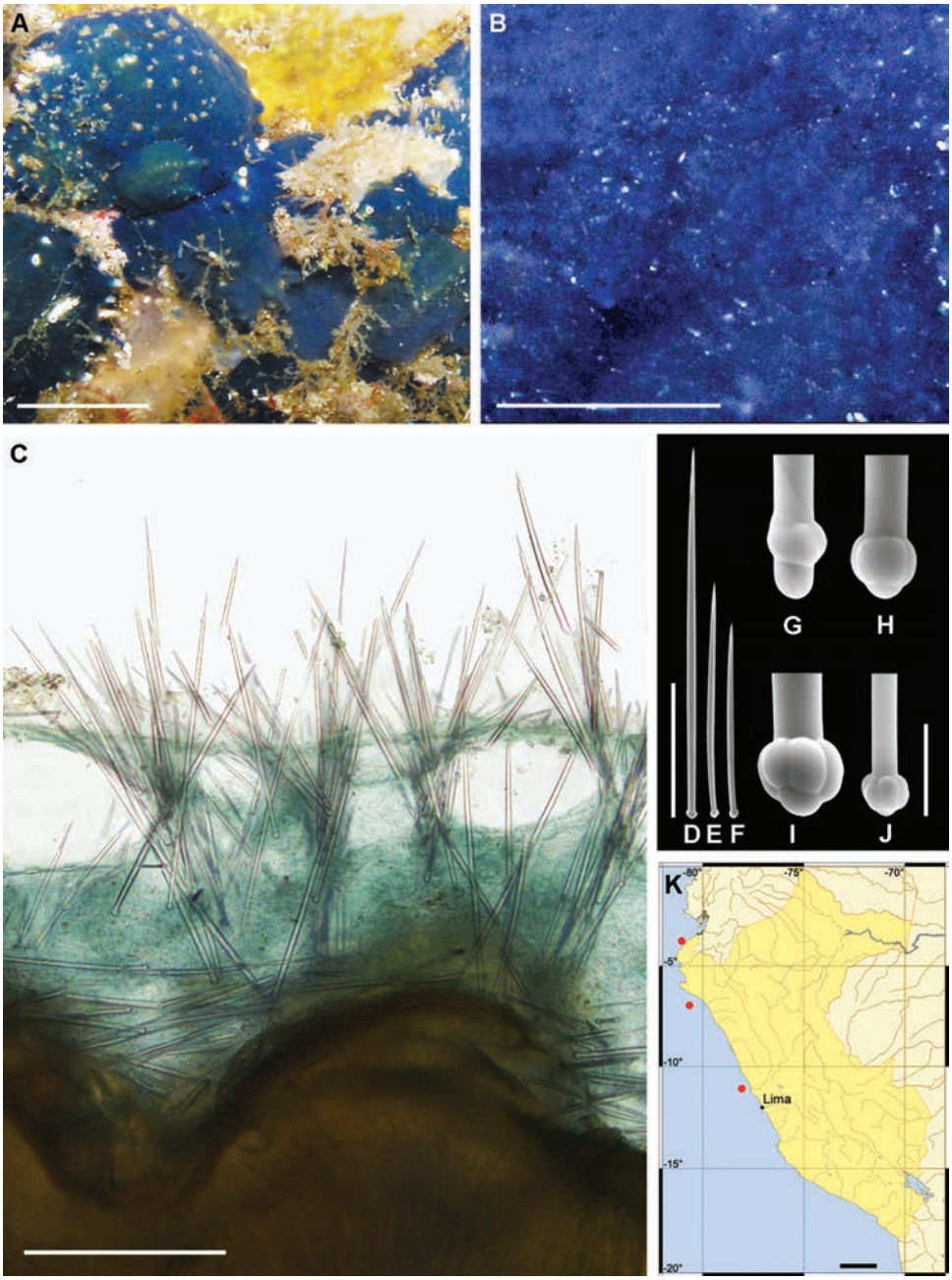


Fig. 129. *Terpios* cf. *granulosus* Bergquist, 1967. A–B, live specimen; C, skeleton architecture in transverse ground section; D–F, tylostyles; G–J, details of tylostyles heads; K, distribution map. Scale bars: A, 2 cm; B, 1 cm; C, 500 µm; D, 100 µm; G–J, 10 µm; K, 200 km.

7. Glossary

This section is not an exhaustive thesaurus and is restricted to terms used in this guide, arranged in alphabetical order. Adapted from Boury-Esnault and Rützler (1997).

For a complete catalogue of sponge spicules illustrated in SEM with updated terms currently used in sponge descriptions, see Łukowiak *et al*. (2022).

Acantho- Prefix meaning spined, as in acanthostyle or acanthotylote.

Acanthostyle  Spined style (e.g. *Acarnus* aff. *peruanus*, *Eurypon lacertus*).

Acanthorhabd Spined rhabd (e.g. *Scleritoderma* spp.).

Actine (Calcarea) Centred ray containing an axis or axial canal. See clad.

Ala One of the thin, usually wing-like or spatulate structures in each recurved portion of a chela. The anterior tooth is the one facing the shaft; other ones are lateral alae. See chela.

Anastomosing skeleton  Tracts, lines, or fibres are interconnected.

Anatriaene  Triaene in which the clads are bent towards the rhabdome (e.g. *Stelletta* spp.).

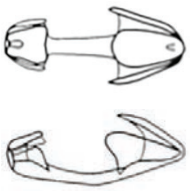
Anchorate chela

Isochela with three or more free alae (at each end) in the form of recurved processes shaped like anchor claws or anchor blades, with two incipient lateral alae fused with the shaft over their entire length and a gently curved, not abruptly arched shaft. An anchorate chela with three teeth is called a tridentate chela (e.g. *Plocamiancora* spp.).

Aniso-

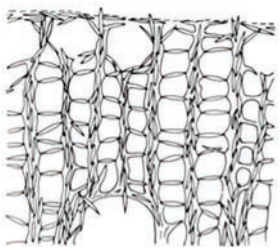
Prefix meaning unequal; generally referring to the ends of a spicule.

Anisochela



Chela with unequal ends (e.g. *Mycale* sp.).

Anisotropic skeleton



Reticulate skeleton with primary and secondary tracts, lines or fibres [e.g. *Amphimedon* spp., *Haliclona* (*Rhizoniera*) spp.].

Anisoxea

Oxea with unequal ends (e.g. *Eurypon lacertus*).

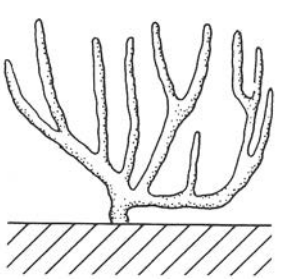
Apical actine (Calcarea)

The fourth actine of a tetractine, which is joined to the basal triradiate system.

Apopyle

Opening of a choanocyte chamber into an exhalant canal.

Arborescent

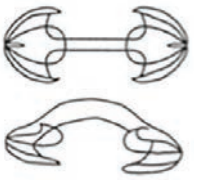


Habit: erect, branching, tree-like in appearance (e.g. *Aplysina chiriquiensis*).

Archaeocyte

Amoeboid cell with large nucleolated nucleus and capable of phagocytosis. May differentiate into other types of cells (Figs 8A & 15E).

Arcuate chela



Isochela with three alae free on a part of their length and a shaft characteristically curved outward, often bow-shaped (e.g. *Lissodendoryx* cf. *carolinensis*).

Articulate skeleton (Calcarea)

Choanoskeleton composed of several rows of similar spicules (e.g. *Grantia*).

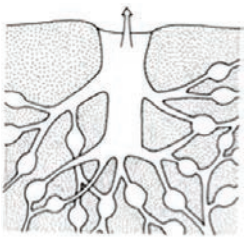
Asconoid (Calcarea)

Aquiferous system in which the internal cavity of the sponge is entirely lined by choanocytes (e.g. *Clathrina* spp. Schema from Cavalcanti & Klautau, 2011).

Atrial spicule / skeleton (Calcarea)

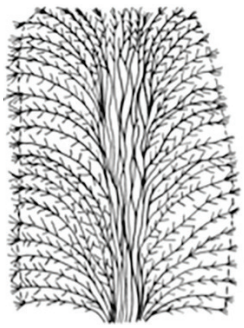
Spicules surrounding the atrium (e.g. *Grantia* spp.).

Atrium



Preoscular cavity. This term is used specifically to designate the central exhalant cavity.

Axial skeleton



Skeletal organization in which some components are condensed to form a central region or axis (e.g. *Ciocalypta magnastyla*).

Bacteriocyte Cell containing prokaryotic microsymbionts (Fig. 8D).

Basement membrane Thin, pliable sheet-like type of extracellular matrix, that provides cell support (Homoscleromorpha sponges).

Basopinacocyte Pinacocyte affixing the sponge to the substratum by external secretion of a collagenous matrix (Fig. 5C).

Bouquet

Ectosomal brush of spicules perpendicular to the surface of the sponge, usually with pointed ends outward (e.g. *Stelletta* spp.).

Branching Habit: spreading out in branches.

Calcareous spicule (Calcarea) Spicule composed largely of calcite having a radiate form, the number of rays being either two (diactine), three (triactine), four (tetractine), or rarely five (pentactine).

Central cell Single cell located at the apopyle of choanocyte chambers (Figs 7F–7G).

Chela Microsclere with a curved shaft and recurved alae at each end. See isochela and anisochela.

Chiaster See strongylaster.

Choanocyte Cell bearing a flagellum surrounded by a collar of cytoplasmic microvilli linked by bridges of glycocalyx (see Figs 6–7).

Choanoderm Surface lined by choanocytes.

Choanosome The internal region of a sponge, including the choanocyte chambers.

Choanosomal skeleton Skeleton of the main body, supporting the canal system and responsible for the form of the sponge.

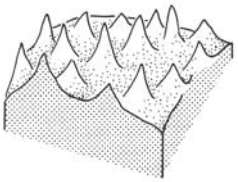
Clad  Any ray or axial branch containing an axis or axial canal; term chiefly used in triaene spicules.

Cladome  Clads of a triaene or triaene-derivative spicule.

Compressible Consistency: easily squeezed.

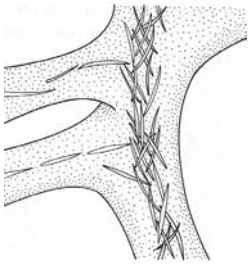
Confused skeleton  Irregularly positioned megascleres [e.g. *Haliclona* (*Gellius*) spp., *Haliclona* (*Halichoclona*) spp.].

Conule, conulose



Surface: with numerous cone-shaped projections raised up by underlying skeleton (e.g. *Mycale* spp.).

Cored fibre

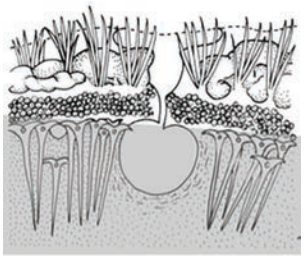


A fibre that incorporates indigenous spicules or foreign material (spicules or sediment). Coring may be light and limited to a central axis or may fill in the whole fibre (e.g. *Aplysinopsis* spp., *Dysidea* cf. *ligneana*).

Cormus

Body of some Clathrinida, composed of ramified and anastomosed tubes (Calcarea).

Cortex



Superficial region of a sponge reinforced by a special organic or inorganic skeleton (e.g. *Geodia* spp., *Tethya* cf. *socius*).

Cortical spicule / skeleton

Spicule or skeleton of the external layer or cortex of the sponge.

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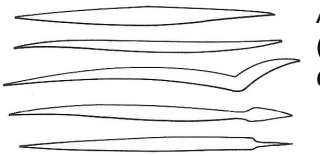
Dendritic skeleton

A skeleton consisting of single or ramifying fibres or tracts that branch but rarely anastomose [e.g. *Aplysina chiriquiensis*, *Mycale* (*Carmia*) cf. *cecilia*].

Desma

A typical interlocked megasclere of lithistids with hypertrophic terminal secretion of silica. In this guide, see “astroclone” (e.g. *Neophrissospongia galapagoensis*).

Diactine (Calcarea)



A spicule with two rays (e.g. *Leucosolenia* spp., *Grantia* spp.).

Diancistra

A microsclere with hooked, knife-shaped ends, notched where they join the shaft and in the middle of the shaft [e.g. *Hamacantha* (*Zygherpe*) *hyaloderma*].

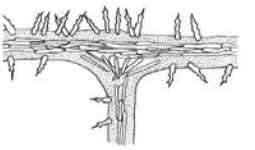
Dicranoclone desma

Desma with swollen terminal couplings (e.g. *Neophrissospongia galapagoensis*).

Dichotriaene

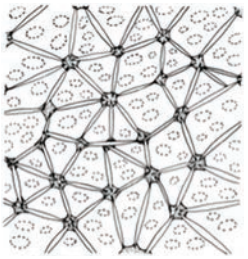
An ortho or plagiotriaene in which the clads are bifurcate (e.g. *Stelletta* spp.).

Echinating spicule



Megasclere that protrudes from the spongin plate, a fibre, or a spicule tract (e.g. *Eurypon hookeri*).

Ectosomal skeleton



Skeleton found in the superficial region of a sponge, distinct from that of the choanosome.

Ectosome

The superficial region of a sponge that has no choanocyte chambers.

Encrusting

Habit: thin, sheet-like coating of the substrate (e.g. *Chalinula chelysa*, *Hymedesmia* spp.).

Endopinacocyte

Pinacocyte lining the inhalant and exhalant canals.

Endopinacoderm

Surface lined by endopinacocytes.

Erect

Habit: General term for having a vertical growth form (e.g. *Plicatellopsis expansa*).

Euaster

Collective term for astrose microscleres in which the rays radiate from a central point.

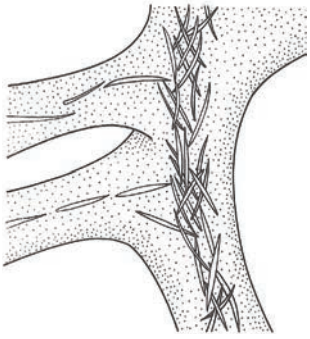
Exopinacocyte

Flat or T-shaped pinacocyte covering the free surface of a sponge (Figs 2–4).

Exopinacoderm

Surface lined by exopinacocytes.

Fibre

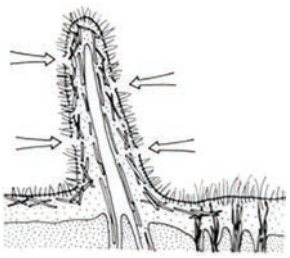


A column (strand, thread) of spongin forming a reticulate or dendritic skeleton (e.g. *Aplysina* spp.). Called **cored fibre** when indigenous spicules or foreign material are incorporated. Coring may be light and limited to a central axis or may fill in the whole fibre (e.g. *Aplysinopsis* spp., *Dysidea* cf. *ligneana*).

Firm

Consistency: solid, requires considerable pressure to deform sponge (e.g. *Geodia* spp., *Stelletta* spp.).

Fistule



A tube-like protuberance projecting from the sponge surface and bearing either ostia, oscula, or both.

Fusiform

Shape of a monactin spicule, tapering regularly toward a point.

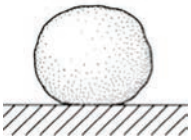
Gemmule

A resistant asexual reproductive body, composed of a mass of archaeocytes filled with reserves and enclosed in a non cellular protective envelope (Figs 13A & 13B).

Glycocyte

Cell with conspicuous dictyosomes, characterized by the presence of glycogen rosettes and osmiophilic inclusions, only seen in TEM. Synonym of grey cells (Fig. 9G).

Globular

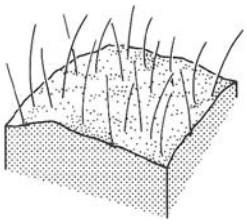


Habit: ball shaped, spherical (e.g. *Geodia* sp., *Tethya* cf. *socius*).

Hastate

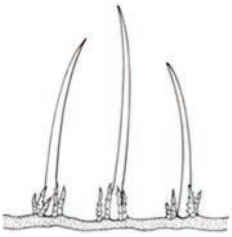
Spicule remaining isodiametric for most of its length, with the point or points tapering abruptly. See oxea.

Hispid



Surface: with long and scattered spicular projections [e.g. *Clathria* (*Microciona*) *aculeofila*].

Hymedesmioid skeleton



Skeleton of encrusting sponge where monactine megascleres are arranged singly with heads fixed to a basal plate of spongin and points directed outward (e.g. *Hymedesmia* spp., *Eurypon lacertus*).

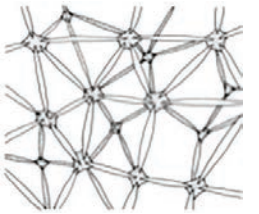
Inarticulate skeleton (Calcarea)

Choanoskeleton composed only of the unpaired rays of the subatrial spicules and of one of the rays of the cortical or subcortical spicules. Without specific spicules of the choanoskeleton (e.g. *Paraleucilla tarazonai*).

Isochela

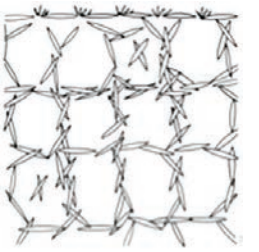
A chela with equal ends. See anchorate chela, arcuate chela, palmate chela.

Isodictyal reticulation



Isotropic reticulation in which the meshes are triangular and have sides one spicule long [e.g. *Haliclona* (*Reniera*) *parvuloxea*].

Isotropic reticulation



Reticulation without differentiation into primary or secondary fibres, tracts, or lines [e.g. *Haliclona* (*Reniera*) spp.].

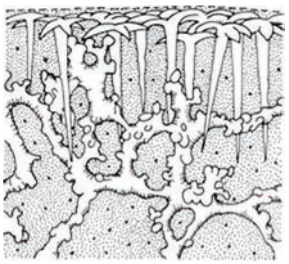
Leuconoid

Aquiferous system with choanocytes forming discrete spherical or elongated chambers, but never anastomosed (e.g. most Demospongiae. Schema from Cavalcanti & Klautau, 2011).

Line of spicules

Unispicular tract (e.g. *Haliclona* spp.).

Lithistid skeleton



Main skeleton consisting of an interlocked assemblage of desmas (e.g. *Neophrissospongia galapagoensis*, *Scleritoderma* spp.).

Lobate Surface: having rounded projections [e.g. *Myxilla* (*Myxilla*) *mexicensis*].

Lophocyte Collencyte with a characteristic tuft of collagen fibrils attached to the posterior pole (Figs 8B & 8C).

Massive Habit: large, compact structure without definable shape (e.g. *Amphimedon* spp., *Stelletta* spp.).

Megasclere Large spicule, usually taking part in the support skeleton.

Megaster Large aster (e.g. *Tethya* spp.).

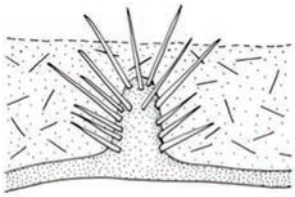
Mesohyl Part of a sponge comprised between pinacoderm and choanoderm.

Mesotriaene

Triaene in which the rhabd is extended beyond the cladome.

Micro- Prefix used for naming microscleres that are similar in shape to megascleres (e.g. microxea, microstrongyle).

Microcionid skeleton



Skeleton with structures in which spicules project from an elevation of the basal plate of spongin [e.g. *Clathria* (*Microciona*) aff. *microjoanna*, *Plocamione matarani*].

Microdiactine (Calcarea)

A small diactine spicule.

Microgranular cell Cell with cytoplasm filled with small dense granules. (Fig. 9F).

Micropyle Opening in the gemmule coat through which cells leave a hatching gemmule.

Microrhabd General term for a straight, monaxonic microsclere.

Microsclere Spicule usually small, often ornate in shape, and mostly not taking part in the support skeleton.

Mucronate Adjective referring to the pointy or blunt, nipple-like point of a megasclere.

Nurse cell Archaeocyte-like cells surrounding oocytes during their growth.

Onychaete

A long, thin, finely spined, asymmetric microsclere, occasionally bearing a subterminal swelling (e.g. *Tedania ecuadoriensis*).

Osculum Opening through which water leaves a sponge (Fig. 2).

Ostium Opening of porocytes through which water enters the sponge (Fig. 3A).

Oxea Monaxon (diactinal) spicule pointed at both ends. Different types are distinguished by shape and tip morphology.

angulate oxea

centrotylote oxea

curved oxea

flexuous oxea

fusiform oxea

Oxea tips

acerate asymmetrical blunt conical

hastate mucronate stepped symmetrical

Oxyaster

Euaster with pointy free rays and a small centrum less than one-third the diameter of the whole spicule (e.g. *Stelletta* sp. 1).

Oxychaete

A very thin, hair-like, iso-terminated (thinning similarly on both ends), microspined microsclere with sharp spines obliquely disposed, often in bundles called oxydragmas (e.g. *Celtodoryx* spp.).

Oxydragma

A bundle of oxychaetes.

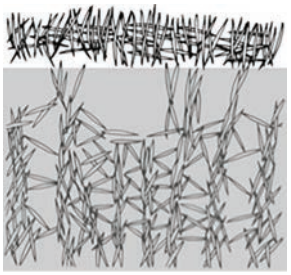
Oxyspheraster

Euaster with obvious centrum clearly smaller than the rays (*Geodia* spp., *Timea* spp.).

Paired actine(s) (Calcarea)

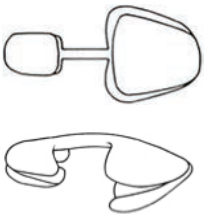
Rays of a sagittal, parasagittal or pseudosagittal spicule that contain the unpaired angle.

Palisade



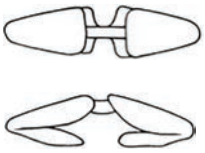
Perpendicular arrangement of ectosomal spicules, with points directed outward (e.g. *Cliona chilensis*).

Palmate anisochela



Anisochela in which the lateral alae coalesce with the shaft over their entire length, and the single, median, anterior ala (one at each end) stands free and widens distally [e.g. *Mycale* (*Carmia*) cf. *cecilia*].

Palmate isochela



Isochela in which the lateral alae coalesce with the shaft over their entire length, and the single, median, anterior ala (one at each end) stands free and widens distally (e.g. *Acarnus* aff. *peruanus*).

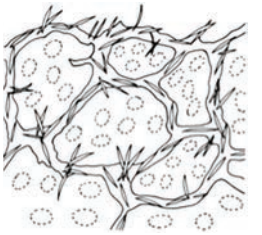
Papilla

Nipple-like protuberance projecting from the sponge surface and bearing either ostia, oscula, or both. See figure of fistule.

Parasagittal spicule (Calcarea)

Bilaterally symmetrical triactine or tetractine with unequal actines, forming equal angles (120˚) between the basal rays when projected into a plane perpendicular to the optic axis.

Paratangential skeleton



Arrangement of ectosomal spicules intermediate between the palisade and tangential type.

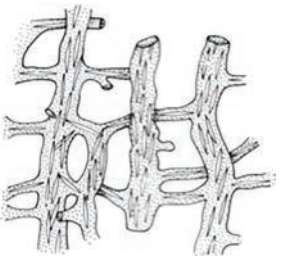
Parchment

Tangential ectosomal skeleton in which the megascleres are arranged in a tight feltwork (e.g. *Hymeniacidon perlevis*).

Parenchymella

Larva composed of an envelope of flagellated cells surrounding an internal mass of cells.

Paucispicular fibre or tract



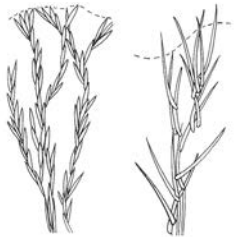
Fibre or tract with two to five megascleres adjacent to one another [e.g. *Haliclona* (*Rhizoniera*) *baslaviae*, *Myxilla* (*Myxilla*) *mexicensis*].

Pinacocyte

Cell delimiting the sponge from the external milieu and always as a layer only one cell thick (See exo- and endopinacocyte).

Pinacoderm Surface lined by pinacocytes.

Plagiotriaene  Triaene in which the clads are directed forward and form with the rhabd an angle of about 45°, and may be recurved distally (e.g. *Stelletta* spp.).

Plumose skeleton  Skeletal construction made of primary fibres or spicule tracts from which skeletal elements radiate obliquely [e.g. *Clathria* (*Microciona*) spp.].

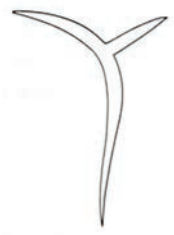
Porocyte Cell of the exopinacoderm surrounding an ostium (Fig. 3A).

Primary fibre  An ascending fibre ended at a right angle to the surface, frequently supporting conules (e.g. *Aplysinopsis* spp., *Dysidea* cf. *ligneana*).

Prosopyle Opening of an inhalant canal into a choanocyte chamber.

Protriaene  Triaene in which the clads are directed or sharply curved forward, away from the rhabd (e.g. *Geodia* spp.).

Punctate Surface: appearing dotted usually because of microscopic pores [e.g. *Haliclona* (*Halichoclona*) *marcoriosi*].

Pseudosagittal spicule (Calcarea)  A subcortical triactine essentially sagittal, but having unequally long and differently curved rays on each side of the unpaired angle. The longer paired actine is directed inwards (e.g. *Leucandra* spp.).

Radiate skeleton

A type of skeleton in which the structural components diverge from a central region toward the sponge surface (e.g. *Stelletta* spp.).

Raphide

A very thin, hair-like microsclere, often in bundles called trichodragmas. See trichodragma [e.g. *Mycale* (*Carmia*) cf. *magnirhaphidifera*].

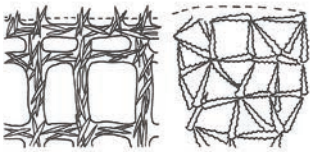
Regular spicule (Calcarea)

Triactine or tetractine spicule with basal rays of equal length, and with equal angles (120˚) between them, when projected into a plane perpendicular to the optic axis.

Resilient

Consistency: resumes original shape after deformation (e.g. *Aplysina chiriquiensis*).

Reticulate skeleton



Three-dimensional network of fibres, tracts, lines, or single spicules (e.g. *Aplysina chiriquiensis*, *Balliviaspongia wirrmanni*).

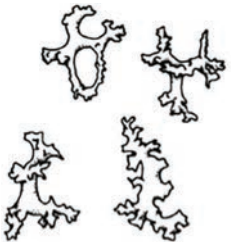
Rhabdiferous cell

Large cell with abundant rod-like inclusions (Fig. 9E).

Rhabdome

Rhabd (ray) of a triaene that is distinct from the other three in length, usually longer (e.g. *Neophrissospongia galapagoensis*).

Rhizoclone

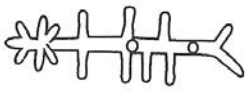


Nontuberculate irregular monaxial desma, with spiny to root-like zygomes that are usually mainly lateral (e.g. *Scleritoderma* spp.).

Sagittal spicule (Calcarea)

Triactine or tetractine with two equal angles (paired angles) and one dissimilar angle (unpaired angle) at the centre, when projected into a plane perpendicular to the optic axis.

Sanidaster



A rhabd-derived, straight microsclere having spines at intervals along its entire length. Spines along the shaft are perpendicular to the axis and may or may not be spirally arranged. Those at the ends diverge obliquely (e.g. *Neophrissospongia galapagoensis*).

Sclerocyte

Cell secreting spicules. In Demospongiae, where secretion is intracellular, sclerocytes contain numerous mitochondria and bear spicule-axial filaments. In Calcarea, secretion is extracellular with septate junctions between sclerocytes (Fig. 8E).

Scopiform

Having the form of a broom or besom.

Secondary fibre

In a reticulate skeleton, a fibre that links the primary fibres, and is usually thinner than those.

Sigma

A microsclere of “C” or “S” shape [e.g. *Hamacantha* (*Zygherpe*) spp.; *Haliclona* (*Gellius*) *concreta*].

Skeleton

All structures supporting and protecting the sponge body.

Soft Yielding to pressure, easily torn (e.g. *Clathrina* spp., *Aplysina gerardogreeni*).

Solenoid

Aquiferous system composed of anastomosed choanocyte tubes and atrium lacking choanocytes (e.g. *Leucascus* spp. Schema from Cavalcanti & Klautau, 2011).

Spheraster

An euaster with short rays and a thick centrum; the diameter of the centrum (more than one-half the total diameter) exceeds the length of the rays (*Tethya* cf. *socius*).

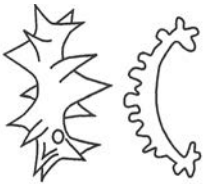
Spheroxyaster

Euaster with discrete centrum that is more than one-third of the total diameter (*Geodia* spp., *Timea* spp.).

Spherulous cell Cell filled with large round spherules that occupy almost the entire cell body, compressing the cytoplasm into thin sheets (Figs 9A–9C).

Spicule A component of the mineral skeleton, typically composed of silica (Demospongiae and Hexactinellida) or calcium carbonate (Calcarea).

Spiraster (= spinispira)

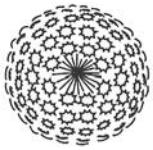


Spiral, rod-shaped microsclere with spines peripherally arranged (e.g. *Cliona* aff. *euryphylle*, *Trachycladus* aff. *minax*).

Spongin Skeletal substance in Demospongiae made up of collagen microfibrils of about 10 µm in diameter.

Spongocyte Cell secreting spongin fibres.

Sterraster



A spherical or ellipsoidal microsclere in which the numerous rays are fused and end in stellate terminations (e.g. *Geodia* spp.).

Strongylaster (= chiaster)

Aster with free, isodiametric, blunt rays (e.g. *Stelletta* spp.).

Strongyle

An often isodiametric, diactinal megasclere with rounded ends [*Hymedesmia* (*Hymedesmia*) *santarositae*].

Strongylostyle

An often isodiametric, diactinal megasclere with unequal endings, one end more pointed, the other more blunt (e.g. *Celtodoryx* spp.).

Strongylote

Alternative name for strongyle, more often used to refer to a category rather than a single spicule.

Style

Monaxon spicule with one end pointed, the other blunt (e.g. *Plocamione matarani*).

Subatrial skeleton (Calcarea)

Part of the skeleton with sagittal spicules with paired rays adjacent to the atrial skeleton (e.g. *Grantia* spp., *Leucandra losangelensis*).

Subcortical skeleton (Calcarea)

Part of the skeleton adjacent to the cortex consisting of pseudosagittal triactines with unpaired actines and shorter paired actines, or tetractines with basal triradiate system adjacent to the cortex (e.g. *Leucandra* spp.).

Subtylostrongyle

An isodiametric, diactinal megasclere with unequal endings, both ends round, one bearing a slight swelling (e.g. *Celtodoryx* spp.).

Subtylostyle

Tylostyle with one end pointed, the other with a slight swelling or knob, the swelling, more or less distinct, may be sub-terminal [e.g. *Antho* (*Plocamia*) spp.].

Subtylote

Tylote with faintly swollen elliptical heads [e.g. *Hymedesmia* (*Hymedesmia*) *santarositae*].

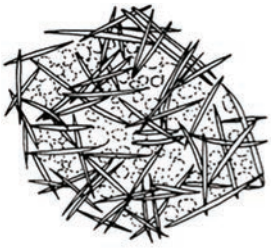
Syconoid

Aquiferous system with elongated choanocyte chambers containing free distal cones or extending from cortex to atrium (*Sycon* spp. Schema from Cavalcanti & Klautau, 2011).

Sylleibid

Aquiferous system with choanocyte chambers radially arranged around invaginations of the atrial cavity (e.g. *Leucandra* spp., *Leucilla* spp. Schema from Cavalcanti & Klautau, 2011).

Tangential skeleton



Ectosomal skeleton arranged parallel to the surface (e.g. *Haliclona* spp., *Hymeniacidon perlevis*).

Tetractine (Calcarea)

A calcareous spicule with four rays.

Thesocyte

Dormant archaeocyte in gemmules in which the cytoplasm is full of reserves partly arranged in vitelline platelets (Fig. 13A).

Tornote

A straight, isodiametric, diactinal megasclere with conical or mucronate extremities [e.g. *Hymedesmia* (*Hymedesmia*) *peruana*].

Toxa

Bow-shaped microsclere (e.g. *Acarnus* aff. *peruanus*).

Tract

A column of aligned megascleres.

Triactine (Calcarea)

A spicule with three rays. See parasagittal, pseudosagittal, regular, and sagittal spicule.

Triaene General term for a tetractinal megasclere having one unequal rhabd (rhabdome) that is commonly much longer than the other three (termed clads, forming the cladome. See anatriaene).

Trichodragma  A bundle of raphides [e.g. *Mycale* (*Carmia*) cf. *magnirhaphidifera*].

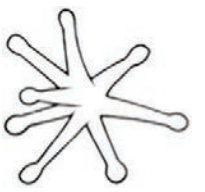
Trichox (Calcarea) Thin, hair-like straight monaxon spicules present in general around the osculum or protruding from the cortex.

Trophocyte Cell providing reserves to archaeocytes during gemmulogenesis and to oocytes during oogenesis (Fig. 11D).

Tubar skeleton (Calcarea)  Choanosomal skeleton of syconoid species (e.g. *Grantia* spp.).

Tuberculate Spicule ornamented with blunt knobs.

Tubular  Habit: shape of hollow, erect cylinder (e.g. *Soleneiscus pedicellatus*).

Tylaster  Aster with free, microtylote rays (e.g. *Stelletta* spp., *Tethya* cf. *socius*).

Tyle Any rounded swelling or knob in a spicule.

Tylostyle

A style with a tyle (globular swelling) at the base (e.g. *Cliona chilensis*).

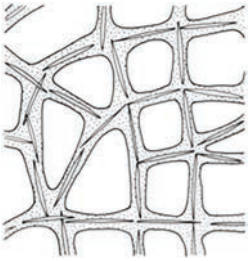
Tylote

Diactinal megasclere with a swelling on each end (e.g. *Acarnus* aff. *peruanus*, *Plocamiancora* spp.).

Unguiferous-anchorate chela

Anchorate chela in which the recurved processes are in the form of claws or sickles and are normally connected to the shaft by expansions called falces (e.g. *Plocamiancora* spp.).

Unispicular fibre / tract



A single aligned row of megascleres (e.g. *Haliclona* spp.).

Unpaired actine (Calcarea) In sagittal, parasagittal or pseudosagittal spicules, the ray of a triactine or of a triradiate basal system of a tetractine lying opposed to the unpaired angle.

Vacuolar cell Cells filled with large vacuoles generally translucent in TEM (Fig. 9H).

Velvety Surface: with dense short spicular projections, feeling soft and smooth to the touch (e.g. *Suberites inti*).

Zygome Part of a desma that interlocks with another spicule.

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People

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10. Field work assistance

10.1. Fishermen and guardians ESPER 2007

Row 1. Carlo Manuel Sernaguez; Mauro León Meza; Victor Ramirez Quiroz. **Row 2.** Adriano Rodriguez Robles; Oscar Eduardo Carrasco Fuentes; Carlos Cirilo Ocaña. **Row 3.** Fisherman at Isla Don Martin; Alfredo Arroyo Garcia; Jose Romero. **Row 4.** Luiz Fiestas Flores; Román Fiestas Flores; Hector Herrera Tume. **Row 5.** Juan Moscol Ruiz; Eduardo Moscol Ruiz; Guillermo Villcas Casaverde. **Row 6.** Eduardo Moscol Ruiz; Jonathan Fiestas Nunura; Manuel Fiestas Nunura.

10.2. Fishermen and guardians ESPER 2008

Row 1. Fausto Ordoño Alca; Carlos Alberto Maguiña; Fishermen of the community of Ccotos. **Row 2.** Fishermen and ladies of the community of Ccotos; Edgar Charca Coila and son. **Row 3.** Worker of the Casa Andina in Suasi; Señor Isidre; Worker of the Casa Andina in Suasi. **Row 4.** Señor Isidre; Pascuala Quispe de Colca; Genaro Sanchez Cruz and son. **Row 5.** Victor Maxiño Diaz; Alex Mendosa and brother; Christian Bardoles Rojas. **Row 6.** Julian Torres Ferreya et Fernando Uchuya; Magno Mejia; Esteban Ramos Araujo.

10.3. Fishermen and guardians ESPER 2009

Row 1. Adriano Rugel Castilo; Richard Paiva Chulle; Hector Herrera Tume. **Row 2.** Exeguiel & Christian Panta Chulle; Hector Herrera Tume; Esteban Ancajima Soplapuco. **Row 3.** Edgar Apolo Olivo; Jorge Luis Peña Reymundo; Layer Cesar Alfaro Fiestas. **Row 4.** Carlos Alfaro Fiestas; Wesley Chulle Colmenarez; Alfredo Altamirano Rufino. **Row 5.** Manuel Bruno Sosa crew member; Manuel Bruno Sosa crew member; Manuel Bruno Sosa crew member. **Row 6.** Martin Silva Sernaque; Juan Pazos Bancayan's son; Juan Pazos Bancayan.

10.4. Participants to Proyecto ESPER and Proyecto EsponjAS

Row 1. Yuri Hooker, Ulrich Zanabria, Marco Rios. **Row 2.** Nelly Mostajo Berrospi, Karem Aguirre, Carolina Segami. **Row 3.** Krizia Manzon, Gisele Lôbo Hajdu, Katherine Altamariano. **Row 4.** Rodrigo Castro, Francisco Menendez, Jorge Leal. **Row 5.** Manuel Vilchez, Bruno Ibañez, Welington Vieira.

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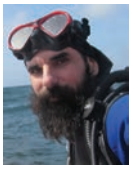

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12. About the authors

Philippe Willenz obtained a master in zoology from the Université Libre de Bruxelles (ULB) in 1973, and a master in oceanography from the Université de Liège in 1975. He was teaching assistant in biology at the ULB until 1983, when he earned his PhD in Zoology with a thesis on ultrastructural description of nutrition mechanisms of a freshwater sponge. From 1984 to 1987 he conducted a post doc in the Biology Department at Yale University, where he applied TEM and SEM techniques to better understand the taxonomical position of hypercalcified sponges from Jamaica and the Bahamas among demosponges and developed techniques to record the growth rates of their skeletons. These were later used as climate change proxies after he joined the Taxonomy and Phylogeny Department of the Royal Belgian Institute of Natural Sciences in 1992. He developed several projects with the Marine Biology Laboratory of the ULB as an invited scientist and advised several PhD students. He is also a research collaborator at the Museu Nacional of the Federal University of Rio de Janeiro.

Eduardo Hajdu graduated in Biology from the Federal University of Rio de Janeiro (UFRJ) in 1987, obtained a Master's degree in Biological Sciences from the University of São Paulo in 1991, and a PhD in Biology from the University of Amsterdam in 1995. He carried out a post-doc at the University of São Paulo between 1995 and 1997, the year in which he was selected for an adjunct professor position at UFRJ. Since then, he has taught the subjects of Porifera Systematics and Marine Biogeography under the Graduate Programs in Biological Sciences Zoology, and more recently Genetics, at the Museu Nacional. Eduardo focuses his research on the theme of Marine Biodiversity, specializing in Porifera (sponges). His main lines of action are in taxonomy, phylogeny and biogeography, carried out with the additional concern of supporting research in chemistry and pharmacology of natural products. His main areas of work are in Brazil, the Antarctic, Argentina, Chile and Peru, where he seeks to understand the patterns of distribution of sponges in a regional scale, as well as the ecological and evolutionary aspects responsible for the establishment of these patterns. He has published about 180 studies and has mentored dozens of undergraduate and graduate students.

Since twenty years Philippe Willenz and Eduardo Hajdu have been regularly meeting on joint expeditions in Chile, Argentina and Peru, exploring South American sponges and cooperating every year in each other's laboratories. They described and published together numerous species of sponges new to science.

13. Appendices

13.1. Taxonomic remarks

***Leucandra* sp. 1** (p. 96)
The combination of cortical and atrial microdiactines and an atrium composed exclusively of tetractines is an important taxonomic character of this species. Although, there are other four known species with microdiactines in both cortical and atrial skeletons, they can be differentiated from *Leucandra* sp. 1 according to other characters. For example, *L*. ***fragilis*** and *L*. ***onigaseana*** (both from Japan) have also triactines in addition to tetractines in the atrial region, while *L*. ***regina*** (New Zealand) and *L*. ***rigida*** (Japan) are the most similar with just tetractines in the atrium. *Leucandra* sp. 1 is easily distinguished from *L*. *regina* by the absence of tetractines in the choanosomal skeleton of the later species and the presence of this category in the canals and lacunae of the former species. Finally, *Leucandra* sp. 1 can be differentiated from *L*. *rigida* by the presence of diactines in the cortex of the later species, also by the thickness of triactines of the choanosomal region, which is three times thicker than it is in the former.

***Mycale* (*Carmia*) cf. *cecilia* de Laubenfels, 1936** (p. 212)
Mycale cecilia has been reported to be rather varied in morphologic terms, with live colour ranging between red, green, or almost blue, but purportedly always with distinctive small orange patches. Previous authors diverged according to the number of chelae categories present. We found at least two morphotypes assignable to *M*. *cecilia* in Peru, one in the reef, the other in the mangrove. These varied according to live colour and presence of orange specks, anisochelae shape and possibly categories, and presence/absence of spheroxyasters. The latter are a first find for the entire order Poecilosclerida, and range among the smallest asters ever found in Porifera. In spite of their abundance under SEM, we could not spot them in the sponge body, even after essaying the cryofracture technique. An integrative approach is needed to verify the identity of both Peruvian morphotypes, in contrast to Mexican and Panamanian ones — preliminary genetic data suggest that colour morphs in Mexico may belong to different species. This species appears close to the western Atlantic *M*. ***microsigmatosa*** and the Hawaiian *M*. ***maunakea***.

***Tethya* cf. *socius* Sarà, Gómez & Sarà, 2001 (white morph)** (p. 242)
The distinction of megascleres into categories demands further detailed evaluation, so that we will be considering only the largest dimensions attained. The East Pacific has 14 species of *Tethya* recorded until now, including four from the Galápagos. Six of these have megascleres either much larger and/or stouter, or smaller than observed in the Peruvian species. These comprise *T*. ***californiana***, *T*. ***ensis***, *T*. ***mexicana***, *T*. ***paroxeata***, *T*. ***sorbetus*** and *T*. ***vacua***. Another three have much smaller megasters, namely *T*. ***melinka***, *T*. ***papillosa*** and *T*. ***taboga***. The remaining five species include *T*. ***annona***, *T*. ***sarai*** and *T*. ***strongylata*** from the Galápagos, none of which has predominant true tylasters under 15 µm in diameter (neatly and heavily spined at rays' tips) as micrasters. Two Mexican species approach the Peruvian materials the most, *T*. ***ovum*** and *T*. ***socius***. The later, with similar habit of

forming clusters of fused individuals, is selected as the main target for subsequent detailed comparison. An apparent important, albeit subtle distinction, stems from the mention that microasters are mainly strongylasters in *T. socius*, while true tylasters prevail in the specimens studied here.

13.2. List of acronyms

DIC	Differential Interference Microscopy
MHNG	Muséum national d'Histoire naturelle de Genève
MNRJ	Museu Nacional, Universidade Federal do Rio de Janeiro
RBINS	Royal Belgian Institute of Natural Sciences
SEM	Scanning Electron Microscopy
TEM	Transmission Electron Microscopy
UCSUR	Universidad Científica del Sur
UFRJ	Universidade Federal do Rio de Janeiro
UPCH	Universidad Peruana Cayetano Heredia

13.3. List of species registered under MNRJ / RBINS codes

(Taxonomical order). Numbers in bold are illustrated *in situ*.

Cl. Calcarea
Subcl. Calcinea
O. Clathrinida
Fam. Clathrinidae
Arturia spirallata – MNRJ 11397, **11414**, **12860**, 12864, 13652, 16745.
Clathrina antofagastensis – MNRJ 11294, **13148**, 13674.
Clathrina aurea – MNRJ **12840**, 13124, 13129, 13130, 13138, 13139, 13143.
Clathrina aphrodita – MNRJ 12994, **13021**, 14180.
Clathrina nuroensis – MNRJ **13032.**
Clathrina peruana – MNRJ 11277, **12839**, 12849, 13127, 13141, 13144.
Ernsta tetractina – MNRJ **11344.**
Fam. Dendyidae
Soleneiscus pedicellatus – MNRJ **16746**, 16781, 16782.

Subcl. Calcaronea
O. Leucosolenida
Fam. Leucosoleniidae
Leucosolenia cf. *variabilis*. MNRJ **13017**, 13070.
Fam. Grantiidae
Grantia sp. 1 – MNRJ 11283, **12836**, 13130, 13148, 13152, **13155**, 13157, 13163.
Grantia sp. 2 – MNRJ **13078.**

Leucandra losangelensis - MNRJ 11420, 11456, 11458, **11459**, 12824, 12961, 13030, 13036.
Leucandra sp. 1 - MNRJ **11339**, 11358, 11365, 11394, 12831, **12834**, 12863.
Leucandra sp. 2 - MNRJ **11337**, 11350, 11360, 11368, 11378, 12953, 14204.

Fam. Amphorisciidae
Leucilla mancoraensis - MNRJ **12948**, 21304, 21305.
Paraleucilla tarazonai - MNRJ **11448**, 21306, 21307.

Cl. Demospongiae
Subcl. Verongiomorpha
O. Verongiida
Fam. Aplysinidae
Aplysina chiriquiensis - MNRJ **11483**, 12983, 13068, **14182** 14190.
Aplysina cf. *chiriquiensis* - MNRJ **12976**.
Aplysina gerardogreeni - MNRJ 11436, 11475, **11482**, **12973**, 13002.

Subcl. Keratosa
O. Dendroceratida
Fam. Darwinellidae
Aplysilla cf. *sulfurea* - MNRJ **12861**, 13025.
O. Dyctioceratida
Fam. Thorectidae
Aplysinopsis sp. - MNRJ 11438, **11464**.
Fam. Dysideidae
Dysidea cf. *ligneana* - MNRJ 11305, **11328**, 11333, 11351, 11371, 11392, 11402, 11404, **11405**, 11406, 11416.

Subcl. Heteroscleromorpha
O. Haplosclerida
Fam. Chalinidae
Chalinula chelysa - MNRJ **11272**, **12075**, 12080, 12145, 12837.
Chalinula ramiculosa - MNRJ 12820, **12889**, **12892**.
Haliclona (*Gellius*) *concreta* - MNRJ **11274**, 11262, 11318, 11362, 13647.
Haliclona (*Halichoclona*) *arequipaensis* - MNRJ **12140**, **12147**.
Haliclona (*Halichoclona*) *marcoriosi* - MNRJ 11470, **12975**, **13069**, 13001.
Haliclona (*Halichoclona*) *multiosculata* - MNRJ **13682**.
Haliclona (*Halichoclona*) *paracas* - MNRJ **12841**.
Haliclona (*Halichoclona*) *pellucida* - MNRJ **12149**.
Haliclona (*Reniera*) *parvuloxea* - MNRJ **13044**.
Haliclona (*Rhizoniera*) *baslaviae* - MNRJ **12856**.
Haliclona (*Rhizoniera*) *manglarensis* - MNRJ **13052**.
Haliclona (*Rhizoniera*) *zanabriai* - MNRJ **12155**.
Fam. Niphatidae van Soest, 1980
Niphates ruthecitae - MNRJ **12141**, **12159**, 12066, 12139.
Pachychalina lupusapia - MNRJ **11357**, 11349, 13676, 13687.
Amphimedon sp. - MNRJ **11432**.
O. Spongillida
Incertae sedis
Balliviaspongia wirrmanni - MNRJ 12094, 12095, 12097, **12098**,

12100, 12102, 12103, 12105, 12107, 12108, 12109, 12110, 12111, **12113**, 12114, 12115, 12116, 12117, 12118, 12119, 12121, **12122**, 12123, 12124, 12125, 12126, 12127, 12128, 12129, 13703.

O. Axinellida

Fam Raspailiidae / Subfam. Raspailiinae

Eurypon lacertus - MNRJ **11334**.

Eurypon hookeri - MNRJ 11363, **11408**.

Plocamione matarani - MNRJ **12131**.

O. Tetractinellida

Fam. Ancorinidae

Stelletta sp.1 - MNRJ **11369**, 13015**.**

Stelletta sp.2 - MNRJ **12970**.

Fam. Corallistidae

Neophrissospongia galapagoensis- MNRJ **13057**, 13709.

Fam. Geodiidae / Subfam Geodiinae

Geodia sp. - MNRJ 11444, **13000**.

Fam. Scleritodermidae

Scleritoderma sp. - MNRJ **13748**.

O. Merliida

Fam. Hamacanthidae

Hamacantha (*Zygherpe*) *desmacelloides* - MNRJ 11342, 12167, **13661**, **13690**, 13699, 14501.

Hamacantha (*Zygherpe*) *hyaloderma* - MNRJ **12146**, **12160**, 12162.

O. Poecilosclerida

Fam. Acarnidae

Acarnus aff. *peruanus* - MNRJ **11442**.

Fam. Coelosphaeridae

Celtodoryx sp. - MNRJ **11419**, 14497.

Lissodendoryx (*Lissodendoryx*) cf. *carolinensis* - MNRJ **13043**.

Fam. Hymedesmiidae

Hymedesmia (*Hymedesmia*) *santarositae* - MNRJ **12843**.

Hymedesmia (*Hymedesmia*) *peruana* - MNRJ **13694**.

Hymedesmia (*Hymedesmia*) *humboldti* - MNRJ **12078**, 12144.

Fam. Microcionidae

Antho (*Plocamia*) sp. - MNRJ **13080**.

Clathria (*Microciona*) *aculeofila* - MNRJ **11332**, 11380, **11437**, 11449, 11453, 11490, 12955, 12981, 12982, 12989, **13031**, 13066, 13317.

Clathria (*Microciona*) aff. *microjoanna* - MNRJ 12189, **12190**.

Fam. Mycalidae

Mycale (*Carmia*) cf. *cecilia* - MNRJ 11445, 12957, 12996, 13011, **13059** 14183, **14195**, 14199.

Mycale (*Carmia*) cf. *cecilia* (from mangrove) - MNRJ **13045**, **13046**, 13053.

Mycale (*Carmia*) cf. *magnirhaphidifera* - MNRJ **13061**, **13067**, 14196.

Mycale (*Carmia*) sp. - MNRJ **11472**.

Fam. Myxillidae

Myxilla (*Ectyomyxilla*) cf. *chilensis* - MNRJ **11439**.

Myxilla (*Myxilla*) *mexicensis* - MNRJ **12987**, **13014**, 14193.

Plocamiancora sp. - MNRJ **12074**, 12990, 12993.

Fam. Tedaniidae

Tedania (*Tedania*) *ecuadoriensis* - MNRJ **13013**, 13072.

O. Clionaida
Fam. Clionaidae
Cliona chilensis - MNRJ 11280, 11443, **11468**, 12069, 12130, 12175, 12178, 12877.
Cliona aff. *euryphylle* - MNRJ **11471**, 13073, 14198.
Cliona amplicavata - MNRJ **11290**, 11461.
Cliona sp. - MNRJ 11312, 11316, **11331**.
Pione sp. - MNRJ **11341**.
O. Tethyida
Fam. Tethyidae
Tethya cf. *socius* (white morph) - MNRJ 11450, **13016**.
Tethya cf. *socius* (yellow morph) - MNRJ 11413, 11446, 12995, 13642, 13644, 13681, **14173**, 14492.
Fam. Timeidae
Timea sp. - MNRJ **11478**.
O. Trachycladida
Fam. Trachycladidae
Trachycladus aff. *minax* - MNRJ 11478, **11503**, **12168**.
O. Suberitida
Fam. Halichondriidae
Halichondria (*Halichondria*) *cristata* - MNRJ **12884**.
Halichondria (*Halichondria*) *prostrata* - MNRJ 11286, 11386, 11387, **11388**, 11389, 12208, **12821.**
Hymeniacidon perlevis (yellow morph) - MNRJ **11252**, 11430, 12859, 12886.
Hymeniacidon perlevis (orange morph) - MNRJ 11288, 12084, 12181, **12183**, 12205, 12206.
Johannesia reticulosa - MNRJ 11496, **12073**, 12161, 12171, **12198**, 12845, 12852.
Ciocalypta magnastyla – **UCSUR 07-000009**.
Fam. Suberitidae
Protosuberites cf. *epiphytoides* - MNRJ **12076**, **12082**, **12133**, 12148, **13665**.
Protosuberites sp. - MNRJ 11330, **11353**, 11377.
Plicatellopsis expansa - MNRJ **11247**, 11248, 12151, 12152, 12868, 12873.
Suberites *inti* - MNRJ **12869**.
Suberites aff. *latus* - MNRJ 12882, **13688, 13698.**
Terpios cf. *granulosus* - MNRJ 11361, 11366, **11390**, 11412, **11495**, 13062.

13.4. Photo credits

F. Azevedo: Figs 31C–D, 32B–D, 33C–F, 34B–D, 35B–D, 36B–E, 37B–E, 38B–D, 39B, 39I, 40B–C, 43B, 45B–H, 46A–F.

B. Cóndor-Luján: Fig. 119A.

E. Hajdu: Book cover, Figs 44A, 47B, 83C–D, 94, 110C, 123A. Cover page Poecilosclerida, Tethyida.

Y. Hooker: Figs 31A–B, 32A, 33A, 34A, 35A, 36A, 37A, 38A, 39A, 40A, 42A, 45A, 48A–B, 49A–B, 50A, 50C, 51A, 52B, 53B, 54A–B, 55A–B, 56A–B, 57A–B, 58A–B, 59A–B, 60A–B, 62A, 64A–B, 65B, 66A–B, 67A–B, 70D, 71A–B, 73A, 76A–B, 77A, 79A, 83A–B, 84A–B, 85A, 86A–B, 88A, 89A, 90A–B, 91A–B, 92B–C, 93A, 95A–B, 97A–B, 98A–B, 99A, 100A–B, 101A, 102A–B, 103A, 104A, 105A, 109A, 111A, 112A–B, 113A–B, 114A, 115A, 116, 117A, 118A–B, 119A–E, 124C, 125A–B, 126A–B, 128A–B, 129A–B. Cover pages Clathrinida, Leucosolenida, Verongiida, Dendroceratida, Axinellida, Tetractinellida, Merliida, Clionaida, Trachycladida, Suberitida.

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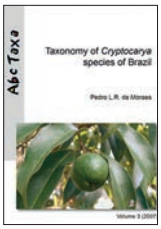

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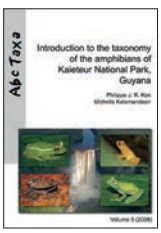

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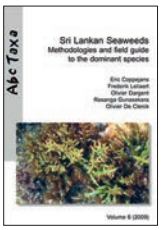

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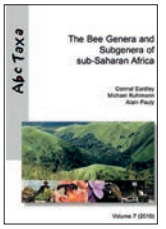

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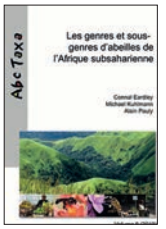

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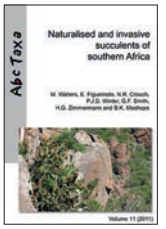

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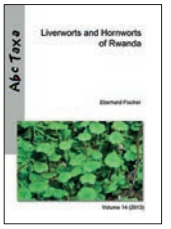

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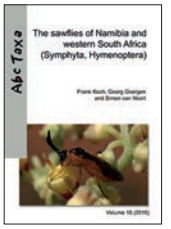

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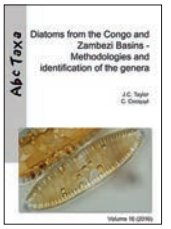

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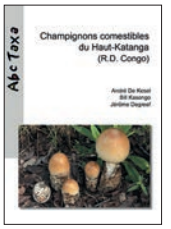

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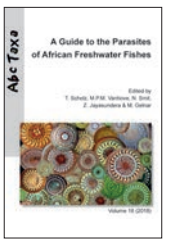

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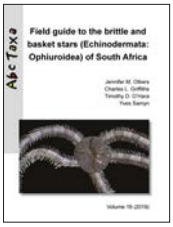

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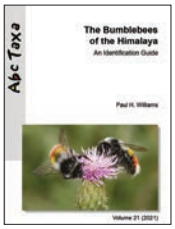

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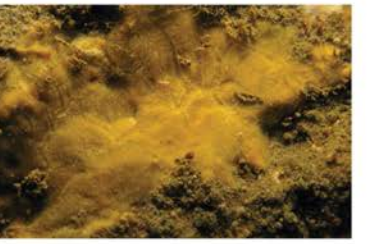

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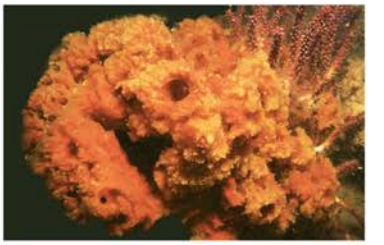

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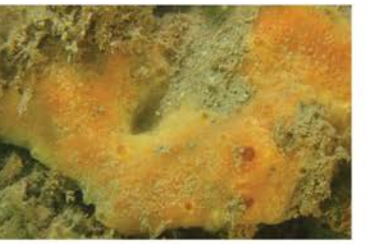

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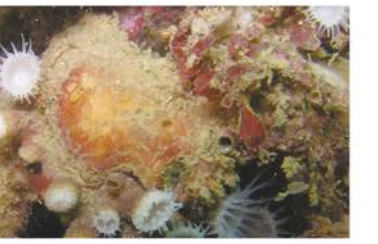

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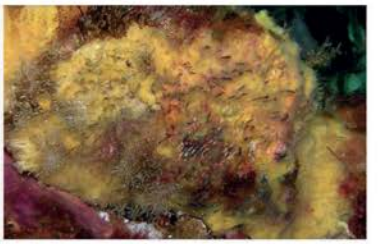

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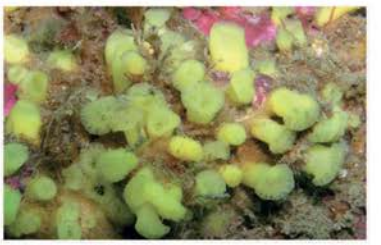

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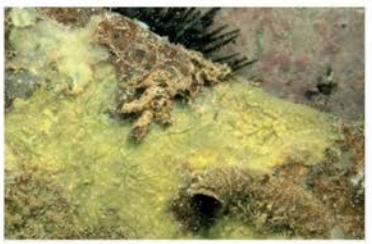

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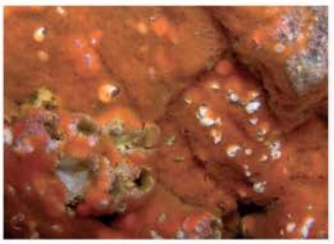

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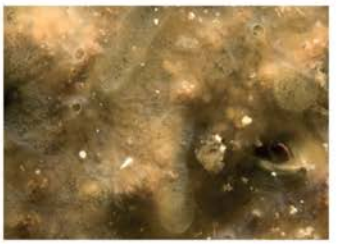

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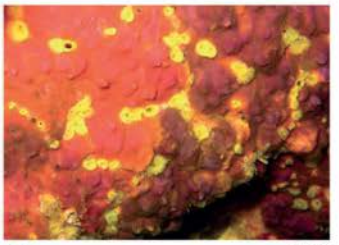

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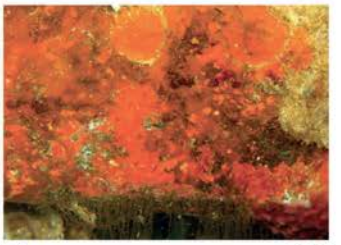

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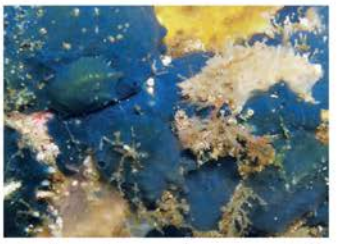

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Marine and Freshwater Sponges of Peru

Identification Guide

Sponges, phylum Porifera, are very efficient filter feeders having a major ecological role and a high diversity in several marine and freshwater ecosystems. Today, sponges are considered as the richest source of natural bioactive compounds. These animals may be expected to play a significant role in marine ecosystems along the nearly 3.000 km long coast of Peru. Nonetheless, the knowledge on the Peruvian sponge fauna was extremely poor, with only 13 species reported at the end of the 20th century. This book is the outcome of two joint projects to perform an intense sampling of the sponge fauna along the complete coast of Peru. About one third of the species illustrated here were recently published as new to science. All species are not only shown as seen *in situ* with distribution maps, but features of their anatomy, used to identify them, are detailed in electron and light microscopy. A general presentation of the cellular biology of Porifera and technical information on how to collect, preserve and identify these organisms bring also a didactical orientation to this book. No doubt that it will be widely used by zoologists, ecologists and students with an interest in the Pacific coasts of South America.

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