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Taxonomic notes on *Poecillastra* sponges (Astrophorida: Pachastrellidae), with the description of three new bathyal southeastern Pacific species

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SUMMARY: Three new species of *Poecillastra* are described here from bathyal waters off central Chile. *P. antonbruunae* n. sp. is diagnosed by its two categories of oxeas, the smaller one only up to 621 µm in length, and calthrops as the sole triaene category; *P. sinetridens* n. sp. by the possession of oxeas larger than 3000 µm long, microxeas which can be over 300 µm long, and absence of triaenes; and *P. maremontana* n. sp. by its three categories of oxeas, three categories of streptasters (one of spirasters and two of plesiasters), one category of calthrops and centrotylote microxeas. Comments upon other *Poecillastra* and an identification key for Pacific species of the genus are given. Evolutionary hypotheses are discussed for the genus given the distribution of spicule morphotypes, as well as the recurrent phenomenon of spicule loss in Astrophorida. Five species of *Pachastrella* are transferred here to *Poecillastra* on the basis of their possession of microxeas instead of microrhabds, viz. *P. cribrum* Lebwohl, 1914; *P. dilifera* de Laubenfels, 1934 [*sensu* Dickinson (1945)]; *P. fusca* Lebwohl, 1914; *P. incrustata* Bergquist, 1968; and *P. scrobiculosa* Lebwohl, 1914. We recognize 28 species of *Poecillastra*, 19 of them occurring in the Pacific Ocean.

Keywords: taxonomy, Porifera, Demospongiae, Chile, Pacific Ocean, bathyal waters.

RESUMEN: TAXONOMÍA DE ESPONJAS *POECILLASTRA* (ASTROPHORIDA: PACHASTRELLIDAE), CON LA DESCRIPCIÓN DE TRES NUEVAS ESPECIES BATIALES DEL PACÍFICO SURORIENTAL. – El presente trabajo describe tres nuevas especies de Porifera del género *Poecillastra*, de aguas profundas de la región central de Chile. *P. antonbruunae* n. sp. presenta dos categorías de oxeas, la más pequeña solo hasta 621 µm de longitud y calthrops como la categoría única de trienios; *P. sinetridens* n. sp. posee oxeas de tamaño superior a 3000 µm de longitud, sus microxeas alcanzan un tamaño superior a 300 µm de longitud y los trienios están ausentes. *P. maremontana* n. sp. posee tres categorías de oxeas y tres de streptasters (una de spirasters y dos de plesiasters). Posee además una sola categoría de calthrops y microxeas centrotylotadas. En el presente trabajo se incluyen comentarios acerca de otras especies de *Poecillastra*, así como una clave de identificación del género para las especies del Pacífico. Se discuten también hipótesis evolutivas del género, basadas sobre la distribución de sus diferentes morfotipos espiculares, así como el fenómeno recurrente de la pérdida de espículas en el orden Astrophorida. Cinco especies del género *Pachastrella* fueron transferidas para *Poecillastra* en consecuencia de poseer micróxeas en vez de microrabdos, viz. *P. cribrum* Lebwohl, 1914; *P. dilifera* de Laubenfels de 1934 [sensu Dickinson (1945)]; *P. fusca* Lebwohl, 1914; *P. incrustata* Bergquist, 1968; y *P. scrobiculosa* Lebwohl de 1914. Actualmente consideramos válidas 28 especies de *Poecillastra*, 19 de ellas ocurren en el Océano Pacífico.

Palabras clave: taxonomía, Porifera, Demospongiae, Chile, Océano Pacífico, aguas profundas.

INTRODUCTION

The order Astrophorida Sollas, 1888 is characterized by possession of triaenes and oxeas as main megascleres, although the absence and rarity of the former is common in Ancorinidae Schmidt, 1870 (*Jaspis* Gray, 1867; *Holoxea* Topsent, 1892; *Melophlus* Thiele, 1899; *Rhabdastrella* Thiele, 1903 and *Asteropus* Sollas, 1888; Uriz, 2002). In Pachastrellidae Carter, 1875, tetraxons are a widespread character, and their absence is described here for the first time.

Poecillastra Sollas, 1888 is diagnosed as Pachastrellidae with calthrops and/or other kinds of short-shafted triaenes as megascleres, and microscleres which are microxeas and several types of streptasters (Maldonado, 2002). According to van Soest *et al.* (2008), 23 species are known, 9 of which were reported from the Pacific Ocean, viz. *P. ciliata* Wilson, 1925 (Philippines); *P. compressa* (Bowerbank, 1866) *sensu* Sollas (1888; Queen Charlote Islands); *P. cribraria* Wilson, 1904 (Galapagos); *P. japonica* (Thile, 1905; Japan); *P. laminaris* (Sollas, 1886; New Caledonia); *P. rickettsi* de Laubenfels, 1930 (California, USA); *P. stipitata* Lévi, 1993 (New Caledonia); *P. tenuilaminaris* (Sollas, 1886; California, USA and Japan); and *P. wondoensis* Sim and Kim, 1995 (Korea). Most appear to be from relatively deep waters. Other areas such as the Atlantic Ocean and Mediterranean, with five species each, and the Indian Ocean, with three species, are poorer or so far have been less thoroughly investigated.

Pachastrellidae is an important source of new bioactive molecules of potential commercial value, such as Dercitine, from *Dercitus* sp., with a marked antitumoral activity (Burres *et al.*, 1989); Psammapline A, from *Poecillastra* sp., with antibacterial activity (Kim *et al.*, 1999); and a citotoxin from *Pachastrella* sp. (Gunawardana *et al.*, 1989). Nevertheless, the relatively small numbers of species known from several large basins and the deep-sea dwelling habit of many species suggest that there is a need for improved taxonomic effort.

Six species of Astrophorida were previously known from Chile, viz. *Asteropus ketostea* (de Laubenfels, 1950), *Asteropus simplex* (Carter, 1879), *Geodia amphistrongyla* Lendenfeld, 1910, *Geodia magellani* (Sollas, 1886), *Stelletta phrissens* Sollas, 1886, and *Stelletta vosmaeri* (Sollas, 1886). In the present study we describe three new species of *Poecillastra* from central Chile (32ºS-35ºS). One of these species is atypical in lacking triaenes. This study further determines the status of the Pacific Ocean as the richest ocean basin for this genus. A brief review of *Poecillastra* species worldwide is undertaken, comparing them to the new species described here, and possible biogeographic scenarios are outlined taking into account the distribution of spicule morphotypes within the genus and their primary suggestion of monophyly of the species group sharing these characters.

MATERIALS AND METHODS

Specimens were collected off the central Chilean coast from 290 to 450 m depth. Figure 1 illustrates the collecting localities for the three specimens studied. These were collected by distinct oceanographic/ fisheries surveys, and were deposited in the following

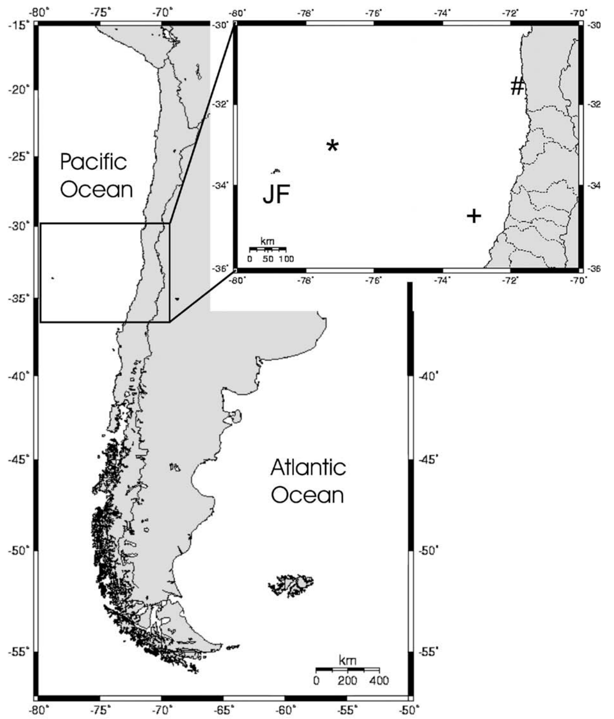

FIG. 1. – Map of the Chilean coast highlighting its central portion and the location of each new species's type locality. **#**, *Poecillastra antonbruunae* n. sp. (off Constitución); *, *P. maremontana* n. sp. (off Juan Fernandez Archipelago); and +, *P. sinetridens* n. sp. (off Zapallar, Valparaiso). JF, Juan Fernandez Archipelago.

institutions: United States National Museum (USNM, Washington, D.C., USA), Museum d'Histoire Naturelle (MHNG, Geneva, Switzerland), and the Huinay Scientific Field Station (HSFS, Huinay, Chile).

Procedures for the study of spicules and skeletal architecture under light microscopy and scanning electron microscopy (SEM) followed Hajdu (1994). SEM analysis was carried out at the Instituto de Biofísica Carlos Chagas Filho and the Museu Nacional, both at the Universidade Federal do Rio de Janeiro, Brazil.

Twenty spicules of each category for each specimen were randomly selected and measured, except for oxeas (50 measurements) or in cases in which more measurements were necessary to precisely establish size ranges for the other spicule types. An exhaustive search for maximum and minimum ranges was done. Spicule dimensions are presented as minimum-mean-maximum length and width, in micrometres.

Abbreviations: MHNG, Museum d'Histoire Naturelle, Geneva; MNRJ, Museu Nacional, Rio de Janeiro; BMNH, Natural History Museum, London; SEPBOP, South-East Pacific Biological Oceanographic Program; SOSC, Smithsonian Oceanographic Sorting Centre; ZMAPOR, Zoological Museum of the University of Amsterdam, Porifera collection; ZIL, Zoological Institute of the Russian Academy of Sciences, St. Petersburg.

SYSTEMATICS

Class Demospongiae Sollas, 1885
Order Astrophorida Sollas, 1888
Family Pachastrellidae Carter, 1875
Genus *Poecillastra* Sollas, 1888

Definition. Pachastrellidae, whose microscleres always include streptasters in the form of spirasters and plesiasters, as well as microxeas in a single category (Maldonado, 2002).

Type species. *Poecillastra compressa* (Bowerbank, 1866: 55) (by original designation).

Poecillastra antonbruunae n. sp.
(Fig. 2, Table 1)

Type material: Holotype Chile: USNM 1109999; off Constitución (SEPBOP Expedition station 18A 697, 35º27'S 73º01'W), 290-450 m depth, coll. 'Anton Bruun' (SOSC), 09/viii/1966. Schizotypes MNRJ 9645, ZMAPOR 14932.

Comparative material. Poecillastra eccentrica Dendy and Burton, 1926 (BMNH 1926.10.1.95, holotype).

Diagnosis. Poecillastra with two categories of oxeas, the smaller one only up to 621 µm in length.

Description. The single known specimen is lamellate, 0.4 cm high, and 6×5.2 cm in diameter (Fig. 2A). Both surfaces are rough to the touch, hispid, with projecting oxeas (*ca*. 1000 µm beyond the surface), and with a great number of pores that seem to be oscules (0.5-1 mm in diameter) on one side, while the other side has fewer pores. The sponge is firm and incompressible. Colour is dark beige in ethanol.

Skeleton: Ectosomal skeleton is composed of abundant spirasters and microxeas, but also contains oxeas and calthrops. The smaller oxeas are principally present in the ectosome, although not forming a crust. Choanosomal skeleton confused and crossed by aquiferous channels, with oxeas and calthrops more abundant than in the ectosome.

Spicules (Fig. 2B-H): Megascleres are oxeas in two categories and calthrops. Oxeas I slightly curved, with acerate tips sharpening gradually, 972-1924.2-3060 µm long and 14-36.9-53 µm thick. Oxeas II (mostly ectosomal) smooth, slightly curved, 262-401.6-621 µm long and 10-14.6-24 µm thick. Calthrops, mostly equiangulated, with equal rays, actines 242-423.4-572 µm long and 17-27.4-36 µm thick. Microscleres are spirasters 15-17.7-24 µm long; and acanthomicroxeas, straight or occasionally slightly curved, 73-99.9-136 µm long and 4-4.6-6 µm thick.

Etymology. The new species name "antonbruunae" is in honour of the ship "Anton Bruun", whose crew collected this species. We opted for female gender termination as ships are usually referred to as "she".

Distribution. Known only from its type locality, off Constitución, central Chile.

Remarks. The new species is closely related to *Poecillastra schulzei* (Sollas, 1886, *sensu* Sollas, 1888) in its spicule composition (see Table 1). Nevertheless, the status of *P. schulzei* and its alleged synonyms has been the subject of a long debate, still in need of some clarification. *Poecillastra schulzei* was considered to be conspecific with *P. compressa* (Bowerbank, 1866) by some authors (Topsent, 1894; Burton, 1930). Recently, however, Maldonado (2002) re-examined the type of the former and determined its validity on the basis of the possession of two categories of oxeas, as opposed to only a single category in *P. compressa*. *Poecillastra tenuilaminaris*, suggested by Burton (1959) to be a likely synonym of *P. schulzei*, has been considered a valid species by Maldonado (2002) on the basis of its lack of slender ectosomal oxeas. According to Maldonado, *Poecillastra schulzei* is an Indo-Pacific/Southern Ocean species (but see below), and *P. tenuilaminaris* is a North Pacific one.

Poecillastra laminaris (Sollas, 1886) and *P. eccentrica* Dendy and Burton, 1926, from the Indo-Pacific region, were also regarded as possible junior synonyms of *P. schulzei* by Maldonado (2002). The proposed likely synonymy of tropical species of *Poecillastra*, *P. eccentrica* and *P. laminaris* with the originally subantarctic *P. schulzei,* though supported by re-examination of the relevant type material (Maldonado, 2002), implies accepting a considerable morphologic variability and a marked eurybathyal distribution in the concept of "*P. schulzei*". *Poecillastra eccentrica* was originally reported with much larger calthrops, a varied set of triaenes, smaller asters, and completely lacking rough microxeas (Dendy and Burton, 1926). Maldonado (2002) had the opportunity to examine microscopic preparations of this species, but unfortunately provided very few arguments to support this proposed synonymy. Re-examination of the holotype of *P. eccentrica* (BMNH 1926.10.1.95; two spicule slides and two thick section slides) revealed the presence of microxeas as well as larger oxeas, both overlooked by Dendy and Burton (1926). We concluded from the confirmed presence of relatively larger calthrops that *P. eccentrica* is a valid species. Conversely, *P. laminaris* was originally described with trichoxeas representing a second category of much larger and slender oxeas, a trait not present in *P. schulzei*. Additionally, *P. laminaris* possesses relatively smaller asters, and occurs in a much deeper and more distant habitat. Consequently, this proposed synonymy should also be verified through re-examination of type material, which has not been possible here. We consider *P. schulzei* to be a subantarctic species, characterized by possession of two categories of oxeas rather well differentiated in terms of length and thickness (Table 1), triaenes in two forms (larger orthotriaenes and smaller calthrops), microxea, metasters and spirasters. It ap-

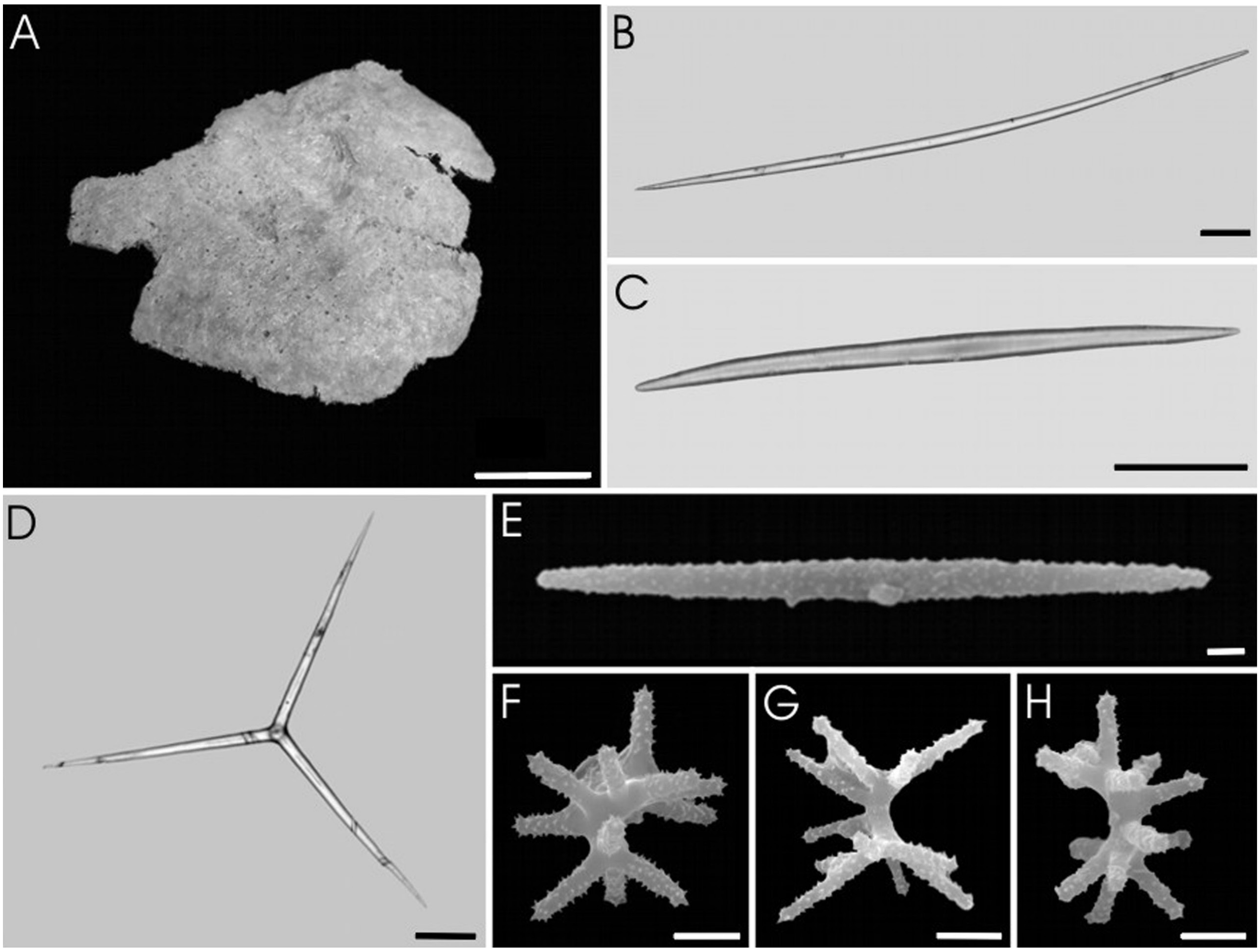

FIG. 2. – *Poecillastra antonbruunae* n. sp. A, schizotype (MNRJ 9645). B, Oxea I. C, Oxea II. D, Calthrops. E, Acanthomicroxea. F-H, Spirasters. Scale: A, 1 cm; B-D, 100 µm; E-H, 5 µm.

proaches the new species as both possess two categories of oxeas and calthrops as megascleres, as well as spirasters as microscleres. However, they differ in the presence of orthotriaenes and metasters in *P. schulzei*. Additionally, oxeas I in the new species are slightly smaller and thinner.

None of the alleged synonyms of *P. schulzei* cited above approaches our new species as closely as Sollas's original material. The other new species described from this region are discussed further below.

Poecillastra maremontana n. sp.
(Fig. 3, Table 1)

Type material. Holotype, Chile: IZUAPOR-0130; Juan Fernandez 2 seamount (33°36'37.2"S 77°41'46.2"W, Juan Fernandez Archipelago), 338-414 m depth, coll. R. Vega ('Portugal II'), 27/vii/2007. Schizotype MNRJ 12563.

Diagnosis. *Poecillastra* with three categories of oxeas, three categories of streptasters (one of spirasters and two of plesiasters), one category of calthrops and centrotylote microxeas.

Description. The single known specimen is lamellate and consists of fragments (Fig. 3A), the largest one 7×4.7×0.5 cm (height×length×thickness). The surface is hispid with several scattered oscules (up to 1.5 mm in diameter). These oscules are more visible on one side of the sponge than the other. The colour is white in ethanol.

Skeleton: Ectosomal skeleton has no specialization, apart from a dense concentration of all microscleres around the pores. Choanosomal skeleton confused with scattered oxeas I, II and III. Calthrops, plesiasters, and spirasters are scattered through the ectosome and choanosome.

Spicules (Fig. 3B-J): Megascleres are oxeas in three categories and calthrops. Oxeas I, slightly curved, mostly with acerate tips (rarely with one or both tips rounded), 1516-3432 µm in length and 24-42.2-54 µm in width. Oxeas II, slightly curved, mostly with acerate tips (rarely with one or both tips rounded), 315-1401 µm in length and 10-21.6-34 µm in width (oxeas shorter than 500 µm are very rare). Oxeas III, extremely thin, with acerate tips, always in tracts, more than 4600 µm in length and 5-10.2-12 µm in width. Calthrops, usually

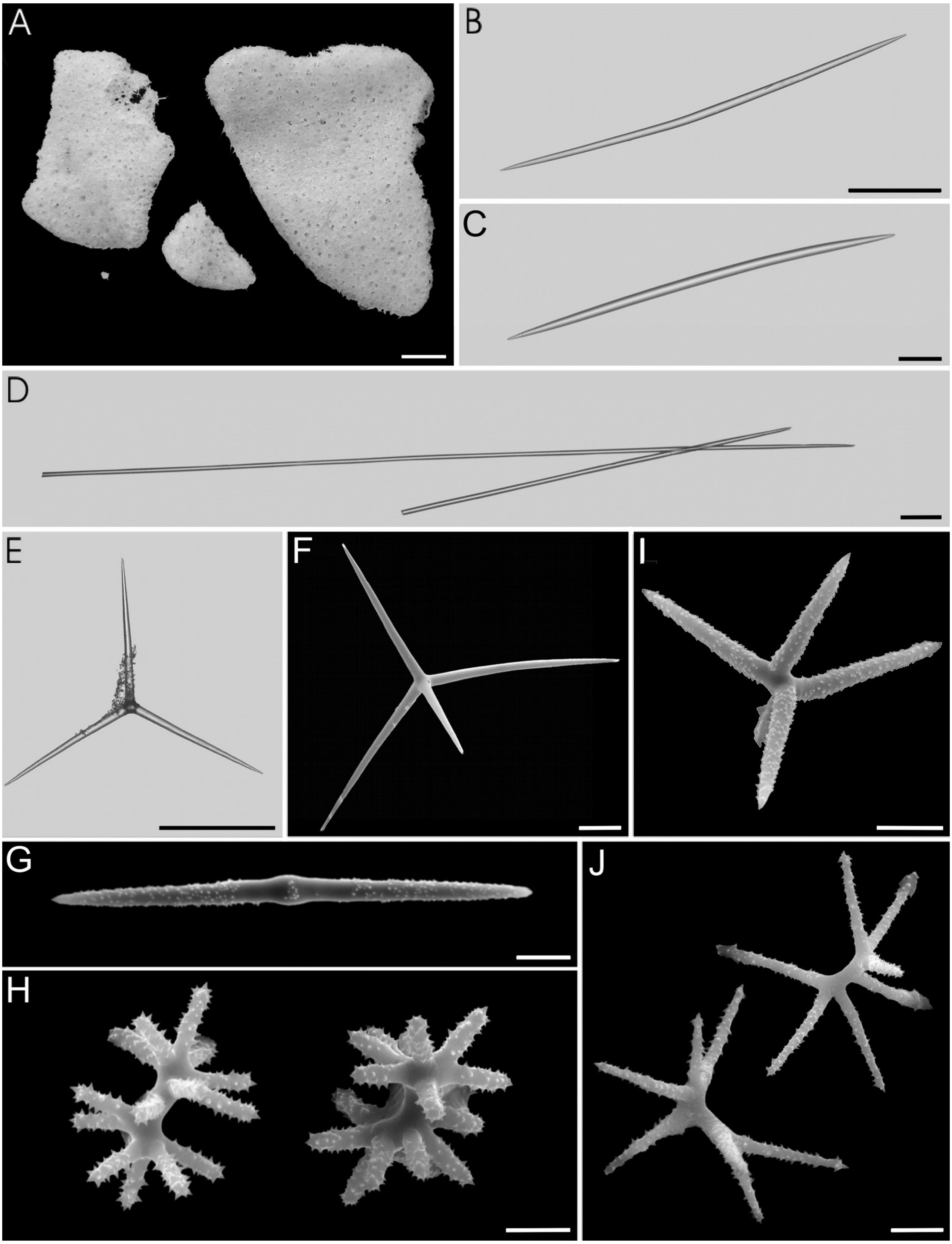

FIG. 3. – *Poecillastra maremontana* n. sp. A, schizotype (MNRJ 12563). B, Oxea I. C, Oxea II. D, Oxea III (broken). E-F, Calthrops. G, Acanthomicroxea. H, Spirasters. I, Plesiaster I. J, Plesiasters II (metasters). Scale: A, 1 cm; B, 500 µm; C-F, 100 µm; G, I, 10 µm; H, J, 5 µm.

equiangulated, with equal rays, actines 272-494.2-776 µm in length and 19-30.5-39 µm in width. Microscleres are slightly curved and centrotylote acanthomicroxeas, 106-126.1-158 µm in length and 2.4-4.4-5 µm in width; spiraster 14-16.5-22 µm in length; and two categories of plesiaster with 26-45.5-74 and 17-24.3-31 µm (ranging from plesiaster to amphiaster).

Etymology. The specific epithet refers to the species seamount habitat ("mare", Latin for sea, "montana", Latin for montane).

Distribution. Currently known only from its type locality – Juan Fernandez seamounts, Chile.

Remarks. Aside from this new species, only two other species of *Poecillastra* possess three categories of oxeas: ***P.*** *japonica* (Thiele, 1898) and *P. tenuilaminaris sensu* Green and Bakus (1994) (see Table 1).

Poecillastra japonica has larger oxeas, approximately the same length as those in this new species but 5-6 times stouter. The intermediary sized oxeas are also much stouter in *P. japonica* than in the new species, and the smaller oxeas are larger than 2500 µm, whereas in the new species the smallest oxeas are only 315 µm. The new species has two plesiasters, with *P. japonica* reportedly having only a single category.

Green and Bakus (1994) described a specimen of *P. tenuilaminaris* from California with three categories of oxeas, similar to our new species, whereas previous records noted only one category (Sollas, 1888; de Laubenfels, 1932). Nevertheless, oxeas in the new species are much longer, the largest category reaching over 4600 µm in length, while the oxeas in the Californian sponge are smaller than 2750 µm in length.

Three categories of oxeas, one of them larger than 4600 µm, three categories of streptasters (one of spirasters and two of plesiasters), one category of calthrops and centrotylote microxeas distinguish *Poecillastra maremontana* n. sp. from all other species of the genus.

Poecillastra sinetridens n. sp.
(Figs. 4, Table 1)

Type material. Holotype, Chile: MHNG 34993; off Zapallar (Valparaiso, 32º33'S 71º43'W), 300 m depth, leg. H. Andrade, 09/iv/1979. Schizotype MNRJ 9392.

Comparative material. Poecillastra compressa antarctica Koltun, 1964 (holotype, ZIL 10862).

Diagnosis. Poecillastra without calthrops or any other kind of triaenes. Oxeas always larger than 3000 µm long, and microxeas can be over 300 µm long.

Description. The single specimen consists of two fragments, the largest one 2.5×1.5×1 cm in size (Fig. 4A). The irregular surface is rough, sometimes hispid with large oxeas projecting through it (3000 µm beyond the surface). The sponge is soft and compressible. The colour is beige in ethanol, with some darker spots.

Skeleton: Ectosomal skeleton has no specialization. It is a tangential layer of microxeas with a marked concentration of spirasters and plesiasters, the former being more abundant. Choanosomal skeleton confused. Spirasters and plesiasters are also present, with plesiasters being more abundant in this region. Microxeas are found in a smaller quantity.

Spicules (Fig. 4B-H): Megascleres are oxeas in a single size category, smooth, slightly curved, with acerate tips sharpening gradually (rarely with one rounded tip), 3003-4253.4-5720 µm long and 48-68.4-82 µm thick. Microscleres are slightly curved acanthomicroxeas, 97-213.9-349 µm long and 2.4-4.9-8 µm thick. Spirasters 17-19.2-22 µm long, and plesiasters 15-24.0-32 µm long.

Etymology. The new species is named "sinetridens" due to its unique character of lacking calthrops or any other type of triaenes, which occur in all other species of the genus (sine, Latin for without; tridens, trident).

Distribution. So far known only from its type locality, off Zapallar, central Chile.

Remarks. The possession of asters is a widespread feature within the order Astrophorida. Sponges belonging to the Pachastrellidae typically have streptasters, microxeas (in most cases) and microrhabds as microscleres (see Table 1). Megascleres include a varied set of tetraxons (Maldonado, 2002). Most genera of Pachastrellidae have calthrops and/or triaenes. The occurrence of microxeas in a single category and streptasters including plesiasters indicates that this new species belongs to Pachastrellidae. The apparent absence is assumed to be a secondary loss of triaenes in this new species. This is unique and as such its allocation to *Poecillastra* requires further discussion.

Five out of the 12 currently valid genera of Pachastrellidae (Maldonado, 2002) are ruled out on the basis of their microscleres: absence of microxeas in *Pachastrella* Schmidt, 1868 and *Thenea* Gray, 1867; and possession of different kinds of microscleres in *Acanthotriaena* Vacelet, Vasseur and Lévi, 1976 (raphides), *Dercitus* Gray, 1867 (toxas), and *Stoeba* Sollas, 1888 (microrhabd-like sanidasters). Four genera are excluded on the basis of their megasclere morphology: *Ancorella* Lendenfeld, 1906 has strongyloxeas transitional to strongyles; *Brachiaster* Wilson, 1925 has short-shafted triaenes and/or mesotriaenes that become mesotrider desmas; *Cladothenea* Koltun, 1964 has cladotyles; and *Triptolemma* de Laubenfels, 1955 has exclusively short-shafted mesotriaenes with diversely branched cladi. *Vulcanella* Sollas, 1886 possesses specialized cribriporal oscula and one or more microsclere categories bearing an annulate decoration (Maldonado, 2002). *Characella* Sollas, 1886 also contains species with streptasters and microxeas as microscleres. However, the fact that the streptasters in

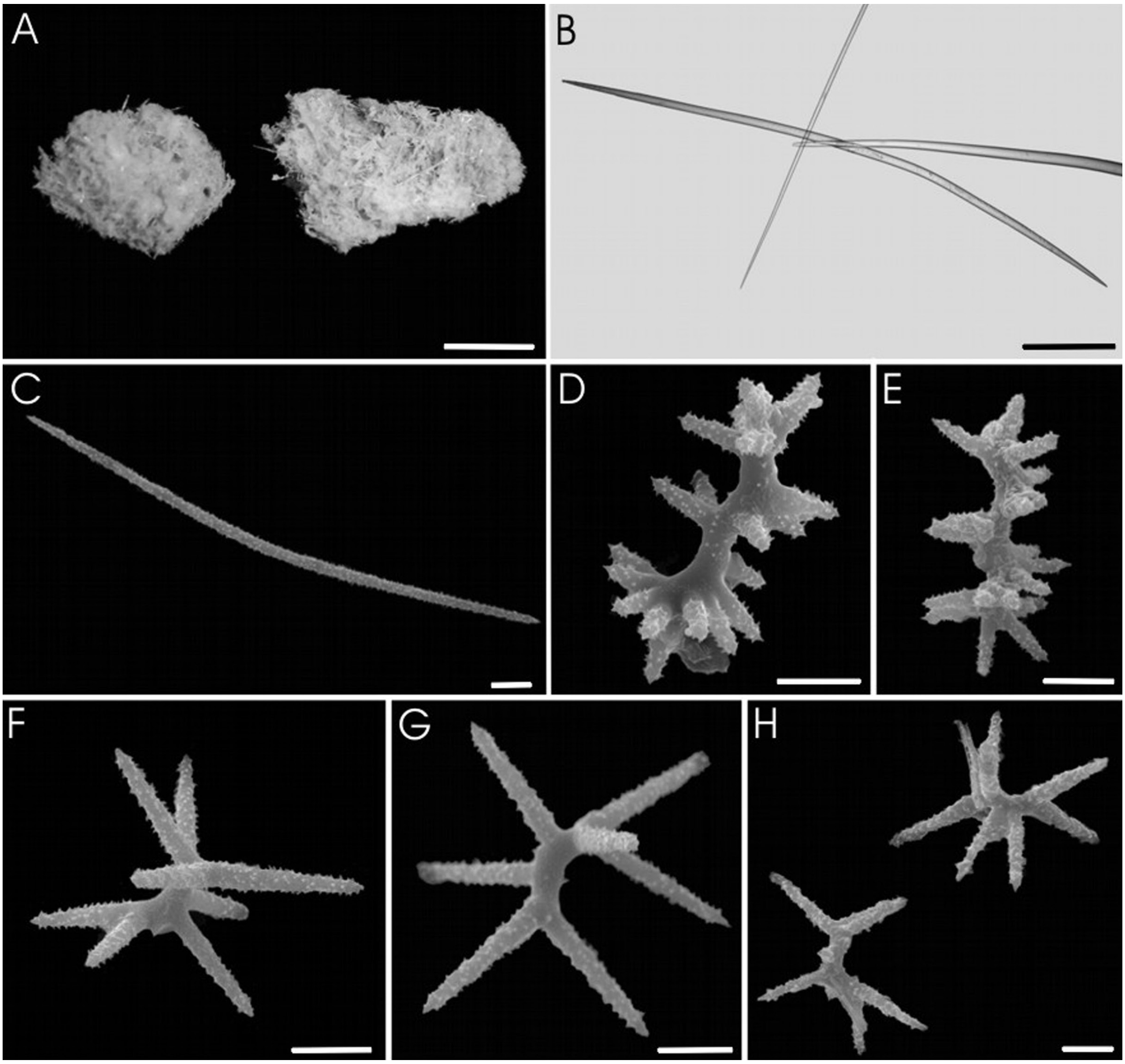

FIG. 4. – *Poecillastra sinetridens* n. sp. A, schizotype (MNRJ 9392). B, Oxeas. C, Acanthomicroxea. D-E, Spirasters. F-H, Plesiasters (F, H, metasters). Scale: A, 1 cm; B, 500 µm; C-H, 5 µm.

Characella are never spirasters, and that its microxeas are always in at least two size categories, also excludes the assignment of the new species to this genus Lerner *et al.* (2004) and Esteves and Muricy (2005) described new species recognizable, among other traits, by the absence of microscleres (*Guitarra sepia* Lerner, Hajdu, Custódio and van Soest 2004 and *Stelletta anasteria* Esteves and Muricy, 2005). While this assumed secondary loss of triaenes is a negative attribute, and unwisely applied at the genus level, we contend it is a valid species trait. The decision to allocate the new species in *Poecillastra* stems from its possession of a set of microscleres which comprises spirasters, plesiasters and acanthose microxeas in a single category, precisely matching the characteristic of other species in this genus.

At the species level there are five species that have the same spicule set as *Poecillastra sinetridens* n. sp., aside from the presence of calthrops absent in the new species, viz. one category each of oxeas and microxeas, and two categories of streptasters. These are *P. antarctica* Koltun, 1964 (as *P. compressa a.*, see below); *P. compressa*; *P. eccentrica*; *P. laminaris* (*sensu* Lévi and Lévi, 1989 [not *sensu* Sollas (1888), with two categories of oxeas]); and *P. tenuilaminaris* (not *sensu* Green and Bakus, 1994 [with three categories of oxeas]).

Poecillastra compressa sensu Boury-Esnault and van Beveren (1982) has oxeas which can be considerably shorter (*ca*. 1000 µm) than those of the new species. It also has a third category of asters reaching 80 μm in length, not seen in the Chilean species. *Poecillastra compressa sensu* Pulitzer-Finali (1993) has oxeas reaching only 3500 μm in length, as well as microxeas which are smaller than 135 μm, and is thus quite distinct from the new species. *Poecillastra antarctica* and *P. eccentrica* (both holotypes re-examined, ZIL 10862 and BMNH 1926.10.1.95, respectively) have oxeas as large as those in *P. sinetridens* n. sp., although both possess smaller microxeas, up to 190 μm in length only. In addition, oxeas in *P. eccentrica* can be very small, *ca*. 420 μm in length.

Poecillastra laminaris sensu Lévi and Lévi, 1989 has smaller microxeas and metasters with a much smaller size range than *P. sinetridens* n. sp. Sollas's (1888) sponge differs in having two categories of oxeas, the smaller one up to 3500 μm long only, while the new species has oxeas always longer than 3000 μm, and sometimes longer than 5000 μm. Additionally, Sollas's material was reported to possess trichoxeas, clearly differentiating it from the new species.

Finally, *P. tenuilaminaris* (*sensu* Sollas, 1888; Lebwohl, 1914) has smaller oxeas and microxeas and was also reported from greater depths off Japan, so it differs both morphologically and biogeographically from the new species. Additional records of *P. tenuilaminaris* need further comments. Dendy's (1916) description appears to concern a distinct taxon. He outlined seven points of divergence between the Indian and Sollas's (1888) original description (from Japan). Significant among these are the presence of long hair-like oxeas, the smaller size of the metasters which show no tendency to pass into plesiasters, and the rarer tetraxons and microxeas in Dendy's specimen. Further distinction stems from the possible shallow water habitat of his specimen, collected in the tropical islands of the Amirantes Archipelago, where the fauna has very little in common with that of Japan. Dendy's sponge appears to more closely resemble *P. laminaris* from Indonesia, which also possesses a second category of large hair-like oxeas. No striking morphological distinction is apparent when the two descriptions are compared, and the main trait setting them apart is the relatively deep water habitat of *P. laminaris*. Both specimens need to be compared in greater detail to correctly allocate Dendy's specimen. *Poecillastra tenuilaminaris* has also been recorded from California in a series of publications (de Laubenfels, 1932; Dickinson, 1945; Green and Bakus, 1994). Judging from each of the descriptions, these appear to conform to the Japanese population, making the species highly disjunct. A thorough revision of morphological characters, especially a detailed SEM study of asterose microscleres is required to verify the status of these populations.

In spite of the greater or lesser diagnostic trends noted above when *P. sinetridens* n. sp. was compared with other species, the main immediate diagnostic feature is the absence of triaenes.

DISCUSSION

Spicule loss

Tetractinellid sponges (Astrophorida and Spirophorida, *sensu* Borchiellini *et al*., 2004) are mainly characterized by the possession of tetractinal megascleres and microscleres (asterose forms and derivatives) (Hooper and van Soest, 2002), though examples of whole evolutionary lineages which have lost one or more of these diagnostic features are known (e.g. *Asteropus* spp., *Jaspis* spp.). According to Hooper and van Soest (2002), microscleres are the major taxonomic characters in tetractinellids, but even these may be totally absent (e.g. *Stelletta anasteria*).

Hooper and van Soest (2002) have recognized eight genera belonging to Astrophorida with a reduction or total loss of triaenes. Six of them belong to Ancorinidae (*Jaspis* Gray, 1867; *Asteropus* Sollas, 1888; *Dorypleres* Sollas, 1888; *Holoxea* Topsent, 1892; *Melophlus* Thiele, 1899; and *Rhabdastrella* Thiele, 1903), one to Pachastrellidae (*Characella* Sollas, 1886), and *Lamellomorpha* Bergquist, 1968, which is *incertae sedis* as to family allocation. Most of these genera have a tangential layer of megascleres in the ectosomal skeleton (e.g. *Asteropus*, *Holoxea*, *Jaspis*, *Lamellomorpha* and *Melophlus*; cf. Hajdu and van Soest, 1992), which may substitute for any possible structural integrity shortcoming arising from the loss of triaenes. Currently, this recurrent pattern is not judged synapomorphic, so the development of a variously neat tangential layer of oxeote megascleres in these genera might be understood as a possible convergent response to solve the likely parallel problem of triaene loss.

Comments upon other *Poecillastra*

Koltun (1964) did not mention the presence of microxeas in the original description of *P. compressa antarctica*, which would prevent the classification of this subspecies in *Poecillastra*. However, the re-examination of its holotype (ZIL 10862) revealed the presence of these spicules (Table 1), straight to very curved. Remarkably, no single morphological character observed by us in the fragment of the holotype re-examined matches the description of Koltun, which makes us wonder whether we have observed the same sponge. It is noteworthy that the micrometric values obtained here for the oxeas and plesiasters (metasters *sensu* Koltun, 1964) were much larger than values originally reported by Koltun. In spite of this confusion, these larger spicules serve the purpose of establishing the status of *P. compressa antarctica* as distinct from typical *P. compressa*. We prefer to raise Koltun's subspecies to full species status, *P. antarctica*, because the meaning of subspecies ranking in sponge classification is absolutely not agreed upon (Lopes *et al*., in press), and emphasizing the markedly allopatric distribution of both. *P. compressa sensu* Boury-Esnault and

TABLE 1. – Comparative table of micrometric and distributional data for the species of *Poecillastra* of the world, including the three newly described eastern Pacific species. Measurements are expressed in µm, as minimum-mean-maximum length/width value whenever available.

Species	Oxeas	Triaenes	Microxeas	Asters	Habit; distribution; depth [morphologic assemblages*]
P. antonbruunae n. sp. USNM 1109999	I. 972-1924.2-3060/ 14-36.9-53 II. 262-401.6-621/ 10-14.6-24	Ca: 242-423.4-572/ 17-27.4-36	73-99.9-136/ 4-4.6-6	Sp: 15-17.7-24	Lamellate; Chile; 290-450 m
P. maremontana n. sp. IZUAPOR-0130	I. 1516-3432/24-42.2-54 II. 315-1401/10-21.6-34 III. >4600/5-10.2-12	Ca: 272-494.2-776/ 19-30.5-39	106-126.1-158/ 2-4.4-5	Sp: 14-16.5-22 Pl I: 26-45.5-74 Pl II: 17-24.3-31	Lamellate; Chile; 338-414 m
P. sinetridens n. sp. MHNG 34993	3003-4253.4-5720/ 48-68.4-82	Absent	97-213.9-349/ 2-4.9-8	Sp: 17-19.2-22 Pl: 15-24.0-32	Lamellate; Chile; 300 m
P. amygdaloides (Carter, 1876)	1651/14	Tr: 706/56	I. 25-127 II. "the same but smaller", centrotylotes	"Aster"	Almond shaped; near Portugal (Cabo São Vicente), Atlantic Ocean, 534 m
P. amygdaloides (Carter, 1876), *sensu* Sollas (1888)	1620/14	Tr: 700/60	115	Sp: 31.6 (to Me)	
P. amygdaloides, *sensu* Pulitzer-Finali (1983)	1200-1600/11-13.5 (rare)	Tr: 650/37	Rarely centrotylotes 65-140/1.5-5.5	Me: 10-40	Globose or massive, off Calvi Mediterranean; 139-200 m
P. antarctica Koltun, 1964 (orig. descr.)	3200-3700/27-52	Ca: 420-1100/20-60 Or: with strongly shortened stalks.	No measures	Me (length of rays): 30-80 Am or Sp: 14-26	Digitiform; Antarctic shores (Wilkes Land); 510-860 m
P. antarctica Holotype remeasured	Larger than 5290/29-42.4-58	Ca: 800-971.2-1175/ 43-54.6-68	130-158.2-190/ 4.8-5.0-6	Sp1: 17-22.1-28 (sharp tip) Sp2: 12-15.5-18 (round tip) Pl: 55-87.5-130	
P. antarctica, *sensu* Boury-Esnault and van Beveren (1982) as *P. compressa*	1033-5075/12-52	Ca: 227-1247/26-40	76-221/5-7	Me: 12-31 Sp: 8-19 Pl: 42-83 (4-5 actines)	Erect, vasiform or digitate; Kerguelen; 172-315 m
P. ciliata Wilson, 1925 (orig. descr.)	I. 2000-3500/70-80 II. 850-8	Di: rhabdome 450/70; protocladi 100/70; deuterocladi 360	I. 160-220/6 II. 32-40/4 (dermal)	St (am/pl): 16-30	Lamellate; Philippines
P. compressa (Bowerbank, 1866), *sensu* Sollas (1888)	1600-1900/30-45	Or/Ca: 170-320/250 (cladi)	140-200	Pl: 28 Sp: 20	Plate-shaped or cup-like; Shetland, west of Scotland and Hebrides, Queen Charlotte Islands, N America; 201 m
P. compressa, *sensu* Lévi and Vacelet (1958)	1400-2000/22-23	Ca: rare	180-190/4-5	Ox: 28-40 Sp: 12-18	Massive; Atlantic, Mediterranean
P. compressa, *sensu* Lévi (1963)	1100-2400/30-40	Ca: 300-350/30-35	100-110/5	St: 15-16 Sp: 12-15	Plate-like; N Atlantic, Azores, Mediterranean, Antartic; 309 m
P. compressa, *sensu* Pulitzer-Finali (1983)	300-1500	Ca: 150-300	70-160	Pl, Am, Sp: 10-30	Flattened; off Calvi, Mediterranean; 123-155 m
P. compressa, *sensu* Pulitzer-Finali (1993)	Up to 3500/60	Ca: 190-650	100-135/5.5	Me: 26-28 Sp: 14	Lamellate; North Kenya; 210 m
P. compressa, *sensu* Boury-Esnault *et al.* (1994)	800-1027-1310/ 24-27-30	Ca: 170-308.5-450/ 14-22-35	90-123-185/4-6-7	Am, Me, Pl: 8-35	Plate-like; Alboran Sea, W Mediterranean; 293-1510 m
P. compressa, *sensu* Maldonado (2002)	960-2080/15-35	Ca and Or (with short shaft): 125-400/10-20	125-200/3-5	Pl (to Am): 35-55/ 12-15(actines) Sp: 15-25	Plate-like, cup-like, rarely encrusting or massive; NE Atlantic and Mediterranean

TABLE 1 (cont.). – Comparative table of micrometric and distributional data for the species of *Poecillastra* of the world, including the three newly described eastern Pacific species. Measurements are expressed in µm, as minimum-mean-maximum length/width value whenever available.

Species	Oxeas	Triaenes	Microxeas	Asters	Habit; distribution; depth [morphologic assemblages*]
P. crassiuscula (Sollas, 1886), *sensu* Sollas (1888)	2856/58	Ca: 650/48 (rare) Or (rare): rhabdome 678/38.7; cladi 607/38.7	136/3.95	Me: 19.8/1.97 (to Pl) Sp: 19.7	Plate-like; Azores, Cape Verde; 183-234 m
P. cribraria Wilson, 1904 (orig. descr.)	I. 2500/40 II. 3500/10	Or (rare): cladi 380/30; rhabdome 200/30	180/4	Sp: 16 Pl: 24	Plate-like; Galapagos; 97 m
P. cribraria Wilson, 1904, *sensu* Desqueyroux-Faúndez and van Soest (1997)	448-1554-2000/18-22-35	Or (rare): cladome 500-579-664; rhabdome 100-200/13-18-26	112-136-171/ 2-3-5	Sp: 10-12-13 Pl: 13-18-26	Lamellate, linguiform; Galapagos; 95 m
P. cribrum (Lebwohl, 1914) (orig. descr.)	1000-2200/25-45 (rarely styles)	Pc: 270-580; clade 120-530; 22-55	80-150/5-7	Me I: 30-40 Me II: 16-21	Japan; 65-180 m
P. cumana Vosmaer, 1894 (orig. descr.)	Slender than those of *P. fragilis*	Ca: Varying in shape An: very rare	Smaller than those of *P. fragilis*	Ox: very abundant	Resembles a leaf of a water-lily; W-Mediterranean; 150 m
P. dilifera (de Laubenfels, 1934) *sensu* Dickinson, 1945	2000/50	Ca: 500/70	200/3	Me: 40	Gulf of California; 250 m
P. eccentrica Dendy and Burton, 1926 (orig. descr.)	I. 420-4200/13-55 II. Style and Tylostyle (evidently abnormal derivatives of the large oxea) III. Amphitylote (once observed; derivative)	Ca: 1000/76 Md/Mo	Absent	Pl: 23 Sp: smaller	Flat plate or plate-like; Andaman S, C Indian Ocean; 237-457 m
P. eccentrica (holotype remeasured)	486-2045.6-4605/10-38.1-58	Ca: 229-610.6-1030/ 19-33.9-49	97-121.2-160/3.6-4.6-6	Pl: 15-23.2-30 Sp: 11-13.6-18	
P. fragilis Vosmaer, 1894 (orig. descr.)	Stout or slender, straight or curved	Ca: Varying in shape An: very rare	Frequent spined	Ox: not very frequent Pl and Sf	Flat cake; W Mediterranean; 150-200 m
P. fusca (Lebwohl, 1914) (orig. descr.)	I. 1000-1700/14-42 II. 2000/10-12	Pg: 150-600/12-42; clade 105-470/12-42 (=Ca)	100-135/5-6	Me I: 22-28 Me II: 14-18 (Sp)	Plate-like; Japan
P. incrustans Sollas, 1888 *sensu* Topsent, 1913	770-1400/8-17	Ca: 40-400/45	90-130/3	Sp (Am rares and Me): 17	Thick crust; Gough Island, Antarctic
P. incrustans *sensu* Lévi and Lévi, 1989	770-1400/8-17	Ca: 40-400/45	Centrotilotes	Sp, Me	Tristan da Cunha; Gough Island (Antarctic); 180 m
P. incrustata (Bergquist, 1968) (orig. descr.)	I. 1450-1860-2620/30-38-46 II. 1200-1800/2.6-3	Ca: 189-397-500/ 20-40-50; cladome 339-562-700	90-139-170/4-4.6-5	Me: 17-29-38 Sp: 11.5-14.8-17	Encrusting; New Zealand; 183 m and 55-110 m
P. japonica Thiele, 1898 (orig. descr.)	I. 5000/65 II. 3000-3500/110 III. 2500	Ca: 750/550	180-270/8 (microrabd)	Sp: 15-20	Japan; 300 m
P. laminaris (Sollas, 1886), *sensu* Sollas (1888)	I. 3500/51.6 II. 5300/8	Ca: 636/63 Or: rhabdome 678/60; cladi 357/60	145/4	Me (to Pl): 19.7 Sp: 19.7	Lamellate; off Indonesia; 1830 m
P. laminaris, *sensu* Lévi and Lévi (1989)	2700-4400/50-100	Ca: rhabdome 500-1000/45-90; cladi 500-800/45-90	140-160/3	Me: 20-25 Sp: 15-20	Lamellate; Indonesia, New Caledonia; 185-198 m
P. nana Carter, 1880 (as *Tisiphonia*) (orig. descr.)	381/14.1	Dc: 84.6/43.3 Head 705 (diameter)	56.4	"Stellate flesh spicule": 12.7	Laminiform; Gulf of Manaar, C. Indian Ocean
P. rickettsi de Laubenfels, 1930, *sensu* de Laubenfels, 1932	I. 3700/65 II. 17000/15-30	Ca: 450-650/50-70	170-270/4-5	Pl: 14-18 Sp or Me: 10-13 Toxas (proper?)	Plate-like; California; 800 m

TABLE 1 (cont.). – Comparative table of micrometric and distributional data for the species of *Poecillastra* of the world, including the three newly described eastern Pacific species. Measurements are expressed in µm, as minimum-<u>mean</u>-maximum length/width value whenever available.

Species	Oxeas	Triaenes	Microxeas	Asters	Habit; distribution; depth [morphologic assemblages*]
P. rudiastra Pulitzer-Finali, 1983 (orig. desc.)	720-1250/16-24	Ca: 120-200 Di (1 observed) An: rhabdome 8-12 thick/cladome 60-80	50-150/2-3	Sp: 13-20 Me: 14-50	Shapeless; off Calvi, Mediterranean; 135 m
P. rudiastra sensu Maldonado (1996) -holotype re-measured	700-1250	Ca: 120-650/25-37 An: 1000/12-18; cladomes 30-45/8-15	75-150/2-3.5	Sp: 18-25 Me: 18-25 Am and Pl: 15-25/2-2.5	W Mediterranean
P. saxicola Topsent, 1892 (as *Characella*) (orig. desc.)	1500	Ca: 300	120-130		Encrusting; France, Mediterranean; 25-30 m
P. schulzei (Sollas, 1886), *sensu* Sollas, 1888	I. 3570/71 II. 428/13	Ca: 400/4 Or: rhabdome 714/71; cladi 357	129/3.95	Me: 31.6 Sp: 20	Plate-like, erect, flabelliform or vasiform; Heard Islands, Sub-Antartic; 274.5 m
P. scrobiculosa (Lebwohl, 1914) (orig. descr.)	I. 700-3200/20-70 II. 2000-5000/10-22 III. 360-2250/20-95 (tylostyle) IV. 550-1250/52-110 (strongyle)	Or: 200-800/25-65 (, Ca)	140-210/6-7.5	Me I: 20-50 Me II: 15-20 “Sphaeres”: 45-120	Plate-like; Japan; 350-950 m
P. stipitata Lévi, 1993 (orig. desc.)	I. 2400-3000/22-28 II. 800-1300/8-20	Oc and Pc: 250-500/20-40	150-270/4-5	Me Sp: 15-20 Me Pl: 18-35 (actines)	Erect, pedunculate; New Caledonia; 675-700m
P. symbiotica Topsent, 1904 (orig. desc.)	1400/25 - 2000/35	Or and Di: 1200-1800/25	70-110/1.5-2	Me and Sp: 15	Endobiont, thin; Mediterranean-Atlantic; 550 m
P. tenuilaminaris (Sollas, 1886), *sensu* Sollas (1888)	3400/42	Ca/Or: 500 (rhabdome) 464 (cladi)	136/5	Me (to Pl): 23.7	Lamellate; Sagami Bay, Japan; 1418 m
P. tenuilaminaris, *sensu* de Laubenfels (1932)	1350-2500/35-45	Ca: 350/40	135/3	Pl: 20-28 Me: 14-16	Lamellate; California, USA
P. tenuilaminaris, *sensu* Dickinson (1945)	3870/60	Ca: 450/50	145/3	Pl: 30 Me: 15	Thin, stiff; California, USA
P. tenuilaminaris, *sensu* Green and Bakus (1994)	I. 1550-2525/8-26 II. 530-1100/13-31 III. 1475-2750/29-78 IV. 675-2500/39-72 (styles)	Ca: 260-700/21-62 310-600/29-68 (derived triactines)	86-151/3-5	Me and Sp: 10-34	Lamellate; California, USA; 69-73.5 m
P. tenuirhabda Lendenfeld, 1907 (as *Chelotropaena*) (orig. desc.)	I. 7000-10000/8-25 II. 3200-4600/35-100 (styles and subtylostyles)	Ca: 300-900/30-70 Pg: 600-1400/40-75; cladi 200-400; cladome 320-630 Di: 420-900/30-80 (+ derivative forms)	I. 90-300/7-10 II. 125-200/1-2	Me	Massive; St. Paul (S Indian Ocean); 672 m
P. tuberosa Lévi, 1964 (as *Characella*) (orig. desc.)	I. 2800-3200/60-70 II. 1300-1800/30	Di: rhabdome 600-750/60-80; protoclades 125; deuteroclades 275-500/60	I. 92-90/4 II. 32-40	St: 20-22 Ss: 10-15	Massive, subcylindrical; South Africa; 430 m
P. wondoensis Sim and Kim, 1995 (orig. desc.)	I. 1320-1820/30-80 II. 1800-3500/3-10 III. 730-1120/38-75(styles)	Ca: 110-500/10-50 Pr: 2500 (clade 80)	150-250/5-10 48-80/2.5	Me: 15-20 Sp: 15	Thickly encrusting; Korea; 15-25 m

Legend: Ca, calthrops; Dc, dichoclathrops; Oc, orthoclathrops; Pc, plagiocalthrops; Tr, triod; Ti, triactine; Tt, tetractine; Or, orthotriaene; Di, dichotriaene; Pg, plagiotriaene; An, anatriaene; Pr, protriaene; De, diaene; Md, mesodiaene; Mo, monaene; St, streptaster; Sp, spiraster; Pl, plesiaster; Am, amphiaster; Me, metaster; Ox, oxyaster; Sf, spheraster; Ss, spirostreptaster. * see discussion (Evolutionary hypotheses).

van Beveren (1982) fits much better in *P. antarctica*, due to its possession of oxeas up to 5075 µm in length, calthrops of up to 1247 µm and one category of plesiasters of up to 83 µm.

Other records of *Poecillastra compressa* also need revision. Pulitzer-Finali (1983) reported an alleged *P. compressa* from the Mediterranean possessing oxeas as small as 300 µm in length; while Pulitzer-Finali (1993), working on materials from the northern Kenyan coast, reported oxeas up to 3500 µm in length and calthrops of up to 650 µm. These two specimens may belong to different species and should be re-analyzed in detail, which has not been possible here.

Poecillastra crassiuscula (Sollas, 1886) and *P. incrustans* Sollas, 1888 were suggested as junior synonyms of *P. compressa* by Maldonado (2002). We disagree with this proposal as oxeas in *P. incrustans* are thinner and have a smaller size range than in *P. compressa* (Table 1). *P. crassiuscula* has larger oxeas and tetraxons. In addition, tetraxons (calthrops/orthotriaenes) are also larger in *P. crassiuscula*. It would be interesting to revise the microscleres of the three species in SEM to figure how micromorphologic features vary among them, but we did not have access to these materials in this study. Boury-Esnault *et al.*'s (1994) redescription of *P. compressa*, is the only one in which SEM was used for the species above, and only a single spicule of each microsclere category was illustrated.

Poecillastra rickettsi was suggested as a likely synonym of *P. tenuilaminaris* by Maldonado (2002). Above we have already used the occurrence of hair-like oxea to argue for the unlikelihood of Dendy's (1916) specimen being properly identified in *P. tenuilaminaris*. *P. rickettsi* has the largest hair-like oxeas described from any species of *Poecillastra* (Table 1), being over 4 times larger than the largest oxeas reported from *P. tenuilaminaris* (3870 µm; Dickinson, 1945), and as such, deserving status as a valid species.

Five Pacific species of *Pachastrella* listed in the WPD (Van Soest *et al.*, 2008) are better assigned to *Poecillastra* (P. Cardenas, pers.comm.), viz. *P. cribrum* Lebwohl, 1914; *P. dilifera* de Laubenfels, 1934 [*sensu* Dickinson (1945)]; *P. fusca* Lebwohl, 1914; *P. incrustata* Bergquist, 1968; and *P. scrobiculosa* Lebwohl, 1914. According to Dickinson (1945), *P. dilifera* has microrhabds 200 µm long, better considered to be true microxeas. All these species possess microxeas instead of microrhabds (oval microstrongyles).

Evolutionary hypotheses

A few repetitive sets of spicules were found in species groups within *Poecillastra sensu* van Soest *et al.* (2008). These are as follows: (A) species bearing dichotriaenes [6 spp.: *ciliata, nana, rudiastra sensu* Pulitzer-Finali (1983), *symbiotica, tenuirhabda, tuberosa*]; (B) species with anatriaenes (3 spp.: *cumana, fragilis, rudiastra*); (C) species with disproportionately long oxeas (length >200x width, 7 spp.: *incrustata, laminaris, maremontana, ricketsi, scrobiculosa, tenuirhabda, wondoensis*); (D) species with two categories of microxea [*Characella*-like, 5 spp.: *amygdaloides sensu* Carter (1876), *ciliata, tenuirhabda, tuberosa, wondoensis*]; and (E) species bearing asterose microscleres reaching over 70 µm in diameter (2 spp.: *antarctica, maremontana*). The distinction between a true calthrops and an orthotriaene can be quite subtle when alleged rhabdomes are nearly as long as the cladi. For this reason, we preferred not to propose possible species groups among species bearing such triaenes, in the absence of their detailed revision. Fifteen species do not belong into obviously recognizable groups, which reflects the difficulty of performing phylogenetic analyses with these sponges on the basis of morphological characters alone.

Cross-checking assemblages for shared species allows one to recognize a triad of species corroborated by two congruent traits. *Poecillastra ciliata, P. tenuirhabda* and *P. tuberosa* share the possession of dichotriaenes as well as two categories of microxeas, which is suggestive of likely phylogenetic affinity. No additional congruent traits were observed.

Figure 5 shows the approximate distribution of each of these recognized morphological assemblages (A-E). Group (A) reflects an apparent relictual Tethyan distribution, and group (B) is restricted to the Mediterranean. The other groups are notorious for their largely disjunct distributions. This is the case too for the species triad highlighted above, occurring in the Philippines, Saint Paul Isl. and South Africa, and spreading across the southern Indian Ocean and western Pacific. Widespread Indo-West Pacific species are known from a variety of sponge genera (Hooper and Lévi, 1994; van Soest, 1994; van Soest and Hajdu, 1997; Fromont *et al.*, 2010). In many of these, several records punctuate the known distribution range of species [e.g. *Acarnus bergquistae* van Soest, Hooper and Hiemstra., 1991; *A. bicladotylus* Hoshino, 1981; *A. wolffgangi* Keller, 1889; *Clathria procera* (Ridley, 1884); cf. van Soest *et al.*, 1991; Hooper and Lévi, 1994], so that discontinuity is not so striking.

Group (D) considerably matches the distribution observed in group (A), but records for the Mediterranean (*rudiastra, symbiotica*) and Central Indian ocean (*nana*) in (A) are replaced by a record for Korea (*wondoensis*) in (D), thus rendering group (D) more widespread, and less likely explained as a relictual Tethyan distribution. Group (C) has a nearly amphi-Pacific distribution, with an off-shoot in the southern Indian ocean. The complete absence of any Atlantic records here suggests that any phylogenetic signal present in this assemblage may be a consequence of trans-Pacific evolutionary tracks (e.g. Sluys, 1994; Hajdu and Desqueyroux-Faúndez, 2008).

Poecillastra vs. *Characella*

The number of categories of microxeas along with the form of streptasters seem to be the most obvious

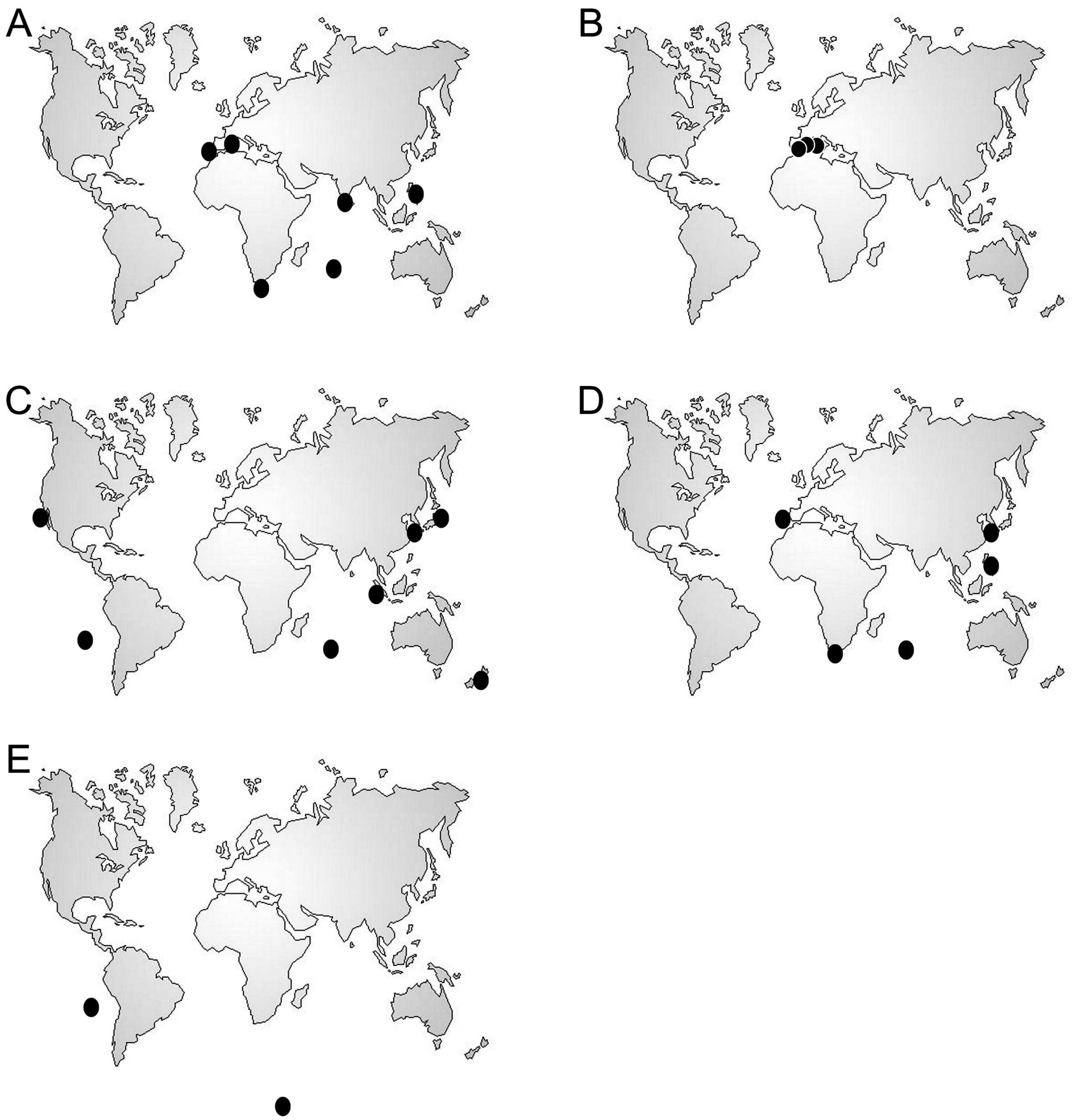

FIG. 5. – Approximate distribution of each assemblage in *Poecillastra* defined by shared sets of spicules. (A) species bearing dichotriaenes (6 spp.), (B) species with anatriaenes (3 spp.), (C) species with disproportionately long oxeas (length >200x width, 7 spp.), (D) species with two categories of microxea (*Characella*-like, 5 spp.), (E) species bearing asterose microscleres reaching over 70 µm in diameter (2 spp.).

characters to distinguish *Characella* and *Poecillastra*. The latter always includes streptasters with twisted shafts (amphiasters, metasters, plesiasters, spirasters and/or transitional forms), while in *Characella* streptasters have straight shafts (amphiasters, sanidasters and/or transitional forms) (Maldonado, 2002). Maldonado (1996, 2002) still emphasized the location of triaenes as diagnostic. These supposedly occur in the ectosome and choanosome in *Poecillastra*, but are restricted to subectosomal locations in *Characella*.

We recognize 28 species of *Poecillastra*, as briefly characterized in table 1: *P. amygdaloides*; *P. antarctica*; *P. antonbruunae* n. sp.; *P. compressa*; *P. crassiuscula*; *P. cribraria*; *P. cribrum*; *P. cumana*; *P. dilifera*; *P. eccentrica*; *P. fragilis*; *P. fusca*; *P. incrustans*; *P. incrustata*; *P. japonica*; *P. laminaris*; *P. maremontana* sp.nov; *P. nana*; *P. rickettsi*; *P. rudiastra*; *P. saxicola*; *P. schulzei*; *P. scrobiculosa;* *P. sinetridens* n. sp.; *P. stipitata*; *P. symbiotica*; *P. tenuilaminaris*; and *P. wondoensis*.

An identification key for the 20 species of *Poecillastra* occurring in the Pacific Ocean is given below.

Identification key for Pacific *Poecillastra*

1. Absence of triaenes................. *P. sinetridens* n. sp.
– Presence of triaenes 2

2. Triaenes are dichocalthrops 3
– Triaenes never include dichocalthrops 4

3. Dichocalthrops with rhabdome up to 450 µm long; the smaller category of oxeas up to 850 µm long.... ....*P. ciliata*
– Dichocalthrops with rhabdome larger than 600 µm long; the smaller category of oxeas larger than 1300 µm long... *P. tuberosa*

4. Triaenes are only orthotriaenes (rhabdome different from the cladi), no calthrops ....*P. cribraria*
– Triaenes include calthrops 5

5. Oxeas in three categories......................................6
– Oxeas in one or two categories.............................8

6. Microxeas larger than 180 µm and only one category of asters...................................... *P. japonica*
– Microxeas smaller than 160 µm long and more than one category of asters 7

7. The larger category of oxeas may be larger than 4600 µm and is less than 15 µm thick; three categories of asters (one of spirasters and two of plesiasters) ....*P. maremontana* n. sp.
– Oxeas never larger than 3400 µm, but up to 78 µm thick; two categories of asters (metasters and spirasters)...................................*P. tenuilaminaris* ....*sensu* Green and Bakus (1994)

8. Oxeas in one category...9
– Oxeas in two categories.......................................13

9. Oxeas can be longer than 3000 µm 10
– Oxeas smaller than 2500 µm 11

10. Calthrops with cladi up to 500 µm long ....*P. tenuilaminaris sensu* Sollas (1888) ....and Dickinson (1945)
– Calthrops with larger cladi (up to 1000 µm) ....*P. laminaris sensu* Lévi and Lévi (1989)

11. Metasters only up to 16 µm long ....*P. tenuilaminaris sensu* de Laubenfels (1932)
– Metasters up to 40 µm long 12

12. Microxeas short and stout (80-150/5-7 µm) .... *P. cribrum*
– Microxeas longer and slender (200/3 µm) ....*P. dilifera sensu* Dickinson (1945)

13. Megascleres include oxeas 5000 µm long or larger 14
– Megascleres include oxeas always smaller than 3500 µm long...16

14. Oxeas can be longer than 10000 µm, microxeas up to 270 µm long .... *P. rickettsi*
– Oxeas shorter than 6000 µm, microxeas shorter than 210 µm 15

15. Larger oxeas slender (8 µm thick), microxeas shorter than 150 µm, metasters up to 20 µm long only ....*P. laminaris sensu* Sollas (1888)
– Larger oxeas stouter (10-22 µm thick), microxeas 140-210 µm long, metasters up to 50 µm long ....*P. scrobiculosa*

16. Triaenes include protriaenes longer than 2000 µm ....*P. wondoensis*
– Triaenes of distinct morphology, shorter than 1000 µm 17

17. Microxeas up to 270 µm long .... *P. stipitata*
– Microxeas up to 170 µm long only 18

18. Oxeas II are 262-621 µm long, asters in a single category .... *P. antonbruunae* n. sp.
– Oxeas never shorter than 1000 µm, asters in two categories 19

19. Oxeas always thicker than 10 µm, plagiotriaenes present next to calthrops............................*P. fusca*
– One category of oxeas much thinner (1200-1800/2.6-3 µm), triaenes are calthrops only ....*P. incrustata*

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